FIRSTRUN – Fiscal Rules and Strategies under Externalities and Uncertainties.
Funded by the Horizon 2020 Framework Programme of the European Union.
Project ID 649261.

FIRSTRUN Deliverable 2.5

Working paper on the MIP Scoreboard (Analysing the Relevance and Predictive Power of the MIP Scoreboard's Indicators)

Abstract:
This research aims to evaluate crisis prediction ability of the Macroeconomic Imbalance Procedure Scoreboard's headline and auxiliary indicators. We test the indicators separately by employing signals approach and loss and usefulness function of the policymaker and then as one system by estimating limited dependent variable models. We also evaluate the thresholds and estimate their optimal value subject to a policymaker with preferences assigning equal importance to both missed crisis and false crisis prediction errors. Moreover, impact of statistical data revisions on crisis predictions is examined. The results show, that the tested indicators perform better for the euro area in comparison to the non-euro area. The external sector indicators along with the new labour market indicators seem to have the best prediction abilities. Our outcomes also suggest that if the Macroeconomic Imbalance Procedure had been employed as an early warning system before the recession in 2009, it would have provided moderately useful alerts in terms of crisis prediction. However, this would mostly have applied to the EA countries and for only few indicators.

Authors:
Tomáš Domonkos, IER SAS, FSES UNIBA
Filip Ostrihoň, IER SAS
Ivana Šikulová, IER SAS
Mária Širaňová, IER SAS, FNE EUBA

Delivery date: 2017-03-06

Table of contents

1 Introduction ... 3

2 The Macroeconomic Imbalance Procedure – Background ... 6

2.1 Preventive and Corrective Arm of the MIP ... 7

2.2 Indicators of the MIP Scoreboard ... 9

2.3 Criticism of the MIP ... 15

3 Data and Methodology ... 17

3.1 Data, Revisions and Crisis Indicators ... 17

3.2 Signals Approach and the Policy Maker Utility Function ... 21

3.3 Econometric Approach ... 24

4 Results and discussion ... 31

4.1 Evaluation of the Scoreboard Variables – Signals Approach and Loss and Usefulness Functions ... 31

4.2 Evaluation of the Scoreboard Headline Indicators – Econometric Approach ... 37

4.3 Statistical Bias in Signalling Properties - Case of Data Revisions ... 47

4.4 Discussion ... 49

5 Conclusion ... 53

6 References ... 54

Appendix A ... 62

Appendix B ... 80

Appendix C ... 86

Appendix D ... 100

Appendix E ... 114

Appendix F ... 128

Appendix G ... 200

1 Introduction

Crisis warning systems have been attracting attention of policy makers and researchers for several decades. In their influential paper, Kaminsky, Lizando and Reinhart (1998) point out the need for systems which are able to correctly predict crisis events in advance.[1] This need became intensified after the recent recession[2] in the European Union (EU), which revealed several deficiencies in the design of the European governance framework. Therefore, in order to avoid future crises, or at least to minimize negative effects of such crisis periods, a complex reform of the European governance framework has been implemented in the EU since 2011. Among the regulations included in the "six-pack", regulation No 1174/2011 (Official Journal of the European Union, 2011a) and regulation No. 1176/2011 (Official Journal of the European Union, 2011b) is a proposal for the implementation of the Macroeconomic Imbalance Procedure (MIP).

The MIP became a substantial part of the European Semester aiming to prevent macroeconomic imbalances and enforce the correction of excessive imbalances. The preventive part of the MIP starts each year in November by the release of the Alert Mechanism Report (AMR). The preventive part is, in fact, an early warning system (EWS) relying in its first phase on signals from the MIP scoreboard, which is currently composed of fourteen headline indicators. All particular indicators have assigned to them upper, lower, or both thresholds, depending on their nature and role in the EWS. The thresholds are, in this phase, applied to all member states in a uniform fashion, ignoring country-specific circumstances, except for the euro area (EA) membership which is accounted for. Countries under adjustment programs are excluded. As a result of the AMR, an in-depth review can be initiated for countries with emerging macroeconomic imbalances. Subsequently, if the European Commission (EC) identifies serious threats which can negatively affect the member state, the EA, or the EU, the procedure of correcting these excessive imbalances can be initiated. The corrective part of the MIP has not been launched since its introduction.

The aim of the EWS is to predict occurrence of crisis events in advance using a preselected set of indicators. One of the most influential paper on topic of EWS is that of Kaminsky, Lizando and Reinhard (1998), where authors propose the signals approach as a nonparametric tool of EWS evaluation. Early warning indicators (EWIs), and the EWS in particular, are analysed and evaluated by e.g. Alessi *et al.* (2014), Alessi and Detken (2011 and 2014), Sarlin (2013), Bussiere and Fratzscher (2006), Borio and Drehmann (2009), Davis and Karim (2008a and 2008b), Barrell *et al.* (2010a and 2010b), Kaminsky, Lizando and Reinhard (1998), Kaminsky and Reinhard (1999), Babecký *et al.* (2012 and 2013), Antunes, Bonfim and Monteiro (2014), Candelon, Dumitrescu and Hurlin, (2012), Berti, Salto and Laquien (2012), Borgy, Clerc and Renne (2014), Christensen and Li (2014). As summarized in European Commission (2016a) most of these studies focus on financial crises (banking crises, currency crises and debt crises) and follow three distinct methodological

[1] Kaminsky, Lizando and Reinhart (1998, p. 1-2) say: "*Financial market participants are interested in this because they want to make money, policymakers because they wish to avoid the crisis, and academics because they have long history of fascination with financial crisis.*"

[2] Economic crisis, financial crisis and debt crisis.

streams, namely EWIs, multivariate discrete choice models, binary recursive trees, and other approaches.

Several research articles and policy briefs discuss the MIP, their number compared to the EWS literature, however, appears rather small likely due to the short time period since the MIP has been introduced and applied. Regarding the MIP-focused studies, these papers can be divided into two distinct categories. The first group discusses the procedure of the MIP and its political background and motivation (Alcidi and Gros, 2014; Belke, Gros and Schnabl, 2016; De Grauwe, 2012; Essl and Stiglbauer, 2012; Gros, 2012; Gros and Giovannini, 2014; Guerrieri, 2012; Hallwirth, 2014; Kamps *et al*., 2013 and 2014; Moschella, 2014). The second group analyses the headline indicators included in the scoreboard, often using the signals approach proposed by Kaminsky, Lizando and Reinhard (1998), e.g. Babecký *et al*. (2012), Csortos and Szalai (2013 and 2014), loss and usefulness functions e.g. Knedlik (2014 and 2015) or econometric techniques e.g. Boysen-Hogrefe *et al*. (2015).

The main aim of this research is to conduct an in-depth analysis of usefulness and relevance of the indicators included in the MIP scoreboard from the perspective of their crisis warning performance. Moreover, we test whether this system would have been able to identify potential macroeconomic imbalances had it been applied across Europe before the most recent crisis. While greatest attention is paid to the MIP headline indicators crucial in the AMR, our analysis also includes the set of MIP auxiliary indicators. The auxiliary indicators serve as a useful source of new indicators which may be further potentially added to the final Scoreboard if performing exceptionally well in terms of crisis prediction. Only Eurostat and EC data were used and all the indicators were taken into consideration in order to replicate the MIP as much as possible. This approach certainly limits the sample size and the time length of the panel database. Data used in the analysis cover the period of 2001-2016[3] which provides an acceptable time span for the analysis of the ability of the MIP indicators to indicate economic imbalances. We work with various sub periods (2001-2008, 2001-2012, 2001-2016) to be able to test the in-sample prediction accuracy as well as the out-of-sample prediction capabilities of the MIP. Moreover, data from all six statistical annexes of the AMR are tested to evaluate the impact of data revisions on prediction performance. We distinguish between EA countries and non-EA countries by time of their accession.

In terms of analytical tools, three different methods are employed. Firstly, we use Signals approach proposed by Kaminsky, Lizando and Reinhard (1998) by which the performance of all particular individual indicators is tested accounting for three different time lags. Then the approach of loss and usefulness functions of the policymaker (Alessi and Detken, 2011) is applied to test the performance of all variables separately. Furthermore, optimal thresholds are determined for a policymaker with equal relative preferences regarding type I error (missed crisis)

[3] Not all indicators are available for the entire period of 2001-2016 for each country, thus, the analysis was conducted on an imbalanced panel.

and type II error (false crisis alarm). Finally, discrete choice models are estimated to test usefulness of all particular variables of the MIP to a single EWS. The main advantage of this approach is that it can treat all variables simultaneously. Both models without thresholds and models accounting for individual thresholds of indicators are estimated. This approach can address Kamps' critique (2013 and 2014) of relatively vague MIP criteria to establish "excessive imbalances" (the corrective part of the MIP), which results from in-depth reviews. Boysen-Hogrefe *et al*. (2015) employ binary response models to analyse how individual signals affect launching in-depth reviews and how, subsequently, those signals affect choice of imbalance category as an outcome of the in-depth review. Alongside treating the scoreboard indicators as one system, the probit or logit estimations have potential to narrow down the list of useful predictors, as pointed out by Kaminsky, Lizando and Reinhard (1998). The usefulness of a variable for models is then evaluated according to the Area Under the Receiver Operating Characteristic (AUROC), which is proposed by Candelon, Dumitrescu and Hurlin (2012).

Since the MIP was applied as a tool of economic surveillance in the EU, it has been adjusted in terms of the thresholds or the list of the baseline scoreboard indicators itself. Because the system is expected to evolve over time, we aim to contribute to the ongoing discussion in this regard by promoting best-performers among the list of existing indicators. Moreover, as number of scholarly articles directly targeting the MIP is not very extensive (as pointed out by Boysen-Hogrefe *et al*., 2015), we aim to contribute to research on the MIP and expand the existing discussion in this direction. Undoubtedly, the introduction of the MIP is a step forward in establishing reliable system for crises prevention; however, there is still a considerable room for further development.

Our results show that the most relevant MIP indicators differ by targeted time horizon and region. In the case of EA group, the most contributing in the short run is export market share. On the other hand, the real effective exchange rate (REER) and private sector credit flow may be beneficial in longer horizons. When focusing on the entire EU, nominal unit labour cost and youth unemployment rate indicators provide added value for predictions in horizon of three years. Comparison of EWIs performance using data from different statistical annexes tentatively suggests that underlying data revisions might have significant effect on the results in case of several indicators from predominantly external sector. However, it is difficult to identify systematic errors, since the differences seem to have rather unpredictable nature.

The study is organized into four main parts. The second section provides an extensive overview of the MIP background, its development, political motivation and assigned roles in the EU governance, in particular. The third section provides a detailed overview of data and methodology applied. The fourth section presents a discussion of results. Finally, the last section concludes.

2 The Macroeconomic Imbalance Procedure – Background[4]

In September 2010, the European Commission adopted a legislative package consisting of six proposals, the so-called six-pack legislation, which aims to reinforce the monitoring and surveillance of fiscal, macroeconomic and structural reform policies in the EU and the EA compared to previously applied legislation. The Ecofin Council and European Council reached an agreement on the six-pack legislation to improve EU economic governance in March 2011. As a result of discussions on economic indicators to detect macroeconomic imbalances, the Ecofin/Eurogroup adopted conclusions on the design of the scoreboard of indicators in November 2011. Legislation on the MIP entered into force in December that year, so it could become a part of the 2012 European Semester.

The MIP legislation consists of two regulations included in the six-pack: Regulation (EU) No. 1176/2011 of the European Parliament and of the Council of 16 November 2011 on the prevention and correction of macroeconomic imbalances and Regulation (EU) No 1174/2011 of the European Parliament and of the Council of 16 November 2011 on enforcement measures to correct excessive macroeconomic imbalances in the EA. Regulation 1176/2011 covers all EU Member States and lays out the details of the surveillance procedure, while Regulation 1174/2011 applies only to EA Member States and focuses on enforcement, including the possibility of sanctions.

The two afore-mentioned MIP regulations, representing secondary legislation, find their legal basis in the articles of the Treaty on the Functioning of the European Union (TFEU), dealing with economic policy coordination and included in the Title VIII Economic and Monetary Policy of the TFEU. Article 119 mentions the importance of economic policy within the EU based on close coordination of Member States' economic policies. The main TFEU basis for MIP surveillance is Article 121, which provides the rationale for multilateral surveillance in the EU, Broad Economic Policy Guidelines, and Country-Specific Recommendations consistent with these guidelines. In addition, Article 136 of the TFEU provides for specific provisions to be adopted in order to ensure the proper functioning of the EA.

Surveillance of macroeconomic imbalances is a part of broader efforts to move towards more integrated surveillance. It is supposed to go beyond the criteria of government debt and deficit of the Stability and Growth Pact (SGP). Therefore, the MIP can be considered complementary to the SGP. As stated by Belke, Gros and Schnabl (2016), the MIP should identify imbalances when the other EWSs as the SGP or risk premiums do not signalize any problems. Thus, the MIP should be able to prevent repeating such crises as Spain or Ireland have experienced recently.

Compared with the SGP, which focuses on budgetary policy and is rules-based, the MIP is wider in coverage and does not follow automatic numerical rules. It is broad in scope in order to cover all the different areas where macroeconomic risks may appear. Thus, the correction of imbalances

[4] This section is based on the papers of Šikulová (2015) and Domonkos *et al.* (2017). Both papers were published under the FIRSTRUN project.

may also require action on a wide range of fronts. In comparison to EU fiscal surveillance, numerical rules play a role only at the start of the MIP process in the form of the scoreboard of indicators; however, applied numerical targets and triggers cannot solely capture the whole economic complexity (European Commission, 2016a).

2.1 Preventive and Corrective Arm of the MIP

As with the SGP, the MIP also consists of preventive and corrective arms. Within the preventive arm of the procedure, potential macroeconomic problems have to be identified and regularly analysed in order to detect the emergence of imbalances early on. The corrective arm will come into effect if macroeconomic imbalances in a particular Member State prove to be serious, i.e. "excessive".[5] Consequently, this Member State will be required to submit a plan for corrective measures. The corrective arm provides the means with which to effectively enforce the correction of imbalances. In case the Member State concerned fails to comply with the recommended corrective actions, sanctions may be imposed.

The preventive arm of the MIP consists of two steps. In the first of these, an alert mechanism, serving as an EWS, focuses attention on risks observed early-on and identifies Member States for which, in the second step, more in-depth analysis needs to be conducted to evaluate their vulnerability and substantiate recommendations, if appropriate (European Commission, 2012b). So, it is in-depth analysis, and not the alert mechanism, which provide the basis for any recommendations to be addressed to Member States under the preventive or corrective arm of the MIP.

The MIP starts with the AMR, prepared by the EC in the autumn of each year since 2012, except the first AMR, which was released at the beginning of 2012. The alert mechanism is based on the so-called scoreboard, i.e. a set of fourteen (previously ten) macroeconomic indicators of external imbalances, competitiveness, internal imbalances and labour market, with their threshold values established by the EC. The threshold values are not interpreted mechanically, but in conjunction with the accompanying qualitative analysis. This approach gives the EC both flexibility and a high degree of discretion in interpreting the data (Moschella, 2014). The number and combination of breaches of thresholds and the severity of individual breaches, potentially signalling broad-based problems, is also taken into account (European Commission, 2011).

Based on the reading of the scoreboard (headline indicators), in combination with relevant data beyond the scope of the scoreboard (auxiliary indicators for which no thresholds have been calculated), economic circumstances and all relevant factors available specific to the country's situation, the EC identifies Member States that face a risk of excessive imbalances. In these

[5] According to Regulation 1176/2011 (Official Journal of the European Union, 2011b, p.28), a macroeconomic imbalance means *"any trend giving rise to macroeconomic developments which are adversely affecting, or have the potential adversely to affect, the proper functioning of the economy of a Member State or of the Economic and Monetary Union, or of the Union as a whole"*, while the excessive imbalances are defined as *"severe imbalances, including imbalances that jeopardise or risks jeopardising the proper functioning of the Economic and Monetary Union"*.

countries, closer analyses (so called in-depth reviews) are carried out by the EC in collaboration with the affected Member States. Following in-debt reviews, the EC determines whether imbalances exist in the Member States identified in the AMR and what their nature is. Depending on the severity of the imbalances, the EC proposes policy recommendations, either under the preventive or corrective arm of the MIP.

In accordance with the Communication of the Commission On steps towards Completing Economic and Monetary Union (European Commission, 2015b), the EC has recently enhanced the transparency in the implementation of the MIP and stabilised the categorisation of macroeconomic imbalances by streamlining the number of imbalance categories from six to four:

1. No imbalances,
2. Imbalances,
3. Excessive imbalances,
4. Excessive imbalances with corrective action (Excessive Imbalance Procedure, EIP).

If the situation in a Member State is considered unproblematic, the EC will not propose any further steps. If the EC considers that macroeconomic imbalances exist, it issues policy recommendations on the correction of the imbalances to the Member State. In the preventive arm, these are part of the integrated package of country-specific recommendations under the European Semester cycle.[6] However, if the EC considers that there are excessive imbalances that may jeopardise the proper functioning of the EA, it may recommend to the Council to open an EIP as an enforcement mechanism, which falls under the corrective arm of the MIP. Alternatively, the EC can decide not to activate the corrective arm, but introduce specific monitoring for a country with excessive imbalances. However, the EC can, at any time, propose launching an EIP for this country, without having to carry out an in-depth review again. In general, all Member States with imbalances or excessive imbalances identified are subject to specific monitoring adapted to the degree and nature of the imbalances presented (European Commission, 2017).

After starting an EIP, the Member State concerned is obliged to submit a corrective action plan, based on the Council recommendations. The plan must contain adequate measures for the correction of the imbalances detected and specify deadlines for the implementation of corrective action. In cases where there are contraventions, financial sanctions may be imposed for EA (but not for non-EA) Member States. An interest-bearing deposit, equal to 0.1% of the country's GDP, can be imposed by the Council after one failure to comply with the recommended corrective action. This interest-bearing deposit can be converted into a fine (0.1% of GDP) after a second failure to comply. Sanctions can also be imposed for failing twice to submit a sufficient corrective action plan. The fine will be used for the financing of the European Stability Mechanism and

[6] With the aim of strengthening integrated surveillance, in 2015 the in-depth reviews became part of the Commission's Country Reports. Before, in-depth reviews were separate analytical documents published in March, while other Commission analyses linked to the European Semester surveillance cycle were published in May as a Staff Working Document, together with the country-specific recommendations proposals (European Commission, 2016a).

applied until the corrective action plan has been accepted or the implementation of the corrective measures is considered to be adequate. The EIP will be closed once the Council, based on a recommendation from the EC, determines that the imbalances have been effectively eliminated (European Commission, 2017).

One of the major innovations of the procedure is the use of reverse qualified majority voting, under which a Council decision on an EC recommendation regarding the activation of sanctions against EA Member States is deemed to be adopted by the Council unless it decides by qualified majority voting to reject the recommendation within ten days. This semi-automatic, decision-making procedure enhances the likelihood that the surveillance and enforcement process will not be blocked by political considerations.

2.2 Indicators of the MIP Scoreboard

In November 2011, the EC published Staff Working Paper presenting its envisaged initial design of the scoreboard of EWIs for the surveillance of macroeconomic imbalances (European Commission, 2011). The proposal contained ten indicators and considered an additional indicator on the banking/financial sector that would be developed by the end of 2012. The design of the scoreboard is based on a set of four principles:

1. The choice of indicators focuses on the most relevant dimensions of macroeconomic imbalances and competitiveness losses, with a particular emphasis on the smooth functioning of the EA.
2. The scoreboard indicators and thresholds should provide a reliable signalling device for potentially harmful imbalances and competitiveness losses at an early stage of their emergence. The thresholds were established using a statistical approach based on the distributions of the indicators' values across the whole panel of EU countries, identifying the thresholds as the lower and/or upper quartiles of the distributions. Such thresholds are consistent with the values found in the available economic literature.[7]
3. The scoreboard has an important communication role.
4. Indicators are of high statistical quality in terms of timeliness and comparability across countries.

Nowadays, the scoreboard used for AMRs consists of fourteen indicators (including an indicator on the financial sector and new employment indicators) along with their indicative thresholds (Table 1). The indicators include both stock and flow indicators which can capture shorter-term deteriorations, as well as the longer-term accumulation of imbalances. From the methodological point of view, more year averages or changes (3 or 5 years) are used in the calculation of several headline indicators, in order to capture the medium-term development and provide indications of the persistence of a potential imbalance. Calculation as a share of GDP is applied in several indicators

[7] However, in some cases it is difficult to establish thresholds, which can be considered as risky. It concerns e.g. the level of net external assets, as well as an optimal level of private sector debt in the economy (European Commission, 2012b).

to allow for cross-country comparability and differentiated thresholds are used for EA and non-EA countries in the cases of two indicators (REER, nominal unit labour cost), given the different characteristics of EU countries outside the monetary union.

Table 1 **Indicators of the MIP Scoreboard – latest version with fourteen indicators included**

External imbalances and competitiveness		**Indicative thresholds**
Current account balance	% of GDP, 3 year backward moving average	+6% and -4%
Net international investment position	% of GDP	-35%
Real effective exchange rate	42 trading partners, HICP deflator, 3 years % change	±5% (EA), ±11 (non-EA)
Export market share	% of world exports, 5 years % change	-6%
Nominal unit labour cost	2010=100, 3 years % change	9% (EA), 12% (non-EA)
Internal imbalances		
House price index	deflated, 1 year % change	6%
Private sector debt	consolidated, % of GDP	133% (previously 160%)
Private sector credit flow	consolidated, % of GDP	14% (previously 15%)
General government gross debt	% of GDP	60%
Unemployment rate	3 year backward moving average	10%
Total financial sector liabilities	non-consolidated, 1 year % change	16.5%
New employment indicators		
Activity rate	% of total population aged 15-64, 3 years change	-0.2 p.p.
Long-term unemployment rate	% of active population aged 15-74, 3 years change	0.5 p.p.
Youth unemployment rate	% of active population aged 15-24, 3 years change	2.0 p.p.

Source: European Commission, 2015c.

As stated in the Occasional Paper of the Commission on the Scoreboard (2012b), the choice of indicators is based on the results found in the economic literature available at that time. It includes, in particular, the paper of Frankel and Saravelos (2010), who, based on an extensive review of more than eighty papers from previous literature on EWIs and their own analysis, identified the causes and symptoms of financial crises that have been most consistent over time, country and crisis. They found the REER, the current account balance, credit growth and the level of external debt to be useful indicators for predicting the incidences of crises. Kaminsky, Lizondo and Reinhart (1998), who examined the empirical evidence on currency crises and proposed a specific EWS, had already identified the REER and domestic credit as indicators that proved to be particularly useful in anticipating crises. The later results of Babecký *et al*. (2013), who identified the most useful leading indicators with Bayesian model averaging, suggest that the current account balance to GDP ratio is robustly associated with the severity of crises (in line with Frankel and Saravelos, 2010), as well as private credit and the government debt-to-GDP ratio.

The economic rationale behind the inclusion of individual indicators in the MIP scoreboard, the transformations used and the determination of threshold values is in short as follows (European Commission, 2012a, 2012b, and 2015a):

Current account balance

- 3-year backward moving average of the current account balance as a percentage of GDP, with indicative thresholds of +6% and -4%

The current account balance is one of the most significant indicators in explaining the incidences of crises. An economy with a high current account deficit borrows and imports in excess of its exports. Surveillance under the MIP covers also current account surpluses; however, more attention is paid to economies with large current account deficits and competitiveness losses. Hence, the need for policy action is strong in economies with large current account deficits; however, Member States with large current account surpluses should also implement the reforms, focusing on strengthening their domestic demand. The average over a three- year period is used in calculations in order to inform about the persistence of a potential imbalance. The indicative threshold for current account deficits of -4% was derived from the historical data for EU Member States, using a simple statistical distribution analysis. The upper value of the threshold is set at +6%.[8]

Net International Investment Position

- Net international investment position as a percentage of GDP, with an indicative threshold of -35%

The net international investment position as the net financial position (assets minus liabilities) of the domestic sectors of the economy versus the rest of the world is the stock counterpart to the current account balance. A persistently high current account deficit leads to a highly negative net international investment position. Calculation as a share of GDP enables cross-country comparability. Value for the last available year is used and the indicative threshold is -35% of GDP. However, in addition to the level, composition of assets and liabilities in terms of maturities is also an important factor when assessing the overall vulnerability of the external position of a Member State.

Real Effective Exchange Rates

- 3-year percentage change of the REER based on HICP/CPI deflators, relative to 41 other industrial countries, with indicative thresholds of -/+5% for EA countries and -/+11% for non-EA countries

This indicator is based on consumer prices in order to capture the drivers of persistent changes in the price and cost competitiveness of each Member State relative to its major trading partners. The REER is frequently included among EWIs. It assesses price and cost competitiveness developments and not some other aspects of competitiveness such as product quality or overhead costs, so it is complemented by other scoreboard indicators such as export market shares. Symmetric indicative thresholds are used and they differ between EA (-/+5%) and non-EA Member States (-/+11%).

Export Market Shares

- 5-year percentage change of export market shares measured in values, with an indicative threshold of -6%

[8] The initial scoreboard used by the Commission had the same 4% trigger point for the current account imbalance, whether this was a surplus or a deficit. However, this was later changed into an asymmetric trigger: +6% for surplus countries and 4% for deficit countries (De Grauwe, 2012).

This indicator focuses on structural losses in competitiveness. Changes in export market shares can be driven by both the increase/decrease of a country's export volume (numerator effect) and the growth of total world exports in goods and services (denominator effect). So countries can lose market share also in the case that their exports grow more slowly than total world exports. The percentage change over five years of exports for each country as a share of world exports allows for the measurement of long-term competitiveness development. The indicative threshold of the export market share indicator corresponds to cumulative losses of 6% over a period of five years.

Nominal Unit Labour Cost

- 3-year percentage change in the nominal unit labour cost, with indicative thresholds of +9% for EA countries and +12% for non-EA countries

The indicator of the nominal unit labour cost monitors developments in price and cost competitiveness across EU Member States. A rise in the nominal unit labour cost in a Member State corresponds to a rise in labour costs exceeding the increase in labour productivity. If other costs are not adjusted in compensation, an economy's cost competitiveness can be jeopardized. The three-year percentage change is used in order to capture medium-term developments in labour costs. The indicative threshold for EA countries is 9%, for non-EA countries 12%. Together with the REER indicator, the nominal unit labour cost indicator allows a comprehensive assessment of cost/price competitiveness developments in Member States.

House Price Index (or House Prices)

- Year-on-year changes in house prices, relative to a Eurostat consumption deflator, with an indicative threshold of 6%

Large movements in housing markets can be an important source of macroeconomic imbalances and have been associated with several economic crises. The consumption deflator is used in calculations to mirror the value of house prices relative to the overall consumption basket.

Private Sector Debt

- Private sector debt (consolidated) as a percentage of GDP, with an indicative threshold of 133% (previously 160%)

Excessively high private sector debt increases vulnerability to economic shocks. The indicative threshold of private sector debt is 133% GDP; however, there is no firm evidence from the literature on an optimal level of debt in an economy.

Private Sector Credit Flow

- Private sector credit flow as a percentage of GDP, with an indicative threshold of 14% (previously 15%)

Private sector credit flow includes loans and securities other than shares. This indicator is the flow counterpart of private sector debt (a stock indicator). Quickly expanding credit is considered among

the best predictors of financial or banking crises. Moreover, credit growth is a good EWI for house price booms and there is also an important link between credit growth and external imbalances.

General Government Sector Debt

- General government sector debt as a percentage of GDP, with an indicative threshold of 60%

A high level of general government debt raises the vulnerability of a Member State, reduces its room for manoeuvre to deal with crisis situations and is even more worrying when it is accompanied by large private sector debt. Therefore, the indicator for general government debt is included in the MIP scoreboard in order to provide a broader picture of Member States' indebtedness, not to monitor risks related to unsustainable public finances, which are taken into account within the SGP. The Treaty reference value of 60% of GDP is used as the indicative threshold for this indicator, since different threshold used within the MIP would be confusing.

Unemployment Rate

- 3-year backward moving average of unemployment rate, with an indicative threshold of 10%

The aim of including this indicator into the scoreboard is not to make unemployment as such an objective for MIP surveillance. The indicator of the unemployment rate rather helps in better understanding the potential severity of macroeconomic imbalances in terms of the capacity of the economy to adjust. The indicator is defined as the three-year backward average of the unemployment rate which was preferred to yearly figures, which are strongly influenced by short-term volatility.

Financial Sector Liabilities

- Year-on-year percentage changes in total financial sector liabilities, with an indicative threshold of 16.5%

This indicator has become the eleventh indicator of the scoreboard (European Commission, 2012a) and was included in the scoreboard for the second AMR published in November 2012. It aims at better capturing the interlinkages between the real economy and the financial sector. As experience has shown, a fast expansion of the financial sector has often anticipated financial crises. While the European Systemic Risk Board monitors financial stability risks, the MIP evaluates the financial sector from the point of view of macroeconomic imbalances.

Three new employment indicators, previously included among the auxiliary indicators, were integrated into the MIP headline scoreboard in 2015. Before, one unemployment indicator had already been included in the scoreboard (as mentioned above). However, this indicator alone seemed not to be sufficient to capture all the aspects of labour market disturbance and social distress during adjustment. Thus, integration of the new employment indicators into the scoreboard enables a better understanding of the social consequences of macroeconomic imbalances, including the phase of correction of these imbalances (European Commission, 2015a).

The inclusion of new indicators into the MIP scoreboard raises the status of labour market developments in the economic analysis and is in accordance with strengthening the social dimension of the EA. Thresholds are computed according to the same statistical approach used for the existing indicators of the MIP scoreboard. The new headline employment indicators include:

Activity Rate

- Percentage point change over 3 years in the rate of activity, with an indicative threshold of -0.2 p.p.

The activity rate (defined as the number of the active population over the total population aged 15-64) complements the indicator of the unemployment rate in assessing variations in the employment rate. The activity rate is substantial for analysing the impact on potential output, as well as for analysing the social impact of adjustment.

Long-term Unemployment Rate

- Percentage point change over 3 years in the long-term unemployment rate, with an indicative threshold of 0.5 p.p.

Changes in long-term unemployment (defined as the number of unemployed for 1 year or more as a percentage of the active population aged 15-74) help to measure future developments in participation, as a longer duration of unemployment reduces considerably the prospects of re-employment. The long-term unemployment rate is also relevant for assessing social developments.

Youth Unemployment Rate

- Percentage point change over 3 years in the youth unemployment rate, with an indicative threshold of 2.0 p.p.

This indicator (defined as a percentage of young, unemployed aged 15-24 of the active population in the same age group) allows an early signalling of worsening labour market conditions, since unemployment risks for young people are more strongly affected by economic activity than those for the overall population.

The appropriateness of the scoreboard of indicators is regularly reviewed by the EC from the perspectives of the composition of indicators, the methodology used and the indicative thresholds established. In line with the MIP legislation, it is possible to add new or better-quality indicators to the scoreboard, or replace some of the existing indicators.

Besides the scoreboard results, economic reading takes into account other relevant information and the broad economic context using complementary auxiliary indicators, which are also reported in the AMRs. The auxiliary indicators include macroeconomic conditions, including GDP growth; investment and productivity growth; competitiveness; R&D spending; foreign direct investment; home prices; private sector indebtedness; labour markets; and social conditions. Furthermore, additional information outside auxiliary indicators is also often needed for an appropriate comprehension of determinants and implications of scoreboard variables, as well as analytical tools in order to qualify scoreboard indicators and assess their drivers.

Since the introduction of the MIP, few modifications have been made in the scoreboard of indicators or the procedure. Six AMRs have already been published and the number of countries identified with imbalances in in-depth reviews has slightly grown over time. However, the EIP has not been launched for any countries identified as having excessive imbalances. One explanation is that the most imbalanced Member States (so called Programme countries), which received financial support, were not covered by the MIP and the EIP as they were being monitored by their macroeconomic financial assistance programme. At the same time, so far, all the Member States identified as having excessive imbalances have succeeded in proposing sufficient measures for the correction of the imbalances detected when submitting their National Reform Programmes for the following year.

According to the European Commission (2016a, p. 67-68), "*although the MIP framework has been in application only for a short number of years, and it is thus still too early to establish a firm judgement on its 'effectiveness', the MIP has contributed to a supportive policy environment for adjustment.*" At the same time, as mentioned in the Communication of the Commission On Steps Towards Completing Economic and Monetary Union (2015b), experience suggests that implementation of the MIP can be improved in several ways. As part of improving economic governance, the EC aims to ensure a transparent implementation of the MIP, stabilise the imbalance categories and clarify the criteria guiding its decisions. Some steps have been already taken in this direction, but much still remains to be done.

2.3 Criticism of the MIP

According to some authors, the MIP suffers from severe shortcomings which should be resolved. Moschella (2014) points out that the MIP does not provide for mechanisms to prevent political considerations from interfering with the decision to activate sanctions and on how to share the burden of adjustments. Furthermore, the single-country focus of the MIP and the limited integration of macroeconomic and financial analysis are factors that may lead to important systemic aspects being missed (the build-up of imbalances that concern a group of countries together) and so undermine the effectiveness of the MIP. In addition, the use of reverse qualified majority voting is confined only to the corrective arm of the MIP. In contrast, the reverse qualified majority voting does not apply to the Council discussion of the AMR, on the basis of which the list of Member States for which in-depth reviews are warranted is identified. An important question is also whether sanctions will be activated at all, especially towards the core EA countries.

According to Kamps *et al.* (2013), several issues regarding the scoreboard indicators and thresholds established need to be targeted, either by amendments of the scoreboard itself or through a broader "economic reading" of the variables. The authors argue that the MIP regulations remain relatively vague on the criteria to establish "excessive imbalances" in a country. In contrast to the corrective arm of the SGP with the reference values 3% of GDP for the budget deficit and 60% of GDP for the general government debt which should automatically trigger corrective action via the launch of an excessive deficit procedure, the rules of the MIP framework do not imply the same degree of automaticity. This creates room for discretion for the exercising and deciding institutions.

Similarly, as Moschella (2014), Kamps *et al.* (2013) criticize the limited application of the reverse qualified majority voting.

Alcidi and Gros (2014), Gros and Giovannini (2014) and later also Belke, Gros and Schnabl (2016) argue that the MIP should be based more on forward looking variables, since the MIP system and its scoreboard are engineered as a preventive tool. They also point out that it makes a substantial difference whether one looks at the absolute or relative indicators. In particular on the example of current account balance, the authors emphasize that deviations from the EA average should be preferred in the MIP instead of absolute thresholds.

Hallwirth (2014) points out several shortcomings of the procedure with respect to the surveillance of competitiveness divergences and current account imbalances. One of the weaknesses of the MIP is consideration of indicator changes and not their deviations from target or reference values in the case of competitiveness surveillance. As a result, it is not clear, at the level of indicators, whether these changes lead to balance or should be seen as unsound development. As the author argues, within competitiveness surveillance, there is not any clear analysis framework. On the indicator level (current account balance, net international investment position, REER, export market shares, nominal unit labour cost), it is unclear how problems with competitiveness are identified, what their size and causes are.

Furthermore, recommendations under the MIP are addressed only to the Member States in which macroeconomic imbalances have been identified. However, in a monetary union correction of macroeconomic imbalances is essentially a matter of a common concern of all Member States (according to Article 121 of the TFEU). Adjustment can be successful only if they coordinate their efforts and put more emphasis on cooperation in convergence and competitiveness. This has been emphasized by several authors (De Grauwe, 2012; Ederer, 2015; Moschella, 2014; Guerrieri, 2012). As De Grauwe (2012) argues, some symmetry in the adjustment mechanism would alleviate the pain in deficit countries; however, surplus countries do not seem to be willing to take their share of responsibility in correcting external imbalances.

3 Data and Methodology

3.1 Data, Revisions and Crisis Indicators

This research relies on data published by Eurostat as the MIP Statistical annexes of the AMR and output gap data from the European Commission (2016b). Up until now, six AMRs (European Commission, 2012c; 2012d; 2013; 2014; 2015c, 2016c) and five Statistical annexes to the AMRs (2012e, 2013b, 2014b, 2015d, 2016d) have been released on an annual basis from 2012 to 2016.[9] The main dataset used in our analysis contains data from the 2017 Statistical annex. This initial dataset was then extended by the most recently released data featured in the older annexes covering the period from 2001 till 2015. Only the original MIP Scoreboard data and the original output gap data from the 2016 Autumn forecast (European Commission, 2016b) were applied. All available headline indicators, as well as all the available auxiliary variables, were accounted for. This data set was used in all analyses presented below except that focusing on the differences between the results based on data from the six different AMRs, which we call the analysis of revisions.

In each new statistical annex, underlying data for the extended set of headline and auxiliary MIP scoreboard indicators are published. The current revision of historical data is presented along with new estimates for the most recent years. This system of continuously updated data coverage creates a specific structure of MIP indicators database which collects data since 2001 (Table 2). Differences in data as reported by various statistical releases might be attributed to the ongoing process of statistical data revisions. Overlaps in the data for the years 2006-2010 across all rounds of releases allows us to further investigate the impact of data revisions on the signalling properties of MIP scoreboard indicators.

Table 2 **Data Coverage and Statistical Releases**

	#	Publication Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revision	1	2012	x	x	x	x	x	x	x	x	x	x					
	2	2012	x	x	x	x	x	x	x	x	x	x	x				
	3	2013			x	x	x	x	x	x	x	x	x	x			
	4	2014				x	x	x	x	x	x	x	x	x	x		
	5	2015					x	x	x	x	x	x	x	x	x	x	
	6	2016						x	x	x	x	x	x	x	x	x	x

Source: Authors, based on Eurostat data.

[9] The AMR Statistical annexes are marked from 2013-2017; however, the year of publishing is one year earlier for all particular annexes. For the first AMR, published in February 2012, no accompanying annex was released. The data used in this study were downloaded from the database of Eurostat called "*Macroeconomic imbalances procedure - Statistical annex indicators*", available at: <http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do>. In this online database, ten observations for all particular six AMRs are available, even for the first AMR.

In order to do that, we employ the following algorithm. Optimal thresholds are firstly calculated using data from the latest available revision published in 2016 (revision #6). As the data published in the latest revision are considered to offer the most accurate reflection of real economic development available, the optimal thresholds derived from them are assumed to provide a best fit of EWIs, given the occurrence of crises. These optimal thresholds are then consequently used to separately calculate three basic signalling scores (adjusted noise-to-signal ratio (aNtS), correct prediction rate, and absolute utility) using data for each individual round of statistical data release. Ultimately, the variation in values of signalling scores reflects the extent of necessary data revisions after each round of new statistical release. In order to capture the magnitude of such variations, the mean squared error (MSE) is calculated in the following way:

$$MSE = \frac{\sum_{j=1}^{J}\left(s_j - s_{J+1}\right)^2}{J} \tag{1}$$

where s_j stands for the value of selected signalling score for releases $j = 1,2, \dots ,6$. EWIs associated with the highest MSE values are prone to suffer from data misspecification to the greatest degree. As a result, imprecise estimates of underlying economic variables used as EWIs might lead to various problematic issues: (i) estimates of optimal thresholds for EWIs might be biased, (ii) policy makers might be forced to react to issuances of false signals even if, in reality, no signals should have been issued, (iii) policy makers will not adopt any pre-emptive measures as no warnings were issued, even if, in reality, signals should have been issued.[10]

Appropriately defining crisis indicators is indeed among the crucial issues of this research. Rather extensive literature is available on the definition of crises and their measurement. Some authors define a crisis event if one particular variable violates a preselected threshold (Csortos and Szalay, 2013 and 2014; Davis and Karim, 2008a). Others define a crisis event by more than one indicator with an assigned threshold. A crisis event is then reported if one or a selected number of thresholds are violated, e.g. the crisis database of Laeven and Valencia (2012) or Kaminsky, Lizando and Reinhart (1998) who report crises events when a currency sharply depreciates or international reserves drop sharply. An often used indicator of crises is the interest rate spread e.g. Kauppi and Saikkonen (2008). Knedlik (2014) defines crisis events when the ratio of long-term government bonds' yield spread and AAA rated long-term government bonds in the EA is greater than the mean by more than one standard deviation. Estrella and Mishkin (1998) use the National Bureau of Economic Research crisis dates database as a crisis indicator. Babecký *et al.* (2012) develop their quarterly crisis database by using a survey of experts, available crisis databases and academic research.[11]

---

[10] Due to the relatively short time period (2006-2010) and highly skewed distribution of underlying data for some indicators the algorithm used for deriving optimal thresholds in utility-based framework might deliver set of corner solutions. The optimal thresholds are then set to maximize absolute utility by choosing one of two extremes (maximum positive or minimum negative value). Imposing this optimal corner solution on recursive estimation of signalling properties for other five revisions might therefore deliver extreme values of aNtS scores.

[11] An extensive and useful survey of crises indicators is discussed in Babecký *et al*. (2012) and Kaminsky, Lizando and Reinhart (1998).

EU rules and surveillance cover various types of crises. For example, debt crises are impeded by the SGP and financial or banking crises are prevented by the European System of Financial Supervision. The EA as a currency area for its proper (optimal) functioning requires a synchronized business cycle, because the common monetary policy might not be relevant in cases of divergent economic development for all particular member countries (de Haan, Inkleer and Jong-A-Pin, 2008). One might argue that there are other policy measures available, however, Essl and Stiglbauer (2012) point out that in the EA, member states have rather limited policy tools available to tackle crises (bounded fiscal policy, insufficiently flexible labour market). They argue that, until transfer union became a politically feasible option, it seems that the only measure available is identifying macroeconomic imbalances which might lead to asymmetric shocks, and then these being addressed with relevant policy interventions. De Grauwe and Ji (2016) shows that the cycles appear rather well correlated across EA countries, the main difference being the magnitude of the fluctuations. We utilized the output gap as a crisis indicator because it accounts for the development of the business cycle[12], has the potential to capture real economy crises through significant drops in GDP and is published and used by the EC in policy guidance and surveillance. A similar indicator was employed by Csortos and Szalay (2013 and 2014), their motivation in employing this variable being stated thus:

"*We will derive the definition from the existing mandates of the modern stability oriented central banks, that is, the goal of price stability. By achieving price stability, central banks aim to smooth out the business cycle, i.e. they want to prevent excessive negative deviation of the GDP from its long-term trend, often preceded by an overshooting of the trend. The reason is that an excessive negative GDP gap often forces economic agents into costly adjustments and means risk to financial stability. We will call a macroeconomic "imbalance episode" any level of GDP deviation below trend exceeding a predefined threshold."* (Csortos and Szalay, 2014, p. 7)

Our motivation in using output gap is closely linked to the EA specificities, but we do not focus exclusively on EA countries in the analysis. We distinguish between groups of EA countries, non-EA member states and then the EU. Most of the countries significantly affected by the crisis are from EA and non-EA countries aiming to join the EA as these should have synchronized business cycles with EA countries. Thus, we assume that the output gap is a relevant crisis indicator in the EU for all member states. For the dependent variable of crises, output gap data published by the EC (DG ECFIN Economic Forecasts) in the most recent Autumn 2016 forecast (European Commission, 2016b) covering the time period of 2001 – 2016 are used[13].

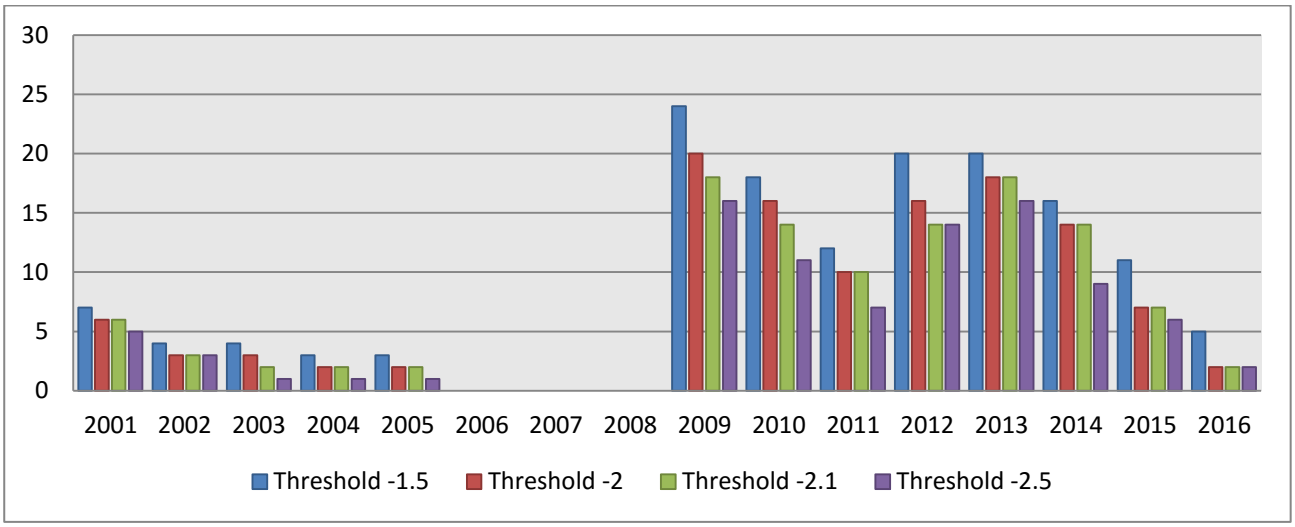
The threshold of the crisis event is determined in line with the lower quartile approach, which is often used by the EC. It was utilized when the threshold values of the MIP scoreboard headline indicators were defined (European Commission, 2012b). Similarly, Csortos and Szalay (2013) applied

[12] This indicator can address both the position of the country in the business cycle as well as the magnitude of the deviation of the cycle to a certain extent.

[13] Except for missing data for the UK in 2001–2003 and for France in 2001–2004.

the lower quartile approach for a different dataset and determined the threshold as negative 2. We define a crisis event as a situation when the output gap of a particular country decreases below negative 2.1 (Figure 1).

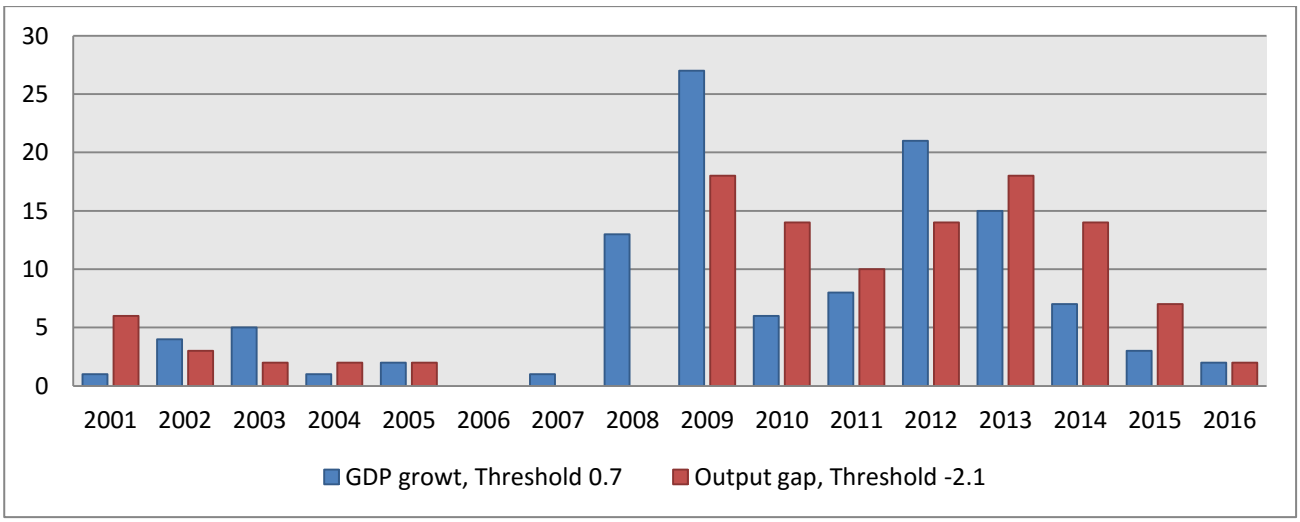
Figure 1 **Number of crisis events based on output gap data**



Source: Authors' calculations based on data from the EC.

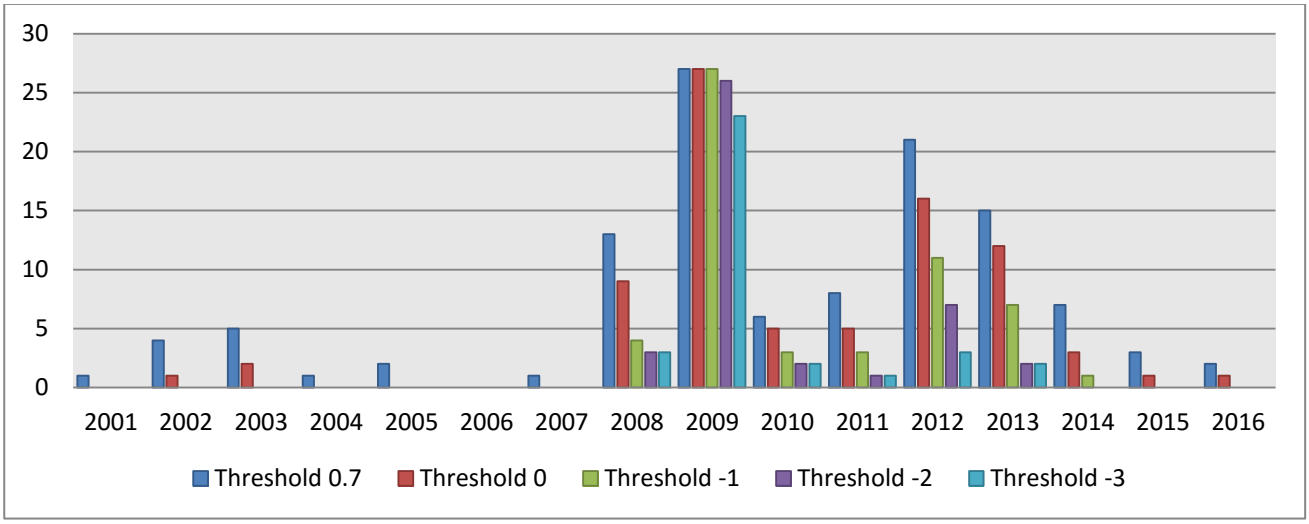
We considered a dependent variable defined as a deviation from the EU average, but later dismissed this, because it could lead to false results in case where events affecting the entire EU and GDP growth were also taken into consideration as a crisis indicator (similarly Domonkos *et al.*, 2017). In particular, we assumed that a sudden drop of GDP growth might be a good predictor of crises. Similar to the output gap, the lower quartile of 0.7 was tested as the threshold. This variable shows more similar characteristics to the output gap approach (Figure 2 and Figure 3), except for the pre-crisis year 2008. Furthermore, a sudden drop of GDP is accounted for in the output gap results, thus, henceforth we use only output GDP data.

Figure 2 **Number of crisis events based on GDP growth data and output gap data**



Source: Authors' calculations based on data from the EC.

Figure 3 **Number of crisis events based on GDP growth data**



Source: Authors' calculations based on data from the EC.

3.2 Signals Approach and the Policy Maker Utility Function

Our methodology assesses the predictive power of the different EWIs introduced as part of the MIP, along with specifying optimal EWIs thresholds given the preferences of decision-makers in terms of committing various types of errors.

The signalling framework introduced in Kaminsky, Lizondo and Reinhart (1998) represents a standard workhorse model to assess the performance of EWIs included in the MIP procedure (Csortos and Szalai, 2013 and 2014; Knedlik, 2014 and 2015; Boysen-Hogrefe *et al.*, 2015; Domonkos *et al.*, 2017). Implementing the EWI system can be a useful tool for policy-makers to tackle forthcoming events. On the other hand, implementing EWIs system brings about the possibility of event prediction error. Prediction errors rely on a level of (arbitrary) individual preferences of policy-makers, which directly affects the prediction threshold levels indicating an upcoming event. There are two types of prediction errors. If the threshold θ is too high, the event is not indicated (no warning). This is typically described as type I error - false negative. Type II error is related to low threshold level θ, when the signal obtained is false positive (false warning). The confusion matrix is usually specified in the following way:

Table 3 **Confusion matrix**

	Crisis event	No crisis event
EWI prediction	A	B
No EWI prediction	C	D

Source: Kaminsky, Lizondo and Reinhart (1998).

For the evaluation of the predictive properties of EWIs, four basic measures are usually employed (Csortos and Szalai, 2013; Candelon, Dumitrescu and Hurlin, 2012). False negative rate (FNR) computes the ratio of missed events to all events, false positive rate (FPR) compares a number of false signals to all tranquil periods and true positive rate (TPR, total accuracy, correct prediction

rate of crises, sensitivity) is the percentage of all correctly predicted events to all events. The specificity represents the proportion of calm periods correctly identified by the model.

The aNtS serves as a tool for evaluating the performance of individual EWIs or the entire system (Kaminsky, Lizando and Reinhart, 1998; Kaminsky and Reinhart, 1999; Alessi and Detken, 2014) by comparing FPR and TPR in the following way, given the pre-defined threshold value θ:

$$aNtS = \frac{FPR}{TPR} = \left[\frac{\frac{B(\theta)}{B(\theta)+D(\theta)}}{\frac{A(\theta)}{A(\theta)+C(\theta)}}\right] \tag{2}$$

In general, the desirable outcome of (2) is below unity for the given indicators and associated thresholds. Searching over all the possible realizations of θ, the optimal cut-off value then minimizes the aNtS criterion (Edison, 2003; Candelon, Dumitrescu and Hurlin, 2012). Another way of deriving optimal cut-off values is based on the credit-scoring approach (Candelon, Dumitrescu and Hurlin, 2012) that minimizes the absolute value of difference between sensitivity TPR and specificity.

The AUROC-based methodology uses the inverse of (2) in order to assess the reliability of the indicator benchmarking it with a random model. AUROC-based assessment of EWIs was advocated in Candelon, Dumitrescu and Hurlin (2012) and, since then, widely used in many recent studies (e.g. Drehmann and Juselius, 2014; Drehmann and Tsatsaronis, 2014).

The receiver operating characteristic curve plots combinations of TPR (sensitivity rate) and FPR over a set of possible threshold values. High thresholds generating a small number of signals will be located close to zero origin, while strict thresholds indicating a higher number of signals will be plotted close to the $[1; 1]$ origin. The integral of the area under the AUROC larger than 0.5 value signifies an indicator having an informative value better than the random model. The 95 percent confidence intervals for the AUROC score are calculated as an average of three algorithms as specified in Hanley and McNeil (1982), Qin and Hotilovac (2008) and Kottas, Kuss and Zapf (2014), namely, the Wald interval, Wald interval with continuity correction and Hanley and McNeil confidence intervals.

Losses related to forecasting errors are generally defined by loss function (Alessi and Detken, 2011; Csortos and Szalai, 2014). Loss function defines the cost of non-reaction to the crisis which does occur and the cost of adaptation to a false warning. The standard Alessi-Detken type of loss function is defined in the following way:

$$L(\mu) = \mu T_1 + (1-\mu)T_2 \tag{3}$$

where μ stands for the factor revealing policy-maker risk-aversion profile towards crisis avoidance, T_1 the type I error associated with share of missed crisis, and T_2 the type II error associated with share of wrongly signalled crisis. Using the confusion matrix specification, the type I error can be formulated as $T_1 = \frac{C(\theta)}{A(\theta)+C(\theta)}$, and the type II error as $T_2 = \frac{B(\theta)}{B(\theta)+D(\theta)}$, where classification of events depend on threshold θ.

The specification in (3) assumes unconditional probability of events and non-events is equal to 0.5 (see discussion in Csortos and Szalai, 2014). The standard Alessi-Detken type of loss function as in (3) might, therefore, be adjusted to account for the probability of crisis in the sample, as proposed in Sarlin (2013):

$$L(\mu) = \mu T_1 P + (1-\mu) T_2 (1-P) \tag{4}$$

where P represents the probability of crisis occurrence in the sample. The Sarlin-type of loss and utility function compensates for the relatively low crisis occurrences by preferences being strongly biased towards the EWI efficiency in predicting the crisis, as pointed out by Alessi and Detken's (2014) response to Sarlin's (2013) paper. As a consequence, in the Sarlin-type utility function framework, the policy-maker might be required to state his preferences in a very precise way as even relatively small changes might render EWI useless.[14]

The absolute utility function calculates the difference of potential loss generated by the model and the cost of completely ignoring EWIs system indicators. Positive values of absolute utility functions are treated as desirable outcomes signifying the added value of following the EWI system recommendations over the random model. Hence, the Alessi-Detken type of absolute utility function is of the following form:

$$U(\mu) = \min[\mu; (1-\mu)] - L(\mu) \tag{5}$$

As apparent, the specification of the policy maker's risk aversion coefficient μ represents a crucial issue in the process of EWI assessment. Usually, the decision range for policymakers is to set preferences (threshold) from interval 0.25 to 0.75 given their inclination towards either type of error. Maximum costs related to EWIs system are based on the probability of prediction error and cost of adoption by the type of error. In light of the recent crisis, however, it has become more evident that policy-makers' preferences have shifted towards more prudent behaviour. In the recent European Systemic Risk Board's publication (Detken *et al.*, 2014) on capital buffer requirements, the advisable sort of action places the μ coefficient within the $[0.5; 1]$ interval justifying this choice by considering policy-makers to be at least as concerned about the missing the crisis as with pre-emptive actions based on false predictions.

If the threshold for the computation of (4) and (5) is pre-determined at θ^* given the known structure of early warning system, is it possible to reveal policy-makers' preferences at the time of its construction. Following Knedlik (2014), the algorithm creates space consisting of absolute utilities given the combinations of all possible μ and θ as in (5). Then the implicit policy maker preferences coefficient μ^* is to be found in a combination of $[\mu^*, \theta^*]$ where utility $U(\mu^*)$ has

[14] An extension of the Alessi and Detken (2011) approach was proposed by Sarlin (2013). Sarlin argues that the method of Alessi and Detken (2011) fails with regard to imbalanced data and, thus, propose an approach which is different in three crucial areas: it considers unconditional probabilities, considers the proportion of available usefulness, and considers policymakers' individual observations. Later, Alessi and Detken (2014) argue, that the method of Sarlin (2013) is not able to account for marginal deviations of the preference parameter and is difficult to use for policy making.

a maximum at the given threshold. In other words, the algorithm searches for preferences coefficient μ^*, where the utility associated with the preferences μ^* reaches its maximum at the pre-determined value of θ^*.

3.3 Econometric Approach

Discrete choice models have emerged as one of the most common approaches to constructing EWS of currency crises, together with the development of alternative methodology on the EWS designated as signalling or signals approach (Kaminsky, Lizando and Reinhart, 1998). Both approaches were at that time applied in the context of predicting currency crises, or other related kinds of financial crises (Kaminsky and Reinhart, 1999).

The first steps towards estimating the probability of currency devaluation can be traced to the now seminal work of Blanco and Garber (1986) who used rather theoretical models for the case of Mexico. Expanding upon the work of Kaminsky, Lizando and Reinhart (1998), Berg and Pattillo (1999) applied pooled probit models on a similar data set (23 countries over the period 1970:1–1997:12 with monthly frequency, estimated on the sample 1970:1–1995:4) to compare the predictive power of the EWS suggested by the former authors, while introducing three additional EWS based on the estimated model. Similarly, Frankel and Rose (1996) estimated a pooled probit model on data at an annual frequency for 105 countries over the period 1971-1992, as part of their analysis of currency crashes. In the following years, Berg, Borensztein and Pattillo (2004) evaluated selected contemporarily used EWS models out of which the majority were discrete dependent variable regression models, namely probit and logit. Their analysis found that the regression models examined provide out-of-sample forecasts of lower accuracy than the alternative EWS model proposed by Kaminsky-Lizando-Reinhart (Berg, Borensztein and Pattillo, 2004). However, the assessed performance was still better than benchmark leading indicators. The authors suggested not using regression EWS models as the only method of currency crisis surveillance, but rather as a complement to more traditional approaches to early warnings, as they are systematic, objective, and not subjected to misperceptions (Berg, Borensztein and Pattillo, 2004). Another assessment of EWS methodology for banking crises occurrence was carried out by Davis and Karim (2008a), who compared the panel logit model approach with an alternative approach to constructing EWS models. When the in-sample prediction accuracy is compared, the logit model outperforms alternative signals methodology. The authors conclude that the econometric approach is more appropriate for a global level EWS, while an alternative approach which relies on signals is more suitable for creating country-specific EWS.

A methodological advancement in the field of financial crises EWSs, based on discrete dependent variable regression models, was made by Bussiere and Fratzcher (2006). The authors introduced a new concept of post-crisis bias, which can occur when the binary regression models do not account for the difference between tranquil and crisis/post-crisis periods. The authors suggested implementing a multinomial discrete dependent variable model framework to overcome this drawback, and specifically used a multinomial panel logit model, which provided better predictive capabilities than the analogous binary counterpart. Caggiano *et al.* (2016) compared alternative

EWSs of banking crises on the basis of binomial and multinomial logit models for a panel of 92 countries over the period 1982-2010, hence, further developing the concept of Bussiere and Fratzcher's (2006) afore-mentioned post-crisis bias. The main finding of the analysis is that for the global sample of countries, the multinomial logit outperforms the binomial logit, and that the improvement becomes more substantial with the increasing length of crisis episodes. Further developing the field of financial EWSs, Candelon, Dumitrescu and Hurlin (2012) proposed a unified toolbox for evaluating EWSs, independent of the nature of the model used. The authors provide a practical example of the toolbox application on regional panel logit models for predicting currency crises in emerging markets. The main finding of the analysis is that a cut off or crisis probability threshold should be taken into account when evaluating EWSs. Mulder, Perrelli and Duarte Rocha (2012) expanded upon the pooled probit model proposed by Berg and Pattilo (1999) by including corporate sector balance sheets, macroeconomic balance sheets, and legal environment indicators in the EWS model. The authors subsequently augmented the model to include financial sector indicators (Mulder, Perrelli and Duarte Rocha, 2016). In both cases the predictive power of the original EWS improved.

Valinskytė and Rupeika (2015) evaluated the performance of leading indicators and EWSs of systemic banking crises with regard to the conditions of Lithuania. While country specific binary logit models were posed as a complement to the signalling approach, the authors state that the superior performance of an EWS built on the basis of the logit model should still be tailored to specific groups of countries, rather than to more general groups. Also estimating an EWS model on more restricted sample, Tirpak (2005) analysed panel data at monthly frequency of eight new and prospective members of the EU (composed of mostly Central and Eastern-European countries and Turkey). He estimated the probability of currency crisis based on selected macroeconomic indicators using binomial pooled logit model, binomial random effects (RE) logit model, and, following the approach of Bussiere and Fratzcher (2006), multinomial pooled logit model. The author concluded that the inclusion of many indicators from first-generation currency crises models was supported by obtained estimates.

Lang and Schmidt (2016) performed an event study analysis and subsequent multivariate binomial panel logit estimation to propose a new EWS for banking crises, using imbalanced panel data with a monthly frequency for 70 countries potentially over the period 1975-2010. Among the main features of their analysis were the incorporation of fixed effects (FE), computation of average marginal effects, inclusion of interaction terms of broad liquidity ratio and demand deposits, omission of post-crisis periods, and utilization of different randomly divided subsamples for an out-of-sample evaluation. An alternative model-based approach for predicting financial crises was presented by Faranda *et al.* (2015), who estimated auto-regressive moving average models of selected stock indices, which can be subsequently used as their respective EWIs. The authors further suggest that the results of this approach can be improved by creating stock-specific models. In order to build financial early warning models on a corporate level, Shuangjie and Shao (2016) estimated a logit model to predict possible negative net profit. The authors also suggested a novel approach for the verification of the predictive power of the estimated model comparing it with the

results of data envelopment analysis. Káčer (2013) addressed the issue of predicting financial crises through modelling the probability of the bursting of asset price bubbles. For this exercise, daily data of Dow Jones Index and Hang Seng Index were used to estimate a linear probability model (LPM), probit and logit models, predicting bubble bursts based on prices, investor sentiment, indicators of explosive growth, and autoregressive terms. The estimated models showed a better predictive accuracy for Hang Seng Index than Dow Jones Index.

Further developing the EWS literature to include external debt crises as a special case of financial crises, Ciarlone and Trebeschi (2005) performed event study analysis, and estimated binomial and multinomial logit models to predict the occurrences of default or failure to meet external debt obligations for emerging market economies, while accounting for the difference between entering a crisis and being in a crisis. The authors found both models to produce a rather high number of false alarms. Fuertes and Kalotychou (2007) proposed a combination of parametric regression methods (univariate logit, multivariate logit, K-means clustering) to build a debt crisis EWS tailored to decision-makers' preferences. The authors reached the conclusion that in cases where the decision-makers are risk-averse, an EWS based on a combined approach outperforms EWSs based on all the individual methods considered, or on a naïve model. Manasse and Roubini (2009) investigated the circumstances under which debt crises typically occur using classification and regression tree methodology, which is a data mining technique for the identification of combinations of variable characteristics which can be regarded as crisis-prone. The authors subsequently tested the statistical significance of the combinations obtained using a logit model with indicator variables. A tree-based EWS provided a rather high in-sample predictive accuracy, while the authors found the out-of-sample performance to be unsatisfactory. Rather than developing another EWS, Davis et al. (2016) estimated LPMs and binomial logit models of banking crises for an unbalanced panel of 35 countries potentially from the year 1975. By means of the described models, the authors estimated the marginal effect of private sector credit growth, while considering that the marginal effect is also a function of the current account level, expressed via interaction terms. The analysis was concluded with the observation that the private sector credit growth marginal effect was, in the case examined, highly dependent on the current account level.

Another parallel strand of literature, which popularized the use of discrete choice models in a similar manner focuses on the probability of economic recession, as presented by Estrella and Hardouvelis (1991), and Estrella and Mishkin (1998). Building upon the work of the latter, Kauppi and Saikkonen (2008) developed the theory of estimating dynamic binary dependent variable models, by incorporating a lagged dependent variable and its lagged probability into the model. Comparing model in-sample and out-of-sample performance in predicting recessions on quarterly U.S. data from 1955:Q4 to 2005:Q4 with a static model, the authors concluded that the dynamic model which also considers a lagged probability outperforms the static model, and is rather inferior to the dynamic model which includes a lagged binary dependent variable.

With regard to the MIP, Boysen-Hogrefe *et al.* (2015) evaluated the early warning properties of MIP Scoreboard indicators for predicting banking, currency, and sovereign debt crises using the

signals approach. However, using the data describing results of the initial four cycles of the MIP, the authors estimated pooled binary probit models for the assessment of the effect of signals from nine headline indicators on initiating an in-depth Review, as well as pooled-ordered probit models to estimate the resulting classification of member states after the MIP was carried out. The authors concluded that the indicators of export market share and public debt drive the final classification of the MIP for a particular country.

For the evaluation of the early warning properties of the MIP Scoreboard, limited dependent variable regression models, also known as discrete choice models were used to create a single EWS. Since the two most common special cases of index models, the probit and the logit, are frequently used in EWS literature, both of them were employed in the analysis presented. The analysis, therefore, focuses on the explanation of a discrete dependent variable, which is, in most cases, a binary variable, representing the situation when macroeconomic imbalances surpass a selected threshold (further details of the dependent variable are provided in the Section 3.1). The dependent variable, together with the rest of the Scoreboard's headline indicators, was potentially available for the 28 EU countries over the period 2001-2016. The word "potentially" in this context indicates that not all of the indicators were reported for every country in every examined year. Therefore, the analysis was focused on the imbalanced panel data framework.

Attention was also paid to the in-sample and out-of-sample performance of the constructed EWS. Thus, multiple estimations were carried out, using both the entire sample with all available data over the period 2001-2016 for the in-sample statistics, and a subsample for the period 2001-2012 which also permitted the computation of alternative in-sample statistics, but most importantly provided the out-of-sample statistics for the not included subsample 2013-2016. Additionally, both the entire samples and the subsamples were further split to include either the countries which were part of the EA during the observed period, or the member states of the EU which were not part of the EA over the observed period. For countries which entered the EA during the observed period 2001-2016, each country was assigned to both groups for the periods it corresponds, while using the year of performing financial operations in the Euro currency as the breaking point for including the county into the group of EA members.

Following Kačer (2013) and Davis *et al.* (2016), the LPMs were also employed as more recent papers (e.g. Lang and Schmidt, 2016, Davis *et al.,* 2016) draw attention towards marginal effects (also referred to as partial effects by Wooldridge, 2010, which are used interchangeably in the following text) of nonlinear specifications rather than slope coefficients. Wooldridge (2010) asserts that LPM consistently estimates average marginal effects, if the vector of explanatory variables follows a multivariate normal distribution. Although this condition is unlikely to be satisfied in the sample used, the LPM results may still serve as a broad benchmark for the average marginal effects estimated via probit and logit models.

The LPM approach served as the starting point of the analysis. The possible application of the ordinary least squares (OLS) method for the analysis of panel data in this context allows us to distinguish different assumptions about the unobserved effects. The analysis approaches the LPMs

by simultaneously using pooled OLS estimation, FE estimation, and the RE estimation technique (which was estimated by the generalized least squares method). In order to test for the most appropriate estimation technique, several statistical tests were employed. Following Wooldridge (2010), the presence of unobserved effects was tested using the Breusch-Pagan statistic and also through a quasi-time-demeaned-data test of serial correlation which does not rely on normality assumption. The consistency of RE estimates was verified using the Hausman test, which relies on the artificial regression approach. Similarly, the equality, or the relevance, of FE was tested for the FE estimates obtained through the dummy variable least squares method with ordinary standard errors (Wooldridge 2010).

However, there is an issue of heteroscedasticity, which stems from the assumption of the Bernoulli distribution of the dependent variable (Wooldridge, 2010). Given the additional serial correlation within the member states, which can be expected for sample analysed, cluster-robust standard errors, which are a generalization of heteroscedasticity-robust standard errors introduced by White (Cameron and Trivedi, 2010), were used in all of the estimated models, if not stated otherwise. The standard errors estimated this way are consistent in the presence of heteroscedasticity and serial correlation within cross-sectional units, but are biased if the assumption of uncorrelated error terms over cross-sectional units (i.e. member states) is violated (Hoechle, 2007). In order to ensure that this assumption holds for the used data and models, the Pesaran (2004) test of cross-sectional dependence was used for FE and RE estimates. To account for potential cross-sectional dependence, Driscoll-Kray standard errors were also used for the variant of pooled and FE estimates, which are consistent in cases of heteroscedasticity and serial correlation over time and cross-sectional dimension (Hoechle, 2007). As an alternative treatment of cross-sectional dependence, panel-corrected standard errors were used for a separate pooled model (Cameron and Trivedi, 2010). Finally, residuals of all LPM models were tested for normality of distribution using Royston's (1991) empirically adjusted D'Agostino test.

Similar to the LPM approach, the binomial panel logit models were estimated using the pooled, FE, and RE techniques, and by employing the maximal likelihood method. In this case, the RE approach was expanded by permitting the correlation of RE with explanatory variables via the so-called Chamberlain's correlated RE logit model (which is henceforth referred to as Chamberlain's logit model) and state dependence through a dynamic RE logit model (which henceforth referred to as dynamic logit model), which treated the initial observation as nonstochastic (Wooldridge, 2010), as Chamberlain's approach to the RE dynamic model in the case presented was not feasible. These models permitted us to test whether RE are correlated with explanatory variables and the state dependence, respectively. The assumption of uncorrelated RE was also tested via the rather traditional Hausman test framework, using ordinary standard errors. The potential merit of a simple pooled logit model was also investigated by the dynamic completeness test described by Wooldridge (2010).

To account for the possible post-crisis bias introduced by Bussiere and Fratzcher (2006), two multinomial pooled logit models were estimated. The models consider one and two periods after

a crisis period as post-crisis periods, respectively, and therefore provided an insight into how much the post-crisis bias might have affected the results of binomial models. Both the multinomial and binomial models were estimated using cluster-robust standard errors, while other approaches (FE and RE techniques) rely on ordinary standard errors. The probit setting mirrors the logit setting in all models and tests used, with the exception of the FE binomial probit estimator which is inconsistent due to incidental parameters problem (Wooldridge, 2010).[15]

To generalize the analysis performed, a general notification for index models is adopted from Wooldridge (2010) and expanded further in the text, in order to describe the EWS based on the aforementioned models estimated through different techniques of the limited dependent variable framework.

$$\mathrm{P}(y=1|\mathbf{x}) = G(\mathbf{x}\boldsymbol{\beta}) \equiv p(\mathbf{x}) \tag{6}$$

In equation (7), y presents the limited (in most cases binary) dependent variable, where value 1 represents the crisis event, $\mathbf{x}$ is the vector of K explanatory variables and, if not stated otherwise, it includes all 14 headline indicators of the MIP Scoreboard which are lagged selected number of periods in order to assess their ability to predict future crisis events, $p(\mathbf{x})$ is a function of $\mathbf{x}$ obtained through the index $\mathbf{x}\boldsymbol{\beta} = \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_K x_K$, and $G(\cdot)$ is the function that maps the described index to space of response probability (Wooldridge 2010) and, simultaneously, determinates the nature of the index model. In the case of the LPM, $G(\cdot)$ is the identity function (Wooldridge 2010):

$$G(z) = z \tag{7}$$

In relation (7), z is a real number. In the case of the logit model, $G(\cdot)$ is logistic cumulative distribution function (Cameron and Trivedi, 2010):

$$G(z) = \Lambda(z) = \exp(z)/[1+\exp(z)] \tag{8}$$

In the case of the probit model, $G(\cdot)$ is the standard normal cumulative distribution function (Wooldridge, 2010):

$$G(z) = \Phi(z) = \int_{-\infty}^{z} \phi(v)\mathrm{d}v = \int_{-\infty}^{z} (2\pi)^{-1/2} \exp\left(-v^2/2\right)\mathrm{d}v \tag{9}$$

Following also the approach of Berg and Pattilo (1999), an indicator model was estimated in addition to models focusing on levels of the variables. This model uses the indicator form of the original explanatory variables. Hence, they are expressed as binary variables, obtaining value 1 when the individual threshold of a particular headline indicator was surpassed, and 0 otherwise. All of the original 14 headline indicators were expressed in this form and included in a separate

[15] The probit setting also features Chamberlain's correlated RE probit model, which is analogously henceforth referred to as Chamberlain's probit model and dynamic RE probit model which is henceforth referred to as dynamic probit model,

model framework with an analogous outline to the equation (6). In contrast to Berg and Pattilo (1998), an LPM framework which corresponds to the relation (7) was applied to this model framework, together with all described specifications and tests. Furthermore, two multinomial pooled logit models and two multinomial pooled probit models were also estimated for the indicator model framework to account for potential post-crisis bias. Similar to logit and probit framework described above, one and two periods, respectively, were assumed to be post-crisis periods.

As stated above, the results of logit and probit models are reported as averaged marginal effects with corresponding *p*-values based on standard errors obtained through the delta method, in case of ordinary standard errors of original coefficients, or through the linearization and variance estimator for the total score. Additionally, together with each model the R-squared statistic is reported, which is McFadden pseudo-R-squared in the case of the index models, as well as specific R-squared statistics in some panel cases for within, between, or overall variability explained by the model.

Goodness of fit measures are also reported, for the selected positive outcome threshold (cut off) of 0.5, including the percent correctly predicted (Wooldridge, 2010), the percent of crises periods correctly identified, and adjusted noise to signal ratio. Furthermore, absolute utility is also presented for the case of decision-makers' preference at the level of 0.5. Following the approach of Candelon, Dumitrescu and Hurlin (2012), the statistic for AUROC is also computed. All of the mentioned goodness of fit measures were reported for the in-sample assessment, as well as for the out-of-sample assessment, for which all the statistics were provided for the entire sub-sample, as well the first year of the sub-sample.

Expanding on the proposed approach of Candelon, Dumitrescu and Hurlin (2012) that the EWS should be evaluated by criteria which are not subjected to the selection of positive outcome threshold, in-sample and out-of-sample AUROC statistics were computed for the same models, which were estimated without a selected headline indicator. Furthermore, the equality between the AUROC statistic of unchanged model and model, which excluded a selected indicator, was tested, applying the generalized U-statistic theory, as suggested by DeLong, DeLong and Clarke-Pearson (1988). Such results of the test for every model specification were reported for each headline indicator, which gave alternative information about the statistical significance of each of the 14 headline indicators, from the perspective of their ability to improve the prediction accuracy measured by the AUROC statistic.

The results of the estimations are presented in Appendix F, leaving blank cells in all rows except the number of observations and R-squared, when the model was not possible to estimate. In case that it was not possible to obtain average marginal effects for the model, all of the coefficients are left blank, with corresponding goodness of fit measures still provided.

4 Results and discussion

4.1 Evaluation of the Scoreboard Variables – Signals Approach and Loss and Usefulness Functions

In Appendix E, for each baseline and auxiliary indicator, the following properties are specified: individual AUROC score with confidence intervals, implied policy-maker preferences, implied absolute utility, prediction rate, inverse value of the aNtS ratio, and a specification of optimal threshold values given the aforementioned characteristics. Confidence intervals for the AUROC score are calculated as specified in the Section 3 and reflect the underlying distribution of crisis and non-crisis periods in the sample. Since we analyse list of all headline and auxiliary indicators, to make our results better readable we organize list of indicators based on their economic nature into three headline groups, namely external sector, labour market and credit and debt indicators and add fourth subgroup for selected auxiliary indicators (real economy indicators). In general, the implied policy-maker preferences reveal a minor tendency of policy-makers towards crisis-avoidance behaviour with regard to the house-priced index (0.716 on average, full sample) and the youth unemployment rate (0.621 on average, full sample) serving as extreme examples of highly crisis risk-averse policy-makers.

- ***External Sector Indicators***

The possible extent of external imbalances is captured by the five baseline indicators (current account balance, REER change, export market share, change in nominal unit labour costs and net international investment position) and a list of associated auxiliary indicators. Overall, measures of external exposure succeed in rendering a list of relatively good performing indicators that maintain their properties over all three time horizons.

The external sector indicators tend to perform better for the subsample of EA countries (Appendix A), especially in the case of net international investment position and current account related indicators. Taking into account the AUROC scores, along with the prediction rate, given the absolute utility maximizing policy-maker preferences, the current account negative balance (and net international investment positions belong to the best performers in all lag specifications). The change in the export market share achieves its best properties in a one-year lag specification. The optimization procedure delivers optimal thresholds that justify the call for a more risk-averse policy-maker behaviour in cases where there is a negative current account balance (-1.1 to -2.0) and net international investment position, especially if serving as a very EWI (-18.3 for three-year lag). On the other hand, changes in export market share, the nominal unit labour cost index and REER tend to be associated with more relaxed optimal thresholds in comparison to the official ones.

Conversely, relatively strict official thresholds imposed on the non-EA countries group tend to deliver only sub-optimal outcomes, potentially forcing policy-makers to adopt economically harmful counter-measures. A negative absolute utility associated with an excessive inclination towards conservative behaviour (avoiding Type I error) is present in all cases, except a change in

nominal unit labour costs for the longest three-year horizon (maximum absolute utility, 0.010). The values of utility-maximizing thresholds justify a call for more relaxed policy-maker attitudes, with the optimal value set in the range of minus 10 to 13 percent change of export market share, minus 10 percent for current account balances (two- and three-year lag), an interval of minus 58 to 87 percent for net international investment position, as well as a less binding upper threshold for the nominal unit labour cost index converging to 22 percent in the three-year lag horizon.

From this perspective, the decision of the EC to impose a different set of binding thresholds for non-EA countries seems to reflect underlying economic conditions, even if the still more risk-averse attitude might potentially lead to a sub-optimal outcome. Yet, by an even more precise specification of official thresholds used for issuing crisis signals, the performance of all external sector indicators might be substantially improved, as measured by inverse an aNtS ratio bigger than unity, as well as a boost in the prediction rate (0.67 on average for the full sample) in comparison to its pre-determined levels (0.56 on average for the full sample).

The widely debated upper cap on the current account balance set at six percent of GDP does not deliver the expected outcomes for the estimation of indirect utility, even though relatively optimally specified (5.5-6.2 for full sample). Interestingly, better than random model performance is achieved in the subsample of non-EA countries, rather than using the sample with Germany and the Netherlands included. The optimal limit imposed by the model of around two percent must be, therefore, viewed in light of the different non-EA countries' experience, rather than an issue of lavish positive current account balances in the case of Germany or the Netherlands.

Appreciation of the REER is usually viewed as a signal warning from a possible deterioration in price competitiveness. Conversely, persistent and excessive REER depreciation might spill over into the domestic economy by driving up imported inflation and/or limit a healthy increase in domestic price levels and nominal wages. In both cases, optimal bounds place the upper limit highly above official EC thresholds, with a value of 27 (EA) and 19 (non-EA) percent change, justifying a call for more than two to three times looser upper bounds.

The change in nominal unit labour costs, as a measure of economic competitiveness, does perform poorly in shorter horizons, even if rather closely specified to the optimal threshold, a finding further reinforced by the modest outcome for the inverse aNtS ratio and prediction rate. However, signs of improvement in a specification with a three-year lag indicate that this EWI might be potentially viewed as one of early indicators whose longer-horizon properties should be investigated in a more detailed way. It is rational to assume that the effects of negative development in nominal unit labour costs will take a longer time to materialize, hence preceding the crisis occurrence with a relatively long time gap.

The set of auxiliary indicators for external economic conditions mostly include diverse variations of baseline indicators, either due to the different methodology of computation or different specification (net lending/borrowing indicator, REER for EA trading partners, OECD export) with some newly introduced indicators present (direct investments in stocks and flows, terms of trade,

net external balance of energy products). While for most of the time over-performing the random model by achieving an AUROC score higher than 0.5, none of them would deliver a significant improvement in MIP signalling properties for either the EA or non-EA group of countries.

Furthermore, many of the newly introduced indicators are associated with a highly skewed underlying data distribution, either due to the presence of countries operating as financial centres (Luxembourg, Cyprus and Ireland for direct investments and net external debt-related indicators) or the existence of convergence processes leading to, or stemming from, deep structural changes (nominal unit labour costs index).

- ***Credit and Debt Indicators***

The reliance of economies on various forms of domestic or foreign financing is reflected in the findings related to the second list of MIP indicators. Indicators representing this group include measures of private and public debt levels, flow indicators of financial system evolution and one indicator aiming to capture recent experience of adverse effects of credit cycles across Europe. Contrary to the external sector group of indicators, the overall performance of most of the indicators ranges from meagre to modest, at most, with only private sector debt over-performing its peers consistently over the time specification or choice of country subsets.

Economically, the levels of threshold adopted by the MIP procedure are too strict in most cases (optimal public debt ratio being larger than the official one by a factor of 1.8, optimal private debt ratio by a factor of 1.3) or sometimes too relaxed, especially over the long-term horizons for flow variables (total financial sector liabilities, private sector credit flow). However, these findings are likely to be driven by country-group specific characteristics, as apparent in the estimates for the subset of non-EA countries (Appendix A). The optimal threshold values, especially in the case of private sector debt (interval between 68 and 101 percent) and general government debt (interval between 28 and 69 percent), would require countries to adopt more stringent policies than the official thresholds might indicate. Not surprisingly, the optimal threshold levels mirror, to some extent, the underlying data distribution with average private and public sector debt levels for non-EA countries much lower than those of other European developed economies.

It has been generally argued that since real asset price bubbles had accentuated problems in domestic financial markets and led to an outburst of several domestic debt crises, variables associated with financial cycles might serve as good warning indicators. Yet, the house price index indicator performs worse among all the other indicators in the three criteria considered - the AUROC score, inverse aNtS and absolute utility value, while its prediction rate score ranks as only as a modest performer. On top of that, not only does the derived optimal threshold resemble the one imposed by the MIP procedure (18.5 percent for three-year lag), estimates for shorter time lags suffer from strong corner-solution issues, making the short-term estimates highly questionable. On the other hand, while reported only for the set of auxiliary indicators in Appendix A, the house price index indicator delivers an arguably superior performance over the short-term horizon, once a *drop* in the house price index is considered, rather than its increase.

Since this result is further supported by findings in (Babecký *et al.*, 2013), as well as by the outcomes from probability model estimates, the ability of indicators to capture financial cycle properties to signal incoming crises in the real economy needs to be further reassessed, reflecting possible decoupling of real economic and financial cycles (Drehmann, Borio and Tsatsaronis, 2012) in line with the reasoning provided by Drehmann and Juselius (2014), and Drehmann and Tsatsaronis (2014). The advocacy for the credit-to-GDP gap early warning indicator presents a strong case to re-consider the current structure of the baseline MIP scoreboard.

Among the list of auxiliary indicators, different variations of baseline indicators do not represent a significant step forward in improving the overall performance for either private or public sector debt, no matter which subsample is used. On the other hand, financial sector leverage seems to be a promising candidate to draw on, once the possibilities of incoming crises in the EA country group are assessed. Scoring high in both AUROC and prediction rate scores, with more pronounced signalling properties over shorter-term horizons (two-year and one-year lags), this indicator might be successful in indicating incoming problems stemming from over-leveraged banking systems in more advanced economies with a deeper financial system.

- ***Labour Market and Social Conditions Indicators***

Among the labour market and social conditions group of EWIs, four baseline MIP scoreboard indicators are accompanied by a set of auxiliary indicators representing either their variations, or capturing a new dimension of social and labour market conditions (young people neither in employment nor in education or training, people at risk of poverty, severely materially deprived people and people living in households with very low work intensity). In general, labour market baseline indicators achieve a modest performance measured by the respective signalling properties in the long-term, but significantly improve their performance in a very short-term horizon (one-year lag).

Changes in the long-term unemployment and youth unemployment rate belong to the best performing indicators among all the EWIs analysed, achieving the highest-ever AUROC score, well above 0.7 value in all samples (EU, EA, non-EA). It is worth noting, that pre-determined thresholds almost coincide with the optimal thresholds derived by our algorithm for two indicators (activity rate, long-term unemployment rate) or might be set to be more accommodating in order to achieve the best signalling properties (youth unemployment rate, total unemployment rate).

The highest absolute positive utility with a good prediction rate only further justify the inclusion of those two best performing labour market indicators in the baseline MIP scoreboard. Once we move into longer-term horizons (lag 3), however, the indicators lose their favourable properties, with only one exception being the youth unemployment rate, especially in the case of EA countries.

There is a strong discrepancy between the officially established and optimal thresholds in the case of the total unemployment rate for which the optimal threshold is set to approach almost 20 percent in the total sample (three-year lag). The high difference in optimal thresholds between EA and non-EA countries in the case of this indicator pinpoints diverse economic conditions between

developed and transitioning economies with optimal values sharply declining from 14.7 (non-EA, one-year horizon) to 2.2 percent (non-EA, three-year lag), on the one hand, while maintaining stable thresholds of 11 percent over all horizons for the group of EA countries.

As in previous cases, most of the auxiliary indicators do not deliver a significant improvement in the performance of baseline indicators adjusted by various methodological changes. However, the short-term horizon (1 year) change in the employment rate and young people neither in employment nor in education or training indicator stands out as one of the best performers among both baseline and auxiliary indicators, achieving the third and fifth highest value for optimal absolute utility. Mirroring the evolution of baseline indicators, this good performance deteriorates quickly once we move to higher time lags.

In summary, while the outcomes in Appendix A might still be used by policy-makers to set up some sort of internal tentative thresholds (e.g. 65-80 percent for activity rate), the signals emanated by the set of all labour market and social conditions indicators should be taken with a high degree of caution since they tend to produce a higher portion of noise over longer time periods. Recently, the Ecofin council in its notes from the January 15 meeting acknowledged that since social and labour market indicators are not relevant for identifying macro-financial risks, the developments in these indicators cannot trigger the steps in the MIP procedure (Council of the European Union 2016, §6). Our outcomes both support and reject this statement given the performance of the selected indicators over time. As our crisis variable is built upon a drop in output gap, the deteriorating labour market and social conditions might reflect an overall drop in economic activity closely preceding the crisis occurrence, hence calling into question their usefulness for signalling over longer time horizons.

- ***Real Economy Auxiliary Indicators***

This group of indicators includes only a short list of four indicators related to business cycle properties and evolution. Not surprisingly, a negative change in real GDP signifying the formation of a downward trend in real economic activity succeeds in signalling a crisis event shortly before the drop in GDP gap. Two other indicators, gross domestic expenditure on R&D and gross fixed capital formation, perform very poorly in the case of non-EA countries whereas the EA group of countries show some modest signs of improvement of signalling properties for gross domestic expenditure on the R&D indicator. The residential construction index, on the other hand, behaves pro-cyclically over longer time horizons (3 years) signalling imminent crises well in advance, once it breaches the optimal thresholds of 2.7 percent, but only for the group of non-EA countries.

While analysing the performance of baseline MIP indicators before the 2009 crisis,[16] some of the findings stand out. Firstly, the majority of EWIs achieve aNtS score higher than unity, which signify higher portion of noise than correctly predicted signals. As in the case of estimates using whole

[16] Retrospective avaluation of the MIP Scoreboard in terms of number of signals was already done by Essl and Stiglbauer (2012), Kamps et al (2013) and Šikulová (2015). We rely on the AUROC and aNtS from signals approach and the econometric approach to revisit the subbject from a different perspective.

sample, external sector indicators deliver better results, with REER, export market share, and nominal unit labour costs indicators dominating the scoreboard. On the other hand, their not-so-powerful prediction rates put them into slight disadvantage when used for crisis prediction. Overall, the export market share appears to achieve best combination of aNtS ratio and prediction rate of 0.824 and 0.71, respectively. From the group of credit and debt indicators, only private sector debt might be considered to be used as reliable EWIs with both aNtS smaller than one and prediction rate at 0.65. House price index fails to show expected performance as its aNtS score and prediction rate put it into the worst position among all scoreboard indicators. Labour market indicators deliver a combination of over-the-average aNtS scores, however, their aNtS scores show that they still produce more noise than reliable signals, with activity rate being an exception. Overall, these outcomes support findings from our analysis using entire dataset by identifying external sector indicators and set of selected labour market indicators along with private sector debt as potentially best EWIs among the MIP scoreboard.

Table 4 **Performance of headline MIP indicators before the crisis in 2009**

Scoreboard Indicators one year lag		Official threshold		
		Value	Prediction Rate	aNtS
External Sector Indicators				
Current account balance - % of GDP, 3 years average	*UP*	6.0	0.434	1.113
	DOWN	-4.0		
Real effective exchange rate, 42 trading partners - 3 years % change	*UP*	11.0/4.0	0.518	0.877
	DOWN	-11.0/-4.0		
Export market shares - 5 years % change	*UP*	x	x	x
	DOWN	-6.0	0.710	0.824
Nominal unit labour cost index - 3 years % change	*UP*	12.0/9.0	0.523	0.731
	DOWN	x	x	x
Net international investment position - % of GDP	*UP*	x	x	x
	DOWN	-35.0	0.580	0.948
Credit and Debt Indicators				
Private sector credit flow, consolidated - % of GDP	*UP*	14.0	0.556	1.891
	DOWN	x	x	x
Private sector debt, consolidated - % of GDP	*UP*	133.0	0.646	0.846
	DOWN	x	x	x
General government sector debt - % of GDP	*UP*	60.0	0.636	1.374
	DOWN	x	x	x
Total financial sector liabilities, non-consolidated - 1 year % change	*UP*	16.5	0.582	1.645
	DOWN	x	x	x
House price index, deflated - 1 year % change	*UP*	6.0	0.400	6.077
	DOWN	x	x	x
Labour Market Indicators				
Activity rate (15-64 years) - % point change (t, t-3)	*UP*	x	x	x
	DOWN	-0.2	0.739	0.962
Long-term unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	0.5	0.695	1.601
	DOWN	x	x	x
Youth unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	2.0	0.665	1.011
	DOWN	x	x	x
Unemployment rate - 3 years average	*UP*	10.0	0.685	1.125
	DOWN	x	x	x

Source: Authors' calculations based on data from the EC and Eurostat.

4.2 Evaluation of the Scoreboard Headline Indicators – Econometric Approach[17]

As mentioned in the Section 3.3, the LPM will serve as a starting point for the econometric analysis, results of which are presented in Appendix F. After having performed statistical verification, the validity of the results obtained was assessed. The Pesaran test for cross-sectional dependence, in those cases which permitted its computation, indicated that the cross-sectional units (the countries of the EU) are, in most models, dependent. This may call into question the efficiency of some of the estimates. Furthermore, the D'Agostino test for normality shows that the residuals are not normality distributed for the vast majority of models. Statistical inference based on t-distribution is, therefore, very likely to be biased, in such cases. The average marginal effects estimated via the logit and probit framework can be robust against such error term misspecification (Wooldridge 2010), but the majority of the estimated effects may still be carrying remnants of high multicollinearity, which is in case of some indicators apparent when observing correlation matrices in Appendix G. This may complicate the analysis, as well as result in false conclusions being drawn. The focus of the presented evaluation has been, therefore, on the prediction accuracy of each estimated model, rather than individual indicators. However, some general results for marginal effects are later commented upon, if they are relevant for the conclusion of the entire analysis. Following Candelon, Dumitrescu and Hurlin (2012), the prediction performance of all models was evaluated mostly by using the AUROC, which is more reliable than statistics based on arbitrarily set positive outcome threshold (cut off). Nevertheless, the additional goodness-of-fit statistics are still presented for the positive outcome threshold value 0.5.

The EWSs constructed for EA countries by means of the estimation of discrete choice models (Appendix F), while using all the headline indicators of the MIP Scoreboard, do provide different results based on the time horizons, as well as specifications, used. In the one-year horizon, the maximum in-sample AUROC is obtained for Chamberlain's logit model with value 0.987 when all available periods 2001-2016 are used, and with value 1 when subsample 2001-2012 is used, which is identical to the AUROC value for Chamberlain's probit model for the same subsample. The highest achieved in-sample AUROC for the indicator model, which only uses information about exceeding the indicator thresholds, is 0.87 for the entire period when using the FE model, and 0.874 for the subsample, also for the FE model. The maximum out-of-sample AUROC is achieved for the dynamic logit model with the value 0.898, while the best indicator model, which is in this case the FE model, provides an AUROC value of 0.753. When all the available years are used, the most reliable in-sample performance in predicting economic crises for EA countries in the two-year horizon is achieved by Chamberlain's logit model with the value 0.956. For the subsample 2001-2012 the Chamberlain's probit model provides the highest in-sample AUROC in the two-year horizon, with the value 0.987. The indicator model yields its best performance for the FE model with AUROC values of 0.864 and 0.92 for the entire sample and the subsample, respectively. The out-of-sample AUROC reaches its peak for the dynamic probit model with the value 0.83, while the

[17] Following text is of a technical nature and all the results of the estimations for EA, non-EA, and EU countries are listed in Appendix C, Appendix D and Appendix E, respectively.

indicator model provides the highest out-of-sample performance for FE with the value 0.644. For three-year EWS models focused on EA countries, the highest obtained in-sample AUROC is for Chamberlain's logit model with a value of 0.976 and 1, when using samples 2001-2016 and 2001-2012, respectively. The top performance, in the case of the 2001-2012 subsample is, however, shared with Chamberlain's probit model, which also yields the AUROC statistic at 1. The indicator model framework can, in such a case, provide a maximal in-sample AUROC at the level of 0.864 for the entire sample, and 0.927 for the subsample, via the FE model. The out-of-sample performance is at its highest for the FE LPM with a value of 0.773, while in the indicator model framework, the highest out-of-sample AUROC is also achieved for the FE model which produces a value of 0.698.

In the case where the focus is only on non-EA member states of the EU, the highest in-sample AUROC at values of 0.991 and 1 is yielded by Chamberlain's logit model for the entire sample and the subsample, respectively. In the case of the subsample 2001-2012, there is also another candidate with an AUROC value of 1, which is again Chamberlain's probit model. The highest in sample performance for the indicator model framework is also obtained in the case of non-EA countries for the FE model, with a value of 0.913 for the entire sample and 0,958 for the subsample. Contradicting previous tendencies, the out-of-sample AUROC for the one-year EWS focused on non-EA countries achieves its peak when the RE logit model is used, which produces an AUROC value of 0.811. In the case of the indicator model framework, the maximum out-of-sample performance is again provided by the FE model with a value of 0.764. For the two-year-prediction horizon, the best in-sample performing model depends on the number of years used for the analysis. If all available years are considered, then the maximal in-sample AUROC is again provided by Chamberlain's logit model with a value of 0.947. For the subsample 2001-2012, the best performing model with an AUROC value of 0.989 is Chamberlain's probit model. When considering only the indicator model framework, the best performing is repeatedly the FE model, with in-sample AUROC values of 0.879 and 0.9 for the entire sample and subsample, respectively. The highest out-of-sample AUROC in the case of two-year EWS models for non-EA countries is obtained for the dynamic logit model, which provides an AUROC value of 0.769. The best performing model of the indicator model framework is the FE model with an out-of-sample AUROC value of 0.616. Similarly, with regard to the two-year horizon, the nature of the model which achieves the highest in-sample AUROC is also dependent on the selection of samples in the case of three-year EWSs for non-EA countries. For the entire sample, the maximum is achieved at a value of 0.976 when using the Chamberlain's logit model, while in the case of the subsample, the highest in-sample AUROC is obtained for Chamberlain's probit model with a value of 1. Corresponding indicator model framework maxima are again provided by the FE model with values of 0.904 and 0.962 for the entire sample and subsample, respectively. The out-of-sample AUROC for the three-year horizon peaks with the dynamic logit model at a value of 0.68. In cases where only the indicator models are considered, the highest out-of-sample AUROC is achieved at a level of 0.641.

When evaluating the EWS performance for the entire EU, the maximum of the in-sample AUROC is in the case of the one-year horizon provided by Chamberlain's logit model, regardless of the sample used. The maximum AUROC value, however, does slightly change with the number of

years included in the sample, yielding 0.936 for the entire sample and 0.937 for the subsample 2001-2012. The indicator model framework provides its maxima for the FE model, which produces an in-sample AUROC with values of 0.878 and 0.896 for the entire sample and subsample, respectively. The best out-of-sample is achieved for the dynamic logit model with an AUROC value of 0.847. The performance of the EU-wide EWS in the two-year horizon may be characterised by in-sample AUROC maxima at values of 0.915 and 0.914, which are achieved when estimating Chamberlain's logit model on the entire sample and the FE LPM on the subsample 2001-2012, respectively. The indicator model framework provides its highest in-sample AUROC for the FE model, which achieves its maximum at 0.831 when the entire sample is used and at 0.855 for the subsample 2001-2012. The best out-of-sample performance for the entire EU is obtained for the dynamic logit model with a value of 0.811, while the highest out-of-sample AUROC within the indicator model framework is 0.63 for the RE model. For the three-year-prediction horizon, the maximal in-sample AUROC is provided for the FE LPM, with values of 0.923 and 0.935 for the entire sample and subsample 2001-2012, respectively. The FE model appears to be the best panel variant also in the case of the indicator models, for which the model obtains an in-sample AUROC with a value of 0.864 when the entire sample is considered and 0.917 for the subsample. In the case of the EU-wide EWS with a three-year-prediction horizon, the highest out-of-sample AUROC is achieved for the dynamic logit model, with a value of 0.793. The top of the indicator models produces an out-of-sample AUROC at 0.539 for the FE model.

As can be expected, the prediction accuracy of best performing EWS estimated to crisis data, as quantified by the in-sample AUROC statistic, by far exceeds the accuracy measured by AUROC statistic of best performing individual EWI as they are presented in section 4.1. However, the out-of-sample AUROC statistic seems as a better tool for comparison e.g. the best indicator model for three-year horizon in case of the EU 28 is rather far behind the best performing individual EWI which are well beyond 0.6 (e.g. private sector debt or youth unemployment rate). It is therefore possible to see, that a well set EWI in some cases provide higher early warning potential than an EWS built on similar EWIs. However, the best performing models in the out-of-the sample perspective still provide higher AUROC than any corresponding EWI examined, regardless of time horizon or focus on particular country group based on EA membership.

Regarding the marginal effects of individual indicators, the most relevant result from the perspective of further evaluation is the case of house prices indicator, as it robustly obtains negative effect on the crisis probability in one-to-two-year horizon for most of the models regardless of group of countries used (the EA, the non-EA, or the EU). This was also confirmed by the signals approach and loss and usefulness functions, that house prices indicator performs exceptionally well when its decrease, rather than increase, is considered. Furthermore, average marginal effect for house prices is one of the highest in absolute value which short term indicator models obtain, while being also negative. This can be interpreted as the probability of crisis in short-term horizon substantially decreases after the indicator issues a signal, which is in contradiction to the role expected in the context of the MIP.

Subsequent evaluation was performed in the framework of AUROC. To analyse statistical significance of a single indicator from the perspective of its effect on prediction probability, the change of AUROC before and after the exclusion of particular indicator from the model was compared (Appendix C - E). Based on the procedure of DeLong, DeLong and Clarke-Pearson (1988), mentioned in section 3.3, statistical significance of such change was evaluated. This seemed as a more robust approach than evaluating the marginal effects of individual indicators, when taking into account all potential phenomena which may affect statistical inference and are indicated by statistical tests described above. The out-of-sample contribution was considered as most important, as the improvement for overall system on priory unknown data was regarded as the desired property, justifying their inclusion.

- ***Current Account Balance***

Hints of a positive contribution of the current account balance indicator to the economic crisis EWS are apparent for non-EA member states of the EU in the short-term horizon (one to two years before the crisis), as improvements to the AUROC are more frequent when the indicator is added to the model. However, these changes are statistically significant only in several of all the examined models. Therefore, the evidence of substantial contribution in the case of used sample is rather weak. Nevertheless, the effect is also indicated for the entire EU when a two-year horizon is used, in which case the stellar performance of the current account indicator in the indicator model framework really stands out. However, based on the results obtained, it is rather debatable to assume substantial added value of the indicator for an EWS built with the non-EA countries in mind. This may seem to contradict the results achieved for the signals approach and loss and usefulness functions mentioned above. However, only potential loss of predictive ability is considered in this case, which may be smaller if most of variability of current account indicator can be substituted by the rest of used headline indicators. The indicator of the current account balance might, therefore, only have substantial contribution in case of EWS predicting economic crises in two years for all EU countries.

- ***Net International Investment Position***

Net international investment position indicator does not seem to reliably contribute to the economic crisis EWS for EA countries, built on the MIP Scoreboard's indicators. There seems to be some added value of the indicator when the models are estimated on all the available data, but when the model is tested out-of-sample, the indicator seems to hinder the performance of the EWS rather than improve it, regardless of the time horizon of prediction. Such tendency is contradicted only for non-EA member states of the EU when using the one-year-prediction horizon, for which the EWS including this indicator performs worse on the sample 2001-2012, but performs rather well outside of this sample, however, with improvements, on average, lacking statistical significance. Therefore, the indicator might have some added value for EWS when in-sample exercises are conducted, but for out-of-sample performance, there is little to no evidence in favour of the indicator.

- ***Export Market Share***

While there is some evidence of a significant contribution of the export market share indicator to the EWS for predicting economic crises of EA countries in a one-year horizon, the added value of the indicator for EWS of EA countries appears to be more debatable in longer time horizons. This also seems to be the case for non-EA member states of the EU, for which the contribution of the indicator is rather questionable in the one-year horizon as well. Results for all of the EU countries seem to support this claim, as the in-sample statistics drawn from the entire sample show that that the indicator has the ability to improve on EWS construction in a one-year horizon when all the information available is considered; its contribution becomes less apparent as the time horizon of a crisis increases. Special attention should be also paid to the individual threshold set for the export market shares indicator, as it provides a rather consistent contribution out-of-sample for the indicator models, thus, possibly implying that the threshold was set appropriately.

- ***Nominal Unit Labour Cost***

The nominal unit labour cost indicator does not seem to have much added value for an EWS aimed at EA countries when efforts are being made to predict economic crises in the one-to-two-year horizon. The three-year horizon is, however, promising as the indicator does statistically significantly contribute to the out-of-sample performance of the EWS for EA countries. When all of the countries of the EU are considered, the indicator seems to contribute mostly in the two-to-three-year horizon, which also tends to be statistically significant. For the non-EA member states of the EU, the results suggest that, in general, the nominal unit labour cost indicator contributes to the EWS, but the significance of such contributions seems questionable, with the exception of the two-year horizon. The indicator model framework does not seem to suit this indicator in most cases. Therefore, it may be assumed that the thresholds for this indicator could be improved, as was also suggested by the signals approach and loss and usefulness functions presented above.

- ***Real Effective Exchange Rates***

Based on the results obtained, the REER indicator appears to be an indicator with a substantial contribution to the EWS built on the MIP Scoreboard for EA countries, in three-year horizon. In the case of non-EA countries, the contribution can be observed for cases when all the information available is used to construct the EWS, but the out-of-sample performance seems to be somewhat lacking. This conclusion can also be extended to the case of the entire EU, where the in-sample added value is undeniable, but the out-of-sample is rather debatable. The indicator model has performed rather poorly in this context, as the out-of-sample AUROC often increased when the indicator was excluded from the model, especially in the case of non-EA countries and the entire EU. This may imply that the full potential of the REER indicator in the context of the rest of the headline indicators has not yet been realized with the thresholds currently set.

- ***Private Sector Debt***

The private sector debt indicator seems to contribute to the EWS in terms of predicting economic crises in EA countries, regardless of the time horizon or the sample used. However, this contribution seems to be scarcely statistically significant, therefore, there is not much evidence to support its place in the EWS. In the case of non-EA countries, the results are even less favourable as the out-of-sample AUROC tends to increase with the omission of private sector debt indicator. This may suggest that the indicator may contribute an EWS for non-EA countries when all the information is available, but after being applied to an unknown sample, the private sector debt indicator seems to hinder the performance of the EWS in comparison to cases when it is not included. The results for the entire EU also point to some added value of the indicator as there are more cases when the private sector debt indicator improved the entire EWS rather than the contrary. However, there is only slender evidence that such an improvement was statistically distinguishable from none. The contribution to the overall performance appears to be in direct contradiction with the results found by the signals approach presented above, when the individual predictive performance of indicator was evaluated.

- ***Private Sector Credit Flow***

Some contribution of the private sector credit flow indicator towards an EWS based on the MIP Scoreboard emerged when comparing the in-sample AUROC before and after the inclusion of the indicator, especially for models estimated on the entire sample. These changes are, however, statistically insignificant for most of the cases examined. The out-of-sample performance paints a different picture, as in the case of EA countries, the contribution of the private sector credit flow indicator becomes more apparent with increases in the time horizons of predictions. The majority of such cases for a time horizon of two-to-three years are statistically significant, providing evidence for the added value of the private sector credit flow indicator to EWS for predicting economic crises in EA countries. The contribution of the indicator in the case of non-EA countries is not supported, as the inclusion of this indicator tends to hinder the out-of-sample performance of EWS, most noticeably in the two-year-prediction horizon. Such a tendency translates also to the case of the EWS for the entire EU, for which the out-of-sample AUROC falls with the inclusion of the private sector credit flow indicator in the prediction horizon of one-to-two years. Beneficial effects of the private sector credit flow indicator incorporation to the EWS transpire only in the three-year-prediction horizon. Overall, most of the results seem to indicate that the private sector credit flow indicator substantially contributes to an EWS built on the basis of the MIP Scoreboard only for EA countries, and only for a time horizon of two-to-three years, while the predictive accuracy in the case of non-EA countries, as well as the entire EA, is rather questionable.

- ***House Price Index***

As an indicator which undeniably contributes to the EWS for EA countries aimed at predicting economic crises within the horizon of one year, the house prices indicator robustly provides an improvement to in- and out-of-sample performance after its inclusion in the EWS. However,

majority of such cases are represented by models which have estimated negative effect of house price growth on the crisis probability. This result appears to be rather robust, as the indicator performs individually rather well when optimal threshold for the drop of prices is considered, as was shown by signals approach. In the longer time horizon, some positive effects are still apparent, but the number of statistically significant effects dramatically drops, concluding with a more frequent negative effect on the overall EWS within the three-year horizon. Outstanding short-term performance is also apparent in the case of non-EA countries, but the improvements for the corresponding EWS after including the indicator are less likely statistically significant. This tendency is to a lesser degree translated to the case of EU-wide EWS with a one-year horizon, whose performance significantly rises in most cases after incorporating the house prices indicator. However, the contribution of the indicator becomes more ambiguous in two and three-year horizons, for both of the EWSs for non-EA countries and the entire EU, as the number of cases where inclusion of the house prices indicator hinders the EWS performance grows. Interestingly, the contribution of house prices indicator to EU-wide EWS in the two-year horizon, according to the indicator model setting, easily outperforms any other framework of models, possibly indicating that thresholds can have a further role in extending the predictive performance of the indicator to longer time horizons.

- ***General Government Sector Debt***

The general government sector debt indicator appears to consistently contribute to common EWS based on the MIP Scoreboard across all time horizons, if the EWS is built exclusively either for EA countries or non-EA countries. However, such a contribution is only rarely statistically significant. On the other hand, when the EWS is meant to predict economic crises across the entire EU, the out-of-sample AUROC tends to improve with the exclusion of the general government sector debt indicator, regardless of the time horizon of prediction. This may imply that there is a difference across EA and non-EA member states of the EU which negatively affects the prediction accuracy of the indicator when it is not accounted for. Furthermore, when the indicator model is applied, there is a strong evidence of the general government sector debt indicator having added value for the predictive power of the EWS for EA countries and for the entire EU in the three-year-prediction horizon. A possible explanation is that, in such cases, individual thresholds of the general government sector debt indicator are relatively well set, allowing the indicator to make a comparably exceptional contribution. This would also support the claim that there is a difference between EA and non-EA countries with regard to the indicator described, as the individual thresholds do not provide such outstanding results in the case of EA countries alone.

- ***Unemployment Rate***

Given all of the available results, the unemployment rate indicator appears to be most beneficial for the EWS of non-EA countries for predicting crises in the longer horizon. However, when examining the contribution of the unemployment rate indicator towards common EWSs built for EA countries, the results are rather ambiguous, regardless of the time horizons. Most straightforward are the results for the three-year-prediction horizon which, in most cases, show that there is

a benefit for the common EWS from the inclusion of the unemployment rate indicator. However, such a positive effect is only rarely statistically significant. On the other hand, there is considerable evidence of a contribution of the unemployment rate indicator to the one-year EWS built for predicting economic crises in the entire EU when out-of-sample performance is considered, but, at the same time, this is contradicted by in-sample results. As mentioned above, in the case of non-EA countries, most of the results point to the tendency to increase the added value of the unemployment rate indicator on the overall performance of the EWS when the prediction horizon is extended, culminating with the three-year horizon for which several estimated models show substantial benefit in incorporating the indicator in the EWS.

- ***Total Financial Sector Liabilities***

Inclusion of the total financial sector liabilities indicator in the common EWS does not show a major contribution to the overall predictive power of the EWS for most of the estimated models. Regarding an EU-wide EWS, the results are not consistent when examined from the in and out-of-sample perspective, especially in longer time horizons. However, these are only scarcely statistically significant, regardless of the time frame used. A similar conclusion would be drawn for the EWS focusing only on EA countries, for which even more episodes of an out-of-sample AUROC increase, with the omission of total financial sector liabilities indicator, are statistically significant. In the case of non-EA countries, hints of a positive impact of the total financial sector liabilities indicator on the overall prediction power of the EWS appears to be statistically significant in few-to-no cases. Interestingly, in the case of the two-year-prediction horizon for non-EA countries, there are several cases when the inclusion or exclusion of the indicator did not result in any change to the AUROC, further supporting the claim of the possible redundancy of the total financial sector liabilities indicator from the perspective of overall EWS.

- ***Activity Rate***

Taking into consideration all of the results, statistically significant evidence is relatively unfavourable to the assumption that the activity rate indicator contributes to EWS built on the basis of the MIP Scoreboard, and even less so to the notion that such a contribution is positive. In the case of the EWS focused on EA countries, the results are, in the vast majority of cases, statistically insignificant. A notable exception is the one-year horizon, for which an EWS for EA countries show in some cases improvement after the inclusion of the indicator. The changes to the EWS for non-EA countries resulting from the inclusion of the activity rate indicator are also, in most cases, statistically indistinguishable from no change. Most promising for non-EA countries are the in-sample changes of the AUROC with the inclusion of the activity rate indicator, which are statistically significant in some cases, but still comprise a relatively minor share of all the episodes examined. However, the most conflicting results are obtained when EA and non-EA countries are combined, which exhibit a mixed tendency of the activity rate indicator to improve or deteriorate the EWS, depending on the sample used or the time horizon considered. These changes are mostly statistically significant in the case of the two-year horizon, when a majority of such instances points towards the activity rate indicator hindering the performance of the EWS when it is

included. Furthermore, it is worth mentioning that the indicator model setting in the three-year horizon, in most cases, draws attention to the activity rate indicator having a negative effect on the overall EWS for EA countries and the entire EU. This may be caused by individual thresholds of the activity rate indicator, which may be set relatively inappropriately compared to other headline indicators.

- ***Long-term Unemployment Rate***

Based on the results obtained, the long-term unemployment rate indicator is suspected of mostly improving the out-of-sample performance of the one-year EWS for predicting crises in EA countries. However, longer prediction horizons than one year do not point to an improvement of the EWS performance for EA countries after including the long-term unemployment rate indicator as unambiguously. In the three-year horizon, the EWS is more prone to lose than gain predictive accuracy when incorporating the indicator. Interestingly, the indicator model setting for the three-year horizon in all cases implies that the long-term unemployment rate indicator would worsen the performance of the EWS for EA countries, possibly revealing a specific shortcoming in the set of individual thresholds. Non-EA countries are not likely to benefit from the long-term unemployment rate indicator even in the one-year horizon. Furthermore, a similar negative tendency in contribution to the out-of-sample performance, as in the EA case, is more visible for non-EA countries, where the AUROC, both in the two and three-year horizons, is hindered after the incorporation of the long-term unemployment rate indicator. However, for the entire EU, there is some evidence that the indicator would have some added value for the EWS with the two-year horizon, especially for the indicator model setting. Nevertheless, some of the cases examined contradict this claim, underlining the potential merit of set thresholds. Several statistically significant positive changes of the out-of-sample AUROC also appear for the time horizon of three years. Other potential contributions of the long-term unemployment rate indicator for the EU-wide EWS are rather questionable.

- ***Youth Unemployment Rate***

In contrast to what one may assume, the contribution of the youth unemployment rate indicator towards EWS based on the MIP Scoreboard is more likely in longer time horizons than short ones, as is apparent from the EWS for the entire EU. Unlike shorter time horizons, the performance of EWS's predicting crises in the three-year horizon, according to the vast majority of cases, has improved after including the youth unemployment rate indicator, with the majority of changes in the out-of-sample AUROC being statistically significant. This is also confirmed by the results for EA countries, for which the EWS with a three-year horizon is far more likely to benefit from the youth unemployment rate indicator than those with a horizon of one or two years. Nevertheless, the frequency of statistically significant changes of the out-of-sample AUROC in the three-year horizon is much higher for the entire EU than it is for EA countries. With regard to the one-year horizon, the decrease of the out-of-sample AUROC for EU-wide EWS's is more often statistically significant in the case of the indicator model setting, than for other applied frameworks. This may suggest that the current individual threshold for the youth unemployment rate indicator is relatively

harmful to its performance and, thus, the entire EWS for the one-year horizon. The in-sample contribution of the youth unemployment rate indicator is also rather significant for EWSs targeting crises in the one-year horizon for EA countries. Such a property is, however, less desirable compared to the high out-of-sample contribution of the indicator when focusing on the ability to predict future crises. In the case of building an EWS for non-EA countries alone, there would scarcely be any statistically significant evidence to support the inclusion of the youth unemployment rate indicator.

Table 5 **Out-of-sample crisis prediction ability for year 2009 of the models estimated on data from 2001 till 2008, AUROC results**

		Model					
Area	Lag	FE LPM	Chamberlain's logit	dynamic logit	Chamberlain's probit	dynamic probit	FE indicator
EA	1	0.540	0.533	0.344	0.500	0.456	0.600
EA	2	0.400	0.333	N/A	0.444	0.556	0.367
EA	3	0.481	N/A	0.700	0.722	0.625	0.333
non-EA	1	0.469	0.406	0.536	0.500	0.554	0.469
non-EA	2	0.350	0.275	0.400	0.400	0.571	0.575
non-EA	3	0.333	0.422	0.500	0.544	0.750	0.533
EU	1	0.464	0.250	0.474	0.389	0.481	0.569
EU	2	0.272	0.393	0.658	0.507	0.671	0.493
EU	3	0.404	0.543	0.333	0.555	0.471	0.574

Source: Authors' calculations based on data from the EC and Eurostat.

To test the out of sample prediction capacity of the MIP as a system for the 2009 crisis, the FE LPM, Chamberlain's logit model, dynamic logit model, Chamberlain's probit model, dynamic probit model, and FE indicator model were employed as the best performing models according to the results presented above. This exercise can shed some light on whether the MIP system could be useful in crisis warning of the 2009 recession. We estimated these models on the sample of only nine MIP headline indicators due to lack of official MIP statistics for the 2001-2008 periods. In particular the private sector credit flow, house price index, youth unemployment rate, activity rate and long-term unemployment rate were excluded from the models. This simplification is necessary to maintain most data possible for the estimations on otherwise short sample.

The AUROC statistic for six selected models shows rather ambiguous findings. First we discuss the first five models and subsequently the sixth FE indicator model is commented upon. In case of the EA countries, all models were estimated for one-year lag of used explanatory variables. Similarly, all of the models were possible to estimate when two-year-prediction horizon was used. However, it was not possible to compute the AUROC for the dynamic logit model, as well its corresponding average marginal effects. Estimation for three-year lags of explanatory variables in case of EA countries was even more difficult, as it was not possible to fit the Chamberlain's logit model due to insufficiency of observations. Chamberlain's probit model and dynamic logit model appear to be the best performing models in the case of EA countries, proving to be to some degree useful in tree-year horizon. Interestingly, the highest predictive accuracy in one-year horizon can be

attributed to FE indicator model, which was based on individual breaches of MIP Scoreboard indicators' thresholds. As these thresholds were set in the aftermath of crisis, they may contain additional information which was not otherwise available for the rest of described models. Unfortunately, similar tendency did not appear in longer time horizons where FE indicator model for EA countries would underperform compared to a random model.

Most of the obtained results for non-EA countries are rather comparable to the performance. The only positive exception is the dynamic probit model which in three-year horizon showed the highest AUROC statistic from all of the models examined, regardless of country group or the number of lags. Given the circumstances this can be also viewed as an outlier, implying that in general the models estimated for non-EA countries would have no more than a marginal usefulness for prediction of 2009 crisis. The FE indicator model is no exception from this tendency, although the model shows better prediction accuracy in higher time horizons.

Similar conclusion can be drawn for all the models estimated focusing on the entire EU. Best results are achieved for the two-year horizon by both examined dynamic models. Regarding the rest of estimated models, they would provide little-to-no usefulness for predicting the crises over the countries of EU in the year 2009. Such is the verdict also for the FE indicator model, which is in case of the entire EU performing the best when three-year lags of indicator signals are used.

When summarizing the results, it appears that the econometric models might had some added value to policymakers in predicting the crisis in the 2009, however, they would be mostly relevant only for the case of EA countries. Presented results should not be straightforwardly generalized, as the models are estimated on a rather limited sample. Hence, different results might have obtained if longer period was used for the estimation of the models.

4.3 Statistical Bias in Signalling Properties - Case of Data Revisions

Imprecise data utilized in policy decision-making processes might not only severely restrict the possible range of options that are available at the time when decisions need to be taken, it might even lead to sub-optimal outcomes doing potential harm rather than helping the domestic economy. In terms of the signalling approach applied in this study, we investigate the effects of inaccuracies due to the usage of unrevised data on three base signalling scores, namely aNtS ratio, prediction rate and absolute utility. The results from this exercise are available in Appendix B.

The MSE, as specified in (1), provides a tool to quantify the extent of inaccuracies in data on a comparable basis across the set of all the MIP baseline and auxiliary indicators. In addition, it permits us to rank indicators from top to bottom according to the respective MSE results. The aNtS ratio tends to be more erratic and susceptible towards data revisions than the prediction rate and absolute utility, as it comprises two separate signalling scores that are, nonetheless, likely to be affected by statistical revisions.

Among the list of baseline MIP indicators, the current account ranks among those mostly dispositioned towards statistical revisions over the short-term horizon (one-year lag). Interestingly, estimations for a current account deficit rather than a surplus tend to be associated

with higher MSE scores. As the time horizon increases, the inaccuracies in aNtS and other scores tend to diminish, even if still being relatively problematic. Different behaviour is observed in the case of the net international investment position, whose level of inaccuracies increases over the time horizon (MSE 48.75 for aNtS), rendering use of this indicator for signalling purposes problematic, if the possible extent of data biases are not accounted for.

Estimates for the REER tend to be biased to the corner solutions in our algorithm. Despite that inconvenience, one might conclude that the REER tends to suffer from this issue to some extent (MSE of 1.33 for the three-year lag), but to a relatively lesser extent than other variables. Export market share, on the other hand, shows a volatile evolution of the MSE for aNtS score across time horizons, with a relatively bad performance in the three-year lag, which improves once moving into a shorter horizon. However, its stable MSE results for the other two signalling scores (absolute utility, prediction rates) assigns this indicator to those with a smaller inclination to deliver biased estimates due to the extent of data imprecision.

The nominal unit labour costs indicator, while logically assigned to the external sector indicators group due to its economic impact on external balances, represents the indicator that is, statistically speaking, calculated using information about domestic labour market conditions. The extent of bias in the data collected is very low (MSE from 1.98 to 5.84 for the aNtS ratio), compared to other indicators, a feature it shares with other labour market based indicators from both the MIP baseline and auxiliary indicator group (youth unemployment rate, long-term unemployment rate). On the other hand, the activity rate and unemployment rate tend to undergo one major revision rather than a series of smaller adjustments (such as export market share or current account), after which the signalling scores' values remain relatively stable. The extent of these major revisions, however, does impact overall MSE levels negatively, especially if other social-related auxiliary indicators (people at risk of poverty after social transfers, severely materially deprived people) are taken into account.

Among the credit and debt MIP baseline indicators, private sector debt related EWIs perform well, even if still susceptible to the impact of series of smaller revisions. Total financial sector liabilities also rank among the over-the-average performers, once we account for one major revision in the one-year lag estimates.

Conversely, general government sector debt suffers from both a high instability of estimates over time periods (MSE for aNtS 0.35 for the one-year lag vs. 915.96 for the two-year lag), as well as the major impact of continuous revisions. This places the general government sector debt in the higher ranking list of EWIs potentially affected by ongoing data revisions. The house price index accompanies the government debt indicator in the list of problematic indicators looking at the longer, three-year horizon. However, the results for the house price index should be taken with a significant grain of salt as they suffer from the presence of corner solutions for shorter time periods.

Results for auxiliary indicators support the tendency to deliver more biased estimates for the group of external-sector related indicators (current account, net lending and borrowing, export

market shares, net balance of energy products, foreign direct investment inflows into reporting economy). Over the short to medium-term horizon, some unrevised estimates of real economic activity, such as gross fixed capital formation and real economic growth, also tend to cause higher variations in the resulting signalling scores. Overall, labour market indicators are associated with the most precise and stable signalling scores among auxiliary indicators.

Since the extent of these biases is likely to be higher for indicators measuring external exposure (current account, net international investment position), rather than domestic conditions (labour market indicators), signals issued by those indicators require deeper scrutiny, while taking into account potential interference due to unprecise data estimates. Estimates for public sector debt, as a highly scrutinized indicator, also show a tendency towards unstable behaviour influenced by ongoing revisions. From this perspective, taking into account the average values of indicators over longer time horizons might help to mitigate this issue.

4.4 Discussion

An assessment of the signalling abilities of EWIs represents a crucial step in the creation of a reliable, efficient and robust crisis warning system. The MIP procedure, as designed and implemented on an EU-wide level, is expected to serve such a purpose. According to our results, the construction of the MIP scoreboard partially succeeded in achieving a relatively strong signalling performance in the case of external sector indicators, even if the choice of official thresholds imposed within the MIP procedure might be considered sub-optimal for the case of both EA (less strict than optimal) or non-EA countries (more strict than optimal). This outcome supports a call for a more country-specific approach, as recently advocated by Knedlik (2014) or Comunale (2015), when evaluating the extent of macroeconomic imbalances during in-depth reviews. On the other hand, the current structure of the MIP scoreboard partially acknowledges such existing underlying heterogeneity by assigning different cut-off thresholds for the groups of EA and non-EA countries.

The level of public debt, while without any doubt an important measure of internal imbalances to be looked at, needs to be reviewed and interpreted in the context of private sector indebtedness as well, as the signalling properties of this indicator overperforms many of the baseline and auxiliary MIP scoreboard indicators. Labour market indicators, while reliable indicators of crises events shortly before their occurrences, might not be suitable to serve as the EWI once moved to the context of a longer horizon, though there are some notable exceptions (youth unemployment rate, long-term unemployment rate, changes in employment rate). Since our crisis indicator is based upon a drop in the potential GDP gap, a strong labour market indicator performance might arguably coincide with economic contraction that is already taking place. When it comes to the social conditions indicators, a well performing candidate for inclusion or replacement of other indicator in the scoreboard is the young people neither in employment nor in education or training indicator that performs exceptionally well in the short run.

When comparing the contribution of individual indicators to the prediction power of the EWS using the econometric approach, the results vary substantially. For the predictions in the one-year

horizon, the export market share indicator and house prices indicator show signs of significantly contributing to the EWS for EA countries. The house prices indicator tends to also have substantial added value for group of non-EU countries as well as for EU-wide EWS in case of one-year horizon. It is important to mention, that these EWSs in most cases consider the drop of house price index as an indicator of crisis rather than its increase. When examining the two-year-prediction horizon, an EWS built on the MIP Scoreboard and focusing on EA countries is very likely to benefit from the private sector credit flow indicator and house price index. The current account balance and nominal unit labour costs are expected to contribute to the performance of the two-year EWS for the entire EU, as well as for the group of non-EA countries. For the longer, three-year horizon, REER and private sector credit flow are most likely to improve the performance of an EWS focused on the countries of EA. The unemployment rate indicator appears to be a significant contributor to the three-year EWS for non-EA countries and the nominal unit labour costs and youth unemployment rate are appearing to be beneficial to an EU-wide EWS.

Not including certain indicators in any of these lists does not imply that they are redundant or should be excluded from the EWS, but rather, that the loss of variability resulting from their omission would not be as severe as in case of the listed indicators. Such variability might be after the exclusion of indicators substituted by other indicators, which, in many examined cases, also appear statistically insignificant for the same reason. The results described only evaluate the cases where one indicator is excluded from the MIP Scoreboard and should, therefore, be disregarded when multiple simultaneous changes are considered. The results, however, do suggest that there is a potential to slim down the MIP Scoreboard without a loss of predictive accuracy, if the entire Scoreboard is treated as a single EWS.

Among the variables tested, the house price index demonstrated, at first sight, promising results, but the econometric analysis revealed that the parameter of this variable is negative in most of the estimated models. The optimization procedure, used for the econometric estimations was not accounting for such restrictions in order to find maximal explained variability. Thus, the sign of the parameter is not in line with the assumption that a high level of house price growth imbalance will lead to a crisis (these findings are supported by Babecký *et al.*, 2013). Furthermore, the signals approach analysis showed a very poor performance in terms of the AUROC due to the fact that it took into account official thresholds using positive change in house price index as a signal rather than its negative drop. We suggest bearing these findings in mind while potentially searching for other indicators concerning the real estate bubble that might further enhance the MIP scoreboard. The residential construction variable, among the auxiliary indicators, tends to overperform the house price index especially in case of non-EA countries.

Comparing the performance of three groups of indicators in Table 4, the credit and debt indicators group performs rather poorly among them. Recent literature tentatively argues that financial cycles might rather differ from business cycles in terms of magnitude and length (Drehmann, Borio and Tsatsaronis, 2012) even if they tend to coincide when major crisis occurs (Claessens, Kose and Terrones, 2012). Hence, our results suggest that the construction of MIP scoreboard that uses

financial sector and debt related indicators should be reconsidered with respect to the primary objective of the MIP procedure (real sector vs. financial sector crisis prediction). Within the group, the private sector credit flow indicator seems to perform better for the EA countries that might be more prone to experience potential over-finalization of their economies (see discussion in Coeure, 2014 on optimal size of financial sector). On the other hand the private sector debt indicator might cause more harm in non-EA countries if coupled with under-developed financial sector.

On the other hand, the external sector indicators seem to perform much better in both signals and probability models than the indicators representing financial sector imbalances. Export market share for short-term predictions and nominal unit labour costs for longer-term predictions belongs to decent runners in this sort of competition. On the other hand, many of the indicators in this group might suffer from multicollinearity issues (export market share, net international investment position) or neglecting simultaneous existence of positive and negative thresholds (current account balance, REER) as signals and probability models outcomes differ substantially. Additionally, heterogeneous economic conditions and level of economic development between EA and non-EA group are reflected in different ranking of indicators between both groups. The potential future re-design of the MIP scoreboard structure should therefore take into argument of Knedlik (2014) that stronger differentiation of optimal thresholds, at least in the external sector group of indicators, based on underlying socio-economic conditions might be beneficial.

In regard to labour market indicators, the long-term unemployment rate and youth unemployment rate show exceptional performance according to the signals approach especially when one- and two-year lag of indicators is used, regardless of the group of examined countries. However, the econometric approach confirms possible effects of high correlation for these two variables, which is also reported by correlation matrices presented in Appendix G. The exclusion of either of these indicators, is very likely to cause only neglectable loss of prediction accuracy of estimated EWSs, especially in case of non-EA countries, as these indicators can to high extent substitute each other. The activity rate appears to be less informative, but its position is more consistent based signals and econometric approach.

In terms of methodological issues, for EWIs based on deviations from trends, or changes in growth rates rather than levels, the MIP scoreboard official thresholds might be more likely to coincide with their optimal values. Hence, even if EU countries might differ in their level of socio-economic conditions due to different stages of economic development (e.g. unemployment levels), an unfavourable dynamic in underlying economic variables might be able to reflect increasing risks more uniformly across a heterogeneous set of countries.

The results from our revision exercise confirm the somewhat widespread view that decisions of policy-makers might be sub-optimal, partially due to statistical biases in the underlying data available at the time when a decision has to be taken. Since the extent of these biases is likely to be higher for indicators measuring external exposure rather than domestic conditions, signals issued by those indicators require deeper scrutiny while taking into account potential interference due to imprecise data estimates.

Table 6 **Final ranking of MIP indicators based on AUROC scores (1=best, 4=worst)**

		EU						EA						non-EA					
		One-year lag		Two-year lag		Three-year lag		One-year lag		Two-year lag		Three-year lag		One-year lag		Two-year lag		Three-year lag	
		Signals	Prob models	Signals	Prob models	Signals	Prob models	Signals	Prob models	Signals	Prob models	Signals	Prob models	Signals	Prob models	Signals	Prob models	Signals	Prob models
External Sector Indicators																			
Current account balance - % of GDP, 3 years average	*UP*	3	3	3	1	3	3	3	3	4	3	4	3	2	2	2	2	2	4
	DOWN	3		2		2		2		1		1		4		3		3	
Real effective exchange rate, 42 trading partners - 3 years % change	*UP*	4	3	4	3	4	3	4	4	4	3	4	1	3	4	3	3	4	3
	DOWN	2		2		2		3		2		3		2		1		1	
Export market shares - 5 years % change		1	2	1	3	1	3	1	1	2	4	2	3	1	4	2	4	1	4
Nominal unit labour cost index - 3 years % change		3	4	3	1	2	1	3	4	3	3	2	2	3	2	3	1	1	3
Net international investment position - % of GDP		2	4	2	4	1	4	2	3	1	3	1	3	3	2	3	3	3	4
Credit and Debt Indicators																			
Private sector credit flow, consolidated - % of GDP		4	4	4	3	3	3	4	4	3	1	3	1	4	3	4	4	3	4
Private sector debt, consolidated - % of GDP		1	4	1	4	1	3	1	4	1	2	1	3	1	3	1	4	1	2
General government sector debt - % of GDP		2	3	3	4	4	3	3	3	3	3	4	3	2	3	2	4	3	3
Total financial sector liabilities, non-consolidated - 1 year % change		4	4	4	4	3	4	4	3	4	4	3	4	4	3	4	4	4	4
House price index, deflated - 1 year % change		4	1	4	2	4	3	4	1	4	1	4	4	4	1	4	3	4	4
Labour Market Indicators																			
Activity rate (15-64 years) - % point change (t, t-3)		2	3	2	3	3	3	2	2	2	4	2	4	2	3	2	3	2	4
Long-term unemployment rate - % of active population in the same age group, % point change (t, t-3)		1	3	1	3	2	2	1	2	2	2	2	4	1	4	1	3	2	4
Youth unemployment rate - % of active population in the same age group, % point change (t, t-3)		1	4	1	3	1	1	1	3	1	4	1	3	1	4	1	4	2	4
Unemployment rate - 3 years average		3	2	3	4	4	4	2	3	3	3	3	4	3	3	4	2	4	1

Note: The ranking of headline MIP indicators ranges from 1 (best outcome) to 4 (worst outcome). Ranking based on signals approach uses AUROC scores of individual indicators, lists them in descending order and by splitting results into four groups of equal size assigns ranking from 1 (highest AUROC) to 4 (lowest AUROC). Ranking based on probability models uses information about number of models for which exclusion of an indicator from MIP system leads to a significantly negative change in out-of-sample AUROC score. Firstly, we assign 4 to all indicators associated with zero number of models, then final ranking lists the number of models associated with indicators in descending order and assigns 1 if number of models is larger than first quintile of underlying distribution (zeros excluded), 2 if number of models is larger than average (zeros excluded) but smaller than first quintile (zeros excluded) and 3 otherwise. This algorithm takes into account highly skewed underlying distribution of number of models with significant negative change in AUROC score.
Source: Authors' calculations based on data from the EC and Eurostat.

5 Conclusion

Within the European Semester, the MIP is a useful complement to the SGP. While the SGP is based on automatic numerical rules, the MIP includes more discretionary elements. According to the MIP legislation, changes in composition of the MIP scoreboard as well as in the methodology and indicative thresholds are possible, thus, there is ample room for researchers addressing the ECs EWS. This research evaluated the performance of the MIP scoreboard indicators by employing three different techniques used to evaluate EWS (signals approach, loss and usefulness functions and discrete choice models). Moreover, an exercise testing the effects of data revisions regularly updating the Eurostat data was conducted. Only the scoreboard indicators and original auxiliary indicators were used to test and to analyse the system as close to reality as possible. The output gap published by the EC was used as the crisis variable. According to the results of the analysis, it appears that if the MIP Scoreboard, as a backbone of the AMRs, had been employed before the recession in 2009, it would have provided moderately useful alerts in terms of crisis prediction. However, this would mostly have applied to the EA countries. Furthermore, it demonstrated capabilities to predict crises periods after the peak year of the recession in 2009. However, the prediction performance of the indicators is definitely not uniform.

6 References

ALCIDI, C. – GROS, D. (2014): Implications of EU Governance Reforms. Rationale and Practical Application. ETLA Reports No. 25. Helsinki: ELTA. Available at: <https://www.etla.fi/wp-content/uploads/ETLA-Raportit-Reports-25.pdf>.

ALESSI, L. – ANTUNES, A. – BABECKY, J. – BALTUSSEN, S. – BEHN, M. – BONFIM, D. – BUSH, O. – DATKEN, C. – FROST, J. – GUIMARAES, R. – HAVRÁNEK, T. – JOY, M. – KAUKO, K. – MATĚJU, J. – MONTEIRO, N. – NEUDORFER, B. – PELTONEN, T. – RODRIGUES, P. M. M. – RUSNÁK, M. – SCHUDEL, W. – SIGMUND, M. – STREMMEL, H. – ŠMÍDKOVÁ, K. – Van TILBURG, R. – VAŠÍČEK, B. – ŽIGAROVÁ, D. (2014): Comparing Different Early Warning Systems: Results from a Horse Race Competition among Members of the Macro-prudential Research Network. Preliminary and Incomplete Draft. Available at: <http://www.ecb.europa.eu/events/pdf/conferences/140623/Vasicek-et-al_Comparing-Different-Early-Warning-Systems.pdf?F96bbb525a26071ecf97f9154fb3cc73>.

ALESSI, L. – DETKEN, C. (2011): Quasi Real Time Early Warning Indicators for Costly Asset Price Boom/Bust Cycles: A Role for Global Liquidity. European Journal of Political Economy, *27,* No. 3, pp. 520 – 533.

ALESSI, L. – DETKEN, C. (2014): On Policymakers' Loss Functions and the Evaluation of Early Warning Systems: Comment. Economic Letters, *124*, No. 3, pp. 338 – 340.

ANTUNES, A. – BONFIM, D. – MONTEIRO, N. – RODRIGUES, P. M. M. (2014): Early Warning Indicators of Banking Crises: Exploring New Data and Tools. Lisbon: Banco de Portugal, Economic Bulletin.

BABECKÝ, J. - HAVRÁNEK, T - MATĚJŮ, J. - RUSNÁK, M. – ŠMÍDKOVÁ, K. – VAŠÍČEK, B. (2012): Banking, Debt, and Currency Crises Early Warning Indicators for Developed Countries. [ECB Working Paper Series, No. 1485, October 2012.]Frankfurt am Main: European Central Bank.

BABECKÝ, J. – HAVRÁNEK, T. – MATĚJŮ, J. – RUSNÁK, M. – ŠMÍDKOVÁ, K. – VAŠÍČEK, B. (2013): Leading Indicators of Crisis Incidence: Evidence from Developed Countries. Journal of International Money and Finance, *35*, No. C, pp. 1 – 19.

BARRELL, R. – DAVIS, E. P. – KARIM, D. – LIADZE, I. (2010a): Bank Regulation, Property Prices and Early Warning Systems for Banking Crises in OECD Countries. Journal of Banking and Finance, *34*, No. 9, pp. 2255 – 2264.

BARRELL, R. – DAVIS, E. P. – KARIM, D. – LIADZE, I. (2010b): Was the Subprime Crisis Unique? An Analysis of the Factors that Help Predict Banking Crises in OECD Countries. [NIESR Discussion Paper, No. 363.] London: National Institute of Economic and Social Research.

BELKE, A. – GROS, D. – SCHNABL, G. (2016): Das europäische Verfahren zur Vermeidung und Korrektur von Leistungsbilanzungleichgewichten. Wirtschaftsdienst, *96*, No. 8, pp. 548 – 556.

BERG, A. – PATTILLO, C. (1999): Predicting Currency Crises: The Indicators Approach and an Alternative. Journal of International Money and Finance, *18*, No. 4, pp. 561 – 586.

BERG, A. – BORENSZTEIN, E. – PATTILLO, C. (2004): Assessing Early Warning Systems: How Have They Worked in Practice? [Working Paper, No. 04/52.] Washington, DC: International Monetary Fund.

BERTI, K. – SALTO, M. – LAQUIEN M. (2012). An early-detection index of fiscal stress for EU countries. [Economic Papers, No. 475.] Brussels: European Commission.

BLANCO, H. – GARBER, P. (1986): Recurrent Devaluation and Speculative Attacks on the Mexican Peso. Journal of Political Economy, *94*, No. 1, pp. 148 – 166. Available at: <http://www.jstor.org/stable/1831963>.

BORGY, V. – CLERC, L. – RENNE, J. P. (2014): Measuring Aggregate Risk: Can We Robustly Identify Asset-price Boom-bust Cycles? Journal of Banking and Finance, *46*, No. C, pp. 132 – 150.

BORIO, C. – DREHMANN, M. (2009): Assessing the Risk of Banking Crises – Revisited. BIS Quarterly Review, March, pp. 29 – 46.

BOYSEN-HOGREFE, J. – JANNSEN, N. – PLÖDT, M. – SCHWARZMÜLLER, T. (2015): An Empirical Evaluation of Macroeconomic Surveillance in the European Union. [Kiel Working Paper, No. 2014.] Kiel: Institute for the World Economy.

BUSSIERE, M. – FRATZSCHER, M. (2006): Towards a New Early Warning System of Financial Crises, Journal of International Money and Finance, *25*, No. 6, pp. 953 – 973. ISSN 0261-5606. Available at: <http://dx.doi.org/10.1016/j.jimonfin.2006.07.007>.

CAGGIANO, G. – CALICE, P. – LEONIDA, L. – KAPETANIOS, G. (2016): Comparing Logit-based Early Warning Systems: Does the Duration of Systemic Banking Crises Matter? Journal of Empirical Finance, *37*, June, pp. 104 – 116. ISSN 0927-5398. Available at: <http://dx.doi.org/10.1016/j.jempfin.2016.01.005>.

CAMERON, A. C. – TRIVEDI, P. K. (2010): Microeconometrics Using Stata – Revised Edition. College Station, Texas: Stata Press. ISBN 1-59718-073-4.

CANDELON, B. – DUMITRESCU, EI. – HURLIN, C. (2012): How to Evaluate an Early-Warning System: Toward a Unified Statistical Framework for Assessing Financial Crises Forecasting Methods. IMF Economic Review, *60*, No. 1, pp. 75 – 113. doi:10.1057/imfer.2012.4.

CHRISTENSEN, I. – LI, F. 2014. Predicting Financial Stress Events: A Signal Extraction Approach. Journal of Financial Stability, *14*, October, pp. 54 – 65.

CIARLONE, A. – TREBESCHI, G. (2005): Designing an Early Warning System for Debt Crises. Emerging Markets Review, *6*, No. 4, pp. 376 – 395. doi:10.1016/j.ememar.2005.09.003.

CLAESSENS, S. – KOSE, M. A. – TERRONES, M. (2012): How do Business and Financial Cycles Interact? Journal of International Economics, *87*, No. 1, pp. 178 – 190.

COEURE, B. (2014): On the Optimal Size of the Financial Sector. Speech by Benoit Coeure, Member of the Executive Board of the ECB, at the ECB Conference 'The optimal size of the financial sector'. Frakfurt, 2 September 2014. Available at: <https://www.ecb.europa.eu/press/key/date/2014/html/sp140902.en.html>.

COMUNALE, M. (2015). Current Account and REER Misalignments in Central Eastern EU Countries: An Update Using the Macroeconomic Balance Approach. [BOFIT Discussion Papers 28/2015.] Helsinki: Bank of Finland.

CSORTOS, O. – SZALAI, Z. (2013): Assessment of Macroeconomic Imbalance Indicators. [MNB Bulletin, October 2013, pp. 14 – 24.] Budapest: Magyar Nemzeti Bank.

CSORTOS, O. – SZALAI, Z. (2014): Early Warning Indicators: Financial and Macroeconomic Imbalances in Central and Eastern European Countries. [MNB Working Papers, No. 2.] Budapest: Magyar Nemzeti Bank.

DAVIS, E. P. – KARIM, D. (2008a): Comparing Early Warning Systems for Banking Crises. Journal of Financial Stability, *4*, June, pp. 89 – 120.

DAVIS, E. P. – KARIM, D. (2008b): Could Early Warning Systems have Helped to Predict the Sub-prime Crisis? National Institute Economic Review, *206*, No. 1, pp. 25 – 37.

DAVIS, J. S. – MACK, A. – PHOA, W. – VANDENABEELE, A. (2016): Credit Booms, Banking Crises, and the Current Account. Journal of International Money and Finance, *60*, February, pp. 360 – 377. ISSN 0261-5606. Available at: <http://dx.doi.org/10.1016/j.jimonfin.2015.09.008>.

DE GRAUWE, P. (2012): In Search of Symmetry in the Eurozone. [CEPS Policy Brief 268.] Brussels: CEPS.

DE GRAUWE, P. – JI, Y. (2016): Flexibility versus Stability. A Difficult Trade-off in the Eurozone. [CEPS Working Document, No. 422.] Brussels: CEPS.

DE HAAN, J. – INKLAAR, R. – JONG-A-PIN, R. (2008): Will Business Cycle in the Euro Area Converge? A Critical Survey of Empirical Research. Journal of Economic Surveys, *22*, No. 2, pp. 234 – 273.

DELONG, E. R. – DELONG, – D. M. CLARKE-PEARSON, D. L. (1988): Comparing the Areas under Two or More Correlated Receiver Operating Characteristic Curves: A Nonparametric Approach. Biometrics, *44*, No. 3, pp. 837 – 845.

DETKEN, C. - WEEKEN, O. - ALESSI, L. - BONFIM, D. - BOUCINHA M. M. - CASTRO, C. - FRONTCZAK, S. – GIORDANA, G. – GIESE, J. - JAHN, N. – KAKES, J. – KLAUS, B. – LANG, J. H. – PUZANOVA, N. – WELZ, P. (2014): Operationalising the countercyclical capital buffer: indicator selection, threshold identification and calibration options. [European Systemic Risk Board Occasional Paper Series No. 5, June 2014.] Frankfurt: European Systemic Risk Board.

DOMONKOS, T. – OSTRIHOŇ, F. – ŠIKULOVÁ, I. – ŠIRAŇOVÁ, M. (2017): Analyzing the Relevance of the MIP Scoreboard's Indicators. National Institute Economic Review, *239*, No. 1, pp. R32 – R52.

DREHMANN, M. – BORIO, C. – TSATSARONIS, K. (2012): Characterising the Financial Cycle: Don't Lose Sight of the Medium Term! [BIS Working Paper, No. 380.] Basel: Bank for International Settlements.

DREHMANN, M. – JUSELIUS, J. (2014): Evaluating early warning indicators of banking crises: Satisfying policy requirements. International Journal of Forecasting, *30*, No. 3, pp. 759-780.

DREHMANN, N. – TSATSARONIS, K. (2015). The credit-to-GDP gap and countercyclical capital buffers: questions and answers. [BIS Quarterly Review, March 2014.] Basel: Bank for International Settlements.

EDERER, S. (2015): Macroeconomic Imbalances and Institutional Reforms in the EMU. [WWWforEurope Working Paper, 87.] Vienna: Austrian Institute of Economic Research.

EDISON, H. J. (2003): Do indicators of financial crises work? An evaluation of an early warning system. International Journal of Finance & Economics, *8*, No. 1, pp. 11 – 53.

ESTRELLA, A. – HARDOUVELIS, G. A. (1991): The Term Structure as a Predictor of Real Economic Activity. The Journal of Finance, *46*, No. 2, pp. 555 – 576.

ESTRELLA, A. – MISHKIN F. S. (1998): Predicting U.S. Recessions: Financial Variables as Leading Indicators. Review of Economics and Statistics, *80*, No. 1, pp. 45 – 61.

ESSL, S. – STIGLBAUER, A. (2012): Prevention and Correction of Macroeconomic Imbalances: The Excessive Imbalances Procedure. In: Monetary Policy & The Economy Q4/11. Vienna: Oesterreichische Nationalbank, pp. 99 – 113.

EUROPEAN COMMISSION (2011): Commission Staff Working Document. Scoreboard for the Surveillance of Macroeconomic Imbalances: Envisaged Initial Design. [SEC(2011) 1361 Final.] Brussels: European Commission.

EUROPEAN COMMISSION (2012a): Commission Staff Working Document. Completing the Scoreboard for the MIP: Financial Sector Indicator. [Swd(2012) 389 Final, 14.11.2012.] Brussels: European Commission.

EUROPEAN COMMISSION (2012b): Scoreboard for the Surveillance of Macroeconomic Imbalances. [European Economy February 2012, Occasional Papers 92.] Brussels: European Commission.

EUROPEAN COMMISSION (2012c): Report from the Commission. Alert Mechanism Report. [14.2.2012, COM(2012) 68 Final.] Brussels: European Commission.

EUROPEAN COMMISSION (2012d): Report from the Commission to the European Parliament, the Council, the European Central Bank, the European Economic and Social Committee, the Committee of Regions and the European Investment Bank on the Alert Mechanism Report 2013. [28.11.2012, COM(2012) 751 Final.] Brussels: European Commission.

EUROPEAN COMMISSION (2012e): Commission Staff Working Document. Statistical Annex Accompanying the Document – Report from the Commission. Alert Mechanism Report – 2013. [28.11.2012, SWD(2012) 421 Final.] Brussels: European Commission.

EUROPEAN COMMISSION (2013a): Report from the Commission to the European Parliament, the Council, the European Central Bank and the European Economic and Social Committee. Alert Mechanism Report 2014. [13.11.2013, COM(2013) 790 Final.] Brussels: European Commission.

EUROPEAN COMMISSION (2013b): Commission Staff Working Document. Statistical Annex of Alert Mechanism Report 2014. Brussels: European Commission.

EUROPEAN COMMISSION (2014a): Report from the Commission to the European Parliament, the Council, the European Central Bank and the European Economic and Social Committee. Alert Mechanism Report 2015. [28.11.2014, COM(2014) 904 Final.] Brussels: European Commission.

EUROPEAN COMMISSION (2014b): Commission Staff Working Document. Statistical Annex of Alert Mechanism Report 2015. Brussels: European Commission.

EUROPEAN COMMISSION (2015a): Adding Employment Indicators to the Scoreboard of the Macroeconomic Imbalance Procedure to Better Capture Employment and Social Developments, 4.9.2015. Brussels: European Commission.

EUROPEAN COMMISSION (2015b): Communication from the Commission to the European Parliament, the Council and the European Central Bank. On steps towards Completing Economic and Monetary Union. [21.10.2015, COM(2015) 600 Final.] Brussels: European Commission.

EUROPEAN COMMISSION (2015c): Report from the Commission to the European Parliament, the Council, the European Central Bank and the European Economic and Social Committee. Alert Mechanism Report 2016. [26.11.2015, COM(2015) 691 Final.] Brussels: European Commission.

EUROPEAN COMMISSION (2015d): Commission Staff Working Document. Statistical Annex of Alert Mechanism Report 2016. Brussels: European Commission.

EUROPEAN COMMISSION (2016a): The Macroeconomic Imbalance Procedure. Rationale, Process, Application: A Compendium. [Institutional Paper 039, November 2016.] Brussels: European Commission.

EUROPEAN COMMISSION (2016b): Cyclical Adjustment of Budget Balances, Autumn 2016. Brussels: European Commission.

EUROPEAN COMMISSION (2016c): Report from the Commission to the European Parliament, the Council, the European Central Bank and the European Economic and Social Committee. Alert Mechanism Report 2017. [16.11.2016, COM(2016) 728 Final.] Brussels: European Commission.

EUROPEAN COMMISSION (2016d): Commission Staff Working Document. Statistical Annex of Alert Mechanism Report 2017. Brussels: European Commission.

EUROPEAN COMMISSION (2017): Macroeconomic Imbalance Procedure. Available at: <https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/macroeconomic-imbalance-procedure_en>.

FARANDA, D. – FLAVIO MARIA EMANUELE PONS, F. M. – GIACHINO, E. – VAIENTI, S. – DUBRULLE, B. (2015): Early Warnings Indicators of Financial Crises via Auto Regressive Moving Average Models. Communications in Nonlinear Science and Numerical Simulation, *29*, No. 1 – 3, pp. 233 – 239. ISSN 1007-5704. Available at: <http://dx.doi.org/10.1016/j.cnsns.2015.05.002>.

FRANKEL, J. A. – ROSE, A. (1996): Currency Crashes in Emerging Markets: An Empirical Treatment. Journal of International Economics, *41*, No. 3 – 4, pp. 351 – 366.

FRANKEL, J. – SARAVELOS, G. (2010): Can Leading Indicators Assess Country Vulnerability? Evidence from the 2008-09 Global Financial Crisis. [Mimeo.] Cambridge: Harvard Kennedy School,

FUERTES, A.-M. – KALOTYCHOU, E. (2007): Optimal Design of Early Warning Systems for Sovereign Debt Crises. International Journal of Forecasting, *23*, No. 1, pp. 85 – 100. ISSN 0169-2070. Available at: <http://dx.doi.org/10.1016/j.ijforecast.2006.07.001>.

GROS, D. (2012): Macroeconomic Imbalances in the Euro Area: Symptom or Cause of the Crisis? [CEPS Policy Brief 266.] Brussels: Centre for European Policy Studies.

GROS, D. – GIOVANNINI, A. (2014): The “Relative” Importance of EMU Macroeconomic Imbalances in the Macroeconomic Imbalance Procedure. [Documenti IAI 14 | 02] March 2014, Instituto Affari Internazionali. ISSN 2280-6164. Available at: <http://www.iai.it/sites/default/files/iai1402.pdf>.

GUERRIERI, P. (2012): Intra-European Imbalances: The Need for a Positive-sum-game Approach. International Economics. [Briefing Paper, IE BP 2012/03.] London: Chatham House.

HALLWIRTH, V. (2014): Überwachung der Wettbewerbsfähigkeit in der Europäischen Wirtschafts- und Währungsunion. Wirtschaftsdienst, *94*, No. 11, pp. 798 – 805.

HANLEY, J. A. – McNEIL, B. J. (1982). The Meaning and Use of the Area under a Receiver Operating Characteristic (ROC) Curve. Radiology, *143*, pp. 29 – 36.

HOECHLE, D. (2007): Robust Standard Errors for Panel Regressions with Cross-sectional Dependence. The Stata Journal, *7*, No. 3, pp. 281 – 312.

KÁČER, M. (2013): Predikcie finančných kríz s využitím metód finančnej ekonometrie. Biatec, *21*, No. 10, pp. 23 – 26.

KAMINSKY, G. – LIZONDO, S. – REINHART, C. (1998): Leading Indicators of Currency Crises. [IMF Staff Papers, 45.] Washington, DC: International Monetary Fund.

KAMINSKY, G. L. – REINHART, C. M. (1999): The Twin Crises: The Causes of Banking and Balance-of-Payments Problems. American Economic Review, *89*, No. 3, pp. 473 – 500.

KAMPS, Ch. – De STEFANI, R. – LEINER-KILLINGER, N. – RÜFFER, R. – SONDERMANN, D. (2013): Would the Strengthened EU Fiscal and Economic Governance Framework Have Helped Signalling Sovereign Debt Crises? [Paper presented at Banca d’Italia 15th Public Finance Workshop.] Rome: Banca d’Italia.

KAMPS, CH. – De STEFANI, R. – LEINER-KILLINGER, N. – RÜFFER, R. – SONDERMANN, D. (2014): The Identification of Fiscal and Macroeconomic Imbalances. Unexploited Synergies under the Strengthened EU Governance Framework, [ECB Occasional Paper Series, No. 157.] Frankfurt am Main: European Central Bank.

KAUPPI, H. – SAIKKONEN, P. (2008): Predicting U.S. Recessions with Dynamic Binary Response Models. The Review of Economics and Statistics, *90*, No. 4, pp. 777 – 791. Available at: <http://www.jstor.org/stable/40043114>.

KNEDLIK, T. (2014): The Impact of Preferences on Early Warning System – The Case of the European Commission's Scoreboard. In European Journal of Political Economy, *34*, pp. 157 – 166.

KNEDLIK, T. (2015): The Usefulness of the Scoreboard of the Macroeconomic Imbalances Procedure in the European Union: Potentials for Reform. European Policy Analysis, *14,* June, pp. 1 – 12.

KOTTAS, M. – KUSS, O. – ZAPF, A. (2014). A modified Wald interval for the area under the ROC curve (AUC) in diagnostic case-control studies. BMC Medical Research Methodology, *14*, No. 26, pp. 1 – 9.

LAEVEN, L. – VALENCIA, F. (2012): Systemic Banking Crisis Database: An Update. [IMF Working Paper, WP/12/163.] Washington, DC: International Monetary Fund.

LANG, M. – SCHMIDT, P. G. (2016): The Early Warnings of Banking Crises: Interaction of Broad Liquidity and Demand Deposits. Journal of International Money and Finance, *61*, March, pp. 1 – 29. ISSN 0261-5606. Available at: <http://dx.doi.org/10.1016/j.jimonfin.2015.11.003>.

MANASSE, P. – ROUBINI, N. (2009): Rules of Thumb" for Sovereign Debt Crises. Journal of International Economics, *78*, No. 2, pp. 192 – 205. ISSN 0022-1996. Available at: <http://dx.doi.org/10.1016/j.jinteco.2008.12.002>.

MOSCHELLA, M. (2014): Monitoring Macroeconomic Imbalances: Is EU Surveillance More Effective than IMF Surveillance? Journal of Common Market Studies, *52*, No. 6, pp. 1273 – 1289.

MULDER, CH. – PERRELLI, R. – DUARTE ROCHA, M. (2012): External Vulnerability, Balance Sheet Effects, and the Institutional Framework — Lessons from the Asian Crisis. International Review of Economics & Finance, *21*, No. 1, pp. 16 – 28. ISSN 1059-0560. Available at: <http://dx.doi.org/10.1016/j.iref.2011.04.002>.

MULDER, CH. – PERRELLI, R. – DUARTE ROCHA, M. (2016): The Role of Bank and Corporate Balance Sheets on Early Warning Systems of Currency Crises: An Empirical Study. Emerging Markets Finance & Trade, *52*, No. 7, pp. 1542 – 1561. ISSN 1540-496X print/1558-0938 online. DOI: 10.1080/1540496X.2016.1158545.

OFFICIAL JOURNAL OF THE EUROPEAN UNION (2011a): Regulation (EU) No. 1174/2011 of the European Parliament and of the Council of 16 November 2011 on Enforcement Measures to Correct Excessive Macroeconomic Imbalances in the Euro Area.

OFFICIAL JOURNAL OF THE EUROPEAN UNION (2011b): Regulation (EU) No. 1176/2011 of the European Parliament and of the Council of 16 November 2011 on the Prevention and Correction of Macroeconomic Imbalances.

OFFICIAL JOURNAL OF THE EUROPEAN UNION (2012): Consolidated Version of The Treaty on the Functioning of the European Union, C 326, pp. 47 – 199.

PESARAN, M. H. (2004): General Diagnostic Tests for Cross Section Dependence in Panels. [Cambridge Working Papers in Economics, No. 0435] Cambridge: University of Cambridge.

QIN, G. – HOTILOVAC, L. (2008): Comparison of non-parametric confidence intervals for the area under the ROC curve of a continuous-scale diagnostic test. Statistical Methods in Medical Research, *17*, pp. 207 – 221.

ROYSTON, P. (1991): sg3.5: Comment on sg3.4 and an Improved D'Agostino Test. Stata Technical Bulletin, Vol. 3, pp. 23 – 24. Reprinted in Stata Technical Bulletin Reprints, Vol. 1, 110 – 112. College Station, Texas: Stata Press.

SARLIN, P. (2013): On Policymakers' Loss Functions and the Evaluation of Early Warning Systems. [ECB Working Paper Series, No. 1509.] Frankfurt am Main: European Central Bank.

SHUANGJIE LI – SHAO WANG (2014): A Financial Early Warning Logit Model and its Efficiency Verification Approach. Knowledge-Based Systems, *70*, November, pp. 78 – 87. ISSN 0950-7051. Available at: <http://dx.doi.org/10.1016/j.knosys.2014.03.017>.

ŠIKULOVÁ, I. (2015): Macroeconomic Imbalance Procedure in the Euro-Area – Ex post Analysis. European Scientific Journal, *11*, special, pp. 161 – 175.

TIRPAK, M. (2005): Explaining Currency Crises Origins in Central and Eastern Europe. [Kiel Advanced Studies Working Papers, No. 425.] Kiel: Kiel Institute for the World Economy, 31 p.

VALINSKYTĖ, N. – RUPEIKA, G. (2015): Leading Indicators for the Countercyclical Capital Buffer in Lithuania. [Occasional Paper Series, No. 4/2015, p. 26.] Vilnius: Bank of Lithuania. ISSN 2424-3213.

WOOLDRIDGE, J. M. (2010): Econometric Analysis of Cross Section and Panel Data – Second Edition. Cambridge – London: MIT Press. ISBN 978-0-262-23258-6.

Appendix A

Table A.1 **Results for the signals approach and loss and usefulness function of the policymaker for the EA, one year time lag**

Scoreboard Indicators 1Y lag		#	Probability of event	Official threshold				AUROC	AUROC confidence interval	Optimal threshold					
				Value	Implied Preferences	Given Absolute Utility	Prediction Rate			Value	Max Absolute Utility	Inverse aNtS	Prediction Rate	mu=0.4	mu=0.6
External Sector Indicators															
Current account balance - % of GDP, 3 years average	*UP*	220	27,27%	6,0	0,355	-0,054	0,609	0,443	(0.36-0.52)	5,7	0,026	1,360	0,673	5,7	5,7
	DOWN			-4,0				**0,607**	(0.53-0.69)	-1,1	0,132	1,955	0,673	-1,1	-1,1
Real effective exchange rate, 42 trading partners - 3 years % change	*UP*	220	27,27%	5,0	0,535	-0,041	0,559	0,439	(0.36-0.52)	27,0	0,000	0,000	0,723	31,4	0,7
	DOWN			-5,0				**0,532**	(0.45-0.61)	-2,3	0,072	1,711	0,673	-2,3	-2,3
Export market shares - 5 years % change	*UP*	216	27,78%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-6,0	0,524	0,106	0,593	**0,695**	(0.62-0.77)	-9,6	0,150	2,033	0,676	-9,4	-3,4
Nominal unit labour cost index - 3 years % change	*UP*	218	27,52%	9,0	0,620	-0,173	0,569	0,452	(0.37-0.53)	11,8	0,080	3,276	0,734	11,8	11,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net international investment position - % of GDP	*UP*	218	27,52%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-35,0	0,553	0,051	0,633	**0,662**	(0.58-0.74)	-79,9	0,162	4,182	0,766	-79,9	-79,9
Credit and Debt Indicators															
Private sector credit flow, consolidated - % of GDP	*UP*	205	29,27%	14,0	0,619	-0,236	0,610	0,305	(0.23-0.38)	41,2	0,005	2,361	0,702	44,5	44,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector debt, consolidated - % of GDP	*UP*	216	27,78%	133,0	0,560	0,017	0,569	**0,671**	(0.59-0.75)	191,9	0,160	3,070	0,741	191,9	186,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
General government sector debt - % of GDP	*UP*	218	27,52%	60,0	0,546	-0,038	0,450	**0,551**	(0.47-0.63)	107,0	0,111	4,862	0,757	107,0	12,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - 1 year % change	*UP*	216	27,78%	16,5	0,580	-0,187	0,648	0,324	(0.25-0.40)	115,7	0,000	0,000	0,718	115,7	115,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
House price index, deflated - 1 year % change	*UP*	211	28,44%	6,0	0,832	-0,709	0,521	0,174	(0.11-0.23)	19,0	0,000	0,000	0,711	45,3	45,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour Market Indicators															
Activity rate (15-64 years) - % point change (t, t-3)	*UP*	195	30,77%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-0,2	0,609	-0,118	0,703	**0,563**	(0.48-0.65)	-0,7	0,077	6,188	0,728	-0,5	-0,5
Long-term unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	194	30,93%	0,5	0,691	-0,055	0,639	**0,731**	(0.66-0.81)	1,0	0,224	4,746	0,784	1,9	1,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	196	30,61%	2,0	0,647	-0,014	0,648	**0,725**	(0.65-0.80)	4,5	0,217	4,281	0,776	5,2	4,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unemployment rate - 3 years average	*UP*	220	27,27%	10,0	0,569	-0,009	0,673	**0,587**	(0.51-0.67)	11,4	0,128	3,910	0,755	11,6	11,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Auxiliary Indicators															
External Sector Indicators															
Current account balance - % of GDP	*UP*	220	27,27%	x	x	x	x	0,475	(0.40-0.56)	3,8	0,021	1,192	0,636	12,0	4,1
	DOWN			x	x	x	x	**0,529**	(0.45-0.61)	-1,4	0,068	1,473	0,632	-1,4	-1,4
Net Lending / Borrowing - % of GDP	*UP*	219	27,40%	x	x	x	x	0,472	(0.39-0.55)	2,1	0,021	1,124	0,584	14,3	2,1
	DOWN			x	x	x	x	**0,522**	(0.44-0.60)	-1,5	0,049	1,354	0,626	-1,5	-1,5
Real effective exchange rate, 42 trading partners - 1 year % change	*UP*	196	30,61%	x	x	x	x	0,495	(0.41-0.58)	1,2	0,031	1,225	0,607	1,8	1,2
	DOWN			x	x	x	x	0,487	(0.40-0.57)	-7,2	0,008	65535,000	0,699	-6,9	-0,2
Real effective exchange rate, Euro area trading partners - 3 years % change	*UP*	220	27,27%	x	x	x	x	**0,534**	(0.45-0.61)	0,7	0,063	1,303	0,573	0,7	0,7
	DOWN			x	x	x	x	0,458	(0.38-0.54)	-5,0	0,041	65535,000	0,745	-4,6	-2,2
Terms of trade - 5 years % change	*UP*	195	30,77%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,599**	(0.52-0.68)	-0,5	0,090	1,357	0,554	-2,7	-0,4
Export market shares - 1 year % change	*UP*	196	30,61%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,528**	(0.44-0.61)	-2,4	0,041	1,191	0,551	-8,7	-2,4
Export market share, volumes - 1 year % change	*UP*	220	27,27%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,544**	(0.46-0.62)	-0,5	0,057	1,212	0,514	-5,3	-0,5
Share of OECD export - 5 years % change	*UP*	194	30,93%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,623**	(0.54-0.71)	-2,4	0,123	1,766	0,644	-2,2	-2,2
Nominal unit labour cost index - 1 year % change	*UP*	196	30,61%	x	x	x	x	0,454	(0.37-0.54)	5,4	0,058	3,238	0,709	5,4	5,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal unit labour cost index - 10 years % change	*UP*	195	30,26%	x	x	x	x	0,490	(0.41-0.57)	0,6	0,010	1,022	0,333	8545,8	0,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unit labour cost performance relative to Euro area - 10 years % change	*UP*	184	32,07%	x	x	x	x	**0,523**	(0.44-0.61)	15,5	0,027	1,290	0,630	15,5	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x

Labour productivity - 1 year % change	*UP*	220	27,27%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,618**	(0.54-0.70)	-0,4	0,108	2,493	0,718	-0,3	-0,1
Direct investment in the reporting economy (flows) - % of GDP	*UP*	215	27,91%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,536**	(0.45-0.62)	-0,5	0,040	2,525	0,716	-0,5	-0,5
Direct investment in the reporting economy (stocks) - % of GDP	*UP*	196	30,61%	x	x	x	x	0,476	(0.39-0.56)	2793,1	0,043	6,800	0,714	2893,5	10,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net external debt - % of GDP	*UP*	206	29,13%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,432	(0.35-0.51)	-2162,5	0,022	1,783	0,694	-2675,7	-1330,5
Net trade balance of energy products - % of GDP	*UP*	211	28,44%	x	x	x	x	0,497	(0.41-0.58)	1,1	0,000	0,000	0,711	1,7	1,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Credit and Debt Indicators															
Private sector debt, non-consolidated - % of GDP	*UP*	211	27,78%	x	x	x	x	**0,626**	(0.55-0.71)	212,6	0,132	2,643	0,722	212,6	113,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Financial sector leverage (debt-to-equity) - %	*UP*	205	29,27%	x	x	x	x	**0,642**	(0.56-0.72)	408,4	0,185	2,973	0,737	569,0	408,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector credit flow, non-consolidated - % of GDP	*UP*	10	0,00%	x	x	x	x	0,000	NA	2,1	0,000	0,000	0,100	0,0	0,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - million of national currency	*UP*	194	30,93%	x	x	x	x	**0,515**	(0.43-0.60)	3271105,1	0,084	1,459	0,603	3271105,1	3271105,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal house price index - 3 years % change	*UP*	210	28,57%	x	x	x	x	0,245	(0.18-0.31)	65,4	0,000	0,000	0,710	113,8	113,8
	DOWN			x	x	x	x	**0,747**	(0.68-0.82)	-2,4	0,237	5,699	0,805	-2,2	-2,2
Real Economic Activity Indicators															
Real gross domestic product (GDP) - 1 year % change	*UP*	219	27,40%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,741**	(0.67-0.81)	-0,2	0,241	7,339	0,822	-0,1	-0,1
Gross fixed capital formation - % of GDP	*UP*	220	27,27%	x	x	x	x	0,296	(0.23-0.37)	28,8	0,001	1,043	0,709	34,8	11,5
	DOWN			x	x	x	x	**0,500**	(0.42-0.58)	0,0	0,000	0,000	0,723	0,0	0,0
Gross domestic expenditure on R&D - % of GDP	*UP*	205	27,80%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,549**	(0.47-0.63)	2,0	0,105	1,365	0,532	1,7	2,0
Residential construction - % of GDP	*UP*	218	27,52%	x	x	x	x	0,356	(0.28-0.43)	13,5	0,000	0,000	0,720	13,5	0,8
	DOWN			x	x	x	x	**0,643**	(0.57-0.72)	5,0	0,132	1,649	0,615	5,1	5,1
Labour Market Indicators															
Unemployment rate - %	*UP*	196	30,61%	x	x	x	x	**0,639**	(0.56-0.72)	11,5	0,173	4,911	0,765	11,7	10,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Employment rate - 1 year % change	*UP*	220	27,27%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,748**	(0.68-0.82)	-0,2	0,229	4,468	0,791	-0,5	-0,1
Activity rate (15-64 years) - % of the total population of the same age group	*UP*	196	30,61%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,471	(0.39-0.56)	74,3	0,032	1,088	0,429	58,3	74,3
Long-term unemployment rate - % of active population in the same age group	*UP*	196	30,61%	x	x	x	x	**0,591**	(0.51-0.67)	5,5	0,146	3,333	0,735	5,5	5,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group	*UP*	196	30,61%	x	x	x	x	**0,671**	(0.59-0.75)	27,0	0,185	5,564	0,776	27,2	27,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population	*UP*	196	30,61%	x	x	x	x	**0,594**	(0.51-0.68)	13,0	0,181	3,346	0,745	13,3	13,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population, % point change (t, t-3)	*UP*	194	30,93%	x	x	x	x	**0,705**	(0.63-0.78)	1,2	0,177	2,978	0,732	2,0	1,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population	*UP*	181	32,04%	x	x	x	x	**0,563**	(0.48-0.65)	25,1	0,131	2,397	0,696	26,7	25,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population, % point change (t, t-3)	*UP*	149	38,26%	x	x	x	x	**0,709**	(0.62-0.80)	0,7	0,170	2,288	0,685	2,3	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population	*UP*	191	30,89%	x	x	x	x	**0,517**	(0.43-0.60)	19,1	0,054	1,549	0,649	20,3	9,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population, % point change (t, t-3)	*UP*	181	32,04%	x	x	x	x	0,470	(0.38-0.56)	0,6	0,016	1,082	0,547	6,0	0,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population	*UP*	186	31,18%	x	x	x	x	**0,549**	(0.46-0.64)	10,0	0,089	2,337	0,694	11,6	5,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population, % point change (t, t-3)	*UP*	149	38,26%	x	x	x	x	**0,684**	(0.59-0.77)	0,7	0,163	2,560	0,691	1,1	0,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work Intensity - % of population aged 0-59	*UP*	181	32,04%	x	x	x	x	**0,508**	(0.42-0.60)	15,5	0,069	9,543	0,718	15,6	4,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work intensity - % of population aged 0-59, % point change (t, t-3)	*UP*	149	38,26%	x	x	x	x	**0,654**	(0.56-0.74)	1,5	0,154	4,511	0,711	1,5	0,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x

Source: Authors' calculations based on data from the EC and Eurostat.

Table A.2 **Results for the signals approach and loss and usefulness function of the policymaker for the EA, two year time lag**

Scoreboard Indicators 2Y lag		#	Probability of event	Official threshold				AUROC	AUROC confidence interval	Optimal threshold					
				Value	Implied Preferences	Max Absolute Utility	Prediction Rate			Value	Max Absolute Utility	Inverse aNtS	Prediction Rate	mu=0.4	mu=0.6
External Sector Indicators															
Current account balance - % of GDP, 3 years average	*UP*	201	27,36%	6,0	0,180	-0,163	0,637	0,432	(0.35-0.51)	6,6	0,024	1,475	0,672	7,0	6,6
	DOWN			-4,0				**0,640**	(0.56-0.72)	-1,3	0,159	2,174	0,687	-1,2	-1,2
Real effective exchange rate, 42 trading partners - 3 years % change	*UP*	201	27,36%	5,0	0,580	-0,159	0,547	0,370	(0.29-0.45)	27,0	0,000	0,000	0,697	31,4	31,4
	DOWN			-5,0				**0,594**	(0.51-0.68)	-0,8	0,094	1,563	0,622	-2,3	-0,7
Export market shares - 5 years % change	*UP*	197	27,92%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-6,0	0,552	0,044	0,563	**0,621**	(0.54-0.70)	-7,9	0,108	1,556	0,609	-16,6	-7,7
Nominal unit labour cost index - 3 years % change	*UP*	199	27,64%	9,0	0,575	-0,084	0,573	0,489	(0.40-0.57)	13,1	0,067	5,656	0,724	13,1	13,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net international investment position - % of GDP	*UP*	199	27,64%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-35,0	0,476	0,079	0,628	**0,678**	(0.60-0.76)	-18,3	0,161	1,810	0,638	-75,4	-18,3
Credit and Debt Indicators															
Private sector credit flow, consolidated - % of GDP	*UP*	186	29,57%	14,0	0,450	0,003	0,634	0,442	(0.36-0.53)	12,9	0,038	1,400	0,634	12,9	10,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector debt, consolidated - % of GDP	*UP*	197	27,92%	133,0	0,583	-0,012	0,569	**0,666**	(0.58-0.75)	186,8	0,173	3,142	0,736	186,8	186,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
General government sector debt - % of GDP	*UP*	199	27,64%	60,0	0,540	-0,099	0,407	0,471	(0.39-0.56)	108,7	0,093	5,279	0,734	109,0	12,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - 1 year % change	*UP*	197	27,92%	16,5	0,517	-0,053	0,635	0,418	(0.34-0.50)	25,5	0,002	1,115	0,680	115,7	2,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
House price index, deflated - 1 year % change	*UP*	192	28,65%	6,0	0,712	-0,464	0,521	0,281	(0.21-0.36)	15,1	0,008	65535,000	0,688	16,9	16,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour Market Indicators															
Activity rate (15-64 years) - % point change (t, t-3)	*UP*	176	31,25%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-0,2	0,310	0,026	0,699	**0,578**	(0.49-0.67)	-0,3	0,089	3,305	0,699	-0,2	-0,2
Long-term unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	175	31,43%	0,5	0,707	-0,132	0,594	**0,638**	(0.55-0.72)	1,0	0,160	3,058	0,720	1,1	1,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	177	31,07%	2,0	0,703	-0,114	0,605	**0,665**	(0.58-0.75)	4,5	0,182	3,263	0,734	6,1	4,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unemployment rate - 3 years average	*UP*	201	27,36%	10,0	0,532	0,001	0,642	**0,531**	(0.45-0.62)	11,8	0,077	2,648	0,706	11,8	4,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Auxiliary Indicators															
External Sector Indicators															
Current account balance - % of GDP	*UP*	201	27,36%	x	x	x	x	0,436	(0.35-0.52)	5,8	0,022	1,329	0,657	5,9	5,9
	DOWN			x	x	x	x	**0,602**	(0.52-0.68)	-1,4	0,135	1,993	0,672	-1,3	-1,3
Net Lending / Borrowing - % of GDP	*UP*	200	27,50%	x	x	x	x	0,424	(0.34-0.51)	6,1	0,001	1,013	0,645	14,3	4,8
	DOWN			x	x	x	x	**0,591**	(0.51-0.67)	-1,3	0,106	1,753	0,650	-1,5	-1,3
Real effective exchange rate, 42 trading partners - 1 year % change	*UP*	177	31,07%	x	x	x	x	0,429	(0.34-0.52)	9,8	0,000	0,000	0,667	13,7	0,5
	DOWN			x	x	x	x	**0,552**	(0.46-0.64)	-1,1	0,081	1,905	0,661	-1,0	-1,0
Real effective exchange rate, Euro area trading partners - 3 years % change	*UP*	201	27,36%	x	x	x	x	**0,565**	(0.48-0.65)	0,6	0,082	1,370	0,572	0,6	0,6
	DOWN			x	x	x	x	0,471	(0.39-0.55)	-2,0	0,037	2,295	0,697	-2,0	-1,4
Terms of trade - 5 years % change	*UP*	176	31,25%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,561**	(0.47-0.65)	-0,5	0,061	1,220	0,523	-3,3	-0,1
Export market shares - 1 year % change	*UP*	177	31,07%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,543**	(0.45-0.63)	-6,4	0,072	2,308	0,678	-6,4	-4,4
Export market share, volumes - 1 year % change	*UP*	201	27,36%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,529**	(0.44-0.61)	-1,4	0,057	1,259	0,557	-6,0	-1,3
Share of OECD export - 5 years % change	*UP*	175	31,43%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,574**	(0.49-0.66)	-7,0	0,083	2,075	0,669	-11,2	-7,0
Nominal unit labour cost index - 1 year % change	*UP*	177	31,07%	x	x	x	x	0,429	(0.34-0.52)	4,9	0,059	2,750	0,684	5,0	5,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal unit labour cost index - 10 years % change	*UP*	176	30,68%	x	x	x	x	0,483	(0.39-0.57)	0,6	0,000	1,000	0,341	8545,8	0,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unit labour cost performance relative to Euro area - 10 years % change	*UP*	165	32,73%	x	x	x	x	**0,593**	(0.50-0.68)	0,1	0,067	1,189	0,485	15,5	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour productivity - 1 year % change	*UP*	201	27,36%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,537**	(0.45-0.62)	-0,6	0,076	2,066	0,687	-0,5	-0,5

Direct investment in the reporting economy (flows) - % of GDP	*UP*	196	28,06%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,505**	(0.42-0.59)	-24,9	0,016	65535,000	0,699	-15,4	-0,6
Direct investment in the reporting economy (stocks) - % of GDP	*UP*	177	31,07%	x	x	x	x	0,475	(0.39-0.56)	354,6	0,042	1,500	0,638	2707,0	10,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net external debt - % of GDP	*UP*	187	29,41%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,441	(0.36-0.53)	-2610,9	0,025	65535,000	0,695	-2581,0	-1330,5
Net trade balance of energy products - % of GDP	*UP*	192	28,65%	x	x	x	x	0,496	(0.41-0.58)	1,1	0,000	0,000	0,688	1,7	1,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Credit and Debt Indicators															
Private sector debt, non-consolidated - % of GDP	*UP*	192	27,92%	x	x	x	x	**0,617**	(0.53-0.70)	194,2	0,133	2,094	0,680	212,6	194,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Financial sector leverage (debt-to-equity) - %	*UP*	186	29,57%	x	x	x	x	**0,630**	(0.55-0.71)	428,5	0,167	3,000	0,726	498,8	433,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector credit flow, non-consolidated - % of GDP	*UP*	10	0,00%	x	x	x	x	**0,667**	NA	11,2	0,333	3,000	0,700	12,4	12,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - million of national currency	*UP*	175	31,43%	x	x	x	x	**0,505**	(0.42-0.59)	2944726,9	0,069	1,354	0,583	4250239,7	2944726,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal house price index - 3 years % change	*UP*	191	28,80%	x	x	x	x	0,341	(0.26-0.42)	50,9	0,009	1,598	0,675	63,0	51,7
	DOWN			x	x	x	x	**0,679**	(0.60-0.76)	-1,3	0,176	3,863	0,749	-1,3	-0,5
Real Economic Activity Indicators															
Real gross domestic product (GDP) - 1 year % change	*UP*	200	27,50%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,649**	(0.57-0.73)	-0,3	0,148	3,291	0,735	-0,3	-0,3
Gross fixed capital formation - % of GDP	*UP*	201	27,36%	x	x	x	x	0,401	(0.32-0.48)	23,8	0,031	1,450	0,662	28,6	11,5
	DOWN			x	x	x	x	**0,500**	(0.42-0.58)	0,0	0,000	0,000	0,697	0,0	0,0
Gross domestic expenditure on R&D - % of GDP	*UP*	196	28,06%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,576**	(0.49-0.66)	1,9	0,128	1,465	0,561	1,7	1,9
Residential construction - % of GDP	*UP*	199	27,64%	x	x	x	x	0,437	(0.35-0.52)	2,7	0,012	1,028	0,362	13,5	2,7
	DOWN			x	x	x	x	**0,563**	(0.48-0.65)	5,0	0,088	1,440	0,593	4,3	5,1
Labour Market Indicators															
Unemployment rate - %	*UP*	177	31,07%	x	x	x	x	**0,569**	(0.48-0.66)	11,3	0,127	3,143	0,712	11,6	11,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Employment rate - 1 year % change	*UP*	201	27,36%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,673**	(0.59-0.75)	-0,6	0,153	3,261	0,736	-0,5	-0,1
Activity rate (15-64 years) - % of the total population of the same age group	*UP*	177	31,07%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,475	(0.39-0.56)	73,7	0,047	1,139	0,475	58,3	73,7
Long-term unemployment rate - % of active population in the same age group	*UP*	177	31,07%	x	x	x	x	**0,529**	(0.44-0.62)	4,2	0,089	1,778	0,650	5,5	4,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group	*UP*	177	31,07%	x	x	x	x	**0,616**	(0.53-0.70)	27,0	0,153	4,600	0,740	27,2	27,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population	*UP*	177	31,07%	x	x	x	x	**0,562**	(0.47-0.65)	13,7	0,140	2,737	0,706	13,7	13,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population, % point change (t, t-3)	*UP*	175	31,43%	x	x	x	x	**0,662**	(0.58-0.75)	2,5	0,165	13,763	0,766	2,6	2,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population	*UP*	163	32,52%	x	x	x	x	**0,525**	(0.43-0.62)	24,3	0,099	1,746	0,638	25,2	23,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population, % point change (t, t-3)	*UP*	131	39,69%	x	x	x	x	**0,581**	(0.48-0.68)	2,2	0,093	2,764	0,641	2,3	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population	*UP*	173	31,21%	x	x	x	x	**0,519**	(0.43-0.61)	19,5	0,077	2,107	0,671	19,5	9,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population, % point change (t, t-3)	*UP*	163	32,52%	x	x	x	x	0,430	(0.34-0.52)	1,8	0,017	1,317	0,626	3,2	1,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population	*UP*	168	31,55%	x	x	x	x	**0,502**	(0.41-0.59)	10,2	0,083	2,529	0,679	10,3	10,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population, % point change (t, t-3)	*UP*	131	39,69%	x	x	x	x	**0,531**	(0.43-0.63)	4,2	0,064	65535,000	0,634	4,6	0,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work Intensity - % of population aged 0-59	*UP*	163	32,52%	x	x	x	x	0,447	(0.36-0.54)	14,0	0,035	1,810	0,644	15,4	4,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work intensity - % of population aged 0-59, % point change (t, t-3)	*UP*	131	39,69%	x	x	x	x	**0,646**	(0.55-0.74)	0,6	0,137	1,947	0,649	1,4	0,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x

Source: Authors' calculations based on data from the EC and Eurostat.

Table A.3 **Results for the signals approach and loss and usefulness function of the policymaker for the EA, three year time lag**

Scoreboard Indicators3Y lag		#	Probability of event	Official threshold				AUROC	AUROC confidence interval	Optimal threshold					
				Value	Implied Preferences	Max Absolute Utility	Prediction Rate			Value	Max Absolute Utility	Inverse aNtS	Prediction Rate	mu=0.4	mu=0.6
External Sector Indicators															
Current account balance - % of GDP, 3 years average	*UP*	183	24,59%	6,0	0,075	-0,248	0,650	0,434	(0.35-0.52)	6,6	0,028	1,576	0,661	6,6	6,6
	DOWN			-4,0				**0,663**	(0.58-0.75)	-2,0	0,180	2,441	0,705	-1,9	-1,9
Real effective exchange rate, 42 trading partners - 3 years % change	*UP*	183	24,59%	5,0	0,505	-0,074	0,508	0,432	(0.34-0.52)	27,0	0,000	0,000	0,678	31,4	0,9
	DOWN			-5,0				**0,533**	(0.44-0.62)	-0,2	0,041	1,190	0,552	-5,2	-0,2
Export market shares - 5 years % change	*UP*	179	25,14%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-6,0	0,544	0,018	0,547	**0,579**	(0.49-0.67)	-7,5	0,092	1,492	0,603	-7,5	-4,6
Nominal unit labour cost index - 3 years % change	*UP*	181	24,86%	9,0	0,475	0,074	0,630	**0,593**	(0.50-0.68)	9,4	0,097	1,909	0,663	11,8	8,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net international investment position - % of GDP	*UP*	181	24,86%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-35,0	0,464	0,069	0,630	**0,676**	(0.59-0.76)	-18,3	0,163	1,848	0,646	-75,4	-18,3
Credit and Debt Indicators															
Private sector credit flow, consolidated - % of GDP	*UP*	168	26,79%	14,0	0,451	0,011	0,625	0,492	(0.40-0.58)	12,9	0,060	1,626	0,637	20,3	12,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector debt, consolidated - % of GDP	*UP*	179	25,14%	133,0	0,596	-0,017	0,581	**0,654**	(0.57-0.74)	176,8	0,179	3,153	0,732	186,8	176,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
General government sector debt - % of GDP	*UP*	181	24,86%	60,0	0,526	-0,114	0,392	0,425	(0.34-0.51)	108,7	0,069	3,791	0,702	109,0	6,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - 1 year % change	*UP*	179	25,14%	16,5	0,445	0,007	0,654	**0,545**	(0.46-0.64)	3,6	0,073	1,249	0,520	4,7	3,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
House price index, deflated - 1 year % change	*UP*	174	25,86%	6,0	0,613	-0,245	0,546	0,376	(0.29-0.46)	13,5	0,009	65535,000	0,672	16,1	16,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour Market Indicators															
Activity rate (15-64 years) - % point change (t, t-3)	*UP*	158	28,48%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-0,2	0,361	0,019	0,658	**0,559**	(0.46-0.65)	-0,3	0,065	2,304	0,658	-0,2	-0,2
Long-term unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	157	28,66%	0,5	0,505	0,049	0,567	**0,572**	(0.48-0.67)	1,0	0,067	1,667	0,631	2,0	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	159	28,30%	2,0	0,528	0,092	0,629	**0,640**	(0.55-0.73)	3,0	0,130	1,913	0,654	7,8	1,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unemployment rate - 3 years average	*UP*	183	24,59%	10,0	0,505	0,006	0,612	**0,505**	(0.42-0.59)	11,4	0,040	1,911	0,672	15,7	4,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Auxiliary Indicators															
External Sector Indicators															
Current account balance - % of GDP	*UP*	183	24,59%	x	x	x	x	0,418	(0.33-0.51)	5,9	0,024	1,401	0,650	6,8	6,0
	DOWN			x	x	x	x	**0,648**	(0.56-0.73)	-1,4	0,168	2,299	0,694	-1,4	-1,4
Net Lending / Borrowing - % of GDP	*UP*	182	24,73%	x	x	x	x	0,406	(0.32-0.49)	5,0	0,016	1,191	0,626	8,6	5,1
	DOWN			x	x	x	x	**0,649**	(0.56-0.74)	-1,4	0,162	2,286	0,692	-1,4	-1,4
Real effective exchange rate, 42 trading partners - 1 year % change	*UP*	159	28,30%	x	x	x	x	0,367	(0.28-0.46)	9,8	0,000	0,000	0,642	13,7	13,7
	DOWN			x	x	x	x	**0,592**	(0.50-0.69)	-0,4	0,085	1,559	0,616	-1,9	-0,2
Real effective exchange rate, Euro area trading partners - 3 years % change	*UP*	183	24,59%	x	x	x	x	**0,572**	(0.48-0.66)	0,6	0,075	1,327	0,563	1,9	0,2
	DOWN			x	x	x	x	0,472	(0.38-0.56)	-1,5	0,036	1,751	0,667	-1,5	-1,5
Terms of trade - 5 years % change	*UP*	158	28,48%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,531**	(0.44-0.63)	-3,2	0,066	1,890	0,646	-3,2	-0,7
Export market shares - 1 year % change	*UP*	159	28,30%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,590**	(0.50-0.68)	-4,5	0,101	1,789	0,642	-4,4	-2,6
Export market share, volumes - 1 year % change	*UP*	183	24,59%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,503**	(0.41-0.59)	-6,0	0,048	2,335	0,683	-6,0	-1,2
Share of OECD export - 5 years % change	*UP*	157	28,66%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,550**	(0.46-0.64)	-10,9	0,063	3,509	0,669	-10,8	-7,2
Nominal unit labour cost index - 1 year % change	*UP*	159	28,30%	x	x	x	x	0,467	(0.37-0.56)	4,7	0,071	3,068	0,673	5,0	4,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal unit labour cost index - 10 years % change	*UP*	158	27,85%	x	x	x	x	0,489	(0.39-0.58)	0,6	0,001	1,002	0,361	8545,8	0,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unit labour cost performance relative to Euro area - 10 years % change	*UP*	147	29,93%	x	x	x	x	**0,646**	(0.55-0.74)	0,1	0,103	1,299	0,537	15,5	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour productivity - 1 year % change	*UP*	183	24,59%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,542**	(0.45-0.63)	-1,6	0,070	2,732	0,694	-1,6	-0,5

Direct investment in the reporting economy (flows) - % of GDP	*UP*	178	25,28%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,492	(0.40-0.58)	-43,4	0,008	65535,000	0,674	-34,2	-34,2
Direct investment in the reporting economy (stocks) - % of GDP	*UP*	159	28,30%	x	x	x	x	0,499	(0.40-0.59)	354,6	0,044	1,566	0,629	2621,0	10,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net external debt - % of GDP	*UP*	169	26,63%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,456	(0.37-0.55)	-2541,2	0,034	65535,000	0,680	-2501,3	-2501,3
Net trade balance of energy products - % of GDP	*UP*	174	25,86%	x	x	x	x	0,496	(0.40-0.59)	1,1	0,000	0,000	0,667	1,7	1,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Credit and Debt Indicators															
Private sector debt, non-consolidated - % of GDP	*UP*	174	25,14%	x	x	x	x	**0,608**	(0.52-0.70)	199,8	0,137	2,373	0,693	204,1	199,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Financial sector leverage (debt-to-equity) - %	*UP*	168	26,79%	x	x	x	x	**0,592**	(0.50-0.68)	609,2	0,149	5,690	0,738	609,2	398,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector credit flow, non-consolidated - % of GDP	*UP*	10	0,00%	x	x	x	x	**0,667**	x	11,2	0,333	3,000	0,700	12,4	12,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - million of national currency	*UP*	157	28,66%	x	x	x	x	0,487	(0.39-0.58)	2618348,8	0,063	1,316	0,573	4576617,9	2618348,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal house price index - 3 years % change	*UP*	173	26,01%	x	x	x	x	0,411	(0.32-0.50)	40,6	0,034	2,313	0,671	40,6	39,5
	DOWN			x	x	x	x	**0,595**	(0.50-0.69)	-2,7	0,094	2,355	0,682	-2,6	-0,5
Real Economic Activity Indicators															
Real gross domestic product (GDP) - 1 year % change	*UP*	182	24,73%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,612**	(0.52-0.70)	-1,4	0,112	3,301	0,714	-1,7	-1,3
Gross fixed capital formation - % of GDP	*UP*	183	24,59%	x	x	x	x	0,482	(0.39-0.57)	23,8	0,054	1,839	0,667	28,6	11,8
	DOWN			x	x	x	x	**0,500**	(0.41-0.59)	0,0	0,000	0,000	0,678	0,0	0,0
Gross domestic expenditure on R&D - % of GDP	*UP*	178	25,28%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,604**	(0.52-0.69)	1,8	0,159	1,713	0,624	1,8	1,8
Residential construction - % of GDP	*UP*	181	24,86%	x	x	x	x	**0,510**	(0.42-0.60)	6,2	0,050	1,455	0,630	6,2	2,7
	DOWN			x	x	x	x	0,490	(0.40-0.58)	4,2	0,047	1,379	0,619	4,3	12,6
Labour Market Indicators															
Unemployment rate - %	*UP*	159	28,30%	x	x	x	x	**0,520**	(0.43-0.61)	10,6	0,084	2,147	0,660	10,6	4,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Employment rate - 1 year % change	*UP*	183	24,59%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,646**	(0.56-0.73)	-0,6	0,148	3,036	0,721	-0,5	-0,5
Activity rate (15-64 years) - % of the total population of the same age group	*UP*	159	28,30%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,480	(0.39-0.57)	73,7	0,043	1,125	0,478	58,3	73,7
Long-term unemployment rate - % of active population in the same age group	*UP*	159	28,30%	x	x	x	x	0,471	(0.38-0.56)	5,5	0,049	1,670	0,635	5,5	1,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group	*UP*	159	28,30%	x	x	x	x	**0,592**	(0.50-0.69)	25,1	0,107	2,556	0,679	25,2	9,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population	*UP*	159	28,30%	x	x	x	x	**0,531**	(0.44-0.63)	14,0	0,092	2,105	0,660	14,0	11,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population, % point change (t, t-3)	*UP*	157	28,66%	x	x	x	x	**0,611**	(0.52-0.70)	2,5	0,114	4,261	0,701	2,8	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population	*UP*	145	29,66%	x	x	x	x	**0,518**	(0.42-0.62)	23,2	0,104	1,654	0,621	23,2	23,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population, % point change (t, t-3)	*UP*	113	37,17%	x	x	x	x	**0,515**	(0.41-0.62)	2,2	0,050	1,796	0,593	2,3	2,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population	*UP*	155	28,39%	x	x	x	x	**0,527**	(0.43-0.62)	19,6	0,081	2,579	0,665	19,7	16,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population, % point change (t, t-3)	*UP*	145	29,66%	x	x	x	x	0,471	(0.37-0.57)	1,1	0,024	1,219	0,579	1,2	0,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population	*UP*	150	28,67%	x	x	x	x	0,485	(0.39-0.58)	11,0	0,076	3,030	0,660	11,0	11,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population, % point change (t, t-3)	*UP*	113	37,17%	x	x	x	x	0,471	(0.36-0.58)	4,9	0,041	65535,000	0,602	5,2	5,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work Intensity - % of population aged 0-59	*UP*	145	29,66%	x	x	x	x	0,421	(0.32-0.52)	12,7	0,014	1,188	0,586	17,0	3,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work intensity - % of population aged 0-59, % point change (t, t-3)	*UP*	113	37,17%	x	x	x	x	**0,612**	(0.50-0.72)	0,3	0,126	1,704	0,628	0,3	0,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x

Source: Authors' calculations based on data from the EC and Eurostat.

Table A.4 **Results for the signals approach and loss and usefulness function of the policymaker for the non-EA, one year time lag**

Scoreboard Indicators 1Y lag		#	Probability of event	Official threshold				AUROC	AUROC confidence interval	Optimal threshold					
				Value	Implied Preferences	Absolute Utility	Prediction Rate			Value	Max Absolute Utility	Inverse aNtS	Prediction Rate	mu=0.4	mu=0.6
External Sector Indicators															
Current account balance - % of GDP, 3 years average	*UP*	197	24,87%	6,0	0,555	-0,096	0,437	**0,545**	(0.46-0.63)	5,5	0,055	3,378	0,772	5,6	0,8
	DOWN			-4,0				0,423	(0.34-0.51)	-12,8	0,014	1,689	0,756	-12,4	-2,4
Real effective exchange rate, 42 trading partners - 3 years % change	*UP*	198	24,75%	11,0	0,445	-0,030	0,487	0,453	(0.37-0.54)	18,6	0,029	2,125	0,758	18,8	5,4
	DOWN			-11,0				**0,602**	(0.52-0.69)	-1,5	0,101	1,838	0,687	-1,5	-0,8
Export market shares - 5 years % change	*UP*	186	25,27%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-6,0	0,671	-0,102	0,726	**0,643**	(0.56-0.73)	-13,4	0,147	5,714	0,806	-13,2	-6,7
Nominal unit labour cost index - 3 years % change	*UP*	192	23,96%	12,0	0,560	-0,092	0,594	0,439	(0.35-0.53)	27,9	0,041	2,021	0,750	35,8	28,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net international investment position - % of GDP	*UP*	197	24,87%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-35,0	0,581	-0,055	0,482	**0,536**	(0.45-0.62)	-79,9	0,079	2,858	0,761	-79,2	-57,8
Credit and Debt Indicators															
Private sector credit flow, consolidated - % of GDP	*UP*	180	24,44%	14,0	0,615	-0,304	0,572	0,227	(0.16-0.30)	41,9	0,000	0,000	0,767	132,8	132,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector debt, consolidated - % of GDP	*UP*	192	25,52%	133,0	0,485	0,057	0,656	**0,621**	(0.54-0.71)	101,7	0,114	1,577	0,609	173,1	70,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
General government sector debt - % of GDP	*UP*	195	25,13%	60,0	0,487	0,055	0,718	**0,600**	(0.51-0.69)	27,8	0,097	1,287	0,451	70,6	27,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - 1 year % change	*UP*	193	25,39%	16,5	0,529	-0,168	0,518	0,305	(0.23-0.38)	69,1	0,000	0,000	0,767	92,4	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
House price index, deflated - 1 year % change	*UP*	150	27,33%	6,0	0,796	-0,629	0,407	0,187	(0.11-0.26)	71,7	0,000	0,000	0,733	71,7	71,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour Market Indicators															
Activity rate (15-64 years) - % point change (t, t-3)	*UP*	166	24,70%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-0,2	0,444	0,062	0,699	**0,587**	(0.49-0.68)	-0,3	0,095	1,951	0,699	-0,2	-0,2
Long-term unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	166	24,70%	0,5	0,365	0,085	0,741	**0,731**	(0.65-0.82)	0,2	0,234	2,947	0,747	0,2	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	167	24,55%	2,0	0,395	0,073	0,695	**0,688**	(0.60-0.78)	1,4	0,178	2,184	0,689	1,8	1,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unemployment rate - 3 years average	*UP*	195	24,62%	10,0	0,503	-0,004	0,590	**0,503**	(0.42-0.59)	14,7	0,047	1,875	0,733	14,8	5,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Auxiliary Indicators															
External Sector Indicators															
Current account balance - % of GDP	*UP*	198	24,75%	x	x	x	x	**0,594**	(0.51-0.68)	0,4	0,099	1,974	0,707	0,6	0,6
	DOWN			x	x	x	x	0,342	(0.26-0.42)	-23,9	0,000	0,000	0,773	-23,9	-23,9
Net Lending / Borrowing - % of GDP	*UP*	195	25,13%	x	x	x	x	**0,615**	(0.53-0.70)	0,4	0,111	1,833	0,677	5,9	0,6
	DOWN			x	x	x	x	0,353	(0.27-0.43)	-25,7	0,000	0,000	0,769	-25,7	-25,7
Real effective exchange rate, 42 trading partners - 1 year % change	*UP*	168	24,40%	x	x	x	x	0,435	(0.34-0.53)	9,8	0,009	1,549	0,744	14,0	1,9
	DOWN			x	x	x	x	**0,606**	(0.51-0.70)	-2,2	0,125	2,508	0,732	-2,2	-2,2
Real effective exchange rate, Euro area trading partners - 3 years % change	*UP*	178	24,16%	x	x	x	x	0,468	(0.38-0.56)	7,6	0,033	1,276	0,652	7,9	7,9
	DOWN			x	x	x	x	**0,566**	(0.48-0.66)	-1,2	0,090	1,663	0,663	-1,2	-1,2
Terms of trade - 5 years % change	*UP*	164	25,00%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,591**	(0.50-0.68)	-0,9	0,106	2,040	0,701	-0,8	-0,6
Export market shares - 1 year % change	*UP*	168	24,40%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,668**	(0.58-0.76)	-1,8	0,166	2,828	0,744	-1,7	-1,2
Export market share, volumes - 1 year % change	*UP*	198	24,75%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,580**	(0.49-0.67)	-0,4	0,103	1,632	0,641	-0,4	-0,4
Share of OECD export - 5 years % change	*UP*	158	25,32%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,661**	(0.57-0.75)	-5,9	0,155	4,068	0,778	-5,8	-5,8
Nominal unit labour cost index - 1 year % change	*UP*	166	24,10%	x	x	x	x	0,395	(0.30-0.49)	15,9	0,009	1,575	0,747	16,3	1,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal unit labour cost index - 10 years % change	*UP*	141	28,37%	x	x	x	x	0,473	(0.37-0.57)	113,8	0,008	1,126	0,660	16977,9	0,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unit labour cost performance relative to Euro area - 10 years % change	*UP*	152	26,32%	x	x	x	x	0,469	(0.37-0.57)	0,1	0,041	1,092	0,336	4625,8	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour productivity - 1 year % change	*UP*	198	24,75%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,662**	(0.58-0.74)	-0,4	0,164	5,564	0,808	-0,3	-0,3

Direct investment in the reporting economy (flows) - % of GDP	*UP*	193	25,39%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,513**	(0.43-0.60)	-2,5	0,020	2,467	0,762	-2,4	-2,4
Direct investment in the reporting economy (stocks) - % of GDP	*UP*	162	25,31%	x	x	x	x	**0,545**	(0.45-0.64)	39,0	0,076	1,215	0,438	196,8	39,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net external debt - % of GDP	*UP*	158	26,58%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,472	(0.38-0.57)	-2989,6	0,000	0,000	0,753	-1689,2	-1689,2
Net trade balance of energy products - % of GDP	*UP*	186	24,19%	x	x	x	x	**0,517**	(0.43-0.61)	0,4	0,021	1,558	0,742	0,4	0,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Credit and Debt Indicators															
Private sector debt, non-consolidated - % of GDP	*UP*	186	25,13%	x	x	x	x	**0,610**	(0.52-0.70)	117,5	0,119	1,585	0,605	177,1	118,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Financial sector leverage (debt-to-equity) - %	*UP*	181	24,31%	x	x	x	x	0,490	(0.40-0.58)	749,7	0,055	1,734	0,713	749,7	117,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector credit flow, non-consolidated - % of GDP	*UP*	13	38,46%	x	x	x	x	0,083	x	20,2	0,000	0,000	0,769	21,3	21,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - million of national currency	*UP*	167	24,55%	x	x	x	x	**0,655**	(0.56-0.75)	333701,5	0,141	1,537	0,557	12083316,0	333701,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal house price index - 3 years % change	*UP*	133	28,57%	x	x	x	x	0,258	(0.17-0.34)	162,1	0,000	0,000	0,737	162,1	60,9
	DOWN			x	x	x	x	**0,741**	(0.65-0.83)	-0,5	0,236	3,200	0,759	-0,5	-0,5
Real Economic Activity Indicators															
Real gross domestic product (GDP) - 1 year % change	*UP*	198	24,75%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,733**	(0.66-0.81)	-0,2	0,236	13,033	0,859	-0,1	-0,1
Gross fixed capital formation - % of GDP	*UP*	198	24,75%	x	x	x	x	0,372	(0.29-0.45)	11,5	0,000	1,000	0,227	38,4	13,5
	DOWN			x	x	x	x	**0,500**	(0.41-0.59)	0,0	0,000	0,000	0,773	0,0	0,0
Gross domestic expenditure on R&D - % of GDP	*UP*	190	25,26%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,406	(0.32-0.49)	3,1	0,012	1,025	0,274	0,2	3,1
Residential construction - % of GDP	*UP*	185	24,32%	x	x	x	x	0,490	(0.40-0.58)	2,5	0,064	1,182	0,416	12,9	2,6
	DOWN			x	x	x	x	**0,509**	(0.42-0.60)	4,3	0,094	1,245	0,395	4,3	4,3
Labour Market Indicators															
Unemployment rate - %	*UP*	168	24,40%	x	x	x	x	**0,544**	(0.45-0.64)	13,4	0,079	2,434	0,738	17,0	5,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Employment rate - 1 year % change	*UP*	195	24,62%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,697**	(0.62-0.78)	-0,8	0,180	3,595	0,779	-1,2	-0,5
Activity rate (15-64 years) - % of the total population of the same age group	*UP*	168	24,40%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,420	(0.33-0.51)	64,9	0,049	1,399	0,655	65,0	80,9
Long-term unemployment rate - % of active population in the same age group	*UP*	168	24,40%	x	x	x	x	0,442	(0.35-0.53)	8,0	0,046	2,168	0,738	8,2	1,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group	*UP*	168	24,40%	x	x	x	x	**0,565**	(0.47-0.66)	32,9	0,090	5,576	0,780	35,2	10,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population	*UP*	168	24,40%	x	x	x	x	**0,502**	(0.41-0.60)	13,1	0,099	1,585	0,631	13,1	13,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population, % point change (t, t-3)	*UP*	157	25,48%	x	x	x	x	**0,736**	(0.65-0.82)	0,2	0,218	2,642	0,726	0,2	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population	*UP*	131	29,77%	x	x	x	x	0,470	(0.37-0.57)	17,2	0,037	1,096	0,412	61,3	14,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population, % point change (t, t-3)	*UP*	85	43,53%	x	x	x	x	**0,531**	(0.41-0.66)	0,1	0,073	1,446	0,588	0,1	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population	*UP*	145	26,90%	x	x	x	x	**0,539**	(0.44-0.64)	19,5	0,101	1,977	0,690	19,5	11,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population, % point change (t, t-3)	*UP*	117	31,62%	x	x	x	x	0,428	(0.32-0.54)	1,3	0,005	1,034	0,581	7,6	1,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population	*UP*	132	29,55%	x	x	x	x	0,426	(0.32-0.53)	1,3	0,016	1,033	0,318	57,7	1,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population, % point change (t, t-3)	*UP*	85	43,53%	x	x	x	x	**0,521**	(0.40-0.65)	0,1	0,055	1,361	0,576	0,2	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work Intensity - % of population aged 0-59	*UP*	131	29,77%	x	x	x	x	**0,570**	(0.47-0.67)	10,1	0,110	1,747	0,649	10,2	10,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work intensity - % of population aged 0-59, % point change (t, t-3)	*UP*	85	43,53%	x	x	x	x	**0,534**	(0.41-0.66)	0,1	0,080	1,437	0,588	0,2	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x

Source: Authors' calculations based on data from the EC and Eurostat.

Table A.5 **Results for the signals approach and loss and usefulness function of the policymaker for the non-EA, two year time lag**

Scoreboard Indicators 2Y lag		#	Probability of event	Official threshold				AUROC	AUROC confidence interval	Optimal threshold					
				Value	Implied Preferences	Absolute Utility	Prediction Rate			Value	Max Absolute Utility	Inverse aNtS	Prediction Rate	mu=0.4	mu=0.6
External Sector Indicators															
Current account balance - % of GDP, 3 years average	*UP*	188	25,00%	6,0	0,520	-0,050	0,436	**0,541**	(0.45-0.63)	2,5	0,068	2,317	0,750	2,6	2,6
	DOWN			-4,0				0,473	(0.39-0.56)	-10,1	0,061	2,781	0,766	-10,1	-8,2
Real effective exchange rate, 42 trading partners - 3 years % change	*UP*	189	24,87%	11,0	0,440	-0,038	0,484	0,408	(0.32-0.49)	18,6	0,017	1,556	0,751	18,8	18,8
	DOWN			-11,0				**0,612**	(0.53-0.70)	-1,2	0,105	1,795	0,677	-4,0	-1,1
Export market shares - 5 years % change	*UP*	177	25,42%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-6,0	0,742	-0,245	0,706	**0,603**	(0.51-0.69)	-10,3	0,136	3,228	0,774	-10,1	-10,1
Nominal unit labour cost index - 3 years % change	*UP*	183	24,04%	12,0	0,545	-0,051	0,601	**0,529**	(0.44-0.62)	27,9	0,075	3,117	0,770	28,2	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net international investment position - % of GDP	*UP*	188	25,00%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-35,0	0,633	-0,088	0,489	**0,530**	(0.44-0.62)	-57,8	0,081	1,604	0,665	-87,9	-50,5
Credit and Debt Indicators															
Private sector credit flow, consolidated - % of GDP	*UP*	171	24,56%	14,0	0,574	-0,155	0,614	0,366	(0.28-0.45)	41,9	0,000	0,000	0,760	132,8	15,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector debt, consolidated - % of GDP	*UP*	183	25,68%	133,0	0,452	0,025	0,650	**0,658**	(0.57-0.74)	70,3	0,138	1,474	0,519	170,6	67,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
General government sector debt - % of GDP	*UP*	186	25,27%	60,0	0,505	0,038	0,715	**0,544**	(0.46-0.63)	63,5	0,063	2,143	0,742	64,7	27,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - 1 year % change	*UP*	184	25,54%	16,5	0,485	-0,104	0,533	0,390	(0.30-0.48)	1,3	0,025	1,060	0,332	92,4	1,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
House price index, deflated - 1 year % change	*UP*	141	27,66%	6,0	0,705	-0,426	0,454	0,297	(0.21-0.39)	71,7	0,000	0,000	0,738	71,7	71,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour Market Indicators															
Activity rate (15-64 years) - % point change (t, t-3)	*UP*	157	24,84%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-0,2	0,507	0,067	0,675	**0,566**	(0.47-0.66)	-1,2	0,078	3,291	0,752	-1,2	-0,2
Long-term unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	157	24,84%	0,5	0,328	-0,006	0,682	**0,643**	(0.55-0.74)	0,2	0,167	2,151	0,688	0,2	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	158	24,68%	2,0	1,000	-0,375	0,684	**0,634**	(0.54-0.73)	2,2	0,177	2,305	0,703	2,2	2,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unemployment rate - 3 years average	*UP*	186	24,73%	10,0	0,497	-0,097	0,522	0,388	(0.30-0.47)	5,0	0,013	1,029	0,285	19,3	5,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Auxiliary Indicators															
External Sector Indicators															
Current account balance - % of GDP	*UP*	189	24,87%	x	x	x	x	**0,575**	(0.49-0.66)	0,2	0,073	1,694	0,693	6,1	0,3
	DOWN			x	x	x	x	0,417	(0.33-0.50)	-11,8	0,044	2,625	0,767	-11,8	-11,8
Net Lending / Borrowing - % of GDP	*UP*	186	25,27%	x	x	x	x	**0,549**	(0.46-0.64)	6,0	0,074	4,571	0,785	6,1	1,1
	DOWN			x	x	x	x	0,441	(0.35-0.53)	-10,9	0,051	3,429	0,774	-10,8	-10,8
Real effective exchange rate, 42 trading partners - 1 year % change	*UP*	159	24,53%	x	x	x	x	**0,525**	(0.43-0.62)	0,7	0,048	1,190	0,522	10,0	0,5
	DOWN			x	x	x	x	**0,512**	(0.42-0.61)	-2,6	0,083	2,231	0,723	-2,5	-2,5
Real effective exchange rate, Euro area trading partners - 3 years % change	*UP*	169	24,26%	x	x	x	x	0,439	(0.35-0.53)	8,4	0,010	1,075	0,633	38,9	8,4
	DOWN			x	x	x	x	**0,555**	(0.46-0.65)	-0,5	0,078	1,528	0,645	-0,5	-0,5
Terms of trade - 5 years % change	*UP*	155	25,16%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,530**	(0.43-0.63)	-1,7	0,046	1,506	0,677	-2,9	-0,5
Export market shares - 1 year % change	*UP*	159	24,53%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,594**	(0.50-0.69)	-3,9	0,099	2,314	0,723	-6,0	-3,6
Export market share, volumes - 1 year % change	*UP*	189	24,87%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,607**	(0.52-0.69)	-0,4	0,119	1,714	0,646	-0,4	-0,4
Share of OECD export - 5 years % change	*UP*	149	25,50%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,622**	(0.53-0.72)	-3,3	0,131	2,838	0,745	-3,2	-3,2
Nominal unit labour cost index - 1 year % change	*UP*	157	24,20%	x	x	x	x	0,491	(0.39-0.59)	15,9	0,060	15,128	0,777	16,3	5,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal unit labour cost index - 10 years % change	*UP*	132	28,79%	x	x	x	x	0,466	(0.36-0.57)	113,8	0,019	1,295	0,652	113,8	0,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unit labour cost performance relative to Euro area - 10 years % change	*UP*	143	26,57%	x	x	x	x	0,463	(0.36-0.56)	61,8	0,030	1,422	0,678	61,8	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour productivity - 1 year % change	*UP*	189	24,87%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,582**	(0.49-0.67)	-0,4	0,085	2,471	0,751	-0,3	-0,3

Direct investment in the reporting economy (flows) - % of GDP	*UP*	184	25,54%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,519**	(0.43-0.61)	-3,5	0,029	5,071	0,777	-3,2	-3,2
Direct investment in the reporting economy (stocks) - % of GDP	*UP*	153	25,49%	x	x	x	x	**0,539**	(0.44-0.64)	39,0	0,067	1,195	0,444	153,7	39,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net external debt - % of GDP	*UP*	150	26,67%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,443	(0.35-0.54)	-2989,6	0,000	0,000	0,767	-1689,2	-1689,2
Net trade balance of energy products - % of GDP	*UP*	177	24,29%	x	x	x	x	**0,533**	(0.44-0.62)	0,4	0,036	1,990	0,746	0,4	0,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Credit and Debt Indicators															
Private sector debt, non-consolidated - % of GDP	*UP*	177	25,27%	x	x	x	x	**0,660**	(0.57-0.75)	111,8	0,144	1,714	0,618	111,8	72,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Financial sector leverage (debt-to-equity) - %	*UP*	172	24,42%	x	x	x	x	0,496	(0.40-0.59)	759,7	0,062	1,850	0,715	764,7	97,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector credit flow, non-consolidated - % of GDP	*UP*	13	38,46%	x	x	x	x	0,125	x	2,1	0,083	1,200	0,231	21,3	3,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - million of national currency	*UP*	158	24,68%	x	x	x	x	**0,667**	(0.57-0.76)	12083316,0	0,153	2,803	0,741	12083316,0	333701,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal house price index - 3 years % change	*UP*	124	29,03%	x	x	x	x	0,364	(0.26-0.47)	59,0	0,037	1,970	0,718	102,7	60,9
	DOWN			x	x	x	x	**0,660**	(0.56-0.76)	-0,5	0,177	2,398	0,710	-0,5	-0,5
Real Economic Activity Indicators															
Real gross domestic product (GDP) - 1 year % change	*UP*	189	24,87%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,646**	(0.56-0.73)	-0,2	0,146	4,308	0,794	-0,1	-0,1
Gross fixed capital formation - % of GDP	*UP*	189	24,87%	x	x	x	x	0,467	(0.38-0.55)	28,5	0,046	2,227	0,757	28,5	13,5
	DOWN			x	x	x	x	**0,500**	(0.41-0.59)	0,0	0,000	0,000	0,778	0,0	0,0
Gross domestic expenditure on R&D - % of GDP	*UP*	186	25,27%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,378	(0.29-0.46)	3,3	0,028	1,059	0,269	0,2	3,3
Residential construction - % of GDP	*UP*	178	24,72%	x	x	x	x	**0,607**	(0.52-0.70)	2,6	0,145	1,442	0,472	2,6	2,6
	DOWN			x	x	x	x	0,393	(0.31-0.48)	4,3	0,041	1,105	0,354	0,9	4,3
Labour Market Indicators															
Unemployment rate - %	*UP*	159	24,53%	x	x	x	x	0,392	(0.30-0.48)	19,5	0,013	65535,000	0,755	19,7	3,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Employment rate - 1 year % change	*UP*	186	24,73%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,654**	(0.57-0.74)	-0,2	0,137	2,047	0,694	-1,1	-0,1
Activity rate (15-64 years) - % of the total population of the same age group	*UP*	159	24,53%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,418	(0.32-0.51)	65,2	0,041	1,302	0,635	65,2	80,9
Long-term unemployment rate - % of active population in the same age group	*UP*	159	24,53%	x	x	x	x	0,341	(0.25-0.43)	1,3	0,021	1,050	0,333	10,6	1,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group	*UP*	159	24,53%	x	x	x	x	0,419	(0.33-0.51)	36,3	0,037	3,967	0,755	36,5	7,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population	*UP*	159	24,53%	x	x	x	x	0,405	(0.31-0.50)	3,7	0,004	1,008	0,258	29,0	4,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population, % point change (t, t-3)	*UP*	148	25,68%	x	x	x	x	**0,659**	(0.56-0.75)	0,9	0,177	2,673	0,730	1,0	1,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population	*UP*	122	30,33%	x	x	x	x	0,449	(0.34-0.55)	15,0	0,029	1,064	0,369	61,3	15,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population, % point change (t, t-3)	*UP*	76	46,05%	x	x	x	x	0,439	(0.31-0.57)	5,9	0,000	0,000	0,618	7,0	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population	*UP*	136	27,21%	x	x	x	x	**0,542**	(0.44-0.65)	19,5	0,089	1,865	0,676	19,5	18,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population, % point change (t, t-3)	*UP*	108	32,41%	x	x	x	x	**0,501**	(0.39-0.61)	1,4	0,028	1,222	0,602	5,1	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population	*UP*	123	30,08%	x	x	x	x	0,408	(0.30-0.51)	1,6	0,023	1,049	0,358	57,7	1,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population, % point change (t, t-3)	*UP*	76	46,05%	x	x	x	x	0,437	(0.31-0.57)	11,7	0,000	0,000	0,618	11,7	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work Intensity - % of population aged 0-59	*UP*	122	30,33%	x	x	x	x	**0,530**	(0.42-0.64)	10,1	0,081	1,498	0,615	10,2	5,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work intensity - % of population aged 0-59, % point change (t, t-3)	*UP*	76	46,05%	x	x	x	x	**0,510**	(0.38-0.64)	0,4	0,067	1,351	0,579	0,5	0,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x

Source: Authors' calculations based on data from the EC and Eurostat.

Table A.6 **Results for the signals approach and loss and usefulness function of the policymaker for the non-EA, three year time lag**

Scoreboard Indicators 3Y lag, non-EA		#	Probability of event	Official threshold				AUROC	AUROC confidence interval	Optimal threshold					
				Value	Implied Preferences	Absolute Utility	Prediction Rate			Value	Max Absolute Utility	Inverse aNtS	Prediction Rate	mu=0.4	mu=0.6
External Sector Indicators															
Current account balance - % of GDP, 3 years average	*UP*	178	24,16%	6,0	0,505	-0,011	0,444	**0,540**	(0.45-0.63)	2,3	0,059	2,148	0,742	2,4	2,4
	DOWN			-4,0				**0,512**	(0.42-0.60)	-10,1	0,093	4,177	0,781	-10,1	-10,1
Real effective exchange rate, 42 trading partners - 3 years % change	*UP*	179	24,02%	11,0	0,480	-0,016	0,472	0,399	(0.31-0.49)	18,6	0,015	1,450	0,737	32,0	18,8
	DOWN			-11,0				**0,586**	(0.50-0.68)	-1,2	0,087	1,678	0,670	-2,4	-1,1
Export market shares - 5 years % change	*UP*	167	24,55%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-6,0	0,666	-0,165	0,701	**0,574**	(0.48-0.67)	-12,4	0,102	3,221	0,772	-12,2	-7,7
Nominal unit labour cost index - 3 years % change	*UP*	173	23,12%	12,0	0,525	0,010	0,613	**0,585**	(0.49-0.68)	22,4	0,086	2,495	0,740	23,1	7,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net international investment position - % of GDP	*UP*	178	24,16%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-35,0	0,618	-0,105	0,478	**0,516**	(0.42-0.61)	-86,8	0,070	3,701	0,770	-86,8	-44,6
Credit and Debt Indicators															
Private sector credit flow, consolidated - % of GDP	*UP*	161	23,60%	14,0	0,506	0,025	0,652	**0,505**	(0.41-0.60)	16,6	0,051	1,722	0,702	16,6	9,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector debt, consolidated - % of GDP	*UP*	173	24,86%	133,0	0,469	0,022	0,636	**0,648**	(0.56-0.74)	67,8	0,127	1,421	0,509	179,3	67,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
General government sector debt - % of GDP	*UP*	176	24,43%	60,0	0,520	-0,013	0,693	0,488	(0.40-0.58)	63,5	0,039	1,702	0,722	63,8	7,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - 1 year % change	*UP*	174	24,71%	16,5	0,472	-0,095	0,529	0,442	(0.35-0.53)	0,9	0,051	1,125	0,356	47,3	1,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
House price index, deflated - 1 year % change	*UP*	131	26,72%	6,0	0,622	-0,205	0,519	0,443	(0.34-0.55)	18,5	0,046	2,262	0,718	18,8	18,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour Market Indicators															
Activity rate (15-64 years) - % point change (t, t-3)	*UP*	147	23,81%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-0,2	0,529	-0,005	0,633	**0,525**	(0.42-0.63)	-1,3	0,045	2,081	0,714	-1,2	-0,2
Long-term unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	147	23,81%	0,5	0,448	-0,013	0,592	**0,517**	(0.42-0.62)	0,2	0,043	1,235	0,585	0,2	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	148	23,65%	2,0	0,690	-0,127	0,615	**0,555**	(0.45-0.65)	2,2	0,100	1,620	0,635	2,2	2,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unemployment rate - 3 years average	*UP*	176	23,86%	10,0	0,500	-0,161	0,466	0,342	(0.26-0.43)	2,2	0,000	1,000	0,239	23,0	2,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Auxiliary Indicators															
External Sector Indicators															
Current account balance - % of GDP	*UP*	179	24,02%	x	x	x	x	**0,526**	(0.44-0.62)	5,6	0,050	3,262	0,765	5,8	2,7
	DOWN			x	x	x	x	0,481	(0.39-0.57)	-11,8	0,089	5,871	0,788	-11,8	-11,8
Net Lending / Borrowing - % of GDP	*UP*	176	24,43%	x	x	x	x	**0,510**	(0.42-0.60)	5,4	0,038	2,127	0,744	5,6	5,6
	DOWN			x	x	x	x	**0,503**	(0.41-0.59)	-10,9	0,096	9,571	0,795	-10,8	-10,8
Real effective exchange rate, 42 trading partners - 1 year % change	*UP*	149	23,49%	x	x	x	x	0,486	(0.39-0.59)	0,9	0,024	1,100	0,523	10,0	0,9
	DOWN			x	x	x	x	**0,532**	(0.43-0.63)	-2,6	0,073	2,141	0,711	-2,5	-2,5
Real effective exchange rate, Euro area trading partners - 3 years % change	*UP*	159	23,27%	x	x	x	x	0,421	(0.33-0.52)	30,1	0,013	65535,000	0,755	34,4	0,4
	DOWN			x	x	x	x	**0,532**	(0.44-0.63)	-0,5	0,049	1,352	0,635	-12,8	-0,5
Terms of trade - 5 years % change	*UP*	145	24,14%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,483	(0.38-0.58)	-2,6	0,005	1,094	0,676	-9,0	-0,5
Export market shares - 1 year % change	*UP*	149	23,49%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,563**	(0.46-0.66)	-5,0	0,067	2,453	0,725	-4,9	-0,2
Export market share, volumes - 1 year % change	*UP*	179	24,02%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,540**	(0.45-0.63)	-0,4	0,040	1,215	0,587	-3,7	-0,4
Share of OECD export - 5 years % change	*UP*	139	24,46%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,579**	(0.48-0.68)	-5,6	0,095	2,623	0,734	-5,4	-5,4
Nominal unit labour cost index - 1 year % change	*UP*	147	23,13%	x	x	x	x	**0,531**	(0.43-0.63)	5,3	0,105	2,497	0,721	5,3	5,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal unit labour cost index - 10 years % change	*UP*	122	27,87%	x	x	x	x	0,477	(0.37-0.58)	113,8	0,014	1,196	0,631	396,7	0,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unit labour cost performance relative to Euro area - 10 years % change	*UP*	133	25,56%	x	x	x	x	0,481	(0.38-0.58)	61,8	0,037	1,495	0,662	61,8	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour productivity - 1 year % change	*UP*	179	24,02%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,570**	(0.48-0.66)	-0,4	0,073	2,243	0,737	-0,3	-0,3

Direct investment in the reporting economy (flows) - % of GDP	*UP*	174	24,71%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,536**	(0.44-0.63)	-2,5	0,036	4,190	0,764	-1,4	-1,4
Direct investment in the reporting economy (stocks) - % of GDP	*UP*	143	24,48%	x	x	x	x	**0,528**	(0.43-0.63)	39,0	0,043	1,124	0,441	125,1	39,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net external debt - % of GDP	*UP*	141	25,53%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,443	(0.34-0.54)	-2989,6	0,000	0,000	0,759	-1689,2	-1689,2
Net trade balance of energy products - % of GDP	*UP*	167	23,35%	x	x	x	x	**0,547**	(0.45-0.64)	0,4	0,050	2,390	0,743	0,4	0,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Credit and Debt Indicators															
Private sector debt, non-consolidated - % of GDP	*UP*	167	24,43%	x	x	x	x	**0,659**	(0.57-0.75)	72,0	0,143	1,461	0,506	104,0	72,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Financial sector leverage (debt-to-equity) - %	*UP*	162	23,46%	x	x	x	x	0,486	(0.39-0.58)	950,4	0,036	1,722	0,716	950,4	97,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector credit flow, non-consolidated - % of GDP	*UP*	13	38,46%	x	x	x	x	0,125	x	2,1	0,083	1,200	0,231	21,3	3,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - million of national currency	*UP*	148	23,65%	x	x	x	x	**0,663**	(0.57-0.76)	10125047,0	0,154	2,850	0,736	10614614,2	333701,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal house price index - 3 years % change	*UP*	114	28,07%	x	x	x	x	0,482	(0.37-0.59)	56,3	0,077	3,124	0,737	57,3	57,3
	DOWN			x	x	x	x	**0,544**	(0.43-0.66)	-0,5	0,059	1,392	0,623	-0,5	-0,5
Real Economic Activity Indicators															
Real gross domestic product (GDP) - 1 year % change	*UP*	179	24,02%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,598**	(0.51-0.69)	-0,2	0,100	2,827	0,754	-0,1	-0,1
Gross fixed capital formation - % of GDP	*UP*	179	24,02%	x	x	x	x	**0,553**	(0.46-0.64)	25,8	0,082	1,680	0,676	31,9	22,8
	DOWN			x	x	x	x	**0,500**	(0.41-0.59)	0,0	0,000	0,000	0,765	0,0	0,0
Gross domestic expenditure on R&D - % of GDP	*UP*	176	24,43%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,348	(0.26-0.43)	3,2	0,022	1,046	0,284	0,2	3,2
Residential construction - % of GDP	*UP*	169	24,26%	x	x	x	x	**0,647**	(0.56-0.74)	2,7	0,144	1,454	0,491	3,5	2,6
	DOWN			x	x	x	x	0,352	(0.27-0.44)	7,2	0,019	1,040	0,254	0,9	7,3
Labour Market Indicators															
Unemployment rate - %	*UP*	149	23,49%	x	x	x	x	0,301	(0.21-0.39)	19,9	0,000	0,000	0,732	23,7	3,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Employment rate - 1 year % change	*UP*	176	23,86%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,589**	(0.50-0.68)	-0,3	0,104	1,772	0,670	-0,3	-0,3
Activity rate (15-64 years) - % of the total population of the same age group	*UP*	149	23,49%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,403	(0.31-0.50)	63,1	0,010	1,122	0,664	57,6	80,9
Long-term unemployment rate - % of active population in the same age group	*UP*	149	23,49%	x	x	x	x	0,290	(0.20-0.38)	12,0	0,000	0,000	0,732	15,7	0,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group	*UP*	149	23,49%	x	x	x	x	0,325	(0.23-0.42)	41,9	0,008	2,725	0,732	41,9	7,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population	*UP*	149	23,49%	x	x	x	x	0,342	(0.25-0.43)	3,4	0,000	1,000	0,268	29,0	3,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population, % point change (t, t-3)	*UP*	138	24,64%	x	x	x	x	**0,585**	(0.48-0.69)	0,9	0,110	1,862	0,667	1,0	1,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population	*UP*	112	29,46%	x	x	x	x	0,446	(0.33-0.56)	16,1	0,037	1,087	0,420	61,3	16,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population, % point change (t, t-3)	*UP*	66	46,97%	x	x	x	x	0,402	(0.26-0.54)	5,9	0,000	0,000	0,682	7,0	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population	*UP*	126	26,19%	x	x	x	x	**0,532**	(0.42-0.64)	20,5	0,072	2,045	0,683	20,8	11,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population, % point change (t, t-3)	*UP*	98	31,63%	x	x	x	x	**0,536**	(0.42-0.66)	3,4	0,065	3,765	0,684	3,7	2,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population	*UP*	113	29,20%	x	x	x	x	0,411	(0.30-0.52)	1,6	0,021	1,045	0,381	57,7	1,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population, % point change (t, t-3)	*UP*	66	46,97%	x	x	x	x	0,405	(0.26-0.55)	11,7	0,000	0,000	0,682	11,7	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work Intensity - % of population aged 0-59	*UP*	112	29,46%	x	x	x	x	**0,526**	(0.41-0.64)	9,7	0,060	1,348	0,589	9,8	5,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work intensity - % of population aged 0-59, % point change (t, t-3)	*UP*	66	46,97%	x	x	x	x	0,395	(0.26-0.53)	7,2	0,000	0,000	0,682	8,9	8,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x

Source: Authors' calculations based on data from the EC and Eurostat.

Table A.7 **Results for the signals approach and loss and usefulness function of the policymaker for the EU28, one year time lag**

Scoreboard Indicators 1Y lag		#	Probability of event	Official threshold				AUROC	AUROC confidence interval	Optimal threshold					
				Value	Implied Preferences	Max Absolute Utility	Prediction Rate			Value	Max Absolute Utility	Inverse aNtS	Prediction Rate	mu=0.4	mu=0.6
External Sector Indicators															
Current account balance - % of GDP, 3 years average	*UP*	417	26,14%	6,0	0,515	-0,010	0,528	0,496	(0.44-0.55)	5,5	0,038	1,742	0,715	5,6	2,4
	DOWN			-4,0				**0,510**	(0.45-0.57)	-1,8	0,037	1,158	0,532	-12,4	-1,4
Real effective exchange rate, 42 trading partners - 3 years % change	*UP*	418	26,08%	11.0/4.0	0,565	-0,050	0,519	0,434	(0.38-0.49)	18,6	0,009	1,635	0,737	18,8	0,1
	DOWN			-11.0/-4.0				**0,564**	(0.51-0.62)	-2,3	0,077	1,748	0,684	-2,3	-2,3
Export market shares - 5 years % change	*UP*	402	26,62%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-6,0	0,536	0,099	0,654	**0,686**	(0.63-0.74)	-8,2	0,151	2,206	0,699	-9,5	-3,4
Nominal unit labour cost index - 3 years % change	*UP*	410	25,85%	12.0/9.0	0,585	-0,131	0,517	0,436	(0.38-0.49)	11,8	0,033	1,329	0,663	35,8	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net international investment position - % of GDP	*UP*	415	26,27%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-35,0	0,582	-0,019	0,561	**0,606**	(0.55-0.66)	-79,9	0,128	3,719	0,764	-79,9	-79,9
Credit and Debt Indicators															
Private sector credit flow, consolidated - % of GDP	*UP*	385	27,01%	14,0	0,617	-0,266	0,592	0,270	(0.22-0.32)	41,9	0,003	2,738	0,732	44,9	44,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector debt, consolidated - % of GDP	*UP*	408	26,72%	133,0	0,533	0,040	0,610	**0,647**	(0.59-0.70)	173,1	0,131	2,520	0,725	191,9	103,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
General government sector debt - % of GDP	*UP*	413	26,39%	60,0	0,509	0,029	0,576	**0,575**	(0.52-0.63)	107,0	0,066	5,471	0,763	109,0	14,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - 1 year % change	*UP*	409	26,65%	16,5	0,564	-0,191	0,587	0,314	(0.26-0.37)	115,7	0,000	0,000	0,741	115,7	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
House price index, deflated - 1 year % change	*UP*	361	27,98%	6,0	0,818	-0,676	0,474	0,181	(0.14-0.23)	71,7	0,000	0,000	0,720	71,7	71,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour Market Indicators															
Activity rate (15-64 years) - % point change (t, t-3)	*UP*	361	27,98%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-0,2	0,458	0,056	0,701	**0,569**	(0.51-0.63)	-0,3	0,074	2,074	0,701	-1,2	-0,2
Long-term unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	360	28,06%	0,5	0,577	0,083	0,686	**0,730**	(0.67-0.79)	0,6	0,202	3,008	0,744	1,1	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	363	27,82%	2,0	0,571	0,076	0,669	**0,712**	(0.66-0.77)	4,5	0,185	3,550	0,760	6,0	1,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unemployment rate - 3 years average	*UP*	415	26,02%	10,0	0,540	-0,008	0,634	**0,545**	(0.49-0.60)	13,1	0,074	2,385	0,730	13,2	2,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Auxiliary Indicators															
External Sector Indicators															
Current account balance - % of GDP	*UP*	418	26,08%	x	x	x	x	**0,537**	(0.48-0.60)	0,4	0,042	1,250	0,600	5,4	0,6
	DOWN			x	x	x	x	0,437	(0.38-0.49)	-23,9	0,000	0,000	0,746	-23,9	-0,1
Net Lending / Borrowing - % of GDP	*UP*	414	26,33%	x	x	x	x	**0,546**	(0.49-0.60)	2,1	0,057	1,418	0,640	8,7	0,3
	DOWN			x	x	x	x	0,438	(0.38-0.50)	-25,7	0,000	0,000	0,744	-25,7	-2,4
Real effective exchange rate, 42 trading partners - 1 year % change	*UP*	364	27,75%	x	x	x	x	0,460	(0.40-0.52)	13,1	0,003	2,604	0,723	14,0	0,1
	DOWN			x	x	x	x	**0,537**	(0.48-0.60)	-1,1	0,039	1,284	0,621	-5,2	-0,4
Real effective exchange rate, Euro area trading partners - 3 years % change	*UP*	398	25,88%	x	x	x	x	0,492	(0.43-0.55)	0,4	0,008	1,029	0,472	38,9	0,2
	DOWN			x	x	x	x	**0,508**	(0.45-0.57)	-2,3	0,036	1,542	0,696	-5,0	-1,2
Terms of trade - 5 years % change	*UP*	359	28,13%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,605**	(0.54-0.67)	-0,5	0,102	1,538	0,610	-2,0	-0,4
Export market shares - 1 year % change	*UP*	364	27,75%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,597**	(0.54-0.66)	-2,4	0,092	1,615	0,640	-2,4	-1,3
Export market share, volumes - 1 year % change	*UP*	418	26,08%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,565**	(0.51-0.62)	-0,4	0,081	1,365	0,569	-0,4	-0,4
Share of OECD export - 5 years % change	*UP*	352	28,41%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,646**	(0.59-0.71)	-2,4	0,137	2,137	0,690	-2,4	-2,4
Nominal unit labour cost index - 1 year % change	*UP*	362	27,62%	x	x	x	x	0,425	(0.36-0.49)	5,1	0,019	1,275	0,671	27,3	0,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal unit labour cost index - 10 years % change	*UP*	336	29,46%	x	x	x	x	0,478	(0.41-0.54)	0,6	0,006	1,012	0,315	16977,9	0,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unit labour cost performance relative to Euro area - 10 years % change	*UP*	336	29,46%	x	x	x	x	0,484	(0.42-0.55)	0,1	0,019	1,047	0,384	4625,8	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour productivity - 1 year % change	*UP*	418	26,08%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,641**	(0.58-0.70)	-0,4	0,134	3,463	0,761	-0,3	-0,1

Direct investment in the reporting economy (flows) - % of GDP	*UP*	408	26,72%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,527**	(0.47-0.59)	-0,5	0,029	2,239	0,733	-0,5	-0,5
Direct investment in the reporting economy (stocks) - % of GDP	*UP*	358	28,21%	x	x	x	x	**0,502**	(0.44-0.56)	2793,1	0,026	7,634	0,729	2893,5	10,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net external debt - % of GDP	*UP*	364	28,02%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,451	(0.39-0.51)	-2162,5	0,015	1,980	0,720	-1330,5	-1330,5
Net trade balance of energy products - % of GDP	*UP*	397	26,45%	x	x	x	x	**0,502**	(0.44-0.56)	0,4	0,004	1,189	0,723	2,3	0,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Credit and Debt Indicators															
Private sector debt, non-consolidated - % of GDP	*UP*	397	26,52%	x	x	x	x	**0,627**	(0.57-0.69)	212,6	0,111	2,877	0,742	212,6	113,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Financial sector leverage (debt-to-equity) - %	*UP*	386	26,94%	x	x	x	x	**0,577**	(0.52-0.64)	408,4	0,100	1,510	0,604	729,6	47,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector credit flow, non-consolidated - % of GDP	*UP*	23	21,74%	x	x	x	x	0,067	(0.00-0.19)	22,4	0,000	0,000	0,870	22,4	3,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - million of national currency	*UP*	361	27,98%	x	x	x	x	**0,581**	(0.52-0.64)	3271105,1	0,090	1,511	0,615	14041585,1	333701,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal house price index - 3 years % change	*UP*	343	28,57%	x	x	x	x	0,248	(0.19-0.30)	162,1	0,000	0,000	0,720	162,1	61,9
	DOWN			x	x	x	x	**0,745**	(0.69-0.80)	-0,5	0,231	3,650	0,773	-0,5	-0,5
Real Economic Activity Indicators															
Real gross domestic product (GDP) - 1 year % change	*UP*	417	26,14%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,738**	(0.69-0.79)	-0,2	0,240	9,291	0,839	-0,1	-0,1
Gross fixed capital formation - % of GDP	*UP*	418	26,08%	x	x	x	x	0,329	(0.28-0.38)	38,4	0,000	0,000	0,746	38,4	11,5
	DOWN			x	x	x	x	**0,500**	(0.44-0.56)	0,0	0,000	0,000	0,746	0,0	0,0
Gross domestic expenditure on R&D - % of GDP	*UP*	395	26,58%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,457	(0.40-0.52)	2,0	0,031	1,086	0,410	0,2	2,0
Residential construction - % of GDP	*UP*	403	26,05%	x	x	x	x	0,429	(0.37-0.49)	2,6	0,018	1,045	0,362	13,5	2,0
	DOWN			x	x	x	x	**0,571**	(0.51-0.63)	5,0	0,085	1,276	0,486	4,3	5,5
Labour Market Indicators															
Unemployment rate - %	*UP*	364	27,75%	x	x	x	x	**0,596**	(0.53-0.66)	12,6	0,123	3,689	0,750	12,6	5,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Employment rate - 1 year % change	*UP*	415	26,02%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,723**	(0.67-0.78)	-0,5	0,204	4,007	0,783	-0,5	-0,5
Activity rate (15-64 years) - % of the total population of the same age group	*UP*	364	27,75%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,436	(0.37-0.50)	64,9	0,007	1,076	0,648	57,6	80,9
Long-term unemployment rate - % of active population in the same age group	*UP*	364	27,75%	x	x	x	x	**0,528**	(0.47-0.59)	7,2	0,083	2,821	0,728	8,5	0,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group	*UP*	364	27,75%	x	x	x	x	**0,628**	(0.57-0.69)	27,1	0,138	3,502	0,750	32,9	9,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population	*UP*	364	27,75%	x	x	x	x	**0,555**	(0.49-0.62)	13,1	0,141	2,156	0,692	13,1	13,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population, % point change (t, t-3)	*UP*	351	28,49%	x	x	x	x	**0,720**	(0.66-0.78)	0,6	0,183	2,510	0,715	2,0	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population	*UP*	312	31,09%	x	x	x	x	**0,516**	(0.45-0.58)	26,7	0,069	1,490	0,625	26,9	14,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population, % point change (t, t-3)	*UP*	234	40,17%	x	x	x	x	**0,645**	(0.57-0.72)	0,1	0,126	1,694	0,628	2,3	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population	*UP*	336	29,45%	x	x	x	x	**0,522**	(0.46-0.59)	19,2	0,071	1,667	0,661	20,3	10,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population, % point change (t, t-3)	*UP*	298	31,88%	x	x	x	x	0,455	(0.39-0.52)	7,6	0,000	0,000	0,681	7,6	0,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population	*UP*	318	30,50%	x	x	x	x	0,486	(0.42-0.55)	14,4	0,034	1,346	0,638	57,7	1,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population, % point change (t, t-3)	*UP*	234	40,17%	x	x	x	x	**0,619**	(0.55-0.69)	0,2	0,118	1,716	0,628	1,1	0,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work Intensity - % of population aged 0-59	*UP*	312	31,09%	x	x	x	x	**0,536**	(0.47-0.60)	10,3	0,067	1,466	0,622	15,6	4,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work intensity - % of population aged 0-59, % point change (t, t-3)	*UP*	234	40,17%	x	x	x	x	**0,613**	(0.54-0.69)	0,6	0,107	1,697	0,624	1,5	0,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x

Source: Authors' calculations based on data from the EC and Eurostat.

Table A.8 **Results for the signals approach and loss and usefulness function of the policymaker for the EU28, two year time lag**

Scoreboard Indicators 2Y lag		#	Probability of event	Official threshold				AUROC	AUROC confidence interval	Optimal threshold					
				Value	Implied Preferences	Max Absolute Utility	Prediction Rate			Value	Max Absolute Utility	Inverse aNtS	Prediction Rate	mu=0.4	mu=0.6
External Sector Indicators															
Current account balance - % of GDP, 3 years average	*UP*	389	26,22%	6,0	0,475	0,010	0,540	0,492	(0.43-0.55)	5,5	0,035	1,666	0,704	6,6	2,4
	DOWN			-4,0				**0,546**	(0.49-0.61)	-2,3	0,067	1,293	0,555	-10,9	-1,9
Real effective exchange rate, 42 trading partners - 3 years % change	*UP*	390	26,15%	11.0/4.0	0,610	-0,141	0,479	0,376	(0.32-0.43)	18,6	0,002	1,115	0,721	35,9	18,8
	DOWN			-11.0/-4.0				**0,603**	(0.54-0.66)	-1,2	0,096	1,659	0,649	-2,3	-0,2
Export market shares - 5 years % change	*UP*	374	26,74%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-6,0	0,557	0,044	0,631	**0,637**	(0.58-0.70)	-7,9	0,124	1,901	0,671	-7,7	-7,7
Nominal unit labour cost index - 3 years % change	*UP*	382	25,92%	12.0/9.0	0,545	-0,042	0,534	0,491	(0.43-0.55)	11,8	0,032	1,303	0,652	28,2	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net international investment position - % of GDP	*UP*	387	26,36%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-35,0	0,567	-0,009	0,561	**0,606**	(0.55-0.67)	-86,8	0,112	4,354	0,762	-86,8	-57,8
Credit and Debt Indicators															
Private sector credit flow, consolidated - % of GDP	*UP*	357	27,17%	14,0	0,536	-0,065	0,625	0,405	(0.34-0.47)	41,9	0,010	65535,000	0,723	44,9	9,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector debt, consolidated - % of GDP	*UP*	380	26,84%	133,0	0,537	0,030	0,608	**0,663**	(0.60-0.72)	171,8	0,140	2,689	0,729	179,3	67,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
General government sector debt - % of GDP	*UP*	385	26,49%	60,0	0,520	-0,019	0,556	**0,524**	(0.46-0.58)	108,7	0,057	6,388	0,753	109,0	13,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - 1 year % change	*UP*	381	26,77%	16,5	0,510	-0,082	0,585	0,397	(0.34-0.46)	115,7	0,000	0,000	0,730	115,7	1,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
House price index, deflated - 1 year % change	*UP*	333	28,23%	6,0	0,709	-0,452	0,492	0,285	(0.23-0.34)	71,7	0,000	0,000	0,706	71,7	15,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour Market Indicators															
Activity rate (15-64 years) - % point change (t, t-3)	*UP*	333	28,23%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-0,2	0,424	0,042	0,688	**0,566**	(0.50-0.63)	-0,3	0,077	2,026	0,688	-0,2	-0,2
Long-term unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	332	28,31%	0,5	0,505	0,104	0,636	**0,641**	(0.58-0.70)	0,5	0,125	1,936	0,669	1,1	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	335	28,06%	2,0	0,687	-0,071	0,642	**0,654**	(0.59-0.72)	4,5	0,151	2,733	0,722	6,0	2,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unemployment rate - 3 years average	*UP*	387	26,10%	10,0	0,509	-0,032	0,584	0,464	(0.40-0.52)	18,0	0,027	3,151	0,736	19,3	2,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Auxiliary Indicators															
External Sector Indicators															
Current account balance - % of GDP	*UP*	390	26,15%	x	x	x	x	**0,510**	(0.45-0.57)	5,8	0,044	2,006	0,718	6,2	0,1
	DOWN			x	x	x	x	**0,501**	(0.44-0.56)	-1,4	0,033	1,134	0,523	-12,2	-1,4
Net Lending / Borrowing - % of GDP	*UP*	386	26,42%	x	x	x	x	0,493	(0.43-0.55)	6,1	0,035	1,832	0,712	6,1	1,7
	DOWN			x	x	x	x	**0,510**	(0.45-0.57)	-1,5	0,030	1,134	0,541	-10,9	-1,5
Real effective exchange rate, 42 trading partners - 1 year % change	*UP*	336	27,98%	x	x	x	x	0,469	(0.40-0.53)	9,8	0,002	1,197	0,699	17,6	0,5
	DOWN			x	x	x	x	**0,529**	(0.46-0.59)	-2,4	0,052	1,881	0,688	-2,4	-1,0
Real effective exchange rate, Euro area trading partners - 3 years % change	*UP*	370	25,95%	x	x	x	x	0,493	(0.43-0.55)	0,6	0,022	1,084	0,503	38,9	0,2
	DOWN			x	x	x	x	**0,507**	(0.44-0.57)	-1,2	0,035	1,332	0,651	-5,2	-1,2
Terms of trade - 5 years % change	*UP*	331	28,40%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,564**	(0.50-0.63)	-0,5	0,067	1,315	0,571	-1,4	-0,4
Export market shares - 1 year % change	*UP*	336	27,98%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,575**	(0.51-0.64)	-5,6	0,084	2,483	0,708	-6,4	-3,3
Export market share, volumes - 1 year % change	*UP*	390	26,15%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,573**	(0.51-0.63)	-0,4	0,074	1,320	0,556	-1,5	-0,4
Share of OECD export - 5 years % change	*UP*	324	28,70%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,604**	(0.54-0.67)	-2,4	0,099	1,792	0,660	-6,9	-2,4
Nominal unit labour cost index - 1 year % change	*UP*	334	27,84%	x	x	x	x	0,447	(0.38-0.51)	5,3	0,047	1,852	0,689	16,3	0,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal unit labour cost index - 10 years % change	*UP*	308	29,87%	x	x	x	x	0,470	(0.40-0.54)	113,8	0,006	1,213	0,659	16977,9	0,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unit labour cost performance relative to Euro area - 10 years % change	*UP*	308	29,87%	x	x	x	x	**0,508**	(0.44-0.58)	0,1	0,038	1,094	0,409	4625,8	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour productivity - 1 year % change	*UP*	390	26,15%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,560**	(0.50-0.62)	-0,4	0,072	1,990	0,705	-0,8	-0,3

Direct investment in the reporting economy (flows) - % of GDP	*UP*	380	26,84%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,512**	(0.45-0.57)	-0,6	0,015	1,655	0,716	-13,2	-0,6
Direct investment in the reporting economy (stocks) - % of GDP	*UP*	330	28,48%	x	x	x	x	0,499	(0.43-0.56)	354,6	0,028	1,591	0,679	2707,0	10,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net external debt - % of GDP	*UP*	337	28,19%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,451	(0.39-0.52)	-2162,5	0,017	2,183	0,715	-2581,0	-1330,5
Net trade balance of energy products - % of GDP	*UP*	369	26,56%	x	x	x	x	**0,507**	(0.45-0.57)	0,4	0,009	1,447	0,713	1,4	0,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Credit and Debt Indicators															
Private sector debt, non-consolidated - % of GDP	*UP*	369	26,63%	x	x	x	x	**0,645**	(0.59-0.70)	188,5	0,119	2,257	0,708	212,6	111,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Financial sector leverage (debt-to-equity) - %	*UP*	358	27,09%	x	x	x	x	**0,566**	(0.50-0.63)	769,7	0,081	2,892	0,726	769,7	47,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector credit flow, non-consolidated - % of GDP	*UP*	23	21,74%	x	x	x	x	0,357	(0.11-0.61)	2,1	0,071	1,167	0,217	22,4	3,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - million of national currency	*UP*	333	28,23%	x	x	x	x	**0,587**	(0.52-0.65)	2944726,9	0,090	1,509	0,613	13878396,0	333701,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal house price index - 3 years % change	*UP*	315	28,89%	x	x	x	x	0,346	(0.28-0.41)	61,1	0,016	2,015	0,698	102,7	61,9
	DOWN			x	x	x	x	**0,671**	(0.61-0.73)	-0,5	0,172	2,725	0,724	-2,7	-0,5
Real Economic Activity Indicators															
Real gross domestic product (GDP) - 1 year % change	*UP*	389	26,22%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,649**	(0.59-0.71)	-0,2	0,148	3,644	0,761	-0,1	-0,1
Gross fixed capital formation - % of GDP	*UP*	390	26,15%	x	x	x	x	0,422	(0.36-0.48)	28,5	0,030	2,090	0,726	28,5	11,5
	DOWN			x	x	x	x	**0,500**	(0.44-0.56)	0,0	0,000	0,000	0,736	0,0	0,0
Gross domestic expenditure on R&D - % of GDP	*UP*	382	26,70%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,453	(0.39-0.51)	1,9	0,033	1,092	0,416	0,2	1,9
Residential construction - % of GDP	*UP*	377	26,26%	x	x	x	x	**0,527**	(0.47-0.59)	2,7	0,072	1,190	0,416	13,5	2,6
	DOWN			x	x	x	x	0,473	(0.41-0.53)	4,9	0,029	1,097	0,464	1,1	8,4
Labour Market Indicators															
Unemployment rate - %	*UP*	336	27,98%	x	x	x	x	0,494	(0.43-0.56)	11,7	0,059	1,719	0,673	19,7	3,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Employment rate - 1 year % change	*UP*	387	26,10%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,661**	(0.60-0.72)	-0,6	0,143	2,735	0,734	-0,5	-0,1
Activity rate (15-64 years) - % of the total population of the same age group	*UP*	336	27,98%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,436	(0.37-0.50)	80,7	0,004	1,009	0,301	57,6	80,9
Long-term unemployment rate - % of active population in the same age group	*UP*	336	27,98%	x	x	x	x	0,448	(0.38-0.51)	8,4	0,032	1,945	0,696	10,6	1,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group	*UP*	336	27,98%	x	x	x	x	**0,532**	(0.47-0.60)	27,5	0,088	2,394	0,705	36,5	9,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population	*UP*	336	27,98%	x	x	x	x	0,494	(0.43-0.56)	13,7	0,065	1,527	0,643	17,3	3,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population, % point change (t, t-3)	*UP*	323	28,79%	x	x	x	x	**0,666**	(0.60-0.73)	2,5	0,137	5,412	0,755	2,6	0,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population	*UP*	285	31,58%	x	x	x	x	0,489	(0.42-0.56)	26,9	0,037	1,256	0,593	61,3	14,8
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population, % point change (t, t-3)	*UP*	207	42,03%	x	x	x	x	**0,526**	(0.45-0.61)	0,2	0,037	1,177	0,546	5,0	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population	*UP*	309	29,45%	x	x	x	x	**0,520**	(0.45-0.59)	19,5	0,080	1,943	0,673	19,5	9,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population, % point change (t, t-3)	*UP*	271	32,47%	x	x	x	x	0,460	(0.39-0.53)	3,3	0,012	1,614	0,649	5,1	0,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population	*UP*	291	30,93%	x	x	x	x	0,450	(0.38-0.52)	14,2	0,026	1,250	0,615	57,7	0,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population, % point change (t, t-3)	*UP*	207	42,03%	x	x	x	x	0,496	(0.42-0.58)	4,5	0,031	2,929	0,614	4,7	0,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work Intensity - % of population aged 0-59	*UP*	285	31,58%	x	x	x	x	0,486	(0.42-0.56)	10,1	0,039	1,239	0,582	14,7	4,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work intensity - % of population aged 0-59, % point change (t, t-3)	*UP*	207	42,03%	x	x	x	x	**0,598**	(0.52-0.68)	0,3	0,107	1,558	0,609	6,6	0,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x

Source: Authors' calculations based on data from the EC and Eurostat.

Table A.9 **Results for the signals approach and loss and usefulness function of the policymaker for the EU28, three year time lag**

Scoreboard Indicators 3Y lag		#	Probability of event	Official threshold				AUROC	AUROC confidence interval	Optimal threshold					
				Value	Implied Preferences	Max Absolute Utility	Prediction Rate			Value	Max Absolute Utility	Inverse aNtS	Prediction Rate	mu=0.4	mu=0.6
External Sector Indicators															
Current account balance - % of GDP, 3 years average	*UP*	361	24,38%	6,0	0,075	-0,248	0,650	0,495	(0.43-0.56)	6,2	0,032	1,996	0,712	6,3	2,6
	DOWN			-4,0				**0,579**	(0.52-0.64)	-2,0	0,085	1,346	0,551	-10,1	-1,9
Real effective exchange rate, 42 trading partners - 3 years % change	*UP*	362	24,31%	11.0/4.0	0,505	-0,100	0,448	0,402	(0.34-0.46)	28,1	0,005	65535,000	0,724	32,0	0,8
	DOWN			-11.0/-4.0				**0,562**	(0.50-0.62)	-0,2	0,062	1,332	0,591	-2,3	-0,2
Export market shares - 5 years % change	*UP*	346	24,86%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-6,0	0,545	0,031	0,621	**0,602**	(0.54-0.67)	-7,5	0,110	1,843	0,668	-7,5	-4,6
Nominal unit labour cost index - 3 years % change	*UP*	354	24,01%	12.0/9.0	0,475	0,074	0,630	**0,569**	(0.50-0.63)	8,1	0,069	1,308	0,562	15,9	2,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net international investment position - % of GDP	*UP*	359	24,51%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-35,0	0,578	-0,036	0,554	**0,598**	(0.54-0.66)	-86,8	0,108	4,470	0,752	-86,8	-60,2
Credit and Debt Indicators															
Private sector credit flow, consolidated - % of GDP	*UP*	329	25,23%	14,0	0,463	0,012	0,638	0,493	(0.43-0.56)	12,9	0,051	1,447	0,638	19,6	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector debt, consolidated - % of GDP	*UP*	352	25,00%	133,0	0,549	0,014	0,608	**0,652**	(0.59-0.71)	176,8	0,146	3,367	0,744	176,8	65,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
General government sector debt - % of GDP	*UP*	357	24,65%	60,0	0,514	-0,036	0,541	0,480	(0.42-0.54)	108,7	0,043	4,647	0,731	109,0	7,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - 1 year % change	*UP*	353	24,93%	16,5	0,471	-0,049	0,592	0,483	(0.42-0.55)	1,3	0,047	1,123	0,416	115,7	1,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
House price index, deflated - 1 year % change	*UP*	305	26,23%	6,0	0,621	-0,242	0,534	0,401	(0.34-0.47)	18,5	0,021	2,245	0,692	18,6	18,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour Market Indicators															
Activity rate (15-64 years) - % point change (t, t-3)	*UP*	305	26,23%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			-0,2	0,463	0,029	0,646	**0,536**	(0.47-0.60)	-0,3	0,045	1,507	0,646	-1,1	-0,2
Long-term unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	304	26,32%	0,5	0,450	0,005	0,579	**0,551**	(0.48-0.62)	0,2	0,060	1,296	0,572	8,9	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	307	26,06%	2,0	0,606	-0,007	0,622	**0,606**	(0.54-0.67)	2,2	0,116	1,719	0,638	4,0	2,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unemployment rate - 3 years average	*UP*	359	24,23%	10,0	0,500	-0,070	0,540	0,424	(0.36-0.49)	19,6	0,013	7,663	0,724	19,6	2,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Auxiliary Indicators															
External Sector Indicators															
Current account balance - % of GDP	*UP*	362	24,31%	x	x	x	x	0,480	(0.42-0.54)	5,9	0,039	1,969	0,707	6,0	3,3
	DOWN			x	x	x	x	**0,557**	(0.49-0.62)	-9,0	0,066	2,713	0,724	-8,9	-1,4
Net Lending / Borrowing - % of GDP	*UP*	358	24,58%	x	x	x	x	0,462	(0.40-0.53)	5,4	0,030	1,545	0,687	6,1	5,5
	DOWN			x	x	x	x	**0,568**	(0.50-0.63)	-1,6	0,078	1,365	0,575	-8,6	-1,6
Real effective exchange rate, 42 trading partners - 1 year % change	*UP*	308	25,97%	x	x	x	x	0,420	(0.35-0.49)	9,8	0,001	1,088	0,679	17,6	0,1
	DOWN			x	x	x	x	**0,561**	(0.49-0.63)	-2,4	0,062	2,085	0,682	-2,4	-0,6
Real effective exchange rate, Euro area trading partners - 3 years % change	*UP*	342	23,98%	x	x	x	x	0,488	(0.42-0.55)	0,6	0,021	1,079	0,494	34,4	0,2
	DOWN			x	x	x	x	0,497	(0.43-0.56)	-1,5	0,017	1,197	0,649	-12,8	-1,0
Terms of trade - 5 years % change	*UP*	303	26,40%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,521**	(0.45-0.59)	-0,8	0,040	1,210	0,568	-3,4	-0,7
Export market shares - 1 year % change	*UP*	308	25,97%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,589**	(0.52-0.66)	-4,5	0,086	1,865	0,666	-4,6	-0,4
Export market share, volumes - 1 year % change	*UP*	362	24,31%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,529**	(0.47-0.59)	-6,0	0,038	2,040	0,710	-6,0	-1,2
Share of OECD export - 5 years % change	*UP*	296	26,69%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,573**	(0.50-0.64)	-0,3	0,066	1,481	0,625	-6,9	-0,2
Nominal unit labour cost index - 1 year % change	*UP*	306	25,82%	x	x	x	x	0,485	(0.42-0.55)	5,3	0,079	2,565	0,696	5,3	5,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal unit labour cost index - 10 years % change	*UP*	280	27,86%	x	x	x	x	0,477	(0.41-0.55)	113,8	0,004	1,118	0,639	16977,9	0,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Unit labour cost performance relative to Euro area - 10 years % change	*UP*	280	27,86%	x	x	x	x	**0,539**	(0.47-0.61)	0,1	0,062	1,155	0,450	4625,8	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Labour productivity - 1 year % change	*UP*	362	24,31%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,558**	(0.50-0.62)	-0,4	0,062	1,809	0,688	-2,1	-0,3

Direct investment in the reporting economy (flows) - % of GDP	*UP*	352	25,00%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,513**	(0.45-0.58)	-0,6	0,015	1,740	0,705	-0,6	-0,6
Direct investment in the reporting economy (stocks) - % of GDP	*UP*	302	26,49%	x	x	x	x	**0,509**	(0.44-0.58)	325,9	0,029	1,585	0,662	2621,0	10,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Net external debt - % of GDP	*UP*	310	26,13%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,462	(0.40-0.53)	-2541,2	0,022	65535,000	0,716	-2501,3	-2501,3
Net trade balance of energy products - % of GDP	*UP*	341	24,63%	x	x	x	x	**0,513**	(0.45-0.58)	0,4	0,015	1,711	0,701	1,4	0,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Credit and Debt Indicators															
Private sector debt, non-consolidated - % of GDP	*UP*	341	24,79%	x	x	x	x	**0,639**	(0.58-0.70)	188,5	0,117	2,296	0,704	204,1	72,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Financial sector leverage (debt-to-equity) - %	*UP*	330	25,15%	x	x	x	x	**0,537**	(0.47-0.60)	649,3	0,070	1,808	0,673	840,0	47,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Private sector credit flow, non-consolidated - % of GDP	*UP*	23	21,74%	x	x	x	x	0,357	(0.11-0.61)	2,1	0,071	1,167	0,217	22,4	3,0
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Total financial sector liabilities, non-consolidated - million of national currency	*UP*	305	26,23%	x	x	x	x	**0,585**	(0.52-0.65)	2618348,8	0,090	1,507	0,610	4576617,9	333701,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Nominal house price index - 3 years % change	*UP*	287	26,83%	x	x	x	x	0,435	(0.37-0.50)	48,7	0,030	1,701	0,676	64,1	0,6
	DOWN			x	x	x	x	**0,573**	(0.50-0.64)	-0,5	0,078	1,657	0,648	-0,5	-0,5
Real Economic Activity Indicators															
Real gross domestic product (GDP) - 1 year % change	*UP*	361	24,38%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,607**	(0.54-0.67)	-0,2	0,104	2,503	0,717	-0,1	-0,1
Gross fixed capital formation - % of GDP	*UP*	362	24,31%	x	x	x	x	**0,506**	(0.44-0.57)	28,5	0,049	2,982	0,727	28,5	11,8
	DOWN			x	x	x	x	**0,500**	(0.44-0.56)	0,0	0,000	0,000	0,721	0,0	0,0
Gross domestic expenditure on R&D - % of GDP	*UP*	354	24,86%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,453	(0.39-0.52)	1,8	0,047	1,141	0,455	0,2	1,8
Residential construction - % of GDP	*UP*	350	24,57%	x	x	x	x	**0,585**	(0.52-0.65)	2,7	0,090	1,236	0,434	6,1	2,7
	DOWN			x	x	x	x	0,415	(0.35-0.48)	0,7	0,000	0,000	0,723	0,9	12,2
Labour Market Indicators															
Unemployment rate - %	*UP*	308	25,97%	x	x	x	x	0,424	(0.36-0.49)	19,9	0,023	10,876	0,698	19,9	3,7
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Employment rate - 1 year % change	*UP*	359	24,23%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	**0,617**	(0.55-0.68)	-0,6	0,120	2,288	0,705	-0,5	-0,3
Activity rate (15-64 years) - % of the total population of the same age group	*UP*	308	25,97%	x	x	x	x	x	x	x	x	x	x	x	x
	DOWN			x	x	x	x	0,432	(0.36-0.50)	80,7	0,002	1,005	0,318	57,6	80,9
Long-term unemployment rate - % of active population in the same age group	*UP*	308	25,97%	x	x	x	x	0,389	(0.32-0.45)	13,0	0,010	65535,000	0,692	13,8	0,5
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Youth unemployment rate - % of active population in the same age group	*UP*	308	25,97%	x	x	x	x	0,473	(0.40-0.54)	40,1	0,029	5,076	0,698	40,8	7,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population	*UP*	308	25,97%	x	x	x	x	0,444	(0.38-0.51)	11,3	0,011	1,046	0,510	29,0	3,4
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Young people neither in employment nor in education and training - % of total population, % point change (t, t-3)	*UP*	295	26,78%	x	x	x	x	**0,610**	(0.54-0.68)	0,5	0,094	1,570	0,620	3,1	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population	*UP*	257	29,57%	x	x	x	x	0,476	(0.40-0.55)	21,8	0,040	1,159	0,529	61,3	14,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty or social exclusion - % of total population, % point change (t, t-3)	*UP*	179	40,78%	x	x	x	x	0,476	(0.39-0.56)	5,9	0,014	65535,000	0,620	6,5	0,2
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population	*UP*	281	27,40%	x	x	x	x	**0,520**	(0.45-0.59)	19,6	0,070	1,927	0,658	19,7	9,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People at risk of poverty after social transfers - % of total population, % point change (t, t-3)	*UP*	243	30,45%	x	x	x	x	0,492	(0.42-0.57)	1,9	0,025	1,407	0,613	4,7	0,1
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population	*UP*	263	28,90%	x	x	x	x	0,436	(0.36-0.51)	14,2	0,004	1,034	0,578	57,7	0,6
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
Severely materially deprived people - % of total population, % point change (t, t-3)	*UP*	179	40,78%	x	x	x	x	0,455	(0.37-0.54)	6,5	0,017	4,671	0,620	6,8	0,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work Intensity - % of population aged 0-59	*UP*	257	29,57%	x	x	x	x	0,468	(0.39-0.54)	10,3	0,014	1,095	0,560	15,8	3,9
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x
People living in households with very low work intensity - % of population aged 0-59, % point change (t, t-3)	*UP*	179	40,78%	x	x	x	x	**0,538**	(0.45-0.62)	0,3	0,070	1,345	0,575	6,6	0,3
	DOWN			x	x	x	x	x	x	x	x	x	x	x	x

Source: Authors' calculations based on data from the EC and Eurostat.

Appendix B

Table B.1 **Results for the six data revisions for the EU28, one year time lag**

Scoreboard Indicators 1Y Lag	Revisions	aNtS #1	#2	#3	#4	#5	#6	***MSE***	Prediction Rate #1	#2	#3	#4	#5	#6	***MSE***	Absolute Utility #1	#2	#3	#4	#5	#6	***MSE***
External Sector Indicators																						
Current account balance - % of GDP, 3 years average	*UP*	0,75	0,75	0,71	0,71	0,71	0,67	***4,39***	0,63	0,63	0,64	0,64	0,64	0,65	***0,14***	0,035	0,035	0,041	0,041	0,041	0,052	***0,18***
	DOWN	1,05	1,05	1,00	1,00	0,60	0,61	***142,17***	0,66	0,66	0,67	0,67	0,69	0,68	***0,29***	-0,002	-0,002	0,000	0,000	0,024	0,023	***0,48***
Real effective exchange rate, 42 trading partners - 3 years % change	*UP*	0,75	0,75	0,62	0,62	0,62	0,62	***6,22***	0,58	0,58	0,64	0,64	0,64	0,64	***1,34***	0,070	0,070	0,090	0,090	0,090	0,090	***0,17***
	DOWN	0,09	0,11	0,17	0,14	0,14	0,14	***0,89***	0,72	0,71	0,72	0,73	0,73	0,73	***0,09***	0,054	0,042	0,049	0,061	0,061	0,061	***0,11***
Export market shares - 5 years % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,23	0,23	0,21	0,21	0,26	0,33	***10,49***	0,71	0,71	0,72	0,72	0,71	0,70	***0,19***	0,055	0,055	0,056	0,056	0,044	0,034	***0,41***
Nominal unit labour cost index - 3 years % change	*UP*	0,45	0,42	0,46	0,52	0,52	0,49	***1,98***	0,69	0,70	0,69	0,66	0,66	0,67	***0,39***	0,163	0,187	0,174	0,153	0,153	0,170	***0,19***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Net international investment position - % of GDP	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,51	0,51	0,63	0,60	0,66	0,54	***5,12***	0,67	0,67	0,65	0,66	0,64	0,67	***0,30***	0,087	0,087	0,066	0,071	0,061	0,082	***0,16***
Credit and Debt Indicators																						
*Private sector credit flow, consolidated - % of GDP**	*UP*	0,00	0,00	0,00	0,00	NA	NA	***NA***	0,69	0,69	0,70	0,70	0,69	0,70	***0,06***	0,000	0,000	0,000	0,000	-0,005	0,000	***0,01***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Private sector debt, consolidated - % of GDP	*UP*	0,72	0,66	0,57	0,58	0,60	0,55	***9,32***	0,62	0,64	0,66	0,65	0,65	0,66	***0,60***	0,053	0,066	0,092	0,089	0,087	0,097	***0,61***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
General government sector debt - % of GDP	*UP*	0,95	0,89	0,93	0,93	0,92	0,92	***0,35***	0,37	0,40	0,37	0,36	0,37	0,37	***0,17***	0,023	0,052	0,034	0,032	0,037	0,037	***0,09***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Total financial sector liabilities, non-consolidated - 1 year % change	*UP*	NA	NA	0,43	0,86	0,86	0,86	***59,97***	0,68	0,68	0,70	0,69	0,69	0,69	***0,07***	-0,005	-0,005	0,007	0,002	0,002	0,002	***0,03***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
*House price index, deflated - 1 year % change**	*UP*	NA	NA	NA	0,00	NA	NA	NA	0,66	0,66	0,66	0,68	0,67	0,68	***0,19***	-0,016	-0,022	-0,006	0,000	-0,006	0,000	***0,16***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Labour Market Indicators																						
Activity rate (15-64 years) - % point change (t, t-3)	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	0,92	1,50	0,60	0,60	***304,92***	x	x	0,67	0,66	0,69	0,69	***0,22***	x	x	0,004	-0,012	0,024	0,024	***0,56***
Long-term unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	x	x	0,40	0,40	0,37	0,37	***0,63***	x	x	0,71	0,71	0,71	0,71	***0,05***	x	x	0,106	0,107	0,112	0,112	***0,02***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Youth unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	x	x	0,37	0,39	0,39	0,39	***0,12***	x	x	0,72	0,71	0,71	0,71	***0,04***	x	x	0,188	0,173	0,173	0,173	***0,07***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Unemployment rate - 3 years average	*UP*	0,45	0,45	0,54	0,54	0,54	0,54	***2,83***	0,69	0,69	0,69	0,69	0,69	0,69	***0,01***	0,026	0,026	0,022	0,022	0,022	0,022	***0,01***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Auxiliary Indicators 1Y Lag	Revisions	aNtS #1	#2	#3	#4	#5	#6	***MSE***	Prediction Rate #1	#2	#3	#4	#5	#6	***MSE***	Absolute Utility #1	#2	#3	#4	#5	#6	***MSE***
External Sector Indicators																						
*Current account balance - % of GDP**	*UP*	0,58	0,68	0,64	0,55	0,55	0,55	***4,75***	0,65	0,63	0,64	0,66	0,66	0,66	***0,36***	0,084	0,061	0,068	0,090	0,090	0,090	***0,27***
	DOWN	NA	NA	NA	NA	NA	NA	***NA***	0,68	0,68	0,69	0,69	0,69	0,70	***0,17***	-0,005	-0,005	-0,005	-0,005	-0,005	0,000	***0,03***
*Net Lending / Borrowing - % of GDP**	*UP*	0,55	0,58	0,55	0,52	0,52	0,54	***0,57***	0,66	0,65	0,66	0,67	0,67	0,66	***0,06***	0,096	0,084	0,090	0,102	0,102	0,098	***0,06***
	DOWN	NA	NA	NA	NA	NA	NA	***NA***	0,68	0,68	0,69	0,69	0,69	0,69	***0,06***	-0,005	-0,005	-0,005	-0,005	-0,005	0,000	***0,03***
Real effective exchange rate, 42 trading partners - 1 year % change	*UP*	x	x	0,62	0,62	0,62	0,62	***0,00***	x	x	0,63	0,63	0,63	0,63	***0,00***	x	x	0,099	0,099	0,099	0,099	***0,00***
	DOWN	x	x	0,18	0,18	0,18	0,18	***0,00***	x	x	0,73	0,73	0,73	0,73	***0,00***	x	x	0,068	0,068	0,068	0,068	***0,00***
Real effective exchange rate, EA trading partners - 3 years % change	*UP*	0,68	0,68	0,91	0,91	0,91	0,89	***17,73***	0,59	0,59	0,50	0,50	0,50	0,51	***2,66***	0,099	0,099	0,027	0,027	0,027	0,032	***1,82***
	DOWN	0,00	0,00	0,14	0,14	0,12	0,12	***6,16***	0,73	0,73	0,73	0,73	0,74	0,74	***0,04***	0,021	0,021	0,061	0,061	0,073	0,073	***1,15***
Terms of trade - 5 years % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	0,49	0,40	0,37	0,43	***3,01***	x	x	0,69	0,71	0,71	0,70	***0,15***	x	x	0,078	0,100	0,105	0,088	***0,18***
Export market shares - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	0,91	0,65	0,60	0,60	***33,57***	x	x	0,51	0,61	0,63	0,63	***4,42***	x	x	0,024	0,095	0,119	0,119	***3,21***
Export market share, volumes - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,77	0,40	0,59	0,59	0,38	0,31	***74,77***	0,64	0,70	0,68	0,68	0,71	0,72	***2,33***	0,028	0,058	0,039	0,039	0,066	0,090	***2,15***
Share of OECD export - 5 years % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	0,75	0,70	0,59	0,70	***4,49***	x	x	0,64	0,65	0,66	0,64	***0,21***	x	x	0,036	0,039	0,063	0,046	***0,15***
Nominal unit labour cost index - 1 year % change	*UP*	x	x	0,62	0,62	0,66	0,61	***0,93***	x	x	0,65	0,65	0,64	0,65	***0,07***	x	x	0,073	0,073	0,070	0,080	***0,07***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Nominal unit labour cost index - 10 years % change	*UP*	0,68	0,71	0,70	0,76	0,75	0,75	***1,93***	0,56	0,55	0,54	0,52	0,53	0,53	***0,30***	0,131	0,113	0,126	0,094	0,097	0,101	***0,34***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Unit labour cost performance relative to EA - 10 years % change	*UP*	0,73	0,91	0,80	0,76	0,75	0,78	***4,15***	0,58	0,52	0,54	0,55	0,56	0,54	***0,40***	0,079	0,025	0,063	0,077	0,082	0,071	***0,48***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Labour productivity - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,30	0,32	0,31	0,29	0,32	0,34	***1,08***	0,75	0,74	0,75	0,76	0,74	0,74	***0,18***	0,200	0,194	0,206	0,211	0,194	0,189	***0,19***

Direct investment in the reporting economy (flows) - % of GDP	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,34	0,23	0,21	0,29	0,32	0,18	***12,54***	0,70	0,70	0,72	0,71	0,71	0,72	***0,11***	0,031	0,037	0,038	0,051	0,032	0,049	***0,17***
Direct investment in the reporting economy (stocks) - % of GDP	*UP*	x	x	0,00	0,14	0,14	0,00	***13,60***	x	x	0,72	0,71	0,71	0,71	***0,07***	x	x	0,036	0,031	0,031	0,036	***0,02***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Net external debt - % of GDP	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,32	0,31	0,29	0,29	0,29	0,32	***0,62***	0,68	0,69	0,71	0,70	0,70	0,68	***0,28***	0,024	0,025	0,027	0,025	0,025	0,026	***0,00***
Net trade balance of energy products - % of GDP	*UP*	1,13	0,99	0,43	0,86	0,86	0,86	***54,65***	0,63	0,66	0,70	0,69	0,69	0,69	***0,84***	-0,002	0,000	0,054	0,003	0,003	0,003	***0,53***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Credit and Debt Indicators																						
Private sector debt, non-consolidated - % of GDP	*UP*	0,83	0,83	0,82	0,78	0,78	0,76	***2,47***	0,46	0,46	0,46	0,49	0,49	0,49	***0,73***	0,075	0,075	0,078	0,097	0,099	0,104	***0,48***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Financial sector leverage (debt-to-equity) - %	*UP*	x	0,52	0,48	0,52	0,41	0,41	***7,46***	x	0,66	0,68	0,67	0,71	0,71	***1,19***	x	0,142	0,155	0,126	0,155	0,155	***0,24***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Private sector credit flow, non-consolidated - % of GDP	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Total financial sector liabilities, non-consolidated - million of national currency	*UP*	x	x	0,63	0,60	0,63	0,63	***0,18***	x	x	0,62	0,63	0,62	0,62	***0,03***	x	x	0,107	0,114	0,107	0,107	***0,01***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Nominal house price index - 3 years % change	*UP*	2,11	2,76	0,00	0,91	0,92	0,92	***1136***	0,58	0,61	0,63	0,68	0,68	0,68	***3,35***	-0,027	-0,021	0,000	0,001	0,001	0,001	***0,26***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Real Economic Activity Indicators																						
Real gross domestic product (GDP) - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,24	0,21	0,23	0,26	0,25	0,24	***0,32***	0,77	0,79	0,78	0,76	0,77	0,78	***0,11***	0,209	0,245	0,237	0,202	0,214	0,226	***0,29***
Gross fixed capital formation - % of GDP	*UP*	2,26	2,26	2,14	0,94	0,94	0,94	***979,91***	0,63	0,63	0,64	0,66	0,66	0,66	***0,34***	-0,030	-0,030	-0,027	0,003	0,003	0,003	***0,63***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Gross domestic expenditure on R&D - % of GDP	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	1,14	1,17	1,19	1,00	1,00	0,97	***24,52***	0,42	0,40	0,39	0,41	0,41	0,42	***0,30***	-0,040	-0,049	-0,055	0,002	0,000	0,012	***2,23***
Residential construction - % of GDP	*UP*	0,88	0,90	0,89	0,96	0,95	0,96	***3,02***	0,41	0,40	0,40	0,37	0,38	0,36	***1,11***	0,055	0,049	0,051	0,017	0,022	0,018	***0,70***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Auxiliary Indicators 1Y Lag		aNtS						***MSE***	Prediction Rate						***MSE***	Absolute Utility						***MSE***
	Revisions	#1	#2	#3	#4	#5	#6		#1	#2	#3	#4	#5	#6		#1	#2	#3	#4	#5	#6	
Labour Market Indicators																						
Unemployment rate - %	*UP*	x	x	0,31	0,31	0,31	0,31	***0,00***	x	x	0,72	0,72	0,72	0,72	***0,00***	x	x	0,090	0,090	0,090	0,090	***0,00***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Employment rate - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,37	0,29	0,33	0,38	0,38	0,36	***1,18***	0,72	0,75	0,74	0,72	0,72	0,73	***0,13***	0,181	0,193	0,192	0,185	0,185	0,190	***0,03***
*Activity rate (15-64 years) - % of the total population of the same age group**	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	NA	0,00	0,00	NA	***NA***	x	x	0,69	0,70	0,70	0,70	***0,02***	x	x	-0,005	0,000	0,000	0,000	***0,01***
Long-term unemployment rate - % of active population in the same age group	*UP*	x	x	0,64	0,75	0,64	0,54	***22,96***	x	x	0,69	0,68	0,69	0,69	***0,10***	x	x	0,017	0,012	0,017	0,022	***0,05***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Youth unemployment rate - % of active population in the same age group	*UP*	x	x	0,43	0,39	0,39	0,39	***0,51***	x	x	0,70	0,71	0,71	0,71	***0,02***	x	x	0,075	0,080	0,080	0,080	***0,01***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Young people neither in employment nor in education and training - % of total population	*UP*	x	x	0,40	0,40	0,43	0,43	***0,42***	x	x	0,71	0,71	0,70	0,70	***0,03***	x	x	0,121	0,121	0,116	0,116	***0,02***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Young people neither in employment nor in education and training - % of total population, % point change (t, t-3)	*UP*	x	x	0,37	0,39	0,39	0,39	***0,12***	x	x	0,72	0,71	0,71	0,71	***0,04***	x	x	0,188	0,173	0,173	0,173	***0,07***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People at risk of poverty or social exclusion - % of total population	*UP*	x	x	0,81	0,81	0,81	0,76	***2,58***	x	x	0,60	0,60	0,60	0,61	***0,05***	x	x	0,033	0,033	0,033	0,045	***0,14***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People at risk of poverty or social exclusion - % of total population, % point change (t, t-3)	*UP*	x	x	0,20	0,30	0,30	0,37	***12,09***	x	x	0,69	0,66	0,66	0,66	***0,38***	x	x	0,164	0,136	0,136	0,124	***0,66***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People at risk of poverty after social transfers - % of total population	*UP*	x	x	0,49	0,49	0,49	0,48	***0,08***	x	x	0,68	0,68	0,68	0,68	***0,00***	x	x	0,091	0,091	0,091	0,093	***0,00***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People at risk of poverty after social transfers - % of total population, % point change (t, t-3)	*UP*	x	x	0,74	0,87	0,87	0,90	***9,26***	x	x	0,60	0,57	0,57	0,56	***0,61***	x	x	0,049	0,027	0,027	0,020	***0,30***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Severely materially deprived people - % of total population	*UP*	x	x	1,02	0,90	0,90	0,90	***4,25***	x	x	0,61	0,62	0,62	0,62	***0,02***	x	x	-0,002	0,010	0,010	0,010	***0,05***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Severely materially deprived people - % of total population, % point change (t, t-3)	*UP*	x	x	0,53	0,42	0,42	0,42	***72,46***	x	x	0,60	0,61	0,61	0,61	***0,05***	x	x	0,041	0,050	0,050	0,050	***0,02***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People living in households with very low work Intensity - % of population aged 0-59	*UP*	x	x	0,98	0,96	0,94	0,94	***0,95***	x	x	0,35	0,36	0,36	0,36	***0,09***	x	x	0,007	0,019	0,031	0,031	***0,24***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People living in households with very low work intensity - % of population aged 0-59, % point change (t, t-3)	*UP*	x	x	0,24	0,11	0,11	0,10	***6,10***	x	x	0,60	0,62	0,62	0,64	***0,77***	x	x	0,065	0,076	0,076	0,076	***0,04***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***

Source: Authors' calculations based on data from the EC and Eurostat.

Table B.2 **Results for the six data revisions for the EU28, two year time lag**

Scoreboard Indicators 2Y Lag	Revisions	aNtS #1	aNtS #2	aNtS #3	aNtS #4	aNtS #5	aNtS #6	***MSE***	Prediction Rate #1	Prediction Rate #2	Prediction Rate #3	Prediction Rate #4	Prediction Rate #5	Prediction Rate #6	***MSE***	Absolute Utility #1	Absolute Utility #2	Absolute Utility #3	Absolute Utility #4	Absolute Utility #5	Absolute Utility #6	***MSE***
External Sector Indicators																						
Current account balance - % of GDP, 3 years average	*UP*	0,78	0,78	0,76	0,76	0,76	0,72	***2,45***	0,58	0,58	0,59	0,59	0,59	0,59	***0,07***	0,030	0,030	0,033	0,033	0,033	0,040	***0,08***
	DOWN	0,46	0,46	0,44	0,37	0,42	0,30	***17,95***	0,61	0,61	0,62	0,63	0,62	0,63	***0,19***	0,044	0,044	0,045	0,051	0,042	0,056	***0,13***
*Real effective exchange rate, 42 trading partners - 3 years % change**	*UP*	NA	NA	0,00	0,00	0,00	NA	NA	0,59	0,59	0,60	0,60	0,60	0,60	***0,09***	-0,006	-0,006	0,000	0,000	0,000	0,000	***0,02***
	DOWN	0,79	0,80	0,67	0,67	0,67	0,67	***6,87***	0,58	0,58	0,60	0,60	0,60	0,60	***0,20***	0,024	0,022	0,065	0,065	0,065	0,065	***0,72***
Export market shares - 5 years % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,80	0,75	0,76	0,71	0,72	0,74	***1,12***	0,57	0,58	0,59	0,59	0,59	0,59	***0,05***	0,023	0,030	0,030	0,039	0,030	0,027	***0,04***
Nominal unit labour cost index - 3 years % change	*UP*	0,50	0,50	0,50	0,62	0,58	0,58	***4,53***	0,65	0,65	0,66	0,61	0,63	0,63	***0,42***	0,132	0,135	0,144	0,104	0,119	0,119	***0,25***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Net international investment position - % of GDP	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,53	0,53	0,63	0,67	0,74	0,53	***15,38***	0,62	0,62	0,61	0,60	0,59	0,63	***0,64***	0,076	0,076	0,063	0,054	0,042	0,080	***0,51***
Credit and Debt Indicators																						
Private sector credit flow, consolidated - % of GDP	*UP*	1,07	1,03	1,11	0,95	0,91	0,91	***15,40***	0,48	0,49	0,48	0,52	0,53	0,53	***1,20***	-0,017	-0,008	-0,024	0,010	0,021	0,021	***0,87***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Private sector debt, consolidated - % of GDP	*UP*	0,53	0,52	0,51	0,45	0,46	0,45	***2,88***	0,64	0,64	0,64	0,66	0,66	0,66	***0,20***	0,100	0,098	0,110	0,125	0,125	0,122	***0,24***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
General government sector debt - % of GDP	*UP*	0,86	2,07	0,86	0,17	0,17	0,17	***915,96***	0,59	0,58	0,58	0,62	0,62	0,62	***0,96***	0,005	-0,010	0,005	0,030	0,030	0,030	***0,57***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Total financial sector liabilities, non-consolidated - 1 year % change	*UP*	0,90	0,88	0,84	0,84	0,84	0,84	***1,20***	0,50	0,51	0,52	0,51	0,51	0,51	***0,05***	0,038	0,046	0,062	0,063	0,068	0,068	***0,30***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
*House price index, deflated - 1 year % change**	*UP*	NA	NA	NA	0,00	NA	NA	NA	0,56	0,56	0,56	0,58	0,58	0,59	***0,45***	-0,019	-0,025	-0,007	0,000	-0,006	0,000	***0,22***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Labour Market Indicators																						
Activity rate (15-64 years) - % point change (t, t-3)	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	0,86	1,05	0,61	0,61	***84,96***	x	x	0,58	0,57	0,61	0,61	***0,63***	x	x	0,014	-0,003	0,042	0,042	***0,91***
Long-term unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	x	x	0,52	0,51	0,51	0,51	***0,01***	x	x	0,63	0,63	0,63	0,63	***0,00***	x	x	0,073	0,074	0,074	0,074	***0,00***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Youth unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	x	x	0,21	0,22	0,22	0,18	***1,76***	x	x	0,68	0,67	0,67	0,68	***0,04***	x	x	0,109	0,104	0,104	0,110	***0,02***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Unemployment rate - 3 years average	*UP*	0,69	1,38	0,67	0,67	0,67	0,67	***100,43***	0,59	0,59	0,60	0,60	0,60	0,60	***0,05***	0,003	-0,003	0,003	0,003	0,003	0,003	***0,01***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Auxiliary Indicators 2Y Lag	Revisions	aNtS #1	aNtS #2	aNtS #3	aNtS #4	aNtS #5	aNtS #6	***MSE***	Prediction Rate #1	Prediction Rate #2	Prediction Rate #3	Prediction Rate #4	Prediction Rate #5	Prediction Rate #6	***MSE***	Absolute Utility #1	Absolute Utility #2	Absolute Utility #3	Absolute Utility #4	Absolute Utility #5	Absolute Utility #6	***MSE***
External Sector Indicators																						
Current account balance - % of GDP	*UP*	0,69	0,69	0,75	0,30	0,33	0,27	***118,63***	0,59	0,59	0,59	0,64	0,63	0,64	***1,56***	0,023	0,023	0,018	0,057	0,048	0,065	***1,26***
	DOWN	1,00	1,00	1,07	0,85	0,88	0,88	***12,55***	0,50	0,50	0,48	0,54	0,53	0,53	***0,93***	0,001	0,001	-0,018	0,042	0,033	0,033	***0,93***
Net Lending / Borrowing - % of GDP	*UP*	0,98	0,76	0,81	0,27	0,30	0,28	***205,12***	0,57	0,59	0,59	0,64	0,64	0,64	***1,83***	0,001	0,019	0,015	0,065	0,057	0,065	***1,72***
	DOWN	0,79	0,82	0,92	0,83	0,83	0,77	***7,37***	0,56	0,56	0,53	0,55	0,55	0,57	***0,53***	0,052	0,043	0,018	0,045	0,042	0,059	***0,49***
Real effective exchange rate, 42 trading partners - 1 year % change	*UP*	x	x	0,69	0,69	0,69	0,69	***0,00***	x	x	0,59	0,59	0,59	0,59	***0,00***	x	x	0,071	0,071	0,071	0,071	***0,00***
	DOWN	x	x	0,75	0,75	0,75	0,75	***0,00***	x	x	0,59	0,59	0,59	0,59	***0,00***	x	x	0,036	0,036	0,036	0,036	***0,00***
Real effective exchange rate, EA trading partners - 3 years % change	*UP*	0,67	0,67	0,97	0,97	0,92	0,92	***26,15***	0,60	0,60	0,51	0,51	0,52	0,52	***2,55***	0,096	0,096	0,009	0,009	0,021	0,021	***2,29***
	DOWN	0,36	0,36	0,46	0,46	0,49	0,49	***6,67***	0,65	0,65	0,63	0,63	0,63	0,63	***0,14***	0,068	0,068	0,063	0,063	0,068	0,068	***0,01***
Terms of trade - 5 years % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	0,80	0,80	0,89	0,89	***4,74***	x	x	0,56	0,56	0,54	0,54	***0,31***	x	x	0,051	0,051	0,027	0,027	***0,38***
Export market shares - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	0,97	0,33	0,39	0,39	***114,14***	x	x	0,56	0,66	0,65	0,65	***2,89***	x	x	0,003	0,095	0,092	0,092	***2,66***
Export market share, volumes - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,80	0,46	0,53	0,53	0,40	0,33	***63,96***	0,58	0,61	0,61	0,61	0,63	0,64	***1,37***	0,022	0,044	0,042	0,042	0,054	0,071	***1,06***
Share of OECD export - 5 years % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	0,80	0,71	0,63	0,72	***5,24***	x	x	0,58	0,59	0,61	0,59	***0,16***	x	x	0,027	0,036	0,054	0,039	***0,12***
Nominal unit labour cost index - 1 year % change	*UP*	x	x	0,53	0,56	0,71	0,57	***7,27***	x	x	0,63	0,62	0,59	0,62	***0,29***	x	x	0,080	0,071	0,042	0,077	***0,44***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Nominal unit labour cost index - 10 years % change	*UP*	0,66	0,69	0,72	0,68	0,62	0,70	***1,90***	0,60	0,59	0,59	0,60	0,62	0,59	***0,21***	0,086	0,074	0,068	0,088	0,109	0,087	***0,20***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Unit labour cost performance relative to EA - 10 years % change	*UP*	0,73	0,73	0,78	0,75	0,75	0,79	***1,70***	0,56	0,56	0,53	0,56	0,56	0,54	***0,29***	0,111	0,111	0,092	0,104	0,101	0,086	***0,36***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Labour productivity - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,76	0,69	0,73	0,74	0,78	0,74	***0,97***	0,58	0,59	0,59	0,59	0,58	0,59	***0,03***	0,039	0,054	0,048	0,042	0,036	0,045	***0,04***

Direct investment in the reporting economy (flows) - % of GDP	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,00	0,00	0,00	0,33	1,33	0,35	***266,82***	0,60	0,61	0,61	0,61	0,59	0,60	***0,08***	0,009	0,018	0,018	0,012	-0,003	0,012	***0,06***
Direct investment in the reporting economy (stocks) - % of GDP	*UP*	x	x	0,00	0,17	0,17	0,00	***18,52***	x	x	0,63	0,62	0,62	0,61	***0,15***	x	x	0,036	0,030	0,030	0,036	***0,02***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Net external debt - % of GDP	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,18	0,18	0,17	0,17	0,17	0,17	***0,04***	0,60	0,61	0,62	0,62	0,62	0,62	***0,08***	0,030	0,030	0,031	0,030	0,030	0,034	***0,01***
Net trade balance of energy products - % of GDP	*UP*	0,40	0,37	0,67	0,67	0,67	0,67	***32,41***	0,57	0,58	0,60	0,60	0,60	0,60	***0,23***	0,016	0,014	0,024	0,009	0,009	0,009	***0,06***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Credit and Debt Indicators																						
Private sector debt, non-consolidated - % of GDP	*UP*	0,83	0,83	0,80	0,77	0,77	0,77	***1,33***	0,52	0,52	0,53	0,54	0,54	0,54	***0,28***	0,077	0,077	0,089	0,102	0,101	0,101	***0,27***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Financial sector leverage (debt-to-equity) - %	*UP*	x	0,69	0,62	0,61	0,53	0,51	***14,27***	x	0,59	0,61	0,62	0,64	0,64	***1,03***	x	0,080	0,095	0,092	0,104	0,110	***0,38***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Private sector credit flow, non-consolidated - % of GDP	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Total financial sector liabilities, non-consolidated - million of national currency	*UP*	x	x	0,56	0,56	0,56	0,56	***0,02***	x	x	0,64	0,64	0,64	0,64	***0,00***	x	x	0,125	0,125	0,125	0,125	***0,00***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Nominal house price index - 3 years % change	*UP*	0,73	0,56	0,42	0,69	0,59	0,59	***11,53***	0,55	0,58	0,55	0,59	0,60	0,60	***0,80***	0,019	0,029	0,014	0,013	0,025	0,025	***0,06***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Real Economic Activity Indicators																						
Real gross domestic product (GDP) - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,77	0,88	0,75	0,61	0,60	0,50	***61,15***	0,59	0,58	0,59	0,61	0,61	0,62	***0,92***	0,016	0,007	0,020	0,039	0,036	0,054	***1,03***
Gross fixed capital formation - % of GDP	*UP*	0,60	0,60	0,58	0,55	0,39	0,39	***30,56***	0,60	0,60	0,61	0,61	0,64	0,64	***0,77***	0,029	0,029	0,030	0,045	0,065	0,065	***0,87***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Gross domestic expenditure on R&D - % of GDP	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	1,04	1,08	1,08	0,89	0,90	0,88	***21,13***	0,46	0,45	0,44	0,49	0,49	0,50	***1,51***	-0,013	-0,024	-0,024	0,042	0,039	0,048	***2,79***
Residential construction - % of GDP	*UP*	0,88	0,86	0,87	0,90	0,87	0,88	***0,21***	0,49	0,50	0,49	0,47	0,49	0,48	***0,14***	0,057	0,071	0,066	0,051	0,063	0,060	***0,05***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Auxiliary Indicators 2Y Lag		aNtS						***MSE***	Prediction Rate						***MSE***	Absolute Utility						***MSE***
	Revisions	#1	#2	#3	#4	#5	#6		#1	#2	#3	#4	#5	#6		#1	#2	#3	#4	#5	#6	
Labour Market Indicators																						
Unemployment rate - %	*UP*	x	x	0,61	0,61	0,61	0,61	***0,00***	x	x	0,61	0,61	0,61	0,61	***0,00***	x	x	0,039	0,039	0,039	0,039	***0,00***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Employment rate - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,66	0,62	0,63	0,61	0,61	0,58	***2,40***	0,60	0,61	0,61	0,61	0,61	0,62	***0,17***	0,060	0,066	0,067	0,077	0,077	0,086	***0,32***
*Activity rate (15-64 years) - % of the total population of the same age group**	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	NA	0,00	0,00	NA	***NA***	x	x	0,59	0,60	0,60	0,60	***0,02***	x	x	-0,006	0,000	0,000	0,000	***0,01***
Long-term unemployment rate - % of active population in the same age group	*UP*	x	x	0,96	0,94	0,95	0,97	***0,36***	x	x	0,44	0,45	0,44	0,44	***0,10***	x	x	0,018	0,027	0,024	0,015	***0,08***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Youth unemployment rate - % of active population in the same age group	*UP*	x	x	0,67	0,61	0,61	0,61	***1,22***	x	x	0,60	0,61	0,61	0,61	***0,02***	x	x	0,033	0,039	0,039	0,039	***0,01***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Young people neither in employment nor in education and training - % of total population	*UP*	x	x	0,69	0,67	0,71	0,71	***0,87***	x	x	0,59	0,60	0,59	0,59	***0,09***	x	x	0,077	0,083	0,074	0,074	***0,03***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Young people neither in employment nor in education and training - % of total population, % point change (t, t-3)	*UP*	x	x	0,21	0,22	0,22	0,18	***1,76***	x	x	0,68	0,67	0,67	0,68	***0,04***	x	x	0,109	0,104	0,104	0,110	***0,02***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People at risk of poverty or social exclusion - % of total population	*UP*	x	x	0,77	0,77	0,77	0,77	***0,00***	x	x	0,56	0,56	0,56	0,56	***0,00***	x	x	0,069	0,069	0,069	0,069	***0,00***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People at risk of poverty or social exclusion - % of total population, % point change (t, t-3)	*UP*	x	x	0,74	0,88	0,88	0,87	***5,89***	x	x	0,55	0,52	0,52	0,54	***0,17***	x	x	0,040	0,017	0,017	0,019	***0,15***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People at risk of poverty after social transfers - % of total population	*UP*	x	x	0,52	0,52	0,52	0,52	***0,01***	x	x	0,63	0,63	0,63	0,63	***0,01***	x	x	0,094	0,094	0,094	0,098	***0,01***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People at risk of poverty after social transfers - % of total population, % point change (t, t-3)	*UP*	x	x	3,24	0,73	0,73	0,76	***2036***	x	x	0,57	0,58	0,58	0,57	***0,10***	x	x	-0,025	0,012	0,012	0,011	***0,44***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
*Severely materially deprived people - % of total population**	*UP*	x	x	0,00	0,00	0,00	NA	***NA***	x	x	0,59	0,59	0,59	0,59	***0,00***	x	x	0,000	0,000	0,000	0,000	***0,00***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
*Severely materially deprived people - % of total population, % point change (t, t-3)**	*UP*	x	x	0,00	0,00	0,00	NA	***NA***	x	x	0,54	0,54	0,54	0,54	***0,01***	x	x	0,000	0,000	0,000	0,000	***0,00***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People living in households with very low work Intensity - % of population aged 0-59	*UP*	x	x	0,83	0,79	0,79	0,83	***1,05***	x	x	0,56	0,57	0,57	0,56	***0,04***	x	x	0,025	0,034	0,034	0,028	***0,03***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People living in households with very low work intensity - % of population aged 0-59, % point change (t, t-3)	*UP*	x	x	0,50	0,42	0,42	0,41	***2,96***	x	x	0,59	0,61	0,61	0,63	***0,80***	x	x	0,089	0,103	0,103	0,112	***0,23***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***

Source: Authors' calculations based on data from the EC and Eurostat.

Table B.3 **Results for the six data revisions for the EU28, three year time lag**

Scoreboard Indicators 3Y Lag	Revisions	aNtS #1	#2	#3	#4	#5	#6	***MSE***	Prediction Rate #1	#2	#3	#4	#5	#6	***MSE***	Absolute Utility #1	#2	#3	#4	#5	#6	***MSE***
External Sector Indicators																						
Current account balance - % of GDP, 3 years average	*UP*	0,70	0,65	0,64	0,69	0,69	0,63	***2,46***	0,50	0,51	0,51	0,51	0,51	0,52	***0,10***	0,027	0,034	0,034	0,027	0,027	0,035	***0,04***
	DOWN	0,61	0,61	0,60	0,60	0,52	0,41	***31,13***	0,52	0,52	0,52	0,51	0,52	0,55	***0,79***	0,041	0,041	0,041	0,035	0,042	0,064	***0,60***
Real effective exchange rate, 42 trading partners - 3 years % change	*UP*	1,14	1,14	NA	NA	NA	NA	***NA***	0,47	0,47	0,48	0,48	0,48	0,48	***0,06***	-0,001	-0,001	0,007	0,007	0,007	0,007	***0,02***
	DOWN	0,54	0,51	0,58	0,58	0,58	0,58	***1,33***	0,54	0,54	0,57	0,57	0,57	0,57	***0,38***	0,061	0,062	0,082	0,082	0,082	0,082	***0,18***
Export market shares - 5 years % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	1,03	0,99	0,92	0,89	0,85	0,72	***50,13***	0,57	0,58	0,59	0,59	0,59	0,59	***0,05***	0,023	0,030	0,030	0,039	0,030	0,027	***0,04***
Nominal unit labour cost index - 3 years % change	*UP*	0,54	0,57	0,62	0,64	0,65	0,67	***5,84***	0,61	0,61	0,59	0,61	0,60	0,61	***0,07***	0,121	0,113	0,097	0,108	0,101	0,105	***0,08***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Net international investment position - % of GDP	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,57	0,53	0,52	0,56	0,46	0,31	***48,75***	0,51	0,52	0,53	0,52	0,54	0,56	***1,70***	0,036	0,043	0,048	0,042	0,062	0,084	***1,50***
Credit and Debt Indicators																						
Private sector credit flow, consolidated - % of GDP	*UP*	0,85	0,80	0,80	0,75	0,77	0,73	***4,48***	0,53	0,54	0,53	0,54	0,54	0,54	***0,09***	0,033	0,047	0,041	0,050	0,044	0,052	***0,12***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Private sector debt, consolidated - % of GDP	*UP*	0,36	0,38	0,37	0,34	0,33	0,31	***2,97***	0,64	0,62	0,63	0,64	0,64	0,64	***0,13***	0,143	0,130	0,140	0,146	0,154	0,155	***0,21***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
General government sector debt - % of GDP	*UP*	0,49	0,75	0,50	0,16	0,19	0,16	***114,02***	0,50	0,48	0,49	0,51	0,51	0,51	***0,44***	0,025	0,006	0,023	0,040	0,033	0,040	***0,34***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Total financial sector liabilities, non-consolidated - 1 year % change	*UP*	0,74	0,69	0,68	0,74	0,71	0,71	***0,67***	0,63	0,65	0,65	0,63	0,64	0,64	***0,12***	0,110	0,135	0,142	0,113	0,128	0,128	***0,16***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
House price index, deflated - 1 year % change	*UP*	0,67	1,16	0,49	0,38	0,33	0,33	***168,72***	0,48	0,46	0,47	0,50	0,50	0,50	***0,61***	0,016	-0,007	0,020	0,027	0,034	0,034	***0,44***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Labour Market Indicators																						
Activity rate (15-64 years) - % point change (t, t-3)	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	0,47	0,71	0,60	0,60	***9,76***	x	x	0,56	0,50	0,52	0,52	***0,64***	x	x	0,069	0,021	0,041	0,041	***0,39***
Long-term unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	x	x	0,57	0,56	0,58	0,49	***7,22***	x	x	0,57	0,57	0,56	0,59	***0,63***	x	x	0,081	0,083	0,076	0,104	***0,58***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Youth unemployment rate - % of active population in the same age group, % point change (t, t-3)	*UP*	x	x	0,40	0,41	0,42	0,42	***0,19***	x	x	0,65	0,64	0,64	0,64	***0,11***	x	x	0,159	0,151	0,144	0,144	***0,10***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
*Unemployment rate - 3 years average**	*UP*	0,00	0,00	0,00	0,00	0,00	0,00	***0,00***	0,47	0,47	0,47	0,47	0,47	0,47	***0,01***	0,000	0,000	0,000	0,000	0,000	0,000	***0,00***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***

Auxiliary Indicators 3Y Lag	Revisions	aNtS #1	#2	#3	#4	#5	#6	***MSE***	Prediction Rate #1	#2	#3	#4	#5	#6	***MSE***	Absolute Utility #1	#2	#3	#4	#5	#6	***MSE***
External Sector Indicators																						
Current account balance - % of GDP	*UP*	1,08	0,94	0,86	0,69	0,69	0,69	***49,53***	0,47	0,49	0,50	0,52	0,52	0,52	***0,75***	-0,009	0,007	0,016	0,038	0,038	0,038	***0,74***
	DOWN	0,96	0,91	0,94	0,86	0,85	0,83	***6,79***	0,52	0,53	0,52	0,55	0,55	0,56	***0,69***	0,012	0,028	0,017	0,045	0,046	0,052	***0,72***
Net Lending / Borrowing - % of GDP	*UP*	1,29	1,03	1,12	0,62	0,70	0,65	***153,02***	0,46	0,47	0,47	0,50	0,49	0,49	***0,31***	-0,016	-0,002	-0,008	0,023	0,016	0,021	***0,56***
	DOWN	0,96	0,93	0,92	0,83	0,80	0,72	***30,33***	0,52	0,53	0,53	0,56	0,56	0,59	***3,07***	0,013	0,021	0,025	0,052	0,061	0,087	***3,17***
Real effective exchange rate, 42 trading partners - 1 year % change	*UP*	x	x	0,56	0,56	0,56	0,56	***0,00***	x	x	0,48	0,48	0,48	0,48	***0,00***	x	x	0,006	0,006	0,006	0,006	***0,00***
	DOWN	x	x	0,52	0,52	0,52	0,52	***0,00***	x	x	0,59	0,59	0,59	0,59	***0,00***	x	x	0,097	0,097	0,097	0,097	***0,00***
Real effective exchange rate, EA trading partners - 3 years % change	*UP*	0,60	0,60	0,93	0,93	0,91	0,91	***37,90***	0,61	0,61	0,52	0,52	0,53	0,53	***2,79***	0,113	0,113	0,019	0,019	0,026	0,026	***3,06***
	DOWN	0,15	0,15	0,40	0,37	0,37	0,37	***19,58***	0,55	0,55	0,54	0,54	0,54	0,54	***0,05***	0,067	0,067	0,057	0,063	0,063	0,063	***0,02***
Terms of trade - 5 years % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	1,12	0,75	0,64	0,64	***80,77***	x	x	0,47	0,49	0,49	0,49	***0,17***	x	x	-0,004	0,010	0,017	0,017	***0,16***
Export market shares - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	0,68	0,86	0,90	0,80	***9,35***	x	x	0,58	0,52	0,51	0,54	***0,83***	x	x	0,083	0,028	0,021	0,043	***0,75***
Export market share, volumes - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,98	0,57	0,56	0,56	0,37	0,32	***123,19***	0,48	0,50	0,51	0,51	0,53	0,54	***1,43***	0,002	0,030	0,036	0,036	0,051	0,064	***1,38***
Share of OECD export - 5 years % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	0,91	0,80	0,69	0,75	***10,62***	x	x	0,50	0,51	0,53	0,52	***0,16***	x	x	0,013	0,028	0,043	0,036	***0,22***
Nominal unit labour cost index - 1 year % change	*UP*	x	x	0,61	0,64	0,73	0,54	***17,41***	x	x	0,54	0,54	0,52	0,56	***1,04***	x	x	0,058	0,051	0,037	0,078	***0,95***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Nominal unit labour cost index - 10 years % change	*UP*	0,76	0,73	0,69	0,76	0,69	0,74	***1,28***	0,59	0,61	0,63	0,60	0,63	0,62	***0,27***	0,084	0,099	0,120	0,089	0,119	0,098	***0,23***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Unit labour cost performance relative to EA - 10 years % change	*UP*	0,66	0,66	0,71	0,69	0,68	0,68	***0,41***	0,65	0,65	0,63	0,64	0,64	0,64	***0,04***	0,141	0,141	0,125	0,131	0,132	0,132	***0,04***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Labour productivity - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	1,14	1,14	1,12	0,70	0,84	0,75	***92,65***	0,47	0,47	0,47	0,49	0,49	0,49	***0,38***	-0,006	-0,006	-0,006	0,016	0,009	0,015	***0,28***

Direct investment in the reporting economy (flows) - % of GDP	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,23	0,00	0,00	0,32	0,84	0,59	***190,82***	0,50	0,50	0,50	0,51	0,48	0,47	***0,65***	0,027	0,035	0,034	0,032	0,004	0,011	***0,36***
*Direct investment in the reporting economy (stocks) - % of GDP**	*UP*	x	x	0,00	0,00	0,00	0,00	***0,00***	x	x	0,51	0,51	0,51	0,49	***0,49***	x	x	0,034	0,034	0,034	0,034	***0,00***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
*Net external debt - % of GDP**	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,00	0,00	0,00	0,00	0,00	0,00	***0,00***	0,49	0,50	0,51	0,50	0,50	0,50	***0,04***	0,035	0,035	0,036	0,034	0,034	0,038	***0,02***
Net trade balance of energy products - % of GDP	*UP*	0,00	0,00	1,68	0,37	0,37	0,37	***398,09***	0,48	0,47	0,45	0,49	0,49	0,49	***0,31***	0,031	0,025	-0,028	0,013	0,013	0,013	***0,43***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Credit and Debt Indicators																						
Private sector debt, non-consolidated - % of GDP	*UP*	0,54	0,55	0,62	0,44	0,37	0,37	***24,67***	0,60	0,59	0,56	0,59	0,60	0,60	***0,30***	0,109	0,102	0,075	0,098	0,114	0,114	***0,40***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Financial sector leverage (debt-to-equity) - %	*UP*	x	0,85	0,77	0,69	0,61	0,61	***21,20***	x	0,53	0,55	0,57	0,57	0,57	***0,49***	x	0,037	0,055	0,070	0,081	0,081	***0,68***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Private sector credit flow, non-consolidated - % of GDP	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Total financial sector liabilities, non-consolidated - million of national currency	*UP*	x	x	0,48	0,49	0,48	0,48	***0,04***	x	x	0,64	0,64	0,64	0,64	***0,01***	x	x	0,147	0,141	0,147	0,147	***0,01***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Nominal house price index - 3 years % change	*UP*	0,67	0,72	1,11	0,92	0,77	0,73	***39,04***	0,51	0,51	0,45	0,49	0,50	0,51	***1,00***	0,046	0,036	-0,008	0,007	0,026	0,034	***0,52***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Real Economic Activity Indicators																						
Real gross domestic product (GDP) - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,90	0,87	0,79	0,90	0,85	0,85	***1,66***	0,50	0,50	0,52	0,50	0,51	0,51	***0,06***	0,013	0,019	0,032	0,014	0,021	0,021	***0,05***
Gross fixed capital formation - % of GDP	*UP*	0,42	0,42	0,41	0,48	0,30	0,30	***14,39***	0,52	0,52	0,52	0,53	0,55	0,55	***0,65***	0,045	0,045	0,044	0,049	0,071	0,071	***0,52***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Gross domestic expenditure on R&D - % of GDP	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,99	0,97	0,98	0,86	0,85	0,84	***13,30***	0,51	0,52	0,51	0,56	0,57	0,58	***2,78***	0,002	0,009	0,005	0,054	0,059	0,065	***2,20***
Residential construction - % of GDP	*UP*	0,61	0,52	0,54	0,51	0,51	0,51	***2,06***	0,52	0,53	0,54	0,55	0,55	0,55	***0,21***	0,049	0,065	0,061	0,067	0,067	0,067	***0,08***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Auxiliary Indicators 3Y Lag		aNtS						***MSE***	Prediction Rate						***MSE***	Absolute Utility						***MSE***
	Revisions	#1	#2	#3	#4	#5	#6		#1	#2	#3	#4	#5	#6		#1	#2	#3	#4	#5	#6	
Labour Market Indicators																						
Unemployment rate - %	*UP*	x	x	1,02	1,01	0,98	0,98	***0,89***	x	x	0,51	0,52	0,54	0,54	***0,22***	x	x	-0,010	-0,003	0,010	0,010	***0,20***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Employment rate - 1 year % change	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	0,66	0,75	0,62	0,58	0,58	0,60	***5,36***	0,56	0,53	0,56	0,58	0,58	0,57	***0,52***	0,066	0,041	0,070	0,088	0,088	0,081	***0,43***
Activity rate (15-64 years) - % of the total population of the same age group	*UP*	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
	DOWN	x	x	1,00	0,98	0,96	0,96	***0,67***	x	x	0,51	0,51	0,52	0,52	***0,09***	x	x	-0,001	0,005	0,012	0,012	***0,08***
Long-term unemployment rate - % of active population in the same age group	*UP*	x	x	0,95	0,94	0,99	0,97	***0,59***	x	x	0,54	0,55	0,53	0,54	***0,10***	x	x	0,022	0,028	0,006	0,013	***0,12***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Youth unemployment rate - % of active population in the same age group	*UP*	x	x	0,92	0,92	0,86	0,86	***2,90***	x	x	0,49	0,49	0,50	0,50	***0,03***	x	x	0,009	0,009	0,016	0,016	***0,04***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Young people neither in employment nor in education and training - % of total population	*UP*	x	x	0,82	0,82	0,81	0,81	***0,14***	x	x	0,54	0,54	0,54	0,54	***0,03***	x	x	0,040	0,040	0,046	0,046	***0,02***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Young people neither in employment nor in education and training - % of total population, % point change (t, t-3)	*UP*	x	x	0,40	0,41	0,42	0,42	***0,19***	x	x	0,65	0,64	0,64	0,64	***0,11***	x	x	0,159	0,151	0,144	0,144	***0,10***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People at risk of poverty or social exclusion - % of total population	*UP*	x	x	0,71	0,71	0,71	0,71	***0,00***	x	x	0,59	0,59	0,59	0,59	***0,00***	x	x	0,085	0,085	0,085	0,085	***0,00***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People at risk of poverty or social exclusion - % of total population, % point change (t, t-3)	*UP*	x	x	0,61	0,75	0,75	0,64	***8,89***	x	x	0,57	0,54	0,54	0,56	***0,16***	x	x	0,063	0,039	0,039	0,059	***0,29***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People at risk of poverty after social transfers - % of total population	*UP*	x	x	0,68	0,68	0,68	0,68	***0,06***	x	x	0,56	0,56	0,56	0,56	***0,03***	x	x	0,070	0,070	0,070	0,067	***0,01***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People at risk of poverty after social transfers - % of total population, % point change (t, t-3)	*UP*	x	x	1,04	0,47	0,47	0,49	***99,30***	x	x	0,49	0,48	0,48	0,47	***0,17***	x	x	-0,001	0,018	0,018	0,018	***0,12***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
Severely materially deprived people - % of total population	*UP*	x	x	0,98	0,98	0,98	0,98	***0,00***	x	x	0,47	0,47	0,47	0,47	***0,00***	x	x	0,002	0,002	0,002	0,002	***0,00***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
*Severely materially deprived people - % of total population, % point change (t, t-3)**	*UP*	x	x	0,00	0,00	0,00	0,00	***0,00***	x	x	0,51	0,49	0,49	0,49	***0,08***	x	x	0,000	0,000	0,000	0,000	***0,00***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People living in households with very low work Intensity - % of population aged 0-59	*UP*	x	x	0,52	0,52	0,52	0,52	***0,00***	x	x	0,50	0,50	0,50	0,50	***0,00***	x	x	0,029	0,029	0,029	0,029	***0,00***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***
People living in households with very low work intensity - % of population aged 0-59, % point change (t, t-3)	*UP*	x	x	0,39	0,27	0,27	0,26	***6,49***	x	x	0,62	0,65	0,65	0,65	***0,25***	x	x	0,117	0,147	0,147	0,152	***0,42***
	DOWN	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***	x	x	x	x	x	x	***x***

Source: Authors' calculations based on data from the EC and Eurostat.

Appendix C

Table C.1 **Econometric results for the EA, Current account**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	of sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,925	0,907	0,279	0,943	0,928	0,157	0,942	0,929	0,243	0,764	0,761	0,615	0,870	0,874	0,708	0,890	0,890	0,935	0,886	0,888	0,734	0,808	0,810	0,599	0,927	0,927	1,000	0,954	0,953	0,674	0,951	0,951	1,000	0,871	0,873	0,711
2013	Pooled	OUT	0,871	0,947	0,066	0,881	0,890	0,807	0,875	0,885	0,777	0,523	0,516	0,491	0,740	0,743	0,905	0,723	0,727	0,898	0,722	0,736	0,532	0,566	0,558	0,249	0,669	0,669	1,000	0,719	0,754	0,112	0,722	0,756	0,093	0,545	0,531	0,164
2013	Pooled	ONE	0,939	0,970	0,531	0,879	0,848	0,531	0,879	0,833	0,409	0,606	0,606		0,652	0,636	0,480	0,576	0,576	1,000	0,576	0,591	0,480	0,833	0,811	0,312	0,764	0,764		0,709	0,800	0,112	0,727	0,800	0,170	0,655	0,691	0,406
2013	Fixed effect	IN	0,974	0,969	0,102	0,545	0,580	0,259				0,874	0,871	0,390	0,954	0,951	0,656	0,683	0,731	0,666				0,920	0,918	0,789	0,974	0,971	0,277	0,584	0,559	0,314				0,927	0,925	0,723
2013	Fixed effect	OUT	0,886	0,883	0,649	0,640	0,625	0,951				0,753	0,763	0,144	0,787	0,777	0,658	0,532	0,626	0,196				0,644	0,634	0,687	0,773	0,740	0,063	0,598	0,566	0,027				0,697	0,709	0,391
2013	Fixed effect	ONE	0,924	0,939	0,634	0,538	0,444	0,542				0,909	0,909		0,924	0,924	1,000	0,438	0,303	0,034				0,803	0,788	0,697	0,982	0,964	0,480	0,564	0,455	0,118				0,800	0,745	0,236
2013	Random effect	IN	0,925	0,905	0,202	0,943	0,928	0,157	0,942	0,929	0,243	0,718	0,766	0,055	0,872	0,875	0,754	0,890	0,890	0,937	0,886	0,888	0,820	0,764	0,792	0,148	0,924	0,926	0,752	0,887	0,953	0,036	0,888	0,951	0,045	0,871	0,873	0,711
2013	Random effect	OUT	0,871	0,966	0,013	0,881	0,890	0,807	0,875	0,885	0,777	0,615	0,573	0,173	0,766	0,757	0,515	0,723	0,739	0,395	0,722	0,753	0,062	0,526	0,560	0,068	0,689	0,677	0,495	0,716	0,754	0,468	0,620	0,756	0,013	0,545	0,531	0,164
2013	Random effect	ONE	0,939	0,985	0,312	0,879	0,848	0,531	0,879	0,833	0,409	0,606	0,606	1,000	0,697	0,667	0,531	0,576	0,591	0,480	0,576	0,591	0,480	0,727	0,811	0,180	0,800	0,764	0,394	0,673	0,800	0,489	0,500	0,800		0,655	0,691	0,406
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,987	0,970	0,063	0,987	0,965	0,037							1,000	1,000		1,000	1,000				
2013	Chamberlain's	OUT				0,752	0,593	0,218	0,779	0,725	0,035							0,618	0,737	0,105	0,590	0,727	0,054							0,562	0,552	0,775	0,558	0,527	0,414			
2013	Chamberlain's	ONE				0,833	0,750		0,864	0,871	0,480							0,573	0,800	0,117	0,573	0,782	0,136							0,600	0,564		0,600	0,500				
2013	Dynamic	IN				0,948	0,935	0,313	0,948	0,935	0,213							0,902	0,901	0,595	0,901	0,899	0,453							0,962	0,956	0,243	0,958	0,955	0,539			
2013	Dynamic	OUT				0,898	0,922	0,268	0,893	0,923	0,152							0,829	0,817	0,275	0,830	0,823	0,396							0,696	0,744	0,047	0,701	0,744	0,051			
2013	Dynamic	ONE				0,927	0,891	0,271	0,909	0,891	0,479							0,745	0,745		0,745	0,745								0,709	0,800	0,239	0,727	0,800	0,234			
2013	Multinomial	IN				0,945	0,931	0,241	0,943	0,928	0,204	0,798	0,794	0,199				0,912	0,907	0,414				0,818	0,820	0,763				0,955	0,953	0,581	0,951	0,949	0,494	0,867	0,872	0,545
2013	Multinomial	OUT				0,745	0,845	0,063	0,772	0,867	0,064	0,542	0,538	0,386				0,649	0,618	0,326				0,533	0,526	0,497				0,756	0,791	0,116	0,757	0,792	0,106	0,581	0,557	0,051
2013	Multinomial	ONE				0,833	0,712	0,309	0,818	0,758	0,545	0,576	0,576					0,545	0,561	0,816				0,788	0,750	0,239				0,745	0,818	0,170	0,709	0,818	0,042	0,691	0,709	0,479
2013	Multinomial robustness	IN				0,944	0,928	0,284	0,941	0,926	0,310	0,813	0,808	0,465				0,922	0,908	0,144	0,917	0,902	0,055	0,822	0,822	0,843				0,959	0,962	0,391	0,959	0,961	0,542	0,879	0,882	0,802
2013	Multinomial robustness	OUT				0,790	0,881	0,047	0,779	0,877	0,040	0,601	0,603	0,800				0,407	0,608	0,000	0,415	0,602	0,000	0,519	0,505	0,055				0,756	0,770	0,433	0,762	0,769	0,733	0,562	0,544	0,219
2013	Multinomial robustness	ONE				0,773	0,758	0,862	0,742	0,758	0,852	0,621	0,621					0,470	0,606	0,101	0,485	0,591	0,204	0,712	0,705	0,480				0,691	0,800	0,101	0,764	0,800	0,531	0,673	0,727	0,236
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,928	0,920	0,367	0,940	0,930	0,152	0,940	0,930	0,154	0,778	0,778	0,982	0,866	0,866	0,655	0,871	0,871	0,783	0,868	0,867	0,369	0,774	0,759	0,372	0,882	0,879	0,458	0,886	0,880	0,339	0,884	0,879	0,438	0,801	0,788	0,485
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,958	0,956	0,072	0,673	0,662	0,188				0,870	0,869	0,861	0,940	0,934	0,139	0,752	0,729	0,122				0,864	0,860	0,523	0,959	0,950	0,140	0,707	0,661	0,079				0,864	0,863	0,892
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,928	0,918	0,259	0,940	0,927	0,081	0,940	0,925	0,055	0,762	0,775	0,154	0,866	0,864	0,800	0,860	0,867	0,222	0,859	0,863	0,511	0,770	0,756	0,433	0,882	0,871	0,239	0,879	0,880	0,432	0,877	0,877	0,783	0,801	0,785	0,376
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,978	0,968	0,146	0,976	0,968	0,159							0,956	0,939	0,065	0,954	0,938	0,056							0,976	0,953	0,039	0,973	0,949	0,024			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,946	0,941	0,299	0,945	0,940	0,296							0,897	0,897	0,914	0,896	0,895	0,903							0,908	0,904	0,534	0,906	0,903	0,598			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,937	0,927	0,191	0,937	0,926	0,105	0,781	0,779	0,779				0,872	0,871	0,856	0,870	0,868	0,702	0,778	0,759	0,282				0,894	0,891	0,521	0,891	0,888	0,562	0,815	0,807	0,659
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,937	0,924	0,131	0,936	0,924	0,133	0,786	0,786	0,981				0,865	0,867	0,858	0,861	0,864	0,728	0,779	0,762	0,311				0,886	0,888	0,743	0,884	0,885	0,954	0,823	0,807	0,367
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																																				
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,816		
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes current account (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat

Table C.2 **Econometric results for the EA, Net international investment position**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,925	0,914	0,367	0,943	0,936	0,263	0,942	0,938	0,457	0,764	0,758	0,558	0,870	0,859	0,399	0,890	0,883	0,532	0,886	0,881	0,652	0,808	0,780	0,155	0,927	0,921	0,437	0,954	0,955	0,686	0,951	0,952	0,479	0,871	0,873	0,777
2013	Pooled	OUT	0,871	0,944	0,044	0,881	0,903	0,393	0,875	0,900	0,339	0,523	0,536	0,575	0,740	0,769	0,537	0,723	0,752	0,599	0,722	0,755	0,533	0,566	0,564	0,950	0,669	0,646	0,429	0,719	0,724	0,252	0,722	0,727	0,196	0,545	0,567	0,233
2013	Pooled	ONE	0,939	0,970	0,601	0,879	0,894	0,801	0,879	0,879	1,000	0,606	0,621	0,801	0,652	0,682	0,603	0,576	0,621	0,608	0,576	0,621	0,609	0,833	0,788	0,590	0,764	0,618	0,087	0,709	0,745	0,271	0,727	0,727		0,655	0,636	0,479
2013	Fixed effect	IN	0,974	0,971	0,387	0,545	0,516	0,146				0,874	0,869	0,235	0,954	0,954	0,895	0,683	0,753	0,004				0,920	0,920	0,866	0,974	0,975	0,480	0,584	0,542	0,143				0,927	0,925	0,208
2013	Fixed effect	OUT	0,886	0,884	0,744	0,640	0,624	0,318				0,753	0,760	0,325	0,787	0,795	0,534	0,532	0,567	0,395				0,644	0,604	0,020	0,773	0,774	0,889	0,598	0,581	0,468				0,697	0,687	0,081
2013	Fixed effect	ONE	0,924	0,939	0,480	0,538	0,561	0,736				0,909	0,909		0,924	0,939	0,626	0,438	0,379	0,808				0,803	0,773	0,579	0,982	0,982		0,564	0,564	1,000				0,800	0,800	1,000
2013	Random effect	IN	0,925	0,914	0,367	0,943	0,936	0,263	0,942	0,938	0,457	0,718	0,755	0,236	0,872	0,864	0,559	0,890	0,877	0,298	0,886	0,877	0,460	0,764	0,778	0,612	0,924	0,922	0,878	0,887	0,886	0,815	0,888	0,888	0,895	0,871	0,873	0,777
2013	Random effect	OUT	0,871	0,944	0,044	0,881	0,903	0,393	0,875	0,900	0,339	0,615	0,558	0,166	0,766	0,784	0,629	0,723	0,792	0,095	0,722	0,802	0,047	0,526	0,555	0,496	0,689	0,674	0,661	0,716	0,728	0,551	0,620	0,680	0,049	0,545	0,567	0,233
2013	Random effect	ONE	0,939	0,970	0,601	0,879	0,894	0,801	0,879	0,879	1,000	0,606	0,606	1,000	0,697	0,667	0,741	0,576	0,667	0,143	0,576	0,682	0,137	0,727	0,773	0,500	0,800	0,745	0,368	0,673	0,764		0,500	0,655		0,655	0,636	0,479
2013	Chamberlain's	IN				1,000	1,000		1,000									0,987	0,985	0,574	0,987	0,984	0,307							1,000	1,000		1,000	1,000				
2013	Chamberlain's	OUT				0,752	0,529	0,073	0,779									0,618	0,657	0,142	0,590	0,636	0,071							0,562	0,579	0,238	0,558	0,581	0,416			
2013	Chamberlain's	ONE				0,833	0,667	0,317	0,864									0,573	0,673	0,275	0,573	0,627	0,537							0,600	0,600		0,600	0,600				
2013	Dynamic	IN				0,948	0,937	0,260	0,948	0,938	0,275							0,902	0,899	0,709	0,901	0,900	0,883							0,962	0,960	0,280	0,958	0,958	1,000			
2013	Dynamic	OUT				0,898	0,919	0,338	0,893	0,919	0,204							0,829	0,856	0,376	0,830	0,862	0,273							0,696	0,712	0,046	0,701	0,709	0,134			
2013	Dynamic	ONE				0,927	0,945	0,637	0,909	0,927	0,480							0,745	0,764	0,818	0,745	0,727	0,699							0,709	0,727	0,480	0,727	0,727				
2013	Multinomial	IN				0,945	0,939	0,385	0,943	0,936	0,323	0,798	0,778	0,117				0,912	0,900	0,201				0,818	0,800	0,283				0,955	0,956	0,480	0,951	0,952	0,480	0,867	0,866	0,948
2013	Multinomial	OUT				0,745	0,754	0,800	0,772	0,758	0,741	0,542	0,530	0,801				0,649	0,607	0,551				0,533	0,540	0,808				0,756	0,760	0,190	0,757	0,760	0,382	0,581	0,576	0,749
2013	Multinomial	ONE				0,833	0,773	0,601	0,818	0,742	0,511	0,576	0,561	0,736				0,545	0,576	0,810				0,788	0,712	0,329				0,745	0,745		0,709	0,709		0,691	0,673	0,480
2013	Multinomial robustness	IN				0,944	0,936	0,217	0,941	0,933	0,381	0,813	0,778	0,065				0,922	0,913	0,332	0,917	0,911	0,537	0,822	0,791	0,112				0,959	0,958	0,413	0,959	0,958	0,311	0,879	0,890	0,443
2013	Multinomial robustness	OUT				0,790	0,795	0,884	0,779	0,770	0,826	0,601	0,516	0,106				0,407	0,392	0,691	0,415	0,398	0,601	0,519	0,554	0,291				0,756	0,751	0,643	0,762	0,746	0,016	0,562	0,567	0,741
2013	Multinomial robustness	ONE				0,773	0,742	0,796	0,742	0,682	0,583	0,621	0,606	0,739				0,470	0,258	0,108	0,485	0,318	0,061	0,712	0,697	0,870				0,691	0,709	0,480	0,764	0,709	0,374	0,673	0,673	
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,928	0,924	0,554	0,940	0,938	0,424	0,940	0,938	0,688	0,778	0,777	0,922	0,866	0,854	0,090	0,871	0,859	0,100	0,868	0,857	0,105	0,774	0,776	0,275	0,882	0,864	0,034	0,886	0,868	0,097	0,884	0,868	0,143	0,801	0,802	0,374
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,958	0,950	0,028	0,673	0,672	0,946				0,870	0,870	0,479	0,940	0,934	0,091	0,752	0,755	0,707				0,864	0,853	0,283	0,959	0,955	0,437	0,707	0,724	0,081				0,864	0,853	0,226
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,928	0,924	0,586	0,940	0,938	0,450	0,940	0,938	0,525	0,762	0,774	0,181	0,866	0,854	0,090	0,860	0,854	0,293	0,859	0,852	0,223	0,770	0,772	0,514	0,882	0,864	0,034	0,879	0,857	0,029	0,877	0,855	0,018	0,801	0,799	0,532
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,978	0,967	0,050	0,976	0,966	0,062							0,956	0,952	0,330	0,954	0,953	0,671							0,976	0,969	0,199	0,973	0,969	0,383			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,946	0,945	0,476	0,945	0,943	0,356							0,897	0,895	0,532	0,896	0,893	0,363							0,908	0,898	0,183	0,906	0,896	0,242			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,937	0,933	0,250	0,937	0,932	0,088	0,781	0,775	0,267				0,872	0,856	0,040	0,870	0,856	0,041	0,778	0,777	0,640				0,894	0,873	0,081	0,891	0,871	0,085	0,815	0,817	0,542
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,937	0,930	0,063	0,936	0,932	0,235	0,786	0,784	0,756				0,865	0,848	0,024	0,861	0,846	0,031	0,779	0,781	0,639				0,886	0,861	0,035	0,884	0,861	0,042	0,823	0,825	0,432
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																																				
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,816	0,819	0,428
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes net international investment position (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table C.3 **Econometric results for the EA, Real effective exchange rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,925	0,924	0,779	0,943	0,943	1,000	0,942	0,944	0,546	0,764	0,744	0,310	0,870	0,807	0,018	0,890	0,814	0,013	0,886	0,808	0,012	0,808	0,756	0,058	0,927	0,799	0,001	0,954	0,813	0,002	0,951	0,804	0,001	0,871	0,806	0,039
2013	Pooled	OUT	0,871	0,872	0,825	0,881	0,884	0,661	0,875	0,879	0,520	0,523	0,682	0,006	0,740	0,711	0,392	0,723	0,687	0,458	0,722	0,678	0,351	0,566	0,653	0,091	0,669	0,531	0,024	0,719	0,548	0,049	0,722	0,543	0,047	0,545	0,600	0,258
2013	Pooled	ONE	0,939	0,939		0,879	0,894	0,480	0,879	0,879		0,606	0,727	0,176	0,652	0,758	0,315	0,576	0,758	0,096	0,576	0,742	0,160	0,833	0,712	0,155	0,764	0,836	0,546	0,709	0,873	0,391	0,727	0,855	0,514	0,655	0,673	0,742
2013	Fixed effect	IN	0,974	0,967	0,282	0,545	0,580	0,504				0,874	0,871	0,632	0,954	0,943	0,211	0,683	0,532	0,029				0,920	0,913	0,477	0,974	0,924	0,025	0,584	0,498	0,309				0,927	0,879	0,083
2013	Fixed effect	OUT	0,886	0,899	0,214	0,640	0,753	0,090				0,753	0,758	0,631	0,787	0,771	0,323	0,532	0,477	0,427				0,644	0,648	0,890	0,773	0,684	0,152	0,598	0,380	0,105				0,697	0,742	0,276
2013	Fixed effect	ONE	0,924	0,985	0,340	0,538	0,652	0,374				0,909	0,894	0,479	0,924	0,924	1,000	0,438	0,394	0,615				0,803	0,773	0,278	0,982	0,927	0,355	0,564	0,418	0,529				0,800	0,836	0,611
2013	Random effect	IN	0,925	0,928	0,553	0,943	0,943	1,000	0,942	0,944	0,546	0,718	0,734	0,469	0,872	0,818	0,012	0,890	0,817	0,020	0,886	0,814	0,020	0,764	0,724	0,091	0,924	0,799	0,001	0,887	0,813	0,150	0,888	0,804	0,094	0,871	0,806	0,039
2013	Random effect	OUT	0,871	0,891	0,074	0,881	0,884	0,661	0,875	0,879	0,520	0,615	0,709	0,037	0,766	0,746	0,461	0,723	0,726	0,956	0,722	0,732	0,838	0,526	0,627	0,039	0,689	0,531	0,008	0,716	0,548	0,068	0,620	0,543	0,374	0,545	0,600	0,258
2013	Random effect	ONE	0,939	0,955	0,479	0,879	0,894	0,480	0,879	0,879		0,606	0,652	0,622	0,697	0,788	0,248	0,576	0,773	0,063	0,576	0,788	0,049	0,727	0,682	0,547	0,800	0,836	0,742	0,673	0,873	0,348	0,500	0,855		0,655	0,673	0,742
2013	Chamberlain's	IN				1,000	0,993	0,117	1,000	0,992	0,108							0,987	0,970	0,097	0,987	0,969	0,061							1,000	0,953	0,049	1,000	0,950	0,024			
2013	Chamberlain's	OUT				0,752	0,869	0,004	0,779	0,876	0,011							0,618	0,706	0,275	0,590	0,695	0,172							0,562	0,706	0,049	0,558	0,693	0,087			
2013	Chamberlain's	ONE				0,833	0,909	0,411	0,864	0,939	0,387							0,573	0,818	0,138	0,573	0,818	0,138							0,600	0,927	0,002	0,600	0,927	0,002			
2013	Dynamic	IN				0,948	0,948	1,000	0,948	0,946	0,596							0,902	0,833	0,030	0,901	0,830	0,016							0,962	0,838	0,005	0,958	0,828	0,004			
2013	Dynamic	OUT				0,898	0,901	0,206	0,893	0,896	0,431							0,829	0,731	0,059	0,830	0,741	0,038							0,696	0,745	0,460	0,701	0,758	0,399			
2013	Dynamic	ONE				0,927	0,927		0,909	0,909	1,000							0,745	0,818	0,490	0,745	0,818	0,490							0,709	0,945	0,112	0,727	0,927	0,134			
2013	Multinomial	IN				0,945	0,945	0,838	0,943	0,945	0,650	0,798	0,774	0,288				0,912	0,830	0,007				0,818	0,766	0,100				0,955	0,811	0,001	0,951	0,804	0,001	0,867	0,815	0,174
2013	Multinomial	OUT				0,745	0,854	0,011	0,772	0,860	0,014	0,542	0,662	0,027				0,649	0,469	0,013				0,533	0,649	0,041				0,756	0,544	0,014	0,757	0,543	0,016	0,581	0,606	0,615
2013	Multinomial	ONE				0,833	0,894	0,278	0,818	0,879	0,278	0,576	0,697	0,190				0,545	0,682	0,157				0,788	0,712	0,332				0,745	0,818	0,700	0,709	0,818	0,576	0,691	0,655	0,531
2013	Multinomial robustness	IN				0,944	0,945	0,924	0,941	0,942	0,747	0,813	0,804	0,700				0,922	0,839	0,011	0,917	0,830	0,009	0,822	0,774	0,132				0,959	0,797	0,000	0,959	0,794	0,000	0,879	0,829	0,133
2013	Multinomial robustness	OUT				0,790	0,815	0,003	0,779	0,805	0,007	0,601	0,705	0,017				0,407	0,518	0,049	0,415	0,515	0,071	0,519	0,628	0,053				0,756	0,598	0,033	0,762	0,597	0,032	0,562	0,594	0,501
2013	Multinomial robustness	ONE				0,773	0,803	0,398	0,742	0,773	0,278	0,621	0,712	0,245				0,470	0,712	0,043	0,485	0,712	0,066	0,712	0,621	0,325				0,691	0,855	0,462	0,764	0,855	0,601	0,673	0,655	0,803
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,928	0,928	0,908	0,940	0,940	0,480	0,940	0,939	0,716	0,778	0,777	0,834	0,866	0,830	0,015	0,871	0,833	0,025	0,868	0,829	0,032	0,774	0,777	0,257	0,882	0,807	0,004	0,886	0,809	0,005	0,884	0,808	0,005	0,801	0,788	0,343
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,958	0,957	0,377	0,673	0,671	0,476				0,870	0,871	0,505	0,940	0,914	0,009	0,752	0,700	0,054				0,864	0,863	0,608	0,959	0,904	0,001	0,707	0,663	0,313				0,864	0,860	0,725
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,928	0,928	0,908	0,940	0,940	0,480	0,940	0,940	0,839	0,762	0,759	0,535	0,866	0,830	0,016	0,860	0,831	0,144	0,859	0,827	0,115	0,770	0,773	0,540	0,882	0,805	0,003	0,879	0,806	0,007	0,877	0,808	0,011	0,801	0,790	0,543
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,978	0,971	0,194	0,976	0,972	0,254							0,956	0,915	0,006	0,954	0,915	0,006							0,976	0,909	0,001	0,973	0,907	0,001			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,946	0,946	0,538	0,945	0,946	0,855							0,897	0,855	0,031	0,896	0,857	0,033							0,908	0,874	0,013	0,906	0,871	0,023			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,937	0,937	0,551	0,937	0,937	0,812	0,781	0,780	0,799				0,872	0,839	0,059	0,870	0,832	0,042	0,778	0,778	0,965				0,894	0,817	0,004	0,891	0,811	0,004	0,815	0,798	0,278
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,937	0,937	0,731	0,936	0,936	0,671	0,786	0,783	0,388				0,865	0,828	0,022	0,861	0,823	0,040	0,779	0,779	0,975				0,886	0,818	0,003	0,884	0,810	0,002	0,823	0,806	0,265
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																																				
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,816	0,800	0,277
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes real effective exchange rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table C.4 **Econometric results for the EA, Export market share**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,925	0,916	0,192	0,943	0,934	0,356	0,942	0,931	0,269	0,764	0,763	0,711	0,870	0,872	1,000	0,890	0,888	0,617	0,886	0,889	0,950	0,808	0,810	1,000	0,927	0,923	0,406	0,954	0,950	0,379	0,951	0,948	0,460	0,871	0,872	0,814
2013	Pooled	OUT	0,871	0,832	0,011	0,881	0,824	0,013	0,875	0,823	0,023	0,523	0,493	0,083	0,740	0,763	0,024	0,723	0,757	0,031	0,722	0,757	0,017	0,566	0,565	0,837	0,669	0,684	0,358	0,719	0,677	0,125	0,722	0,690	0,195	0,545	0,526	0,012
2013	Pooled	ONE	0,939	0,879	0,178	0,879	0,848	0,398	0,879	0,848	0,398	0,606	0,606		0,652	0,682	0,406	0,576	0,606	0,278	0,576	0,606	0,278	0,833	0,833		0,764	0,782	0,838	0,709	0,782	0,505	0,727	0,800	0,409	0,655	0,636	0,479
2013	Fixed effect	IN	0,974	0,965	0,198	0,545	0,574	0,610				0,874	0,876	0,918	0,954	0,954	0,685	0,683	0,669	0,532				0,920	0,920	0,752	0,974	0,974	0,686	0,584	0,539	0,137				0,927	0,925	0,452
2013	Fixed effect	OUT	0,886	0,875	0,388	0,640	0,643	0,860				0,753	0,745	0,474	0,787	0,780	0,134	0,532	0,638	0,686				0,644	0,642	0,874	0,773	0,755	0,123	0,598	0,592	0,576				0,697	0,692	0,451
2013	Fixed effect	ONE	0,924	0,955	0,601	0,538	0,455	0,531				0,909	0,879	0,406	0,924	0,909	0,480	0,438	0,417	0,856				0,803	0,788	0,480	0,982	0,982		0,564	0,545	0,480				0,800	0,800	
2013	Random effect	IN	0,925	0,905	0,109	0,943	0,934	0,356	0,942	0,931	0,269	0,718	0,756	0,165	0,872	0,876	0,807	0,890	0,888	0,604	0,886	0,887	0,898	0,764	0,782	0,339	0,924	0,925	0,897	0,887	0,886	0,492	0,888	0,886	0,437	0,871	0,872	0,814
2013	Random effect	OUT	0,871	0,856	0,543	0,881	0,824	0,013	0,875	0,823	0,023	0,615	0,535	0,030	0,766	0,760	0,534	0,723	0,759	0,024	0,722	0,767	0,013	0,526	0,545	0,119	0,689	0,694	0,666	0,716	0,714	0,914	0,620	0,607	0,282	0,545	0,526	0,012
2013	Random effect	ONE	0,939	0,924	0,701	0,879	0,848	0,398	0,879	0,848	0,398	0,606	0,576	0,531	0,697	0,667	0,531	0,576	0,606	0,278	0,576	0,606	0,278	0,727	0,758	0,406	0,800	0,836	0,635	0,673	0,745		0,500	0,500		0,655	0,636	0,479
2013	Chamberlain's	IN				1,000	0,982	0,053	1,000	0,982	0,050							0,987	0,987	1,000	0,987	0,983	0,327							1,000	1,000		1,000	1,000				
2013	Chamberlain's	OUT				0,752	0,811	0,178	0,779	0,800	0,652							0,618	0,686	0,085	0,590	0,691	0,038							0,562	0,575	0,317	0,558	0,575	0,319			
2013	Chamberlain's	ONE				0,833	0,939	0,221	0,864	0,939	0,370							0,573	0,709	0,048	0,573	0,709	0,048							0,600	0,600		0,600	0,600				
2013	Dynamic	IN				0,948	0,938	0,341	0,948	0,940	0,331							0,902	0,903	0,953	0,901	0,900	0,692							0,962	0,896	0,037	0,958	0,901	0,060			
2013	Dynamic	OUT				0,898	0,847	0,038	0,893	0,846	0,053							0,829	0,860	0,175	0,830	0,861	0,058							0,696	0,663	0,464	0,701	0,608	0,058			
2013	Dynamic	ONE				0,927	0,927	1,000	0,909	0,909	1,000							0,745	0,764	0,480	0,745	0,764	0,480							0,709	0,491	0,117	0,727	0,455	0,046			
2013	Multinomial	IN				0,945	0,934	0,261	0,943	0,936	0,432	0,798	0,788	0,206				0,912	0,895	0,079				0,818	0,818	0,549				0,955	0,949	0,230	0,951	0,947	0,265	0,867	0,873	0,700
2013	Multinomial	OUT				0,745	0,801	0,200	0,772	0,806	0,356	0,542	0,508	0,147				0,649	0,641	0,911				0,533	0,533	0,948				0,756	0,729	0,324	0,757	0,741	0,503	0,581	0,557	0,022
2013	Multinomial	ONE				0,833	0,864	0,626	0,818	0,864	0,442	0,576	0,561	0,697				0,545	0,576	0,601				0,788	0,758	0,278				0,745	0,836	0,363	0,709	0,836	0,210	0,691	0,673	0,480
2013	Multinomial robustness	IN				0,944	0,931	0,163	0,941	0,935	0,484	0,813	0,807	0,464				0,922	0,903	0,085	0,917	0,894	0,045	0,822	0,820	0,330				0,959	0,952	0,292	0,959	0,947	0,113	0,879	0,888	0,571
2013	Multinomial robustness	OUT				0,790	0,764	0,340	0,779	0,763	0,481	0,601	0,543	0,023				0,407	0,563	0,004	0,415	0,584	0,004	0,519	0,530	0,116				0,756	0,712	0,245	0,762	0,723	0,282	0,562	0,557	0,649
2013	Multinomial robustness	ONE				0,773	0,773	1,000	0,742	0,758	0,480	0,621	0,606	0,697				0,470	0,606	0,240	0,485	0,606	0,271	0,712	0,727	0,480				0,691	0,800	0,447	0,764	0,818	0,450	0,673	0,691	0,480
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,928	0,916	0,156	0,940	0,929	0,112	0,940	0,928	0,094	0,778	0,751	0,153	0,866	0,864	0,445	0,871	0,871	0,623	0,868	0,867	0,133	0,774	0,762	0,412	0,882	0,884	0,930	0,886	0,887	0,936	0,884	0,886	0,801	0,801	0,796	0,481
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,958	0,950	0,114	0,673	0,687	0,330				0,870	0,857	0,222	0,940	0,940	0,688	0,752	0,755	0,764				0,864	0,863	0,655	0,959	0,959	0,480	0,707	0,702	0,439				0,864	0,867	0,229
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,928	0,916	0,156	0,940	0,925	0,091	0,940	0,925	0,089	0,762	0,750	0,533	0,866	0,864	0,445	0,860	0,862	0,486	0,859	0,861	0,643	0,770	0,756	0,287	0,882	0,884	0,930	0,879	0,880	0,961	0,877	0,876	0,564	0,801	0,799	0,609
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,978	0,971	0,128	0,976	0,969	0,153							0,956	0,956	0,957	0,954	0,956	0,581							0,976	0,976	0,945	0,973	0,972	0,744			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,946	0,937	0,193	0,945	0,936	0,183							0,897	0,899	0,251	0,896	0,897	0,660							0,908	0,909	0,866	0,906	0,906	0,914			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,937	0,922	0,040	0,937	0,923	0,047	0,781	0,759	0,255				0,872	0,869	0,469	0,870	0,864	0,214	0,778	0,762	0,282				0,894	0,898	0,485	0,891	0,895	0,679	0,815	0,803	0,216
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,937	0,921	0,027	0,936	0,922	0,040	0,786	0,761	0,180				0,865	0,862	0,499	0,861	0,857	0,403	0,779	0,765	0,326				0,886	0,892	0,364	0,884	0,888	0,629	0,823	0,814	0,209
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																																				
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,816	0,810	0,441
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes export market share (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table C.5 **Econometric results for the EA, Nominal unit labour cost**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,925	0,890	0,179	0,943	0,909	0,110	0,942	0,908	0,109	0,764	0,750	0,529	0,870	0,866	0,807	0,890	0,877	0,358	0,886	0,878	0,511	0,808	0,804	0,343	0,927	0,917	0,546	0,954	0,944	0,431	0,951	0,943	0,528	0,871	0,864	0,685
2013	Pooled	OUT	0,871	0,926	0,049	0,881	0,928	0,062	0,875	0,927	0,044	0,523	0,593	0,037	0,740	0,694	0,100	0,723	0,660	0,147	0,722	0,673	0,223	0,566	0,567	0,891	0,669	0,577	0,006	0,719	0,660	0,031	0,722	0,657	0,042	0,545	0,531	0,566
2013	Pooled	ONE	0,939	0,985	0,312	0,879	0,924	0,236	0,879	0,924	0,236	0,606	0,606	1,000	0,652	0,652	1,000	0,576	0,606	0,474	0,576	0,621	0,236	0,833	0,833		0,764	0,764	1,000	0,709	0,655	0,487	0,727	0,655	0,372	0,655	0,691	0,651
2013	Fixed effect	IN	0,974	0,975	0,283	0,545	0,532	0,473				0,874	0,873	0,925	0,954	0,957	0,469	0,683	0,741	0,212				0,920	0,913	0,351	0,974	0,974	1,000	0,584	0,588	0,830				0,927	0,926	0,311
2013	Fixed effect	OUT	0,886	0,887	0,480	0,640	0,680	0,271				0,753	0,772	0,146	0,787	0,795	0,737	0,532	0,559	0,548				0,644	0,652	0,775	0,773	0,745	0,013	0,598	0,608	0,617				0,697	0,694	0,453
2013	Fixed effect	ONE	0,924	0,924		0,538	0,517	0,859				0,909	0,939	0,406	0,924	0,833	0,364	0,438	0,348	0,840				0,803	0,818	0,693	0,982	0,945	0,406	0,564	0,545	0,685				0,800	0,818	0,479
2013	Random effect	IN	0,925	0,892	0,188	0,943	0,905	0,050	0,942	0,904	0,059	0,718	0,742	0,464	0,872	0,864	0,334	0,890	0,877	0,368	0,886	0,875	0,390	0,764	0,784	0,361	0,924	0,921	0,808	0,887	0,882	0,563	0,888	0,873	0,170	0,871	0,864	0,685
2013	Random effect	OUT	0,871	0,919	0,132	0,881	0,917	0,105	0,875	0,917	0,074	0,615	0,610	0,903	0,766	0,742	0,007	0,723	0,751	0,323	0,722	0,758	0,144	0,526	0,524	0,919	0,689	0,592	0,008	0,716	0,757	0,061	0,620	0,645	0,137	0,545	0,531	0,566
2013	Random effect	ONE	0,939	1,000	0,278	0,879	0,924	0,236	0,879	0,924	0,236	0,606	0,636	0,667	0,697	0,652	0,361	0,576	0,636	0,119	0,576	0,636	0,119	0,727	0,803	0,369	0,800	0,782	0,737	0,673	0,818	0,294	0,500	0,600		0,655	0,691	0,651
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000	0,480							0,987	0,983	0,475	0,987	0,982	0,274							1,000	1,000		1,000	1,000				
2013	Chamberlain's	OUT				0,752	0,585	0,582	0,779	0,766	0,534							0,618	0,692	0,140	0,590	0,670	0,099							0,562	0,516	0,318	0,558	0,595	0,151			
2013	Chamberlain's	ONE				0,833	0,500		0,864	0,894	0,398							0,573	0,691	0,084	0,573	0,664	0,187							0,600	0,500		0,600	0,600				
2013	Dynamic	IN				0,948	0,894	0,036	0,948	0,888	0,031							0,902	0,903	0,937	0,901	0,901	0,929							0,962	0,888	0,025	0,958	0,881	0,028			
2013	Dynamic	OUT				0,898	0,897	0,958	0,893	0,877	0,585							0,829	0,828	0,965	0,830	0,841	0,653							0,696	0,694	0,968	0,701	0,620	0,102			
2013	Dynamic	ONE				0,927	0,945	0,480	0,909	0,945	0,394							0,745	0,727	0,480	0,745	0,727	0,480							0,709	0,655	0,715	0,727	0,455	0,046			
2013	Multinomial	IN				0,945	0,913	0,102	0,943	0,907	0,077	0,798	0,767	0,157				0,912	0,898	0,244				0,818	0,815	0,216				0,955	0,939	0,247	0,951	0,940	0,370	0,867	0,878	0,381
2013	Multinomial	OUT				0,745	0,757	0,773	0,772	0,775	0,936	0,542	0,576	0,066				0,649	0,587	0,134				0,533	0,528	0,480				0,756	0,710	0,106	0,757	0,704	0,119	0,581	0,547	0,027
2013	Multinomial	ONE				0,833	0,712	0,254	0,818	0,773	0,663	0,576	0,591	0,697				0,545	0,545	1,000				0,788	0,788					0,745	0,709	0,649	0,709	0,727	0,833	0,691	0,691	1,000
2013	Multinomial robustness	IN				0,944	0,912	0,123	0,941	0,908	0,111	0,813	0,791	0,297				0,922	0,906	0,231	0,917	0,903	0,237	0,822	0,812	0,108				0,959	0,948	0,409	0,959	0,948	0,358	0,879	0,882	0,815
2013	Multinomial robustness	OUT				0,790	0,818	0,502	0,779	0,808	0,496	0,601	0,645	0,059				0,407	0,460	0,002	0,415	0,459	0,015	0,519	0,533	0,212				0,756	0,686	0,020	0,762	0,688	0,022	0,562	0,546	0,320
2013	Multinomial robustness	ONE				0,773	0,803	0,628	0,742	0,788	0,547	0,621	0,636	0,803				0,470	0,576	0,015	0,485	0,545	0,178	0,712	0,727	0,480				0,691	0,727	0,649	0,764	0,745	0,850	0,673	0,709	0,675
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,928	0,922	0,552	0,940	0,926	0,149	0,940	0,926	0,171	0,778	0,772	0,342	0,866	0,849	0,334	0,871	0,855	0,292	0,868	0,850	0,233	0,774	0,775	0,894	0,882	0,834	0,066	0,886	0,847	0,097	0,884	0,837	0,047	0,801	0,795	0,639
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,958	0,956	0,514	0,673	0,674	0,964				0,870	0,866	0,547	0,940	0,938	0,120	0,752	0,751	0,866				0,864	0,866	0,586	0,959	0,945	0,077	0,707	0,738	0,136				0,864	0,864	1,000
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,928	0,919	0,350	0,940	0,925	0,116	0,940	0,923	0,099	0,762	0,767	0,560	0,866	0,852	0,450	0,860	0,851	0,280	0,859	0,848	0,202	0,770	0,774	0,494	0,882	0,820	0,022	0,879	0,830	0,023	0,877	0,825	0,011	0,801	0,792	0,463
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,978	0,973	0,237	0,976	0,971	0,211							0,956	0,951	0,357	0,954	0,952	0,532							0,976	0,955	0,015	0,973	0,953	0,034			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,946	0,939	0,329	0,945	0,938	0,288							0,897	0,887	0,360	0,896	0,887	0,342							0,908	0,879	0,113	0,906	0,878	0,107			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,937	0,922	0,137	0,937	0,921	0,110	0,781	0,780	0,922				0,872	0,860	0,434	0,870	0,852	0,220	0,778	0,777	0,361				0,894	0,856	0,072	0,891	0,848	0,041	0,815	0,808	0,563
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,937	0,918	0,073	0,936	0,918	0,103	0,786	0,783	0,643				0,865	0,853	0,453	0,861	0,849	0,421	0,779	0,778	0,407				0,886	0,842	0,059	0,884	0,834	0,020	0,823	0,810	0,325
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																																				
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,816		
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes nominal unit labour cost (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table C.6 **Econometric results for the EA, House prices**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,925	0,858	0,002	0,943	0,874	0,005	0,942	0,874	0,004	0,764	0,749	0,199	0,870	0,865	0,637	0,890	0,876	0,298	0,886	0,875	0,325	0,808	0,806	0,737	0,927	0,928	0,931	0,954	0,956	0,479	0,951	0,953	0,480	0,871	0,862	0,382
2013	Pooled	OUT	0,871	0,817	0,046	0,881	0,759	0,006	0,875	0,760	0,010	0,523	0,464	0,050	0,740	0,684	0,039	0,723	0,658	0,025	0,722	0,673	0,063	0,566	0,526	0,035	0,669	0,669	0,964	0,719	0,719	0,727	0,722	0,724	0,529	0,545	0,573	0,060
2013	Pooled	ONE	0,939	0,894	0,243	0,879	0,818	0,348	0,879	0,833	0,412	0,606	0,576	0,278	0,652	0,652	1,000	0,576	0,561	0,736	0,576	0,591	0,765	0,833	0,773	0,278	0,764	0,764		0,709	0,709		0,727	0,727		0,655	0,636	0,479
2013	Fixed effect	IN	0,974	0,930	0,034	0,545	0,615	0,281				0,874	0,852	0,345	0,954	0,947	0,206	0,683	0,801	0,190				0,920	0,887	0,230	0,974	0,972	0,386	0,584	0,596	0,438				0,927	0,918	0,147
2013	Fixed effect	OUT	0,886	0,834	0,067	0,640	0,562	0,177				0,753	0,710	0,075	0,787	0,748	0,067	0,532	0,630	0,391				0,644	0,616	0,501	0,773	0,755	0,300	0,598	0,578	0,157				0,697	0,691	0,674
2013	Fixed effect	ONE	0,924	0,939	0,480	0,538	0,424	0,338				0,909	0,909		0,924	0,894	0,398	0,438	0,424	0,732				0,803	0,848	0,622	0,982	0,982		0,564	0,491	0,156				0,800	0,818	0,742
2013	Random effect	IN	0,925	0,843	0,003	0,943	0,874	0,005	0,942	0,874	0,004	0,718	0,750	0,377	0,872	0,853	0,262	0,890	0,876	0,298	0,886	0,875	0,325	0,764	0,793	0,422	0,924	0,920	0,357	0,887	0,888	0,812	0,888	0,884	0,208	0,871	0,862	0,382
2013	Random effect	OUT	0,871	0,832	0,282	0,881	0,759	0,006	0,875	0,760	0,010	0,615	0,481	0,017	0,766	0,742	0,341	0,723	0,658	0,025	0,722	0,673	0,063	0,526	0,498	0,265	0,689	0,694	0,739	0,716	0,733	0,282	0,620	0,619	0,479	0,545	0,573	0,060
2013	Random effect	ONE	0,939	0,924	0,803	0,879	0,818	0,348	0,879	0,833	0,412	0,606	0,576	0,719	0,697	0,727	0,535	0,576	0,561	0,736	0,576	0,591	0,765	0,727	0,758	0,746	0,800	0,836	0,271	0,673	0,655		0,500	0,500		0,655	0,636	0,479
2013	Chamberlain's	IN				1,000	0,960	0,014	1,000	0,960	0,011							0,987	0,977	0,204	0,987	0,977	0,153							1,000	1,000		1,000	1,000				
2013	Chamberlain's	OUT				0,752	0,809	0,235	0,779	0,814	0,479							0,618	0,653	0,470	0,590	0,658	0,111							0,562	0,581	0,478	0,558	0,581	0,512			
2013	Chamberlain's	ONE				0,833	0,955	0,124	0,864	0,955	0,234							0,573	0,709	0,269	0,573	0,709	0,269							0,600	0,600		0,600	0,600				
2013	Dynamic	IN				0,948	0,884	0,006	0,948	0,885	0,006							0,902	0,905	0,917	0,901	0,903	0,754							0,962	0,963	0,529	0,958	0,959	0,657			
2013	Dynamic	OUT				0,898	0,794	0,016	0,893	0,798	0,032							0,829	0,839	0,348	0,830	0,851	0,070							0,696	0,698	0,727	0,701	0,700	0,877			
2013	Dynamic	ONE				0,927	0,909	0,828	0,909	0,909	1,000							0,745	0,727	0,480	0,745	0,727	0,480							0,709	0,691	0,479	0,727	0,682	0,200			
2013	Multinomial	IN				0,945	0,893	0,013	0,943	0,891	0,013	0,798	0,772	0,062				0,912	0,886	0,144				0,818	0,809	0,471				0,955	0,956	0,337	0,951	0,952	0,367	0,867	0,866	0,702
2013	Multinomial	OUT				0,745	0,609	0,001	0,772	0,617	0,001	0,542	0,460	0,035				0,649	0,644	0,911				0,533	0,501	0,069				0,756	0,754	0,654	0,757	0,761	0,659	0,581	0,589	0,592
2013	Multinomial	ONE				0,833	0,697	0,070	0,818	0,742	0,377	0,576	0,576	1,000				0,545	0,561	0,800				0,788	0,773	0,736				0,745	0,745	1,000	0,709	0,727	0,480	0,691	0,727	0,271
2013	Multinomial robustness	IN				0,944	0,898	0,021	0,941	0,897	0,030	0,813	0,781	0,091				0,922	0,909	0,351	0,917	0,899	0,187	0,822	0,823	0,897				0,959	0,958	0,491	0,959	0,958	0,626	0,879	0,878	0,978
2013	Multinomial robustness	OUT				0,790	0,573	0,000	0,779	0,570	0,000	0,601	0,499	0,012				0,407	0,597	0,001	0,415	0,609	0,001	0,519	0,498	0,219				0,756	0,726	0,164	0,762	0,740	0,259	0,562	0,575	0,450
2013	Multinomial robustness	ONE				0,773	0,545	0,034	0,742	0,530	0,062	0,621	0,606	0,697				0,470	0,606	0,153	0,485	0,636	0,075	0,712	0,758	0,243				0,691	0,709	0,803	0,764	0,709	0,517	0,673	0,727	0,129
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,928	0,880	0,000	0,940	0,888	0,001	0,940	0,885	0,001	0,778	0,742	0,013	0,866	0,848	0,053	0,871	0,855	0,103	0,868	0,852	0,093	0,774	0,744	0,091	0,882	0,883	0,770	0,886	0,888	1,000	0,884	0,885	0,604	0,801	0,800	0,703
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,958	0,928	0,008	0,673	0,670	0,720				0,870	0,856	0,309	0,940	0,933	0,101	0,752	0,738	0,101				0,864	0,835	0,055	0,959	0,957	0,483	0,707	0,706	0,462				0,864	0,865	0,936
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,928	0,880	0,000	0,940	0,884	0,001	0,940	0,882	0,000	0,762	0,731	0,022	0,866	0,848	0,053	0,860	0,842	0,098	0,859	0,840	0,061	0,770	0,744	0,158	0,882	0,883	0,770	0,879	0,883	0,797	0,877	0,878	0,726	0,801	0,798	0,522
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,978	0,951	0,016	0,976	0,951	0,013							0,956	0,951	0,343	0,954	0,948	0,243							0,976	0,976	0,744	0,973	0,972	0,693			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,946	0,902	0,007	0,945	0,902	0,005							0,897	0,899	0,894	0,896	0,896	0,608							0,908	0,908	0,790	0,906	0,904	0,505			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,937	0,886	0,001	0,937	0,886	0,001	0,781	0,746	0,020				0,872	0,850	0,064	0,870	0,849	0,050	0,778	0,746	0,083				0,894	0,897	0,959	0,891	0,894	0,915	0,815	0,807	0,258
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,937	0,887	0,002	0,936	0,884	0,002	0,786	0,747	0,011				0,865	0,841	0,031	0,861	0,839	0,028	0,779	0,746	0,074				0,886	0,896	0,306	0,884	0,893	0,447	0,823	0,809	0,099
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																																				
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,816	0,804	0,167
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes house price index (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table C.7 **Econometric results for the EA, Private sector debt**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,925	0,927	0,550	0,943	0,942	0,775	0,942	0,942	0,480	0,764	0,758	0,416	0,870	0,871	0,795	0,890	0,888	0,609	0,886	0,887	0,840	0,808	0,801	0,667	0,927	0,924	0,480	0,954	0,950	0,521	0,951	0,951	1,000	0,871	0,845	0,194
2013	Pooled	OUT	0,871	0,872	0,942	0,881	0,882	0,686	0,875	0,875		0,523	0,500	0,191	0,740	0,737	0,715	0,723	0,723	1,000	0,722	0,720	0,692	0,566	0,508	0,016	0,669	0,679	0,420	0,719	0,759	0,103	0,722	0,761	0,120	0,545	0,520	0,449
2013	Pooled	ONE	0,939	0,894	0,361	0,879	0,879		0,879	0,879		0,606	0,591	0,480	0,652	0,652		0,576	0,606	0,278	0,576	0,621	0,143	0,833	0,758	0,166	0,764	0,691	0,215	0,709	0,800	0,151	0,727	0,818	0,112	0,655	0,727	0,582
2013	Fixed effect	IN	0,974	0,969	0,245	0,545	0,544	0,941				0,874	0,862	0,442	0,954	0,953	0,858	0,683	0,728	0,466				0,920	0,908	0,376	0,974	0,974		0,584	0,603	0,647				0,927	0,915	0,145
2013	Fixed effect	OUT	0,886	0,886	1,000	0,640	0,664	0,194				0,753	0,758	0,817	0,787	0,813	0,161	0,532	0,563	0,526				0,644	0,616	0,366	0,773	0,775	0,726	0,598	0,600	0,977				0,697	0,684	0,568
2013	Fixed effect	ONE	0,924	0,924	1,000	0,538	0,500	1,000				0,909	0,909	1,000	0,924	0,879	0,312	0,438	0,439	0,343				0,803	0,742	0,433	0,982	1,000	0,480	0,564	0,527	0,772				0,800	0,836	0,488
2013	Random effect	IN	0,925	0,929	0,497	0,943	0,942	0,775	0,942	0,942	0,480	0,718	0,729	0,477	0,872	0,875	0,790	0,890	0,888	0,609	0,886	0,887	0,840	0,764	0,753	0,266	0,924	0,919	0,326	0,887	0,885	0,837	0,888	0,882	0,650	0,871	0,840	0,258
2013	Random effect	OUT	0,871	0,892	0,260	0,881	0,882	0,686	0,875	0,875		0,615	0,582	0,298	0,766	0,752	0,500	0,723	0,723	1,000	0,722	0,720	0,692	0,526	0,507	0,359	0,689	0,694	0,692	0,716	0,712	0,920	0,620	0,662	0,229	0,545	0,507	0,329
2013	Random effect	ONE	0,939	0,909	0,601	0,879	0,879		0,879	0,879		0,606	0,561	0,482	0,697	0,667	0,531	0,576	0,606	0,278	0,576	0,621	0,143	0,727	0,712	0,782	0,800	0,782	0,693	0,673	0,709	0,752	0,500	0,545		0,655	0,709	0,716
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,987	0,981	0,414	0,987	0,978	0,274							1,000	1,000		1,000	1,000				
2013	Chamberlain's	OUT				0,752	0,619	0,894	0,779	0,768	0,663							0,618	0,752	0,005	0,590	0,766	0,000							0,562	0,550	0,752	0,558	0,568	0,798			
2013	Chamberlain's	ONE				0,833	0,667	0,317	0,864	0,788	0,376							0,573	0,782	0,032	0,573	0,782	0,032							0,600	0,500		0,600	0,600				
2013	Dynamic	IN				0,948	0,947	0,685	0,948	0,947	0,479							0,902	0,901	0,619	0,901	0,900	0,528							0,962	0,884	0,015	0,958	0,887	0,026			
2013	Dynamic	OUT				0,898	0,894	0,310	0,893	0,893	1,000							0,829	0,834	0,505	0,830	0,832	0,640							0,696	0,687	0,855	0,701	0,618	0,140			
2013	Dynamic	ONE				0,927	0,927		0,909	0,891	0,479							0,745	0,745		0,745	0,745								0,709	0,655	0,704	0,727	0,564				
2013	Multinomial	IN				0,945	0,947	0,480	0,943	0,944	0,813	0,798	0,797	0,895				0,912	0,899	0,070				0,818	0,810	0,503				0,955	0,951	0,401	0,951	0,948	0,633	0,867	0,859	0,676
2013	Multinomial	OUT				0,745	0,750	0,820	0,772	0,787	0,509	0,542	0,538	0,800				0,649	0,531	0,039				0,533	0,487	0,052				0,756	0,794	0,215	0,757	0,794	0,194	0,581	0,510	0,025
2013	Multinomial	ONE				0,833	0,833	1,000	0,818	0,848	0,531	0,576	0,576	1,000				0,545	0,561	0,480				0,788	0,682	0,050				0,745	0,818	0,348	0,709	0,782	0,111	0,691	0,636	0,705
2013	Multinomial robustness	IN				0,944	0,941	0,465	0,941	0,941	1,000	0,813	0,815	0,729				0,922	0,891	0,008	0,917	0,885	0,004	0,822	0,814	0,464				0,959	0,946	0,115	0,959	0,946	0,085	0,879	0,865	0,448
2013	Multinomial robustness	OUT				0,790	0,829	0,232	0,779	0,806	0,399	0,601	0,591	0,637				0,407	0,459	0,121	0,415	0,455	0,219	0,519	0,481	0,038				0,756	0,756	1,000	0,762	0,757	0,875	0,562	0,496	0,040
2013	Multinomial robustness	ONE				0,773	0,848	0,266	0,742	0,788	0,450	0,621	0,591	0,398				0,470	0,500	0,671	0,485	0,470	0,849	0,712	0,667	0,243				0,691	0,745	0,583	0,764	0,745	0,850	0,673	0,655	0,886
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,928	0,925	0,653	0,940	0,936	0,303	0,940	0,936	0,376	0,778	0,774	0,552	0,866	0,866	0,713	0,871	0,872	0,742	0,868	0,868	1,000	0,774	0,769	0,727	0,882	0,880	0,482	0,886	0,887	0,757	0,884	0,883	0,824	0,801	0,785	0,302
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,958	0,954	0,083	0,673	0,665	0,528				0,870	0,867	0,727	0,940	0,938	0,350	0,752	0,750	0,775				0,864	0,860	0,604	0,959	0,959	0,502	0,707	0,710	0,474				0,864	0,865	0,883
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,928	0,925	0,653	0,940	0,937	0,418	0,940	0,936	0,418	0,762	0,752	0,142	0,866	0,866	0,713	0,860	0,859	0,567	0,859	0,858	0,429	0,770	0,751	0,231	0,882	0,880	0,482	0,879	0,878	0,694	0,877	0,874	0,211	0,801	0,776	0,072
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,978	0,974	0,352	0,976	0,972	0,378							0,956	0,953	0,575	0,954	0,954	0,818							0,976	0,977	0,547	0,973	0,974	0,347			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,946	0,946	0,835	0,945	0,946	0,856							0,897	0,895	0,600	0,896	0,893	0,503							0,908	0,909	0,713	0,906	0,906	1,000			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,937	0,935	0,752	0,937	0,935	0,703	0,781	0,777	0,482				0,872	0,872	0,929	0,870	0,870	0,809	0,778	0,773	0,748				0,894	0,893	0,379	0,891	0,892	0,832	0,815	0,798	0,304
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,937	0,935	0,734	0,936	0,935	0,868	0,786	0,781	0,411				0,865	0,866	0,758	0,861	0,864	0,093	0,779	0,771	0,562				0,886	0,885	0,739	0,884	0,883	0,819	0,823	0,802	0,182
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																																				
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,816		
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes private sector debt (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table C.8 **Econometric results for the EA, Private sector credit flow**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,925	0,924	0,937	0,943	0,942	0,640	0,942	0,942	0,657	0,764	0,753	0,416	0,870	0,870	0,840	0,890	0,886	0,327	0,886	0,883	0,354	0,808	0,813	0,162	0,927	0,926	0,672	0,954	0,954	0,893	0,951	0,951	0,907	0,871	0,869	0,718
2013	Pooled	OUT	0,871	0,885	0,184	0,881	0,881	1,000	0,875	0,877	0,452	0,523	0,594	0,011	0,740	0,721	0,022	0,723	0,705	0,029	0,722	0,707	0,026	0,566	0,561	0,479	0,669	0,649	0,020	0,719	0,691	0,047	0,722	0,702	0,176	0,545	0,533	0,074
2013	Pooled	ONE	0,939	0,955	0,479	0,879	0,879		0,879	0,879		0,606	0,667	0,402	0,652	0,667	0,480	0,576	0,591	0,479	0,576	0,591	0,479	0,833	0,833		0,764	0,764		0,709	0,709	1,000	0,727	0,709	0,761	0,655	0,655	
2013	Fixed effect	IN	0,974	0,966	0,177	0,545	0,541	0,388				0,874	0,876	0,724	0,954	0,953	0,805	0,683	0,657					0,920	0,916	0,355	0,974	0,974	0,480	0,584	0,515	0,112				0,927	0,927	1,000
2013	Fixed effect	OUT	0,886	0,885	0,784	0,640	0,615	0,103				0,753	0,747	0,284	0,787	0,795	0,348	0,532	0,542	0,649				0,644	0,645	0,920	0,773	0,769	0,275	0,598	0,574	0,357				0,697	0,704	0,293
2013	Fixed effect	ONE	0,924	0,924	1,000	0,538	0,477	0,039				0,909	0,909		0,924	0,924		0,438	0,500					0,803	0,773	0,278	0,982	0,982		0,564	0,564	1,000				0,800	0,818	0,479
2013	Random effect	IN	0,925	0,926	0,839	0,943	0,942	0,640	0,942	0,942	0,657	0,718	0,707	0,664	0,872	0,875	0,789	0,890	0,886	0,327	0,886	0,884	0,412	0,764	0,767	0,688	0,924	0,922	0,697	0,887	0,887	0,911	0,888	0,885	0,439	0,871	0,869	0,718
2013	Random effect	OUT	0,871	0,901	0,057	0,881	0,881	1,000	0,875	0,877	0,452	0,615	0,684	0,035	0,766	0,739	0,041	0,723	0,705	0,029	0,722	0,707	0,026	0,526	0,533	0,294	0,689	0,669	0,027	0,716	0,718	0,922	0,620	0,609	0,361	0,545	0,533	0,074
2013	Random effect	ONE	0,939	0,955	0,479	0,879	0,879		0,879	0,879		0,606	0,652	0,528	0,697	0,652	0,236	0,576	0,591	0,479	0,576	0,591	0,479	0,727	0,727		0,800	0,764	0,271	0,673	0,700		0,500	0,500		0,655	0,655	
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,987	0,987		0,987	0,986	0,596							1,000	1,000		1,000	1,000				
2013	Chamberlain's	OUT				0,752	0,579	0,368	0,779	0,771	0,589							0,618	0,630	0,507	0,590	0,616	0,181							0,562	0,581	0,614	0,558	0,554	0,920			
2013	Chamberlain's	ONE				0,833	0,667	0,317	0,864	0,788	0,376							0,573	0,609	0,537	0,573	0,618	0,459							0,600	0,700	0,317	0,600	0,600				
2013	Dynamic	IN				0,948	0,947	0,657	0,948	0,948	0,815							0,902	0,896	0,208	0,901	0,896	0,200							0,962	0,955	0,247	0,958	0,953	0,319			
2013	Dynamic	OUT				0,898	0,896	0,727	0,893	0,895	0,382							0,829	0,789	0,010	0,830	0,803	0,022							0,696	0,656	0,017	0,701	0,653	0,007			
2013	Dynamic	ONE				0,927	0,927		0,909	0,909								0,745	0,745		0,745	0,745								0,709	0,655	0,306	0,727	0,673	0,306			
2013	Multinomial	IN				0,945	0,945	1,000	0,943	0,944	0,754	0,798	0,787	0,282				0,912	0,908	0,182				0,818	0,807	0,066				0,955	0,954	0,718	0,951	0,950	0,788	0,867	0,871	0,528
2013	Multinomial	OUT				0,745	0,761	0,150	0,772	0,783	0,173	0,542	0,554	0,383				0,649	0,571	0,040				0,533	0,534	0,943				0,756	0,735	0,088	0,757	0,738	0,196	0,581	0,570	0,155
2013	Multinomial	ONE				0,833	0,833		0,818	0,833	0,479	0,576	0,606	0,630				0,545	0,530	0,480				0,788	0,773	0,736				0,745	0,764	0,693	0,709	0,745	0,394	0,691	0,655	0,271
2013	Multinomial robustness	IN				0,944	0,943	0,727	0,941	0,942	0,672	0,813	0,804	0,320				0,922	0,922	0,912	0,917	0,917	1,000	0,822	0,817	0,336				0,959	0,958	0,840	0,959	0,960	0,833	0,879	0,881	0,711
2013	Multinomial robustness	OUT				0,790	0,802	0,313	0,779	0,790	0,397	0,601	0,623	0,058				0,407	0,403	0,630	0,415	0,411	0,692	0,519	0,517	0,871				0,756	0,725	0,041	0,762	0,739	0,129	0,562	0,554	0,404
2013	Multinomial robustness	ONE				0,773	0,803	0,406	0,742	0,773	0,406	0,621	0,606	0,739				0,470	0,470	1,000	0,485	0,561	0,055	0,712	0,742	0,278				0,691	0,709	0,824	0,764	0,764	1,000	0,673	0,655	0,480
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,928	0,927	0,582	0,940	0,940	0,376	0,940	0,940	1,000	0,778	0,776	0,715	0,866	0,858	0,150	0,871	0,863	0,193	0,868	0,859	0,180	0,774	0,771	0,781	0,882	0,871	0,080	0,886	0,876	0,225	0,884	0,874	0,277	0,801	0,800	0,847
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,958	0,952	0,108	0,673	0,673	0,981				0,870	0,869	0,591	0,940	0,939	0,314	0,752	0,754	0,389				0,864	0,861	0,187	0,959	0,957	0,379	0,707	0,698	0,304				0,864	0,866	0,590
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,928	0,927	0,582	0,940	0,940	0,580	0,940	0,940	1,000	0,762	0,768	0,102	0,866	0,858	0,150	0,860	0,854	0,202	0,859	0,850	0,124	0,770	0,768	0,861	0,882	0,871	0,080	0,879	0,866	0,068	0,877	0,863	0,055	0,801	0,797	0,636
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,978	0,971	0,153	0,976	0,969	0,158							0,956	0,956	0,865	0,954	0,955	0,725							0,976	0,974	0,214	0,973	0,972	0,648			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,946	0,947	0,725	0,945	0,945	0,314							0,897	0,884	0,223	0,896	0,883	0,271							0,908	0,904	0,370	0,906	0,902	0,468			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,937	0,937	1,000	0,937	0,937	0,758	0,781	0,779	0,559				0,872	0,867	0,321	0,870	0,862	0,124	0,778	0,776	0,853				0,894	0,883	0,219	0,891	0,880	0,252	0,815	0,809	0,504
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,937	0,939	0,366	0,936	0,938	0,211	0,786	0,785	0,806				0,865	0,858	0,134	0,861	0,854	0,144	0,779	0,777	0,811				0,886	0,875	0,179	0,884	0,876	0,338	0,823	0,813	0,217
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																																				
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,816		
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes private sector credit flow (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table C.9 **Econometric results for the EA, General government gross debt**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,925	0,928	0,275	0,943	0,944	0,479	0,942	0,944	0,384	0,764	0,749	0,552	0,870	0,871	0,919	0,890	0,882	0,557	0,886	0,880	0,635	0,808	0,730	0,069	0,927	0,930	0,745	0,954	0,952	0,692	0,951	0,951	0,844	0,871	0,823	0,251
2013	Pooled	OUT	0,871	0,897	0,010	0,881	0,881		0,875	0,874	0,686	0,523	0,449	0,064	0,740	0,721	0,519	0,723	0,717	0,864	0,722	0,715	0,844	0,566	0,446	0,002	0,669	0,647	0,636	0,719	0,712	0,675	0,722	0,714	0,615	0,545	0,456	0,065
2013	Pooled	ONE	0,939	0,970	0,398	0,879	0,879		0,879	0,879		0,606	0,568	0,699	0,652	0,712	0,228	0,576	0,667	0,310	0,576	0,636	0,400	0,833	0,788	0,498	0,764	0,855	0,366	0,709	0,782	0,170	0,727	0,727	1,000	0,655	0,409	0,137
2013	Fixed effect	IN	0,974	0,971	0,172	0,545	0,528	0,343				0,874	0,861	0,141	0,954	0,954		0,683	0,677	0,983				0,920	0,922	0,931	0,974	0,976	0,311	0,584	0,581	0,867				0,927	0,931	0,449
2013	Fixed effect	OUT	0,886	0,889	0,586	0,640	0,671	0,452				0,753	0,713	0,316	0,787	0,789	0,412	0,532	0,621	0,906				0,644	0,668	0,327	0,773	0,771	0,834	0,598	0,596	0,815				0,697	0,696	0,897
2013	Fixed effect	ONE	0,924	0,939	0,480	0,538	0,492	0,635				0,909	0,864	0,361	0,924	0,924		0,438	0,427	0,856				0,803	0,833	0,474	0,982	0,982		0,564	0,564					0,800	0,800	1,000
2013	Random effect	IN	0,925	0,928	0,771	0,943	0,944	0,479	0,942	0,944	0,384	0,718	0,693	0,008	0,872	0,871	0,923	0,890	0,882	0,557	0,886	0,880	0,635	0,764	0,694	0,050	0,924	0,927	0,813	0,887	0,952	0,046	0,888	0,951	0,053	0,871	0,763	0,029
2013	Random effect	OUT	0,871	0,929	0,006	0,881	0,881		0,875	0,874	0,686	0,615	0,626	0,478	0,766	0,731	0,213	0,723	0,717	0,864	0,722	0,715	0,844	0,526	0,470	0,240	0,689	0,647	0,471	0,716	0,712	0,950	0,620	0,713	0,111	0,545	0,495	0,416
2013	Random effect	ONE	0,939	0,970	0,398	0,879	0,879		0,879	0,879		0,606	0,621	0,480	0,697	0,712	0,736	0,576	0,667	0,310	0,576	0,636	0,400	0,727	0,667	0,346	0,800	0,855	0,657	0,673	0,782	0,554	0,500	0,727		0,655	0,373	0,088
2013	Chamberlain's	IN				1,000	1,000		1,000									0,987	0,980	0,321	0,987	0,979	0,284							1,000	1,000		1,000	1,000				
2013	Chamberlain's	OUT				0,752	0,506	0,137	0,779									0,618	0,672	0,231	0,590	0,692	0,028							0,562	0,622	0,045	0,558	0,556	0,357			
2013	Chamberlain's	ONE				0,833	0,500		0,864									0,573	0,691	0,271	0,573	0,727	0,071							0,600	0,700	0,317	0,600	0,600				
2013	Dynamic	IN				0,948	0,949		0,948	0,949	0,754							0,902	0,894	0,323	0,901	0,893	0,368							0,962	0,957	0,248	0,958	0,956	0,480			
2013	Dynamic	OUT				0,898	0,898	1,000	0,893	0,891	0,411							0,829	0,810	0,557	0,830	0,812	0,554							0,696	0,713	0,237	0,701	0,712	0,415			
2013	Dynamic	ONE				0,927	0,927		0,909	0,909								0,745	0,745	1,000	0,745	0,764	0,871							0,709	0,727	0,480	0,727	0,727	1,000			
2013	Multinomial	IN				0,945	0,945	0,480	0,943	0,944	0,480	0,798	0,768	0,178				0,912	0,908	0,623				0,818	0,764	0,128				0,955	0,948	0,399	0,951	0,947	0,506	0,867	0,822	0,238
2013	Multinomial	OUT				0,745	0,747	0,686	0,772	0,771	0,776	0,542	0,489	0,123				0,649	0,617	0,317				0,533	0,440	0,018				0,756	0,754	0,863	0,757	0,743	0,296	0,581	0,444	0,008
2013	Multinomial	ONE				0,833	0,818	0,480	0,818	0,818		0,576	0,485	0,193				0,545	0,576	0,746				0,788	0,727	0,369				0,745	0,782	0,604	0,709	0,727	0,812	0,691	0,318	0,019
2013	Multinomial robustness	IN				0,944	0,943	0,602	0,941	0,942	0,523	0,813	0,779	0,154				0,922	0,918	0,589	0,917	0,914	0,774	0,822	0,780	0,174				0,959	0,951	0,303	0,959	0,949	0,215	0,879	0,831	0,209
2013	Multinomial robustness	OUT				0,790	0,787	0,869	0,779	0,783	0,776	0,601	0,556	0,155				0,407	0,422	0,553	0,415	0,426	0,619	0,519	0,449	0,049				0,756	0,725	0,230	0,762	0,736	0,235	0,562	0,445	0,014
2013	Multinomial robustness	ONE				0,773	0,742	0,278	0,742	0,742		0,621	0,545	0,231				0,470	0,530	0,567	0,485	0,530	0,549	0,712	0,712	1,000				0,691	0,764	0,464	0,764	0,818	0,306	0,673	0,318	0,028
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,928	0,924	0,419	0,940	0,939	0,588	0,940	0,939	0,767	0,778	0,714	0,013	0,866	0,854	0,321	0,871	0,864	0,428	0,868	0,860	0,478	0,774	0,699	0,013	0,882	0,876	0,836	0,886	0,879	0,718	0,884	0,877	0,716	0,801	0,749	0,058
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,958	0,955	0,117	0,673	0,683	0,683				0,870	0,871	0,725	0,940	0,923	0,083	0,752	0,721	0,230				0,864	0,851	0,083	0,959	0,936	0,064	0,707	0,740	0,158				0,864	0,868	0,730
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,928	0,924	0,419	0,940	0,939	0,647	0,940	0,939	0,818	0,762	0,706	0,013	0,866	0,854	0,321	0,860	0,850	0,524	0,859	0,849	0,560	0,770	0,695	0,012	0,882	0,876	0,836	0,879	0,878	0,852	0,877	0,876	0,891	0,801	0,739	0,013
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,978	0,970	0,133	0,976	0,969	0,173							0,956	0,944	0,207	0,954	0,939	0,137							0,976	0,955	0,071	0,973	0,951	0,033			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,946	0,947	0,969	0,945	0,946	0,936							0,897	0,891	0,346	0,896	0,889	0,373							0,908	0,902	0,509	0,906	0,899	0,341			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,937	0,936	0,532	0,937	0,938	0,936	0,781	0,718	0,015				0,872	0,863	0,341	0,870	0,861	0,389	0,778	0,702	0,008				0,894	0,888	0,611	0,891	0,885	0,571	0,815	0,754	0,020
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,937	0,935	0,305	0,936	0,935	0,681	0,786	0,716	0,010				0,865	0,858	0,370	0,861	0,852	0,353	0,779	0,711	0,015				0,886	0,884	0,904	0,884	0,878	0,495	0,823	0,760	0,018
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																																				
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,816		
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes general government gross debt (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table C.10 **Econometric results for the EA, Total financial sector liabilities**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,925	0,924	0,667	0,943	0,941	0,748	0,942	0,942	1,000	0,764	0,769	0,478	0,870	0,868	0,738	0,890	0,887	0,799	0,886	0,884	0,814	0,808	0,811	0,700	0,927	0,923	0,603	0,954	0,952	0,626	0,951	0,953	0,776	0,871	0,867	0,785
2013	Pooled	OUT	0,871	0,866	0,324	0,881	0,863	0,150	0,875	0,860	0,164	0,523	0,520	0,412	0,740	0,735	0,701	0,723	0,736	0,445	0,722	0,744	0,227	0,566	0,552	0,171	0,669	0,723	0,002	0,719	0,718	0,816	0,722	0,729	0,447	0,545	0,538	0,354
2013	Pooled	ONE	0,939	0,939		0,879	0,879	1,000	0,879	0,848	0,398	0,606	0,591	0,480	0,652	0,712	0,182	0,576	0,667	0,119	0,576	0,667	0,119	0,833	0,833		0,764	0,800	0,611	0,709	0,727	0,480	0,727	0,727	1,000	0,655	0,636	0,480
2013	Fixed effect	IN	0,974	0,972	0,428	0,545	0,594	0,327				0,874	0,871	0,116	0,954	0,955	0,827	0,683	0,783	0,055				0,920	0,921	0,924	0,974	0,972	0,661	0,584	0,583	0,836				0,927	0,928	0,945
2013	Fixed effect	OUT	0,886	0,885	0,641	0,640	0,699	0,258				0,753	0,753		0,787	0,773	0,230	0,532	0,567	0,668				0,644	0,647	0,842	0,773	0,775	0,910	0,598	0,594	0,499				0,697	0,680	0,179
2013	Fixed effect	ONE	0,924	0,924		0,538	0,509	0,938				0,909	0,909		0,924	0,894	0,406	0,438	0,402	0,886				0,803	0,818	0,479	0,982	1,000	0,480	0,564	0,545	0,480				0,800	0,727	0,215
2013	Random effect	IN	0,925	0,926	0,814	0,943	0,941	0,748	0,942	0,942	1,000	0,718	0,733	0,162	0,872	0,870	0,901	0,890	0,887	0,799	0,886	0,884	0,814	0,764	0,778	0,332	0,924	0,921	0,801	0,887	0,951	0,027	0,888	0,953	0,027	0,871	0,867	0,785
2013	Random effect	OUT	0,871	0,893	0,131	0,881	0,863	0,150	0,875	0,860	0,164	0,615	0,596	0,033	0,766	0,746	0,385	0,723	0,736	0,445	0,722	0,744	0,227	0,526	0,540	0,431	0,689	0,731	0,057	0,716	0,744	0,565	0,620	0,749	0,018	0,545	0,538	0,354
2013	Random effect	ONE	0,939	0,955	0,479	0,879	0,879	1,000	0,879	0,848	0,398	0,606	0,545	0,119	0,697	0,712	0,840	0,576	0,667	0,119	0,576	0,667	0,119	0,727	0,773	0,504	0,800	0,800	1,000	0,673	0,745	0,675	0,500	0,745		0,655	0,636	0,480
2013	Chamberlain's	IN				1,000			1,000	1,000								0,987	0,987		0,987	0,987	0,775							1,000	1,000		1,000	1,000				
2013	Chamberlain's	OUT				0,752			0,779	0,755	0,530							0,618	0,638	0,273	0,590	0,616	0,062							0,562	0,608	0,086	0,558	0,579	0,236			
2013	Chamberlain's	ONE				0,833			0,864	0,909	0,631							0,573	0,673	0,081	0,573	0,645	0,234							0,600	0,600		0,600	0,600				
2013	Dynamic	IN				0,948	0,948	0,900	0,948	0,946	0,601							0,902	0,898	0,690	0,901	0,896	0,626							0,962	0,959	0,428	0,958	0,956	0,697			
2013	Dynamic	OUT				0,898	0,886	0,370	0,893	0,885	0,568							0,829	0,842	0,694	0,830	0,857	0,308							0,696	0,719	0,015	0,701	0,718	0,118			
2013	Dynamic	ONE				0,927	0,945	0,737	0,909	0,945	0,601							0,745	0,800	0,589	0,745	0,764	0,805							0,709	0,709		0,727	0,709	0,480			
2013	Multinomial	IN				0,945	0,939	0,170	0,943	0,939	0,338	0,798	0,795	0,800				0,912	0,905	0,228				0,818	0,800	0,080				0,955	0,952	0,358	0,951	0,951	1,000	0,867	0,874	0,553
2013	Multinomial	OUT				0,745	0,837	0,003	0,772	0,839	0,007	0,542	0,547	0,554				0,649	0,648	0,943				0,533	0,538	0,796				0,756	0,755	0,687	0,757	0,759	0,738	0,581	0,563	0,169
2013	Multinomial	ONE				0,833	0,879	0,366	0,818	0,894	0,128	0,576	0,591	0,479				0,545	0,576	0,573				0,788	0,803	0,798				0,745	0,782	0,271	0,709	0,764	0,306	0,691	0,655	0,271
2013	Multinomial robustness	IN				0,944	0,940	0,432	0,941	0,939	0,639	0,813	0,810	0,763				0,922	0,913	0,227	0,917	0,912	0,547	0,822	0,817	0,587				0,959	0,960	0,480	0,959	0,961	0,280	0,879	0,875	0,729
2013	Multinomial robustness	OUT				0,790	0,812	0,062	0,779	0,785	0,662	0,601	0,611	0,144				0,407	0,429	0,251	0,415	0,418	0,795	0,519	0,528	0,542				0,756	0,755	0,686	0,762	0,769	0,177	0,562	0,556	0,732
2013	Multinomial robustness	ONE				0,773	0,864	0,111	0,742	0,803	0,125	0,621	0,636	0,480				0,470	0,561	0,116	0,485	0,561	0,055	0,712	0,773	0,340				0,691	0,691		0,764	0,764	1,000	0,673	0,655	0,480
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,928	0,928	0,785	0,940	0,938	0,264	0,940	0,938	0,562	0,778	0,776	0,800	0,866	0,865	0,721	0,871	0,870	0,666	0,868	0,867	0,694	0,774	0,772	0,650	0,882	0,881	0,790	0,886	0,885	0,666	0,884	0,882	0,458	0,801	0,799	0,658
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,958	0,957	0,422	0,673	0,664	0,564				0,870	0,872	0,693	0,940	0,938	0,551	0,752	0,742	0,363				0,864	0,862	0,825	0,959	0,959	0,612	0,707	0,722	0,032				0,864	0,860	0,678
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,928	0,928	0,785	0,940	0,938	0,349	0,940	0,938	0,572	0,762	0,757	0,525	0,866	0,865	0,721	0,860	0,863	0,568	0,859	0,859	0,957	0,770	0,772	0,855	0,882	0,881	0,790	0,879	0,878	0,719	0,877	0,876	0,660	0,801	0,797	0,617
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,978	0,977	0,745	0,976	0,975	0,689							0,956	0,952	0,425	0,954	0,951	0,427							0,976	0,973	0,434	0,973	0,967	0,339			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,946	0,945	0,371	0,945	0,945	0,941							0,897	0,897	0,943	0,896	0,894	0,614							0,908	0,906	0,649	0,906	0,903	0,316			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,937	0,936	0,687	0,937	0,936	0,460	0,781	0,782	0,903				0,872	0,871	0,658	0,870	0,868	0,470	0,778	0,775	0,544				0,894	0,885	0,047	0,891	0,883	0,058	0,815	0,816	0,804
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,937	0,936	0,650	0,936	0,936	0,951	0,786	0,786	0,949				0,865	0,863	0,270	0,861	0,860	0,713	0,779	0,778	0,773				0,886	0,880	0,160	0,884	0,879	0,216	0,823	0,812	0,068
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																																				
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,816		
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes total financial sector liabilities (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table C.11 **Econometric results for the EA, Unemployment rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,925	0,925	0,912	0,943	0,943	0,924	0,942	0,944	0,718	0,764	0,765	0,841	0,870	0,874	0,385	0,890	0,891	0,697	0,886	0,888	0,586	0,808	0,807	0,311	0,927	0,926	0,479	0,954	0,954	0,479	0,951	0,951		0,871	0,863	0,485
2013	Pooled	OUT	0,871	0,896	0,124	0,881	0,900	0,179	0,875	0,896	0,110	0,523	0,517	0,622	0,740	0,747	0,561	0,723	0,715	0,353	0,722	0,722	1,000	0,566	0,563	0,524	0,669	0,665	0,366	0,719	0,722	0,383	0,722	0,726	0,275	0,545	0,562	0,442
2013	Pooled	ONE	0,939	0,909	0,601	0,879	0,909	0,398	0,879	0,894	0,479	0,606	0,621	0,480	0,652	0,636	0,480	0,576	0,576		0,576	0,591	0,479	0,833	0,833		0,764	0,764		0,709	0,709	1,000	0,727	0,727		0,655	0,709	0,355
2013	Fixed effect	IN	0,974	0,973	0,672	0,545	0,510	0,091				0,874	0,867	0,054	0,954	0,957	0,228	0,683	0,744	0,206				0,920	0,920	1,000	0,974	0,975	0,480	0,584	0,565	0,643				0,927	0,930	0,719
2013	Fixed effect	OUT	0,886	0,886	0,852	0,640	0,600	0,074				0,753	0,751	0,668	0,787	0,780	0,763	0,532	0,574	0,351				0,644	0,645	0,960	0,773	0,780	0,420	0,598	0,544	0,165				0,697	0,683	0,566
2013	Fixed effect	ONE	0,924	0,924	1,000	0,538	0,409	0,096				0,909	0,909		0,924	0,864	0,552	0,438	0,318	0,611				0,803	0,818	0,479	0,982	1,000	0,480	0,564	0,491	0,635				0,800	0,818	0,814
2013	Random effect	IN	0,925	0,925	0,912	0,943	0,943	0,924	0,942	0,944	0,718	0,718	0,723	0,193	0,872	0,874	0,840	0,890	0,891	0,697	0,886	0,887	0,708	0,764	0,778	0,107	0,924	0,929	0,115	0,887	0,901	0,206	0,888	0,891	0,748	0,871	0,872	0,909
2013	Random effect	OUT	0,871	0,896	0,124	0,881	0,900	0,179	0,875	0,896	0,110	0,615	0,617	0,715	0,766	0,755	0,414	0,723	0,715	0,353	0,722	0,724	0,845	0,526	0,542	0,157	0,689	0,674	0,264	0,716	0,722	0,814	0,620	0,609	0,711	0,545	0,554	0,753
2013	Random effect	ONE	0,939	0,909	0,601	0,879	0,909	0,398	0,879	0,894	0,479	0,606	0,621	0,480	0,697	0,652	0,236	0,576	0,576		0,576	0,591	0,479	0,727	0,742	0,479	0,800	0,764	0,394	0,673	0,727	0,606	0,500	0,564		0,655	0,745	0,284
2013	Chamberlain's	IN				1,000	1,000		1,000									0,987	0,987	0,480	0,987	0,987	0,775							1,000	1,000		1,000	1,000				
2013	Chamberlain's	OUT				0,752	0,750	0,743	0,779									0,618	0,599	0,341	0,590	0,576	0,523							0,562	0,581	0,478	0,558	0,581	0,512			
2013	Chamberlain's	ONE				0,833	0,800	0,317	0,864									0,573	0,573	1,000	0,573	0,591	0,705							0,600	0,600		0,600	0,600				
2013	Dynamic	IN				0,948	0,949	0,741	0,948	0,948	1,000							0,902	0,902	1,000	0,901	0,901								0,962	0,956	0,266	0,958	0,955	0,625			
2013	Dynamic	OUT				0,898	0,911	0,211	0,893	0,907	0,129							0,829	0,828	0,870	0,830	0,830								0,696	0,736	0,026	0,701	0,735	0,078			
2013	Dynamic	ONE				0,927	0,909	0,480	0,909	0,909								0,745	0,745		0,745	0,745								0,709	0,727	0,480	0,727	0,782	0,236			
2013	Multinomial	IN				0,945	0,942	0,418	0,943	0,941	0,568	0,798	0,792	0,396				0,912	0,910	0,096				0,818	0,824	0,468				0,955	0,954	0,479	0,951	0,953	0,565	0,867	0,870	0,484
2013	Multinomial	OUT				0,745	0,762	0,471	0,772	0,788	0,433	0,542	0,544	0,924				0,649	0,490	0,042				0,533	0,532	0,935				0,756	0,754	0,692	0,757	0,754	0,677	0,581	0,585	0,666
2013	Multinomial	ONE				0,833	0,848	0,816	0,818	0,848	0,608	0,576	0,545	0,278				0,545	0,470	0,462				0,788	0,788					0,745	0,764	0,479	0,709	0,745	0,271	0,691	0,709	0,479
2013	Multinomial robustness	IN				0,944	0,942	0,576	0,941	0,941	0,846	0,813	0,812	0,963				0,922	0,922	1,000	0,917	0,917	0,873	0,822	0,822	0,914				0,959	0,958	0,673	0,959	0,956	0,464	0,879	0,877	0,592
2013	Multinomial robustness	OUT				0,790	0,835	0,038	0,779	0,819	0,036	0,601	0,588	0,543				0,407	0,422	0,388	0,415	0,425	0,428	0,519	0,520	0,870				0,756	0,736	0,423	0,762	0,744	0,383	0,562	0,567	0,640
2013	Multinomial robustness	ONE				0,773	0,833	0,356	0,742	0,788	0,374	0,621	0,636	0,480				0,470	0,455	0,786	0,485	0,439	0,370	0,712	0,727	0,736				0,691	0,727	0,271	0,764	0,764		0,673	0,691	0,479
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,928	0,928	0,655	0,940	0,939	0,437	0,940	0,940	0,850	0,778	0,779	0,785	0,866	0,866	1,000	0,871	0,871	0,721	0,868	0,865	0,069	0,774	0,774	0,980	0,882	0,882	0,928	0,886	0,886	0,944	0,884	0,884	1,000	0,801	0,799	0,625
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,958	0,959	0,679	0,673	0,679	0,078				0,870	0,869	0,813	0,940	0,938	0,053	0,752	0,745	0,205				0,864	0,864	1,000	0,959	0,950	0,064	0,707	0,687	0,015				0,864	0,864	0,978
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,928	0,928	0,655	0,940	0,939	0,450	0,940	0,939	0,763	0,762	0,763	0,883	0,866	0,866	1,000	0,860	0,858	0,708	0,859	0,855	0,268	0,770	0,761	0,245	0,882	0,877	0,520	0,879	0,879	0,813	0,877	0,878	0,792	0,801	0,794	0,345
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,978	0,977	0,141	0,976	0,975	0,328							0,956	0,954	0,734	0,954	0,954	0,961							0,976	0,969	0,187	0,973	0,969	0,346			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,946	0,946	0,480	0,945	0,946	0,479							0,897	0,897	0,774	0,896	0,894	0,161							0,908	0,908	1,000	0,906	0,905	0,870			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,937	0,940	0,425	0,937	0,940	0,525	0,781	0,782	0,750				0,872	0,871	0,343	0,870	0,868	0,182	0,778	0,779	0,741				0,894	0,893	0,595	0,891	0,890	0,750	0,815	0,816	0,729
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,937	0,940	0,553	0,936	0,940	0,339	0,786	0,787	0,867				0,865	0,869	0,182	0,861	0,865	0,208	0,779	0,781	0,756				0,886	0,885	0,689	0,884	0,882	0,462	0,823	0,822	0,760
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																																				
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,816	0,820	0,294
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes unemployment rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table C.12 **Econometric results for the EA, Activity rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,925	0,923	0,795	0,943	0,941	0,489	0,942	0,943	0,925	0,764	0,772	0,752	0,870	0,872	1,000	0,890	0,888	0,744	0,886	0,885	0,744	0,808	0,805	0,560	0,927	0,928	0,902	0,954	0,957	0,311	0,951	0,954	0,384	0,871	0,848	0,247
2013	Pooled	OUT	0,871	0,875	0,540	0,881	0,864	0,069	0,875	0,860	0,092	0,523	0,526	0,913	0,740	0,748	0,392	0,723	0,720	0,755	0,722	0,724	0,859	0,566	0,555	0,389	0,669	0,656	0,204	0,719	0,718	0,480	0,722	0,725	0,479	0,545	0,624	0,019
2013	Pooled	ONE	0,939	0,909	0,398	0,879	0,894	0,480	0,879	0,864	0,480	0,606	0,636	0,567	0,652	0,682	0,406	0,576	0,636	0,057	0,576	0,621	0,143	0,833	0,788	0,236	0,764	0,691	0,221	0,709	0,727	0,480	0,727	0,727		0,655	0,791	0,223
2013	Fixed effect	IN	0,974	0,968	0,097	0,545	0,522	0,252				0,874	0,872	0,244	0,954	0,951	0,817	0,683	0,734	0,418				0,920	0,906	0,426	0,974	0,975	0,480	0,584	0,651	0,173				0,927	0,926	0,696
2013	Fixed effect	OUT	0,886	0,887	0,919	0,640	0,640	0,717				0,753	0,755	0,646	0,787	0,811	0,429	0,532	0,638	0,054				0,644	0,652	0,843	0,773	0,776	0,719	0,598	0,571	0,275				0,697	0,733	0,027
2013	Fixed effect	ONE	0,924	0,924	1,000	0,538	0,500	1,000				0,909	0,909		0,924	0,894	0,789	0,438	0,417	0,665				0,803	0,803	1,000	0,982	1,000	0,480	0,564	0,582	0,699				0,800	0,836	0,537
2013	Random effect	IN	0,925	0,926	0,872	0,943	0,941	0,489	0,942	0,943	0,925	0,718	0,747	0,072	0,872	0,872	0,909	0,890	0,888	0,708	0,886	0,885	0,739	0,764	0,772	0,800	0,924	0,925	0,920	0,887	0,895	0,393	0,888	0,892	0,664	0,871	0,849	0,253
2013	Random effect	OUT	0,871	0,901	0,028	0,881	0,864	0,069	0,875	0,860	0,092	0,615	0,603	0,457	0,766	0,748	0,435	0,723	0,719	0,701	0,722	0,733	0,313	0,526	0,512	0,610	0,689	0,686	0,872	0,716	0,745	0,131	0,620	0,668	0,043	0,545	0,607	0,077
2013	Random effect	ONE	0,939	0,955	0,479	0,879	0,894	0,480	0,879	0,864	0,480	0,606	0,591	0,763	0,697	0,682	0,785	0,576	0,636	0,057	0,576	0,621	0,143	0,727	0,667	0,601	0,800	0,782	0,479	0,673	0,745	0,471	0,500	0,600		0,655	0,827	0,113
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,987	0,990	0,363	0,987	0,988	0,865							1,000	1,000		1,000	1,000				
2013	Chamberlain's	OUT				0,752	0,802	0,043	0,779	0,809	0,311							0,618	0,610	0,747	0,590	0,554	0,266							0,562	0,568	0,842	0,558	0,568	0,757			
2013	Chamberlain's	ONE				0,833	0,765	0,389	0,864	0,780	0,317							0,573	0,564	0,902	0,573	0,509	0,368							0,600	0,500		0,600	0,500				
2013	Dynamic	IN				0,948	0,946	0,592	0,948	0,946	0,579							0,902	0,900	0,580	0,901	0,898	0,583							0,962	0,958	0,370	0,958	0,957	0,791			
2013	Dynamic	OUT				0,898	0,873	0,035	0,893	0,873	0,079							0,829	0,834	0,701	0,830	0,837	0,414							0,696	0,698	0,771	0,701	0,694	0,435			
2013	Dynamic	ONE				0,927	0,909	0,479	0,909	0,909	1,000							0,745	0,745		0,745	0,745								0,709	0,691	0,479	0,727	0,709	0,480			
2013	Multinomial	IN				0,945	0,947	0,657	0,943	0,942	0,619	0,798	0,798	0,752				0,912	0,909	0,562				0,818	0,805	0,136				0,955	0,956		0,951	0,952	0,754	0,867	0,845	0,225
2013	Multinomial	OUT				0,745	0,749	0,753	0,772	0,780	0,503	0,542	0,543	0,886				0,649	0,613	0,160				0,533	0,525	0,492				0,756	0,757	0,755	0,757	0,766	0,045	0,581	0,652	0,047
2013	Multinomial	ONE				0,833	0,803	0,535	0,818	0,818	1,000	0,576	0,606	0,398				0,545	0,621	0,084				0,788	0,727	0,119				0,745	0,745		0,709	0,745	0,271	0,691	0,936	0,027
2013	Multinomial robustness	IN				0,944	0,945	1,000	0,941	0,942	0,865	0,813	0,815	0,956				0,922	0,916	0,409	0,917	0,910	0,257	0,822	0,822	0,807				0,959	0,960	0,480	0,959	0,959	0,686	0,879	0,867	0,364
2013	Multinomial robustness	OUT				0,790	0,799	0,568	0,779	0,785	0,675	0,601	0,606	0,506				0,407	0,438	0,106	0,415	0,444	0,135	0,519	0,501	0,123				0,756	0,758	0,558	0,762	0,759	0,638	0,562	0,642	0,044
2013	Multinomial robustness	ONE				0,773	0,742	0,278	0,742	0,727	0,479	0,621	0,652	0,278				0,470	0,530	0,308	0,485	0,530	0,498	0,712	0,697	0,480				0,691	0,709	0,480	0,764	0,764	1,000	0,673	0,936	0,026
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,928	0,928	0,847	0,940	0,940	0,546	0,940	0,939	0,572	0,778	0,778	0,724	0,866	0,868	0,797	0,871	0,872	0,906	0,868	0,868	0,451	0,774	0,773	0,797	0,882	0,878	0,391	0,886	0,882	0,414	0,884	0,880	0,319	0,801	0,799	0,702
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,958	0,956	0,347	0,673	0,663	0,027				0,870	0,870	0,802	0,940	0,940	0,717	0,752	0,749	0,331				0,864	0,864	0,987	0,959	0,957	0,360	0,707	0,713	0,614				0,864	0,862	0,717
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,928	0,928	0,847	0,940	0,940	0,655	0,940	0,939	0,562	0,762	0,774	0,164	0,866	0,868	0,797	0,860	0,861	0,948	0,859	0,858	0,391	0,770	0,772	0,904	0,882	0,878	0,391	0,879	0,872	0,166	0,877	0,871	0,121	0,801	0,799	0,645
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,978	0,974	0,144	0,976	0,974	0,405							0,956	0,954	0,648	0,954	0,952	0,565							0,976	0,975	0,508	0,973	0,973	0,891			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,946	0,947	0,892	0,945	0,947	0,715							0,897	0,900	0,253	0,896	0,897	0,824							0,908	0,907	0,774	0,906	0,904	0,552			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,937	0,937	1,000	0,937	0,937	0,789	0,781	0,781	0,676				0,872	0,874	0,398	0,870	0,871	0,929	0,778	0,776	0,779				0,894	0,891	0,578	0,891	0,889	0,540	0,815	0,813	0,972
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,937	0,936	0,539	0,936	0,936	0,909	0,786	0,789	0,682				0,865	0,866	0,930	0,861	0,863	0,794	0,779	0,780	0,955				0,886	0,882	0,467	0,884	0,879	0,182	0,823	0,818	0,369
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																																				
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,816		
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes activity rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table C.13 **Econometric results for the EA, Long-term unemployment rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,925	0,907	0,233	0,943	0,919	0,142	0,942	0,921	0,159	0,764	0,766	0,850	0,870	0,876	0,278	0,890	0,891		0,886	0,888	0,754	0,808	0,813	0,646	0,927	0,918	0,298	0,954	0,936	0,190	0,951	0,938	0,307	0,871	0,866	0,508
2013	Pooled	OUT	0,871	0,838	0,084	0,881	0,837	0,056	0,875	0,846	0,196	0,523	0,519	0,784	0,740	0,715	0,045	0,723	0,720	0,206	0,722	0,718	0,225	0,566	0,550	0,098	0,669	0,697	0,600	0,719	0,779	0,310	0,722	0,777	0,322	0,545	0,602	0,006
2013	Pooled	ONE	0,939	0,955	0,701	0,879	0,909	0,474	0,879	0,909	0,474	0,606	0,591	0,739	0,652	0,652		0,576	0,576		0,576	0,576		0,833	0,788	0,236	0,764	0,764	1,000	0,709	0,836	0,184	0,727	0,836	0,253	0,655	0,745	0,248
2013	Fixed effect	IN	0,974	0,972	0,785	0,545	0,524	0,414				0,874	0,874	0,921	0,954	0,955	0,872	0,683	0,723	0,544				0,920	0,918	0,478	0,974	0,975		0,584	0,563	0,651				0,927	0,925	0,550
2013	Fixed effect	OUT	0,886	0,868	0,042	0,640	0,663	0,111				0,753	0,750	0,178	0,787	0,764	0,021	0,532	0,579	0,364				0,644	0,629	0,193	0,773	0,773	1,000	0,598	0,560	0,503				0,697	0,717	0,020
2013	Fixed effect	ONE	0,924	0,909	0,480	0,538	0,483	0,734				0,909	0,909		0,924	0,924		0,438	0,364	0,840				0,803	0,773	0,278	0,982	0,964	0,479	0,564	0,518	0,776				0,800	0,800	
2013	Random effect	IN	0,925	0,911	0,464	0,943	0,919	0,142	0,942	0,921	0,159	0,718	0,763	0,079	0,872	0,878	0,608	0,890	0,891		0,886	0,888	0,754	0,764	0,807	0,082	0,924	0,914	0,157	0,887	0,923	0,156	0,888	0,929	0,131	0,871	0,866	0,508
2013	Random effect	OUT	0,871	0,877	0,787	0,881	0,837	0,056	0,875	0,846	0,196	0,615	0,576	0,166	0,766	0,732	0,028	0,723	0,721	0,310	0,722	0,718	0,225	0,526	0,540	0,529	0,689	0,708	0,611	0,716	0,799	0,149	0,620	0,788	0,006	0,545	0,602	0,006
2013	Random effect	ONE	0,939	0,970	0,406	0,879	0,909	0,474	0,879	0,909	0,474	0,606	0,606	1,000	0,697	0,667	0,398	0,576	0,576		0,576	0,576		0,727	0,727	1,000	0,800	0,764	0,629	0,673	0,855	0,225	0,500	0,836		0,655	0,745	0,248
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,987	0,986	0,805	0,987	0,986	0,503							1,000	1,000		1,000	1,000				
2013	Chamberlain's	OUT				0,752	0,619	0,172	0,779	0,774	0,876							0,618	0,654	0,177	0,590	0,633	0,057							0,562	0,581	0,478	0,558	0,541	0,673			
2013	Chamberlain's	ONE				0,833	0,750	0,317	0,864	0,788	0,376							0,573	0,636	0,476	0,573	0,618	0,537							0,600	0,600		0,600	0,600				
2013	Dynamic	IN				0,948	0,925	0,184	0,948	0,926	0,169							0,902	0,901	0,770	0,901	0,901	1,000							0,962	0,942	0,110	0,958	0,943	0,213			
2013	Dynamic	OUT				0,898	0,867	0,171	0,893	0,877	0,477							0,829	0,834	0,783	0,830	0,834	0,723							0,696	0,732	0,269	0,701	0,728	0,374			
2013	Dynamic	ONE				0,927	0,964	0,480	0,909	0,964	0,355							0,745	0,745		0,745	0,727	0,480							0,709	0,818	0,165	0,727	0,818	0,166			
2013	Multinomial	IN				0,945	0,925	0,183	0,943	0,922	0,180	0,798	0,795	0,741				0,912	0,906	0,174				0,818	0,815	0,255				0,955	0,937	0,180	0,951	0,936	0,224	0,867	0,866	0,832
2013	Multinomial	OUT				0,745	0,593	0,001	0,772	0,664	0,008	0,542	0,537	0,723				0,649	0,657	0,794				0,533	0,533	1,000				0,756	0,795	0,507	0,757	0,786	0,609	0,581	0,623	0,055
2013	Multinomial	ONE				0,833	0,667	0,206	0,818	0,818	1,000	0,576	0,576	1,000				0,545	0,621	0,166				0,788	0,803	0,480				0,745	0,836	0,191	0,709	0,818	0,158	0,691	0,782	0,151
2013	Multinomial robustness	IN				0,944	0,934	0,469	0,941	0,931	0,451	0,813	0,808	0,768				0,922	0,915	0,250	0,917	0,911	0,339	0,822	0,823	0,818				0,959	0,948	0,375	0,959	0,945	0,244	0,879	0,875	0,585
2013	Multinomial robustness	OUT				0,790	0,712	0,027	0,779	0,736	0,147	0,601	0,566	0,115				0,407	0,650	0,000	0,415	0,652	0,000	0,519	0,528	0,402				0,756	0,768	0,819	0,762	0,763	0,985	0,562	0,629	0,014
2013	Multinomial robustness	ONE				0,773	0,879	0,304	0,742	0,879	0,218	0,621	0,606	0,788				0,470	0,667	0,047	0,485	0,636	0,134	0,712	0,758	0,236				0,691	0,818	0,318	0,764	0,818	0,405	0,673	0,782	0,148
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,928	0,922	0,345	0,940	0,928	0,212	0,940	0,930	0,273	0,778	0,765	0,263	0,866	0,863	0,593	0,871	0,870	0,644	0,868	0,867	0,550	0,774	0,773	0,653	0,882	0,882	0,794	0,886	0,885	0,811	0,884	0,884	0,912	0,801	0,803	1,000
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,958	0,953	0,271	0,673	0,710	0,049				0,870	0,867	0,539	0,940	0,940	0,513	0,752	0,755	0,511				0,864	0,863	0,663	0,959	0,958	0,481	0,707	0,708	0,770				0,864	0,870	0,360
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,928	0,922	0,345	0,940	0,926	0,174	0,940	0,928	0,201	0,762	0,754	0,514	0,866	0,863	0,593	0,860	0,861	0,919	0,859	0,856	0,220	0,770	0,771	0,919	0,882	0,882	0,794	0,879	0,881	0,885	0,877	0,879	0,959	0,801	0,802	0,522
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,978	0,969	0,184	0,976	0,967	0,134							0,956	0,955	0,769	0,954	0,956	0,480							0,976	0,972	0,190	0,973	0,971	0,480			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,946	0,936	0,276	0,945	0,937	0,306							0,897	0,897	0,479	0,896	0,896	0,839							0,908	0,907	0,704	0,906	0,904	0,534			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,937	0,921	0,088	0,937	0,920	0,087	0,781	0,771	0,387				0,872	0,875	0,610	0,870	0,868	0,593	0,778	0,772	0,323				0,894	0,890	0,412	0,891	0,887	0,468	0,815	0,815	0,190
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,937	0,919	0,069	0,936	0,921	0,154	0,786	0,771	0,230				0,865	0,866	0,982	0,861	0,858	0,570	0,779	0,777	0,555				0,886	0,885	0,516	0,884	0,882	0,432	0,823	0,820	0,134
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																																				
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,816	0,815	0,224
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes long-term unemployment rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table C.14 **Econometric results for the EA, Youth unemployment rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,925	0,904	0,037	0,943	0,919	0,075	0,942	0,920	0,083	0,764	0,766	0,783	0,870	0,870	1,000	0,890	0,890		0,886	0,886	1,000	0,808	0,803	0,464	0,927	0,907	0,062	0,954	0,921	0,054	0,951	0,920	0,072	0,871	0,829	0,118
2013	Pooled	OUT	0,871	0,899	0,127	0,881	0,907	0,281	0,875	0,898	0,323	0,523	0,551	0,146	0,740	0,738	0,864	0,723	0,721	0,310	0,722	0,720	0,620	0,566	0,566	1,000	0,669	0,584	0,055	0,719	0,632	0,177	0,722	0,634	0,202	0,545	0,551	0,835
2013	Pooled	ONE	0,939	0,970	0,406	0,879	0,939	0,343	0,879	0,924	0,409	0,606	0,667	0,057	0,652	0,667	0,480	0,576	0,576		0,576	0,591	0,480	0,833	0,818	0,480	0,764	0,782	0,479	0,709	0,727	0,872	0,727	0,745	0,889	0,655	0,727	0,376
2013	Fixed effect	IN	0,974	0,972	0,498	0,545	0,575	0,143				0,874	0,871	0,390	0,954	0,954	1,000	0,683	0,744	0,186				0,920	0,917	0,591	0,974	0,969	0,225	0,584	0,713					0,927	0,898	0,130
2013	Fixed effect	OUT	0,886	0,878	0,181	0,640	0,658	0,134				0,753	0,751	0,630	0,787	0,779	0,212	0,532	0,551	0,409				0,644	0,649	0,682	0,773	0,765	0,663	0,598	0,506	0,529				0,697	0,714	0,531
2013	Fixed effect	ONE	0,924	0,924		0,538	0,525	0,311				0,909	0,909		0,924	0,894	0,278	0,438	0,333	0,840				0,803	0,818	0,480	0,982	1,000	0,480	0,564	0,367	0,515				0,800	0,855	0,587
2013	Random effect	IN	0,925	0,906	0,045	0,943	0,919	0,075	0,942	0,920	0,083	0,718	0,752	0,111	0,872	0,874	0,856	0,890	0,890		0,886	0,886	1,000	0,764	0,799	0,146	0,924	0,901	0,012	0,887	0,921	0,345	0,888	0,920	0,363	0,871	0,829	0,118
2013	Random effect	OUT	0,871	0,899	0,132	0,881	0,907	0,281	0,875	0,898	0,323	0,615	0,612	0,891	0,766	0,754	0,441	0,723	0,721	0,310	0,722	0,720	0,620	0,526	0,545	0,436	0,689	0,623	0,089	0,716	0,632	0,262	0,620	0,634	0,850	0,545	0,551	0,835
2013	Random effect	ONE	0,939	0,970	0,406	0,879	0,939	0,343	0,879	0,924	0,409	0,606	0,652	0,243	0,697	0,667	0,278	0,576	0,576		0,576	0,591	0,480	0,727	0,742	0,848	0,800	0,782	0,737	0,673	0,727	0,778	0,500	0,745		0,655	0,727	0,376
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,987	0,987		0,987	0,987	0,726							1,000	1,000		1,000	1,000				
2013	Chamberlain's	OUT				0,752	0,640	0,178	0,779	0,799	0,202							0,618	0,620	0,879	0,590	0,587	0,860							0,562	0,530	0,315	0,558	0,635	0,196			
2013	Chamberlain's	ONE				0,833	0,625	0,083	0,864	0,864								0,573	0,591	0,705	0,573	0,591	0,705							0,600	0,500		0,600	0,700	0,593			
2013	Dynamic	IN				0,948	0,925	0,059	0,948	0,925	0,055							0,902	0,902	0,911	0,901	0,900	0,802							0,962	0,934	0,077	0,958	0,932	0,111			
2013	Dynamic	OUT				0,898	0,919	0,350	0,893	0,916	0,336							0,829	0,828	0,969	0,830	0,828	0,902							0,696	0,642	0,305	0,701	0,646	0,305			
2013	Dynamic	ONE				0,927	0,964	0,480	0,909	0,964	0,355							0,745	0,745		0,745	0,727	0,480							0,709	0,673	0,694	0,727	0,691	0,681			
2013	Multinomial	IN				0,945	0,924	0,074	0,943	0,921	0,078	0,798	0,796	0,794				0,912	0,904	0,168				0,818	0,820	0,697				0,955	0,923	0,043	0,951	0,920	0,063	0,867	0,837	0,322
2013	Multinomial	OUT				0,745	0,639	0,130	0,772	0,688	0,200	0,542	0,562	0,151				0,649	0,639	0,760				0,533	0,530	0,749				0,756	0,688	0,331	0,757	0,681	0,285	0,581	0,569	0,652
2013	Multinomial	ONE				0,833	0,788	0,733	0,818	0,833	0,903	0,576	0,636	0,119				0,545	0,636	0,083				0,788	0,758	0,278				0,745	0,764	0,848	0,709	0,727	0,854	0,691	0,800	0,236
2013	Multinomial robustness	IN				0,944	0,927	0,121	0,941	0,929	0,296	0,813	0,806	0,499				0,922	0,919	0,349	0,917	0,917	1,000	0,822	0,824	0,619				0,959	0,944	0,243	0,959	0,944	0,203	0,879	0,849	0,276
2013	Multinomial robustness	OUT				0,790	0,701	0,098	0,779	0,728	0,343	0,601	0,604	0,843				0,407	0,493	0,003	0,415	0,491	0,007	0,519	0,529	0,162				0,756	0,635	0,055	0,762	0,640	0,053	0,562	0,567	0,886
2013	Multinomial robustness	ONE				0,773	0,818	0,714	0,742	0,803	0,641	0,621	0,682	0,182				0,470	0,606	0,103	0,485	0,591	0,134	0,712	0,758	0,236				0,691	0,709	0,902	0,764	0,745	0,864	0,673	0,782	0,236
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,928	0,927	0,444	0,940	0,932	0,105	0,940	0,934	0,197	0,778	0,774	0,502	0,866	0,864	0,686	0,871	0,873	0,686	0,868	0,868	0,979	0,774	0,778	0,423	0,882	0,859	0,154	0,886	0,861	0,123	0,884	0,860	0,161	0,801	0,777	0,145
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,958	0,956	0,232	0,673	0,717	0,033				0,870	0,870	0,903	0,940	0,936	0,161	0,752	0,755	0,778				0,864	0,865	0,865	0,959	0,944	0,052	0,707	0,737	0,232				0,864	0,856	0,493
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,928	0,927	0,444	0,940	0,932	0,131	0,940	0,934	0,200	0,762	0,775	0,155	0,866	0,864	0,686	0,860	0,863	0,596	0,859	0,861	0,791	0,770	0,776	0,360	0,882	0,859	0,154	0,879	0,857	0,171	0,877	0,853	0,167	0,801	0,776	0,193
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,978	0,970	0,125	0,976	0,969	0,070							0,956	0,953	0,653	0,954	0,949	0,400							0,976	0,953	0,011	0,973	0,953	0,018			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,946	0,938	0,166	0,945	0,939	0,250							0,897	0,896	0,909	0,896	0,891	0,526							0,908	0,893	0,170	0,906	0,888	0,158			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,937	0,928	0,095	0,937	0,928	0,110	0,781	0,783	0,639				0,872	0,875	0,445	0,870	0,872	0,676	0,778	0,780	0,535				0,894	0,871	0,137	0,891	0,867	0,145	0,815	0,795	0,276
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,937	0,927	0,116	0,936	0,928	0,222	0,786	0,784	0,680				0,865	0,867	0,513	0,861	0,864	0,501	0,779	0,782	0,700				0,886	0,865	0,101	0,884	0,859	0,068	0,823	0,802	0,229
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																																				
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,816		
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes youth unemployment rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Appendix D

Table D.1 **Econometric results for the non-EA, Current account**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,929	0,932	0,527	0,948	0,944	0,593	0,946	0,946	1,000	0,870	0,854	0,249	0,863	0,857	0,529	0,871	0,868	0,502	0,869	0,866	0,367	0,770	0,771	0,847	0,911	0,905	0,712	0,940	0,933	0,420	0,940	0,928	0,159	0,802	0,795	0,626
2013	Pooled	OUT	0,698	0,691	0,560	0,811	0,789	0,275	0,804	0,782	0,131	0,651	0,610	0,174	0,606	0,575	0,034	0,652	0,646	0,271	0,644	0,640	0,567	0,570	0,568	0,409	0,641	0,643	0,932	0,600	0,606	0,794	0,602	0,606	0,841	0,641	0,648	0,807
2013	Pooled	ONE	0,750	0,750		0,781	0,781		0,781	0,781	1,000	0,547	0,563	0,848	0,781	0,750	0,480	0,625	0,625		0,625	0,625		0,563	0,563		0,600	0,650	0,609	0,525	0,575	0,480	0,525	0,600	0,218	0,675	0,700	0,480
2013	Fixed effect	IN	0,972	0,969	0,281	0,649	0,651	0,694				0,958	0,960	0,620	0,942	0,944	0,206	0,651	0,675	0,002				0,900	0,900	1,000	0,963	0,962	0,728	0,437	0,430	0,713				0,962	0,962	
2013	Fixed effect	OUT	0,633	0,669	0,044	0,405	0,690	0,027				0,764	0,700	0,117	0,538	0,542	0,304	0,597	0,627	0,442				0,616	0,572	0,032	0,508	0,514	0,808	0,427	0,384	0,162				0,550	0,552	0,480
2013	Fixed effect	ONE	0,938	0,969	0,480	0,500	0,625					0,844	0,750	0,091	1,000	1,000		0,825	0,719	0,573				0,750	0,750		0,775	0,750	0,480	0,612	0,562	0,332				0,775	0,775	
2013	Random effect	IN	0,914	0,927	0,045	0,948	0,944	0,644	0,946	0,946	1,000	0,870	0,852	0,221	0,863	0,857	0,529	0,871	0,868	0,502	0,869	0,866	0,367	0,759	0,771	0,481	0,911	0,905	0,712	0,940	0,933	0,420	0,940	0,928	0,159	0,802	0,795	0,626
2013	Random effect	OUT	0,624	0,651	0,290	0,811	0,793	0,382	0,804	0,782	0,131	0,651	0,626	0,349	0,606	0,575	0,034	0,652	0,646	0,271	0,644	0,640	0,567	0,576	0,568	0,808	0,641	0,643	0,932	0,600	0,606	0,794	0,602	0,606	0,841	0,641	0,648	0,807
2013	Random effect	ONE	0,813	0,719	0,292	0,781	0,781		0,781	0,781	1,000	0,547	0,531	0,772	0,781	0,750	0,480	0,625	0,625		0,625	0,625		0,563	0,563		0,600	0,650	0,609	0,525	0,575	0,480	0,525	0,600	0,218	0,675	0,700	0,480
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,985	0,979	0,535	0,989	0,980	0,259										1,000	1,000				
2013	Chamberlain's	OUT				0,602	0,740	0,140	0,564	0,784	0,005							0,617	0,652	0,516	0,580	0,671	0,137										0,346	0,347	0,842			
2013	Chamberlain's	ONE				0,656	0,516	0,404	0,625	0,656	0,847							1,000	0,969	0,480	0,875	0,969	0,198										0,313	0,313				
2013	Dynamic	IN				0,951	0,946	0,564	0,953	0,945	0,235							0,895	0,897	0,802	0,897	0,901	0,446							0,939	0,943	0,670	0,939	0,943	0,590			
2013	Dynamic	OUT				0,791	0,860	0,083	0,791	0,868	0,074							0,769	0,731	0,038	0,758	0,738	0,114							0,680	0,694	0,506	0,662	0,680	0,353			
2013	Dynamic	ONE				0,893	0,893	1,000	0,893	0,857	0,743							0,969	0,969		0,969	0,969								0,575	0,575	1,000	0,562	0,600	0,405			
2013	Multinomial	IN				0,961	0,943	0,105				0,868	0,865	0,796				0,897	0,899	0,686				0,821												0,836	0,849	0,546
2013	Multinomial	OUT				0,773	0,784	0,855				0,658	0,568	0,005				0,608	0,540	0,545				0,451												0,561	0,562	0,970
2013	Multinomial	ONE				0,766	0,781	0,864				0,547	0,500	0,575				0,719	0,563	0,214				0,594												0,525	0,475	0,394
2013	Multinomial robustness	IN				0,963	0,940	0,063				0,867	0,869	0,871				0,922	0,887	0,092				0,778	0,778	1,000				0,958	0,933	0,080				0,849	0,850	0,982
2013	Multinomial robustness	OUT				0,756	0,744	0,863				0,633	0,552	0,013				0,473	0,577	0,425				0,386	0,457	0,031				0,646	0,614	0,597				0,587	0,730	0,107
2013	Multinomial robustness	ONE				0,719	0,656	0,252				0,484	0,438	0,575				0,516	0,688	0,194				0,406	0,469	0,403				0,475	0,525	0,604				0,725	0,775	0,696
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,888	0,894	0,285	0,920	0,919	0,903	0,920	0,916	0,617	0,835	0,814	0,145	0,842	0,844	0,876	0,851	0,851	0,927	0,848	0,849	0,851	0,767	0,763	0,688	0,866	0,866	0,966	0,876	0,877	0,787	0,877	0,878	0,944	0,760	0,759	0,394
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,951	0,951	0,850	0,780	0,779	0,519				0,913	0,908	0,638	0,917	0,916	0,876	0,816	0,810	0,668				0,879	0,870	0,346	0,948	0,949	0,788	0,840	0,847	0,615				0,904	0,900	0,331
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,885	0,894	0,112	0,920	0,920	0,977	0,920	0,919	0,852	0,835	0,814	0,145	0,842	0,844	0,876	0,851	0,851	0,927	0,848	0,849	0,851	0,767	0,763	0,688	0,866	0,866	0,966	0,872	0,875	0,655	0,873	0,875	0,826	0,760	0,759	0,394
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,991	0,990	0,385	0,991	0,991	0,726							0,947	0,940	0,411	0,946	0,938	0,312							0,976	0,972	0,278	0,973	0,970	0,447			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,936	0,929	0,272	0,936	0,931	0,408							0,900	0,895	0,351	0,899	0,897	0,595							0,924	0,923	0,702	0,924	0,924	0,868			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,925	0,916	0,416	0,919	0,915	0,662	0,848	0,831	0,206				0,839	0,842	0,657	0,836	0,838	0,805	0,768	0,758	0,276				0,876	0,877	0,859	0,873	0,877	0,413	0,742	0,740	0,846
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,921	0,914	0,461	0,916	0,912	0,629	0,848	0,831	0,230				0,845	0,846	0,966	0,840	0,841	0,932	0,770	0,759	0,115				0,879	0,878	0,859	0,878	0,876	0,788	0,750	0,752	0,235
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																						0,769												0,743	0,742	0,907
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,749	0,750	0,600
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes current account (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for non-EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table D.2 **Econometric results for the non-EA, Net international investment position**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,929	0,931	0,479	0,948	0,948	1,000	0,946	0,946	0,792	0,870	0,872	0,505	0,863	0,847	0,184	0,871	0,858	0,322	0,869	0,862	0,556	0,770	0,757	0,306	0,911	0,874	0,159	0,940	0,897	0,109	0,940	0,892	0,070	0,802	0,783	0,192
2013	Pooled	OUT	0,698	0,698	1,000	0,811	0,804	0,479	0,804	0,802	0,858	0,651	0,661	0,404	0,606	0,721	0,039	0,652	0,713	0,143	0,644	0,719	0,118	0,570	0,569	0,969	0,641	0,692	0,153	0,600	0,592	0,850	0,602	0,604	0,961	0,641	0,651	0,726
2013	Pooled	ONE	0,750	0,781	0,480	0,781	0,781		0,781	0,781		0,547	0,547		0,781	0,781	1,000	0,625	0,688	0,386	0,625	0,688	0,386	0,563	0,563		0,600	0,600	1,000	0,525	0,550	0,701	0,525	0,550	0,769	0,675	0,700	0,480
2013	Fixed effect	IN	0,972	0,972	0,852	0,649	0,691	0,004				0,958	0,953	0,268	0,942	0,940	0,657	0,651	0,688	0,001				0,900	0,906	0,306	0,963	0,963	1,000	0,437	0,469	0,073				0,962	0,958	0,481
2013	Fixed effect	OUT	0,633	0,576	0,013	0,405	0,444	0,167				0,764	0,749	0,222	0,538	0,513	0,057	0,597	0,719	0,158				0,616	0,639	0,114	0,508	0,503	0,678	0,427	0,461	0,096				0,550	0,548	0,880
2013	Fixed effect	ONE	0,938	0,906	0,480	0,500	0,550					0,844	0,813	0,480	1,000	1,000		0,825	0,750	0,725				0,750	0,719	0,480	0,775	0,750	0,480	0,612	0,612					0,775	0,750	0,480
2013	Random effect	IN	0,914	0,921	0,224	0,948	0,948	1,000	0,946	0,946	0,792	0,870	0,872	0,505	0,863	0,847	0,184	0,871	0,858	0,322	0,869	0,862	0,556	0,759	0,731	0,024	0,911	0,874	0,159	0,940	0,897	0,109	0,940	0,892	0,070	0,802	0,761	0,394
2013	Random effect	OUT	0,624	0,660	0,164	0,811	0,804	0,479	0,804	0,802	0,858	0,651	0,661	0,404	0,606	0,721	0,039	0,652	0,713	0,143	0,644	0,719	0,118	0,576	0,579	0,855	0,641	0,692	0,153	0,600	0,592	0,850	0,602	0,604	0,961	0,641	0,659	0,724
2013	Random effect	ONE	0,813	0,719	0,292	0,781	0,781		0,781	0,781		0,547	0,547		0,781	0,781	1,000	0,625	0,688	0,386	0,625	0,688	0,386	0,563	0,563		0,600	0,600	1,000	0,525	0,550	0,701	0,525	0,550	0,769	0,675	0,700	0,828
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,985	0,978	0,557	0,989	0,978	0,329										1,000	1,000				
2013	Chamberlain's	OUT				0,602	0,556	0,624	0,564	0,533	0,552							0,617	0,673	0,415	0,580	0,660	0,271										0,346	0,404	0,101			
2013	Chamberlain's	ONE				0,656	0,714	0,699	0,625	0,609	0,837							1,000	1,000		0,875	1,000	0,127										0,313	0,487	0,173			
2013	Dynamic	IN				0,951	0,945	0,095	0,953	0,948	0,168							0,895	0,889	0,497	0,897	0,891	0,521							0,939	0,933	0,666	0,939	0,934	0,718			
2013	Dynamic	OUT				0,791	0,847	0,031	0,791	0,844	0,040							0,769	0,800	0,198	0,758	0,802	0,115							0,680	0,694	0,655	0,662	0,698	0,338			
2013	Dynamic	ONE				0,893	0,857	0,480	0,893	0,857	0,480							0,969	0,969		0,969	0,969								0,575	0,575		0,562	0,575	0,480			
2013	Multinomial	IN				0,961	0,961	1,000				0,868	0,863	0,188				0,897	0,888	0,500				0,821	0,754	0,013										0,836	0,805	0,242
2013	Multinomial	OUT				0,773	0,624	0,044				0,658	0,652	0,772				0,608	0,544	0,489				0,451	0,496	0,513										0,561	0,561	1,000
2013	Multinomial	ONE				0,766	0,625	0,260				0,547	0,578	0,480				0,719	0,766	0,292				0,594	0,594	1,000										0,525	0,625	0,581
2013	Multinomial robustness	IN				0,963	0,964	0,311				0,867	0,872	0,432				0,922	0,901	0,183				0,778	0,731	0,023				0,958	0,913	0,074				0,849		
2013	Multinomial robustness	OUT				0,756	0,628	0,067				0,633	0,621	0,569				0,473	0,454	0,875				0,386	0,435	0,140				0,646	0,663	0,721				0,587		
2013	Multinomial robustness	ONE				0,719	0,656	0,683				0,484	0,453	0,480				0,516	0,625	0,348				0,406	0,469	0,252				0,475	0,475	1,000				0,725		
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,888	0,892	0,649	0,920	0,920	0,966	0,920	0,920	0,933	0,835	0,832	0,160	0,842	0,844	0,749	0,851	0,848	0,328	0,848	0,848	1,000	0,767	0,766	0,708	0,866	0,863	0,540	0,876	0,872	0,580	0,877	0,870	0,333	0,760	0,760	1,000
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,951	0,943	0,238	0,780	0,782	0,938				0,913	0,915	0,763	0,917	0,910	0,370	0,816	0,782	0,158				0,879	0,871	0,217	0,948	0,947	0,955	0,840	0,819	0,338				0,904	0,901	0,701
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,885	0,892	0,409	0,920	0,920	0,966	0,920	0,919	0,842	0,835	0,812	0,068	0,842	0,844	0,749	0,851	0,848	0,328	0,848	0,848	1,000	0,767	0,765	0,824	0,866	0,863	0,540	0,872	0,870	0,705	0,873	0,868	0,440	0,760	0,760	1,000
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,991	0,973	0,076	0,991	0,973	0,039							0,947	0,939	0,255	0,946	0,936	0,257							0,976	0,969	0,077	0,973	0,966	0,120			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,936	0,935	0,705	0,936	0,934	0,670							0,900	0,899	0,313	0,899	0,898	0,146							0,924	0,928	0,379	0,924	0,925	0,786			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,925	0,922	0,465	0,919	0,915	0,547	0,848	0,843	0,167				0,839	0,834	0,277	0,836	0,834	0,597	0,768	0,755	0,054				0,876	0,865	0,218	0,873	0,868	0,500	0,742	0,743	0,702
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,921	0,918	0,534	0,916	0,912	0,425	0,848	0,849	0,876				0,845	0,836	0,390	0,840	0,833	0,530	0,770	0,750	0,029				0,879	0,869	0,298	0,878	0,869	0,356	0,750	0,743	0,590
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																						0,769	0,755	0,023										0,743	0,745	0,662
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,749	0,740	0,324
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes net international investment position (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for non-EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table D.3 **Econometric results for the non-EA, Real effective exchange rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,929	0,926	0,721	0,948	0,945	0,574	0,946	0,943	0,439	0,870	0,844	0,250	0,863	0,842	0,292	0,871	0,849	0,381	0,869	0,847	0,392	0,770	0,752	0,586	0,911	0,811	0,017	0,940	0,833	0,013	0,940	0,828	0,010	0,802	0,775	0,330
2013	Pooled	OUT	0,698	0,713	0,576	0,811	0,824	0,504	0,804	0,813	0,633	0,651	0,673	0,245	0,606	0,610	0,922	0,652	0,650	0,974	0,644	0,663	0,794	0,570	0,603	0,094	0,641	0,612	0,485	0,600	0,575	0,675	0,602	0,580	0,729	0,641	0,641	1,000
2013	Pooled	ONE	0,750	0,719	0,480	0,781	0,844	0,252	0,781	0,844	0,252	0,547	0,547		0,781	0,781	1,000	0,625	0,781	0,375	0,625	0,813	0,283	0,563	0,609	0,413	0,600	0,525	0,586	0,525	0,375	0,313	0,525	0,425	0,555	0,675	0,725	0,474
2013	Fixed effect	IN	0,972	0,973	0,698	0,649	0,625	0,013				0,958	0,939	0,166	0,942	0,940	0,699	0,651	0,721	0,120				0,900	0,889	0,473	0,963	0,947	0,093	0,437	0,600	0,034				0,962	0,965	0,742
2013	Fixed effect	OUT	0,633	0,616	0,247	0,405	0,507	0,436				0,764	0,787	0,410	0,538	0,523	0,276	0,597	0,454	0,339				0,616	0,686	0,110	0,508	0,412	0,008	0,427	0,552	0,006				0,550	0,543	0,710
2013	Fixed effect	ONE	0,938	0,938		0,500	0,417					0,844	0,813	0,480	1,000	1,000		0,825	0,656	0,157				0,750	0,813	0,699	0,775	0,725	0,265	0,612	0,600	0,194				0,775	0,775	1,000
2013	Random effect	IN	0,914	0,920	0,397	0,948	0,946	0,856	0,946	0,944	0,715	0,870	0,844	0,250	0,863	0,842	0,292	0,871	0,847	0,359	0,869	0,847	0,392	0,759	0,752	0,860	0,911	0,811	0,017	0,940	0,833	0,013	0,940	0,828	0,010	0,802	0,775	0,330
2013	Random effect	OUT	0,624	0,651	0,097	0,811	0,813	0,908	0,804	0,811	0,688	0,651	0,673	0,245	0,606	0,610	0,922	0,652	0,642	0,865	0,644	0,660	0,816	0,576	0,603	0,528	0,641	0,612	0,485	0,600	0,575	0,675	0,602	0,580	0,729	0,641	0,641	1,000
2013	Random effect	ONE	0,813	0,781	0,480	0,781	0,813	0,480	0,781	0,813	0,480	0,547	0,547		0,781	0,781	1,000	0,625	0,813	0,283	0,625	0,813	0,283	0,563	0,609	0,413	0,600	0,525	0,586	0,525	0,375	0,313	0,525	0,425	0,555	0,675	0,725	0,474
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,985	0,986	0,480	0,989	0,987	0,280										1,000	0,990	0,232			
2013	Chamberlain's	OUT				0,602	0,659	0,410	0,564	0,580	0,728							0,617	0,614	0,153	0,580	0,606	0,451										0,346	0,533	0,007			
2013	Chamberlain's	ONE				0,656	0,734	0,327	0,625	0,625								1,000	1,000		0,875	0,938	0,317										0,313	0,625	0,085			
2013	Dynamic	IN				0,951	0,951	1,000	0,953	0,952	0,817							0,895	0,879	0,436	0,897	0,876	0,309							0,939	0,869	0,049	0,939	0,869	0,040			
2013	Dynamic	OUT				0,791	0,810	0,341	0,791	0,807	0,402							0,769	0,758	0,801	0,758	0,754	0,924							0,680	0,710	0,580	0,662	0,716	0,358			
2013	Dynamic	ONE				0,893	0,857	0,480	0,893	0,857	0,480							0,969	0,938	0,480	0,969	0,938	0,480							0,575	0,525	0,669	0,562	0,525	0,742			
2013	Multinomial	IN				0,961	0,964	0,462				0,868	0,852	0,389				0,897						0,821	0,785	0,156										0,836	0,840	0,842
2013	Multinomial	OUT				0,773	0,754	0,306				0,658	0,691	0,306				0,608						0,451	0,327	0,066										0,561	0,649	0,296
2013	Multinomial	ONE				0,766	0,766	1,000				0,547	0,609	0,533				0,719						0,594	0,516	0,239										0,525	0,700	0,254
2013	Multinomial robustness	IN				0,963	0,967	0,204				0,867	0,855	0,538				0,922						0,778	0,752	0,362				0,958	0,883	0,014				0,849	0,851	0,962
2013	Multinomial robustness	OUT				0,756	0,737	0,306				0,633	0,636	0,926				0,473						0,386	0,374	0,523				0,646	0,651	0,947				0,587	0,724	0,052
2013	Multinomial robustness	ONE				0,719	0,750	0,480				0,484	0,453	0,480				0,516						0,406	0,484	0,375				0,475	0,325	0,343				0,725	0,800	0,542
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,888	0,893	0,551	0,920	0,920	0,741	0,920	0,919	0,453	0,835	0,818	0,245	0,842	0,818	0,157	0,851	0,821	0,116	0,848	0,820	0,146	0,767	0,752	0,363	0,866	0,790	0,036	0,876	0,800	0,027	0,877	0,800	0,021	0,760	0,760	0,967
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,951	0,950	0,745	0,780	0,787	0,695				0,913	0,912	0,920	0,917	0,912	0,594	0,816	0,797	0,139				0,879	0,874	0,746	0,948	0,924	0,103	0,840	0,836	0,861				0,904	0,900	0,309
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,885	0,893	0,267	0,920	0,920	0,741	0,920	0,919	0,453	0,835	0,818	0,245	0,842	0,818	0,157	0,851	0,821	0,116	0,848	0,820	0,146	0,767	0,752	0,363	0,866	0,790	0,036	0,872	0,800	0,055	0,873	0,800	0,044	0,760	0,760	0,967
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,991	0,976	0,152	0,991	0,974	0,087							0,947	0,947	0,893	0,946	0,944	0,649							0,976	0,967	0,298	0,973	0,963	0,194			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,936	0,933	0,613	0,936	0,932	0,567							0,900	0,874	0,094	0,899	0,872	0,070							0,924	0,883	0,037	0,924	0,882	0,029			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,925	0,924	0,764	0,919	0,917	0,592	0,848	0,840	0,492				0,839	0,806	0,117	0,836	0,804	0,138	0,768	0,754	0,474				0,876	0,792	0,017	0,873	0,794	0,016	0,742	0,746	0,760
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,921	0,920	0,672	0,916	0,915	0,470	0,848	0,844	0,764				0,845	0,805	0,076	0,840	0,804	0,095	0,770	0,759	0,522				0,879	0,787	0,008	0,878	0,785	0,008	0,750	0,745	0,744
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																						0,769												0,743	0,744	0,943
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,749	0,747	0,868
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes real effective exchange rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for non-EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table D.4 **Econometric results for the non-EA, Export market share**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,929	0,921	0,314	0,948	0,945	0,285	0,946	0,943	0,323	0,870	0,843	0,084	0,863	0,861	0,544	0,871	0,881	0,722	0,869	0,880	0,758	0,770	0,764	0,203	0,911	0,887	0,097	0,940	0,902	0,051	0,940	0,904	0,046	0,802	0,835	0,964
2013	Pooled	OUT	0,698	0,764	0,143	0,811	0,836	0,542	0,804	0,840	0,347	0,651	0,617	0,302	0,606	0,710	0,056	0,652	0,696	0,117	0,644	0,692	0,073	0,570	0,513	0,312	0,641	0,782	0,027	0,600	0,702	0,061	0,602	0,702	0,052	0,641	0,575	0,143
2013	Pooled	ONE	0,750	0,750	1,000	0,781	0,906	0,186	0,781	0,906	0,186	0,547	0,547	1,000	0,781	0,719	0,712	0,625	0,625	1,000	0,625	0,656	0,833	0,563	0,516	0,535	0,600	0,750	0,141	0,525	0,750	0,038	0,525	0,750	0,091	0,675	0,725	0,712
2013	Fixed effect	IN	0,972	0,973	0,640	0,649	0,623	0,010				0,958	0,956	0,848	0,942	0,945	0,305	0,651	0,691	0,006				0,900	0,902	0,589	0,963	0,946	0,049	0,437	0,558	0,140				0,962	0,939	0,136
2013	Fixed effect	OUT	0,633	0,647	0,271	0,405	0,460	0,327				0,764	0,752	0,696	0,538	0,571	0,292	0,597	0,648	0,478				0,616	0,651	0,521	0,508	0,710	0,001	0,427	0,612	0,034				0,550	0,711	0,031
2013	Fixed effect	ONE	0,938	0,969	0,480	0,500	0,563					0,844	0,781	0,252	1,000	1,000		0,825	0,750	0,725				0,750	0,688	0,578	0,775	1,000	0,104	0,612	0,775	0,409				0,775	0,875	0,332
2013	Random effect	IN	0,914	0,903	0,275	0,948	0,945	0,285	0,946	0,936	0,152	0,870	0,838	0,057	0,863	0,857	0,454	0,871	0,881	0,722	0,869	0,880	0,758	0,759	0,764	0,468	0,911	0,887	0,097	0,940	0,902	0,051	0,940	0,904	0,046	0,802	0,835	0,964
2013	Random effect	OUT	0,624	0,640	0,751	0,811	0,836	0,542	0,804	0,842	0,177	0,651	0,617	0,292	0,606	0,679	0,131	0,652	0,696	0,117	0,644	0,692	0,073	0,576	0,513	0,269	0,641	0,784	0,023	0,600	0,702	0,061	0,602	0,702	0,052	0,641	0,575	0,143
2013	Random effect	ONE	0,813	0,625	0,152	0,781	0,906	0,186	0,781	0,875	0,343	0,547	0,547	1,000	0,781	0,719	0,589	0,625	0,625	1,000	0,625	0,656	0,833	0,563	0,516	0,535	0,600	0,750	0,141	0,525	0,750	0,038	0,525	0,750	0,091	0,675	0,725	0,712
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,985	0,969	0,120	0,989	0,972	0,085										1,000	0,981	0,115			
2013	Chamberlain's	OUT				0,602	0,729	0,160	0,564	0,616	0,562							0,617	0,719	0,117	0,580	0,705	0,078										0,346	0,498	0,047			
2013	Chamberlain's	ONE				0,656	0,656	1,000	0,625	0,484	0,497							1,000	1,000		0,875	1,000	0,127										0,313	0,700	0,012			
2013	Dynamic	IN				0,951	0,947	0,297	0,953	0,951	0,435							0,895	0,904	0,960	0,897	0,904	0,846							0,939	0,932	0,259	0,939	0,931	0,297			
2013	Dynamic	OUT				0,791	0,910	0,056	0,791	0,910	0,045							0,769	0,813	0,064	0,758	0,810	0,048							0,680	0,804	0,009	0,662	0,802	0,007			
2013	Dynamic	ONE				0,893	0,964	0,386	0,893	0,964	0,386							0,969	0,969		0,969	0,969								0,575	0,775	0,046	0,562	0,775	0,040			
2013	Multinomial	IN				0,961	0,958	0,278				0,868	0,856	0,233				0,897	0,917	0,700				0,821	0,818	0,308										0,836	0,851	0,665
2013	Multinomial	OUT				0,773	0,790	0,657				0,658	0,639	0,555				0,608	0,615	0,923				0,451	0,371	0,266										0,561	0,655	0,238
2013	Multinomial	ONE				0,766	0,813	0,480				0,547	0,547	1,000				0,719	0,734	0,765				0,594	0,625	0,599										0,525	0,725	0,105
2013	Multinomial robustness	IN				0,963	0,960	0,210				0,867	0,859	0,469				0,922						0,778	0,783	0,214				0,958	0,919	0,077				0,849	0,854	0,531
2013	Multinomial robustness	OUT				0,756	0,788	0,303				0,633	0,590	0,272				0,473						0,386	0,381	0,873				0,646	0,816	0,003				0,587	0,657	0,382
2013	Multinomial robustness	ONE				0,719	0,813	0,292				0,484	0,547	0,692				0,516						0,406	0,469	0,403				0,475	0,725	0,021				0,725	0,825	0,257
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,888	0,896	0,875	0,920	0,926	1,000	0,920	0,926	0,714	0,835	0,810	0,127	0,842	0,857	0,801	0,851	0,864	0,916	0,848	0,861	0,949	0,767	0,770	0,701	0,866	0,880	0,549	0,876	0,889	0,703	0,877	0,888	0,900	0,760	0,772	0,542
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,951	0,951	0,257	0,780	0,766	0,783				0,913	0,906	0,445	0,917	0,928	0,505	0,816	0,777	0,217				0,879	0,880	0,384	0,948	0,950	0,525	0,840	0,827	0,408				0,904	0,897	0,219
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,885	0,895	0,516	0,920	0,926	1,000	0,920	0,926	0,714	0,835	0,809	0,260	0,842	0,857	0,801	0,851	0,862	0,909	0,848	0,861	0,951	0,767	0,771	0,856	0,866	0,880	0,549	0,872	0,887	0,339	0,873	0,889	0,195	0,760	0,772	0,589
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,991	0,988	0,212	0,991	0,987	0,161							0,947	0,953	0,872	0,946	0,953	0,727							0,976	0,977	0,519	0,973	0,976	1,000			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,936	0,941	0,856	0,936	0,941	0,840							0,900	0,902	0,385	0,899	0,905	0,654							0,924	0,933	0,533	0,924	0,932	0,710			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,925	0,923	0,052	0,919	0,920	0,125	0,848	0,829	0,300				0,839	0,847	0,630	0,836	0,844	0,586	0,768	0,768	0,463				0,876	0,888	0,813	0,873	0,888	0,355	0,742	0,763	0,850
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,921	0,922	0,233	0,916	0,917	0,132	0,848	0,829	0,359				0,845	0,852	0,677	0,840	0,847	0,628	0,770	0,781	0,817				0,879	0,888	0,887	0,878	0,888	0,688	0,750	0,769	0,829
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																						0,769												0,743	0,759	0,717
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,749	0,765	0,720
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes export market share (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for non-EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table D.5 **Econometric results for the non-EA, Nominal unit labour cost**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,929	0,924	0,429	0,948	0,944	0,488	0,946	0,940	0,291	0,870	0,868	0,775	0,863	0,864	0,951	0,871	0,868	0,841	0,869	0,866	0,833	0,770	0,765	0,455	0,911	0,888	0,328	0,940	0,893	0,046	0,940	0,897	0,067	0,802	0,807	0,747
2013	Pooled	OUT	0,698	0,698	1,000	0,811	0,767	0,227	0,804	0,769	0,248	0,651	0,638	0,216	0,606	0,563	0,064	0,652	0,610	0,032	0,644	0,600	0,032	0,570	0,580	0,382	0,641	0,629	0,791	0,600	0,575	0,497	0,602	0,573	0,431	0,641	0,635	0,747
2013	Pooled	ONE	0,750	0,750		0,781	0,781		0,781	0,813	0,480	0,547	0,516	0,480	0,781	0,719	0,252	0,625	0,656	0,480	0,625	0,656	0,480	0,563	0,563		0,600	0,625	0,805	0,525	0,500	0,743	0,525	0,475	0,403	0,675	0,662	0,845
2013	Fixed effect	IN	0,972	0,973	0,862	0,649	0,753	0,044				0,958	0,956	0,701	0,942	0,942		0,651	0,626	0,000				0,900	0,903	0,730	0,963	0,955	0,234	0,437	0,500	0,057				0,962	0,951	0,309
2013	Fixed effect	OUT	0,633	0,627	0,503	0,405	0,513	0,267				0,764	0,762	0,479	0,538	0,538		0,597	0,508	0,631				0,616	0,582	0,160	0,508	0,596	0,016	0,427	0,488	0,113				0,550	0,483	0,006
2013	Fixed effect	ONE	0,938	0,938		0,500	0,542					0,844	0,844		1,000	1,000		0,825	0,625	0,292				0,750	0,719	0,480	0,775	0,900	0,103	0,612	0,612					0,775	0,775	
2013	Random effect	IN	0,914	0,923	0,355	0,948	0,942	0,409	0,946	0,940	0,330	0,870	0,822	0,065	0,863	0,863	1,000	0,871	0,868	0,841	0,869	0,866	0,833	0,759	0,725	0,044	0,911	0,888	0,328	0,940	0,893	0,046	0,940	0,897	0,067	0,802	0,807	0,747
2013	Random effect	OUT	0,624	0,678	0,108	0,811	0,767	0,236	0,804	0,769	0,256	0,651	0,687	0,440	0,606	0,565	0,073	0,652	0,610	0,032	0,644	0,600	0,032	0,576	0,568	0,610	0,641	0,629	0,791	0,600	0,575	0,497	0,602	0,573	0,431	0,641	0,635	0,747
2013	Random effect	ONE	0,813	0,750	0,578	0,781	0,781		0,781	0,813	0,480	0,547	0,609	0,386	0,781	0,719	0,252	0,625	0,656	0,480	0,625	0,656	0,480	0,563	0,563		0,600	0,625	0,805	0,525	0,500	0,743	0,525	0,475	0,403	0,675	0,662	0,845
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,985	0,979	0,124	0,989	0,981	0,143										1,000	1,000				
2013	Chamberlain's	OUT				0,602	0,485	0,228	0,564	0,503	0,305							0,617	0,673	0,171	0,580	0,665	0,087										0,346	0,596	0,003			
2013	Chamberlain's	ONE				0,656	0,578	0,391	0,625	0,656	0,629							1,000	0,938	0,403	0,875	0,938	0,533										0,313	0,625	0,085			
2013	Dynamic	IN				0,951	0,949	0,699	0,953	0,952	0,673							0,895	0,894	0,894	0,897	0,896	0,847							0,939	0,908	0,156	0,939	0,906	0,108			
2013	Dynamic	OUT				0,791	0,767	0,239	0,791	0,772	0,390							0,769	0,744	0,050	0,758	0,735	0,043							0,680	0,706	0,514	0,662	0,704	0,261			
2013	Dynamic	ONE				0,893	0,893		0,893	0,893								0,969	0,969		0,969	0,969								0,575	0,700	0,107	0,562	0,700	0,111			
2013	Multinomial	IN				0,961	0,957	0,468				0,868	0,858	0,214				0,897	0,895	0,880				0,821	0,775	0,036										0,836	0,841	0,803
2013	Multinomial	OUT				0,773	0,553	0,003				0,658	0,604	0,025				0,608	0,555	0,514				0,451	0,570	0,105										0,561	0,639	0,282
2013	Multinomial	ONE				0,766	0,609	0,196				0,547	0,484	0,403				0,719	0,734	0,480				0,594	0,594	1,000										0,525	0,662	0,181
2013	Multinomial robustness	IN				0,963	0,957	0,376				0,867	0,864	0,815				0,922	0,902	0,285				0,778	0,763	0,227				0,958						0,849	0,825	0,468
2013	Multinomial robustness	OUT				0,756	0,682	0,164				0,633	0,582	0,018				0,473	0,435	0,257				0,386	0,493	0,006				0,646						0,587	0,667	0,444
2013	Multinomial robustness	ONE				0,719	0,625	0,213				0,484	0,422	0,403				0,516	0,516					0,406	0,484	0,456				0,475						0,725	0,687	0,811
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,888	0,888	1,000	0,920	0,920	0,946	0,920	0,919	0,859	0,835	0,831	0,532	0,842	0,824	0,252	0,851	0,819	0,099	0,848	0,818	0,104	0,767	0,767	1,000	0,866	0,842	0,274	0,876	0,846	0,177	0,877	0,844	0,112	0,760	0,761	0,919
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,951	0,950	0,628	0,780	0,777	0,700				0,913	0,913	1,000	0,917	0,917	0,787	0,816	0,815	0,800				0,879	0,879		0,948	0,947	0,947	0,840	0,845	0,291				0,904	0,903	0,634
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,885	0,888	0,583	0,920	0,920	0,946	0,920	0,919	0,859	0,835	0,831	0,532	0,842	0,824	0,252	0,851	0,811	0,089	0,848	0,811	0,082	0,767	0,767	1,000	0,866	0,842	0,274	0,872	0,833	0,056	0,873	0,832	0,051	0,760	0,761	0,919
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,991	0,988	0,294	0,991	0,987	0,280							0,947	0,946	0,587	0,946	0,947	0,815							0,976	0,975	0,832	0,973	0,974	0,734			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,936	0,935	0,831	0,936	0,933	0,645							0,900	0,890	0,160	0,899	0,888	0,066							0,924	0,911	0,250	0,924	0,911	0,258			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,925	0,916	0,192	0,919	0,915	0,539	0,848	0,841	0,431				0,839	0,818	0,276	0,836	0,815	0,276	0,768	0,766	0,747				0,876	0,844	0,129	0,873	0,845	0,146	0,742	0,746	0,641
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,921	0,914	0,337	0,916	0,914	0,758	0,848	0,841	0,375				0,845	0,820	0,175	0,840	0,823	0,314	0,770	0,769	0,810				0,879	0,853	0,162	0,878	0,851	0,124	0,750	0,748	0,903
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																						0,769	0,770	0,882										0,743	0,742	0,928
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,749	0,748	0,929
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes nominal unit labour cost (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for non-EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table D.6 **Econometric results for the non-EA, House prices**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,929	0,898	0,056	0,948	0,908	0,075	0,946	0,909	0,096	0,870	0,811	0,021	0,863	0,863	0,058	0,871	0,875	0,252	0,869	0,872	0,194	0,770	0,763	0,092	0,911	0,867	0,101	0,940	0,891	0,068	0,940	0,882	0,025	0,802	0,829	0,423
2013	Pooled	OUT	0,698	0,684	0,743	0,811	0,707	0,160	0,804	0,713	0,160	0,651	0,704	0,385	0,606	0,596	0,849	0,652	0,642	0,724	0,644	0,635	0,808	0,570	0,566	0,915	0,641	0,586	0,452	0,600	0,629	0,604	0,602	0,659	0,325	0,641	0,637	0,927
2013	Pooled	ONE	0,750	0,844	0,480	0,781	0,844	0,578	0,781	0,906	0,391	0,547	0,609	0,386	0,781	0,813	0,480	0,625	0,625		0,625	0,625		0,563	0,656	0,369	0,600	0,675	0,530	0,525	0,700	0,234	0,525	0,675	0,368	0,675	0,650	0,765
2013	Fixed effect	IN	0,972	0,959	0,122	0,649	0,782	0,447				0,958	0,948	0,221	0,942	0,940	0,128	0,651	0,661	0,000				0,900	0,912	0,845	0,963	0,941	0,036	0,437	0,582	0,286				0,962	0,949	0,117
2013	Fixed effect	OUT	0,633	0,567	0,039	0,405	0,292	0,460				0,764	0,742	0,622	0,538	0,477	0,040	0,597	0,487	0,407				0,616	0,641	0,686	0,508	0,473	0,270	0,427	0,553	0,233				0,550	0,544	0,858
2013	Fixed effect	ONE	0,938	0,906	0,712	0,500	0,500					0,844	0,813	0,480	1,000	1,000		0,825	0,625	0,206				0,750	0,625	0,448	0,775	0,850	0,485	0,612	0,825	0,260				0,775	0,650	0,337
2013	Random effect	IN	0,914	0,898	0,280	0,948	0,908	0,075	0,946	0,909	0,096	0,870	0,811	0,021	0,863	0,863	0,058	0,871	0,875	0,252	0,869	0,872	0,194	0,759	0,763	0,191	0,911	0,867	0,101	0,940	0,891	0,068	0,940	0,882	0,025	0,802	0,829	0,423
2013	Random effect	OUT	0,624	0,684	0,114	0,811	0,707	0,160	0,804	0,713	0,160	0,651	0,704	0,385	0,606	0,596	0,849	0,652	0,642	0,724	0,644	0,635	0,808	0,576	0,566	0,845	0,641	0,586	0,452	0,600	0,629	0,604	0,602	0,659	0,325	0,641	0,637	0,927
2013	Random effect	ONE	0,813	0,844	0,826	0,781	0,844	0,578	0,781	0,906	0,391	0,547	0,609	0,386	0,781	0,813	0,480	0,625	0,625		0,625	0,625		0,563	0,656	0,369	0,600	0,675	0,530	0,525	0,700	0,234	0,525	0,675	0,368	0,675	0,650	0,765
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,985	0,989	0,452	0,989	0,990	0,309										1,000	0,977	0,073			
2013	Chamberlain's	OUT				0,602	0,551	0,727	0,564	0,447	0,117							0,617	0,671	0,178	0,580	0,660	0,088										0,346	0,520	0,026			
2013	Chamberlain's	ONE				0,656	0,813	0,262	0,625	0,750	0,414							1,000	0,969	0,480	0,875	0,938	0,386										0,313	0,850	0,000			
2013	Dynamic	IN				0,951	0,933	0,244	0,953	0,935	0,239							0,895	0,910	0,884	0,897	0,912	1,000							0,939	0,898	0,068	0,939	0,893	0,065			
2013	Dynamic	OUT				0,791	0,722	0,067	0,791	0,712	0,042							0,769	0,773	0,736	0,758	0,765	0,621							0,680	0,794	0,044	0,662	0,824	0,013			
2013	Dynamic	ONE				0,893	0,964	0,248	0,893	0,964	0,248							0,969	0,969		0,969	0,969								0,575	0,900	0,047	0,562	0,925	0,057			
2013	Multinomial	IN				0,961						0,868	0,819	0,044				0,897	0,885	0,121				0,821	0,765	0,010										0,836	0,855	0,554
2013	Multinomial	OUT				0,773						0,658	0,673	0,854				0,608	0,673	0,543				0,451	0,372	0,522										0,561	0,618	0,158
2013	Multinomial	ONE				0,766						0,547	0,609	0,599				0,719	0,719	1,000				0,594	0,563	0,891										0,525	0,650	0,140
2013	Multinomial robustness	IN				0,963	0,915	0,032				0,867	0,806	0,029				0,922	0,888	0,017				0,778	0,757	0,049				0,958	0,896	0,009				0,849	0,855	0,490
2013	Multinomial robustness	OUT				0,756	0,631	0,077				0,633	0,644	0,895				0,473	0,700	0,027				0,386	0,501	0,006				0,646	0,708	0,417				0,587	0,659	0,410
2013	Multinomial robustness	ONE				0,719	0,750	0,855				0,484	0,672	0,271				0,516	0,813	0,002				0,406	0,594	0,245				0,475	0,750	0,148				0,725	0,750	0,900
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,888	0,862	0,021	0,920	0,873	0,012	0,920	0,870	0,008	0,835	0,805	0,036	0,842	0,840	0,119	0,851	0,850	0,194	0,848	0,849	0,180	0,767	0,755	0,164	0,866	0,835	0,209	0,876	0,847	0,109	0,877	0,842	0,093	0,760	0,785	0,656
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,951	0,924	0,013	0,780	0,844	0,188				0,913	0,906	0,241	0,917	0,910	0,046	0,816	0,823	0,349				0,879	0,859	0,086	0,948	0,901	0,023	0,840	0,823	0,462				0,904	0,890	0,035
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,885	0,862	0,036	0,920	0,873	0,012	0,920	0,870	0,008	0,835	0,805	0,036	0,842	0,840	0,119	0,851	0,848	0,148	0,848	0,849	0,180	0,767	0,755	0,164	0,866	0,835	0,209	0,872	0,847	0,155	0,873	0,842	0,142	0,760	0,785	0,656
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,991	0,964	0,017	0,991	0,963	0,008							0,947	0,948	0,284	0,946	0,946	0,169							0,976	0,943	0,010	0,973	0,942	0,016			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,936	0,908	0,082	0,936	0,910	0,064							0,900	0,905	0,601	0,899	0,906	0,704							0,924	0,898	0,068	0,924	0,898	0,063			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,925	0,864	0,005	0,919	0,861	0,005	0,848	0,817	0,060				0,839	0,855	0,887	0,836	0,851	0,816	0,768	0,760	0,176				0,876	0,847	0,110	0,873	0,844	0,131	0,742	0,776	0,710
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,921	0,852	0,002	0,916	0,850	0,002	0,848	0,818	0,071				0,845	0,849	0,289	0,840	0,845	0,295	0,770	0,771	0,262				0,879	0,851	0,087	0,878	0,848	0,080	0,750	0,791	0,892
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																						0,769	0,764	0,155										0,743	0,776	0,708
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,749	0,786	0,923
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes house price index (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for non-EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table D.7 **Econometric results for the non-EA, Private sector debt**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,929	0,920	0,320	0,948	0,948	0,726	0,946	0,945	0,815	0,870	0,867	0,818	0,863	0,860	0,776	0,871	0,871	1,000	0,869	0,867	0,382	0,770	0,756	0,456	0,911	0,893	0,213	0,940	0,905	0,054	0,940	0,903	0,052	0,802	0,801	0,963
2013	Pooled	OUT	0,698	0,720	0,696	0,811	0,807	0,810	0,804	0,807	0,863	0,651	0,658	0,678	0,606	0,635	0,183	0,652	0,652		0,644	0,646	0,688	0,570	0,549	0,700	0,641	0,678	0,316	0,600	0,616	0,726	0,602	0,616	0,757	0,641	0,565	0,085
2013	Pooled	ONE	0,750	0,750	1,000	0,781	0,875	0,198	0,781	0,813	0,480	0,547	0,547		0,781	0,781		0,625	0,625		0,625	0,625		0,563	0,531	0,629	0,600	0,725	0,271	0,525	0,675	0,170	0,525	0,675	0,261	0,675	0,625	0,631
2013	Fixed effect	IN	0,972	0,955	0,186	0,649	0,645	0,017				0,958	0,952	0,453	0,942	0,923	0,137	0,651	0,690	0,011				0,900	0,900	0,945	0,963	0,963	1,000	0,437	0,462	0,426				0,962	0,955	0,361
2013	Fixed effect	OUT	0,633	0,653	0,618	0,405	0,724	0,117				0,764	0,760	0,304	0,538	0,515	0,449	0,597	0,744	0,365				0,616	0,653	0,087	0,508	0,507	0,957	0,427	0,516	0,044				0,550	0,552	0,894
2013	Fixed effect	ONE	0,938	0,875	0,252	0,500	0,766					0,844	0,813	0,480	1,000	0,969	0,480	0,825	0,750	0,725				0,750	0,781	0,480	0,775	0,700	0,226	0,612	0,587	0,716				0,775	0,725	0,403
2013	Random effect	IN	0,914	0,916	0,908	0,948	0,948	0,726	0,946	0,945	0,815	0,870	0,855	0,296	0,863	0,860	0,776	0,871	0,871	1,000	0,869	0,867	0,382	0,759	0,747	0,613	0,911	0,893	0,213	0,940	0,905	0,054	0,940	0,903	0,052	0,802	0,801	0,963
2013	Random effect	OUT	0,624	0,678	0,465	0,811	0,807	0,810	0,804	0,807	0,863	0,651	0,678	0,213	0,606	0,635	0,183	0,652	0,652		0,644	0,646	0,688	0,576	0,622	0,356	0,641	0,678	0,316	0,600	0,616	0,726	0,602	0,616	0,757	0,641	0,565	0,085
2013	Random effect	ONE	0,813	0,781	0,788	0,781	0,875	0,198	0,781	0,813	0,480	0,547	0,516	0,480	0,781	0,781		0,625	0,625		0,625	0,625		0,563	0,594	0,480	0,600	0,725	0,271	0,525	0,675	0,170	0,525	0,675	0,261	0,675	0,625	0,631
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,985	0,949	0,071	0,989	0,949	0,057										1,000					
2013	Chamberlain's	OUT				0,602	0,738	0,206	0,564	0,722	0,096							0,617	0,723	0,126	0,580	0,698	0,139										0,346					
2013	Chamberlain's	ONE				0,656	0,719	0,710	0,625	0,688	0,715							1,000	1,000		0,875	0,969	0,343										0,313					
2013	Dynamic	IN				0,951	0,953	0,524	0,953	0,949	0,388							0,895	0,896	0,480	0,897	0,897	0,726							0,939	0,913	0,103	0,939	0,910	0,076			
2013	Dynamic	OUT				0,791	0,860	0,131	0,791	0,865	0,094							0,769	0,773	0,409	0,758	0,767	0,429							0,680	0,667	0,716	0,662	0,667	0,909			
2013	Dynamic	ONE				0,893	0,893	1,000	0,893	0,893	1,000							0,969	0,969		0,969	0,969								0,575	0,600	0,637	0,562	0,600	0,535			
2013	Multinomial	IN				0,961						0,868	0,866	0,598				0,897						0,821	0,758	0,058										0,836	0,829	0,744
2013	Multinomial	OUT				0,773						0,658	0,656	0,827				0,608						0,451	0,376	0,516										0,561	0,514	0,097
2013	Multinomial	ONE				0,766						0,547	0,547					0,719						0,594	0,656	0,567										0,525	0,550	0,480
2013	Multinomial robustness	IN				0,963						0,867	0,875	0,397				0,922	0,901	0,180				0,778	0,734	0,100				0,958	0,927	0,062				0,849	0,828	0,354
2013	Multinomial robustness	OUT				0,756						0,633	0,620	0,097				0,473	0,738	0,015				0,386	0,505	0,003				0,646	0,642	0,961				0,587	0,530	0,120
2013	Multinomial robustness	ONE				0,719						0,484	0,484					0,516	0,656	0,161				0,406	0,531	0,111				0,475	0,350	0,477				0,725	0,737	0,480
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,888	0,890	0,762	0,920	0,922	0,231	0,920	0,921	0,657	0,835	0,835	0,726	0,842	0,843	0,884	0,851	0,850	0,685	0,848	0,848	0,775	0,767	0,752	0,172	0,866	0,865	0,619	0,876	0,875	0,774	0,877	0,875	0,624	0,760	0,726	0,195
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,951	0,931	0,092	0,780	0,785	0,855				0,913	0,910	0,765	0,917	0,907	0,184	0,816	0,800	0,382				0,879	0,881	0,791	0,948	0,933	0,186	0,840	0,808	0,213				0,904	0,892	0,187
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,885	0,890	0,360	0,920	0,922	0,231	0,920	0,921	0,657	0,835	0,835	0,726	0,842	0,843	0,884	0,851	0,850	0,685	0,848	0,848	0,775	0,767	0,752	0,172	0,866	0,865	0,619	0,872	0,871	0,479	0,873	0,870	0,355	0,760	0,726	0,195
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,991	0,973	0,159	0,991	0,968	0,049							0,947	0,937	0,189	0,946	0,937	0,230							0,976	0,962	0,100	0,973	0,957	0,089			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,936	0,932	0,302	0,936	0,933	0,530							0,900	0,900	1,000	0,899	0,899	0,385							0,924	0,919	0,359	0,924	0,917	0,200			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,925	0,925	0,881	0,919	0,919	1,000	0,848	0,840	0,152				0,839	0,839	1,000	0,836	0,838	0,696	0,768	0,753	0,269				0,876	0,873	0,459	0,873	0,875	0,770	0,742	0,709	0,259
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,921	0,919	0,461	0,916	0,916	0,889	0,848	0,843	0,512				0,845	0,849	0,534	0,840	0,844	0,552	0,770	0,759	0,488				0,879	0,875	0,387	0,878	0,872	0,164	0,750	0,708	0,180
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																						0,769												0,743	0,707	0,217
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,749	0,706	0,142
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes private sector debt (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for non-EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table D.8 **Econometric results for the non-EA, Private sector credit flow**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,929	0,932	0,517	0,948	0,947	0,479	0,946	0,946	1,000	0,870	0,855	0,287	0,863	0,854	0,466	0,871	0,874	0,689	0,869	0,873	0,654	0,770	0,770	1,000	0,911	0,911		0,940	0,940	1,000	0,940	0,938	0,481	0,802	0,797	0,853
2013	Pooled	OUT	0,698	0,702	0,728	0,811	0,813	0,729	0,804	0,809	0,304	0,651	0,671	0,176	0,606	0,677	0,019	0,652	0,679	0,049	0,644	0,675	0,024	0,570	0,580	0,267	0,641	0,641		0,600	0,600	1,000	0,602	0,604	0,688	0,641	0,647	0,801
2013	Pooled	ONE	0,750	0,750	1,000	0,781	0,781		0,781	0,781		0,547	0,547		0,781	0,750	0,480	0,625	0,625		0,625	0,625		0,563	0,563		0,600	0,600		0,525	0,500	0,480	0,525	0,525		0,675	0,675	
2013	Fixed effect	IN	0,972	0,972	0,480	0,649	0,660	0,229				0,958	0,954	0,562	0,942	0,938	0,705	0,651	0,621	0,003				0,900	0,899	0,785	0,963	0,963		0,437	0,420	0,319				0,962	0,962	1,000
2013	Fixed effect	OUT	0,633	0,631	0,688	0,405	0,405					0,764	0,776	0,271	0,538	0,556	0,214	0,597	0,517	0,556				0,616	0,618	0,480	0,508	0,508		0,427	0,398	0,427				0,550	0,544	0,601
2013	Fixed effect	ONE	0,938	0,938		0,500	0,500					0,844	0,844		1,000	1,000		0,825	0,625	0,206				0,750	0,750		0,775	0,775		0,612	0,562	0,332				0,775	0,750	0,480
2013	Random effect	IN	0,914	0,923	0,174	0,948	0,947	0,479	0,946	0,946	1,000	0,870	0,855	0,287	0,863	0,853	0,427	0,871	0,874	0,689	0,869	0,873	0,654	0,759	0,770	0,487	0,911	0,911		0,940	0,940	1,000	0,940	0,938	0,481	0,802	0,797	0,853
2013	Random effect	OUT	0,624	0,662	0,180	0,811	0,813	0,729	0,804	0,809	0,304	0,651	0,671	0,176	0,606	0,671	0,016	0,652	0,679	0,049	0,644	0,675	0,024	0,576	0,580	0,898	0,641	0,641		0,600	0,600	1,000	0,602	0,604	0,688	0,641	0,647	0,801
2013	Random effect	ONE	0,813	0,750	0,480	0,781	0,781		0,781	0,781		0,547	0,547		0,781	0,781		0,625	0,625		0,625	0,625		0,563	0,563		0,600	0,600		0,525	0,500	0,480	0,525	0,525		0,675	0,675	
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,985	0,984	0,812	0,989	0,984	0,413										1,000					
2013	Chamberlain's	OUT				0,602	0,598	0,888	0,564	0,550	0,767							0,617	0,671	0,142	0,580	0,646	0,143										0,346					
2013	Chamberlain's	ONE				0,656	0,656		0,625	0,688	0,645							1,000	1,000		0,875	1,000	0,127										0,313					
2013	Dynamic	IN				0,951	0,951	1,000	0,953	0,954	0,874							0,895	0,900	0,647	0,897	0,899	0,803							0,939	0,941	0,412	0,939	0,939	1,000			
2013	Dynamic	OUT				0,791	0,778	0,470	0,791	0,770	0,247							0,769	0,781	0,318	0,758	0,783	0,110							0,680	0,692	0,072	0,662	0,673	0,153			
2013	Dynamic	ONE				0,893	0,893		0,893	0,893								0,969	0,969		0,969	0,969								0,575	0,575		0,562	0,575	0,480			
2013	Multinomial	IN				0,961	0,962	0,672				0,868	0,861	0,732				0,897	0,897	0,792				0,821	0,792	0,174										0,836	0,822	0,515
2013	Multinomial	OUT				0,773	0,664	0,176				0,658	0,658	1,000				0,608	0,539	0,374				0,451	0,430	0,819										0,561	0,639	0,122
2013	Multinomial	ONE				0,766	0,688	0,466				0,547	0,547	1,000				0,719	0,688	0,567				0,594	0,656	0,386										0,525	0,625	0,261
2013	Multinomial robustness	IN				0,963	0,964	0,640				0,867	0,855	0,555				0,922						0,778	0,759	0,149				0,958	0,958					0,849	0,849	0,978
2013	Multinomial robustness	OUT				0,756	0,647	0,078				0,633	0,622	0,737				0,473						0,386	0,426	0,030				0,646	0,632	0,713				0,587	0,597	0,334
2013	Multinomial robustness	ONE				0,719	0,594	0,435				0,484	0,547	0,533				0,516						0,406	0,406					0,475	0,525	0,394				0,725	0,725	
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,888	0,888	1,000	0,920	0,921	0,800	0,920	0,920	0,860	0,835	0,825	0,129	0,842	0,842	0,936	0,851	0,851	1,000	0,848	0,848	0,930	0,767	0,766	0,809	0,866	0,866		0,876	0,876	0,889	0,877	0,877	0,886	0,760	0,760	0,989
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,951	0,950	0,639	0,780	0,769	0,055				0,913	0,916	0,431	0,917	0,920	0,627	0,816	0,819	0,608				0,879	0,879	1,000	0,948	0,946	0,725	0,840	0,850	0,276				0,904	0,899	0,401
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,885	0,885	0,841	0,920	0,921	0,800	0,920	0,920	0,860	0,835	0,825	0,129	0,842	0,842	0,936	0,851	0,851	1,000	0,848	0,848	0,863	0,767	0,766	0,809	0,866	0,866		0,872	0,874	0,099	0,873	0,874	0,384	0,760	0,760	0,989
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,991	0,990	0,629	0,991	0,988	0,371							0,947	0,948	0,726	0,946	0,945	0,619							0,976	0,975	0,674	0,973	0,975	0,518			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,936	0,932	0,159	0,936	0,935	0,762							0,900	0,899	0,413	0,899	0,899								0,924	0,920	0,519	0,924	0,920	0,465			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,925	0,922	0,376	0,919	0,919	0,888	0,848	0,834	0,203				0,839	0,839	0,759	0,836	0,835	0,770	0,768	0,768	0,963				0,876	0,873	0,480	0,873	0,873	1,000	0,742	0,747	0,594
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,921	0,923	0,448	0,916	0,921	0,161	0,848	0,834	0,186				0,845	0,841	0,262	0,840	0,839	0,747	0,770	0,769	0,795				0,879	0,877	0,579	0,878	0,875	0,537	0,750	0,749	0,988
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																						0,769	0,767	0,411										0,743	0,744	0,932
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,749	0,745	0,630
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes private sector credit flow (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for non-EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table D.9 **Econometric results for the non-EA, General government gross debt**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,929	0,928	0,897	0,948	0,933	0,259	0,946	0,936	0,391	0,870	0,860	0,573	0,863	0,862	0,944	0,871	0,875	0,565	0,869	0,874	0,444	0,770	0,771	0,914	0,911	0,913	0,412	0,940	0,934	0,336	0,940	0,937	0,587	0,802	0,811	0,323
2013	Pooled	OUT	0,698	0,736	0,525	0,811	0,780	0,549	0,804	0,771	0,548	0,651	0,739	0,081	0,606	0,648	0,326	0,652	0,646	0,728	0,644	0,638	0,717	0,570	0,554	0,684	0,641	0,643	0,688	0,600	0,608	0,575	0,602	0,612	0,438	0,641	0,623	0,305
2013	Pooled	ONE	0,750	0,531	0,160	0,781	0,531	0,121	0,781	0,531	0,134	0,547	0,422	0,252	0,781	0,719	0,589	0,625	0,625		0,625	0,625		0,563	0,547	0,480	0,600	0,575	0,480	0,525	0,550	0,701	0,525	0,550	0,480	0,675	0,725	0,265
2013	Fixed effect	IN	0,972	0,957	0,167	0,649	0,767	0,010				0,958	0,947	0,309	0,942	0,935	0,592	0,651	0,785	0,039				0,900	0,899	0,411	0,963	0,946	0,135	0,437	0,481	0,097				0,962	0,960	0,772
2013	Fixed effect	OUT	0,633	0,711	0,182	0,405	0,657	0,166				0,764	0,738	0,502	0,538	0,567	0,560	0,597	0,758	0,196				0,616	0,568	0,185	0,508	0,539	0,548	0,427	0,378	0,242				0,550	0,495	0,013
2013	Fixed effect	ONE	0,938	0,906	0,629	0,500	0,446					0,844	0,719	0,204	1,000	1,000		0,825	0,719	0,725				0,750	0,625	0,137	0,775	0,775	1,000	0,612	0,612	1,000				0,775	0,725	0,265
2013	Random effect	IN	0,914	0,904	0,626	0,948	0,938	0,460	0,946	0,941	0,669	0,870	0,860	0,573	0,863	0,862	0,944	0,871	0,875	0,565	0,869	0,874	0,444	0,759	0,771	0,511	0,911	0,913	0,412	0,940	0,934	0,336	0,940	0,937	0,587	0,802	0,811	0,323
2013	Random effect	OUT	0,624	0,709	0,133	0,811	0,791	0,665	0,804	0,782	0,664	0,651	0,739	0,081	0,606	0,648	0,326	0,652	0,646	0,728	0,644	0,638	0,717	0,576	0,554	0,587	0,641	0,643	0,688	0,600	0,608	0,575	0,602	0,612	0,438	0,641	0,623	0,305
2013	Random effect	ONE	0,813	0,594	0,333	0,781	0,531	0,160	0,781	0,531	0,246	0,547	0,422	0,252	0,781	0,719	0,589	0,625	0,625		0,625	0,625		0,563	0,547	0,480	0,600	0,575	0,480	0,525	0,550	0,701	0,525	0,550	0,480	0,675	0,725	0,265
2013	Chamberlain's	IN				1,000	1,000		1,000									0,985	0,972	0,368	0,989	0,972	0,204										1,000	1,000				
2013	Chamberlain's	OUT				0,602	0,354	0,021	0,564									0,617	0,756	0,101	0,580	0,733	0,072										0,346	0,344	0,737			
2013	Chamberlain's	ONE				0,656	0,250	0,028	0,625									1,000	1,000		0,875	0,906	0,808										0,313	0,313				
2013	Dynamic	IN				0,951	0,944	0,537	0,953	0,949	0,684							0,895	0,893	0,804	0,897	0,896	0,910							0,939	0,942	0,542	0,939	0,938	0,805			
2013	Dynamic	OUT				0,791	0,757	0,318	0,791	0,754	0,229							0,769	0,760	0,681	0,758	0,758	1,000							0,680	0,694	0,276	0,662	0,692	0,027			
2013	Dynamic	ONE				0,893	0,786	0,366	0,893	0,821	0,401							0,969	0,969		0,969	0,969								0,575	0,625	0,265	0,562	0,625	0,221			
2013	Multinomial	IN				0,961	0,951	0,257				0,868	0,871	0,896				0,897	0,901	0,505				0,821	0,811	0,566										0,836		
2013	Multinomial	OUT				0,773	0,678	0,117				0,658	0,757	0,037				0,608	0,529	0,392				0,451	0,434	0,858										0,561		
2013	Multinomial	ONE				0,766	0,531	0,179				0,547	0,547	1,000				0,719	0,766	0,292				0,594	0,625	0,665										0,525		
2013	Multinomial robustness	IN				0,963	0,953	0,283				0,867	0,866	0,988				0,922						0,778	0,781	0,630				0,958	0,957	0,619				0,849	0,864	0,578
2013	Multinomial robustness	OUT				0,756	0,713	0,372				0,633	0,677	0,321				0,473						0,386	0,408	0,142				0,646	0,643	0,948				0,587	0,583	0,943
2013	Multinomial robustness	ONE				0,719	0,531	0,310				0,484	0,422	0,403				0,516						0,406	0,453	0,292				0,475	0,450	0,841				0,725	0,575	0,356
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,888	0,887	0,874	0,920	0,911	0,412	0,920	0,912	0,387	0,835	0,838	0,504	0,842	0,844	0,838	0,851	0,850	0,923	0,848	0,845	0,695	0,767	0,762	0,438	0,866	0,866	1,000	0,876	0,878	0,624	0,877	0,878	0,810	0,760	0,759	0,586
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,951	0,949	0,835	0,780	0,776	0,433				0,913	0,918	0,503	0,917	0,920	0,633	0,816	0,811	0,503				0,879	0,877	0,817	0,948	0,949	0,749	0,840	0,841	0,587				0,904	0,904	1,000
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,885	0,887	0,821	0,920	0,913	0,500	0,920	0,913	0,455	0,835	0,816	0,160	0,842	0,844	0,838	0,851	0,848	0,843	0,848	0,846	0,794	0,767	0,763	0,638	0,866	0,866	1,000	0,872	0,871	0,538	0,873	0,872	0,538	0,760	0,759	0,586
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,991	0,985	0,223	0,991	0,986	0,222							0,947	0,947	0,920	0,946	0,947	0,860							0,976	0,976	0,685	0,973	0,973	0,480			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,936	0,931	0,538	0,936	0,929	0,323							0,900	0,898	0,677	0,899	0,893	0,066							0,924	0,923	0,759	0,924	0,923	0,766			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,925	0,907	0,148	0,919	0,905	0,211	0,848	0,846	0,726				0,839	0,839	0,954	0,836	0,836	0,975	0,768	0,768	0,941				0,876	0,878	0,751	0,873	0,876	0,572	0,742	0,760	0,025
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,921	0,902	0,116	0,916	0,903	0,235	0,848	0,847	0,945				0,845	0,848	0,817	0,840	0,845	0,699	0,770	0,770	0,939				0,879	0,880	0,858	0,878	0,876	0,694	0,750	0,761	0,117
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																						0,769												0,743	0,758	0,034
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,749	0,760	0,125
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes general government gross debt (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for non-EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table D.10 **Econometric results for the non-EA, Total financial sector liabilities**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,929	0,934	0,398	0,948	0,946	0,524	0,946	0,945	0,620	0,870	0,864	0,493	0,863	0,863		0,871	0,872	0,480	0,869	0,869	1,000	0,770	0,771	0,559	0,911	0,903	0,513	0,940	0,923	0,285	0,940	0,923	0,254	0,802	0,778	0,230
2013	Pooled	OUT	0,698	0,700	0,827	0,811	0,811		0,804	0,811	0,417	0,651	0,651	1,000	0,606	0,606		0,652	0,652		0,644	0,646	0,688	0,570	0,570		0,641	0,624	0,123	0,600	0,580	0,350	0,602	0,584	0,351	0,641	0,633	0,682
2013	Pooled	ONE	0,750	0,750		0,781	0,781		0,781	0,781		0,547	0,547		0,781	0,781		0,625	0,625		0,625	0,625		0,563	0,563		0,600	0,575	0,480	0,525	0,450	0,116	0,525	0,450	0,116	0,675	0,675	
2013	Fixed effect	IN	0,972	0,973	0,479	0,649	0,761	0,055				0,958	0,955	0,761	0,942	0,943	0,640	0,651	0,662	0,375				0,900	0,902	0,771	0,963	0,959	0,275	0,437	0,533	0,121				0,962	0,939	0,179
2013	Fixed effect	OUT	0,633	0,627	0,195	0,405	0,442	0,425				0,764	0,769	0,304	0,538	0,538	1,000	0,597	0,581	1,000				0,616	0,614	0,480	0,508	0,512	0,720	0,427	0,639	0,010				0,550	0,593	0,073
2013	Fixed effect	ONE	0,938	0,938		0,500	0,609					0,844	0,844		1,000	1,000		0,825	0,825					0,750	0,719	0,480	0,775	0,750	0,480	0,612	0,463	0,453				0,775	0,800	0,480
2013	Random effect	IN	0,914	0,918	0,510	0,948	0,946	0,524	0,946	0,945	0,620	0,870	0,864	0,493	0,863	0,863		0,871	0,872	0,480	0,869	0,869	1,000	0,759	0,771	0,463	0,911	0,903	0,513	0,940	0,923	0,285	0,940	0,923	0,254	0,802	0,778	0,230
2013	Random effect	OUT	0,624	0,616	0,566	0,811	0,811		0,804	0,811	0,417	0,651	0,651	1,000	0,606	0,606		0,652	0,652		0,644	0,646	0,688	0,576	0,570	0,856	0,641	0,624	0,123	0,600	0,580	0,350	0,602	0,584	0,351	0,641	0,633	0,682
2013	Random effect	ONE	0,813	0,719	0,292	0,781	0,781		0,781	0,781		0,547	0,547		0,781	0,781		0,625	0,625		0,625	0,625		0,563	0,563		0,600	0,575	0,480	0,525	0,450	0,116	0,525	0,450	0,116	0,675	0,675	
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,985	0,984	0,870	0,989	0,988	0,479										1,000	0,984	0,225			
2013	Chamberlain's	OUT				0,602	0,674	0,362	0,564	0,661	0,219							0,617	0,652	0,292	0,580	0,619	0,132										0,346	0,559	0,000			
2013	Chamberlain's	ONE				0,656	0,672	0,904	0,625	0,703	0,407							1,000	1,000		0,875	0,875											0,313	0,500	0,178			
2013	Dynamic	IN				0,951	0,954	0,369	0,953	0,954	0,727							0,895	0,894	0,749	0,897	0,896	0,862							0,939	0,928	0,447	0,939	0,932	0,560			
2013	Dynamic	OUT				0,791	0,786	0,598	0,791	0,788	0,835							0,769	0,750	0,224	0,758	0,748	0,185							0,680	0,678	0,935	0,662	0,661	0,972			
2013	Dynamic	ONE				0,893	0,893		0,893	0,893								0,969	0,969		0,969	0,969								0,575	0,463	0,085	0,562	0,463	0,105			
2013	Multinomial	IN				0,961	0,944	0,152				0,868	0,868	0,966				0,897	0,897	0,480				0,821	0,784	0,079										0,836	0,832	0,745
2013	Multinomial	OUT				0,773	0,671	0,076				0,658	0,684	0,322				0,608	0,585	0,496				0,451	0,547	0,368										0,561	0,655	0,218
2013	Multinomial	ONE				0,766	0,750	0,830				0,547	0,547					0,719	0,688	0,480				0,594	0,719	0,244										0,525	0,700	0,145
2013	Multinomial robustness	IN				0,963	0,945	0,106				0,867	0,867	1,000				0,922						0,778	0,769	0,313				0,958	0,957	0,894				0,849	0,852	0,918
2013	Multinomial robustness	OUT				0,756	0,667	0,133				0,633	0,653	0,344				0,473						0,386	0,451	0,030				0,646	0,625	0,378				0,587	0,651	0,237
2013	Multinomial robustness	ONE				0,719	0,750	0,712				0,484	0,453	0,480				0,516						0,406	0,563	0,086				0,475	0,375	0,223				0,725	0,650	0,413
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,888	0,888	0,870	0,920	0,920	1,000	0,920	0,921	0,212	0,835	0,835	0,947	0,842	0,839	0,399	0,851	0,849	0,656	0,848	0,846	0,649	0,767	0,767	0,896	0,866	0,850	0,229	0,876	0,853	0,204	0,877	0,853	0,145	0,760	0,760	0,971
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,951	0,948	0,484	0,780	0,798	0,198				0,913	0,911	0,787	0,917	0,917	0,854	0,816	0,820	0,601				0,879	0,876	0,743	0,948	0,942	0,326	0,840	0,841	0,938				0,904	0,896	0,236
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,885	0,888	0,256	0,920	0,920	1,000	0,920	0,921	0,212	0,835	0,835	0,947	0,842	0,839	0,399	0,851	0,848	0,543	0,848	0,846	0,649	0,767	0,767	0,896	0,866	0,850	0,229	0,872	0,854	0,222	0,873	0,852	0,145	0,760	0,760	0,971
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,991	0,980	0,043	0,991	0,980	0,059							0,947	0,948	0,906	0,946	0,945	0,556							0,976	0,971	0,178	0,973	0,971	0,653			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,936	0,934	0,473	0,936	0,935	0,691							0,900	0,893	0,144	0,899	0,892	0,082							0,924	0,905	0,152	0,924	0,904	0,120			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,925	0,917	0,035	0,919	0,910	0,066	0,848	0,845	0,513				0,839	0,838	0,749	0,836	0,835	0,772	0,768	0,764	0,442				0,876	0,848	0,136	0,873	0,846	0,119	0,742	0,752	0,476
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,921	0,915	0,025	0,916	0,913	0,103	0,848	0,848	0,949				0,845	0,830	0,163	0,840	0,829	0,267	0,770	0,770	0,985				0,879	0,855	0,175	0,878	0,851	0,093	0,750	0,750	0,958
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																						0,769	0,766	0,351										0,743	0,750	0,667
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,749	0,752	0,862
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes total financial sector liabilities (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for non-EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table D.11 **Econometric results for the non-EA, Unemployment rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,929	0,929	0,775	0,948	0,945	0,706	0,946	0,943	0,626	0,870	0,860	0,297	0,863	0,831	0,090	0,871	0,834	0,122	0,869	0,833	0,119	0,770	0,725	0,093	0,911	0,869	0,145	0,940	0,878	0,048	0,940	0,876	0,038	0,802	0,733	0,141
2013	Pooled	OUT	0,698	0,689	0,269	0,811	0,773	0,482	0,804	0,773	0,561	0,651	0,703	0,027	0,606	0,650	0,643	0,652	0,671	0,875	0,644	0,654	0,931	0,570	0,384	0,093	0,641	0,518	0,044	0,600	0,504	0,121	0,602	0,502	0,119	0,641	0,398	0,036
2013	Pooled	ONE	0,750	0,719	0,480	0,781	0,625	0,223	0,781	0,625	0,223	0,547	0,609	0,403	0,781	0,781	1,000	0,625	0,750	0,540	0,625	0,719	0,629	0,563	0,453	0,606	0,600	0,400	0,297	0,525	0,350	0,272	0,525	0,350	0,334	0,675	0,550	0,578
2013	Fixed effect	IN	0,972	0,972		0,649	0,642	0,436				0,958	0,956	0,700	0,942	0,938	0,472	0,651	0,687	0,720				0,900	0,884	0,338	0,963	0,962	0,480	0,437	0,430	0,725				0,962	0,925	0,069
2013	Fixed effect	OUT	0,633	0,642	0,267	0,405	0,502	0,553				0,764	0,756	0,529	0,538	0,506	0,076	0,597	0,571	0,886				0,616	0,611	0,902	0,508	0,492	0,155	0,427	0,461	0,242				0,550	0,343	0,001
2013	Fixed effect	ONE	0,938	0,938		0,500	0,417					0,844	0,844		1,000	1,000		0,825	0,688	0,343				0,750	0,750	1,000	0,775	0,775		0,612	0,625	0,480				0,775	0,575	0,201
2013	Random effect	IN	0,914	0,926	0,085	0,948	0,944	0,598	0,946	0,943	0,645	0,870	0,860	0,297	0,863	0,830	0,075	0,871	0,834	0,122	0,869	0,833	0,119	0,759	0,725	0,289	0,911	0,869	0,145	0,940	0,878	0,048	0,940	0,876	0,038	0,802	0,724	0,144
2013	Random effect	OUT	0,624	0,669	0,173	0,811	0,776	0,499	0,804	0,773	0,559	0,651	0,703	0,027	0,606	0,648	0,659	0,652	0,671	0,875	0,644	0,654	0,931	0,576	0,384	0,121	0,641	0,518	0,044	0,600	0,504	0,121	0,602	0,502	0,119	0,641	0,412	0,025
2013	Random effect	ONE	0,813	0,750	0,480	0,781	0,625	0,223	0,781	0,625	0,223	0,547	0,609	0,403	0,781	0,781	1,000	0,625	0,750	0,540	0,625	0,719	0,629	0,563	0,453	0,606	0,600	0,400	0,297	0,525	0,350	0,272	0,525	0,350	0,334	0,675	0,500	0,311
2013	Chamberlain's	IN				1,000	1,000		1,000	1,000								0,985	1,000	0,109	0,989												1,000					
2013	Chamberlain's	OUT				0,602	0,742	0,022	0,564	0,667	0,111							0,617	0,500		0,580												0,346					
2013	Chamberlain's	ONE				0,656	0,656	1,000	0,625	0,531	0,514							1,000			0,875												0,313					
2013	Dynamic	IN				0,951	0,950	0,479	0,953	0,951	0,280							0,895	0,866	0,172	0,897	0,870	0,224							0,939	0,924	0,366	0,939	0,924	0,349			
2013	Dynamic	OUT				0,791	0,778	0,354	0,791	0,778	0,427							0,769	0,771	0,973	0,758	0,781	0,712							0,680	0,647	0,405	0,662	0,629	0,499			
2013	Dynamic	ONE				0,893	0,893		0,893	0,893								0,969	0,969		0,969	1,000	0,480							0,575	0,450	0,103	0,562	0,438	0,221			
2013	Multinomial	IN				0,961	0,958	0,568				0,868	0,873	0,765				0,897	0,873	0,198				0,821	0,768	0,092										0,836	0,733	0,024
2013	Multinomial	OUT				0,773	0,746	0,459				0,658	0,692	0,436				0,608	0,600	0,918				0,451	0,305	0,237										0,561	0,359	0,085
2013	Multinomial	ONE				0,766	0,625	0,171				0,547	0,609	0,533				0,719	0,813	0,383				0,594	0,703	0,273										0,525	0,300	0,354
2013	Multinomial robustness	IN				0,963	0,960	0,460				0,867	0,875	0,573				0,922	0,894	0,102				0,778	0,751	0,241				0,958	0,914	0,044				0,849	0,763	0,096
2013	Multinomial robustness	OUT				0,756	0,678	0,037				0,633	0,686	0,090				0,473	0,374	0,093				0,386	0,174	0,020				0,646	0,638	0,852				0,587	0,478	0,340
2013	Multinomial robustness	ONE				0,719	0,500	0,085				0,484	0,609	0,334				0,516	0,500	0,837				0,406	0,422	0,938				0,475	0,375	0,512				0,725	0,450	0,327
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,888	0,887	0,363	0,920	0,914	0,555	0,920	0,914	0,398	0,835	0,834	0,746	0,842	0,826	0,213	0,851	0,828	0,237	0,848	0,826	0,249	0,767	0,720	0,036	0,866	0,818	0,040	0,876	0,820	0,042	0,877	0,816	0,029	0,760	0,704	0,162
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,951	0,950	0,775	0,780	0,780	0,867				0,913	0,914	0,947	0,917	0,913	0,558	0,816	0,784	0,057				0,879	0,861	0,129	0,948	0,935	0,075	0,840	0,817	0,234				0,904	0,843	0,005
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,885	0,887	0,290	0,920	0,914	0,555	0,920	0,914	0,398	0,835	0,834	0,746	0,842	0,826	0,213	0,851	0,829	0,258	0,848	0,826	0,249	0,767	0,720	0,036	0,866	0,818	0,040	0,872	0,806	0,016	0,873	0,807	0,014	0,760	0,704	0,162
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,991			0,991	0,989	0,328							0,947	0,941	0,484	0,946	0,937	0,334							0,976	0,962	0,067	0,973	0,960	0,076			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,936	0,928	0,338	0,936	0,928	0,328							0,900	0,879	0,088	0,899	0,876	0,079							0,924	0,884	0,037	0,924	0,886	0,027			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,925	0,913	0,142	0,919	0,911	0,215	0,848	0,849	0,748				0,839	0,818	0,187	0,836	0,820	0,298	0,768	0,729	0,127				0,876	0,820	0,046	0,873	0,818	0,037	0,742	0,692	0,247
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,921	0,911	0,167	0,916	0,908	0,147	0,848	0,849	0,326				0,845	0,821	0,095	0,840	0,819	0,128	0,770	0,740	0,191				0,879	0,828	0,041	0,878	0,825	0,034	0,750	0,686	0,131
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																						0,769												0,743	0,695	0,251
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,749	0,690	0,136
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes unemployment rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for non-EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table D.12 **Econometric results for the non-EA, Activity rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,929	0,921	0,364	0,948	0,940	0,452	0,946	0,943	0,728	0,870	0,863	0,511	0,863	0,865	0,675	0,871	0,868	0,630	0,869	0,866	0,494	0,770	0,772	0,859	0,911	0,913	0,862	0,940	0,933	0,198	0,940	0,933	0,148	0,802	0,798	0,804
2013	Pooled	OUT	0,698	0,638	0,016	0,811	0,773	0,123	0,804	0,758	0,104	0,651	0,631	0,165	0,606	0,565	0,003	0,652	0,638	0,208	0,644	0,635	0,412	0,570	0,636	0,027	0,641	0,606	0,168	0,600	0,592	0,430	0,602	0,596	0,559	0,641	0,649	0,616
2013	Pooled	ONE	0,750	0,750		0,781	0,844	0,252	0,781	0,781	1,000	0,547	0,547		0,781	0,781		0,625	0,656	0,480	0,625	0,656	0,480	0,563	0,500	0,403	0,600	0,550	0,576	0,525	0,525	1,000	0,525	0,525		0,675	0,675	
2013	Fixed effect	IN	0,972	0,972		0,649	0,790	0,022				0,958	0,956	0,437	0,942	0,939	0,602	0,651	0,611	0,006				0,900	0,903	0,726	0,963	0,958	0,223	0,437	0,445	0,795				0,962	0,956	0,519
2013	Fixed effect	OUT	0,633	0,640	0,271	0,405	0,428	0,881				0,764	0,764		0,538	0,621	0,003	0,597	0,629	0,435				0,616	0,634	0,300	0,508	0,576	0,019	0,427	0,529	0,110				0,550	0,534	0,366
2013	Fixed effect	ONE	0,938	0,938		0,500	0,667					0,844	0,844		1,000	1,000		0,825	0,719	0,573				0,750	0,656	0,213	0,775	0,850	0,301	0,612	0,650	0,608				0,775	0,750	0,480
2013	Random effect	IN	0,914	0,919	0,541	0,948	0,940	0,452	0,946	0,943	0,728	0,870	0,863	0,511	0,863	0,859	0,566	0,871	0,868	0,630	0,869	0,866	0,494	0,759	0,772	0,526	0,911	0,913	0,862	0,940	0,933	0,198	0,940	0,933	0,148	0,802	0,744	0,258
2013	Random effect	OUT	0,624	0,591	0,210	0,811	0,773	0,123	0,804	0,758	0,104	0,651	0,631	0,165	0,606	0,560	0,016	0,652	0,638	0,208	0,644	0,635	0,412	0,576	0,636	0,201	0,641	0,606	0,168	0,600	0,592	0,430	0,602	0,596	0,559	0,641	0,627	0,804
2013	Random effect	ONE	0,813	0,688	0,137	0,781	0,844	0,252	0,781	0,781	1,000	0,547	0,547		0,781	0,781		0,625	0,656	0,480	0,625	0,656	0,480	0,563	0,500	0,403	0,600	0,550	0,576	0,525	0,525	1,000	0,525	0,525		0,675	0,700	0,828
2013	Chamberlain's	IN				1,000	1,000		1,000	0,999	0,480							0,985	0,977	0,257	0,989	0,976	0,132										1,000	1,000				
2013	Chamberlain's	OUT				0,602	0,592	0,966	0,564	0,650	0,231							0,617	0,679	0,214	0,580	0,704	0,031										0,346	0,373	0,684			
2013	Chamberlain's	ONE				0,656	0,734	0,327	0,625	0,813	0,009							1,000	1,000		0,875	1,000	0,127										0,313	0,475	0,282			
2013	Dynamic	IN				0,951	0,947	0,697	0,953	0,949	0,621							0,895	0,899	0,497	0,897	0,901	0,349							0,939	0,939	1,000	0,939	0,939	1,000			
2013	Dynamic	OUT				0,791	0,786	0,757	0,791	0,778	0,489							0,769	0,794	0,057	0,758	0,785	0,049							0,680	0,673	0,431	0,662	0,663	0,936			
2013	Dynamic	ONE				0,893	0,929	0,480	0,893	0,929	0,480							0,969	0,969		0,969	0,969								0,575	0,575		0,562	0,575	0,480			
2013	Multinomial	IN				0,961	0,962	0,923				0,868	0,865	0,655				0,897	0,895	0,738				0,821	0,767	0,093										0,836	0,824	0,667
2013	Multinomial	OUT				0,773	0,740	0,275				0,658	0,680	0,276				0,608	0,609	0,986				0,451	0,524	0,549										0,561	0,698	0,052
2013	Multinomial	ONE				0,766	0,750	0,480				0,547	0,547					0,719	0,688	0,690				0,594	0,688	0,470										0,525	0,700	0,040
2013	Multinomial robustness	IN				0,963	0,964	0,922				0,867	0,874	0,415				0,922	0,888	0,065				0,778	0,769	0,546				0,958	0,941	0,094				0,849	0,848	0,963
2013	Multinomial robustness	OUT				0,756	0,722	0,106				0,633	0,609	0,201				0,473	0,654	0,020				0,386	0,553	0,000				0,646	0,651	0,936				0,587	0,619	0,119
2013	Multinomial robustness	ONE				0,719	0,750	0,480				0,484	0,453	0,480				0,516	0,750	0,024				0,406	0,438	0,480				0,475	0,525	0,394				0,725	0,762	0,301
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,888	0,882	0,593	0,920	0,921	0,827	0,920	0,921	0,954	0,835	0,832	0,778	0,842	0,803	0,095	0,851	0,822	0,214	0,848	0,818	0,195	0,767	0,759	0,641	0,866	0,833	0,130	0,876	0,845	0,126	0,877	0,842	0,089	0,760	0,742	0,349
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,951	0,950	0,966	0,780	0,788	0,493				0,913	0,914	0,739	0,917	0,918	0,889	0,816	0,816	0,909				0,879	0,879	0,898	0,948	0,949	0,843	0,840	0,841	0,728				0,904	0,903	0,557
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,885	0,882	0,817	0,920	0,921	0,827	0,920	0,921	0,954	0,835	0,832	0,778	0,842	0,803	0,095	0,851	0,814	0,128	0,848	0,815	0,167	0,767	0,759	0,641	0,866	0,833	0,130	0,872	0,842	0,080	0,873	0,841	0,077	0,760	0,742	0,349
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,991	0,983	0,154	0,991	0,984	0,154							0,947	0,946	0,634	0,946	0,945	0,519							0,976	0,975	0,384	0,973	0,973	0,725			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,936	0,935	0,861	0,936	0,932	0,671							0,900	0,892	0,486	0,899	0,887	0,220							0,924	0,908	0,218	0,924	0,909	0,233			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,925	0,924	0,701	0,919	0,921	0,748	0,848	0,849	0,954				0,839	0,803	0,079	0,836	0,800	0,072	0,768	0,755	0,365				0,876	0,843	0,106	0,873	0,843	0,143	0,742	0,725	0,223
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,921	0,921	1,000	0,916	0,914	0,810	0,848	0,847	0,954				0,845	0,810	0,077	0,840	0,805	0,081	0,770	0,765	0,732				0,879	0,842	0,097	0,878	0,840	0,085	0,750	0,750	0,978
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																						0,769												0,743	0,736	0,644
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,749	0,736	0,356
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes activity rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for non-EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table D.13 **Econometric results for the non-EA, Long-term unemployment rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,929	0,929	0,480	0,948	0,944	0,700	0,946	0,941	0,596	0,870	0,859	0,514	0,863	0,863	1,000	0,871	0,869	0,917	0,869	0,865	0,775	0,770	0,756	0,450	0,911	0,899	0,189	0,940	0,920	0,140	0,940	0,917	0,083	0,802	0,792	0,346
2013	Pooled	OUT	0,698	0,698	1,000	0,811	0,809	0,964	0,804	0,807	0,965	0,651	0,598	0,134	0,606	0,619	0,275	0,652	0,654	0,936	0,644	0,650	0,829	0,570	0,514	0,157	0,641	0,665	0,228	0,600	0,635	0,287	0,602	0,657	0,063	0,641	0,649	0,625
2013	Pooled	ONE	0,750	0,781	0,480	0,781	0,875	0,292	0,781	0,875	0,292	0,547	0,547	1,000	0,781	0,781		0,625	0,625	1,000	0,625	0,656	0,480	0,563	0,531	0,480	0,600	0,600	1,000	0,525	0,525	1,000	0,525	0,575	0,659	0,675	0,687	0,769
2013	Fixed effect	IN	0,972	0,978	0,122	0,649	0,657	0,479				0,958	0,954	0,537	0,942	0,943	0,776	0,651	0,619	0,000				0,900	0,901	0,885	0,963	0,963		0,437	0,556	0,055				0,962	0,953	0,324
2013	Fixed effect	OUT	0,633	0,656	0,141	0,405	0,423	0,867				0,764	0,768	0,815	0,538	0,508	0,084	0,597	0,469	0,240				0,616	0,611	0,700	0,508	0,535	0,070	0,427	0,659	0,009				0,550	0,558	0,821
2013	Fixed effect	ONE	0,938	0,844	0,213	0,500	0,250					0,844	0,844		1,000	1,000		0,825	0,656	0,206				0,750	0,719	0,480	0,775	0,800	0,480	0,612	0,600	0,952				0,775	0,750	0,696
2013	Random effect	IN	0,914	0,925	0,136	0,948	0,944	0,700	0,946	0,941	0,596	0,870	0,859	0,514	0,863	0,863	1,000	0,871	0,869	0,917	0,869	0,865	0,775	0,759	0,754	0,753	0,911	0,899	0,189	0,940	0,920	0,140	0,940	0,917	0,083	0,802	0,758	0,293
2013	Random effect	OUT	0,624	0,658	0,261	0,811	0,809	0,964	0,804	0,807	0,965	0,651	0,598	0,134	0,606	0,619	0,275	0,652	0,654	0,936	0,644	0,650	0,829	0,576	0,539	0,382	0,641	0,665	0,228	0,600	0,635	0,287	0,602	0,657	0,063	0,641	0,676	0,484
2013	Random effect	ONE	0,813	0,688	0,137	0,781	0,875	0,292	0,781	0,875	0,292	0,547	0,547	1,000	0,781	0,781		0,625	0,625	1,000	0,625	0,656	0,480	0,563	0,563		0,600	0,600	1,000	0,525	0,525	1,000	0,525	0,575	0,659	0,675	0,662	0,899
2013	Chamberlain's	IN				1,000	1,000		1,000	0,999	0,413							0,985	0,985		0,989	0,986	0,191										1,000	0,990	0,232			
2013	Chamberlain's	OUT				0,602	0,659	0,298	0,564	0,662	0,219							0,617	0,650	0,040	0,580	0,629	0,157										0,346	0,462	0,005			
2013	Chamberlain's	ONE				0,656	0,781	0,119	0,625	0,844	0,012							1,000	1,000		0,875	1,000	0,127										0,313	0,512	0,142			
2013	Dynamic	IN				0,951	0,952	0,479	0,953	0,952	0,480							0,895	0,894	0,479	0,897	0,897	0,852							0,939	0,934	0,589	0,939	0,931	0,339			
2013	Dynamic	OUT				0,791	0,791	1,000	0,791	0,802	0,120							0,769	0,754	0,136	0,758	0,752	0,418							0,680	0,751	0,039	0,662	0,765	0,006			
2013	Dynamic	ONE				0,893	0,893		0,893	0,893								0,969	0,969		0,969	0,969								0,575	0,725	0,204	0,562	0,725	0,186			
2013	Multinomial	IN				0,961	0,959	0,759				0,868	0,863	0,528				0,897	0,893	0,703				0,821	0,798	0,353										0,836	0,832	0,732
2013	Multinomial	OUT				0,773	0,760	0,702				0,658	0,631	0,395				0,608	0,647	0,541				0,451	0,416	0,439										0,561	0,573	0,795
2013	Multinomial	ONE				0,766	0,750	0,830				0,547	0,734	0,186				0,719	0,750	0,386				0,594	0,438	0,447										0,525	0,612	0,633
2013	Multinomial robustness	IN				0,963	0,959	0,570				0,867	0,863	0,723				0,922	0,902	0,185				0,778	0,767	0,607				0,958	0,945	0,123				0,849	0,857	0,812
2013	Multinomial robustness	OUT				0,756	0,726	0,378				0,633	0,602	0,289				0,473	0,665	0,048				0,386	0,366	0,480				0,646	0,686	0,356				0,587	0,651	0,509
2013	Multinomial robustness	ONE				0,719	0,750	0,712				0,484	0,609	0,252				0,516	0,750	0,024				0,406	0,406					0,475	0,500	0,765				0,725	0,812	0,761
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,888	0,889	0,815	0,920	0,917	0,738	0,920	0,917	0,586	0,835	0,823	0,526	0,842	0,843	0,565	0,851	0,848	0,667	0,848	0,848	0,870	0,767	0,756	0,405	0,866	0,865	0,211	0,876	0,876	1,000	0,877	0,877	0,851	0,760	0,760	0,905
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,951	0,952	0,267	0,780	0,779	0,901				0,913	0,913	0,961	0,917	0,917		0,816	0,813	0,705				0,879	0,874	0,556	0,948	0,944	0,441	0,840	0,852	0,143				0,904	0,898	0,372
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,885	0,883	0,561	0,920	0,917	0,738	0,920	0,917	0,586	0,835	0,810	0,239	0,842	0,843	0,565	0,851	0,848	0,667	0,848	0,848	0,870	0,767	0,756	0,405	0,866	0,865	0,211	0,872	0,875	0,285	0,873	0,876	0,184	0,760	0,760	0,905
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,991	0,983	0,279	0,991	0,981	0,131							0,947	0,945	0,553	0,946	0,943	0,380							0,976	0,975	0,667	0,973	0,973	0,741			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,936	0,930	0,441	0,936	0,930	0,398							0,900	0,897	0,520	0,899	0,899	0,833							0,924	0,922	0,736	0,924	0,918	0,299			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,925	0,913	0,149	0,919	0,911	0,283	0,848	0,828	0,172				0,839	0,827	0,216	0,836	0,824	0,158	0,768	0,754	0,371				0,876	0,874	0,358	0,873	0,872	0,421	0,742	0,739	0,523
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,921	0,904	0,072	0,916	0,907	0,302	0,848	0,831	0,276				0,845	0,837	0,361	0,840	0,836	0,609	0,770	0,768	0,886				0,879	0,869	0,033	0,878	0,867	0,028	0,750	0,744	0,561
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																						0,769												0,743	0,736	0,343
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,749	0,745	0,665
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes long-term unemployment rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for non-EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table D.14 **Econometric results for the non-EA, Youth unemployment rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,929	0,930	0,857	0,948	0,946	0,677	0,946	0,946	0,922	0,870	0,844	0,240	0,863	0,860	0,734	0,871	0,871	0,799	0,869	0,871	0,612	0,770	0,759	0,184	0,911	0,887	0,455	0,940	0,919	0,519	0,940	0,914	0,238	0,802	0,801	0,927
2013	Pooled	OUT	0,698	0,687	0,244	0,811	0,838	0,208	0,804	0,838	0,155	0,651	0,669	0,661	0,606	0,613	0,480	0,652	0,663	0,450	0,644	0,656	0,419	0,570	0,591	0,172	0,641	0,608	0,141	0,600	0,584	0,238	0,602	0,586	0,192	0,641	0,626	0,626
2013	Pooled	ONE	0,750	0,719	0,480	0,781	0,844	0,252	0,781	0,844	0,252	0,547	0,547	1,000	0,781	0,781		0,625	0,625		0,625	0,625		0,563	0,563		0,600	0,625	0,701	0,525	0,525	1,000	0,525	0,550	0,480	0,675	0,700	0,701
2013	Fixed effect	IN	0,972	0,976	0,414	0,649	0,681	0,255				0,958	0,954	0,513	0,942	0,940	0,310	0,651	0,656	0,005				0,900	0,901	1,000	0,963	0,951	0,241	0,437	0,455	0,838				0,962	0,935	0,242
2013	Fixed effect	OUT	0,633	0,616	0,151	0,405	0,405	1,000				0,764	0,784	0,154	0,538	0,556	0,050	0,597	0,573	0,879				0,616	0,603	0,219	0,508	0,504	0,801	0,427	0,533	0,247				0,550	0,538	0,574
2013	Fixed effect	ONE	0,938	0,844	0,213	0,500	0,531					0,844	0,844		1,000	1,000		0,825	0,656	0,206				0,750	0,719	0,480	0,775	0,775		0,612	0,600	0,960				0,775	0,775	1,000
2013	Random effect	IN	0,914	0,919	0,510	0,948	0,946	0,677	0,946	0,946	0,922	0,870	0,833	0,181	0,863	0,860	0,734	0,871	0,871	0,799	0,869	0,871	0,612	0,759	0,738	0,049	0,911	0,887	0,455	0,940	0,919	0,519	0,940	0,914	0,238	0,802	0,801	0,927
2013	Random effect	OUT	0,624	0,616	0,386	0,811	0,838	0,208	0,804	0,838	0,155	0,651	0,718	0,131	0,606	0,613	0,480	0,652	0,663	0,450	0,644	0,656	0,419	0,576	0,568	0,614	0,641	0,608	0,141	0,600	0,584	0,238	0,602	0,586	0,192	0,641	0,626	0,626
2013	Random effect	ONE	0,813	0,750	0,252	0,781	0,844	0,252	0,781	0,844	0,252	0,547	0,641	0,480	0,781	0,781		0,625	0,625		0,625	0,625		0,563	0,563		0,600	0,625	0,701	0,525	0,525	1,000	0,525	0,550	0,480	0,675	0,700	0,701
2013	Chamberlain's	IN				1,000	1,000		1,000									0,985	0,982	0,388	0,989	0,981	0,136										1,000	0,978	0,201			
2013	Chamberlain's	OUT				0,602	0,620	0,936	0,564									0,617	0,690	0,101	0,580	0,694	0,008										0,346	0,571	0,002			
2013	Chamberlain's	ONE				0,656	0,786	0,446	0,625									1,000	1,000		0,875	1,000	0,127										0,313	0,550	0,250			
2013	Dynamic	IN				0,951	0,952	0,686	0,953	0,952	0,686							0,895	0,890	0,432	0,897	0,894	1,000							0,939	0,929	0,731	0,939	0,924	0,753			
2013	Dynamic	OUT				0,791	0,812	0,135	0,791	0,823	0,059							0,769	0,750	0,194	0,758	0,746	0,271							0,680	0,673	0,611	0,662	0,673	0,623			
2013	Dynamic	ONE				0,893	0,893		0,893	0,893								0,969	0,969		0,969	0,969								0,575	0,625	0,265	0,562	0,625	0,221			
2013	Multinomial	IN				0,961	0,963	0,805				0,868	0,851	0,347				0,897	0,898	0,793				0,821	0,821	0,748										0,836	0,830	0,675
2013	Multinomial	OUT				0,773	0,786	0,587				0,658	0,658	1,000				0,608	0,629	0,778				0,451	0,419	0,722										0,561	0,572	0,813
2013	Multinomial	ONE				0,766	0,750	0,830				0,547	0,641	0,480				0,719	0,719					0,594	0,563	0,681										0,525	0,625	0,581
2013	Multinomial robustness	IN				0,963	0,965	0,647				0,867	0,850	0,344				0,922	0,909	0,397				0,778	0,776	0,748				0,958	0,923	0,098				0,849	0,845	0,829
2013	Multinomial robustness	OUT				0,756	0,773	0,123				0,633	0,627	0,911				0,473	0,615	0,209				0,386	0,422	0,049				0,646	0,555	0,123				0,587	0,644	0,488
2013	Multinomial robustness	ONE				0,719	0,781	0,403				0,484	0,609	0,513				0,516	0,750	0,024				0,406	0,406					0,475	0,450	0,827				0,725	0,925	0,339
2013	Multinomial probit	IN																																				
2013	Multinomial probit	OUT																																				
2013	Multinomial probit	ONE																																				
2013	Multinomial robustness, probit	IN																																				
2013	Multinomial robustness, probit	OUT																																				
2013	Multinomial robustness, probit	ONE																																				
2017	Pooled	IN	0,888	0,895	0,206	0,920	0,920	0,882	0,920	0,919	0,552	0,835	0,829	0,497	0,842	0,841	0,895	0,851	0,849	0,520	0,848	0,847	0,428	0,767	0,772	0,521	0,866	0,853	0,584	0,876	0,862	0,413	0,877	0,859	0,211	0,760	0,753	0,984
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,951	0,954	0,370	0,780	0,790	0,414				0,913	0,916	0,500	0,917	0,916	0,873	0,816	0,816	0,611				0,879	0,875	0,703	0,948	0,931	0,189	0,840	0,840	0,987				0,904	0,878	0,181
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,885	0,891	0,187	0,920	0,920	0,882	0,920	0,919	0,552	0,835	0,800	0,052	0,842	0,841	0,895	0,851	0,846	0,872	0,848	0,847	0,428	0,767	0,768	0,926	0,866	0,853	0,584	0,872	0,861	0,788	0,873	0,861	0,726	0,760	0,753	0,984
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,991	0,985	0,320	0,991	0,984	0,228							0,947	0,946	0,573	0,946	0,945	0,385							0,976	0,962	0,145	0,973	0,959	0,161			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,936	0,932	0,487	0,936	0,932	0,476							0,900	0,891	0,364	0,899	0,892	0,271							0,924	0,906	0,334	0,924	0,906	0,274			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,925	0,922	0,314	0,919	0,916	0,261	0,848	0,849	0,894				0,839	0,829	0,263	0,836	0,826	0,233	0,768	0,764	0,474				0,876	0,861	0,472	0,873	0,858	0,439	0,742	0,738	0,883
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,921	0,913	0,037	0,916	0,910	0,109	0,848	0,852	0,804				0,845	0,838	0,527	0,840	0,832	0,403	0,770	0,770	0,853				0,879	0,855	0,054	0,878	0,853	0,056	0,750	0,738	0,811
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN																						0,769	0,763	0,340										0,743	0,740	0,868
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN																																		0,749	0,739	0,919
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes youth unemployment rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for non-EA countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Appendix E

Table E.1 **Econometric results for the EU28, Current account**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,876	0,867	0,203	0,897	0,890	0,468	0,896	0,891	0,590	0,761	0,762	0,764	0,824	0,822	0,559	0,823	0,823	0,855	0,820	0,821	0,874	0,692	0,689	0,394	0,856	0,857	0,753	0,860	0,861	0,753	0,857	0,857	1,000	0,798	0,801	0,295
2013	Pooled	OUT	0,766	0,805	0,011	0,827	0,870	0,117	0,822	0,869	0,063	0,697	0,688	0,092	0,668	0,682	0,067	0,653	0,662	0,019	0,652	0,656	0,240	0,562	0,545	0,023	0,652	0,651	0,528	0,641	0,642	0,283	0,640	0,639	0,453	0,535	0,543	0,070
2013	Pooled	ONE	0,767	0,750	0,604	0,822	0,833	0,805	0,817	0,806	0,746	0,464	0,472	0,653	0,711	0,689	0,159	0,656	0,656		0,644	0,628	0,179	0,578	0,556	0,145	0,756	0,750	0,480	0,717	0,717		0,711	0,711		0,578	0,592	0,383
2013	Fixed effect	IN	0,932	0,932	0,528	0,672	0,684	0,379				0,896	0,896	0,994	0,914	0,911	0,496	0,790	0,799	0,519				0,855	0,856	0,763	0,935	0,936	0,876	0,611	0,657	0,026				0,917	0,917	0,945
2013	Fixed effect	OUT	0,706	0,707	0,557	0,654	0,706	0,011				0,734	0,718	0,348	0,695	0,662	0,022	0,665	0,595	0,084				0,626	0,631	0,052	0,728	0,699	0,037	0,585	0,553	0,394				0,539	0,582	0,002
2013	Fixed effect	ONE	0,867	0,867		0,583	0,661	0,027				0,789	0,794	0,850	0,889	0,872	0,624	0,606	0,467	0,181				0,694	0,700	0,479	0,889	0,850	0,240	0,606	0,472	0,096				0,644	0,650	0,888
2013	Random effect	IN	0,850	0,843	0,255	0,890	0,888	0,832	0,887	0,886	0,971	0,724	0,724	0,968	0,816	0,816	1,000	0,818	0,819	0,753	0,819	0,820	0,707	0,679	0,672	0,247	0,856	0,857	0,832	0,856	0,856		0,855	0,855	1,000	0,793	0,796	0,330
2013	Random effect	OUT	0,740	0,759	0,041	0,820	0,860	0,083	0,816	0,856	0,073	0,733	0,693	0,087	0,683	0,688	0,307	0,660	0,659	0,313	0,650	0,651	0,211	0,630	0,600	0,011	0,654	0,651	0,238	0,653	0,654	0,480	0,648	0,646	0,391	0,522	0,531	0,048
2013	Random effect	ONE	0,783	0,778	0,731	0,828	0,839	0,764	0,817	0,844	0,468	0,636	0,589	0,314	0,711	0,700	0,532	0,633	0,633		0,628	0,628		0,583	0,550	0,218	0,750	0,750	1,000	0,694	0,694		0,694	0,694		0,533	0,547	0,477
2013	Chamberlain's	IN				0,937	0,930	0,186	0,937	0,931	0,236							0,911	0,903	0,447	0,910	0,902	0,412							0,923	0,916	0,323	0,919	0,913	0,389			
2013	Chamberlain's	OUT				0,753	0,741	0,168	0,742	0,734	0,323							0,628	0,574	0,068	0,628	0,578	0,095							0,694	0,638	0,005	0,684	0,631	0,004			
2013	Chamberlain's	ONE				0,839	0,778	0,091	0,828	0,772	0,071							0,761	0,661	0,199	0,767	0,672	0,225							0,861	0,767	0,038	0,861	0,739	0,037			
2013	Dynamic	IN				0,900	0,893	0,533	0,900	0,894	0,554							0,859	0,859	0,946	0,859	0,859	0,863							0,881	0,881	0,541	0,880	0,880				
2013	Dynamic	OUT				0,847	0,917	0,006	0,846	0,917	0,001							0,811	0,805	0,103	0,814	0,809	0,170							0,793	0,796	0,040	0,789	0,789				
2013	Dynamic	ONE				0,882	0,895	0,796	0,889	0,895	0,896							0,802	0,802		0,802	0,815	0,294							0,839	0,839		0,839	0,839				
2013	Multinomial	IN				0,895	0,884	0,312	0,895	0,884	0,301	0,770	0,770	0,971				0,837	0,825	0,285	0,833	0,823	0,378	0,692	0,687	0,270				0,865	0,862	0,306	0,861	0,859	0,530	0,797	0,800	0,657
2013	Multinomial	OUT				0,811	0,851	0,151	0,811	0,845	0,174	0,707	0,663	0,075				0,543	0,555	0,640	0,538	0,564	0,283	0,572	0,541	0,010				0,655	0,661	0,392	0,654	0,651	0,708	0,507	0,526	0,021
2013	Multinomial	ONE				0,806	0,794	0,765	0,800	0,767	0,378	0,508	0,483	0,578				0,644	0,667	0,559	0,667	0,656	0,691	0,578	0,567	0,520				0,706	0,711	0,480	0,694	0,700	0,480	0,522	0,536	0,587
2013	Multinomial robustness	IN				0,897	0,881	0,197	0,894	0,881	0,259	0,770	0,771	0,870				0,840	0,829	0,419	0,839	0,824	0,279	0,694	0,679	0,013				0,865	0,865	0,904	0,858	0,861	0,659	0,795	0,796	0,865
2013	Multinomial robustness	OUT				0,804	0,828	0,413	0,791	0,816	0,325	0,663	0,653	0,515				0,535	0,563	0,328	0,528	0,568	0,154	0,565	0,527	0,048				0,676	0,676	1,000	0,669	0,669	1,000	0,504	0,520	0,025
2013	Multinomial robustness	ONE				0,778	0,733	0,420	0,739	0,683	0,241	0,481	0,450	0,501				0,689	0,661	0,633	0,667	0,639	0,578	0,589	0,556	0,383				0,717	0,700	0,483	0,717	0,706	0,296	0,517	0,536	0,379
2013	Multinomial probit	IN																						0,691	0,684	0,046										0,795	0,794	0,826
2013	Multinomial probit	OUT																						0,567	0,535	0,000										0,512	0,533	0,014
2013	Multinomial probit	ONE																						0,578	0,550	0,080										0,522	0,542	0,438
2013	Multinomial robustness, probit	IN																						0,691	0,679	0,021										0,791	0,791	0,962
2013	Multinomial robustness, probit	OUT																						0,560	0,530	0,012										0,509	0,525	0,018
2013	Multinomial robustness, probit	ONE																						0,594	0,550	0,081										0,522	0,542	0,516
2017	Pooled	IN	0,876	0,875	0,383	0,901	0,899	0,602	0,900	0,897	0,481	0,786	0,780	0,412	0,825	0,825	0,990	0,830	0,830	0,965	0,828	0,829	0,871	0,723	0,710	0,317	0,819	0,819	0,985	0,819	0,817	0,611	0,818	0,818	0,849	0,732	0,724	0,471
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,922	0,922	0,920	0,761	0,765	0,156				0,878	0,877	0,833	0,908	0,896	0,051	0,788	0,759	0,069				0,831	0,824	0,363	0,923	0,914	0,107	0,786	0,755	0,015				0,864	0,856	0,149
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,868	0,868	0,737	0,899	0,896	0,329	0,899	0,895	0,410	0,761	0,754	0,311	0,823	0,824	0,856	0,818	0,823	0,564	0,815	0,819	0,705	0,719	0,708	0,453	0,812	0,817	0,558	0,811	0,816	0,572	0,808	0,816	0,427	0,733	0,723	0,522
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,936	0,929	0,094	0,935	0,926	0,034							0,915	0,891	0,007	0,911	0,888	0,012							0,911	0,892	0,015	0,910	0,891	0,017			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,915	0,915	0,947	0,914	0,914	0,954							0,868	0,869	0,792	0,867	0,866	0,966							0,872	0,873	0,480	0,870	0,872	0,220			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,896	0,892	0,357	0,894	0,890	0,324	0,787	0,786	0,827				0,816	0,815	0,870	0,813	0,810	0,554	0,725	0,709	0,233				0,823	0,821	0,442	0,822	0,819	0,540	0,733	0,723	0,422
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,896	0,890	0,229	0,894	0,888	0,189	0,785	0,783	0,761				0,812	0,806	0,325	0,809	0,804	0,394	0,726	0,707	0,117				0,822	0,823	0,892	0,820	0,821	0,832	0,739	0,731	0,554
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN										0,786												0,727	0,711	0,200										0,735	0,723	0,320
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN										0,781	0,782	0,964										0,728	0,707	0,090										0,736	0,727	0,433
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes current account (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EU countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table E.2 **Econometric results for the EU28, Net international investment position**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,876	0,869	0,406	0,897	0,894	0,561	0,896	0,894	0,649	0,761	0,762	0,953	0,824	0,811	0,297	0,823	0,818	0,664	0,820	0,816	0,744	0,692	0,682	0,509	0,856	0,843	0,389	0,860	0,846	0,270	0,857	0,845	0,359	0,798	0,793	0,683
2013	Pooled	OUT	0,766	0,791	0,180	0,827	0,854	0,111	0,822	0,856	0,062	0,697	0,710	0,495	0,668	0,729	0,077	0,653	0,720	0,039	0,652	0,714	0,058	0,562	0,599	0,132	0,652	0,688	0,324	0,641	0,687	0,191	0,640	0,685	0,223	0,535	0,563	0,052
2013	Pooled	ONE	0,767	0,739	0,524	0,822	0,828	0,885	0,817	0,800	0,698	0,464	0,453	0,691	0,711	0,667	0,518	0,656	0,622	0,500	0,644	0,611	0,500	0,578	0,589	0,825	0,756	0,694	0,373	0,717	0,667	0,413	0,711	0,656	0,323	0,578	0,606	0,365
2013	Fixed effect	IN	0,932	0,932	0,215	0,672	0,688	0,149				0,896	0,893	0,443	0,914	0,912	0,482	0,790	0,797	0,629				0,855	0,852	0,615	0,935	0,924	0,067	0,611	0,660	0,016				0,917	0,915	0,610
2013	Fixed effect	OUT	0,706	0,705	0,313	0,654	0,664	0,649				0,734	0,733	0,858	0,695	0,700	0,578	0,665	0,660	0,825				0,626	0,624	0,771	0,728	0,754	0,227	0,585	0,653	0,003				0,539	0,534	0,520
2013	Fixed effect	ONE	0,867	0,867		0,583	0,656	0,065				0,789	0,789	1,000	0,889	0,894	0,809	0,606	0,600	0,890				0,694	0,689	0,856	0,889	0,928	0,369	0,606	0,683	0,076				0,644	0,633	0,645
2013	Random effect	IN	0,850	0,844	0,337	0,890	0,889	0,777	0,887	0,883	0,552	0,724	0,729	0,730	0,816	0,808	0,492	0,818	0,814	0,678	0,819	0,815	0,667	0,679	0,672	0,756	0,856	0,843	0,392	0,856	0,847	0,499	0,855	0,845	0,419	0,793	0,788	0,683
2013	Random effect	OUT	0,740	0,750	0,439	0,820	0,849	0,136	0,816	0,842	0,164	0,733	0,751	0,472	0,683	0,726	0,175	0,660	0,718	0,066	0,650	0,712	0,058	0,630	0,632	0,946	0,654	0,688	0,364	0,653	0,701	0,184	0,648	0,699	0,160	0,522	0,555	0,059
2013	Random effect	ONE	0,783	0,767	0,482	0,828	0,833	0,909	0,817	0,806	0,820	0,636	0,631	0,922	0,711	0,694	0,800	0,633	0,633	1,000	0,628	0,611	0,736	0,583	0,611	0,731	0,750	0,694	0,424	0,694	0,678	0,778	0,694	0,678	0,778	0,533	0,561	0,329
2013	Chamberlain's	IN				0,937	0,936	0,726	0,937	0,935	0,662							0,911	0,905	0,426	0,910	0,906	0,558							0,923	0,914	0,384	0,919	0,907	0,245			
2013	Chamberlain's	OUT				0,753	0,755	0,946	0,742	0,752	0,587							0,628	0,623	0,771	0,628	0,627	0,949							0,694	0,717	0,357	0,684	0,711	0,303			
2013	Chamberlain's	ONE				0,839	0,850	0,802	0,828	0,844	0,715							0,761	0,739	0,551	0,767	0,750	0,652							0,861	0,878	0,781	0,861	0,889	0,667			
2013	Dynamic	IN				0,900	0,890	0,180	0,900	0,890	0,164							0,859	0,850	0,332	0,859	0,849	0,271							0,881	0,867	0,214	0,880	0,864	0,158			
2013	Dynamic	OUT				0,847	0,875	0,237	0,846	0,880	0,156							0,811	0,855	0,005	0,814	0,851	0,020							0,793	0,859	0,011	0,789	0,858	0,007			
2013	Dynamic	ONE				0,882	0,895	0,775	0,889	0,895	0,892							0,802	0,809	0,851	0,802	0,790	0,692							0,839	0,844	0,864	0,839	0,839	1,000			
2013	Multinomial	IN				0,895	0,892	0,499	0,895	0,892	0,536	0,770	0,769	0,952				0,837	0,826	0,325	0,833	0,824	0,408	0,692	0,681	0,494				0,865	0,850	0,261	0,861	0,847	0,267	0,797	0,795	0,836
2013	Multinomial	OUT				0,811	0,843	0,046	0,811	0,842	0,092	0,707	0,746	0,230				0,543	0,576	0,244	0,538	0,583	0,112	0,572	0,610	0,087				0,655	0,687	0,331	0,654	0,684	0,382	0,507	0,552	0,007
2013	Multinomial	ONE				0,806	0,817	0,785	0,800	0,789	0,747	0,508	0,519	0,712				0,644	0,628	0,811	0,667	0,617	0,415	0,578	0,594	0,697				0,706	0,672	0,553	0,694	0,656	0,522	0,522	0,567	0,268
2013	Multinomial robustness	IN				0,897	0,892	0,388	0,894	0,889	0,448	0,770	0,763	0,552				0,840	0,831	0,408	0,839	0,831	0,439	0,694	0,682	0,491				0,865	0,850	0,231	0,858	0,846	0,355	0,795	0,792	0,819
2013	Multinomial robustness	OUT				0,804	0,827	0,233	0,791	0,807	0,396	0,663	0,634	0,312				0,535	0,569	0,096	0,528	0,569	0,042	0,565	0,613	0,034				0,676	0,696	0,526	0,669	0,684	0,644	0,504	0,549	0,010
2013	Multinomial robustness	ONE				0,778	0,772	0,925	0,739	0,700	0,425	0,481	0,458	0,530				0,689	0,661	0,575	0,667	0,650	0,789	0,589	0,628	0,355				0,717	0,678	0,511	0,717	0,644	0,288	0,517	0,572	0,210
2013	Multinomial probit	IN																						0,691	0,684	0,669										0,795	0,794	0,892
2013	Multinomial probit	OUT																						0,567	0,609	0,070										0,512	0,552	0,024
2013	Multinomial probit	ONE																						0,578	0,600	0,640										0,522	0,556	0,488
2013	Multinomial robustness, probit	IN																						0,691	0,680	0,566										0,791	0,791	0,979
2013	Multinomial robustness, probit	OUT																						0,560	0,606	0,096										0,509	0,550	0,024
2013	Multinomial robustness, probit	ONE																						0,594	0,611	0,702										0,522	0,561	0,472
2017	Pooled	IN	0,876	0,872	0,080	0,901	0,901	0,806	0,900	0,900	0,840	0,786	0,783	0,593	0,825	0,822	0,148	0,830	0,825	0,064	0,828	0,823	0,070	0,723	0,726	0,562	0,819	0,803	0,032	0,819	0,804	0,056	0,818	0,804	0,053	0,732	0,735	0,246
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,922	0,922	0,224	0,761	0,766	0,495				0,878	0,877	0,363	0,908	0,907	0,213	0,788	0,786	0,728				0,831	0,829	0,360	0,923	0,922	0,612	0,786	0,781	0,617				0,864	0,864	0,618
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,868	0,867	0,429	0,899	0,899	0,899	0,899	0,899	0,950	0,761	0,759	0,725	0,823	0,821	0,245	0,818	0,816	0,428	0,815	0,815	0,716	0,719	0,721	0,736	0,812	0,800	0,027	0,811	0,798	0,040	0,808	0,798	0,069	0,733	0,735	0,676
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,936	0,935	0,532	0,935	0,933	0,334							0,915	0,910	0,284	0,911	0,909	0,709							0,911	0,900	0,075	0,910	0,898	0,053			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,915	0,914	0,792	0,914	0,913	0,744							0,868	0,867	0,753	0,867	0,867	0,860							0,872	0,863	0,092	0,870	0,863	0,173			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,896	0,895	0,495	0,894	0,895	0,888	0,787	0,784	0,573				0,816	0,810	0,033	0,813	0,806	0,023	0,725	0,728	0,459				0,823	0,806	0,027	0,822	0,805	0,022	0,733	0,736	0,245
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,896	0,893	0,170	0,894	0,892	0,389	0,785	0,780	0,294				0,812	0,803	0,025	0,809	0,800	0,030	0,726	0,729	0,495				0,822	0,804	0,019	0,820	0,800	0,010	0,739	0,737	0,606
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN										0,786	0,784	0,783										0,727	0,727	0,844										0,735	0,737	0,421
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN										0,781	0,781	0,866										0,728	0,726	0,714										0,736	0,735	0,675
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes net international investment position (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EU countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table E.3 **Econometric results for the EU28, Real effective exchange rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,876	0,872	0,607	0,897	0,893	0,455	0,896	0,893	0,442	0,761	0,761	0,821	0,824	0,772	0,015	0,823	0,774	0,040	0,820	0,774	0,047	0,692	0,689	0,653	0,856	0,751	0,001	0,860	0,758	0,002	0,857	0,756	0,003	0,798	0,766	0,204
2013	Pooled	OUT	0,766	0,775	0,287	0,827	0,843	0,029	0,822	0,838	0,021	0,697	0,697	1,000	0,668	0,661	0,836	0,653	0,671	0,683	0,652	0,659	0,862	0,562	0,585	0,036	0,652	0,628	0,524	0,641	0,617	0,576	0,640	0,620	0,665	0,535	0,576	0,162
2013	Pooled	ONE	0,767	0,794	0,379	0,822	0,878	0,025	0,817	0,861	0,130	0,464	0,464	1,000	0,711	0,783	0,349	0,656	0,778	0,200	0,644	0,772	0,173	0,578	0,564	0,440	0,756	0,772	0,822	0,717	0,761	0,523	0,711	0,767	0,496	0,578	0,583	0,922
2013	Fixed effect	IN	0,932	0,930	0,781	0,672	0,697	0,002				0,896	0,894	0,752	0,914	0,901	0,053	0,790	0,687	0,000				0,855	0,855	1,000	0,935	0,896	0,003	0,611	0,517	0,000				0,917	0,886	0,046
2013	Fixed effect	OUT	0,706	0,712	0,489	0,654	0,670	0,496				0,734	0,723	0,291	0,695	0,653	0,006	0,665	0,556	0,003				0,626	0,632	0,191	0,728	0,654	0,082	0,585	0,356	0,000				0,539	0,581	0,122
2013	Fixed effect	ONE	0,867	0,878	0,532	0,583	0,583	1,000				0,789	0,789	1,000	0,889	0,894	0,889	0,606	0,606	1,000				0,694	0,700	0,797	0,889	0,867	0,738	0,606	0,483	0,180				0,644	0,683	0,593
2013	Random effect	IN	0,850	0,844	0,058	0,890	0,888	0,136	0,887	0,887		0,724	0,712	0,158	0,816	0,759	0,006	0,818	0,765	0,022	0,819	0,766	0,020	0,679	0,673	0,394	0,856	0,751	0,001	0,856	0,751	0,002	0,855	0,752	0,003	0,793	0,757	0,196
2013	Random effect	OUT	0,740	0,743	0,275	0,820	0,823	0,393	0,816	0,817	0,480	0,733	0,688	0,004	0,683	0,656	0,375	0,660	0,660	0,987	0,650	0,648	0,955	0,630	0,651	0,062	0,654	0,640	0,695	0,653	0,631	0,618	0,648	0,626	0,639	0,522	0,580	0,084
2013	Random effect	ONE	0,783	0,806	0,159	0,828	0,850	0,256	0,817	0,817		0,636	0,569	0,134	0,711	0,783	0,283	0,633	0,761	0,168	0,628	0,761	0,149	0,583	0,581	0,906	0,750	0,789	0,599	0,694	0,778	0,285	0,694	0,772	0,321	0,533	0,572	0,447
2013	Chamberlain's	IN				0,937	0,936	0,692	0,937	0,933	0,334							0,911	0,881	0,017	0,910	0,882	0,026							0,923	0,852	0,003	0,919	0,849	0,004			
2013	Chamberlain's	OUT				0,753	0,788	0,052	0,742	0,778	0,060							0,628	0,642	0,699	0,628	0,638	0,766							0,694	0,655	0,450	0,684	0,653	0,517			
2013	Chamberlain's	ONE				0,839	0,850	0,765	0,828	0,822	0,882							0,761	0,822	0,448	0,767	0,817	0,504							0,861	0,872	0,896	0,861	0,878	0,834			
2013	Dynamic	IN				0,900	0,900	1,000	0,900	0,900	0,883							0,859	0,821	0,054	0,859	0,819	0,034							0,881	0,803	0,003	0,880	0,800	0,002			
2013	Dynamic	OUT				0,847	0,851	0,249	0,846	0,849	0,493							0,811	0,787	0,420	0,814	0,782	0,253							0,793	0,843	0,076	0,789	0,840	0,071			
2013	Dynamic	ONE				0,882	0,876	0,480	0,889	0,882	0,480							0,802	0,864	0,317	0,802	0,864	0,304							0,839	0,911	0,172	0,839	0,917	0,121			
2013	Multinomial	IN				0,895	0,894	0,737	0,895	0,893	0,549	0,770	0,771	0,482				0,837	0,776	0,006	0,833	0,776	0,012	0,692	0,691	0,940				0,865	0,755	0,002	0,861	0,754	0,002	0,797	0,765	0,254
2013	Multinomial	OUT				0,811	0,842	0,030	0,811	0,837	0,030	0,707	0,695	0,072				0,543	0,547	0,921	0,538	0,553	0,762	0,572	0,606	0,015				0,655	0,650	0,891	0,654	0,646	0,864	0,507	0,574	0,054
2013	Multinomial	ONE				0,806	0,844	0,189	0,800	0,844	0,173	0,508	0,514	0,480				0,644	0,856	0,005	0,667	0,850	0,028	0,578	0,586	0,728				0,706	0,761	0,451	0,694	0,772	0,348	0,522	0,611	0,121
2013	Multinomial robustness	IN				0,897	0,893	0,334	0,894	0,891	0,449	0,770	0,767	0,295				0,840	0,789	0,021	0,839	0,790	0,031	0,694	0,694	0,993				0,865	0,750	0,001	0,858	0,747	0,002	0,795	0,765	0,305
2013	Multinomial robustness	OUT				0,804	0,829	0,008	0,791	0,814	0,006	0,663	0,661	0,719				0,535	0,548	0,757	0,528	0,532	0,921	0,565	0,597	0,025				0,676	0,682	0,909	0,669	0,676	0,888	0,504	0,578	0,035
2013	Multinomial robustness	ONE				0,778	0,828	0,167	0,739	0,806	0,060	0,481	0,464	0,323				0,689	0,872	0,008	0,667	0,839	0,009	0,589	0,586	0,900				0,717	0,750	0,625	0,717	0,750	0,675	0,517	0,594	0,199
2013	Multinomial probit	IN																						0,691	0,689	0,813										0,795	0,762	0,220
2013	Multinomial probit	OUT																						0,567	0,600	0,026										0,512	0,582	0,035
2013	Multinomial probit	ONE																						0,578	0,569	0,721										0,522	0,622	0,083
2013	Multinomial robustness, probit	IN																						0,691	0,692	0,943										0,791	0,766	0,375
2013	Multinomial robustness, probit	OUT																						0,560	0,592	0,082										0,509	0,578	0,043
2013	Multinomial robustness, probit	ONE																						0,594	0,558	0,095										0,522	0,578	0,404
2017	Pooled	IN	0,876	0,876	0,671	0,901	0,901	0,480	0,900	0,900	0,880	0,786	0,783	0,633	0,825	0,799	0,012	0,830	0,802	0,021	0,828	0,800	0,024	0,723	0,719	0,287	0,819	0,765	0,004	0,819	0,764	0,006	0,818	0,764	0,007	0,732	0,730	0,835
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,922	0,922	0,924	0,761	0,759	0,362				0,878	0,875	0,463	0,908	0,887	0,005	0,788	0,761	0,141				0,831	0,833	0,387	0,923	0,892	0,002	0,786	0,755	0,228				0,864	0,856	0,153
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,868	0,869	0,840	0,899	0,900	0,929	0,899	0,900	0,486	0,761	0,759	0,769	0,823	0,799	0,027	0,818	0,792	0,043	0,815	0,791	0,067	0,719	0,719	0,953	0,812	0,757	0,004	0,811	0,751	0,003	0,808	0,751	0,006	0,733	0,725	0,514
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,936	0,934	0,367	0,935	0,933	0,321							0,915	0,884	0,003	0,911	0,882	0,002							0,911	0,869	0,003	0,910	0,866	0,001			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,915	0,914	0,640	0,914	0,913	0,501							0,868	0,846	0,023	0,867	0,846	0,032							0,872	0,852	0,055	0,870	0,853	0,084			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,896	0,896	0,573	0,894	0,896	0,354	0,787	0,785	0,792				0,816	0,792	0,068	0,813	0,790	0,089	0,725	0,719	0,167				0,823	0,771	0,008	0,822	0,767	0,007	0,733	0,732	0,971
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,896	0,896	0,547	0,894	0,894	0,975	0,785	0,781	0,455				0,812	0,787	0,047	0,809	0,787	0,080	0,726	0,720	0,179				0,822	0,771	0,009	0,820	0,765	0,007	0,739	0,735	0,737
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN										0,786	0,784	0,772										0,727	0,725	0,435										0,735	0,731	0,712
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN										0,781	0,779	0,743										0,728	0,722	0,097										0,736	0,733	0,777
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes real effective exchange rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EU countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table E.4 **Econometric results for the EU28, Export market share**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,876	0,886	0,603	0,897	0,904	0,575	0,896	0,903	0,826	0,761	0,767	0,660	0,824	0,836	0,828	0,823	0,840	0,670	0,820	0,838	0,709	0,692	0,699	0,233	0,856	0,865	0,850	0,860	0,869	0,923	0,857	0,868	0,651	0,798	0,812	0,675
2013	Pooled	OUT	0,766	0,805	0,011	0,827	0,834	0,026	0,822	0,843	0,013	0,697	0,631	0,001	0,668	0,688	0,407	0,653	0,686	0,053	0,652	0,673	0,241	0,562	0,526	0,081	0,652	0,652	0,983	0,641	0,649	0,507	0,640	0,640	0,961	0,535	0,530	0,758
2013	Pooled	ONE	0,767	0,800	0,424	0,822	0,844	0,101	0,817	0,844	0,165	0,464	0,475	0,663	0,711	0,722	0,831	0,656	0,667	0,810	0,644	0,672	0,556	0,578	0,533	0,295	0,756	0,761	0,781	0,717	0,711	0,731	0,711	0,717	0,820	0,578	0,583	0,889
2013	Fixed effect	IN	0,932	0,935	0,607	0,672	0,672	0,186				0,896	0,899	0,672	0,914	0,916	0,098	0,790	0,787	0,197				0,855	0,864	0,485	0,935	0,934	0,099	0,611	0,666	0,000				0,917	0,914	0,185
2013	Fixed effect	OUT	0,706	0,709	0,519	0,654	0,627	0,203				0,734	0,710	0,028	0,695	0,700	0,720	0,665	0,628	0,065				0,626	0,648	0,131	0,728	0,767	0,192	0,585	0,617	0,026				0,539	0,590	0,009
2013	Fixed effect	ONE	0,867	0,878	0,530	0,583	0,561	0,547				0,789	0,794	0,781	0,889	0,906	0,179	0,606	0,567	0,265				0,694	0,722	0,363	0,889	0,922	0,554	0,606	0,644	0,206				0,644	0,689	0,311
2013	Random effect	IN	0,850	0,861	0,714	0,890	0,897	0,731	0,887	0,893	0,894	0,724	0,741	0,210	0,816	0,827	0,792	0,818	0,834	0,808	0,819	0,834	0,932	0,679	0,694	0,954	0,856	0,863	0,584	0,856	0,867	0,549	0,855	0,866	0,641	0,793	0,809	0,880
2013	Random effect	OUT	0,740	0,774	0,011	0,820	0,832	0,029	0,816	0,829	0,030	0,733	0,650	0,001	0,683	0,700	0,442	0,660	0,690	0,062	0,650	0,678	0,104	0,630	0,581	0,051	0,654	0,667	0,367	0,653	0,656	0,844	0,648	0,651	0,791	0,522	0,527	0,726
2013	Random effect	ONE	0,783	0,817	0,365	0,828	0,856	0,260	0,817	0,839	0,330	0,636	0,481	0,043	0,711	0,767	0,224	0,633	0,661	0,522	0,628	0,656	0,572	0,583	0,567	0,755	0,750	0,772	0,298	0,694	0,728	0,202	0,694	0,711	0,417	0,533	0,561	0,231
2013	Chamberlain's	IN				0,937	0,950	0,184	0,937	0,950	0,128							0,911	0,920	0,916	0,910	0,919	0,885							0,923	0,925	0,519	0,919	0,920	0,446			
2013	Chamberlain's	OUT				0,753	0,705	0,022	0,742	0,702	0,042							0,628	0,623	0,832	0,628	0,624	0,873							0,694	0,689	0,887	0,684	0,685	0,984			
2013	Chamberlain's	ONE				0,839	0,756	0,083	0,828	0,761	0,108							0,761	0,728	0,606	0,767	0,739	0,669							0,861	0,811	0,400	0,861	0,828	0,580			
2013	Dynamic	IN				0,900	0,907	0,934	0,900	0,906	0,908							0,859	0,869	0,848	0,859	0,868	0,741							0,881	0,891	0,821	0,880	0,889	0,937			
2013	Dynamic	OUT				0,847	0,866	0,017	0,846	0,868	0,024							0,811	0,841	0,004	0,814	0,836	0,049							0,793	0,812	0,027	0,789	0,808	0,022			
2013	Dynamic	ONE				0,882	0,908	0,251	0,889	0,895	0,820							0,802	0,846	0,111	0,802	0,852	0,112							0,839	0,856	0,264	0,839	0,844	0,479			
2013	Multinomial	IN				0,895	0,903	0,360	0,895	0,902	0,623	0,770	0,775	0,953				0,837	0,842	0,526	0,833	0,843	0,750	0,692	0,697	0,154				0,865	0,872	0,773	0,861	0,871	0,810	0,797	0,811	0,546
2013	Multinomial	OUT				0,811	0,810	0,959	0,811	0,825	0,172	0,707	0,651	0,011				0,543	0,636	0,000	0,538	0,621	0,001	0,572	0,534	0,069				0,655	0,673	0,164	0,654	0,666	0,431	0,507	0,496	0,270
2013	Multinomial	ONE				0,806	0,806	1,000	0,800	0,811	0,532	0,508	0,503	0,883				0,644	0,694	0,220	0,667	0,728	0,274	0,578	0,539	0,443				0,706	0,711	0,731	0,694	0,711	0,415	0,522	0,511	0,724
2013	Multinomial robustness	IN				0,897	0,902	1,000	0,894	0,903	0,204	0,770	0,773	0,601				0,840	0,853	0,976	0,839	0,855	0,769	0,694	0,697	0,117				0,865	0,876	0,585	0,858	0,870	0,599	0,795	0,810	0,581
2013	Multinomial robustness	OUT				0,804	0,814	0,029	0,791	0,819	0,004	0,663	0,595	0,003				0,535	0,630	0,000	0,528	0,608	0,000	0,565	0,534	0,144				0,676	0,686	0,388	0,669	0,675	0,687	0,504	0,491	0,161
2013	Multinomial robustness	ONE				0,778	0,794	0,264	0,739	0,794	0,042	0,481	0,464	0,652				0,689	0,783	0,039	0,667	0,772	0,057	0,589	0,567	0,567				0,717	0,694	0,159	0,717	0,700	0,561	0,517	0,506	0,704
2013	Multinomial probit	IN																						0,691	0,695	0,121										0,795	0,805	0,235
2013	Multinomial probit	OUT																						0,567	0,532	0,112										0,512	0,492	0,082
2013	Multinomial probit	ONE																						0,578	0,539	0,395										0,522	0,506	0,666
2013	Multinomial robustness, probit	IN																						0,691	0,693	0,097										0,791	0,803	0,361
2013	Multinomial robustness, probit	OUT																						0,560	0,517	0,051										0,509	0,488	0,061
2013	Multinomial robustness, probit	ONE																						0,594	0,544	0,245										0,522	0,489	0,338
2017	Pooled	IN	0,876	0,878	0,074	0,901	0,897	0,057	0,900	0,897	0,057	0,786	0,761	0,056	0,825	0,834	0,556	0,830	0,839	0,207	0,828	0,838	0,408	0,723	0,725	0,664	0,819	0,823	0,583	0,819	0,824	0,796	0,818	0,825	0,916	0,732	0,738	0,629
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,922	0,922	0,359	0,761	0,748	0,013				0,878	0,868	0,128	0,908	0,912	0,487	0,788	0,791	0,184				0,831	0,836	0,481	0,923	0,928	0,596	0,786	0,786	0,364				0,864	0,866	0,316
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,868	0,872	0,568	0,899	0,894	0,038	0,899	0,896	0,062	0,761	0,741	0,184	0,823	0,833	0,174	0,818	0,829	0,158	0,815	0,827	0,126	0,719	0,718	0,676	0,812	0,819	0,770	0,811	0,815	0,335	0,808	0,813	0,554	0,733	0,733	0,311
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,936	0,934	0,300	0,935	0,933	0,268							0,915	0,920	0,851	0,911	0,917	0,760							0,911	0,916	1,000	0,910	0,916	0,944			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,915	0,915	0,205	0,914	0,916	0,388							0,868	0,874	0,410	0,867	0,873	0,341							0,872	0,875	0,432	0,870	0,876	0,891			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,896	0,891	0,027	0,894	0,893	0,068	0,787	0,763	0,078				0,816	0,827	0,529	0,813	0,825	0,571	0,725	0,724	0,495				0,823	0,829	0,652	0,822	0,829	0,766	0,733	0,738	0,577
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,896	0,893	0,027	0,894	0,893	0,031	0,785	0,763	0,075				0,812	0,824	0,536	0,809	0,822	0,389	0,726	0,726	0,495				0,822	0,826	0,826	0,820	0,824	0,909	0,739	0,744	0,595
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN										0,786	0,764	0,088										0,727	0,724	0,348										0,735	0,736	0,371
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN										0,781	0,763	0,138										0,728	0,725	0,341										0,736	0,740	0,526
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes export market share (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EU countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table E.5 **Econometric results for the EU28, Nominal unit labour cost**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,876	0,858	0,110	0,897	0,886	0,213	0,896	0,885	0,186	0,761	0,756	0,581	0,824	0,813	0,273	0,823	0,813	0,347	0,820	0,813	0,476	0,692	0,692	0,855	0,856	0,845	0,420	0,860	0,847	0,321	0,857	0,845	0,340	0,798	0,791	0,569
2013	Pooled	OUT	0,766	0,775	0,571	0,827	0,857	0,090	0,822	0,855	0,047	0,697	0,731	0,098	0,668	0,615	0,011	0,653	0,605	0,002	0,652	0,608	0,003	0,562	0,562	0,895	0,652	0,610	0,012	0,641	0,594	0,016	0,640	0,591	0,011	0,535	0,516	0,230
2013	Pooled	ONE	0,767	0,778	0,739	0,822	0,861	0,158	0,817	0,844	0,260	0,464	0,525	0,262	0,711	0,667	0,146	0,656	0,617	0,137	0,644	0,611	0,262	0,578	0,581	0,480	0,756	0,739	0,591	0,717	0,711	0,879	0,711	0,683	0,507	0,578	0,508	0,071
2013	Fixed effect	IN	0,932	0,934	0,235	0,672	0,689	0,150				0,896	0,896	0,974	0,914	0,914	1,000	0,790	0,745	0,062				0,855	0,857	0,834	0,935	0,930	0,223	0,611	0,609	0,298				0,917	0,917	0,945
2013	Fixed effect	OUT	0,706	0,699	0,327	0,654	0,668	0,518				0,734	0,735	0,648	0,695	0,695	0,833	0,665	0,663	0,940				0,626	0,631	0,491	0,728	0,706	0,025	0,585	0,583	0,551				0,539	0,543	0,123
2013	Fixed effect	ONE	0,867	0,867	1,000	0,583	0,667	0,106				0,789	0,800	0,410	0,889	0,889	1,000	0,606	0,539	0,229				0,694	0,717	0,464	0,889	0,889	1,000	0,606	0,594	0,296				0,644	0,650	0,781
2013	Random effect	IN	0,850	0,838	0,183	0,890	0,881	0,249	0,887	0,878	0,299	0,724	0,716	0,158	0,816	0,811	0,599	0,818	0,812	0,501	0,819	0,810	0,293	0,679	0,673	0,464	0,856	0,845	0,418	0,856	0,846	0,461	0,855	0,844	0,366	0,793	0,780	0,059
2013	Random effect	OUT	0,740	0,754	0,366	0,820	0,834	0,460	0,816	0,833	0,331	0,733	0,728	0,571	0,683	0,636	0,016	0,660	0,621	0,006	0,650	0,616	0,008	0,630	0,634	0,748	0,654	0,610	0,010	0,653	0,609	0,036	0,648	0,602	0,023	0,522	0,508	0,079
2013	Random effect	ONE	0,783	0,817	0,350	0,828	0,872	0,297	0,817	0,861	0,313	0,636	0,647	0,626	0,711	0,700	0,746	0,633	0,639	0,731	0,628	0,606	0,213	0,583	0,608	0,536	0,750	0,739	0,704	0,694	0,700	0,896	0,694	0,683	0,789	0,533	0,492	0,052
2013	Chamberlain's	IN				0,937	0,937	0,827	0,937	0,938	0,690							0,911	0,904	0,336	0,910	0,903	0,345							0,923	0,912	0,234	0,919	0,912	0,399			
2013	Chamberlain's	OUT				0,753	0,747	0,368	0,742	0,741	0,882							0,628	0,663	0,036	0,628	0,662	0,034							0,694	0,668	0,001	0,684	0,664	0,000			
2013	Chamberlain's	ONE				0,839	0,833	0,795	0,828	0,822	0,758							0,761	0,778	0,779	0,767	0,767	1,000							0,861	0,833	0,092	0,861	0,833	0,131			
2013	Dynamic	IN				0,900	0,895	0,444	0,900	0,900	0,982							0,859	0,859	0,968	0,859	0,858	0,755							0,881	0,869	0,319	0,880	0,868	0,258			
2013	Dynamic	OUT				0,847	0,868	0,082	0,846	0,866	0,063							0,811	0,800	0,050	0,814	0,809	0,136							0,793	0,782	0,464	0,789	0,776	0,352			
2013	Dynamic	ONE				0,882	0,908	0,209	0,889	0,902	0,409							0,802	0,796	0,780	0,802	0,802	1,000							0,839	0,856	0,417	0,839	0,822	0,544			
2013	Multinomial	IN				0,895	0,877	0,069	0,895	0,879	0,087	0,770	0,764	0,411				0,837	0,823	0,253	0,833	0,821	0,250	0,692	0,692	0,836				0,865	0,849	0,211	0,861	0,845	0,136	0,797	0,793	0,609
2013	Multinomial	OUT				0,811	0,825	0,446	0,811	0,827	0,327	0,707	0,695	0,207				0,543	0,506	0,003	0,538	0,507	0,007	0,572	0,574	0,545				0,655	0,616	0,085	0,654	0,616	0,052	0,507	0,501	0,603
2013	Multinomial	ONE				0,806	0,811	0,845	0,800	0,817	0,578	0,508	0,492	0,417				0,644	0,611	0,428	0,667	0,617	0,307	0,578	0,581	0,869				0,706	0,700	0,906	0,694	0,678	0,674	0,522	0,503	0,459
2013	Multinomial robustness	IN				0,897	0,875	0,060	0,894	0,877	0,103	0,770	0,760	0,178				0,840	0,822	0,243	0,839	0,821	0,233	0,694	0,687	0,184				0,865	0,845	0,093	0,858	0,839	0,095	0,795	0,791	0,698
2013	Multinomial robustness	OUT				0,804	0,802	0,915	0,791	0,789	0,929	0,663	0,658	0,625				0,535	0,467	0,000	0,528	0,481	0,002	0,565	0,559	0,420				0,676	0,621	0,013	0,669	0,619	0,012	0,504	0,500	0,681
2013	Multinomial robustness	ONE				0,778	0,756	0,578	0,739	0,733	0,902	0,481	0,475	0,691				0,689	0,594	0,020	0,667	0,578	0,010	0,589	0,586	0,837				0,717	0,678	0,522	0,717	0,689	0,580	0,517	0,497	0,460
2013	Multinomial probit	IN																						0,691	0,688	0,311										0,795	0,789	0,482
2013	Multinomial probit	OUT																						0,567	0,567	0,915										0,512	0,499	0,264
2013	Multinomial probit	ONE																						0,578	0,575	0,480										0,522	0,481	0,281
2013	Multinomial robustness, probit	IN																						0,691	0,686	0,256										0,791	0,785	0,508
2013	Multinomial robustness, probit	OUT																						0,560	0,554	0,386										0,509	0,496	0,269
2013	Multinomial robustness, probit	ONE																						0,594	0,586	0,326										0,522	0,481	0,291
2017	Pooled	IN	0,876	0,869	0,225	0,901	0,897	0,487	0,900	0,896	0,419	0,786	0,786	0,954	0,825	0,805	0,076	0,830	0,808	0,062	0,828	0,804	0,031	0,723	0,723	0,761	0,819	0,792	0,084	0,819	0,792	0,078	0,818	0,791	0,061	0,732	0,728	0,705
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,922	0,918	0,175	0,761	0,773	0,068				0,878	0,879	0,704	0,908	0,908	1,000	0,788	0,791	0,285				0,831	0,831	0,742	0,923	0,918	0,371	0,786	0,793	0,571				0,864	0,865	0,660
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,868	0,859	0,143	0,899	0,896	0,456	0,899	0,896	0,540	0,761	0,763	0,287	0,823	0,805	0,057	0,818	0,800	0,007	0,815	0,798	0,007	0,719	0,718	0,748	0,812	0,784	0,029	0,811	0,778	0,005	0,808	0,775	0,004	0,733	0,728	0,496
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,936	0,933	0,333	0,935	0,932	0,214							0,915	0,908	0,159	0,911	0,905	0,200							0,911	0,898	0,082	0,910	0,896	0,049			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,915	0,914	0,743	0,914	0,913	0,715							0,868	0,860	0,147	0,867	0,859	0,099							0,872	0,861	0,240	0,870	0,861	0,286			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,896	0,891	0,306	0,894	0,890	0,346	0,787	0,792	0,012				0,816	0,797	0,157	0,813	0,792	0,109	0,725	0,727	0,269				0,823	0,796	0,085	0,822	0,794	0,059	0,733	0,732	0,950
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,896	0,890	0,270	0,894	0,889	0,346	0,785	0,790	0,051				0,812	0,788	0,080	0,809	0,788	0,090	0,726	0,727	0,388				0,822	0,794	0,084	0,820	0,788	0,046	0,739	0,735	0,704
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN										0,786	0,789	0,046										0,727	0,725	0,491										0,735	0,730	0,584
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN										0,781	0,789	0,008										0,728	0,726	0,387										0,736	0,734	0,844
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes nominal unit labour cost (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EU countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table E.6 **Econometric results for the EU28, House prices**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,876	0,833	0,001	0,897	0,845	0,003	0,896	0,845	0,003	0,761	0,739	0,036	0,824	0,819	0,071	0,823	0,827	0,123	0,820	0,827	0,187	0,692	0,689	0,097	0,856	0,839	0,069	0,860	0,853	0,187	0,857	0,849	0,251	0,798	0,806	0,747
2013	Pooled	OUT	0,766	0,741	0,252	0,827	0,730	0,011	0,822	0,733	0,016	0,697	0,674	0,583	0,668	0,681	0,477	0,653	0,636	0,421	0,652	0,629	0,259	0,562	0,483	0,008	0,652	0,622	0,434	0,641	0,615	0,212	0,640	0,611	0,205	0,535	0,527	0,502
2013	Pooled	ONE	0,767	0,783	0,803	0,822	0,750	0,433	0,817	0,761	0,547	0,464	0,586	0,061	0,711	0,700	0,807	0,656	0,661	0,837	0,644	0,639	0,819	0,578	0,550	0,608	0,756	0,756	1,000	0,717	0,722	0,900	0,711	0,728	0,740	0,578	0,550	0,165
2013	Fixed effect	IN	0,932	0,924	0,064	0,672	0,782	0,025				0,896	0,882	0,261	0,914	0,916	0,074	0,790	0,822	0,578				0,855	0,851	0,249	0,935	0,919	0,111	0,611	0,632	0,610				0,917	0,909	0,152
2013	Fixed effect	OUT	0,706	0,697	0,559	0,654	0,569	0,116				0,734	0,742	0,584	0,695	0,671	0,091	0,665	0,615	0,079				0,626	0,655	0,117	0,728	0,644	0,034	0,585	0,540	0,116				0,539	0,565	0,314
2013	Fixed effect	ONE	0,867	0,889	0,296	0,583	0,539	0,672				0,789	0,839	0,061	0,889	0,861	0,308	0,606	0,583	0,674				0,694	0,756	0,277	0,889	0,839	0,431	0,606	0,622	0,785				0,644	0,594	0,527
2013	Random effect	IN	0,850	0,822	0,009	0,890	0,844	0,009	0,887	0,845	0,015	0,724	0,721	0,179	0,816	0,814	0,080	0,818	0,826	0,201	0,819	0,826	0,168	0,679	0,688	0,145	0,856	0,833	0,038	0,856	0,850	0,232	0,855	0,847	0,234	0,793	0,802	0,689
2013	Random effect	OUT	0,740	0,732	0,621	0,820	0,726	0,011	0,816	0,731	0,015	0,733	0,742	0,785	0,683	0,682	0,953	0,660	0,632	0,172	0,650	0,628	0,278	0,630	0,562	0,030	0,654	0,638	0,700	0,653	0,617	0,108	0,648	0,614	0,187	0,522	0,530	0,492
2013	Random effect	ONE	0,783	0,789	0,912	0,828	0,767	0,496	0,817	0,778	0,678	0,636	0,708	0,321	0,711	0,733	0,549	0,633	0,661	0,258	0,628	0,639	0,677	0,583	0,622	0,352	0,750	0,783	0,493	0,694	0,711	0,773	0,694	0,717	0,693	0,533	0,522	0,623
2013	Chamberlain's	IN				0,937	0,925	0,039	0,937	0,924	0,028							0,911	0,919	0,604	0,910	0,917	0,520							0,923	0,896	0,013	0,919	0,893	0,017			
2013	Chamberlain's	OUT				0,753	0,689	0,055	0,742	0,688	0,109							0,628	0,625	0,860	0,628	0,627	0,973							0,694	0,664	0,578	0,684	0,666	0,712			
2013	Chamberlain's	ONE				0,839	0,833	0,926	0,828	0,833	0,934							0,761	0,767	0,915	0,767	0,767	1,000							0,861	0,878	0,853	0,861	0,889	0,750			
2013	Dynamic	IN				0,900	0,877	0,068	0,900	0,880	0,078							0,859	0,871	0,231	0,859	0,871	0,233							0,881	0,868	0,113	0,880	0,862	0,065			
2013	Dynamic	OUT				0,847	0,796	0,060	0,846	0,794	0,041							0,811	0,814	0,685	0,814	0,815	0,822							0,793	0,788	0,825	0,789	0,801	0,591			
2013	Dynamic	ONE				0,882	0,876	0,917	0,889	0,869	0,707							0,802	0,809	0,733	0,802	0,815	0,294							0,839	0,861	0,628	0,839	0,861	0,628			
2013	Multinomial	IN				0,895	0,853	0,011	0,895	0,851	0,008	0,770	0,747	0,050				0,837	0,839	0,262	0,833	0,839	0,331	0,692	0,692	0,105				0,865	0,858	0,281	0,861	0,854	0,296	0,797	0,805	0,314
2013	Multinomial	OUT				0,811	0,636	0,001	0,811	0,645	0,001	0,707	0,642	0,132				0,543	0,636	0,010	0,538	0,616	0,012	0,572	0,473	0,000				0,655	0,643	0,588	0,654	0,644	0,675	0,507	0,505	0,847
2013	Multinomial	ONE				0,806	0,772	0,694	0,800	0,789	0,897	0,508	0,597	0,237				0,644	0,667	0,692	0,667	0,656	0,747	0,578	0,533	0,442				0,706	0,750	0,463	0,694	0,744	0,412	0,522	0,511	0,678
2013	Multinomial robustness	IN				0,897	0,850	0,005	0,894	0,849	0,007	0,770	0,742	0,036				0,840	0,841	0,229	0,839	0,837	0,194	0,694	0,696	0,119				0,865	0,868	0,675	0,858	0,860	0,728	0,795	0,804	0,405
2013	Multinomial robustness	OUT				0,804	0,608	0,000	0,791	0,609	0,001	0,663	0,576	0,071				0,535	0,608	0,020	0,528	0,603	0,028	0,565	0,490	0,004				0,676	0,668	0,723	0,669	0,667	0,929	0,504	0,501	0,725
2013	Multinomial robustness	ONE				0,778	0,706	0,549	0,739	0,711	0,827	0,481	0,592	0,181				0,689	0,683	0,924	0,667	0,667	1,000	0,589	0,572	0,754				0,717	0,783	0,326	0,717	0,756	0,571	0,517	0,506	0,678
2013	Multinomial probit	IN																						0,691	0,687	0,059										0,795	0,804	0,410
2013	Multinomial probit	OUT																						0,567	0,470	0,000										0,512	0,504	0,441
2013	Multinomial probit	ONE																						0,578	0,522	0,343										0,522	0,511	0,731
2013	Multinomial robustness, probit	IN																						0,691	0,686	0,060										0,791	0,803	0,586
2013	Multinomial robustness, probit	OUT																						0,560	0,475	0,001										0,509	0,501	0,450
2013	Multinomial robustness, probit	ONE																						0,594	0,544	0,405										0,522	0,506	0,613
2017	Pooled	IN	0,876	0,837	0,000	0,901	0,841	0,000	0,900	0,841	0,000	0,786	0,766	0,009	0,825	0,816	0,010	0,830	0,823	0,028	0,828	0,822	0,030	0,723	0,714	0,074	0,819	0,804	0,147	0,819	0,809	0,140	0,818	0,809	0,156	0,732	0,742	0,635
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,922	0,908	0,006	0,761	0,799	0,434				0,878	0,867	0,083	0,908	0,900	0,007	0,788	0,799	0,257				0,831	0,831	0,211	0,923	0,910	0,246	0,786	0,780	0,305				0,864	0,864	0,369
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,868	0,832	0,000	0,899	0,834	0,000	0,899	0,836	0,000	0,761	0,740	0,002	0,823	0,814	0,006	0,818	0,815	0,019	0,815	0,814	0,027	0,719	0,711	0,083	0,812	0,793	0,073	0,811	0,791	0,008	0,808	0,789	0,016	0,733	0,737	0,159
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,936	0,915	0,002	0,935	0,913	0,001							0,915	0,910	0,092	0,911	0,908	0,122							0,911	0,900	0,349	0,910	0,897	0,269			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,915	0,883	0,004	0,914	0,884	0,003							0,868	0,873	0,518	0,867	0,873	0,596							0,872	0,866	0,380	0,870	0,866	0,447			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,896	0,837	0,000	0,894	0,837	0,000	0,787	0,771	0,029				0,816	0,822	0,314	0,813	0,821	0,389	0,725	0,715	0,076				0,823	0,816	0,254	0,822	0,814	0,221	0,733	0,745	0,761
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,896	0,835	0,000	0,894	0,835	0,000	0,785	0,767	0,020				0,812	0,815	0,174	0,809	0,814	0,210	0,726	0,716	0,071				0,822	0,823	0,701	0,820	0,817	0,517	0,739	0,749	0,590
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN										0,786	0,772	0,044										0,727	0,715	0,060										0,735	0,743	0,450
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN										0,781	0,767	0,034										0,728	0,715	0,053										0,736	0,746	0,544
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes house price index (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EU countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table E.7 **Econometric results for the EU28, Private sector debt**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,876	0,879	0,767	0,897	0,895	0,662	0,896	0,893	0,580	0,761	0,762	0,762	0,824	0,823	0,925	0,823	0,821	0,733	0,820	0,819	0,850	0,692	0,687	0,648	0,856	0,856	1,000	0,860	0,858	0,426	0,857	0,857	0,821	0,798	0,784	0,384
2013	Pooled	OUT	0,766	0,774	0,835	0,827	0,822	0,782	0,822	0,819	0,883	0,697	0,722	0,023	0,668	0,636	0,350	0,653	0,637	0,380	0,652	0,630	0,240	0,562	0,551	0,510	0,652	0,643	0,533	0,641	0,638	0,690	0,640	0,631	0,168	0,535	0,513	0,344
2013	Pooled	ONE	0,767	0,739	0,703	0,822	0,817	0,901	0,817	0,800	0,741	0,464	0,475	0,692	0,711	0,644	0,148	0,656	0,628	0,410	0,644	0,622	0,463	0,578	0,583	0,873	0,756	0,733	0,409	0,717	0,706	0,480	0,711	0,683	0,092	0,578	0,544	0,584
2013	Fixed effect	IN	0,932	0,925	0,135	0,672	0,650	0,058				0,896	0,897	0,556	0,914	0,901	0,066	0,790	0,770	0,469				0,855	0,848	0,450	0,935	0,935	1,000	0,611	0,605	0,762				0,917	0,910	0,303
2013	Fixed effect	OUT	0,706	0,712	0,571	0,654	0,688	0,050				0,734	0,734		0,695	0,691	0,834	0,665	0,693	0,364				0,626	0,660	0,052	0,728	0,725	0,580	0,585	0,557	0,360				0,539	0,546	0,681
2013	Fixed effect	ONE	0,867	0,850	0,419	0,583	0,594	0,714				0,789	0,789		0,889	0,878	0,569	0,606	0,522	0,340				0,694	0,767	0,142	0,889	0,872	0,417	0,606	0,583	0,772				0,644	0,589	0,246
2013	Random effect	IN	0,850	0,858	0,702	0,890	0,888	0,743	0,887	0,882	0,551	0,724	0,726	0,685	0,816	0,821	0,694	0,818	0,817	0,858	0,819	0,815	0,627	0,679	0,676	0,827	0,856	0,854	0,732	0,856	0,856	1,000	0,855	0,855	0,890	0,793	0,785	0,682
2013	Random effect	OUT	0,740	0,741	0,983	0,820	0,813	0,764	0,816	0,812	0,862	0,733	0,742	0,284	0,683	0,643	0,313	0,660	0,636	0,284	0,650	0,626	0,263	0,630	0,632	0,918	0,654	0,662	0,635	0,653	0,644	0,141	0,648	0,642	0,307	0,522	0,532	0,647
2013	Random effect	ONE	0,783	0,728	0,565	0,828	0,811	0,706	0,817	0,806	0,820	0,636	0,608	0,165	0,711	0,683	0,616	0,633	0,622	0,775	0,628	0,606	0,531	0,583	0,633	0,262	0,750	0,750	1,000	0,694	0,689	0,622	0,694	0,683	0,296	0,533	0,528	0,914
2013	Chamberlain's	IN				0,937	0,930	0,339	0,937	0,930	0,338							0,911	0,884	0,072	0,910	0,881	0,048							0,923	0,911	0,228	0,919	0,906	0,204			
2013	Chamberlain's	OUT				0,753	0,745	0,748	0,742	0,729	0,590							0,628	0,661	0,204	0,628	0,660	0,212							0,694	0,691	0,879	0,684	0,687	0,892			
2013	Chamberlain's	ONE				0,839	0,789	0,198	0,828	0,756	0,100							0,761	0,650	0,145	0,767	0,656	0,145							0,861	0,794	0,166	0,861	0,806	0,289			
2013	Dynamic	IN				0,900	0,898	0,682	0,900	0,897	0,672							0,859	0,860	0,872	0,859	0,860	0,873							0,881	0,881	0,313	0,880	0,880	0,733			
2013	Dynamic	OUT				0,847	0,858	0,621	0,846	0,859	0,539							0,811	0,803	0,477	0,814	0,807	0,594							0,793	0,793	0,565	0,789	0,785	0,088			
2013	Dynamic	ONE				0,882	0,895	0,752	0,889	0,876	0,764							0,802	0,802	1,000	0,802	0,796	0,811							0,839	0,833	0,480	0,839	0,839				
2013	Multinomial	IN				0,895	0,890	0,452	0,895	0,891	0,597	0,770	0,772	0,718				0,837	0,819	0,042	0,833	0,815	0,045	0,692	0,687	0,664				0,865	0,860	0,256	0,861	0,857	0,416	0,797	0,785	0,429
2013	Multinomial	OUT				0,811	0,794	0,615	0,811	0,799	0,730	0,707	0,723	0,249				0,543	0,573	0,422	0,538	0,557	0,620	0,572	0,552	0,207				0,655	0,647	0,463	0,654	0,640	0,216	0,507	0,482	0,184
2013	Multinomial	ONE				0,806	0,783	0,518	0,800	0,794	0,879	0,508	0,519	0,664				0,644	0,544	0,064	0,667	0,539	0,075	0,578	0,594	0,624				0,706	0,694	0,646	0,694	0,683	0,296	0,522	0,489	0,528
2013	Multinomial robustness	IN				0,897	0,889	0,348	0,894	0,891	0,710	0,770	0,765	0,480				0,840	0,813	0,057	0,839	0,810	0,044	0,694	0,691	0,753				0,865	0,861	0,425	0,858	0,855	0,613	0,795	0,780	0,315
2013	Multinomial robustness	OUT				0,804	0,804	1,000	0,791	0,796	0,888	0,663	0,663	0,987				0,535	0,534	0,973	0,528	0,536	0,847	0,565	0,550	0,332				0,676	0,653	0,191	0,669	0,640	0,104	0,504	0,475	0,116
2013	Multinomial robustness	ONE				0,778	0,778	1,000	0,739	0,783	0,451	0,481	0,481	1,000				0,689	0,533	0,100	0,667	0,539	0,139	0,589	0,578	0,783				0,717	0,694	0,332	0,717	0,683	0,204	0,517	0,467	0,364
2013	Multinomial probit	IN																						0,691	0,683	0,405										0,795	0,776	0,225
2013	Multinomial probit	OUT																						0,567	0,540	0,115										0,512	0,480	0,102
2013	Multinomial probit	ONE																						0,578	0,583	0,882										0,522	0,467	0,364
2013	Multinomial robustness, probit	IN																						0,691	0,689	0,792										0,791	0,776	0,343
2013	Multinomial robustness, probit	OUT																						0,560	0,538	0,220										0,509	0,480	0,160
2013	Multinomial robustness, probit	ONE																						0,594	0,583	0,745										0,522	0,472	0,363
2017	Pooled	IN	0,876	0,873	0,697	0,901	0,896	0,343	0,900	0,894	0,282	0,786	0,786	0,629	0,825	0,818	0,458	0,830	0,822	0,365	0,828	0,820	0,396	0,723	0,723	0,930	0,819	0,813	0,397	0,819	0,813	0,352	0,818	0,812	0,313	0,732	0,726	0,377
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,922	0,918	0,385	0,761	0,749	0,198				0,878	0,878	0,899	0,908	0,904	0,341	0,788	0,775	0,156				0,831	0,831	0,883	0,923	0,926	0,545	0,786	0,786	0,790				0,864	0,861	0,388
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,868	0,864	0,683	0,899	0,892	0,263	0,899	0,891	0,289	0,761	0,762	0,611	0,823	0,813	0,379	0,818	0,810	0,468	0,815	0,806	0,432	0,719	0,716	0,695	0,812	0,803	0,401	0,811	0,805	0,466	0,808	0,803	0,562	0,733	0,724	0,336
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,936	0,929	0,129	0,935	0,927	0,093							0,915	0,903	0,154	0,911	0,901	0,239							0,911	0,898	0,138	0,910	0,896	0,105			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,915	0,911	0,293	0,914	0,912	0,466							0,868	0,867	0,850	0,867	0,866	0,700							0,872	0,872	0,842	0,870	0,870	0,950			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,896	0,891	0,398	0,894	0,890	0,501	0,787	0,786	0,583				0,816	0,809	0,349	0,813	0,806	0,412	0,725	0,722	0,686				0,823	0,818	0,445	0,822	0,814	0,336	0,733	0,728	0,524
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,896	0,889	0,271	0,894	0,888	0,344	0,785	0,784	0,614				0,812	0,803	0,341	0,809	0,801	0,420	0,726	0,724	0,766				0,822	0,817	0,438	0,820	0,815	0,489	0,739	0,736	0,755
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN										0,786	0,787	0,612										0,727	0,723	0,489										0,735	0,730	0,519
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN										0,781	0,783	0,441										0,728	0,723	0,423										0,736	0,732	0,639
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes private sector debt (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EU countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table E.8 **Econometric results for the EU28, Private sector credit flow**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,876	0,874	0,756	0,897	0,893	0,379	0,896	0,892	0,359	0,761	0,754	0,612	0,824	0,824	0,684	0,823	0,823	0,422	0,820	0,820	0,214	0,692	0,691	0,683	0,856	0,857	0,884	0,860	0,860	0,739	0,857	0,858	0,489	0,798	0,807	0,373
2013	Pooled	OUT	0,766	0,785	0,032	0,827	0,829	0,850	0,822	0,830	0,466	0,697	0,771	0,002	0,668	0,670	0,140	0,653	0,652	0,240	0,652	0,651	0,211	0,562	0,566	0,207	0,652	0,648	0,210	0,641	0,636	0,103	0,640	0,634	0,065	0,535	0,529	0,427
2013	Pooled	ONE	0,767	0,772	0,838	0,822	0,850	0,384	0,817	0,833	0,627	0,464	0,553	0,029	0,711	0,711		0,656	0,650	0,480	0,644	0,644		0,578	0,572	0,480	0,756	0,761	0,733	0,717	0,728	0,410	0,711	0,711	1,000	0,578	0,572	0,819
2013	Fixed effect	IN	0,932	0,928	0,381	0,672	0,651	0,177				0,896	0,896	0,960	0,914	0,912	0,265	0,790	0,773	0,056				0,855	0,858	0,392	0,935	0,936	0,479	0,611	0,618	0,722				0,917	0,918	0,651
2013	Fixed effect	OUT	0,706	0,716	0,098	0,654	0,699	0,018				0,734	0,744	0,018	0,695	0,699	0,351	0,665	0,665	0,953				0,626	0,632	0,034	0,728	0,729	0,685	0,585	0,565	0,428				0,539	0,536	0,358
2013	Fixed effect	ONE	0,867	0,878	0,296	0,583	0,622	0,189				0,789	0,811	0,162	0,889	0,889		0,606	0,600	0,480				0,694	0,706	0,532	0,889	0,889		0,606	0,583	0,737				0,644	0,622	0,260
2013	Random effect	IN	0,850	0,849	0,843	0,890	0,890	0,862	0,887	0,885	0,715	0,724	0,709	0,222	0,816	0,816	0,660	0,818	0,819	0,324	0,819	0,820	0,194	0,679	0,678	0,621	0,856	0,856	0,928	0,856	0,856	0,900	0,855	0,856	0,595	0,793	0,792	0,865
2013	Random effect	OUT	0,740	0,757	0,080	0,820	0,828	0,570	0,816	0,823	0,635	0,733	0,770	0,016	0,683	0,690	0,033	0,660	0,660	0,565	0,650	0,653	0,141	0,630	0,637	0,029	0,654	0,684	0,002	0,653	0,649	0,126	0,648	0,648	0,807	0,522	0,515	0,231
2013	Random effect	ONE	0,783	0,778	0,837	0,828	0,839	0,715	0,817	0,828	0,755	0,636	0,675	0,264	0,711	0,711	1,000	0,633	0,633		0,628	0,628		0,583	0,583	1,000	0,750	0,767	0,326	0,694	0,706	0,296	0,694	0,700	0,480	0,533	0,533	1,000
2013	Chamberlain's	IN				0,937	0,935	0,663	0,937	0,933	0,534							0,911	0,908	0,709	0,910	0,907	0,650							0,923	0,900	0,094	0,919	0,898	0,132			
2013	Chamberlain's	OUT				0,753	0,757	0,849	0,742	0,746	0,829							0,628	0,647	0,062	0,628	0,647	0,038							0,694	0,700	0,721	0,684	0,694	0,597			
2013	Chamberlain's	ONE				0,839	0,817	0,409	0,828	0,794	0,312							0,761	0,700	0,076	0,767	0,706	0,084							0,861	0,861	1,000	0,861	0,856	0,904			
2013	Dynamic	IN				0,900	0,897	0,608	0,900	0,897	0,673							0,859	0,859	0,900	0,859	0,857	0,346							0,881	0,880	0,869	0,880	0,879	0,667			
2013	Dynamic	OUT				0,847	0,873	0,028	0,846	0,872	0,017							0,811	0,806	0,199	0,814	0,810	0,183							0,793	0,788	0,158	0,789	0,786	0,246			
2013	Dynamic	ONE				0,882	0,902	0,174	0,889	0,889	1,000							0,802	0,809	0,479	0,802	0,796	0,480							0,839	0,839		0,839	0,833	0,480			
2013	Multinomial	IN				0,895	0,893	0,659	0,895	0,891	0,391	0,770	0,771	0,950				0,837	0,835	0,118	0,833	0,833	0,846	0,692	0,688	0,338				0,865	0,865	0,813	0,861	0,861	0,908	0,797	0,800	0,697
2013	Multinomial	OUT				0,811	0,817	0,558	0,811	0,825	0,275	0,707	0,782	0,003				0,543	0,542	0,799	0,538	0,540	0,611	0,572	0,576	0,453				0,655	0,648	0,037	0,654	0,651	0,334	0,507	0,500	0,253
2013	Multinomial	ONE				0,806	0,822	0,606	0,800	0,811	0,625	0,508	0,581	0,099				0,644	0,644	1,000	0,667	0,656	0,410	0,578	0,589	0,410				0,706	0,717	0,296	0,694	0,706	0,410	0,522	0,533	0,477
2013	Multinomial robustness	IN				0,897	0,897	1,000	0,894	0,895	0,795	0,770	0,770	0,981				0,840	0,840	0,685	0,839	0,839	0,753	0,694	0,694	0,972				0,865	0,864	0,534	0,858	0,858	0,900	0,795	0,798	0,653
2013	Multinomial robustness	OUT				0,804	0,828	0,026	0,791	0,820	0,020	0,663	0,731	0,002				0,535	0,531	0,067	0,528	0,527	0,453	0,565	0,561	0,521				0,676	0,671	0,116	0,669	0,663	0,171	0,504	0,498	0,316
2013	Multinomial robustness	ONE				0,778	0,806	0,330	0,739	0,794	0,131	0,481	0,542	0,098				0,689	0,689		0,667	0,656	0,410	0,589	0,606	0,379				0,717	0,722	0,480	0,717	0,711	0,479	0,517	0,522	0,781
2013	Multinomial probit	IN																						0,691	0,687	0,261										0,795	0,794	0,832
2013	Multinomial probit	OUT																						0,567	0,569	0,498										0,512	0,500	0,029
2013	Multinomial probit	ONE																						0,578	0,578											0,522	0,500	0,213
2013	Multinomial robustness, probit	IN																						0,691	0,693	0,533										0,791	0,791	0,929
2013	Multinomial robustness, probit	OUT																						0,560	0,565	0,323										0,509	0,499	0,060
2013	Multinomial robustness, probit	ONE																						0,594	0,600	0,821										0,522	0,517	0,731
2017	Pooled	IN	0,876	0,873	0,269	0,901	0,898	0,260	0,900	0,896	0,244	0,786	0,784	0,451	0,825	0,823	0,355	0,830	0,827	0,225	0,828	0,826	0,465	0,723	0,721	0,773	0,819	0,816	0,353	0,819	0,816	0,418	0,818	0,816	0,419	0,732	0,731	0,877
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,922	0,920	0,542	0,761	0,765	0,692				0,878	0,879	0,683	0,908	0,908	1,000	0,788	0,787	0,245				0,831	0,831	0,990	0,923	0,923	0,716	0,786	0,783	0,242				0,864	0,864	0,849
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,868	0,868	0,833	0,899	0,897	0,264	0,899	0,896	0,311	0,761	0,760	0,790	0,823	0,821	0,538	0,818	0,816	0,255	0,815	0,812	0,032	0,719	0,720	0,826	0,812	0,808	0,131	0,811	0,806	0,021	0,808	0,805	0,122	0,733	0,730	0,670
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,936	0,934	0,345	0,935	0,932	0,334							0,915	0,915	0,861	0,911	0,911	0,890							0,911	0,905	0,254	0,910	0,903	0,152			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,915	0,914	0,322	0,914	0,912	0,340							0,868	0,862	0,197	0,867	0,861	0,224							0,872	0,869	0,175	0,870	0,870	0,873			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,896	0,893	0,407	0,894	0,892	0,472	0,787	0,784	0,363				0,816	0,814	0,360	0,813	0,811	0,448	0,725	0,725	0,958				0,823	0,821	0,464	0,822	0,818	0,299	0,733	0,731	0,837
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,896	0,893	0,328	0,894	0,891	0,382	0,785	0,783	0,581				0,812	0,812	0,778	0,809	0,809	0,963	0,726	0,724	0,775				0,822	0,820	0,437	0,820	0,817	0,266	0,739	0,740	0,834
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN										0,786	0,784	0,644										0,727	0,728	0,920										0,735	0,728	0,323
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN										0,781	0,782	0,935										0,728	0,726	0,729										0,736	0,734	0,739
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes private sector credit flow (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EU countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table E.9 **Econometric results for the EU28, General government gross debt**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,876	0,877	0,933	0,897	0,898	0,854	0,896	0,898	0,804	0,761	0,756	0,593	0,824	0,825	0,884	0,823	0,823	0,422	0,820	0,822	0,824	0,692	0,682	0,659	0,856	0,858	0,908	0,860	0,855	0,255	0,857	0,854	0,412	0,798	0,760	0,154
2013	Pooled	OUT	0,766	0,786	0,033	0,827	0,876	0,005	0,822	0,866	0,004	0,697	0,659	0,155	0,668	0,669	0,784	0,653	0,656	0,153	0,652	0,652	0,875	0,562	0,556	0,902	0,652	0,654	0,815	0,641	0,651	0,274	0,640	0,644	0,664	0,535	0,496	0,153
2013	Pooled	ONE	0,767	0,761	0,837	0,822	0,822	1,000	0,817	0,817	1,000	0,464	0,497	0,608	0,711	0,706	0,480	0,656	0,661	0,479	0,644	0,639	0,479	0,578	0,636	0,540	0,756	0,761	0,810	0,717	0,722	0,851	0,711	0,700	0,664	0,578	0,436	0,066
2013	Fixed effect	IN	0,932	0,927	0,436	0,672	0,683	0,440				0,896	0,886	0,171	0,914	0,915	1,000	0,790	0,805	0,026				0,855	0,859	0,667	0,935	0,932	0,522	0,611	0,656	0,000				0,917	0,918	0,765
2013	Fixed effect	OUT	0,706	0,754	0,019	0,654	0,719	0,002				0,734	0,735	0,965	0,695	0,740	0,034	0,665	0,667	0,813				0,626	0,619	0,658	0,728	0,756	0,085	0,585	0,647	0,000				0,539	0,542	0,358
2013	Fixed effect	ONE	0,867	0,856	0,567	0,583	0,628	0,171				0,789	0,717	0,105	0,889	0,917	0,408	0,606	0,611	0,837				0,694	0,656	0,173	0,889	0,911	0,480	0,606	0,683	0,046				0,644	0,656	0,405
2013	Random effect	IN	0,850	0,861	0,413	0,890	0,898	0,298	0,887	0,895	0,338	0,724	0,743	0,083	0,816	0,821	0,272	0,818	0,823	0,138	0,819	0,821	0,858	0,679	0,665	0,258	0,856	0,858	0,879	0,856	0,853	0,483	0,855	0,853	0,421	0,793	0,741	0,011
2013	Random effect	OUT	0,740	0,772	0,092	0,820	0,872	0,003	0,816	0,861	0,011	0,733	0,784	0,009	0,683	0,682	0,913	0,660	0,661	0,824	0,650	0,650	0,948	0,630	0,634	0,892	0,654	0,663	0,430	0,653	0,659	0,510	0,648	0,654	0,421	0,522	0,509	0,631
2013	Random effect	ONE	0,783	0,772	0,846	0,828	0,833	0,865	0,817	0,806	0,753	0,636	0,664	0,541	0,711	0,711	1,000	0,633	0,639	0,691	0,628	0,628		0,583	0,586	0,966	0,750	0,761	0,626	0,694	0,706	0,625	0,694	0,706	0,532	0,533	0,436	0,077
2013	Chamberlain's	IN				0,937	0,940	0,739	0,937	0,937	0,983							0,911	0,913	0,857	0,910	0,912	0,859							0,923	0,924	0,929	0,919	0,917	0,709			
2013	Chamberlain's	OUT				0,753	0,791	0,033	0,742	0,787	0,018							0,628	0,634	0,535	0,628	0,637	0,352							0,694	0,711	0,230	0,684	0,704	0,233			
2013	Chamberlain's	ONE				0,839	0,850	0,760	0,828	0,833	0,902							0,761	0,717	0,147	0,767	0,733	0,260							0,861	0,867	0,849	0,861	0,867	0,869			
2013	Dynamic	IN				0,900	0,901	0,972	0,900	0,900	0,973							0,859	0,860	0,851	0,859	0,860	0,618							0,881	0,881	1,000	0,880	0,882	0,804			
2013	Dynamic	OUT				0,847	0,893	0,002	0,846	0,891	0,001							0,811	0,813	0,322	0,814	0,814	0,833							0,793	0,797	0,582	0,789	0,790	0,840			
2013	Dynamic	ONE				0,882	0,915	0,376	0,889	0,902	0,746							0,802	0,802		0,802	0,796	0,480							0,839	0,844	0,733	0,839	0,828	0,296			
2013	Multinomial	IN				0,895	0,896	0,966	0,895	0,896	1,000	0,770	0,768	0,732				0,837	0,838	0,618	0,833	0,832	0,402	0,692	0,677	0,499				0,865	0,861	0,368	0,861	0,857	0,285	0,797	0,765	0,202
2013	Multinomial	OUT				0,811	0,855	0,010	0,811	0,842	0,048	0,707	0,659	0,014				0,543	0,547	0,174	0,538	0,544	0,129	0,572	0,560	0,779				0,655	0,660	0,597	0,654	0,659	0,578	0,507	0,452	0,047
2013	Multinomial	ONE				0,806	0,811	0,797	0,800	0,783	0,527	0,508	0,508	1,000				0,644	0,667	0,260	0,667	0,672	0,480	0,578	0,614	0,744				0,706	0,717	0,748	0,694	0,689	0,844	0,522	0,386	0,086
2013	Multinomial robustness	IN				0,897	0,894	0,633	0,894	0,893	0,778	0,770	0,761	0,393				0,840	0,841	0,917	0,839	0,839	0,934	0,694	0,685	0,666				0,865	0,859	0,257	0,858	0,856	0,612	0,795	0,760	0,176
2013	Multinomial robustness	OUT				0,804	0,830	0,039	0,791	0,810	0,112	0,663	0,597	0,001				0,535	0,535	1,000	0,528	0,531	0,476	0,565	0,523	0,281				0,676	0,680	0,760	0,669	0,670	0,975	0,504	0,453	0,068
2013	Multinomial robustness	ONE				0,778	0,761	0,561	0,739	0,722	0,626	0,481	0,453	0,489				0,689	0,683	0,479	0,667	0,694	0,202	0,589	0,581	0,937				0,717	0,722	0,879	0,717	0,689	0,397	0,517	0,386	0,110
2013	Multinomial probit	IN																						0,691	0,673	0,442										0,795	0,758	0,162
2013	Multinomial probit	OUT																						0,567	0,544	0,564										0,512	0,456	0,048
2013	Multinomial probit	ONE																						0,578	0,614	0,749										0,522	0,386	0,093
2013	Multinomial robustness, probit	IN																						0,691	0,676	0,497										0,791	0,756	0,194
2013	Multinomial robustness, probit	OUT																						0,560	0,508	0,193										0,509	0,454	0,052
2013	Multinomial robustness, probit	ONE																						0,594	0,564	0,800										0,522	0,397	0,124
2017	Pooled	IN	0,876	0,875	0,533	0,901	0,900	0,318	0,900	0,900	0,387	0,786	0,767	0,062	0,825	0,819	0,077	0,830	0,826	0,155	0,828	0,824	0,178	0,723	0,710	0,319	0,819	0,815	0,270	0,819	0,814	0,101	0,818	0,815	0,236	0,732	0,715	0,173
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,922	0,923	0,577	0,761	0,766	0,253				0,878	0,879	0,810	0,908	0,905	0,248	0,788	0,785	0,634				0,831	0,831	0,968	0,923	0,913	0,183	0,786	0,775	0,316				0,864	0,865	0,931
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,868	0,864	0,009	0,899	0,900	0,655	0,899	0,899	0,696	0,761	0,758	0,022	0,823	0,817	0,085	0,818	0,813	0,187	0,815	0,811	0,361	0,719	0,704	0,095	0,812	0,807	0,479	0,811	0,808	0,605	0,808	0,807	0,846	0,733	0,712	0,050
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,936	0,935	0,732	0,935	0,934	0,549							0,915	0,907	0,225	0,911	0,903	0,306							0,911	0,888	0,039	0,910	0,886	0,037			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,915	0,915	0,286	0,914	0,914	0,305							0,868	0,866	0,276	0,867	0,866	0,451							0,872	0,873	0,613	0,870	0,872	0,573			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,896	0,895	0,183	0,894	0,894	0,308	0,787	0,773	0,148				0,816	0,815	0,168	0,813	0,813	0,456	0,725	0,713	0,356				0,823	0,821	0,279	0,822	0,819	0,200	0,733	0,714	0,131
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,896	0,895	0,110	0,894	0,894	0,226	0,785	0,769	0,096				0,812	0,812	0,157	0,809	0,809	0,527	0,726	0,712	0,247				0,822	0,819	0,135	0,820	0,819	0,364	0,739	0,718	0,123
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN										0,786	0,771	0,151										0,727	0,713	0,266										0,735	0,713	0,100
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN										0,781	0,769	0,191										0,728	0,713	0,242										0,736	0,714	0,103
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes general government gross debt (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EU countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table E.10 **Econometric results for the EU28, Total financial sector liabilities**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,876	0,875	0,729	0,897	0,897	0,618	0,896	0,894	0,067	0,761	0,761	1,000	0,824	0,817	0,331	0,823	0,817	0,438	0,820	0,815	0,523	0,692	0,691	0,666	0,856	0,837	0,131	0,860	0,837	0,123	0,857	0,836	0,198	0,798	0,798	0,993
2013	Pooled	OUT	0,766	0,763	0,184	0,827	0,827	1,000	0,822	0,822	1,000	0,697	0,698	0,196	0,668	0,679	0,261	0,653	0,674	0,058	0,652	0,666	0,190	0,562	0,562	1,000	0,652	0,662	0,453	0,641	0,662	0,213	0,640	0,653	0,465	0,535	0,541	0,456
2013	Pooled	ONE	0,767	0,772	0,622	0,822	0,822		0,817	0,822	0,480	0,464	0,475	0,296	0,711	0,722	0,624	0,656	0,678	0,329	0,644	0,661	0,375	0,578	0,578		0,756	0,778	0,410	0,717	0,750	0,355	0,711	0,739	0,414	0,578	0,578	1,000
2013	Fixed effect	IN	0,932	0,932	0,772	0,672	0,674	0,598				0,896	0,896	1,000	0,914	0,915	0,369	0,790	0,791	0,394				0,855	0,854	0,822	0,935	0,934	0,714	0,611	0,616	0,463				0,917	0,902	0,086
2013	Fixed effect	OUT	0,706	0,706	1,000	0,654	0,663	0,256				0,734	0,735	0,211	0,695	0,692	0,193	0,665	0,663	0,440				0,626	0,639	0,062	0,728	0,723	0,460	0,585	0,603	0,093				0,539	0,554	0,156
2013	Fixed effect	ONE	0,867	0,872	0,480	0,583	0,583	1,000				0,789	0,789		0,889	0,883	0,480	0,606	0,600	0,480				0,694	0,717	0,298	0,889	0,894	0,479	0,606	0,611	0,691				0,644	0,644	1,000
2013	Random effect	IN	0,850	0,853	0,187	0,890	0,890	0,588	0,887	0,885	0,271	0,724	0,731	0,125	0,816	0,813	0,646	0,818	0,816	0,716	0,819	0,815	0,536	0,679	0,682	0,710	0,856	0,836	0,104	0,856	0,839	0,259	0,855	0,840	0,307	0,793	0,788	0,716
2013	Random effect	OUT	0,740	0,740	0,807	0,820	0,816	0,231	0,816	0,813	0,184	0,733	0,731	0,814	0,683	0,685	0,845	0,660	0,675	0,154	0,650	0,668	0,099	0,630	0,632	0,796	0,654	0,663	0,501	0,653	0,673	0,234	0,648	0,670	0,151	0,522	0,531	0,396
2013	Random effect	ONE	0,783	0,783	1,000	0,828	0,828		0,817	0,817		0,636	0,597	0,172	0,711	0,728	0,375	0,633	0,678	0,070	0,628	0,667	0,095	0,583	0,617	0,199	0,750	0,778	0,262	0,694	0,767	0,153	0,694	0,750	0,195	0,533	0,539	0,691
2013	Chamberlain's	IN				0,937	0,938	0,622	0,937	0,937	0,809							0,911	0,909	0,704	0,910	0,910	0,878							0,923	0,908	0,100	0,919	0,904	0,106			
2013	Chamberlain's	OUT				0,753	0,750	0,378	0,742	0,742	0,930							0,628	0,638	0,297	0,628	0,638	0,296							0,694	0,684	0,339	0,684	0,684	0,945			
2013	Chamberlain's	ONE				0,839	0,817	0,256	0,828	0,811	0,260							0,761	0,794	0,501	0,767	0,800	0,435							0,861	0,839	0,539	0,861	0,850	0,644			
2013	Dynamic	IN				0,900	0,900	0,759	0,900	0,900	0,912							0,859	0,849	0,201	0,859	0,851	0,265							0,881	0,866	0,159	0,880	0,862	0,081			
2013	Dynamic	OUT				0,847	0,846	0,619	0,846	0,845	0,470							0,811	0,819	0,410	0,814	0,822	0,345							0,793	0,811	0,181	0,789	0,808	0,135			
2013	Dynamic	ONE				0,882	0,889	0,480	0,889	0,889								0,802	0,846	0,131	0,802	0,846	0,111							0,839	0,867	0,310	0,839	0,844	0,866			
2013	Multinomial	IN				0,895	0,895	0,961	0,895	0,894	0,644	0,770	0,765	0,486				0,837	0,829	0,217	0,833	0,826	0,228	0,692	0,694	0,653				0,865	0,842	0,089	0,861	0,838	0,111	0,797	0,794	0,755
2013	Multinomial	OUT				0,811	0,786	0,228	0,811	0,801	0,538	0,707	0,720	0,111				0,543	0,552	0,245	0,538	0,555	0,019	0,572	0,575	0,497				0,655	0,670	0,332	0,654	0,666	0,381	0,507	0,513	0,317
2013	Multinomial	ONE				0,806	0,817	0,480	0,800	0,811	0,480	0,508	0,514	0,480				0,644	0,672	0,233	0,667	0,672	0,780	0,578	0,578					0,706	0,761	0,178	0,694	0,739	0,260	0,522	0,517	0,733
2013	Multinomial robustness	IN				0,897	0,896	0,812	0,894	0,893	0,820	0,770	0,767	0,611				0,840	0,829	0,121	0,839	0,828	0,116	0,694	0,696	0,565				0,865	0,842	0,095	0,858	0,837	0,133	0,795	0,792	0,742
2013	Multinomial robustness	OUT				0,804	0,794	0,512	0,791	0,794	0,792	0,663	0,670	0,072				0,535	0,551	0,290	0,528	0,546	0,181	0,565	0,559	0,380				0,676	0,693	0,252	0,669	0,683	0,369	0,504	0,513	0,171
2013	Multinomial robustness	ONE				0,778	0,783	0,821	0,739	0,767	0,229	0,481	0,492	0,410				0,689	0,722	0,442	0,667	0,722	0,090	0,589	0,578	0,405				0,717	0,733	0,668	0,717	0,722	0,877	0,517	0,528	0,296
2013	Multinomial probit	IN																						0,691	0,691	0,870										0,795	0,791	0,683
2013	Multinomial probit	OUT																						0,567	0,568	0,726										0,512	0,518	0,266
2013	Multinomial probit	ONE																						0,578	0,578											0,522	0,522	1,000
2013	Multinomial robustness, probit	IN																						0,691	0,694	0,519										0,791	0,788	0,835
2013	Multinomial robustness, probit	OUT																						0,560	0,558	0,768										0,509	0,514	0,363
2013	Multinomial robustness, probit	ONE																						0,594	0,561	0,101										0,522	0,517	0,781
2017	Pooled	IN	0,876	0,876	0,909	0,901	0,901	0,704	0,900	0,900	1,000	0,786	0,784	0,426	0,825	0,823	0,626	0,830	0,830	0,911	0,828	0,826	0,695	0,723	0,723	0,909	0,819	0,815	0,510	0,819	0,814	0,336	0,818	0,813	0,330	0,732	0,732	0,900
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,922	0,922	0,545	0,761	0,761	0,803				0,878	0,878	0,652	0,908	0,908	0,830	0,788	0,792	0,282				0,831	0,832	0,772	0,923	0,923	0,958	0,786	0,785	0,814				0,864	0,858	0,397
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,868	0,868	0,734	0,899	0,899	0,641	0,899	0,898	0,443	0,761	0,761	0,861	0,823	0,821	0,632	0,818	0,818	0,986	0,815	0,815	0,987	0,719	0,721	0,729	0,812	0,810	0,685	0,811	0,807	0,417	0,808	0,806	0,714	0,733	0,724	0,412
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,936	0,937	0,202	0,935	0,935	0,582							0,915	0,914	0,673	0,911	0,911	0,957							0,911	0,909	0,461	0,910	0,908	0,534			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,915	0,914	0,250	0,914	0,913	0,464							0,868	0,868	0,975	0,867	0,866	0,923							0,872	0,871	0,617	0,870	0,871	0,930			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,896	0,895	0,551	0,894	0,894	0,840	0,787	0,785	0,331				0,816	0,815	0,470	0,813	0,811	0,339	0,725	0,725	0,677				0,823	0,818	0,287	0,822	0,817	0,312	0,733	0,730	0,671
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,896	0,895	0,514	0,894	0,894	0,870	0,785	0,784	0,643				0,812	0,805	0,068	0,809	0,802	0,094	0,726	0,724	0,541				0,822	0,815	0,109	0,820	0,813	0,122	0,739	0,737	0,793
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN										0,786												0,727	0,726	0,195										0,735	0,731	0,504
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN										0,781	0,782	0,774										0,728	0,727	0,567										0,736	0,736	0,967
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes total financial sector liabilities (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EU countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table E.11 **Econometric results for the EU28, Unemployment rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,876	0,876	0,966	0,897	0,898	0,641	0,896	0,896	0,910	0,761	0,764	0,432	0,824	0,819	0,248	0,823	0,821	0,825	0,820	0,819	0,890	0,692	0,683	0,642	0,856	0,844	0,255	0,860	0,848	0,365	0,857	0,849	0,513	0,798	0,765	0,159
2013	Pooled	OUT	0,766	0,773	0,398	0,827	0,820	0,408	0,822	0,821	0,838	0,697	0,710	0,239	0,668	0,669	0,928	0,653	0,670	0,603	0,652	0,658	0,832	0,562	0,577	0,704	0,652	0,687	0,400	0,641	0,686	0,285	0,640	0,675	0,385	0,535	0,501	0,364
2013	Pooled	ONE	0,767	0,783	0,505	0,822	0,817	0,779	0,817	0,806	0,623	0,464	0,475	0,600	0,711	0,700	0,754	0,656	0,661	0,914	0,644	0,650	0,919	0,578	0,564	0,884	0,756	0,750	0,923	0,717	0,739	0,720	0,711	0,728	0,674	0,578	0,517	0,504
2013	Fixed effect	IN	0,932	0,935	0,282	0,672	0,663	0,001				0,896	0,895	0,701	0,914	0,914	0,848	0,790	0,757	0,001				0,855	0,847	0,450	0,935	0,935	0,897	0,611	0,634	0,001				0,917	0,899	0,183
2013	Fixed effect	OUT	0,706	0,702	0,492	0,654	0,651	0,691				0,734	0,725	0,368	0,695	0,688	0,341	0,665	0,645	0,136				0,626	0,638	0,390	0,728	0,735	0,703	0,585	0,620	0,025				0,539	0,517	0,404
2013	Fixed effect	ONE	0,867	0,878	0,410	0,583	0,572	0,405				0,789	0,800	0,532	0,889	0,883	0,691	0,606	0,606	1,000				0,694	0,733	0,254	0,889	0,906	0,561	0,606	0,639	0,243				0,644	0,611	0,605
2013	Random effect	IN	0,850	0,856	0,391	0,890	0,890	0,965	0,887	0,886	0,857	0,724	0,726	0,646	0,816	0,813	0,521	0,818	0,818	0,974	0,819	0,817	0,795	0,679	0,671	0,726	0,856	0,842	0,195	0,856	0,847	0,501	0,855	0,848	0,558	0,793	0,755	0,126
2013	Random effect	OUT	0,740	0,753	0,338	0,820	0,810	0,361	0,816	0,807	0,311	0,733	0,752	0,113	0,683	0,681	0,876	0,660	0,664	0,890	0,650	0,654	0,910	0,630	0,618	0,784	0,654	0,695	0,328	0,653	0,681	0,489	0,648	0,673	0,514	0,522	0,497	0,562
2013	Random effect	ONE	0,783	0,811	0,346	0,828	0,794	0,153	0,817	0,794	0,296	0,636	0,669	0,261	0,711	0,711	1,000	0,633	0,661	0,645	0,628	0,650	0,650	0,583	0,569	0,867	0,750	0,756	0,924	0,694	0,728	0,506	0,694	0,706	0,834	0,533	0,472	0,562
2013	Chamberlain's	IN				0,937	0,938	0,841	0,937	0,939	0,730							0,911	0,904	0,414	0,910	0,904	0,487							0,923	0,913	0,287	0,919	0,910	0,339			
2013	Chamberlain's	OUT				0,753	0,740	0,462	0,742	0,730	0,492							0,628	0,654	0,304	0,628	0,654	0,284							0,694	0,712	0,442	0,684	0,710	0,261			
2013	Chamberlain's	ONE				0,839	0,800	0,155	0,828	0,794	0,155							0,761	0,800	0,431	0,767	0,806	0,395							0,861	0,900	0,426	0,861	0,894	0,384			
2013	Dynamic	IN				0,900	0,900	0,868	0,900	0,899	0,780							0,859	0,852	0,420	0,859	0,853	0,428							0,881	0,871	0,285	0,880	0,872	0,294			
2013	Dynamic	OUT				0,847	0,830	0,034	0,846	0,831	0,019							0,811	0,829	0,448	0,814	0,823	0,694							0,793	0,809	0,519	0,789	0,802	0,603			
2013	Dynamic	ONE				0,882	0,869	0,530	0,889	0,876	0,530							0,802	0,802	1,000	0,802	0,802	1,000							0,839	0,839	1,000	0,839	0,833	0,829			
2013	Multinomial	IN				0,895	0,896	0,839	0,895	0,894	0,486	0,770	0,770	0,972				0,837	0,830	0,373	0,833	0,827	0,362	0,692	0,690	0,921				0,865	0,852	0,286	0,861	0,851	0,385	0,797	0,759	0,126
2013	Multinomial	OUT				0,811	0,798	0,061	0,811	0,797	0,052	0,707	0,675	0,071				0,543	0,545	0,868	0,538	0,536	0,865	0,572	0,582	0,833				0,655	0,709	0,157	0,654	0,700	0,201	0,507	0,466	0,307
2013	Multinomial	ONE				0,806	0,789	0,260	0,800	0,778	0,296	0,508	0,475	0,297				0,644	0,672	0,396	0,667	0,689	0,531	0,578	0,569	0,935				0,706	0,717	0,825	0,694	0,711	0,729	0,522	0,478	0,681
2013	Multinomial robustness	IN				0,897	0,896	0,813	0,894	0,894	0,838	0,770	0,773	0,637				0,840	0,836	0,609	0,839	0,833	0,411	0,694	0,685	0,660				0,865	0,854	0,296	0,858	0,852	0,588	0,795	0,752	0,094
2013	Multinomial robustness	OUT				0,804	0,788	0,074	0,791	0,774	0,049	0,663	0,659	0,786				0,535	0,523	0,357	0,528	0,518	0,489	0,565	0,568	0,943				0,676	0,719	0,190	0,669	0,707	0,252	0,504	0,473	0,426
2013	Multinomial robustness	ONE				0,778	0,750	0,307	0,739	0,717	0,294	0,481	0,458	0,330				0,689	0,728	0,240	0,667	0,717	0,219	0,589	0,586	0,982				0,717	0,700	0,757	0,717	0,683	0,499	0,517	0,472	0,682
2013	Multinomial probit	IN																						0,691	0,683	0,723										0,795	0,755	0,107
2013	Multinomial probit	OUT																						0,567	0,572	0,903										0,512	0,469	0,268
2013	Multinomial probit	ONE																						0,578	0,558	0,843										0,522	0,467	0,579
2013	Multinomial robustness, probit	IN																						0,691	0,678	0,502										0,791	0,751	0,115
2013	Multinomial robustness, probit	OUT																						0,560	0,562	0,951										0,509	0,473	0,356
2013	Multinomial robustness, probit	ONE																						0,594	0,558	0,717										0,522	0,472	0,625
2017	Pooled	IN	0,876	0,879	0,255	0,901	0,900	0,617	0,900	0,899	0,844	0,786	0,787	0,741	0,825	0,822	0,150	0,830	0,825	0,258	0,828	0,824	0,413	0,723	0,720	0,630	0,819	0,812	0,326	0,819	0,812	0,395	0,818	0,811	0,358	0,732	0,714	0,177
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,922	0,921	0,899	0,761	0,759	0,174				0,878	0,880	0,531	0,908	0,907	0,667	0,788	0,788	0,786				0,831	0,826	0,218	0,923	0,925	0,509	0,786	0,787	0,697				0,864	0,845	0,056
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,868	0,872	0,170	0,899	0,898	0,713	0,899	0,898	0,873	0,761	0,766	0,098	0,823	0,820	0,191	0,818	0,814	0,526	0,815	0,811	0,529	0,719	0,712	0,298	0,812	0,801	0,110	0,811	0,796	0,075	0,808	0,795	0,121	0,733	0,713	0,193
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,936	0,937	0,694	0,935	0,935	0,902							0,915	0,913	0,582	0,911	0,910	0,782							0,911	0,904	0,119	0,910	0,904	0,242			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,915	0,913	0,613	0,914	0,912	0,668							0,868	0,865	0,454	0,867	0,864	0,492							0,872	0,866	0,381	0,870	0,865	0,420			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,896	0,896	0,979	0,894	0,895	0,844	0,787	0,790	0,181				0,816	0,812	0,162	0,813	0,810	0,399	0,725	0,722	0,657				0,823	0,815	0,237	0,822	0,813	0,210	0,733	0,714	0,145
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,896	0,896	0,593	0,894	0,894	0,944	0,785	0,785	0,732				0,812	0,808	0,118	0,809	0,806	0,353	0,726	0,726	0,973				0,822	0,815	0,242	0,820	0,812	0,142	0,739	0,715	0,064
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN										0,786	0,787	0,239										0,727	0,722	0,397										0,735	0,715	0,114
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN										0,781	0,785	0,024										0,728	0,723	0,448										0,736	0,713	0,068
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes unemployment rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EU countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table E.12 **Econometric results for the EU28, Activity rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,876	0,872	0,345	0,897	0,896	0,674	0,896	0,895	0,661	0,761	0,762	0,594	0,824	0,826	0,803	0,823	0,825	0,950	0,820	0,823	0,528	0,692	0,693	0,706	0,856	0,859	0,765	0,860	0,860	0,319	0,857	0,858	0,685	0,798	0,796	0,702
2013	Pooled	OUT	0,766	0,747	0,027	0,827	0,825	0,787	0,822	0,812	0,285	0,697	0,691	0,091	0,668	0,650	0,008	0,653	0,676	0,000	0,652	0,666	0,004	0,562	0,552	0,010	0,652	0,634	0,006	0,641	0,639	0,413	0,640	0,640	0,775	0,535	0,553	0,233
2013	Pooled	ONE	0,767	0,744	0,386	0,822	0,839	0,417	0,817	0,806	0,646	0,464	0,464		0,711	0,706	0,480	0,656	0,656	1,000	0,644	0,644	1,000	0,578	0,581	0,760	0,756	0,750	0,796	0,717	0,706	0,296	0,711	0,711		0,578	0,597	0,580
2013	Fixed effect	IN	0,932	0,932	0,702	0,672	0,713	0,001				0,896	0,897	0,669	0,914	0,910	0,090	0,790	0,763	0,012				0,855	0,847	0,219	0,935	0,935	0,618	0,611	0,612	0,979				0,917	0,918	0,930
2013	Fixed effect	OUT	0,706	0,712	0,060	0,654	0,668	0,565				0,734	0,730	0,317	0,695	0,710	0,047	0,665	0,689	0,077				0,626	0,625	0,912	0,728	0,726	0,145	0,585	0,611	0,216				0,539	0,539	1,000
2013	Fixed effect	ONE	0,867	0,872	0,480	0,583	0,683	0,068				0,789	0,789		0,889	0,894	0,760	0,606	0,628	0,430				0,694	0,722	0,473	0,889	0,889		0,606	0,617	0,860				0,644	0,650	0,480
2013	Random effect	IN	0,850	0,849	0,580	0,890	0,892	0,758	0,887	0,886	0,757	0,724	0,730	0,373	0,816	0,820	0,414	0,818	0,822	0,474	0,819	0,822	0,671	0,679	0,684	0,689	0,856	0,859	0,781	0,856	0,857	1,000	0,855	0,858	0,450	0,793	0,791	0,432
2013	Random effect	OUT	0,740	0,720	0,003	0,820	0,809	0,283	0,816	0,805	0,278	0,733	0,723	0,378	0,683	0,662	0,001	0,660	0,681	0,001	0,650	0,672	0,002	0,630	0,580	0,023	0,654	0,634	0,002	0,653	0,652	0,421	0,648	0,652	0,139	0,522	0,543	0,040
2013	Random effect	ONE	0,783	0,761	0,296	0,828	0,817	0,680	0,817	0,822	0,844	0,636	0,575	0,115	0,711	0,689	0,162	0,633	0,644	0,410	0,628	0,644	0,264	0,583	0,564	0,728	0,750	0,750	1,000	0,694	0,694		0,694	0,694		0,533	0,569	0,092
2013	Chamberlain's	IN				0,937	0,938	0,766	0,937	0,938	0,869							0,911	0,908	0,554	0,910	0,908	0,630							0,923	0,924	0,819	0,919	0,919	0,675			
2013	Chamberlain's	OUT				0,753	0,760	0,122	0,742	0,749	0,050							0,628	0,651	0,072	0,628	0,651	0,062							0,694	0,686	0,151	0,684	0,682	0,432			
2013	Chamberlain's	ONE				0,839	0,833	0,760	0,828	0,833	0,480							0,761	0,778	0,642	0,767	0,772	0,869							0,861	0,872	0,482	0,861	0,867	0,480			
2013	Dynamic	IN				0,900	0,900	0,888	0,900	0,901	0,849							0,859	0,859	0,859	0,859	0,860	0,874							0,881	0,882	0,714	0,880	0,881	1,000			
2013	Dynamic	OUT				0,847	0,853	0,245	0,846	0,851	0,586							0,811	0,832	0,001	0,814	0,829	0,007							0,793	0,786	0,051	0,789	0,786	0,244			
2013	Dynamic	ONE				0,882	0,889	0,480	0,889	0,895	0,480							0,802	0,821	0,377	0,802	0,821	0,262							0,839	0,839		0,839	0,833	0,480			
2013	Multinomial	IN				0,895	0,896	1,000	0,895	0,892	0,387	0,770	0,772	0,845				0,837	0,836	0,434	0,833	0,830	0,187	0,692	0,696	0,545				0,865	0,862	0,299	0,861	0,862	0,941	0,797	0,795	0,712
2013	Multinomial	OUT				0,811	0,816	0,547	0,811	0,812	0,866	0,707	0,688	0,134				0,543	0,580	0,004	0,538	0,575	0,002	0,572	0,574	0,736				0,655	0,660	0,606	0,654	0,660	0,262	0,507	0,547	0,019
2013	Multinomial	ONE				0,806	0,811	0,761	0,800	0,794	0,798	0,508	0,508	1,000				0,644	0,661	0,593	0,667	0,656	0,680	0,578	0,586	0,591				0,706	0,706	1,000	0,694	0,700	0,480	0,522	0,592	0,066
2013	Multinomial robustness	IN				0,897	0,896	0,879	0,894	0,893	0,675	0,770	0,772	0,924				0,840	0,840	0,600	0,839	0,836	0,263	0,694	0,700	0,403				0,865	0,866	0,906	0,858	0,863	0,151	0,795	0,791	0,566
2013	Multinomial robustness	OUT				0,804	0,817	0,315	0,791	0,802	0,383	0,663	0,656	0,164				0,535	0,594	0,004	0,528	0,598	0,001	0,565	0,574	0,403				0,676	0,677	0,770	0,669	0,676	0,120	0,504	0,539	0,041
2013	Multinomial robustness	ONE				0,778	0,783	0,865	0,739	0,722	0,645	0,481	0,475	0,480				0,689	0,694	0,930	0,667	0,678	0,846	0,589	0,581	0,805				0,717	0,722	0,480	0,717	0,717		0,517	0,581	0,071
2013	Multinomial probit	IN																						0,691	0,692	0,881										0,795	0,788	0,381
2013	Multinomial probit	OUT																						0,567	0,569	0,765										0,512	0,548	0,036
2013	Multinomial probit	ONE																						0,578	0,581	0,838										0,522	0,569	0,122
2013	Multinomial robustness, probit	IN																						0,691	0,698	0,434										0,791	0,787	0,649
2013	Multinomial robustness, probit	OUT																						0,560	0,564	0,540										0,509	0,546	0,041
2013	Multinomial robustness, probit	ONE																						0,594	0,592	0,876										0,522	0,564	0,283
2017	Pooled	IN	0,876	0,870	0,301	0,901	0,900	0,715	0,900	0,898	0,519	0,786	0,783	0,496	0,825	0,811	0,231	0,830	0,815	0,135	0,828	0,814	0,170	0,723	0,719	0,660	0,819	0,807	0,222	0,819	0,808	0,157	0,818	0,809	0,216	0,732	0,730	0,773
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,922	0,922	0,928	0,761	0,766	0,085				0,878	0,880	0,277	0,908	0,911	0,566	0,788	0,791	0,550				0,831	0,830	0,945	0,923	0,924	0,929	0,786	0,783	0,349				0,864	0,860	0,556
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,868	0,858	0,087	0,899	0,897	0,211	0,899	0,895	0,161	0,761	0,759	0,451	0,823	0,807	0,146	0,818	0,802	0,020	0,815	0,799	0,020	0,719	0,714	0,638	0,812	0,801	0,210	0,811	0,795	0,018	0,808	0,794	0,035	0,733	0,723	0,198
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,936	0,933	0,281	0,935	0,932	0,309							0,915	0,910	0,316	0,911	0,906	0,328							0,911	0,907	0,374	0,910	0,904	0,248			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,915	0,914	0,524	0,914	0,914	0,833							0,868	0,865	0,550	0,867	0,863	0,470							0,872	0,870	0,656	0,870	0,871	0,950			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,896	0,894	0,527	0,894	0,893	0,562	0,787	0,788	0,986				0,816	0,805	0,244	0,813	0,801	0,229	0,725	0,722	0,752				0,823	0,811	0,153	0,822	0,811	0,189	0,733	0,731	0,874
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,896	0,893	0,320	0,894	0,891	0,380	0,785	0,786	0,922				0,812	0,799	0,204	0,809	0,797	0,244	0,726	0,723	0,727				0,822	0,807	0,112	0,820	0,805	0,081	0,739	0,734	0,614
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN										0,786	0,787	0,978										0,727	0,719	0,345										0,735	0,730	0,556
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN										0,781	0,782	0,857										0,728	0,723	0,534										0,736	0,732	0,632
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes activity rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EU countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table E.13 **Econometric results for the EU28, Long-term unemployment rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,876	0,872	0,139	0,897	0,890	0,253	0,896	0,890	0,297	0,761	0,759	0,813	0,824	0,827	0,601	0,823	0,827	0,647	0,820	0,824	0,743	0,692	0,695	0,959	0,856	0,856	0,568	0,860	0,859	0,399	0,857	0,857	0,671	0,798	0,803	0,472
2013	Pooled	OUT	0,766	0,761	0,230	0,827	0,818	0,510	0,822	0,816	0,611	0,697	0,662	0,118	0,668	0,660	0,304	0,653	0,634	0,295	0,652	0,616	0,088	0,562	0,545	0,297	0,652	0,652	0,974	0,641	0,642	0,851	0,640	0,639	0,674	0,535	0,539	0,235
2013	Pooled	ONE	0,767	0,772	0,691	0,822	0,828	0,909	0,817	0,856	0,383	0,464	0,525	0,357	0,711	0,722	0,296	0,656	0,683	0,201	0,644	0,667	0,449	0,578	0,544	0,295	0,756	0,728	0,259	0,717	0,711	0,731	0,711	0,706	0,480	0,578	0,586	0,479
2013	Fixed effect	IN	0,932	0,934	0,240	0,672	0,658	0,216				0,896	0,896	0,664	0,914	0,915	0,656	0,790	0,769	0,018				0,855	0,857	0,959	0,935	0,936	0,725	0,611	0,611	0,385				0,917	0,911	0,300
2013	Fixed effect	OUT	0,706	0,711	0,106	0,654	0,604	0,167				0,734	0,731	0,123	0,695	0,695	1,000	0,665	0,648	0,173				0,626	0,625	0,542	0,728	0,729	0,775	0,585	0,584	0,480				0,539	0,565	0,032
2013	Fixed effect	ONE	0,867	0,867	1,000	0,583	0,617	0,600				0,789	0,794	0,479	0,889	0,894	0,479	0,606	0,628	0,159				0,694	0,694		0,889	0,889		0,606	0,600	0,480				0,644	0,689	0,288
2013	Random effect	IN	0,850	0,847	0,127	0,890	0,889	0,824	0,887	0,886	0,921	0,724	0,719	0,500	0,816	0,817	0,775	0,818	0,822	0,759	0,819	0,823	0,790	0,679	0,674	0,310	0,856	0,856	0,681	0,856	0,857	1,000	0,855	0,857	1,000	0,793	0,796	0,962
2013	Random effect	OUT	0,740	0,741	0,595	0,820	0,812	0,601	0,816	0,797	0,256	0,733	0,724	0,556	0,683	0,682	0,838	0,660	0,626	0,130	0,650	0,612	0,124	0,630	0,625	0,721	0,654	0,656	0,850	0,653	0,653	0,480	0,648	0,649	0,493	0,522	0,531	0,403
2013	Random effect	ONE	0,783	0,783		0,828	0,856	0,589	0,817	0,844	0,598	0,636	0,692	0,224	0,711	0,717	0,691	0,633	0,672	0,137	0,628	0,656	0,331	0,583	0,556	0,408	0,750	0,739	0,624	0,694	0,694		0,694	0,694		0,533	0,558	0,371
2013	Chamberlain's	IN				0,937	0,923	0,145	0,937	0,923	0,142							0,911	0,908	0,581	0,910	0,907	0,631							0,923	0,922	0,809	0,919	0,921	0,793			
2013	Chamberlain's	OUT				0,753	0,721	0,272	0,742	0,714	0,325							0,628	0,620	0,533	0,628	0,621	0,608							0,694	0,686	0,424	0,684	0,682	0,720			
2013	Chamberlain's	ONE				0,839	0,867	0,646	0,828	0,867	0,529							0,761	0,772	0,712	0,767	0,783	0,621							0,861	0,850	0,703	0,861	0,872	0,723			
2013	Dynamic	IN				0,900	0,899	0,843	0,900	0,899	0,880							0,859	0,858	0,737	0,859	0,860	0,791							0,881	0,882	0,774	0,880	0,882	0,385			
2013	Dynamic	OUT				0,847	0,838	0,474	0,846	0,834	0,299							0,811	0,803	0,183	0,814	0,804	0,160							0,793	0,790	0,051	0,789	0,787	0,212			
2013	Dynamic	ONE				0,882	0,915	0,229	0,889	0,908	0,261							0,802	0,815	0,294	0,802	0,821	0,175							0,839	0,833	0,480	0,839	0,839				
2013	Multinomial	IN				0,895	0,891	0,436	0,895	0,890	0,430	0,770	0,763	0,500				0,837	0,826	0,114	0,833	0,824	0,215	0,692	0,694	0,932				0,865	0,868	0,659	0,861	0,866	0,360	0,797	0,797	0,476
2013	Multinomial	OUT				0,811	0,802	0,622	0,811	0,794	0,245	0,707	0,669	0,197				0,543	0,629	0,016	0,538	0,623	0,008	0,572	0,545	0,033				0,655	0,636	0,021	0,654	0,639	0,027	0,507	0,509	0,666
2013	Multinomial	ONE				0,806	0,833	0,599	0,800	0,839	0,456	0,508	0,581	0,232				0,644	0,678	0,483	0,667	0,672	0,865	0,578	0,544	0,310				0,706	0,706	1,000	0,694	0,706	0,296	0,522	0,525	0,899
2013	Multinomial robustness	IN				0,897	0,894	0,683	0,894	0,892	0,764	0,770	0,764	0,593				0,840	0,838	0,646	0,839	0,838	0,781	0,694	0,695	0,926				0,865	0,874	0,249	0,858	0,868	0,121	0,795	0,796	0,654
2013	Multinomial robustness	OUT				0,804	0,797	0,734	0,791	0,783	0,620	0,663	0,612	0,051				0,535	0,634	0,001	0,528	0,627	0,001	0,565	0,525	0,005				0,676	0,642	0,001	0,669	0,635	0,001	0,504	0,506	0,648
2013	Multinomial robustness	ONE				0,778	0,839	0,306	0,739	0,833	0,147	0,481	0,547	0,246				0,689	0,700	0,872	0,667	0,689	0,730	0,589	0,556	0,384				0,717	0,717	1,000	0,717	0,711	0,479	0,517	0,514	0,911
2013	Multinomial probit	IN																						0,691	0,691	0,825										0,795	0,795	0,148
2013	Multinomial probit	OUT																						0,567	0,545	0,086										0,512	0,511	0,438
2013	Multinomial probit	ONE																						0,578	0,544	0,201										0,522	0,508	0,201
2013	Multinomial robustness, probit	IN																						0,691	0,689	0,697										0,791	0,791	0,261
2013	Multinomial robustness, probit	OUT																						0,560	0,525	0,017										0,509	0,511	0,165
2013	Multinomial robustness, probit	ONE																						0,594	0,533	0,050										0,522	0,525	0,760
2017	Pooled	IN	0,876	0,868	0,088	0,901	0,895	0,249	0,900	0,896	0,397	0,786	0,780	0,428	0,825	0,823	0,245	0,830	0,826	0,232	0,828	0,825	0,424	0,723	0,725	0,978	0,819	0,819	0,909	0,819	0,818	0,732	0,818	0,819	0,976	0,732	0,734	0,844
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,922	0,921	0,490	0,761	0,769	0,427				0,878	0,875	0,357	0,908	0,907	0,414	0,788	0,789	0,925				0,831	0,830	0,573	0,923	0,925	0,673	0,786	0,786	0,554				0,864	0,864	0,375
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,868	0,856	0,008	0,899	0,896	0,549	0,899	0,896	0,642	0,761	0,757	0,564	0,823	0,817	0,083	0,818	0,818	0,838	0,815	0,815	0,787	0,719	0,722	0,792	0,812	0,807	0,138	0,811	0,810	0,397	0,808	0,809	0,871	0,733	0,734	0,869
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,936	0,929	0,229	0,935	0,928	0,198							0,915	0,905	0,131	0,911	0,902	0,164							0,911	0,901	0,135	0,910	0,900	0,124			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,915	0,909	0,301	0,914	0,909	0,358							0,868	0,867	0,523	0,867	0,867	0,881							0,872	0,868	0,311	0,870	0,868	0,440			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,896	0,890	0,230	0,894	0,889	0,372	0,787	0,779	0,300				0,816	0,815	0,583	0,813	0,811	0,562	0,725	0,727	0,930				0,823	0,823	0,836	0,822	0,822	0,920	0,733	0,735	0,609
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,896	0,887	0,143	0,894	0,889	0,407	0,785	0,778	0,305				0,812	0,808	0,202	0,809	0,807	0,444	0,726	0,728	0,849				0,822	0,823	0,918	0,820	0,821	0,923	0,739	0,739	0,525
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN										0,786	0,778	0,373										0,727	0,727	0,779										0,735	0,735	0,163
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN										0,781	0,775	0,460										0,728	0,729	0,913										0,736	0,735	0,250
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes long-term unemployment rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EU countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Table E.14 **Econometric results for the EU28, Youth unemployment rate**

			Lag 1												Lag 2												Lag 3											
			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model			LPM			Logit			Probit			Indicator model		
		In/out of	AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC		AUROC	AUROC	
Sample	Model	sample	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val	Unr	R	P-Val
2013	Pooled	IN	0,876	0,876	0,545	0,897	0,895	0,435	0,896	0,894	0,343	0,761	0,760	0,770	0,824	0,823	0,922	0,823	0,825	0,623	0,820	0,822	0,694	0,692	0,695	0,983	0,856	0,845	0,483	0,860	0,845	0,336	0,857	0,843	0,400	0,798	0,787	0,562
2013	Pooled	OUT	0,766	0,765	0,891	0,827	0,826	0,861	0,822	0,825	0,729	0,697	0,736	0,032	0,668	0,673	0,755	0,653	0,645	0,624	0,652	0,638	0,490	0,562	0,588	0,075	0,652	0,619	0,014	0,641	0,613	0,073	0,640	0,611	0,049	0,535	0,521	0,467
2013	Pooled	ONE	0,767	0,761	0,691	0,822	0,850	0,462	0,817	0,856	0,398	0,464	0,581	0,059	0,711	0,733	0,448	0,656	0,683	0,166	0,644	0,678	0,245	0,578	0,594	0,525	0,756	0,772	0,481	0,717	0,733	0,562	0,711	0,722	0,663	0,578	0,600	0,590
2013	Fixed effect	IN	0,932	0,932	0,770	0,672	0,727	0,068				0,896	0,897	0,900	0,914	0,910	0,142	0,790	0,775	0,443				0,855	0,850	0,349	0,935	0,925	0,266	0,611	0,563	0,001				0,917	0,893	0,165
2013	Fixed effect	OUT	0,706	0,708	0,530	0,654	0,686	0,477				0,734	0,733	0,857	0,695	0,706	0,446	0,665	0,669	0,904				0,626	0,642	0,002	0,728	0,712	0,222	0,585	0,464	0,000				0,539	0,525	0,388
2013	Fixed effect	ONE	0,867	0,883	0,419	0,583	0,711	0,187				0,789	0,800	0,405	0,889	0,906	0,260	0,606	0,639	0,472				0,694	0,711	0,179	0,889	0,883	0,480	0,606	0,528	0,166				0,644	0,672	0,568
2013	Random effect	IN	0,850	0,852	0,647	0,890	0,895	0,543	0,887	0,888	0,946	0,724	0,728	0,738	0,816	0,819	0,591	0,818	0,821	0,586	0,819	0,821	0,739	0,679	0,679	0,749	0,856	0,845	0,493	0,856	0,843	0,527	0,855	0,842	0,458	0,793	0,786	0,742
2013	Random effect	OUT	0,740	0,740	1,000	0,820	0,822	0,886	0,816	0,826	0,531	0,733	0,748	0,231	0,683	0,685	0,918	0,660	0,644	0,486	0,650	0,632	0,470	0,630	0,633	0,813	0,654	0,619	0,009	0,653	0,627	0,059	0,648	0,622	0,082	0,522	0,511	0,654
2013	Random effect	ONE	0,783	0,783	1,000	0,828	0,856	0,604	0,817	0,861	0,490	0,636	0,675	0,206	0,711	0,728	0,544	0,633	0,683	0,073	0,628	0,678	0,123	0,583	0,589	0,869	0,750	0,772	0,298	0,694	0,733	0,174	0,694	0,722	0,260	0,533	0,589	0,183
2013	Chamberlain's	IN				0,937	0,936	0,743	0,937	0,934	0,600							0,911	0,907	0,602	0,910	0,906	0,525							0,923	0,905	0,159	0,919	0,904	0,182			
2013	Chamberlain's	OUT				0,753	0,760	0,802	0,742	0,746	0,876							0,628	0,639	0,591	0,628	0,644	0,407							0,694	0,694	0,984	0,684	0,687	0,927			
2013	Chamberlain's	ONE				0,839	0,906	0,384	0,828	0,894	0,410							0,761	0,689	0,129	0,767	0,717	0,276							0,861	0,883	0,590	0,861	0,878	0,648			
2013	Dynamic	IN				0,900	0,896	0,600	0,900	0,898	0,733							0,859	0,854	0,388	0,859	0,855	0,541							0,881	0,869	0,330	0,880	0,870	0,375			
2013	Dynamic	OUT				0,847	0,859	0,304	0,846	0,854	0,467							0,811	0,795	0,091	0,814	0,795	0,111							0,793	0,776	0,225	0,789	0,775	0,271			
2013	Dynamic	ONE				0,882	0,922	0,176	0,889	0,928	0,123							0,802	0,815	0,530	0,802	0,827	0,207							0,839	0,839	1,000	0,839	0,833	0,781			
2013	Multinomial	IN				0,895	0,894	0,493	0,895	0,894	0,631	0,770	0,769	0,822				0,837	0,831	0,332	0,833	0,828	0,464	0,692	0,695	0,886				0,865	0,850	0,471	0,861	0,849	0,589	0,797	0,785	0,483
2013	Multinomial	OUT				0,811	0,788	0,168	0,811	0,785	0,221	0,707	0,776	0,006				0,543	0,608	0,034	0,538	0,629	0,002	0,572	0,580	0,513				0,655	0,611	0,013	0,654	0,613	0,035	0,507	0,492	0,460
2013	Multinomial	ONE				0,806	0,828	0,608	0,800	0,833	0,468	0,508	0,669	0,099				0,644	0,672	0,598	0,667	0,678	0,722	0,578	0,578	1,000				0,706	0,744	0,303	0,694	0,733	0,209	0,522	0,550	0,626
2013	Multinomial robustness	IN				0,897	0,894	0,245	0,894	0,892	0,560	0,770	0,768	0,751				0,840	0,841	0,866	0,839	0,839	0,952	0,694	0,693	0,782				0,865	0,854	0,615	0,858	0,852	0,902	0,795	0,781	0,410
2013	Multinomial robustness	OUT				0,804	0,796	0,594	0,791	0,783	0,677	0,663	0,720	0,077				0,535	0,607	0,001	0,528	0,606	0,000	0,565	0,585	0,086				0,676	0,631	0,018	0,669	0,627	0,027	0,504	0,499	0,813
2013	Multinomial robustness	ONE				0,778	0,817	0,452	0,739	0,794	0,390	0,481	0,647	0,081				0,689	0,678	0,828	0,667	0,678	0,796	0,589	0,589	1,000				0,717	0,728	0,662	0,717	0,722	0,758	0,517	0,572	0,304
2013	Multinomial probit	IN																						0,691	0,694	0,844										0,795	0,778	0,351
2013	Multinomial probit	OUT																						0,567	0,578	0,333										0,512	0,498	0,493
2013	Multinomial probit	ONE																						0,578	0,583	0,809										0,522	0,561	0,512
2013	Multinomial robustness, probit	IN																						0,691	0,693	0,935										0,791	0,778	0,486
2013	Multinomial robustness, probit	OUT																						0,560	0,571	0,351										0,509	0,495	0,492
2013	Multinomial robustness, probit	ONE																						0,594	0,567	0,449										0,522	0,561	0,473
2017	Pooled	IN	0,876	0,876	0,242	0,901	0,897	0,166	0,900	0,897	0,314	0,786	0,786	0,670	0,825	0,826	0,504	0,830	0,830	0,698	0,828	0,827	0,940	0,723	0,720	0,519	0,819	0,797	0,109	0,819	0,799	0,179	0,818	0,800	0,198	0,732	0,717	0,323
2017	Pooled	OUT																																				
2017	Pooled	ONE																																				
2017	Fixed effect	IN	0,922	0,923	0,362	0,761	0,770	0,329				0,878	0,879	0,287	0,908	0,907	0,927	0,788	0,791	0,056				0,831	0,829	0,447	0,923	0,914	0,334	0,786	0,783	0,836				0,864	0,840	0,044
2017	Fixed effect	OUT																																				
2017	Fixed effect	ONE																																				
2017	Random effect	IN	0,868	0,869	0,220	0,899	0,897	0,504	0,899	0,897	0,577	0,761	0,762	0,637	0,823	0,822	0,908	0,818	0,817	0,957	0,815	0,814	0,899	0,719	0,716	0,472	0,812	0,788	0,070	0,811	0,786	0,058	0,808	0,786	0,092	0,733	0,714	0,273
2017	Random effect	OUT																																				
2017	Random effect	ONE																																				
2017	Chamberlain's	IN				0,936	0,932	0,361	0,935	0,931	0,270							0,915	0,909	0,336	0,911	0,907	0,524							0,911	0,892	0,114	0,910	0,889	0,081			
2017	Chamberlain's	OUT																																				
2017	Chamberlain's	ONE																																				
2017	Dynamic	IN				0,915	0,911	0,255	0,914	0,909	0,288							0,868	0,866	0,810	0,867	0,865	0,535							0,872	0,861	0,306	0,870	0,859	0,279			
2017	Dynamic	OUT																																				
2017	Dynamic	ONE																																				
2017	Multinomial	IN				0,896	0,892	0,222	0,894	0,892	0,335	0,787	0,789	0,649				0,816	0,817	0,847	0,813	0,813	0,988	0,725	0,725	0,920				0,823	0,803	0,116	0,822	0,800	0,108	0,733	0,716	0,280
2017	Multinomial	OUT																																				
2017	Multinomial	ONE																																				
2017	Multinomial robustness	IN				0,896	0,891	0,151	0,894	0,891	0,316	0,785	0,788	0,325				0,812	0,812	0,819	0,809	0,809	0,871	0,726	0,725	0,908				0,822	0,803	0,148	0,820	0,799	0,101	0,739	0,723	0,329
2017	Multinomial robustness	OUT																																				
2017	Multinomial robustness	ONE																																				
2017	Multinomial probit	IN										0,786	0,787	0,906										0,727	0,721	0,192										0,735	0,711	0,156
2017	Multinomial probit	OUT																																				
2017	Multinomial probit	ONE																																				
2017	Multinomial robustness, probit	IN										0,781	0,786	0,109										0,728	0,723	0,296										0,736	0,716	0,229
2017	Multinomial robustness, probit	OUT																																				
2017	Multinomial robustness, probit	ONE																																				

Note: The table presents results for area under receiver operating characteristic (AUROC) curve which has been computed for the original model (unrestricted model – AUROC Unr) and for model which excludes youth unemployment rate (restricted model – AUROC R), with corresponding p-value which evaluates the statistical significance of such change, when using the data for EU countries over the period 2001-2016. The sample year (2013 – 2017) denotes the first year of the sub-sample excluded from the estimation, which is the same as out-of-ample period. The in-sample period is the period used as estimation sample (before the sample year) and one-year-out-of-sample period is the first year of out-of-sample period (only the period of the sample year). The multinomial model designates results for multinomial logit and multinomial probit models, depending on the used framework. In case of indicator models, the multinomial model represents the results for multinomial logit models, while multinomial probit provides the results for multinomial probit models.
Source: Authors' calculations based on data from the EC and Eurostat.

Appendix F

Table F.1 **In-sample econometric results for the EA, one year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	0.021**	0.012	0.021***	0.027**	0.019**	0.021**	0.023**
	(0.013)	(0.330)	(0.005)	(0.045)	(0.035)	(0.026)	(0.011)
NIIP	-0.001	-0.003	-0.001	-0.005***	-0.001	-0.001*	-0.001**
	(0.185)	(0.359)	(0.163)	(0.003)	(0.244)	(0.086)	(0.022)
EMS	-0.008***	-0.004	-0.008***	-0.011**	-0.007***	-0.007**	-0.007***
	(0.001)	(0.388)	(0.002)	(0.012)	(0.006)	(0.011)	(0.003)
NULC	0.025***	0.013	0.025***	0.018**	0.021***	0.030***	0.029***
	(0.002)	(0.338)	(0.001)	(0.042)	(0.003)	(0.000)	(0.000)
REER	-0.000	-0.001	-0.000	0.002	-0.002	0.001	0.004
	(0.964)	(0.735)	(0.963)	(0.703)	(0.744)	(0.862)	(0.470)
PSD	0.000	0.003	0.000	0.006**	0.000	0.001	0.001**
	(0.413)	(0.109)	(0.221)	(0.025)	(0.323)	(0.118)	(0.044)
PSCF	-0.001	-0.003	-0.001	-0.005	-0.001	-0.001	-0.001
	(0.629)	(0.273)	(0.730)	(0.127)	(0.749)	(0.356)	(0.273)
HPI	-0.041***	-0.020	-0.041***	-0.035***	-0.043***	-0.041***	-0.040***
	(0.000)	(0.318)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GGSD	-0.001	-0.006	-0.001	-0.010***	-0.001	-0.001	-0.001
	(0.164)	(0.304)	(0.161)	(0.003)	(0.166)	(0.342)	(0.562)
UR	0.005	0.008	0.004	0.002	-0.002	0.011	0.016
	(0.547)	(0.710)	(0.708)	(0.944)	(0.883)	(0.262)	(0.160)
TFSL	-0.003	-0.006	-0.003	-0.006	-0.003	-0.003	-0.002
	(0.283)	(0.385)	(0.355)	(0.139)	(0.375)	(0.349)	(0.358)
AR	0.018	0.012	0.020	0.033	0.019	0.022	0.021
	(0.405)	(0.444)	(0.365)	(0.223)	(0.341)	(0.316)	(0.274)
LTUR	0.117***	0.074	0.117***	0.133***	0.110***	0.144***	0.137***
	(0.000)	(0.325)	(0.001)	(0.001)	(0.002)	(0.000)	(0.000)
YUR	-0.019**	-0.018	-0.019**	-0.027***	-0.020**	-0.025***	-0.026***
	(0.023)	(0.335)	(0.030)	(0.009)	(0.023)	(0.001)	(0.001)
L.DV					0.077		
					(0.181)		
R-sqr	0.545	0.739				0.514	0.509
No. of observations	186	159	186	186	174	186	186
Dynamic completeness test	3.540						
Dynamic completeness test, P-val	0.060						
Hausman test			4.832				
Hausman test, P-val			0.988				
Correlated random effects test				18.313			
Correlated random effects test, P-val				0.193			
State dependence tests					1.312		
State dependence tests, P-val					0.189		
State dependence tests (Robust)					1.365		
State dependence tests, P-val (Robust)					0.172		
Cor.Pred.Crisis - In sample	0.783	0.217	0.783	0.867	0.831	0.783	0.750
aNtS - In sample	0.081	0.183	0.081	0.073	0.073	0.101	0.116
CPR - In sample	0.887	0.720	0.887	0.914	0.902	0.876	0.860
Absolute Utility - In sample	0.360	0.088	0.360	0.402	0.385	0.352	0.331
AUROC - In sample	0.940	0.673	0.940	0.978	0.946	0.937	0.937
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for euro area countries, using one year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.2 **Out-of-sample econometric results for the EA, one year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	0.039***		0.039***	0.031	0.043***	0.020	0.016
	(0.001)		(0.000)	(0.452)	(0.003)	(0.142)	(0.163)
NIIP	-0.003***		-0.003**	-0.008	-0.003**	-0.003***	-0.003***
	(0.001)		(0.029)	(0.537)	(0.037)	(0.005)	(0.006)
EMS	-0.008**		-0.008**	-0.039	-0.010**	-0.001	-0.003
	(0.016)		(0.016)	(0.198)	(0.017)	(0.948)	(0.432)
NULC	0.037***		0.037***	-0.014	0.037***	0.039***	0.033***
	(0.000)		(0.000)	(0.619)	(0.000)	(0.001)	(0.000)
REER	-0.004		-0.004	0.035	-0.002	-0.011	-0.006
	(0.629)		(0.551)	(0.298)	(0.753)	(0.482)	(0.488)
PSD	0.000		0.000	-0.004	0.000	0.001	0.001
	(0.897)		(0.864)	(0.414)	(0.883)	(0.502)	(0.412)
PSCF	-0.001		-0.001	0.001	-0.001	-0.000	-0.002
	(0.535)		(0.745)	(0.905)	(0.734)	(0.949)	(0.503)
HPI	-0.049***		-0.049***	-0.065	-0.056***	-0.044***	-0.044***
	(0.000)		(0.000)	(0.140)	(0.000)	(0.000)	(0.000)
GGSD	-0.000		-0.000	-0.003	0.000	0.000	-0.000
	(0.998)		(0.997)	(0.831)	(0.957)	(0.817)	(0.886)
UR	0.021		0.021	0.073	0.015	0.021	0.017
	(0.289)		(0.297)	(0.386)	(0.483)	(0.286)	(0.414)
TFSL	-0.006		-0.006	-0.018	-0.006	-0.002	-0.004
	(0.114)		(0.183)	(0.373)	(0.235)	(0.622)	(0.386)
AR	0.028		0.028	0.002	0.036	0.025	0.020
	(0.171)		(0.311)	(0.985)	(0.204)	(0.294)	(0.308)
LTUR	0.155***		0.155***	0.036	0.173***	0.157***	0.120***
	(0.000)		(0.000)	(0.500)	(0.000)	(0.000)	(0.003)
YUR	-0.043***		-0.043***	-0.014	-0.047***	-0.051***	-0.042***
	(0.000)		(0.000)	(0.614)	(0.000)	(0.000)	(0.000)
L.DV					0.027		
					(0.733)		
R-sqr	0.567	1.003				0.590	0.599
No. of observations	115	235	115	115	107	115	115
Dynamic completeness test	4.132						
Dynamic completeness test, P-val	0.042						
Hausman test			168.192				
Hausman test, P-val			0.000				
Correlated random effects test				51.129			
Correlated random effects test, P-val				0.000			
State dependence tests					1.312		
State dependence tests, P-val					0.189		
State dependence tests (Robust)					1.365		
State dependence tests, P-val (Robust)					0.172		
Cor.Pred.Crisis - In sample	0.818	0.121	0.818	1.000	0.813	0.818	0.848
aNtS - In sample	0.060	0.201	0.060	0.000	0.049	0.060	0.057
CPR - In sample	0.913	0.730	0.913	1.000	0.916	0.913	0.922
Absolute Utility - In sample	0.385	0.048	0.385	0.500	0.386	0.385	0.400
AUROC - In sample	0.943	0.545	0.943	1.000	0.948	0.945	0.944
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.926	0.308	0.926	0.889	0.926	0.630	0.741
aNtS - Out sample	0.368	0.369	0.368	0.439	0.378	0.469	0.430
CPR - Out sample	0.761	0.671	0.761	0.721	0.761	0.676	0.704
Absolute Utility - Out sample	0.293	0.097	0.293	0.249	0.288	0.167	0.211
AUROC - Out sample	0.881	0.640	0.881	0.752	0.898	0.745	0.790
Cor.Pred.Crisis - Out sample (first year only)	0.909	0.182	0.909	0.909	0.909	0.727	0.818
aNtS - Out sample (first year only)	0.367	0.917	0.367	0.183	0.220	0.458	0.407
CPR - Out sample (first year only)	0.824	0.412	0.824	0.882	0.875	0.706	0.765
Absolute Utility - Out sample (first year only)	0.288	0.008	0.288	0.371	0.355	0.197	0.242
AUROC - Out sample (first year only)	0.879	0.538	0.879	0.833	0.927	0.833	0.773

Note: The table presents estimated models for crisis variable for euro area countries, using one year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.3 **In-sample econometric results for the EA, two year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	0.004	-0.022	-0.011	-0.045**	-0.010	0.003	0.005
	(0.696)	(0.321)	(0.341)	(0.025)	(0.307)	(0.762)	(0.691)
NIIP	-0.002	-0.001	-0.001	-0.002	-0.001	-0.002*	-0.002*
	(0.133)	(0.441)	(0.291)	(0.164)	(0.441)	(0.099)	(0.063)
EMS	-0.002	0.000	-0.001	-0.000	0.001	0.000	0.001
	(0.653)	(0.950)	(0.860)	(0.953)	(0.782)	(0.965)	(0.854)
NULC	0.026**	0.007	0.014	0.014	0.019**	0.028***	0.030***
	(0.022)	(0.504)	(0.186)	(0.148)	(0.031)	(0.005)	(0.002)
REER	-0.035**	-0.022	-0.036***	-0.048***	-0.039***	-0.036***	-0.035***
	(0.020)	(0.368)	(0.000)	(0.000)	(0.000)	(0.004)	(0.004)
PSD	-0.000	0.001	0.000	0.003	-0.000	-0.000	0.000
	(0.859)	(0.626)	(0.881)	(0.269)	(0.364)	(0.930)	(0.802)
PSCF	0.004*	0.000	0.002	0.000	0.003*	0.004*	0.004*
	(0.074)	(0.771)	(0.335)	(0.801)	(0.079)	(0.050)	(0.087)
HPI	-0.021**	-0.007	-0.018**	-0.016**	-0.004	-0.024**	-0.024**
	(0.039)	(0.390)	(0.023)	(0.021)	(0.628)	(0.021)	(0.018)
GGSD	-0.003**	-0.007	-0.004***	-0.015***	-0.003**	-0.003*	-0.002
	(0.043)	(0.380)	(0.005)	(0.000)	(0.014)	(0.083)	(0.159)
UR	-0.003	0.018	-0.008	0.039	-0.001	-0.001	0.003
	(0.753)	(0.530)	(0.639)	(0.234)	(0.937)	(0.932)	(0.836)
TFSL	-0.002	-0.004	-0.004	-0.008**	-0.002	-0.002	-0.001
	(0.312)	(0.335)	(0.311)	(0.041)	(0.594)	(0.345)	(0.513)
AR	-0.005	0.014	0.008	0.029	-0.006	-0.004	-0.001
	(0.880)	(0.553)	(0.793)	(0.280)	(0.828)	(0.903)	(0.982)
LTUR	0.025	0.006	0.019	0.013	0.000	0.044	0.055
	(0.511)	(0.787)	(0.583)	(0.765)	(0.998)	(0.183)	(0.128)
YUR	0.011	0.010	0.011	0.021**	0.016*	0.006	0.002
	(0.336)	(0.385)	(0.238)	(0.021)	(0.084)	(0.568)	(0.881)
L.DV					0.257***		
					(0.000)		
R-sqr	0.346	0.557				0.366	0.375
No. of observations	167	145	167	167	156	167	167
Dynamic completeness test	14.040						
Dynamic completeness test, P-val	0.000						
Hausman test			-750.126				
Hausman test, P-val			1.000				
Correlated random effects test				20.653			
Correlated random effects test, P-val				0.111			
State dependence tests					3.333		
State dependence tests, P-val					0.001		
State dependence tests (Robust)					3.333		
State dependence tests, P-val (Robust)					0.001		
Cor.Pred.Crisis - In sample	0.678	0.119	0.593	0.797	0.759	0.695	0.661
aNtS - In sample	0.123	0.390	0.156	0.116	0.135	0.107	0.112
CPR - In sample	0.832	0.659	0.796	0.868	0.846	0.844	0.832
Absolute Utility - In sample	0.297	0.036	0.250	0.352	0.328	0.310	0.293
AUROC - In sample	0.871	0.752	0.860	0.956	0.897	0.872	0.865
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for euro area countries, using two year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.4 **Out-of-sample econometric results for the EA, two year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	0.011		0.011	-0.318**	-0.006	0.015	-0.020
	(0.396)		(0.412)	(0.016)	(0.711)	(0.234)	(0.210)
NIIP	-0.004**		-0.004**	-0.013	-0.002	-0.004**	-0.004**
	(0.017)		(0.049)	(0.180)	(0.253)	(0.016)	(0.027)
EMS	0.003		0.003	-0.019	0.005	0.001	0.017**
	(0.410)		(0.354)	(0.153)	(0.170)	(0.806)	(0.023)
NULC	0.022**		0.022**	-0.060	0.010	0.022**	0.016**
	(0.035)		(0.048)	(0.138)	(0.419)	(0.019)	(0.041)
REER	-0.051***		-0.051***	-0.125**	-0.055***	-0.042**	-0.065***
	(0.003)		(0.000)	(0.032)	(0.000)	(0.011)	(0.001)
PSD	-0.000		-0.000	0.023**	-0.000	-0.000	0.001
	(0.826)		(0.814)	(0.019)	(0.735)	(0.817)	(0.192)
PSCF	0.001		0.001	-0.005	0.002	0.001	0.005*
	(0.168)		(0.545)	(0.204)	(0.288)	(0.186)	(0.078)
HPI	-0.019*		-0.019**	-0.049**	-0.006	-0.023**	0.003
	(0.061)		(0.041)	(0.026)	(0.589)	(0.027)	(0.868)
GGSD	-0.003*		-0.003*	-0.018	-0.003*	-0.002	-0.001
	(0.057)		(0.088)	(0.141)	(0.097)	(0.159)	(0.528)
UR	0.006		0.006	0.082	-0.003	0.004	0.014
	(0.807)		(0.811)	(0.508)	(0.918)	(0.863)	(0.583)
TFSL	-0.007		-0.007	0.004	-0.012	-0.004	-0.004
	(0.152)		(0.294)	(0.557)	(0.113)	(0.338)	(0.460)
AR	0.033		0.033	0.079	0.034	0.037	0.010
	(0.196)		(0.353)	(0.229)	(0.383)	(0.147)	(0.726)
LTUR	0.001		0.001	-0.164	-0.035	0.012	-0.116
	(0.981)		(0.984)	(0.353)	(0.652)	(0.846)	(0.166)
YUR	-0.001		-0.001	-0.013	0.015	-0.007	0.011
	(0.973)		(0.977)	(0.777)	(0.514)	(0.718)	(0.558)
L.DV					0.226**		
					(0.047)		
R-sqr	0.400	1.011				0.602	0.561
No. of observations	98	235	98	98	91	98	98
Dynamic completeness test	0.012						
Dynamic completeness test, P-val	0.912						
Hausman test			246.006				
Hausman test, P-val			0.000				
Correlated random effects test				6.277			
Correlated random effects test, P-val				0.959			
State dependence tests					3.333		
State dependence tests, P-val					0.001		
State dependence tests (Robust)					3.333		
State dependence tests, P-val (Robust)					0.001		
Cor.Pred.Crisis - In sample	0.719	0.095	0.719	0.906	0.677	0.750	0.719
aNtS - In sample	0.148	0.233	0.148	0.017	0.172	0.101	0.084
CPR - In sample	0.837	0.697	0.837	0.959	0.813	0.867	0.867
Absolute Utility - In sample	0.306	0.037	0.306	0.446	0.280	0.337	0.329
AUROC - In sample	0.890	0.644	0.890	0.987	0.902	0.912	0.922
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.741	0.286	0.741	0.593	0.926	0.630	0.333
aNtS - Out sample	0.611	0.583	0.611	0.821	0.455	0.605	1.214
CPR - Out sample	0.623	0.608	0.623	0.547	0.723	0.623	0.493
Absolute Utility - Out sample	0.144	0.060	0.144	0.053	0.252	0.124	-0.036
AUROC - Out sample	0.723	0.544	0.723	0.618	0.829	0.649	0.407
Cor.Pred.Crisis - Out sample (first year only)	0.636	0.125	0.636	0.636	0.909	0.636	0.545
aNtS - Out sample (first year only)	0.786	2.000	0.786	0.943	0.660	0.786	0.917
CPR - Out sample (first year only)	0.588	0.333	0.588	0.563	0.750	0.588	0.529
Absolute Utility - Out sample (first year only)	0.068	-0.063	0.068	0.018	0.155	0.068	0.023
AUROC - Out sample (first year only)	0.576	0.438	0.576	0.573	0.745	0.545	0.470

Note: The table presents estimated models for crisis variable for euro area countries, using two year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.5 **In-sample econometric results for the EA, three year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	0.013	-0.030***	-0.001	-0.077***	0.011	0.014	0.013
	(0.372)	(0.000)	(0.966)	(0.002)	(0.261)	(0.286)	(0.417)
NIIP	-0.003**	-0.001	-0.003*	-0.003	-0.003**	-0.004***	-0.004**
	(0.030)	(0.144)	(0.071)	(0.125)	(0.021)	(0.010)	(0.026)
EMS	0.001	0.003	0.002	0.008*	0.002	0.004	0.004
	(0.701)	(0.275)	(0.480)	(0.077)	(0.378)	(0.327)	(0.254)
NULC	0.049***	0.018**	0.042***	0.047***	0.041***	0.049***	0.046***
	(0.000)	(0.029)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
REER	-0.045***	-0.031**	-0.048***	-0.077***	-0.034***	-0.046***	-0.048***
	(0.000)	(0.021)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PSD	-0.000	-0.000	-0.000	-0.001	-0.000	-0.000	-0.000
	(0.390)	(0.500)	(0.682)	(0.458)	(0.509)	(0.871)	(0.614)
PSCF	0.006**	0.001	0.004	0.002	0.005	0.007***	0.007***
	(0.022)	(0.360)	(0.197)	(0.257)	(0.127)	(0.001)	(0.003)
HPI	0.004	0.004	0.006	0.009	0.009	0.003	0.001
	(0.542)	(0.297)	(0.369)	(0.234)	(0.189)	(0.599)	(0.913)
GGSD	-0.002	-0.007*	-0.003**	-0.017***	-0.001	-0.002	-0.002
	(0.137)	(0.060)	(0.040)	(0.000)	(0.381)	(0.258)	(0.334)
UR	0.007	0.028**	0.006	0.068**	0.006	0.007	0.008
	(0.558)	(0.047)	(0.743)	(0.026)	(0.652)	(0.594)	(0.685)
TFSL	0.002	-0.002	0.001	-0.006	0.002	0.003	0.002
	(0.306)	(0.307)	(0.751)	(0.196)	(0.330)	(0.311)	(0.339)
AR	-0.035	-0.012	-0.032	-0.030	-0.028	-0.046	-0.042
	(0.288)	(0.372)	(0.302)	(0.306)	(0.304)	(0.124)	(0.184)
LTUR	-0.038	-0.020	-0.037	-0.044	-0.031	-0.045	-0.034
	(0.479)	(0.266)	(0.378)	(0.270)	(0.425)	(0.367)	(0.369)
YUR	0.038**	0.024**	0.037***	0.059***	0.031***	0.042***	0.037***
	(0.011)	(0.033)	(0.001)	(0.000)	(0.004)	(0.006)	(0.001)
L.DV					0.233***		
					(0.000)		
R-sqr	0.390	0.667				0.406	0.408
No. of observations	149	131	149	149	149	149	149
Dynamic completeness test	13.277						
Dynamic completeness test, P-val	0.000						
Hausman test			16.485				
Hausman test, P-val			0.285				
Correlated random effects test				107.631			
Correlated random effects test, P-val				0.000			
State dependence tests					3.421		
State dependence tests, P-val					0.001		
State dependence tests (Robust)					2.855		
State dependence tests, P-val (Robust)					0.004		
Cor.Pred.Crisis - In sample	0.667	0.193	0.719	0.912	0.737	0.684	0.719
aNtS - In sample	0.179	0.113	0.181	0.048	0.148	0.175	0.151
CPR - In sample	0.799	0.678	0.812	0.940	0.832	0.805	0.826
Absolute Utility - In sample	0.274	0.086	0.294	0.434	0.314	0.282	0.305
AUROC - In sample	0.886	0.707	0.879	0.976	0.908	0.894	0.886
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for euro area countries, using three year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.6 **Out-of-sample econometric results for the EA, three year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	-0.017	-0.002	-0.072		-0.023	-0.017	-0.018
	(0.369)	(1.000)	(0.432)		(0.244)	(0.338)	(0.234)
NIIP	0.000	0.000	0.002		0.001	0.000	-0.000
	(0.846)	(1.000)	(0.562)		(0.784)	(0.907)	(0.849)
EMS	0.008***	-0.000	0.005		0.009**	0.009***	0.011***
	(0.004)	(1.000)	(0.456)		(0.028)	(0.001)	(0.002)
NULC	0.027**	-0.001	0.014		0.038***	0.028***	0.030***
	(0.011)	(1.000)	(0.445)		(0.007)	(0.009)	(0.000)
REER	-0.109***	-0.010	-0.158		-0.123***	-0.109***	-0.110***
	(0.000)	(1.000)	(0.434)		(0.000)	(0.000)	(0.000)
PSD	0.001	0.001	0.003		0.002*	0.001*	0.002*
	(0.183)	(1.000)	(0.510)		(0.052)	(0.063)	(0.055)
PSCF	0.005*	0.000	0.005		0.008	0.003*	0.004
	(0.059)	(1.000)	(0.537)		(0.206)	(0.081)	(0.172)
HPI	0.000	-0.000	-0.004		0.004	0.000	0.000
	(0.982)	(1.000)	(0.712)		(0.648)	(0.971)	(0.967)
GGSD	-0.003	-0.000	-0.008		-0.002	-0.003	-0.003*
	(0.175)	(1.000)	(0.516)		(0.356)	(0.119)	(0.076)
UR	-0.004	-0.015	-0.049		-0.027	0.002	0.019
	(0.921)	(1.000)	(0.533)		(0.414)	(0.947)	(0.534)
TFSL	-0.003	0.000	-0.010		-0.002	-0.002	-0.001
	(0.445)	(1.000)	(0.525)		(0.580)	(0.647)	(0.586)
AR	0.005	0.003	0.026		-0.023	0.008	0.001
	(0.918)	(1.000)	(0.584)		(0.563)	(0.864)	(0.978)
LTUR	-0.250***	-0.016	-0.281		-0.224***	-0.249***	-0.277***
	(0.003)	(1.000)	(0.470)		(0.006)	(0.002)	(0.000)
YUR	0.093***	0.011	0.175		0.097***	0.092***	0.096***
	(0.000)	(1.000)	(0.447)		(0.000)	(0.000)	(0.000)
L.DV					0.036		
					(0.689)		
R-sqr	0.602	1.000				0.562	0.614
No. of observations	82	71	82	235	82	82	82
Dynamic completeness test	2.025						
Dynamic completeness test, P-val	0.155						
Hausman test			0.000				
Hausman test, P-val			1.000				
Correlated random effects test				0.000			
Correlated random effects test, P-val				1.000			
State dependence tests					3.421		
State dependence tests, P-val					0.001		
State dependence tests (Robust)					2.855		
State dependence tests, P-val (Robust)					0.004		
Cor.Pred.Crisis - In sample	0.833	0.067	0.700	1.000	0.867	0.833	0.867
aNtS - In sample	0.092	0.000	0.220	0.000	0.089	0.138	0.067
CPR - In sample	0.890	0.659	0.793	1.000	0.902	0.866	0.915
Absolute Utility - In sample	0.378	0.033	0.273	0.500	0.395	0.359	0.404
AUROC - In sample	0.954	0.588	0.887	1.000	0.962	0.955	0.959
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.889	0.259	0.963	0.963	0.889	0.889	0.926
aNtS - Out sample	0.759	0.771	0.805	0.898	0.731	0.647	0.594
CPR - Out sample	0.552	0.582	0.522	0.484	0.567	0.612	0.642
Absolute Utility - Out sample	0.107	0.030	0.094	0.049	0.119	0.157	0.188
AUROC - Out sample	0.719	0.593	0.716	0.562	0.696	0.756	0.756
Cor.Pred.Crisis - Out sample (first year only)	0.909	0.182	1.000	1.000	0.909	0.909	1.000
aNtS - Out sample (first year only)	1.100	0.000	1.000	0.800	1.100	1.100	1.000
CPR - Out sample (first year only)	0.625	0.438	0.688	0.750	0.625	0.625	0.688
Absolute Utility - Out sample (first year only)	-0.045	0.091	0.000	0.100	-0.045	-0.045	0.000
AUROC - Out sample (first year only)	0.709	0.564	0.673	0.600	0.709	0.745	0.691

Note: The table presents estimated models for crisis variable for euro area countries, using three year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.7 **In-sample econometric results for the EA, one year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	0.025**	0.025***	0.017***	0.008	0.008	0.008	0.025***
	(0.013)	(0.001)	(0.000)	(0.606)	(0.608)	(0.363)	(0.006)
NIIP	-0.003***	-0.003***	-0.002***	-0.004**	-0.004**	-0.004**	-0.003***
	(0.003)	(0.000)	(0.000)	(0.012)	(0.034)	(0.038)	(0.001)
EMS	-0.007**	-0.007***	-0.009***	-0.009**	-0.009***	-0.009***	-0.007***
	(0.015)	(0.000)	(0.002)	(0.015)	(0.009)	(0.000)	(0.007)
NULC	0.025***	0.025***	0.015**	0.012	0.012	0.012	0.025***
	(0.010)	(0.001)	(0.026)	(0.201)	(0.168)	(0.180)	(0.004)
REER	-0.002	-0.002	0.005	0.005	0.005	0.005	-0.002
	(0.834)	(0.667)	(0.474)	(0.598)	(0.525)	(0.333)	(0.831)
PSD	0.001	0.001*	0.001**	0.003**	0.003	0.003***	0.001
	(0.297)	(0.066)	(0.012)	(0.019)	(0.107)	(0.001)	(0.283)
PSCF	-0.002**	-0.002***	-0.002***	-0.003***	-0.003**	-0.003***	-0.002**
	(0.023)	(0.000)	(0.000)	(0.000)	(0.032)	(0.000)	(0.013)
HPI	-0.032***	-0.032***	-0.032***	-0.029***	-0.029***	-0.029***	-0.032***
	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)
GGSD	-0.002	-0.002	-0.002**	-0.003	-0.003	-0.003	-0.002
	(0.307)	(0.175)	(0.036)	(0.602)	(0.399)	(0.494)	(0.293)
UR	0.005	0.005	0.004	-0.008	-0.008	-0.008	0.005
	(0.660)	(0.564)	(0.446)	(0.774)	(0.739)	(0.657)	(0.654)
TFSL	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.457)	(0.261)	(0.461)	(0.216)	(0.431)	(0.346)	(0.448)
AR	0.010	0.010	0.021	0.022	0.022	0.022	0.010
	(0.744)	(0.680)	(0.198)	(0.559)	(0.474)	(0.524)	(0.741)
LTUR	0.072**	0.072***	0.056***	0.072*	0.072**	0.072***	0.072**
	(0.042)	(0.002)	(0.004)	(0.070)	(0.042)	(0.002)	(0.029)
YUR	-0.006	-0.006	-0.007	-0.010	-0.010	-0.010*	-0.006
	(0.577)	(0.363)	(0.195)	(0.395)	(0.294)	(0.050)	(0.570)
constant	0.007	0.007	0.065	-0.109	-0.148	-0.109	0.007
	(0.978)	(0.963)	(0.528)	(0.712)	(0.618)	(0.665)	(0.978)
R-sqr	0.484	0.484	0.440	0.453	0.573		
Within.R-sqr				0.453		0.453	0.424
Over.R-sqr				0.391			0.484
Betw.R-sqr				0.467			0.702
No. of observations	186	186	186	186	186	186	186
Pesaran cross-sectional dependence test				.			.
Pesaran cross-sectional dependence test, P-val				.			.
D'Agostino normality test	8.535	8.535	7.564	6.083	6.083	3.338	8.535
D'Agostino normality test, P-val	0.014	0.014	0.023	0.048	0.048	0.188	0.014
Breusch-Pagan test	1.988						
Breusch-Pagan test, P-val	0.063						
Quasi-time-demeaned-data test of ser. corr.	1.017						
Quasi-time-demeaned-data test of ser. corr., P-val	0.309						
Relevance/redundancy of FE test					1.766		
Relevance/redundancy of FE test, P-val					0.034		
Hausman test							.
Hausman test, P-val							.
Cor.Pred.Crisis - In sample	0.700	0.700	0.650	0.767	0.767	0.683	0.700
aNtS - In sample	0.068	0.068	0.061	0.062	0.062	0.174	0.068
CPR - In sample	0.871	0.871	0.860	0.892	0.892	0.817	0.871
Absolute Utility - In sample	0.326	0.326	0.305	0.360	0.360	0.282	0.326
AUROC - In sample	0.928	0.928	0.927	0.958	0.958	0.887	0.928
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for euro area countries, using one year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.8 **Out-of-sample econometric results for the EA, one year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	0.042***	0.042***	0.038***	0.024	0.024	0.024	0.042***
	(0.006)	(0.000)	(0.000)	(0.408)	(0.420)	(0.301)	(0.001)
NIIP	-0.004***	-0.004***	-0.003**	-0.003	-0.003	-0.003**	-0.004***
	(0.001)	(0.000)	(0.019)	(0.171)	(0.300)	(0.018)	(0.000)
EMS	-0.005	-0.005***	-0.007***	-0.012**	-0.012**	-0.012***	-0.005
	(0.131)	(0.001)	(0.003)	(0.027)	(0.036)	(0.007)	(0.111)
NULC	0.041***	0.041***	0.028***	0.001	0.001	0.001	0.041***
	(0.000)	(0.000)	(0.001)	(0.908)	(0.924)	(0.910)	(0.000)
REER	-0.004	-0.004	0.009*	0.018**	0.018*	0.018***	-0.004
	(0.715)	(0.449)	(0.069)	(0.033)	(0.069)	(0.000)	(0.710)
PSD	0.001	0.001	0.001	0.003*	0.003	0.003***	0.001
	(0.606)	(0.544)	(0.381)	(0.050)	(0.192)	(0.004)	(0.599)
PSCF	-0.002***	-0.002***	-0.002	-0.003***	-0.003*	-0.003***	-0.002***
	(0.001)	(0.000)	(0.337)	(0.001)	(0.060)	(0.000)	(0.000)
HPI	-0.033***	-0.033***	-0.036***	-0.034***	-0.034***	-0.034***	-0.033***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
GGSD	0.001	0.001	-0.000	0.003	0.003	0.003	0.001
	(0.789)	(0.753)	(0.989)	(0.541)	(0.462)	(0.227)	(0.786)
UR	0.019	0.019**	0.028***	-0.022	-0.022	-0.022	0.019
	(0.369)	(0.016)	(0.001)	(0.562)	(0.675)	(0.357)	(0.356)
TFSL	-0.001	-0.001	-0.002	-0.002	-0.002	-0.002	-0.001
	(0.564)	(0.445)	(0.219)	(0.519)	(0.655)	(0.414)	(0.556)
AR	0.018	0.018	0.010	0.056	0.056	0.056	0.018
	(0.585)	(0.507)	(0.683)	(0.102)	(0.214)	(0.125)	(0.577)
LTUR	0.119***	0.119***	0.096**	0.069*	0.069	0.069*	0.119***
	(0.005)	(0.001)	(0.032)	(0.098)	(0.233)	(0.059)	(0.001)
YUR	-0.026**	-0.026**	-0.024	-0.014	-0.014	-0.014	-0.026**
	(0.043)	(0.020)	(0.121)	(0.313)	(0.325)	(0.174)	(0.028)
constant	-0.302	-0.302	-0.364	-0.382	-0.514	-0.382	-0.302
	(0.507)	(0.293)	(0.292)	(0.391)	(0.266)	(0.146)	(0.497)
R-sqr	0.465	0.465	0.539	0.524	0.622		
Within.R-sqr				0.524		0.524	0.458
Over.R-sqr				0.311			0.465
Betw.R-sqr				0.054			0.296
No. of observations	115	115	115	115	115	115	115
Pesaran cross-sectional dependence test				.			.
Pesaran cross-sectional dependence test, P-val				.			.
D'Agostino normality test	7.923	7.923	7.431	12.666	12.666	6.915	7.923
D'Agostino normality test, P-val	0.019	0.019	0.024	0.002	0.002	0.032	0.019
Breusch-Pagan test	-1.044						
Breusch-Pagan test, P-val	0.313						
Quasi-time-demeaned-data test of ser. corr.	0.017						
Quasi-time-demeaned-data test of ser. corr., P-val	0.987						
Relevance/redundancy of FE test					0.671		
Relevance/redundancy of FE test, P-val					0.748		
Hausman test							.
Hausman test, P-val							.
Cor.Pred.Crisis - In sample	0.636	0.636	0.697	0.667	0.667	0.606	0.636
aNtS - In sample	0.038	0.038	0.070	0.018	0.018	0.161	0.038
CPR - In sample	0.878	0.878	0.878	0.896	0.896	0.817	0.878
Absolute Utility - In sample	0.306	0.306	0.324	0.327	0.327	0.254	0.306
AUROC - In sample	0.925	0.925	0.925	0.974	0.974	0.849	0.925
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.741	0.741	0.778	0.926	0.926	0.889	0.741
aNtS - Out sample	0.215	0.215	0.234	0.184	0.172	0.205	0.215
CPR - Out sample	0.803	0.803	0.803	0.868	0.873	0.845	0.803
Absolute Utility - Out sample	0.291	0.291	0.298	0.378	0.383	0.354	0.291
AUROC - Out sample	0.871	0.871	0.898	0.878	0.886	0.879	0.871
Cor.Pred.Crisis - Out sample (first year only)	0.727	0.727	0.727	0.909	0.909	0.818	0.727
aNtS - Out sample (first year only)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CPR - Out sample (first year only)	0.824	0.824	0.824	0.941	0.941	0.882	0.824
Absolute Utility - Out sample (first year only)	0.364	0.364	0.364	0.455	0.455	0.409	0.364
AUROC - Out sample (first year only)	0.939	0.939	0.939	0.924	0.924	0.909	0.939

Note: The table presents estimated models for crisis variable for euro area countries, using one year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.9 **In-sample econometric results for the EA, two year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	0.003	0.003	-0.025**	-0.028	-0.028	-0.028**	0.003
	(0.827)	(0.623)	(0.011)	(0.225)	(0.157)	(0.040)	(0.824)
NIIP	-0.002*	-0.002*	0.001	-0.003	-0.003	-0.003	-0.002**
	(0.056)	(0.056)	(0.507)	(0.170)	(0.212)	(0.152)	(0.040)
EMS	-0.002	-0.002	-0.000	-0.002	-0.002	-0.002	-0.002
	(0.572)	(0.536)	(0.953)	(0.626)	(0.581)	(0.465)	(0.564)
NULC	0.028**	0.028***	0.008	0.005	0.005	0.005	0.028**
	(0.038)	(0.000)	(0.374)	(0.653)	(0.678)	(0.625)	(0.024)
REER	-0.030**	-0.030***	-0.033***	-0.029**	-0.029***	-0.029***	-0.030**
	(0.021)	(0.000)	(0.000)	(0.028)	(0.001)	(0.000)	(0.011)
PSD	-0.000	-0.000	0.000	0.003*	0.003	0.003**	-0.000
	(0.884)	(0.793)	(0.355)	(0.076)	(0.207)	(0.044)	(0.882)
PSCF	0.003***	0.003***	0.002***	0.000	0.000	0.000	0.003***
	(0.007)	(0.002)	(0.004)	(0.587)	(0.847)	(0.713)	(0.002)
HPI	-0.019**	-0.019***	-0.018***	-0.013*	-0.013*	-0.013***	-0.019**
	(0.020)	(0.000)	(0.000)	(0.098)	(0.093)	(0.002)	(0.010)
GGSD	-0.003*	-0.003***	-0.004***	-0.011*	-0.011***	-0.011***	-0.003*
	(0.068)	(0.000)	(0.000)	(0.088)	(0.004)	(0.007)	(0.052)
UR	-0.001	-0.001	0.001	0.013	0.013	0.013	-0.001
	(0.950)	(0.945)	(0.856)	(0.563)	(0.678)	(0.587)	(0.949)
TFSL	-0.002	-0.002	-0.004	-0.005***	-0.005	-0.005***	-0.002
	(0.399)	(0.494)	(0.209)	(0.002)	(0.123)	(0.000)	(0.387)
AR	-0.014	-0.014	0.005	-0.009	-0.009	-0.009	-0.014
	(0.657)	(0.674)	(0.835)	(0.831)	(0.808)	(0.868)	(0.651)
LTUR	0.034	0.034	0.013	0.010	0.010	0.010	0.034
	(0.390)	(0.222)	(0.715)	(0.800)	(0.803)	(0.803)	(0.377)
YUR	0.012	0.012	0.012	0.011	0.011	0.011	0.012
	(0.334)	(0.198)	(0.168)	(0.323)	(0.297)	(0.320)	(0.320)
constant	0.362	0.362	0.557***	0.483	0.596*	0.483*	0.362
	(0.207)	(0.164)	(0.000)	(0.163)	(0.077)	(0.074)	(0.190)
R-sqr	0.369	0.369	0.385	0.365	0.521		
Within.R-sqr				0.365		0.365	0.292
Over.R-sqr				0.232			0.369
Betw.R-sqr				0.178			0.612
No. of observations	167	167	167	167	167	167	167
Pesaran cross-sectional dependence test				.			.
Pesaran cross-sectional dependence test, P-val				.			.
D'Agostino normality test	8.173	8.173	13.405	1.850	1.850	0.204	8.173
D'Agostino normality test, P-val	0.017	0.017	0.001	0.396	0.396	0.903	0.017
Breusch-Pagan test	1.911						
Breusch-Pagan test, P-val	0.074						
Quasi-time-demeaned-data test of ser. corr.	1.434						
Quasi-time-demeaned-data test of ser. corr., P-val	0.152						
Relevance/redundancy of FE test					1.925		
Relevance/redundancy of FE test, P-val					0.047		
Hausman test							.
Hausman test, P-val							.
Cor.Pred.Crisis - In sample	0.627	0.627	0.627	0.814	0.814	0.610	0.627
aNtS - In sample	0.133	0.133	0.162	0.102	0.102	0.319	0.133
CPR - In sample	0.814	0.814	0.802	0.880	0.880	0.737	0.814
Absolute Utility - In sample	0.272	0.272	0.263	0.365	0.365	0.208	0.272
AUROC - In sample	0.866	0.866	0.841	0.940	0.940	0.780	0.866
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for euro area countries, using two year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.10 **Out-of-sample econometric results for the EA, two year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	0.015	0.015	-0.001	-0.051*	-0.051	-0.051***	-0.001
	(0.413)	(0.155)	(0.949)	(0.099)	(0.178)	(0.005)	(0.957)
NIIP	-0.004**	-0.004**	-0.003*	-0.003	-0.003	-0.003**	-0.003**
	(0.018)	(0.027)	(0.056)	(0.188)	(0.399)	(0.015)	(0.038)
EMS	0.002	0.002	0.004	0.001	0.001	0.001	0.001
	(0.638)	(0.151)	(0.228)	(0.886)	(0.901)	(0.833)	(0.862)
NULC	0.024*	0.024***	0.013	-0.024	-0.024	-0.024*	0.005
	(0.089)	(0.000)	(0.131)	(0.248)	(0.191)	(0.051)	(0.723)
REER	-0.038***	-0.038***	-0.035***	-0.019	-0.019	-0.019***	-0.033***
	(0.005)	(0.000)	(0.000)	(0.151)	(0.134)	(0.003)	(0.005)
PSD	0.000	0.000	0.001	0.005***	0.005*	0.005***	0.001
	(0.759)	(0.594)	(0.149)	(0.001)	(0.090)	(0.001)	(0.452)
PSCF	0.001	0.001*	0.000	-0.002**	-0.002	-0.002*	0.000
	(0.218)	(0.059)	(0.621)	(0.029)	(0.458)	(0.073)	(0.871)
HPI	-0.018**	-0.018***	-0.013	-0.016**	-0.016	-0.016***	-0.021**
	(0.027)	(0.000)	(0.128)	(0.044)	(0.172)	(0.002)	(0.011)
GGSD	-0.003	-0.003	-0.002	-0.000	-0.000	-0.000	-0.004
	(0.183)	(0.197)	(0.323)	(0.987)	(0.983)	(0.967)	(0.173)
UR	0.014	0.014	0.016	-0.064	-0.064	-0.064	-0.002
	(0.594)	(0.242)	(0.332)	(0.223)	(0.369)	(0.199)	(0.959)
TFSL	-0.005	-0.005**	-0.008	-0.005**	-0.005	-0.005***	-0.006**
	(0.175)	(0.014)	(0.103)	(0.015)	(0.275)	(0.000)	(0.017)
AR	0.019	0.019	0.035	0.099	0.099*	0.099**	0.028
	(0.585)	(0.350)	(0.206)	(0.160)	(0.092)	(0.023)	(0.478)
LTUR	0.028	0.028	0.053	0.043	0.043	0.043**	0.037
	(0.509)	(0.536)	(0.277)	(0.192)	(0.539)	(0.011)	(0.322)
YUR	-0.008	-0.008	-0.016	-0.005	-0.005	-0.005	-0.010
	(0.559)	(0.212)	(0.177)	(0.541)	(0.782)	(0.415)	(0.395)
constant	0.264	0.264	0.210	0.160	0.081	0.160	0.447
	(0.556)	(0.493)	(0.555)	(0.637)	(0.888)	(0.570)	(0.328)
R-sqr	0.384	0.384	0.400	0.446	0.586		
Within.R-sqr				0.446		0.446	0.383
Over.R-sqr				0.162			0.356
Betw.R-sqr				0.058			0.341
No. of observations	98	98	98	98	98	98	98
Pesaran cross-sectional dependence test				.			.
Pesaran cross-sectional dependence test, P-val				.			.
D'Agostino normality test	5.770	5.770	5.505	5.550	5.550	8.102	4.982
D'Agostino normality test, P-val	0.056	0.056	0.064	0.062	0.062	0.017	0.083
Breusch-Pagan test	-0.032						
Breusch-Pagan test, P-val	0.975						
Quasi-time-demeaned-data test of ser. corr.	0.287						
Quasi-time-demeaned-data test of ser. corr., P-val	0.774						
Relevance/redundancy of FE test					1.925		
Relevance/redundancy of FE test, P-val					0.134		
Hausman test							2903.641
Hausman test, P-val							0.000
Cor.Pred.Crisis - In sample	0.688	0.688	0.688	0.750	0.750	0.594	0.656
aNtS - In sample	0.110	0.110	0.220	0.020	0.020	0.383	0.162
CPR - In sample	0.847	0.847	0.796	0.908	0.908	0.714	0.816
Absolute Utility - In sample	0.306	0.306	0.268	0.367	0.367	0.183	0.275
AUROC - In sample	0.870	0.870	0.866	0.954	0.954	0.767	0.872
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.704	0.704	0.704	0.704	0.704	0.556	0.778
aNtS - Out sample	0.609	0.609	0.677	0.499	0.440	0.471	0.582
CPR - Out sample	0.623	0.623	0.594	0.672	0.696	0.667	0.638
Absolute Utility - Out sample	0.138	0.138	0.114	0.176	0.197	0.147	0.163
AUROC - Out sample	0.740	0.740	0.703	0.759	0.787	0.745	0.766
Cor.Pred.Crisis - Out sample (first year only)	0.636	0.636	0.636	0.636	0.636	0.545	0.636
aNtS - Out sample (first year only)	0.524	0.524	0.524	0.000	0.000	0.306	0.524
CPR - Out sample (first year only)	0.647	0.647	0.647	0.750	0.765	0.647	0.647
Absolute Utility - Out sample (first year only)	0.152	0.152	0.152	0.318	0.318	0.189	0.152
AUROC - Out sample (first year only)	0.652	0.652	0.667	0.909	0.924	0.727	0.697

Note: The table presents estimated models for crisis variable for euro area countries, using two year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.11 **In-sample econometric results for the EA, three year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	0.007	0.007	-0.013	-0.058**	-0.058***	-0.058**	0.007
	(0.640)	(0.115)	(0.247)	(0.023)	(0.010)	(0.011)	(0.633)
NIIP	-0.003*	-0.003***	-0.000	-0.004	-0.004*	-0.004**	-0.003*
	(0.071)	(0.002)	(0.890)	(0.133)	(0.086)	(0.037)	(0.053)
EMS	0.001	0.001	0.005	0.002	0.002	0.002	0.001
	(0.850)	(0.811)	(0.138)	(0.715)	(0.719)	(0.515)	(0.847)
NULC	0.050***	0.050***	0.051***	0.038***	0.038***	0.038***	0.050***
	(0.003)	(0.000)	(0.000)	(0.006)	(0.002)	(0.001)	(0.000)
REER	-0.042***	-0.042***	-0.052***	-0.049***	-0.049***	-0.049***	-0.042***
	(0.003)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
PSD	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.407)	(0.500)	(0.771)	(0.849)	(0.898)	(0.844)	(0.395)
PSCF	0.003***	0.003**	0.003*	0.002**	0.002	0.002*	0.003***
	(0.003)	(0.015)	(0.099)	(0.033)	(0.245)	(0.098)	(0.001)
HPI	0.004	0.004	0.003	0.012	0.012	0.012***	0.004
	(0.616)	(0.541)	(0.671)	(0.111)	(0.133)	(0.000)	(0.609)
GGSD	-0.003	-0.003***	-0.004**	-0.014**	-0.014***	-0.014***	-0.003
	(0.160)	(0.010)	(0.015)	(0.047)	(0.001)	(0.000)	(0.141)
UR	0.012	0.012	0.020	0.077**	0.077**	0.077***	0.012
	(0.418)	(0.234)	(0.261)	(0.034)	(0.040)	(0.002)	(0.405)
TFSL	0.003	0.003	-0.000	-0.002	-0.002	-0.002	0.003
	(0.366)	(0.555)	(1.000)	(0.460)	(0.618)	(0.439)	(0.352)
AR	-0.040	-0.040	-0.051	-0.052	-0.052	-0.052	-0.040
	(0.282)	(0.276)	(0.101)	(0.109)	(0.184)	(0.188)	(0.265)
LTUR	-0.036	-0.036	-0.035	-0.057	-0.057	-0.057*	-0.036
	(0.423)	(0.475)	(0.434)	(0.373)	(0.233)	(0.073)	(0.411)
YUR	0.038***	0.038***	0.033***	0.037**	0.037***	0.037***	0.038***
	(0.010)	(0.000)	(0.000)	(0.020)	(0.002)	(0.000)	(0.003)
constant	0.112	0.112	0.221	0.375	0.714*	0.375*	0.112
	(0.680)	(0.705)	(0.424)	(0.342)	(0.057)	(0.091)	(0.674)
R-sqr	0.402	0.402	0.485	0.412	0.579		
Within.R-sqr				0.412		0.412	0.296
Over.R-sqr				0.230			0.402
Betw.R-sqr				0.191			0.659
No. of observations	149	149	149	149	149	149	149
Pesaran cross-sectional dependence test				2.045			3.511
Pesaran cross-sectional dependence test, P-val				0.041			0.000
D'Agostino normality test	7.531	7.531	4.488	0.060	0.060	0.834	7.531
D'Agostino normality test, P-val	0.023	0.023	0.106	0.970	0.970	0.659	0.023
Breusch-Pagan test	2.081						
Breusch-Pagan test, P-val	0.054						
Quasi-time-demeaned-data test of ser. corr.	1.202						
Quasi-time-demeaned-data test of ser. corr., P-val	0.229						
Relevance/redundancy of FE test					2.374		
Relevance/redundancy of FE test, P-val					0.013		
Hausman test							.
Hausman test, P-val							.
Cor.Pred.Crisis - In sample	0.632	0.632	0.719	0.877	0.877	0.702	0.632
aNtS - In sample	0.138	0.138	0.227	0.099	0.099	0.356	0.138
CPR - In sample	0.805	0.805	0.792	0.899	0.899	0.732	0.805
Absolute Utility - In sample	0.272	0.272	0.278	0.395	0.395	0.226	0.272
AUROC - In sample	0.882	0.882	0.863	0.959	0.959	0.781	0.882
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for euro area countries, using three year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.12 **Out-of-sample econometric results for the EA, three year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	-0.002	-0.002	-0.008	-0.046	-0.046	-0.046**	-0.012
	(0.930)	(0.793)	(0.495)	(0.219)	(0.287)	(0.042)	(0.566)
NIIP	-0.003*	-0.003	-0.003	-0.001	-0.001	-0.001	-0.003
	(0.085)	(0.155)	(0.177)	(0.776)	(0.811)	(0.636)	(0.135)
EMS	0.005	0.005	0.003	0.003	0.003	0.003**	0.004
	(0.223)	(0.134)	(0.197)	(0.450)	(0.663)	(0.041)	(0.304)
NULC	0.029*	0.029***	0.011	0.009	0.009	0.009	0.021
	(0.093)	(0.000)	(0.328)	(0.638)	(0.714)	(0.238)	(0.205)
REER	-0.059***	-0.059***	-0.052***	-0.067***	-0.067***	-0.067***	-0.062***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PSD	0.001	0.001**	0.002*	0.001	0.001	0.001	0.001
	(0.440)	(0.013)	(0.076)	(0.398)	(0.641)	(0.277)	(0.318)
PSCF	0.001	0.001*	0.001	0.001	0.001	0.001	0.001
	(0.184)	(0.068)	(0.151)	(0.455)	(0.763)	(0.329)	(0.181)
HPI	0.010	0.010**	0.010	0.015	0.015	0.015*	0.010
	(0.313)	(0.041)	(0.144)	(0.365)	(0.239)	(0.074)	(0.330)
GGSD	-0.004	-0.004**	-0.003	0.002	0.002	0.002	-0.006*
	(0.100)	(0.030)	(0.540)	(0.826)	(0.845)	(0.611)	(0.056)
UR	0.003	0.003	0.015	-0.026	-0.026	-0.026	0.005
	(0.935)	(0.760)	(0.236)	(0.738)	(0.773)	(0.407)	(0.882)
TFSL	-0.005	-0.005***	-0.006***	-0.007**	-0.007	-0.007***	-0.007**
	(0.181)	(0.003)	(0.000)	(0.037)	(0.145)	(0.001)	(0.050)
AR	-0.018	-0.018	-0.025	0.010	0.010	0.010	-0.030
	(0.688)	(0.376)	(0.536)	(0.864)	(0.881)	(0.645)	(0.503)
LTUR	-0.121*	-0.121**	-0.123***	-0.018	-0.018	-0.018	-0.094
	(0.091)	(0.016)	(0.000)	(0.773)	(0.824)	(0.569)	(0.155)
YUR	0.035***	0.035*	0.035***	0.029*	0.029	0.029***	0.033***
	(0.008)	(0.050)	(0.000)	(0.075)	(0.155)	(0.003)	(0.005)
constant	0.452	0.452	0.113	0.371	0.129	0.371	0.628*
	(0.241)	(0.106)	(0.810)	(0.599)	(0.858)	(0.182)	(0.098)
R-sqr	0.498	0.498	0.619	0.497	0.645		
Within.R-sqr				0.497		0.497	0.465
Over.R-sqr				0.240			0.483
Betw.R-sqr				0.142			0.631
No. of observations	82	82	82	82	82	82	82
Pesaran cross-sectional dependence test				.			.
Pesaran cross-sectional dependence test, P-val				.			.
D'Agostino normality test	2.123	2.123	2.558	0.129	0.129	0.055	0.766
D'Agostino normality test, P-val	0.346	0.346	0.278	0.937	0.937	0.973	0.682
Breusch-Pagan test	0.176						
Breusch-Pagan test, P-val	0.863						
Quasi-time-demeaned-data test of ser. corr.	0.327						
Quasi-time-demeaned-data test of ser. corr., P-val	0.744						
Relevance/redundancy of FE test					0.379		
Relevance/redundancy of FE test, P-val					0.768		
Hausman test							633.760
Hausman test, P-val							0.000
Cor.Pred.Crisis - In sample	0.733	0.733	0.767	0.867	0.867	0.700	0.767
aNtS - In sample	0.157	0.157	0.125	0.067	0.067	0.275	0.151
CPR - In sample	0.829	0.829	0.854	0.915	0.915	0.768	0.841
Absolute Utility - In sample	0.309	0.309	0.335	0.404	0.404	0.254	0.326
AUROC - In sample	0.927	0.927	0.918	0.974	0.974	0.819	0.924
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.630	0.630	0.926	1.000	1.000	0.815	0.741
aNtS - Out sample	0.675	0.675	0.567	0.730	0.675	0.920	0.844
CPR - Out sample	0.597	0.597	0.657	0.578	0.597	0.478	0.522
Absolute Utility - Out sample	0.102	0.102	0.200	0.135	0.163	0.032	0.058
AUROC - Out sample	0.669	0.669	0.709	0.755	0.773	0.670	0.689
Cor.Pred.Crisis - Out sample (first year only)	0.818	0.818	0.909	1.000	1.000	0.818	0.909
aNtS - Out sample (first year only)	0.978	0.978	0.440	0.600	0.600	0.978	0.880
CPR - Out sample (first year only)	0.625	0.625	0.813	0.813	0.813	0.625	0.688
Absolute Utility - Out sample (first year only)	0.009	0.009	0.255	0.200	0.200	0.009	0.055
AUROC - Out sample (first year only)	0.764	0.764	0.891	0.982	0.982	0.636	0.800

Note: The table presents estimated models for crisis variable for euro area countries, using three year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.13 **In-sample econometric results for the EA, one year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.052	0.052	-0.015	-0.083	-0.083	-0.083	0.028	0.055	0.058		
	(0.611)	(0.264)	(0.723)	(0.266)	(0.405)	(0.212)	(0.761)	(0.546)	(0.525)		
NIIP	0.052	0.052	0.049	-0.014	-0.014	-0.014	0.053	0.046	0.043		
	(0.691)	(0.292)	(0.474)	(0.958)	(0.976)	(0.963)	(0.680)	(0.691)	(0.712)		
EMS	0.220**	0.220***	0.171**	0.230*	0.230***	0.230***	0.218**	0.221**	0.220**		
	(0.035)	(0.007)	(0.025)	(0.059)	(0.009)	(0.000)	(0.030)	(0.017)	(0.017)		
NULC	0.058	0.058	0.078	0.147	0.147	0.147**	0.052	0.053	0.059		
	(0.570)	(0.367)	(0.417)	(0.238)	(0.132)	(0.018)	(0.596)	(0.611)	(0.570)		
REER	0.029	0.029	0.024	0.021	0.021	0.021	0.026	0.019	0.042		
	(0.665)	(0.706)	(0.830)	(0.690)	(0.802)	(0.678)	(0.663)	(0.754)	(0.486)		
PSD	-0.049	-0.049	0.049	-0.244*	-0.244	-0.244**	-0.038	-0.050	-0.055		
	(0.620)	(0.216)	(0.538)	(0.083)	(0.165)	(0.017)	(0.697)	(0.585)	(0.547)		
PSCF	0.057	0.057	-0.059	-0.029	-0.029	-0.029	0.029	0.053	0.061		
	(0.537)	(0.608)	(0.350)	(0.759)	(0.821)	(0.731)	(0.730)	(0.532)	(0.466)		
HPI	-0.368***	-0.368***	-0.234***	-0.352***	-0.352**	-0.352***	-0.350***	-2.458***	-2.792***		
	(0.000)	(0.000)	(0.009)	(0.004)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)		
GGSD	-0.257***	-0.257***	-0.116	0.027	0.027	0.027	-0.202**	-0.240***	-0.237***		
	(0.009)	(0.000)	(0.146)	(0.889)	(0.841)	(0.875)	(0.041)	(0.005)	(0.008)		
UR	0.067	0.067	-0.011	0.158	0.158	0.158**	0.074	0.055	0.061		
	(0.631)	(0.249)	(0.928)	(0.144)	(0.177)	(0.040)	(0.542)	(0.636)	(0.612)		
TFSL	-0.124	-0.124	-0.091	-0.169	-0.169	-0.169	-0.151	-0.093	-0.098		
	(0.408)	(0.365)	(0.398)	(0.289)	(0.276)	(0.314)	(0.311)	(0.639)	(0.635)		
AR	-0.037	-0.037	-0.015	-0.027	-0.027	-0.027	-0.030	-0.039	-0.035		
	(0.724)	(0.776)	(0.867)	(0.767)	(0.788)	(0.830)	(0.763)	(0.678)	(0.712)		
LTUR	0.135	0.135**	0.106	0.130	0.130	0.130	0.136	0.136	0.136		
	(0.250)	(0.040)	(0.126)	(0.266)	(0.217)	(0.116)	(0.220)	(0.191)	(0.182)		
YUR	0.059	0.059	0.002	-0.012	-0.012	-0.012	0.044	0.026	0.027		
	(0.478)	(0.427)	(0.971)	(0.860)	(0.905)	(0.826)	(0.561)	(0.734)	(0.718)		
constant	0.280***	0.280*	0.188*	0.260	-0.073	0.260	0.252**				
	(0.005)	(0.052)	(0.078)	(0.168)	(0.691)	(0.101)	(0.011)				
R-sqr	0.188	0.188	0.093	0.202	0.376					0.000	0.000
Within.R-sqr				0.202		0.202	0.161				
Over.R-sqr				0.065			0.183				
Betw.R-sqr				0.037			0.130				
Pseud.R-sqr								0.188	0.195		
No. of observations	186	186	186	186	186	186	186	186	186	235	235
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	31.669	31.669	.	6.072	6.072	46.439	21.376				
D'Agostino normality test, P-val	0.000	0.000	.	0.048	0.048	0.000	0.000				
Breusch-Pagan test	3.283										
Breusch-Pagan test, P-val	0.004										
Quasi-time-demeaned-data test of ser. corr.	1.493										
Quasi-time-demeaned-data test of ser. corr., P-val	0.135										
Relevance/redundancy of FE test					2.563						
Relevance/redundancy of FE test, P-val					0.001						
Hausman test							563.959				
Hausman test, P-val							0.000				
Cor.Pred.Crisis - In sample	0.467	0.467	0.083	0.617	0.617	0.400	0.433	0.400	0.417		
aNtS - In sample	0.238	0.238	0.286	0.167	0.167	0.575	0.220	0.278	0.267		
CPR - In sample	0.753	0.753	0.688	0.806	0.806	0.651	0.753	0.731	0.737		
Absolute Utility - In sample	0.178	0.178	0.030	0.257	0.257	0.085	0.169	0.144	0.153		
AUROC - In sample	0.778	0.778	0.760	0.870	0.870	0.639	0.762	0.781	0.786		
First year out of sample	2017										
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.	.	.		
aNtS - Out sample	.	.	.	.	.	.	.	.	.		
CPR - Out sample	.	.	.	.	.	.	.	.	.		
Absolute Utility - Out sample	.	.	.	.	.	.	.	.	.		
AUROC - Out sample	.	.	.	.	.	.	.	.	.		
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.	.	.		
aNtS - Out sample (first year only)	.	.	.	.	.	.	.	.	.		
CPR - Out sample (first year only)	.	.	.	.	.	.	.	.	.		
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.	.	.		
AUROC - Out sample (first year only)	.	.	.	.	.	.	.	.	.		

Note: The table presents estimated models for crisis variable for euro area countries, using one year lag of all explanatory variables. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.14 **Out-of-sample econometric results for the EA, one year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.020	0.020	0.096	0.039	0.039	0.039	0.019	0.007	0.011		
	(0.899)	(0.676)	(0.509)	(0.776)	(0.819)	(0.709)	(0.896)	(0.954)	(0.926)		
NIIP	0.073	0.073	-0.044	0.387	0.387	0.387**	0.095	0.388**	0.613***		
	(0.718)	(0.279)	(0.775)	(0.182)	(0.448)	(0.037)	(0.667)	(0.036)	(0.009)		
EMS	0.047	0.047	0.055	0.127	0.127	0.127*	0.063	0.046	0.035		
	(0.664)	(0.498)	(0.669)	(0.368)	(0.331)	(0.081)	(0.595)	(0.664)	(0.728)		
NULC	0.171	0.171***	0.132	0.209	0.209*	0.209***	0.140	0.157*	0.169*		
	(0.147)	(0.000)	(0.146)	(0.196)	(0.093)	(0.000)	(0.247)	(0.092)	(0.071)		
REER	-0.197*	-0.197**	-0.046	-0.069	-0.069	-0.069*	-0.141	-0.231**	-0.192*		
	(0.072)	(0.040)	(0.712)	(0.500)	(0.563)	(0.065)	(0.141)	(0.037)	(0.073)		
PSD	-0.043	-0.043	0.007	-0.413**	-0.413	-0.413***	-0.072	-0.038	-0.032		
	(0.707)	(0.445)	(0.934)	(0.032)	(0.126)	(0.000)	(0.571)	(0.736)	(0.765)		
PSCF	-0.164*	-0.164*	-0.166*	-0.109	-0.109	-0.109	-0.185**	0.128	0.366**		
	(0.081)	(0.077)	(0.056)	(0.325)	(0.510)	(0.235)	(0.042)	(0.267)	(0.029)		
HPI	-0.248***	-0.248***	-0.262**	-0.390**	-0.390**	-0.390***	-0.316***	-2.661***	-2.184***		
	(0.005)	(0.000)	(0.037)	(0.011)	(0.025)	(0.000)	(0.000)	(0.000)	(0.000)		
GGSD	-0.184*	-0.184**	-0.034	0.493**	0.493**	0.493***	-0.023	-0.151*	-0.122		
	(0.089)	(0.018)	(0.790)	(0.042)	(0.034)	(0.000)	(0.856)	(0.061)	(0.167)		
UR	0.024	0.024	0.053	0.067	0.067	0.067	0.015	-0.017	-0.499*		
	(0.908)	(0.544)	(0.730)	(0.648)	(0.697)	(0.704)	(0.932)	(0.927)	(0.051)		
TFSL	-0.039	-0.039	-0.029	0.018	0.018	0.018	-0.043	0.274*	0.111		
	(0.782)	(0.687)	(0.759)	(0.926)	(0.917)	(0.887)	(0.793)	(0.056)	(0.459)		
AR	-0.097	-0.097	0.013	-0.027	-0.027	-0.027	-0.041	-0.077	-0.052		
	(0.350)	(0.507)	(0.950)	(0.753)	(0.840)	(0.859)	(0.651)	(0.441)	(0.571)		
LTUR	0.088	0.088	0.021	0.014	0.014	0.014	0.079	0.075	0.106		
	(0.409)	(0.430)	(0.888)	(0.909)	(0.919)	(0.862)	(0.410)	(0.518)	(0.267)		
YUR	-0.065	-0.065	-0.048	0.038	0.038	0.038	-0.057	-0.081	-0.073		
	(0.584)	(0.558)	(0.712)	(0.751)	(0.786)	(0.408)	(0.581)	(0.534)	(0.523)		
constant	0.415***	0.415**	0.209	-0.011	-0.441	-0.011	0.317***				
	(0.000)	(0.019)	(0.136)	(0.954)	(0.122)	(0.928)	(0.007)				
R-sqr	0.169	0.169	0.089	0.270	0.421					0.000	0.000
Within.R-sqr				0.270		0.270	0.200				
Over.R-sqr				0.007			0.124				
Betw.R-sqr				0.103			0.012				
Pseud.R-sqr								0.248	0.324		
No. of observations	115	115	115	115	115	115	115	115	115	235	235
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	16.868	16.868	24.588	12.514	12.514	8.500	11.602				
D'Agostino normality test, P-val	0.000	0.000	0.000	0.002	0.002	0.014	0.003				
Breusch-Pagan test	1.182										
Breusch-Pagan test, P-val	0.256										
Quasi-time-demeaned-data test of ser. corr.	-0.387										
Quasi-time-demeaned-data test of ser. corr., P-val	0.699										
Relevance/redundancy of FE test					1.619						
Relevance/redundancy of FE test, P-val					0.115						
Hausman test							997.640				
Hausman test, P-val							0.000				
Cor.Pred.Crisis - In sample	0.242	0.242	0.000	0.515	0.515	0.394	0.182	0.303	0.394		
aNtS - In sample	0.302	0.302	.	0.000	0.000	0.991	0.134	0.241	0.186		
CPR - In sample	0.730	0.730	0.713	0.861	0.861	0.548	0.748	0.748	0.774		
Absolute Utility - In sample	0.085	0.085	0.000	0.258	0.258	0.002	0.079	0.115	0.160		
AUROC - In sample	0.764	0.764	0.717	0.874	0.874	0.532	0.718	0.798	0.813		
First year out of sample	2013										
Cor.Pred.Crisis - Out sample	0.111	0.111	0.000	0.481	0.481	0.630	0.074	0.148	0.074		
aNtS - Out sample	1.227	1.227	.	0.405	0.378	0.650	1.227	0.920	1.841		
CPR - Out sample	0.577	0.577	0.620	0.676	0.690	0.606	0.592	0.592	0.563		
Absolute Utility - Out sample	-0.013	-0.013	0.000	0.143	0.150	0.110	-0.008	0.006	-0.031		
AUROC - Out sample	0.523	0.523	0.546	0.746	0.753	0.664	0.615	0.542	0.601		
Cor.Pred.Crisis - Out sample (first year only)	0.091	0.091	0.000	0.364	0.364	0.545	0.091	0.182	0.091		
aNtS - Out sample (first year only)	1.833	1.833	.	0.000	0.000	0.611	1.833	0.917	1.833		
CPR - Out sample (first year only)	0.353	0.353	0.353	0.588	0.588	0.588	0.353	0.412	0.353		
Absolute Utility - Out sample (first year only)	-0.038	-0.038	0.000	0.182	0.182	0.106	-0.038	0.008	-0.038		
AUROC - Out sample (first year only)	0.606	0.606	0.530	0.909	0.909	0.606	0.606	0.576	0.621		

Note: The table presents estimated models for crisis variable for euro area countries, using one year lag of all explanatory variables, which are represented as indicator variables for the cases when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.15 **In-sample econometric results for the EA, two year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.179	0.179***	0.098**	0.111	0.111	0.111	0.175	0.180*	0.184*		
	(0.172)	(0.001)	(0.032)	(0.413)	(0.329)	(0.148)	(0.161)	(0.093)	(0.085)		
NIIP	0.012	0.012	-0.008	-1.075***	-1.075**	-1.075***	0.003	0.013	0.017		
	(0.938)	(0.845)	(0.914)	(0.000)	(0.034)	(0.000)	(0.985)	(0.921)	(0.896)		
EMS	0.174*	0.174	0.094	0.079	0.079	0.079	0.150	0.185*	0.187**		
	(0.083)	(0.137)	(0.219)	(0.513)	(0.438)	(0.565)	(0.129)	(0.052)	(0.045)		
NULC	0.018	0.018	-0.127	-0.049	-0.049	-0.049	-0.017	0.003	0.008		
	(0.843)	(0.753)	(0.102)	(0.614)	(0.640)	(0.422)	(0.843)	(0.973)	(0.936)		
REER	-0.015	-0.015	0.012	-0.051	-0.051	-0.051	-0.024	-0.027	-0.016		
	(0.825)	(0.913)	(0.917)	(0.353)	(0.579)	(0.578)	(0.688)	(0.687)	(0.801)		
PSD	-0.152	-0.152***	-0.062	-0.265**	-0.265	-0.265***	-0.134	-0.155	-0.164		
	(0.180)	(0.001)	(0.354)	(0.019)	(0.171)	(0.001)	(0.212)	(0.162)	(0.148)		
PSCF	0.218*	0.218***	0.166***	0.088	0.088	0.088	0.190*	0.695***	0.243**		
	(0.099)	(0.005)	(0.005)	(0.354)	(0.526)	(0.407)	(0.096)	(0.000)	(0.012)		
HPI	-0.345***	-0.345***	-0.244**	-0.436***	-0.436***	-0.436***	-0.345***	0.114	0.476**		
	(0.004)	(0.000)	(0.020)	(0.009)	(0.005)	(0.000)	(0.002)	(0.512)	(0.023)		
GGSD	-0.324***	-0.324***	-0.271***	-0.252	-0.252	-0.252	-0.297***	-0.328***	-0.325***		
	(0.000)	(0.000)	(0.000)	(0.196)	(0.105)	(0.135)	(0.000)	(0.000)	(0.000)		
UR	0.038	0.038	0.003	0.003	0.003	0.003	0.032	0.047	0.042		
	(0.792)	(0.579)	(0.983)	(0.988)	(0.983)	(0.981)	(0.821)	(0.703)	(0.740)		
TFSL	-0.146	-0.146**	-0.145	-0.323	-0.323*	-0.323**	-0.184	-0.123	-0.093		
	(0.453)	(0.049)	(0.219)	(0.143)	(0.055)	(0.013)	(0.345)	(0.542)	(0.642)		
AR	0.116	0.116*	0.145*	0.181	0.181*	0.181**	0.132	0.112	0.121		
	(0.440)	(0.092)	(0.080)	(0.233)	(0.097)	(0.035)	(0.368)	(0.346)	(0.315)		
LTUR	0.121	0.121	0.075	0.167	0.167	0.167	0.129	0.113	0.117		
	(0.238)	(0.330)	(0.321)	(0.167)	(0.168)	(0.165)	(0.201)	(0.215)	(0.239)		
YUR	0.062	0.062	0.031	-0.032	-0.032	-0.032	0.043	0.052	0.053		
	(0.561)	(0.576)	(0.491)	(0.754)	(0.774)	(0.780)	(0.677)	(0.590)	(0.586)		
constant	0.371***	0.371*	0.379***	0.916***	0.318	0.916***	0.382***				
	(0.000)	(0.050)	(0.000)	(0.000)	(0.121)	(0.000)	(0.000)				
R-sqr	0.200	0.200	0.089	0.158	0.365					0.000	0.000
Within.R-sqr				0.158		0.158	0.107				
Over.R-sqr				0.002			0.196				
Betw.R-sqr				0.030			0.387				
Pseud.R-sqr								0.172	0.191		
No. of observations	167	167	167	167	167	167	167	167	167	235	235
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	29.481	29.481	.	6.713	6.713	13.843	25.519				
D'Agostino normality test, P-val	0.000	0.000	.	0.035	0.035	0.001	0.000				
Breusch-Pagan test	4.644										
Breusch-Pagan test, P-val	0.000										
Quasi-time-demeaned-data test of ser. corr.	0.760										
Quasi-time-demeaned-data test of ser. corr., P-val	0.447										
Relevance/redundancy of FE test					1.997						
Relevance/redundancy of FE test, P-val					0.038						
Hausman test							4030.903				
Hausman test, P-val							0.000				
Cor.Pred.Crisis - In sample	0.407	0.407	0.186	0.576	0.576	0.508	0.424	0.475	0.475		
aNtS - In sample	0.296	0.296	0.199	0.177	0.177	1.074	0.284	0.273	0.273		
CPR - In sample	0.713	0.713	0.689	0.784	0.784	0.473	0.719	0.731	0.731		
Absolute Utility - In sample	0.143	0.143	0.075	0.237	0.237	-0.019	0.152	0.172	0.172		
AUROC - In sample	0.774	0.774	0.740	0.864	0.864	0.512	0.770	0.778	0.779		
First year out of sample	2017										
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.	.	.		
aNtS - Out sample	.	.	.	.	.	.	.	.	.		
CPR - Out sample	.	.	.	.	.	.	.	.	.		
Absolute Utility - Out sample	.	.	.	.	.	.	.	.	.		
AUROC - Out sample	.	.	.	.	.	.	.	.	.		
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.	.	.		
aNtS - Out sample (first year only)	.	.	.	.	.	.	.	.	.		
CPR - Out sample (first year only)	.	.	.	.	.	.	.	.	.		
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.	.	.		
AUROC - Out sample (first year only)	.	.	.	.	.	.	.	.	.		

Note: The table presents estimated models for crisis variable for euro area countries, using two year lag of all explanatory variables. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.16 **Out-of-sample econometric results for the EA, two year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.022	0.022	-0.113	-0.202	-0.202	-0.202***	-0.063	0.053	0.035		
	(0.899)	(0.597)	(0.225)	(0.258)	(0.301)	(0.008)	(0.676)	(0.685)	(0.793)		
NIIP	0.174	0.174*	0.289*	-0.632**	-0.632	-0.632***	0.247	0.486**	0.751***		
	(0.433)	(0.067)	(0.088)	(0.012)	(0.231)	(0.000)	(0.291)	(0.040)	(0.008)		
EMS	-0.016	-0.016	-0.091	-0.077	-0.077	-0.077	-0.055	-0.018	-0.027		
	(0.895)	(0.839)	(0.281)	(0.662)	(0.588)	(0.632)	(0.694)	(0.858)	(0.787)		
NULC	-0.021	-0.021	-0.201***	-0.206**	-0.206	-0.206**	-0.154	-0.029	-0.029		
	(0.839)	(0.725)	(0.009)	(0.023)	(0.182)	(0.037)	(0.100)	(0.769)	(0.771)		
REER	-0.270**	-0.270***	-0.121	-0.175*	-0.175	-0.175**	-0.237***	-0.366***	-0.357***		
	(0.013)	(0.007)	(0.189)	(0.080)	(0.173)	(0.036)	(0.009)	(0.006)	(0.005)		
PSD	-0.140	-0.140**	-0.141**	-0.499**	-0.499	-0.499**	-0.103	-0.149	-0.121		
	(0.190)	(0.016)	(0.045)	(0.035)	(0.131)	(0.022)	(0.488)	(0.139)	(0.233)		
PSCF	0.034	0.034	0.000	-0.071	-0.071	-0.071	-0.038	0.620**	0.593***		
	(0.754)	(0.686)	(1.000)	(0.535)	(0.698)	(0.621)	(0.699)	(0.012)	(0.002)		
HPI	-0.175	-0.175*	-0.180**	-0.590***	-0.590***	-0.590***	-0.289**	0.380	0.365		
	(0.142)	(0.071)	(0.031)	(0.008)	(0.002)	(0.000)	(0.027)	(0.149)	(0.117)		
GGSD	-0.323***	-0.323**	-0.291***	-0.239*	-0.239	-0.239	-0.303***	-0.311***	-0.291***		
	(0.003)	(0.014)	(0.000)	(0.099)	(0.498)	(0.153)	(0.005)	(0.000)	(0.000)		
UR	0.005	0.005	0.081	-0.184	-0.184	-0.184	-0.061	0.354*	0.026		
	(0.982)	(0.960)	(0.605)	(0.431)	(0.331)	(0.397)	(0.766)	(0.057)	(0.890)		
TFSL	-0.161	-0.161	-0.239*	-0.266	-0.266	-0.266***	-0.198	-0.449**	-0.141		
	(0.245)	(0.201)	(0.054)	(0.180)	(0.141)	(0.001)	(0.193)	(0.024)	(0.237)		
AR	0.042	0.042	0.227	0.415**	0.415**	0.415***	0.183	0.351*	0.079		
	(0.852)	(0.675)	(0.101)	(0.012)	(0.015)	(0.000)	(0.376)	(0.089)	(0.645)		
LTUR	0.020	0.020	0.026	0.138	0.138	0.138	0.054	-0.054	-0.044		
	(0.897)	(0.912)	(0.840)	(0.338)	(0.356)	(0.382)	(0.715)	(0.736)	(0.783)		
YUR	-0.036	-0.036	-0.152*	-0.158	-0.158	-0.158**	-0.097	0.003	-0.002		
	(0.729)	(0.741)	(0.074)	(0.108)	(0.276)	(0.024)	(0.251)	(0.980)	(0.985)		
constant	0.623***	0.623***	0.668***	1.205***	0.449	1.205***	0.706***				
	(0.000)	(0.004)	(0.000)	(0.000)	(0.265)	(0.000)	(0.000)				
R-sqr	0.218	0.218	0.212	0.329	0.499					0.000	0.000
Within.R-sqr				0.329		0.329	0.256				
Over.R-sqr				0.009			0.179				
Betw.R-sqr				0.011			0.146				
Pseud.R-sqr								0.243	0.262		
No. of observations	98	98	98	98	98	98	98	98	98	235	235
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	17.420	17.420	8.922	6.679	6.679	5.199	11.264				
D'Agostino normality test, P-val	0.000	0.000	0.012	0.035	0.035	0.074	0.004				
Breusch-Pagan test	2.415										
Breusch-Pagan test, P-val	0.029										
Quasi-time-demeaned-data test of ser. corr.	-0.016										
Quasi-time-demeaned-data test of ser. corr., P-val	0.987										
Relevance/redundancy of FE test					1.441						
Relevance/redundancy of FE test, P-val					0.238						
Hausman test							10585.366				
Hausman test, P-val							0.000				
Cor.Pred.Crisis - In sample	0.438	0.438	0.406	0.688	0.688	0.438	0.469	0.625	0.563		
aNtS - In sample	0.312	0.312	0.224	0.088	0.088	1.074	0.323	0.170	0.189		
CPR - In sample	0.724	0.724	0.745	0.857	0.857	0.500	0.724	0.806	0.786		
Absolute Utility - In sample	0.151	0.151	0.158	0.313	0.313	-0.016	0.159	0.259	0.228		
AUROC - In sample	0.808	0.808	0.729	0.920	0.920	0.561	0.764	0.818	0.822		
First year out of sample	2013										
Cor.Pred.Crisis - Out sample	0.296	0.296	0.259	0.519	0.519	0.333	0.259	0.333	0.333		
aNtS - Out sample	0.884	0.884	1.286	0.678	0.597	1.357	1.378	0.786	0.786		
CPR - Out sample	0.565	0.565	0.507	0.594	0.623	0.464	0.493	0.580	0.580		
Absolute Utility - Out sample	0.017	0.017	-0.037	0.084	0.104	-0.060	-0.049	0.036	0.036		
AUROC - Out sample	0.566	0.566	0.536	0.596	0.644	0.379	0.526	0.533	0.519		
Cor.Pred.Crisis - Out sample (first year only)	0.364	0.364	0.364	0.636	0.636	0.455	0.364	0.455	0.455		
aNtS - Out sample (first year only)	0.458	0.458	0.458	0.000	0.000	1.100	0.458	0.367	0.367		
CPR - Out sample (first year only)	0.529	0.529	0.529	0.750	0.765	0.471	0.529	0.588	0.588		
Absolute Utility - Out sample (first year only)	0.098	0.098	0.098	0.318	0.318	-0.023	0.098	0.144	0.144		
AUROC - Out sample (first year only)	0.833	0.833	0.652	0.764	0.803	0.409	0.727	0.788	0.712		

Note: The table presents estimated models for crisis variable for euro area countries, using two year lag of all explanatory variables. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016. *Source*: Authors' calculations based on data from the EC and Eurostat.

Table F.17 **In-sample econometric results for the EA, three year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.214*	0.214***	0.135	0.107	0.107	0.107	0.187*	0.213**	0.197**		0.195**
	(0.059)	(0.000)	(0.128)	(0.340)	(0.410)	(0.272)	(0.060)	(0.029)	(0.035)		(0.034)
NIIP	0.008	0.008	0.009	-0.964***	-0.964*	-0.964***	-0.001	0.019	0.018		0.021
	(0.952)	(0.937)	(0.932)	(0.000)	(0.064)	(0.001)	(0.994)	(0.860)	(0.865)		(0.835)
EMS	0.104	0.104	0.046	0.007	0.007	0.007	0.063	0.088	0.085		0.106
	(0.237)	(0.354)	(0.699)	(0.953)	(0.953)	(0.960)	(0.492)	(0.255)	(0.288)		(0.164)
NULC	0.187**	0.187***	0.124	0.106	0.106	0.106*	0.132	0.185**	0.194***		0.190***
	(0.028)	(0.000)	(0.222)	(0.245)	(0.337)	(0.100)	(0.106)	(0.025)	(0.009)		(0.007)
REER	-0.153	-0.153	-0.108	-0.177*	-0.177*	-0.177	-0.165*	-0.152	-0.155		-0.147
	(0.116)	(0.396)	(0.361)	(0.066)	(0.069)	(0.232)	(0.062)	(0.149)	(0.139)		(0.104)
PSD	-0.160	-0.160**	-0.090	-0.185*	-0.185	-0.185	-0.125	-0.168	-0.167		-0.159
	(0.159)	(0.033)	(0.246)	(0.088)	(0.381)	(0.287)	(0.224)	(0.124)	(0.124)		(0.134)
PSCF	0.153	0.153***	0.156*	0.079	0.079	0.079	0.130	0.154*	0.173*		0.170*
	(0.182)	(0.007)	(0.084)	(0.379)	(0.587)	(0.213)	(0.180)	(0.097)	(0.051)		(0.059)
HPI	-0.114	-0.114	-0.127	-0.181	-0.181	-0.181	-0.118	0.501***	0.818***		277.546***
	(0.439)	(0.227)	(0.224)	(0.384)	(0.260)	(0.116)	(0.454)	(0.000)	(0.000)		(0.000)
GGSD	-0.309***	-0.309***	-0.258***	-0.180	-0.180	-0.180	-0.253***	-0.291***	-0.293***		-0.305***
	(0.000)	(0.002)	(0.000)	(0.190)	(0.317)	(0.317)	(0.001)	(0.000)	(0.000)		(0.000)
UR	-0.075	-0.075	-0.198	-0.157	-0.157	-0.157*	-0.094	-0.056	-0.050		-0.042
	(0.584)	(0.369)	(0.156)	(0.478)	(0.306)	(0.099)	(0.552)	(0.645)	(0.677)		(0.718)
TFSL	-0.114	-0.114	-0.119	-0.265*	-0.265	-0.265	-0.155	-0.116	-0.122		-0.131
	(0.517)	(0.546)	(0.392)	(0.100)	(0.128)	(0.104)	(0.359)	(0.408)	(0.351)		(0.320)
AR	0.073	0.073	0.141	0.128	0.128	0.128	0.087	0.053	0.083		0.082
	(0.630)	(0.520)	(0.140)	(0.394)	(0.276)	(0.241)	(0.575)	(0.696)	(0.512)		(0.486)
LTUR	0.029	0.029	0.097	0.047	0.047	0.047	0.030	-0.001	0.009		-0.003
	(0.748)	(0.686)	(0.332)	(0.714)	(0.712)	(0.512)	(0.762)	(0.989)	(0.924)		(0.974)
YUR	0.271**	0.271***	0.231***	0.239	0.239**	0.239***	0.265**	0.278**	0.272**		0.281**
	(0.048)	(0.001)	(0.006)	(0.107)	(0.046)	(0.001)	(0.037)	(0.029)	(0.033)		(0.022)
constant	0.364***	0.364**	0.338***	0.788***	0.204	0.788***	0.372***				
	(0.000)	(0.046)	(0.006)	(0.000)	(0.372)	(0.000)	(0.000)				
R-sqr	0.254	0.254	0.219	0.140	0.384					0.000	
Within.R-sqr				0.140		0.140	0.105				
Over.R-sqr				0.003			0.247				
Betw.R-sqr				0.054			0.628				
Pseud.R-sqr								0.227	0.226		
No. of observations	149	149	149	149	149	149	149	149	149	235	149
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	18.242	18.242	31.005	7.057	7.057	15.688	14.756				
D'Agostino normality test, P-val	0.000	0.000	0.000	0.029	0.029	0.000	0.001				
Breusch-Pagan test	3.369										
Breusch-Pagan test, P-val	0.004										
Quasi-time-demeaned-data test of ser. corr.	-0.034										
Quasi-time-demeaned-data test of ser. corr., P-val	0.973										
Relevance/redundancy of FE test					1.877						
Relevance/redundancy of FE test, P-val					0.055						
Hausman test							515.481				
Hausman test, P-val							0.000				
Cor.Pred.Crisis - In sample	0.561	0.561	0.439	0.614	0.614	0.491	0.491	0.544	0.561		0.544
aNtS - In sample	0.252	0.252	0.173	0.195	0.195	1.306	0.221	0.240	0.271		0.280
CPR - In sample	0.745	0.745	0.738	0.779	0.779	0.409	0.738	0.745	0.738		0.732
Absolute Utility - In sample	0.210	0.210	0.181	0.247	0.247	-0.075	0.191	0.207	0.205		0.196
AUROC - In sample	0.801	0.801	0.788	0.864	0.864	0.520	0.801	0.815	0.823		0.816
First year out of sample	2017										
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.	.	.		.
aNtS - Out sample	.	.	.	.	.	.	.	.	.		.
CPR - Out sample	.	.	.	.	.	.	.	.	.		.
Absolute Utility - Out sample	.	.	.	.	.	.	.	.	.		.
AUROC - Out sample	.	.	.	.	.	.	.	.	.		.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.	.	.		.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.	.	.		.
CPR - Out sample (first year only)	.	.	.	.	.	.	.	.	.		.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.	.	.		.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.	.	.		.

Note: The table presents estimated models for crisis variable for euro area countries, using three year lag of all explanatory variables. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.18 **Out-of-sample econometric results for the EA, three year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.083	0.083	0.045	-0.151	-0.151	-0.151	0.083	0.108	0.111		
	(0.593)	(0.331)	(0.778)	(0.103)	(0.530)	(0.343)	(0.585)	(0.333)	(0.325)		
NIIP	0.146	0.146	0.207	-0.166	-0.166	-0.166	0.146	0.350*	0.612***		
	(0.350)	(0.437)	(0.232)	(0.509)	(0.787)	(0.195)	(0.334)	(0.066)	(0.006)		
EMS	0.054	0.054	0.106	0.074	0.074	0.074	0.054	0.088	0.086		
	(0.627)	(0.751)	(0.179)	(0.663)	(0.677)	(0.562)	(0.620)	(0.462)	(0.473)		
NULC	0.170	0.170**	0.083	0.023	0.023	0.023	0.170	0.371**	0.172*		
	(0.189)	(0.014)	(0.408)	(0.820)	(0.903)	(0.808)	(0.169)	(0.044)	(0.086)		
REER	-0.406***	-0.406***	-0.463***	-0.442***	-0.442***	-0.442***	-0.406***	-0.448***	-0.436***		
	(0.003)	(0.000)	(0.000)	(0.005)	(0.003)	(0.000)	(0.000)	(0.003)	(0.002)		
PSD	-0.270**	-0.270***	-0.334***	-0.472	-0.472	-0.472***	-0.270**	-0.287***	-0.289***		
	(0.027)	(0.000)	(0.009)	(0.159)	(0.253)	(0.001)	(0.015)	(0.004)	(0.004)		
PSCF	0.065	0.065	0.054	-0.054	-0.054	-0.054	0.065	0.079	0.091		
	(0.676)	(0.401)	(0.763)	(0.740)	(0.795)	(0.255)	(0.670)	(0.521)	(0.448)		
HPI	0.092	0.092	0.046	-0.104	-0.104	-0.104	0.092	0.269	0.573***		
	(0.612)	(0.559)	(0.578)	(0.714)	(0.624)	(0.361)	(0.604)	(0.128)	(0.001)		
GGSD	-0.441***	-0.441***	-0.506***	-0.010	-0.010	-0.010	-0.441***	-0.435***	-0.429***		
	(0.000)	(0.001)	(0.000)	(0.924)	(0.984)	(0.952)	(0.000)	(0.000)	(0.000)		
UR	-0.177	-0.177	-0.120	-0.259	-0.259	-0.259*	-0.177	0.139	0.421**		
	(0.278)	(0.241)	(0.531)	(0.234)	(0.283)	(0.084)	(0.260)	(0.332)	(0.022)		
TFSL	-0.207	-0.207	-0.230	-0.232	-0.232	-0.232*	-0.207	-0.207	-0.243*		
	(0.274)	(0.379)	(0.127)	(0.225)	(0.255)	(0.088)	(0.256)	(0.107)	(0.058)		
AR	-0.302	-0.302**	-0.375*	-0.130	-0.130	-0.130	-0.302	-0.308*	-0.295*		
	(0.187)	(0.041)	(0.050)	(0.560)	(0.608)	(0.644)	(0.167)	(0.086)	(0.073)		
LTUR	-0.158	-0.158**	-0.227	-0.076	-0.076	-0.076	-0.158	-0.221	-0.229		
	(0.452)	(0.021)	(0.114)	(0.719)	(0.719)	(0.243)	(0.440)	(0.281)	(0.255)		
YUR	0.362**	0.362***	0.398***	0.316	0.316*	0.316***	0.362**	0.438**	0.413**		
	(0.045)	(0.000)	(0.000)	(0.135)	(0.075)	(0.000)	(0.028)	(0.032)	(0.029)		
constant	0.647***	0.647***	0.757***	0.785***	0.088	0.785***	0.647***				
	(0.000)	(0.000)	(0.000)	(0.007)	(0.873)	(0.000)	(0.000)				
R-sqr	0.375	0.375	0.399	0.299	0.506					0.000	0.000
Within.R-sqr				0.299		0.299	0.215				
Over.R-sqr				0.012			0.375				
Betw.R-sqr				0.001			0.708				
Pseud.R-sqr								0.385	0.396		
No. of observations	82	82	82	82	82	82	82	82	82	235	235
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	5.491	5.491	5.909	2.066	2.066	10.116	5.491				
D'Agostino normality test, P-val	0.064	0.064	0.052	0.356	0.356	0.006	0.064				
Breusch-Pagan test	1.080										
Breusch-Pagan test, P-val	0.298										
Quasi-time-demeaned-data test of ser. corr.	-2.279										
Quasi-time-demeaned-data test of ser. corr., P-val	0.023										
Relevance/redundancy of FE test					0.447						
Relevance/redundancy of FE test, P-val					0.721						
Hausman test							.				
Hausman test, P-val							.				
Cor.Pred.Crisis - In sample	0.700	0.700	0.733	0.733	0.733	0.433	0.700	0.767	0.767		
aNtS - In sample	0.247	0.247	0.236	0.157	0.157	0.976	0.247	0.201	0.176		
CPR - In sample	0.780	0.780	0.793	0.829	0.829	0.524	0.780	0.817	0.829		
Absolute Utility - In sample	0.263	0.263	0.280	0.309	0.309	0.005	0.263	0.306	0.316		
AUROC - In sample	0.871	0.871	0.865	0.927	0.927	0.543	0.871	0.867	0.879		
First year out of sample	2013										
Cor.Pred.Crisis - Out sample	0.444	0.444	0.407	0.630	0.630	0.333	0.444	0.407	0.407		
aNtS - Out sample	0.506	0.506	0.736	0.558	0.516	1.350	0.506	0.736	0.675		
CPR - Out sample	0.642	0.642	0.582	0.641	0.657	0.463	0.642	0.582	0.597		
Absolute Utility - Out sample	0.110	0.110	0.054	0.139	0.152	-0.058	0.110	0.054	0.066		
AUROC - Out sample	0.545	0.545	0.523	0.674	0.697	0.394	0.545	0.581	0.562		
Cor.Pred.Crisis - Out sample (first year only)	0.636	0.636	0.545	0.727	0.727	0.455	0.636	0.545	0.545		
aNtS - Out sample (first year only)	0.000	0.000	0.367	0.275	0.275	1.760	0.000	0.367	0.000		
CPR - Out sample (first year only)	0.750	0.750	0.625	0.750	0.750	0.375	0.750	0.625	0.688		
Absolute Utility - Out sample (first year only)	0.318	0.318	0.173	0.264	0.264	-0.173	0.318	0.173	0.273		

Note: The table presents estimated models for crisis variable for euro area countries, using three -year lag of all explanatory variables. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.

Source: Authors' calculations based on data from the EC and Eurostat.

Table F.19 **In-sample econometric results for the EA, one year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	0.021***	0.021***	0.025*	0.017*	0.020**	0.021***
	(0.006)	(0.007)	(0.058)	(0.058)	(0.014)	(0.008)
NIIP	-0.001	-0.001	-0.005***	-0.001	-0.001**	-0.001***
	(0.118)	(0.143)	(0.002)	(0.286)	(0.048)	(0.010)
EMS	-0.007***	-0.007***	-0.010***	-0.006**	-0.006**	-0.006***
	(0.001)	(0.003)	(0.008)	(0.011)	(0.017)	(0.004)
NULC	0.025***	0.025***	0.018**	0.021***	0.028***	0.028***
	(0.002)	(0.001)	(0.034)	(0.003)	(0.000)	(0.000)
REER	-0.001	-0.001	0.001	-0.004	-0.002	0.001
	(0.817)	(0.829)	(0.867)	(0.578)	(0.764)	(0.798)
PSD	0.000	0.000	0.006**	0.000	0.001	0.001*
	(0.352)	(0.208)	(0.018)	(0.300)	(0.172)	(0.075)
PSCF	-0.001	-0.001	-0.006	-0.001	-0.001	-0.001
	(0.453)	(0.660)	(0.159)	(0.707)	(0.257)	(0.176)
HPI	-0.042***	-0.042***	-0.034***	-0.043***	-0.043***	-0.042***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GGSD	-0.001	-0.001	-0.011***	-0.001	-0.001	-0.001
	(0.144)	(0.126)	(0.002)	(0.138)	(0.239)	(0.369)
UR	0.006	0.005	0.006	0.001	0.009	0.013
	(0.445)	(0.624)	(0.823)	(0.949)	(0.365)	(0.251)
TFSL	-0.003	-0.003	-0.006	-0.003	-0.003	-0.003
	(0.307)	(0.370)	(0.117)	(0.392)	(0.366)	(0.341)
AR	0.020	0.021	0.033	0.020	0.023	0.022
	(0.388)	(0.343)	(0.214)	(0.338)	(0.313)	(0.283)
LTUR	0.112***	0.112***	0.125***	0.101***	0.133***	0.130***
	(0.000)	(0.001)	(0.001)	(0.005)	(0.000)	(0.000)
YUR	-0.019**	-0.019**	-0.025**	-0.019**	-0.025***	-0.026***
	(0.028)	(0.038)	(0.011)	(0.035)	(0.001)	(0.001)
L.DV				0.087		
				(0.153)		
R-sqr	0.541					
No. of observations	186	186	186	174	186	186
Dynamic completeness test	3.798					
Dynamic completeness test, P-val	0.051					
Correlated random effects test			20.657			
Correlated random effects test, P-val			0.111			
State dependence tests				1.398		
State dependence tests, P-val				0.162		
State dependence tests (Robust)				1.449		
State dependence tests, P-val (Robust)				0.147		
Cor.Pred.Crisis - In sample	0.783	0.783	0.850	0.831	0.783	0.750
aNtS - In sample	0.081	0.081	0.084	0.073	0.122	0.116
CPR - In sample	0.887	0.887	0.903	0.902	0.866	0.860
Absolute Utility - In sample	0.360	0.360	0.389	0.385	0.344	0.331
AUROC - In sample	0.940	0.940	0.976	0.945	0.937	0.936
First year out of sample	2017					
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for euro area countries, using one year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.20 **Out-of-sample econometric results for the EA, one year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	0.039***	0.039***	0.062	0.042***	0.021**	0.016
	(0.000)	(0.000)	(0.121)	(0.003)	(0.043)	(0.151)
NIIP	-0.003***	-0.003**	-0.012	-0.003**	-0.003***	-0.003***
	(0.000)	(0.023)	(0.230)	(0.033)	(0.003)	(0.003)
EMS	-0.008**	-0.008**	-0.063***	-0.009**	-0.002	-0.003
	(0.012)	(0.020)	(0.008)	(0.017)	(0.723)	(0.439)
NULC	0.037***	0.037***	-0.024	0.037***	0.037***	0.034***
	(0.000)	(0.000)	(0.503)	(0.000)	(0.000)	(0.000)
REER	-0.006	-0.006	0.058*	-0.005	-0.010	-0.007
	(0.492)	(0.441)	(0.082)	(0.549)	(0.337)	(0.356)
PSD	0.000	0.000	-0.005	-0.000	0.000	0.001
	(0.991)	(0.989)	(0.262)	(0.927)	(0.543)	(0.329)
PSCF	-0.001	-0.001	0.004	-0.001	-0.001	-0.003
	(0.478)	(0.727)	(0.207)	(0.753)	(0.849)	(0.429)
HPI	-0.051***	-0.051***	-0.104***	-0.058***	-0.047***	-0.046***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GGSD	-0.000	-0.000	-0.005	-0.000	-0.000	-0.001
	(0.904)	(0.906)	(0.597)	(0.877)	(0.977)	(0.732)
UR	0.019	0.019	0.088	0.013	0.017	0.014
	(0.237)	(0.335)	(0.470)	(0.539)	(0.295)	(0.365)
TFSL	-0.007*	-0.007	-0.029	-0.007	-0.004	-0.005
	(0.091)	(0.175)	(0.102)	(0.193)	(0.363)	(0.233)
AR	0.028	0.028	0.016	0.034	0.026	0.021
	(0.175)	(0.326)	(0.860)	(0.233)	(0.200)	(0.290)
LTUR	0.155***	0.155***	0.083	0.172***	0.156***	0.125***
	(0.000)	(0.000)	(0.222)	(0.000)	(0.000)	(0.001)
YUR	-0.043***	-0.043***	-0.022	-0.048***	-0.050***	-0.045***
	(0.000)	(0.001)	(0.407)	(0.001)	(0.000)	(0.000)
L.DV				0.040		
				(0.639)		
R-sqr	0.563					
No. of observations	115	115	115	107	115	115
Dynamic completeness test	6.492					
Dynamic completeness test, P-val	0.011					
Correlated random effects test			942.107			
Correlated random effects test, P-val			0.000			
State dependence tests				1.398		
State dependence tests, P-val				0.162		
State dependence tests (Robust)				1.449		
State dependence tests, P-val (Robust)				0.147		
Cor.Pred.Crisis - In sample	0.848	0.848	1.000	0.813	0.788	0.818
aNtS - In sample	0.072	0.072	0.000	0.049	0.062	0.060
CPR - In sample	0.913	0.913	1.000	0.916	0.904	0.913
Absolute Utility - In sample	0.394	0.394	0.500	0.386	0.370	0.385
AUROC - In sample	0.942	0.942	1.000	0.948	0.943	0.941
First year out of sample	2013					
Cor.Pred.Crisis - Out sample	0.926	0.926	0.889	0.926	0.667	0.741
aNtS - Out sample	0.368	0.368	0.384	0.351	0.443	0.399
CPR - Out sample	0.761	0.761	0.750	0.776	0.690	0.718
Absolute Utility - Out sample	0.293	0.293	0.274	0.300	0.186	0.223
AUROC - Out sample	0.875	0.875	0.779	0.893	0.772	0.779
Cor.Pred.Crisis - Out sample (first year only)	0.909	0.909	0.909	0.909	0.818	0.818
aNtS - Out sample (first year only)	0.367	0.367	0.183	0.220	0.407	0.407
CPR - Out sample (first year only)	0.824	0.824	0.882	0.875	0.765	0.765
Absolute Utility - Out sample (first year only)	0.288	0.288	0.371	0.355	0.242	0.242
AUROC - Out sample (first year only)	0.879	0.879	0.864	0.909	0.818	0.742

Note: The table presents estimated models for crisis variable for euro area countries, using one year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.21 **In-sample econometric results for the EA, two year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	0.002	-0.013	-0.042**	-0.011	0.000	0.000
	(0.850)	(0.280)	(0.026)	(0.245)	(0.985)	(0.981)
NIIP	-0.002	-0.001	-0.002	-0.001	-0.002	-0.002*
	(0.147)	(0.364)	(0.153)	(0.567)	(0.113)	(0.071)
EMS	-0.001	-0.001	-0.001	0.001	0.001	0.002
	(0.763)	(0.868)	(0.784)	(0.724)	(0.701)	(0.591)
NULC	0.024**	0.013	0.013	0.015*	0.025**	0.027***
	(0.037)	(0.188)	(0.164)	(0.074)	(0.014)	(0.009)
REER	-0.035**	-0.036***	-0.048***	-0.037***	-0.039***	-0.038***
	(0.018)	(0.000)	(0.000)	(0.000)	(0.003)	(0.004)
PSD	-0.000	0.000	0.003	-0.000	-0.000	-0.000
	(0.710)	(0.929)	(0.280)	(0.323)	(0.769)	(0.933)
PSCF	0.003**	0.002	0.000	0.003*	0.004**	0.004*
	(0.018)	(0.294)	(0.788)	(0.058)	(0.023)	(0.070)
HPI	-0.019**	-0.017**	-0.016**	-0.006	-0.020**	-0.020**
	(0.025)	(0.018)	(0.019)	(0.427)	(0.032)	(0.029)
GGSD	-0.003**	-0.005***	-0.016***	-0.003**	-0.003*	-0.003*
	(0.033)	(0.004)	(0.000)	(0.013)	(0.055)	(0.097)
UR	-0.003	-0.007	0.040	-0.001	-0.003	-0.001
	(0.754)	(0.694)	(0.201)	(0.926)	(0.827)	(0.959)
TFSL	-0.002	-0.004	-0.008**	-0.002	-0.002	-0.002
	(0.312)	(0.307)	(0.047)	(0.558)	(0.363)	(0.440)
AR	-0.003	0.010	0.028	-0.002	-0.004	-0.002
	(0.930)	(0.737)	(0.270)	(0.950)	(0.903)	(0.941)
LTUR	0.022	0.017	0.008	-0.006	0.042	0.051
	(0.566)	(0.623)	(0.854)	(0.855)	(0.218)	(0.168)
YUR	0.013	0.013	0.023***	0.017*	0.009	0.005
	(0.212)	(0.173)	(0.009)	(0.059)	(0.399)	(0.666)
L.DV				0.267***		
				(0.000)		
R-sqr	0.338					
No. of observations	167	167	167	156	167	167
Dynamic completeness test	17.951					
Dynamic completeness test, P-val	0.000					
Correlated random effects test			23.727			
Correlated random effects test, P-val			0.049			
State dependence tests				3.430		
State dependence tests, P-val				0.001		
State dependence tests (Robust)				3.430		
State dependence tests, P-val (Robust)				0.001		
Cor.Pred.Crisis - In sample	0.627	0.593	0.814	0.724	0.695	0.644
aNtS - In sample	0.133	0.156	0.114	0.155	0.133	0.115
CPR - In sample	0.814	0.796	0.874	0.827	0.832	0.826
Absolute Utility - In sample	0.272	0.250	0.360	0.306	0.301	0.285
AUROC - In sample	0.868	0.859	0.954	0.896	0.870	0.861
First year out of sample	2017					
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for euro area countries, using two year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.22 **Out-of-sample econometric results for the EA, two year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	0.010	0.010	-0.300**	-0.005		-0.023
	(0.432)	(0.461)	(0.019)	(0.734)		(0.125)
NIIP	-0.004**	-0.004*	-0.012	-0.002		-0.004**
	(0.023)	(0.060)	(0.220)	(0.266)		(0.035)
EMS	0.003	0.003	-0.021	0.005		0.017***
	(0.351)	(0.323)	(0.146)	(0.198)		(0.006)
NULC	0.020**	0.020*	-0.048	0.009		0.014*
	(0.032)	(0.059)	(0.224)	(0.501)		(0.084)
REER	-0.049***	-0.049***	-0.123**	-0.051***		-0.061***
	(0.001)	(0.000)	(0.045)	(0.000)		(0.000)
PSD	-0.000	-0.000	0.023**	-0.000		0.001*
	(0.820)	(0.821)	(0.024)	(0.812)		(0.099)
PSCF	0.001	0.001	-0.005	0.002		0.005*
	(0.134)	(0.559)	(0.182)	(0.312)		(0.065)
HPI	-0.019**	-0.019**	-0.046**	-0.007		0.002
	(0.029)	(0.043)	(0.039)	(0.508)		(0.867)
GGSD	-0.003**	-0.003*	-0.019	-0.003*		-0.002
	(0.031)	(0.070)	(0.136)	(0.092)		(0.322)
UR	0.007	0.007	0.092	-0.001		0.012
	(0.767)	(0.783)	(0.457)	(0.982)		(0.578)
TFSL	-0.007	-0.007	0.004	-0.013		-0.004
	(0.125)	(0.286)	(0.540)	(0.109)		(0.444)
AR	0.030	0.030	0.067	0.030		0.007
	(0.218)	(0.414)	(0.313)	(0.438)		(0.773)
LTUR	0.009	0.008	-0.131	-0.023		-0.102
	(0.892)	(0.907)	(0.467)	(0.767)		(0.164)
YUR	-0.002	-0.002	-0.020	0.011		0.010
	(0.904)	(0.917)	(0.668)	(0.624)		(0.591)
L.DV				0.221**		
				(0.048)		
R-sqr	0.398					
No. of observations	98	98	98	91	235	98
Dynamic completeness test	0.000					
Dynamic completeness test, P-val	0.989					
Correlated random effects test			7.294			
Correlated random effects test, P-val			0.923			
State dependence tests				3.430		
State dependence tests, P-val				0.001		
State dependence tests (Robust)				3.430		
State dependence tests, P-val (Robust)				0.001		
Cor.Pred.Crisis - In sample	0.688	0.688	0.906	0.677		0.719
aNtS - In sample	0.154	0.154	0.084	0.172		0.084
CPR - In sample	0.827	0.827	0.918	0.813		0.867
Absolute Utility - In sample	0.291	0.291	0.415	0.280		0.329
AUROC - In sample	0.886	0.886	0.987	0.901		0.917
First year out of sample	2013					
Cor.Pred.Crisis - Out sample	0.778	0.778	0.593	0.963		0.333
aNtS - Out sample	0.673	0.673	0.867	0.437		1.143
CPR - Out sample	0.594	0.594	0.531	0.738		0.507
Absolute Utility - Out sample	0.127	0.127	0.040	0.271		-0.024
AUROC - Out sample	0.722	0.722	0.590	0.830		0.415
Cor.Pred.Crisis - Out sample (first year only)	0.636	0.636	0.636	0.909		0.545
aNtS - Out sample (first year only)	0.786	0.786	0.943	0.660		0.917
CPR - Out sample (first year only)	0.588	0.588	0.563	0.750		0.529
Absolute Utility - Out sample (first year only)	0.068	0.068	0.018	0.155		0.023
AUROC - Out sample (first year only)	0.576	0.576	0.573	0.745		0.485

Note: The table presents estimated models for crisis variable for euro area countries, using two year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.23 **In-sample econometric results for the EA, three year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	0.013	-0.002	-0.081***	0.012	0.013	0.011
	(0.388)	(0.902)	(0.001)	(0.254)	(0.331)	(0.441)
NIIP	-0.003**	-0.002	-0.003	-0.003**	-0.003**	-0.003**
	(0.031)	(0.117)	(0.167)	(0.024)	(0.013)	(0.017)
EMS	0.002	0.003	0.009**	0.003	0.004	0.005
	(0.628)	(0.437)	(0.033)	(0.344)	(0.268)	(0.175)
NULC	0.047***	0.039***	0.047***	0.041***	0.045***	0.043***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
REER	-0.046***	-0.049***	-0.078***	-0.035***	-0.047***	-0.049***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PSD	-0.000	-0.000	-0.001	-0.000	-0.000	-0.000
	(0.328)	(0.695)	(0.426)	(0.455)	(0.894)	(0.602)
PSCF	0.006**	0.004	0.002	0.005	0.006***	0.007***
	(0.017)	(0.228)	(0.255)	(0.109)	(0.001)	(0.002)
HPI	0.003	0.005	0.008	0.009	0.002	-0.000
	(0.668)	(0.509)	(0.268)	(0.226)	(0.713)	(0.977)
GGSD	-0.002	-0.004**	-0.016***	-0.001	-0.002	-0.002
	(0.119)	(0.035)	(0.000)	(0.353)	(0.189)	(0.242)
UR	0.008	0.007	0.065**	0.007	0.009	0.008
	(0.488)	(0.688)	(0.037)	(0.648)	(0.472)	(0.621)
TFSL	0.002	0.001	-0.006	0.003	0.003	0.002
	(0.317)	(0.720)	(0.179)	(0.286)	(0.306)	(0.297)
AR	-0.027	-0.024	-0.027	-0.025	-0.030	-0.029
	(0.424)	(0.448)	(0.357)	(0.377)	(0.321)	(0.349)
LTUR	-0.045	-0.046	-0.042	-0.034	-0.056	-0.043
	(0.285)	(0.260)	(0.298)	(0.369)	(0.181)	(0.206)
YUR	0.040***	0.041***	0.060***	0.033***	0.045***	0.040***
	(0.001)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)
L.DV				0.240***		
				(0.000)		
R-sqr	0.383					
No. of observations	149	149	149	149	149	149
Dynamic completeness test	18.880					
Dynamic completeness test, P-val	0.000					
Correlated random effects test			32.963			
Correlated random effects test, P-val			0.003			
State dependence tests				3.526		
State dependence tests, P-val				0.000		
State dependence tests (Robust)				2.921		
State dependence tests, P-val (Robust)				0.003		
Cor.Pred.Crisis - In sample	0.684	0.702	0.895	0.702	0.702	0.702
aNtS - In sample	0.207	0.201	0.061	0.155	0.170	0.186
CPR - In sample	0.792	0.799	0.926	0.819	0.812	0.805
Absolute Utility - In sample	0.271	0.280	0.420	0.297	0.291	0.286
AUROC - In sample	0.884	0.877	0.973	0.906	0.891	0.884
First year out of sample	2017					
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for euro area countries, using three year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. *Source*: Authors' calculations based on data from the EC and Eurostat.

Table F.24 **Out-of-sample econometric results for the EA, three year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	-0.015	-0.067	.	-0.020	-0.014	-0.015
	(0.425)	(0.102)	.	(0.303)	(0.423)	(0.316)
NIIP	0.000	0.002	.	0.000	-0.000	-0.000
	(0.938)	(0.523)	.	(0.892)	(0.956)	(0.678)
EMS	0.008***	0.004	.	0.008**	0.008***	0.011***
	(0.004)	(0.438)	.	(0.036)	(0.002)	(0.000)
NULC	0.028***	0.013	.	0.038***	0.029**	0.031***
	(0.009)	(0.407)	.	(0.005)	(0.012)	(0.002)
REER	-0.109***	-0.152	.	-0.119***	-0.107***	-0.107***
	(0.000)	(0.117)	.	(0.000)	(0.000)	(0.000)
PSD	0.001	0.002	.	0.002*	0.001	0.002**
	(0.202)	(0.266)	.	(0.055)	(0.105)	(0.045)
PSCF	0.005**	0.004	.	0.007	0.003	0.004
	(0.046)	(0.351)	.	(0.180)	(0.285)	(0.177)
HPI	0.001	-0.004	.	0.005	0.001	0.002
	(0.938)	(0.712)	.	(0.578)	(0.921)	(0.757)
GGSD	-0.002	-0.008	.	-0.002	-0.002	-0.003
	(0.185)	(0.213)	.	(0.419)	(0.130)	(0.131)
UR	-0.002	-0.052	.	-0.028	0.005	0.020
	(0.957)	(0.241)	.	(0.395)	(0.879)	(0.481)
TFSL	-0.004	-0.011	.	-0.002	-0.002	-0.001
	(0.461)	(0.144)	.	(0.562)	(0.643)	(0.625)
AR	0.007	0.021	.	-0.026	0.011	0.005
	(0.844)	(0.596)	.	(0.516)	(0.770)	(0.894)
LTUR	-0.242***	-0.271	.	-0.211***	-0.237***	-0.255***
	(0.003)	(0.230)	.	(0.010)	(0.001)	(0.001)
YUR	0.093***	0.169	.	0.093***	0.091***	0.092***
	(0.000)	(0.129)	.	(0.001)	(0.000)	(0.000)
L.DV				0.035		
				(0.694)		
R-sqr	0.604					
No. of observations	82	82	82	82	82	82
Dynamic completeness test	2.447					
Dynamic completeness test, P-val	0.118					
Correlated random effects test			0.000			
Correlated random effects test, P-val			1.000			
State dependence tests				3.526		
State dependence tests, P-val				0.000		
State dependence tests (Robust)				2.921		
State dependence tests, P-val (Robust)				0.003		
Cor.Pred.Crisis - In sample	0.800	0.633	1.000	0.833	0.800	0.867
aNtS - In sample	0.120	0.243	0.000	0.138	0.144	0.089
CPR - In sample	0.866	0.768	1.000	0.866	0.854	0.902
Absolute Utility - In sample	0.352	0.240	0.500	0.359	0.342	0.395
AUROC - In sample	0.951	0.888	1.000	0.958	0.951	0.959
First year out of sample	2013					
Cor.Pred.Crisis - Out sample	0.926	0.963	0.926	0.889	0.889	0.963
aNtS - Out sample	0.810	0.805	0.876	0.731	0.787	0.571
CPR - Out sample	0.522	0.522	0.500	0.567	0.537	0.657
Absolute Utility - Out sample	0.088	0.094	0.058	0.119	0.094	0.206
AUROC - Out sample	0.722	0.620	0.558	0.701	0.757	0.762
Cor.Pred.Crisis - Out sample (first year only)	1.000	1.000	1.000	0.909	0.909	1.000
aNtS - Out sample (first year only)	1.000	1.000	0.800	1.100	1.100	1.000
CPR - Out sample (first year only)	0.688	0.688	0.750	0.625	0.625	0.688
Absolute Utility - Out sample (first year only)	0.000	0.000	0.100	-0.045	-0.045	0.000
AUROC - Out sample (first year only)	0.727	0.500	0.600	0.727	0.709	0.764

Note: The table presents estimated models for crisis variable for euro area countries, using three year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.25 **In-sample econometric results for the non-EA, one year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	0.017	-0.000	0.017*	-0.007	0.013	0.013	0.013
	(0.133)	(0.704)	(0.075)	(0.724)	(0.240)	(0.257)	(0.244)
NIIP	0.001*	0.001	0.001	0.050***	0.001	0.002*	0.001
	(0.097)	(0.762)	(0.210)	(0.000)	(0.357)	(0.050)	(0.128)
EMS	0.002	-0.000	0.002	-0.010**	0.001	0.001	0.002
	(0.356)	(0.760)	(0.403)	(0.011)	(0.723)	(0.426)	(0.293)
NULC	0.006	0.000	0.006	0.020**	0.005	0.004	0.004
	(0.160)	(0.765)	(0.187)	(0.021)	(0.226)	(0.298)	(0.358)
REER	0.001	0.001	0.001	0.047***	0.006	0.001	0.001
	(0.826)	(0.765)	(0.821)	(0.001)	(0.320)	(0.729)	(0.797)
PSD	-0.000	0.001	-0.000	0.046***	-0.001	0.000	0.000
	(0.809)	(0.758)	(0.863)	(0.000)	(0.377)	(0.822)	(0.704)
PSCF	-0.004	0.000	-0.004	0.014*	0.004	-0.005	-0.003
	(0.384)	(0.740)	(0.485)	(0.096)	(0.520)	(0.334)	(0.579)
HPI	-0.030***	-0.001	-0.030***	-0.063***	-0.024***	-0.032***	-0.032***
	(0.000)	(0.767)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GGSD	0.005*	0.000	0.005**	0.016***	0.004*	0.005*	0.005
	(0.094)	(0.770)	(0.013)	(0.003)	(0.065)	(0.090)	(0.103)
UR	-0.028	0.001	-0.028	0.064*	-0.023	-0.027	-0.023
	(0.219)	(0.737)	(0.104)	(0.077)	(0.150)	(0.195)	(0.271)
TFSL	0.000	0.000	0.000	0.024***	-0.002	0.006**	0.002
	(0.966)	(0.770)	(0.975)	(0.001)	(0.621)	(0.034)	(0.541)
AR	-0.029	-0.002	-0.029	-0.144***	-0.031	-0.020	-0.026
	(0.146)	(0.767)	(0.207)	(0.005)	(0.151)	(0.313)	(0.207)
LTUR	0.062	0.003	0.062	0.241***	0.065	0.065	0.051
	(0.311)	(0.763)	(0.132)	(0.003)	(0.173)	(0.259)	(0.360)
YUR	-0.008	-0.001	-0.008	-0.044***	-0.011	-0.008	-0.007
	(0.602)	(0.763)	(0.399)	(0.002)	(0.270)	(0.557)	(0.602)
L.DV					0.146**		
					(0.046)		
R-sqr	0.488	0.832				0.503	0.470
No. of observations	137	110	137	137	125	137	137
Dynamic completeness test	4.007						
Dynamic completeness test, P-val	0.045						
Hausman test			43.485				
Hausman test, P-val			0.000				
Correlated random effects test				385.656			
Correlated random effects test, P-val				0.000			
State dependence tests					1.844		
State dependence tests, P-val					0.065		
State dependence tests (Robust)					2.222		
State dependence tests, P-val (Robust)					0.026		
Cor.Pred.Crisis - In sample	0.690	0.238	0.690	0.929	0.757	0.762	0.738
aNtS - In sample	0.091	0.221	0.091	0.023	0.120	0.111	0.114
CPR - In sample	0.861	0.730	0.861	0.964	0.864	0.869	0.861
Absolute Utility - In sample	0.314	0.093	0.314	0.454	0.333	0.339	0.327
AUROC - In sample	0.920	0.780	0.920	0.991	0.936	0.925	0.921
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for non-euro area countries, using one year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.26 **Out-of-sample econometric results for the non-EA, one year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	0.008	0.027	0.008		0.018	0.011	0.012
	(0.302)	(1.000)	(0.375)		(0.132)	(0.189)	(0.169)
NIIP	0.000	0.000	0.000		-0.001	-0.000	-0.000
	(0.676)	(1.000)	(0.786)		(0.465)	(0.744)	(0.773)
EMS	0.004***	0.004	0.004**		0.005**	0.004***	0.004***
	(0.000)	(1.000)	(0.032)		(0.039)	(0.000)	(0.001)
NULC	0.006***	0.003	0.006		0.004	0.006**	0.006**
	(0.008)	(1.000)	(0.191)		(0.490)	(0.018)	(0.015)
REER	-0.003	0.001	-0.003		0.003	-0.003	-0.002
	(0.432)	(1.000)	(0.458)		(0.623)	(0.582)	(0.681)
PSD	0.000	0.004	0.000		0.001	0.000	0.000
	(0.493)	(1.000)	(0.681)		(0.444)	(0.546)	(0.764)
PSCF	-0.001	-0.003	-0.001		0.003	-0.002	-0.002
	(0.796)	(1.000)	(0.875)		(0.646)	(0.416)	(0.448)
HPI	-0.020***	-0.008	-0.020***		-0.017***	-0.018***	-0.018***
	(0.000)	(1.000)	(0.000)		(0.007)	(0.000)	(0.000)
GGSD	0.005**	0.005	0.005**		0.004	0.006*	0.006*
	(0.027)	(1.000)	(0.024)		(0.148)	(0.055)	(0.075)
UR	-0.030**	-0.035	-0.030		-0.005	-0.033*	-0.036
	(0.011)	(1.000)	(0.250)		(0.852)	(0.100)	(0.156)
TFSL	-0.001	0.004	-0.001		-0.002	-0.001	-0.001
	(0.660)	(1.000)	(0.863)		(0.814)	(0.367)	(0.384)
AR	-0.027	-0.014	-0.027		-0.024	-0.019	-0.019
	(0.168)	(1.000)	(0.313)		(0.373)	(0.302)	(0.298)
LTUR	0.068	0.032	0.068		-0.008	0.072	0.069
	(0.260)	(1.000)	(0.206)		(0.909)	(0.161)	(0.191)
YUR	-0.009	-0.009	-0.009		0.004	-0.011	-0.010
	(0.660)	(1.000)	(0.504)		(0.765)	(0.510)	(0.554)
L.DV					0.050		
					(0.586)		
R-sqr	0.574	1.000				0.734	0.751
No. of observations	92	70	92	242	84	92	92
Dynamic completeness test	0.208						
Dynamic completeness test, P-val	0.649						
Hausman test			0.000				
Hausman test, P-val			1.000				
Correlated random effects test				0.000			
Correlated random effects test, P-val				1.000			
State dependence tests					1.844		
State dependence tests, P-val					0.065		
State dependence tests (Robust)					2.222		
State dependence tests, P-val (Robust)					0.026		
Cor.Pred.Crisis - In sample	0.778	0.455	0.778	1.000	0.739	0.852	0.889
aNtS - In sample	0.099	0.175	0.099	0.000	0.067	0.054	0.052
CPR - In sample	0.880	0.800	0.880	1.000	0.893	0.924	0.935
Absolute Utility - In sample	0.350	0.188	0.350	0.500	0.345	0.403	0.421
AUROC - In sample	0.948	0.691	0.948	1.000	0.951	0.961	0.963
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.267	0.000	0.267	0.400	0.214	0.400	0.400
aNtS - Out sample	0.125	.	0.125	0.500	0.346	0.250	0.250
CPR - Out sample	0.733	0.703	0.733	0.667	0.683	0.733	0.733
Absolute Utility - Out sample	0.117	-0.019	0.117	0.100	0.070	0.150	0.150
AUROC - Out sample	0.811	0.515	0.811	0.602	0.791	0.773	0.756
Cor.Pred.Crisis - Out sample (first year only)	0.500	0.000	0.500	0.375	0.286	0.625	0.625
aNtS - Out sample (first year only)	0.000	.	0.000	0.667	0.000	0.000	0.000
CPR - Out sample (first year only)	0.667	0.400	0.667	0.500	0.545	0.750	0.750
Absolute Utility - Out sample (first year only)	0.250	0.000	0.250	0.063	0.143	0.313	0.313
AUROC - Out sample (first year only)	0.781	0.417	0.781	0.656	0.893	0.766	0.719

Note: The table presents estimated models for crisis variable for non-euro area countries, using one year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.27 **In-sample econometric results for the non-EA, two year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	-0.005	-0.031	-0.005	-0.052**	-0.007	-0.012	-0.019*
	(0.597)	(0.269)	(0.667)	(0.025)	(0.488)	(0.262)	(0.074)
NIIP	0.000	0.005	0.000	0.008***	-0.000	0.000	0.001
	(0.900)	(0.200)	(0.898)	(0.005)	(0.996)	(0.742)	(0.475)
EMS	0.002	0.001	0.002	0.002	0.001	0.004*	0.004*
	(0.421)	(0.502)	(0.342)	(0.418)	(0.456)	(0.066)	(0.094)
NULC	0.011**	-0.003	0.011**	-0.006	0.006	0.012**	0.012**
	(0.028)	(0.439)	(0.015)	(0.347)	(0.122)	(0.028)	(0.026)
REER	-0.016***	-0.005	-0.016***	-0.008	-0.016***	-0.021***	-0.020***
	(0.001)	(0.221)	(0.003)	(0.153)	(0.004)	(0.000)	(0.000)
PSD	-0.000	0.005	-0.000	0.008**	-0.000	0.001	0.001
	(0.988)	(0.275)	(0.988)	(0.015)	(0.940)	(0.507)	(0.477)
PSCF	-0.002	-0.002	-0.002	-0.003	0.000	-0.001	-0.002
	(0.715)	(0.670)	(0.701)	(0.626)	(0.973)	(0.932)	(0.820)
HPI	-0.006	-0.002	-0.006	-0.003	0.001	-0.005	-0.006
	(0.104)	(0.636)	(0.217)	(0.590)	(0.812)	(0.112)	(0.153)
GGSD	0.003	0.003	0.003	0.005	0.002	0.003	0.004
	(0.371)	(0.400)	(0.256)	(0.275)	(0.500)	(0.332)	(0.316)
UR	-0.052**	-0.060**	-0.052**	-0.102**	-0.038**	-0.040*	-0.030
	(0.027)	(0.017)	(0.014)	(0.013)	(0.038)	(0.064)	(0.156)
TFSL	-0.002	0.002	-0.002	0.004	-0.003	-0.001	0.007
	(0.581)	(0.587)	(0.635)	(0.481)	(0.416)	(0.878)	(0.127)
AR	-0.067**	-0.010	-0.067***	-0.018	-0.040*	-0.071**	-0.074***
	(0.016)	(0.593)	(0.005)	(0.504)	(0.057)	(0.012)	(0.002)
LTUR	0.026	0.038	0.026	0.062	-0.026	0.013	0.018
	(0.597)	(0.332)	(0.545)	(0.290)	(0.549)	(0.808)	(0.698)
YUR	0.002	0.002	0.002	0.003	0.011	0.005	0.002
	(0.886)	(0.802)	(0.844)	(0.815)	(0.245)	(0.736)	(0.865)
L.DV					0.276***		
					(0.000)		
R-sqr	0.299	0.528				0.379	0.415
No. of observations	127	102	127	127	127	127	127
Dynamic completeness test	7.349						
Dynamic completeness test, P-val	0.007						
Hausman test			-6.292				
Hausman test, P-val			1.000				
Correlated random effects test				3777.104			
Correlated random effects test, P-val				0.000			
State dependence tests					3.571		
State dependence tests, P-val					0.000		
State dependence tests (Robust)					3.435		
State dependence tests, P-val (Robust)					0.001		
Cor.Pred.Crisis - In sample	0.513	0.128	0.513	0.795	0.718	0.538	0.564
aNtS - In sample	0.199	0.355	0.177	0.086	0.111	0.211	0.201
CPR - In sample	0.780	0.701	0.787	0.890	0.858	0.780	0.787
Absolute Utility - In sample	0.205	0.041	0.211	0.363	0.319	0.212	0.225
AUROC - In sample	0.851	0.816	0.851	0.947	0.900	0.839	0.845
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for non-euro area countries, using two year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.28 **Out-of-sample econometric results for the non-EA, two year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	-0.005	.	-0.005	-0.301	-0.008	0.006	0.016
	(0.689)	.	(0.720)	(0.369)	(0.530)	(0.483)	(0.145)
NIIP	-0.003***	.	-0.003	0.070	-0.002	-0.004***	-0.004***
	(0.006)	.	(0.118)	(0.369)	(0.270)	(0.001)	(0.008)
EMS	0.004**	.	0.004	0.018	0.003	0.004**	0.004
	(0.020)	.	(0.115)	(0.195)	(0.226)	(0.049)	(0.118)
NULC	0.007	.	0.007	-0.047	0.003	0.009**	0.011***
	(0.130)	.	(0.175)	(0.359)	(0.523)	(0.020)	(0.005)
REER	-0.018***	.	-0.018***	-0.023	-0.018**	-0.017***	-0.019***
	(0.002)	.	(0.006)	(0.235)	(0.015)	(0.001)	(0.007)
PSD	0.000	.	0.000	0.052	0.000	-0.000	-0.000
	(0.927)	.	(0.930)	(0.329)	(0.969)	(0.881)	(0.997)
PSCF	-0.005	.	-0.005	0.024	-0.006	-0.002	-0.003
	(0.350)	.	(0.439)	(0.399)	(0.372)	(0.618)	(0.644)
HPI	-0.006**	.	-0.006	-0.017	-0.001	-0.009***	-0.010**
	(0.042)	.	(0.328)	(0.466)	(0.902)	(0.003)	(0.049)
GGSD	0.002	.	0.002	0.177	0.003	0.002	-0.000
	(0.391)	.	(0.470)	(0.342)	(0.406)	(0.648)	(0.973)
UR	-0.092***	.	-0.092***	-0.058	-0.066**	-0.093***	-0.092***
	(0.000)	.	(0.007)	(0.756)	(0.031)	(0.000)	(0.000)
TFSL	-0.000	.	-0.000	0.003	-0.002	0.000	-0.001
	(0.896)	.	(0.927)	(0.896)	(0.648)	(0.976)	(0.871)
AR	-0.009	.	-0.009	0.198	0.012	-0.022	-0.028
	(0.755)	.	(0.779)	(0.297)	(0.674)	(0.367)	(0.170)
LTUR	0.072	.	0.072	-0.124	0.011	0.070	0.061
	(0.248)	.	(0.181)	(0.694)	(0.854)	(0.183)	(0.221)
YUR	-0.009	.	-0.009	-0.065	-0.004	-0.009	-0.008
	(0.617)	.	(0.510)	(0.253)	(0.758)	(0.628)	(0.653)
L.DV					0.229**		
					(0.023)		
R-sqr	0.379	0.801				0.612	0.664
No. of observations	80	61	80	80	80	80	80
Dynamic completeness test	3.004						
Dynamic completeness test, P-val	0.083						
Hausman test			2778.506				
Hausman test, P-val			0.000				
Correlated random effects test				5831.961			
Correlated random effects test, P-val				0.000			
State dependence tests					3.571		
State dependence tests, P-val					0.000		
State dependence tests (Robust)					3.435		
State dependence tests, P-val (Robust)					0.001		
Cor.Pred.Crisis - In sample	0.625	0.143	0.625	0.833	0.708	0.667	0.708
aNtS - In sample	0.086	0.875	0.086	0.064	0.050	0.054	0.076
CPR - In sample	0.850	0.685	0.850	0.912	0.887	0.875	0.875
Absolute Utility - In sample	0.286	0.009	0.286	0.390	0.336	0.315	0.327
AUROC - In sample	0.871	0.651	0.871	0.985	0.895	0.897	0.922
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.267	0.222	0.267	0.733	0.467	0.067	0.000
aNtS - Out sample	0.703	0.587	0.703	0.810	0.536	1.406	.
CPR - Out sample	0.638	0.688	0.638	0.511	0.660	0.638	0.660
Absolute Utility - Out sample	0.040	0.046	0.040	0.070	0.108	-0.014	-0.016
AUROC - Out sample	0.652	0.597	0.652	0.617	0.769	0.608	0.473
Cor.Pred.Crisis - Out sample (first year only)	0.375	0.200	0.375	0.625	0.625	0.125	0.000
aNtS - Out sample (first year only)	1.333	0.000	1.333	0.000	0.000	2.000	.
CPR - Out sample (first year only)	0.417	0.556	0.417	0.750	0.750	0.333	0.250
Absolute Utility - Out sample (first year only)	-0.063	0.100	-0.063	0.313	0.313	-0.063	-0.125
AUROC - Out sample (first year only)	0.625	0.825	0.625	1.000	0.969	0.719	0.516

Note: The table presents estimated models for crisis variable for non-euro area countries, using two year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.29 **In-sample econometric results for the non-EA, three year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	-0.006	-0.018	-0.010	-0.061*	-0.005	-0.007	-0.009
	(0.663)	(0.654)	(0.503)	(0.067)	(0.596)	(0.620)	(0.479)
NIIP	-0.002	0.002	-0.001	0.006*	-0.001	-0.002	-0.002
	(0.278)	(0.631)	(0.508)	(0.098)	(0.374)	(0.259)	(0.224)
EMS	0.001	0.001	0.001	0.004	0.000	0.001	0.002
	(0.766)	(0.682)	(0.701)	(0.116)	(0.817)	(0.682)	(0.512)
NULC	0.014***	-0.001	0.013**	-0.003	0.009**	0.014**	0.013**
	(0.006)	(0.705)	(0.017)	(0.587)	(0.028)	(0.016)	(0.022)
REER	-0.027***	-0.007	-0.029***	-0.021***	-0.021***	-0.027***	-0.029***
	(0.000)	(0.613)	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)
PSD	-0.000	0.003	-0.000	0.011***	-0.001	-0.000	-0.000
	(0.616)	(0.680)	(0.852)	(0.002)	(0.306)	(0.728)	(0.857)
PSCF	0.002	-0.002	-0.001	-0.007	0.004	0.002	0.003
	(0.694)	(0.674)	(0.925)	(0.281)	(0.379)	(0.724)	(0.553)
HPI	0.013***	0.008	0.014***	0.025***	0.015***	0.014***	0.017***
	(0.008)	(0.651)	(0.005)	(0.000)	(0.004)	(0.007)	(0.004)
GGSD	0.001	0.000	0.001	0.001	0.001	0.001	0.001
	(0.630)	(0.860)	(0.825)	(0.852)	(0.629)	(0.681)	(0.686)
UR	-0.088***	-0.038	-0.088***	-0.114***	-0.065***	-0.088***	-0.079***
	(0.000)	(0.598)	(0.001)	(0.005)	(0.002)	(0.001)	(0.002)
TFSL	-0.012**	-0.002	-0.011**	-0.006*	-0.010***	-0.012**	-0.011**
	(0.039)	(0.614)	(0.017)	(0.052)	(0.005)	(0.033)	(0.033)
AR	-0.079***	-0.004	-0.068**	-0.013	-0.062**	-0.080***	-0.085***
	(0.003)	(0.740)	(0.022)	(0.669)	(0.013)	(0.001)	(0.000)
LTUR	0.004	-0.018	-0.010	-0.052	-0.051	0.004	-0.005
	(0.920)	(0.703)	(0.841)	(0.405)	(0.272)	(0.921)	(0.874)
YUR	0.009	0.012	0.014	0.036**	0.023**	0.009	0.009
	(0.468)	(0.649)	(0.278)	(0.019)	(0.048)	(0.474)	(0.452)
L.DV					0.255***		
					(0.000)		
R-sqr	0.363	0.700				0.315	0.387
No. of observations	116	96	116	116	116	116	116
Dynamic completeness test	5.171						
Dynamic completeness test, P-val	0.023						
Hausman test			2.205				
Hausman test, P-val			1.000				
Correlated random effects test				1131.755			
Correlated random effects test, P-val				0.000			
State dependence tests					3.259		
State dependence tests, P-val					0.001		
State dependence tests (Robust)					3.259		
State dependence tests, P-val (Robust)					0.001		
Cor.Pred.Crisis - In sample	0.595	0.270	0.568	0.892	0.757	0.568	0.568
aNtS - In sample	0.192	0.234	0.223	0.043	0.100	0.201	0.178
CPR - In sample	0.793	0.724	0.776	0.940	0.871	0.784	0.793
Absolute Utility - In sample	0.240	0.103	0.220	0.427	0.340	0.227	0.233
AUROC - In sample	0.876	0.840	0.872	0.976	0.924	0.876	0.879
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for non-euro area countries, using three year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. *Source*: Authors' calculations based on data from the EC and Eurostat.

Table F.30 **Out-of-sample econometric results for the non-EA, three year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	-0.017	-0.000	-0.017		-0.022		-0.005
	(0.151)	(0.993)	(0.304)		(0.184)		(0.496)
NIIP	-0.006***	-0.000	-0.006***		-0.004**		-0.007***
	(0.002)	(0.993)	(0.007)		(0.043)		(0.000)
EMS	-0.003	-0.000	-0.003		-0.005		-0.003
	(0.156)	(0.993)	(0.274)		(0.130)		(0.188)
NULC	0.014**	0.000	0.014**		0.012**		0.012***
	(0.011)	(0.993)	(0.013)		(0.017)		(0.010)
REER	-0.034***	-0.000	-0.034***		-0.032***		-0.028***
	(0.000)	(0.993)	(0.000)		(0.001)		(0.000)
PSD	-0.003**	-0.000	-0.003**		-0.004***		-0.003***
	(0.011)	(0.993)	(0.012)		(0.009)		(0.002)
PSCF	-0.002	-0.000	-0.002		-0.001		-0.000
	(0.651)	(0.993)	(0.761)		(0.827)		(0.899)
HPI	0.017***	0.000	0.017**		0.021***		0.008*
	(0.009)	(0.993)	(0.014)		(0.009)		(0.085)
GGSD	-0.002	0.000	-0.002		-0.002		-0.004
	(0.465)	(0.993)	(0.608)		(0.554)		(0.308)
UR	-0.110***	-0.000	-0.110***		-0.070**		-0.111***
	(0.000)	(0.994)	(0.000)		(0.013)		(0.000)
TFSL	-0.008**	-0.000	-0.008*		-0.010*		-0.004
	(0.033)	(0.993)	(0.097)		(0.053)		(0.119)
AR	-0.012	0.000	-0.012		-0.016		-0.011
	(0.651)	(0.993)	(0.714)		(0.608)		(0.617)
LTUR	0.133	0.002	0.133		0.118		0.107
	(0.133)	(0.993)	(0.148)		(0.219)		(0.121)
YUR	0.006	-0.000	0.006		0.014		0.007
	(0.702)	(0.993)	(0.734)		(0.466)		(0.678)
L.DV					0.230**		
					(0.035)		
R-sqr	0.512	1.000					0.733
No. of observations	67	51	67	242	67	242	67
Dynamic completeness test	4.613						
Dynamic completeness test, P-val	0.032						
Hausman test			73.254				
Hausman test, P-val			0.000				
Correlated random effects test							
Correlated random effects test, P-val							
State dependence tests					3.259		
State dependence tests, P-val					0.001		
State dependence tests (Robust)					3.259		
State dependence tests, P-val (Robust)					0.001		
Cor.Pred.Crisis - In sample	0.818	0.045	0.818		0.727		0.818
aNtS - In sample	0.190	1.467	0.190		0.092		0.081
CPR - In sample	0.836	0.642	0.836		0.866		0.896
Absolute Utility - In sample	0.331	-0.011	0.331		0.330		0.376
AUROC - In sample	0.940	0.437	0.940		0.939		0.958
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.667	0.200	0.667		0.667		0.533
aNtS - Out sample	0.882	1.324	0.882		0.882		0.662
CPR - Out sample	0.490	0.571	0.490		0.490		0.612
Absolute Utility - Out sample	0.039	-0.032	0.039		0.039		0.090
AUROC - Out sample	0.600	0.427	0.600		0.680		0.646
Cor.Pred.Crisis - Out sample (first year only)	0.750	0.250	0.750		0.750		0.625
aNtS - Out sample (first year only)	0.800	0.800	0.800		1.067		0.960
CPR - Out sample (first year only)	0.615	0.462	0.615		0.538		0.538
Absolute Utility - Out sample (first year only)	0.075	0.025	0.075		-0.025		0.013
AUROC - Out sample (first year only)	0.525	0.612	0.525		0.575		0.475

Note: The table presents estimated models for crisis variable for non-euro area countries, using three year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.31 **In-sample econometric results for the non-EA, one year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.180	0.180***		0.236*	0.236**	0.236***	0.180	0.206*	0.186		
	(0.184)	(0.001)		(0.061)	(0.016)	(0.000)	(0.164)	(0.082)	(0.110)		
NIIP	-0.004	-0.004		0.206*	0.206	0.206***	-0.004	-0.012	-0.025		
	(0.973)	(0.970)		(0.074)	(0.240)	(0.007)	(0.973)	(0.924)	(0.839)		
EMS	0.174	0.174		0.389**	0.389***	0.389***	0.174	0.172	0.184		
	(0.193)	(0.177)		(0.030)	(0.001)	(0.000)	(0.173)	(0.201)	(0.161)		
NULC	-0.083	-0.083*		0.021	0.021	0.021	-0.083	-0.131	-0.088		
	(0.504)	(0.083)		(0.798)	(0.858)	(0.795)	(0.494)	(0.272)	(0.440)		
REER	0.193*	0.193*		0.263**	0.263**	0.263***	0.193*	0.167**	0.172**		
	(0.076)	(0.098)		(0.012)	(0.023)	(0.007)	(0.057)	(0.014)	(0.018)		
PSD	-0.001	-0.001		0.235	0.235	0.235*	-0.001	-0.007	-0.022		
	(0.996)	(0.994)		(0.297)	(0.309)	(0.099)	(0.996)	(0.950)	(0.856)		
PSCF	-0.161	-0.161***		-0.035	-0.035	-0.035	-0.161	0.122	0.487*		
	(0.167)	(0.000)		(0.774)	(0.777)	(0.489)	(0.147)	(0.636)	(0.087)		
HPI	-0.244**	-0.244**		-0.209**	-0.209**	-0.209***	-0.244***	0.090	-0.353***		
	(0.020)	(0.019)		(0.048)	(0.045)	(0.010)	(0.009)	(0.559)	(0.008)		
GGSD	0.067	0.067		0.333*	0.333**	0.333**	0.067	0.061	0.089		
	(0.582)	(0.649)		(0.072)	(0.041)	(0.044)	(0.573)	(0.553)	(0.396)		
UR	-0.047	-0.047		0.086	0.086	0.086	-0.047	-0.016	-0.017		
	(0.584)	(0.600)		(0.450)	(0.507)	(0.342)	(0.576)	(0.848)	(0.844)		
TFSL	-0.025	-0.025		0.114	0.114	0.114	-0.025	0.321**	0.689***		
	(0.766)	(0.769)		(0.323)	(0.366)	(0.193)	(0.762)	(0.010)	(0.000)		
AR	0.135	0.135*		0.020	0.020	0.020	0.135*	0.104**	0.114**		
	(0.112)	(0.057)		(0.740)	(0.850)	(0.786)	(0.092)	(0.043)	(0.028)		
LTUR	0.298***	0.298***		0.255**	0.255**	0.255**	0.298***	0.212***	0.215***		
	(0.008)	(0.008)		(0.030)	(0.037)	(0.022)	(0.002)	(0.001)	(0.001)		
YUR	-0.142	-0.142**		-0.026	-0.026	-0.026	-0.142	-0.118	-0.126		
	(0.368)	(0.031)		(0.847)	(0.816)	(0.617)	(0.353)	(0.308)	(0.284)		
constant	0.219*	0.219		-0.243	-0.497*	-0.243	0.219*				
	(0.094)	(0.107)		(0.149)	(0.059)	(0.106)	(0.074)				
R-sqr	0.294	0.294	0.000	0.365	0.491					0.000	0.000
Within.R-sqr				0.365		0.365	0.293				
Over.R-sqr				0.160			0.294				
Betw.R-sqr				0.004			0.134				
Pseud.R-sqr								0.339	0.335		
No. of observations	137	137	242	137	137	137	137	137	137	242	242
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	9.751	9.751		4.680	4.680	6.968	9.751				
D'Agostino normality test, P-val	0.008	0.008		0.096	0.096	0.031	0.008				
Breusch-Pagan test	3.099										
Breusch-Pagan test, P-val	0.008										
Quasi-time-demeaned-data test of ser. corr.	1.353										
Quasi-time-demeaned-data test of ser. corr., P-val	0.176										
Relevance/redundancy of FE test					2.948						
Relevance/redundancy of FE test, P-val					0.001						
Hausman test							.				
Hausman test, P-val							.				
Cor.Pred.Crisis - In sample	0.548	0.548		0.643	0.643	0.571	0.548	0.571	0.571		
aNtS - In sample	0.192	0.192		0.049	0.049	0.350	0.192	0.166	0.129		
CPR - In sample	0.788	0.788		0.869	0.869	0.730	0.788	0.803	0.818		
Absolute Utility - In sample	0.221	0.221		0.306	0.306	0.186	0.221	0.238	0.249		
AUROC - In sample	0.835	0.835		0.913	0.913	0.739	0.835	0.848	0.848		
First year out of sample	2017										
Cor.Pred.Crisis - Out sample	.	.		.	.	.	.	.	.		
aNtS - Out sample	.	.		.	.	.	.	.	.		
CPR - Out sample	.	.		.	.	.	.	.	.		
Absolute Utility - Out sample	.	.		.	.	.	.	.	.		
AUROC - Out sample	.	.		.	.	.	.	.	.		
Cor.Pred.Crisis - Out sample (first year only)	.	.		.	.	.	.	.	.		
aNtS - Out sample (first year only)	.	.		.	.	.	.	.	.		
CPR - Out sample (first year only)	.	.		.	.	.	.	.	.		
Absolute Utility - Out sample (first year only)	.	.		.	.	.	.	.	.		
AUROC - Out sample (first year only)	.	.		.	.	.	.	.	.		

Note: The table presents estimated models for crisis variable for non-euro area countries, using one year lag of all explanatory variables. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.32 **Out-of-sample econometric results for the non-EA, one year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.096	0.096		0.307**	0.307*	0.307***	0.096	0.176	0.168		
	(0.418)	(0.115)		(0.012)	(0.058)	(0.000)	(0.405)	(0.115)	(0.121)		
NIIP	0.030	0.030		0.096	0.096	0.096*	0.030	-0.060	-0.073		
	(0.687)	(0.846)		(0.378)	(0.632)	(0.075)	(0.681)	(0.627)	(0.451)		
EMS	0.028	0.028		0.319*	0.319*	0.319***	0.028	0.086	0.072		
	(0.800)	(0.414)		(0.075)	(0.078)	(0.000)	(0.797)	(0.448)	(0.527)		
NULC	-0.024	-0.024		-0.071	-0.071	-0.071	-0.024	-0.121	-0.105		
	(0.809)	(0.555)		(0.441)	(0.601)	(0.215)	(0.806)	(0.276)	(0.342)		
REER	0.214	0.214**		0.282***	0.282**	0.282***	0.214*	0.210*	0.202*		
	(0.113)	(0.013)		(0.007)	(0.027)	(0.004)	(0.092)	(0.068)	(0.053)		
PSD	0.109	0.109*		0.192	0.192	0.192	0.109	0.089	0.084		
	(0.341)	(0.061)		(0.514)	(0.416)	(0.141)	(0.325)	(0.473)	(0.476)		
PSCF	-0.216*	-0.216***		-0.138	-0.138	-0.138***	-0.216**	0.023	0.106		
	(0.055)	(0.000)		(0.228)	(0.307)	(0.000)	(0.038)	(0.919)	(0.624)		
HPI	-0.269**	-0.269**		-0.187	-0.187	-0.187***	-0.269***	0.016	-0.428*		
	(0.021)	(0.011)		(0.196)	(0.144)	(0.002)	(0.010)	(0.956)	(0.083)		
GGSD	0.299**	0.299***		0.541***	0.541**	0.541***	0.299**	0.338***	0.340***		
	(0.046)	(0.003)		(0.002)	(0.018)	(0.000)	(0.029)	(0.001)	(0.002)		
UR	0.094	0.094		0.142	0.142	0.142	0.094	0.264*	0.249**		
	(0.379)	(0.284)		(0.332)	(0.395)	(0.117)	(0.365)	(0.056)	(0.039)		
TFSL	-0.090	-0.090		-0.079	-0.079	-0.079***	-0.090	0.199	0.335***		
	(0.246)	(0.269)		(0.432)	(0.562)	(0.003)	(0.228)	(0.106)	(0.004)		
AR	0.070	0.070		-0.005	-0.005	-0.005	0.070	0.073*	0.067		
	(0.392)	(0.223)		(0.949)	(0.965)	(0.942)	(0.378)	(0.095)	(0.212)		
LTUR	0.184	0.184*		0.105	0.105	0.105	0.184	0.137	0.129		
	(0.234)	(0.055)		(0.394)	(0.495)	(0.243)	(0.215)	(0.295)	(0.302)		
YUR	-0.248	-0.248***		-0.135	-0.135	-0.135**	-0.248	-0.248	-0.265*		
	(0.179)	(0.008)		(0.359)	(0.361)	(0.044)	(0.159)	(0.149)	(0.084)		
constant	0.314**	0.314*		-0.025	-0.228	-0.025	0.314***				
	(0.017)	(0.061)		(0.897)	(0.471)	(0.857)	(0.007)				
R-sqr	0.330	0.330	0.000	0.408	0.578					0.000	0.000
Within.R-sqr				0.408		0.408	0.340				
Over.R-sqr				0.193			0.330				
Betw.R-sqr				0.003			0.183				
Pseud.R-sqr								0.435	0.412		
No. of observations	92	92	242	92	92	92	92	92	92	242	242
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	6.743	6.743		2.225	2.225	4.337	6.743				
D'Agostino normality test, P-val	0.034	0.034		0.329	0.329	0.114	0.034				
Breusch-Pagan test	2.023										
Breusch-Pagan test, P-val	0.063										
Quasi-time-demeaned-data test of ser. corr.	1.537										
Quasi-time-demeaned-data test of ser. corr., P-val	0.124										
Relevance/redundancy of FE test					2.538						
Relevance/redundancy of FE test, P-val					0.006						
Hausman test							.				
Hausman test, P-val							.				
Cor.Pred.Crisis - In sample	0.444	0.444		0.704	0.704	0.519	0.444	0.630	0.519		
aNtS - In sample	0.173	0.173		0.044	0.044	0.326	0.173	0.122	0.148		
CPR - In sample	0.783	0.783		0.891	0.891	0.739	0.783	0.837	0.804		
Absolute Utility - In sample	0.184	0.184		0.336	0.336	0.175	0.184	0.276	0.221		
AUROC - In sample	0.870	0.870		0.958	0.958	0.748	0.870	0.868	0.867		
First year out of sample	2013										
Cor.Pred.Crisis - Out sample	0.600	0.600		0.733	0.733	0.600	0.600	0.667	0.667		
aNtS - Out sample	0.500	0.500		0.455	0.455	0.389	0.500	0.500	0.600		
CPR - Out sample	0.667	0.667		0.689	0.689	0.711	0.667	0.667	0.622		
Absolute Utility - Out sample	0.150	0.150		0.200	0.200	0.183	0.150	0.167	0.133		
AUROC - Out sample	0.651	0.651		0.764	0.764	0.716	0.651	0.658	0.633		
Cor.Pred.Crisis - Out sample (first year only)	0.500	0.500		0.625	0.625	0.500	0.500	0.625	0.625		
aNtS - Out sample (first year only)	1.000	1.000		0.400	0.400	0.000	1.000	0.800	0.800		
CPR - Out sample (first year only)	0.500	0.500		0.667	0.667	0.667	0.500	0.583	0.583		
Absolute Utility - Out sample (first year only)	0.000	0.000		0.188	0.188	0.250	0.000	0.063	0.063		
AUROC - Out sample (first year only)	0.547	0.547		0.844	0.844	0.734	0.547	0.547	0.484		

Note: The table presents estimated models for crisis variable for non-euro area countries, using one year lag of all explanatory variables, which are represented as indicator variables for the cases when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.33 **In-sample econometric results for the non-EA, two year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.103	0.103		0.151	0.151	0.151***	0.103	0.076	0.077	0.081	
	(0.479)	(0.168)		(0.316)	(0.204)	(0.004)	(0.467)	(0.541)	(0.511)	(0.490)	
NIIP	-0.010	-0.010		0.213	0.213	0.213*	-0.010	-0.055	-0.033	-0.042	
	(0.919)	(0.951)		(0.107)	(0.314)	(0.091)	(0.918)	(0.483)	(0.707)	(0.614)	
EMS	0.099	0.099*		0.163	0.163	0.163*	0.099	0.097	0.104	0.096	
	(0.561)	(0.083)		(0.441)	(0.282)	(0.081)	(0.552)	(0.502)	(0.488)	(0.517)	
NULC	-0.042	-0.042		-0.000	-0.000	-0.000	-0.042	-0.010	-0.007	-0.016	
	(0.771)	(0.444)		(0.999)	(0.999)	(0.999)	(0.766)	(0.944)	(0.961)	(0.904)	
REER	0.148	0.148		0.235*	0.235*	0.235***	0.148	0.145	0.139	0.140	
	(0.319)	(0.109)		(0.067)	(0.073)	(0.000)	(0.303)	(0.210)	(0.210)	(0.213)	
PSD	-0.128	-0.128		-0.324***	-0.324	-0.324***	-0.128	-0.158	-0.152	-0.139	
	(0.339)	(0.226)		(0.001)	(0.218)	(0.000)	(0.323)	(0.258)	(0.311)	(0.280)	
PSCF	-0.037	-0.037		0.011	0.011	0.011	-0.037	-0.061	-0.005	-0.034	
	(0.836)	(0.663)		(0.951)	(0.937)	(0.896)	(0.833)	(0.748)	(0.979)	(0.838)	
HPI	-0.090	-0.090		-0.058	-0.058	-0.058	-0.090	-0.090	-0.044	-0.075	
	(0.292)	(0.428)		(0.507)	(0.648)	(0.509)	(0.274)	(0.153)	(0.418)	(0.253)	
GGSD	0.062	0.062		0.149	0.149	0.149	0.062	0.071	0.088	0.076	
	(0.623)	(0.491)		(0.419)	(0.443)	(0.247)	(0.616)	(0.468)	(0.328)	(0.440)	
UR	-0.251***	-0.251***		-0.228	-0.228	-0.228**	-0.251***	-0.262***	-0.258***	-0.272***	
	(0.006)	(0.000)		(0.117)	(0.137)	(0.031)	(0.001)	(0.002)	(0.002)	(0.000)	
TFSL	0.010	0.010		0.110	0.110	0.110	0.010	0.506***	0.819***	0.541***	
	(0.918)	(0.944)		(0.352)	(0.447)	(0.337)	(0.916)	(0.005)	(0.000)	(0.001)	
AR	0.149	0.149		0.060	0.060	0.060	0.149	0.121	0.133	0.122	
	(0.372)	(0.298)		(0.695)	(0.623)	(0.553)	(0.357)	(0.343)	(0.277)	(0.311)	
LTUR	0.178	0.178*		0.159	0.159	0.159*	0.178	0.149	0.153	0.149	
	(0.308)	(0.057)		(0.334)	(0.260)	(0.089)	(0.291)	(0.246)	(0.237)	(0.264)	
YUR	0.037	0.037		0.150	0.150	0.150*	0.037	0.042	0.030	0.059	
	(0.847)	(0.701)		(0.422)	(0.243)	(0.091)	(0.845)	(0.792)	(0.851)	(0.712)	
constant	0.250*	0.250		0.042	-0.337	0.042	0.250*				
	(0.072)	(0.148)		(0.805)	(0.282)	(0.816)	(0.053)				
R-sqr	0.176	0.176	0.000	0.231	0.368						0.000
Within.R-sqr				0.231		0.231	0.192				
Over.R-sqr				0.086			0.176				
Betw.R-sqr				0.009			0.011				
Pseud.R-sqr								0.212	0.242		
No. of observations	127	127	242	127	127	127	127	127	127	127	242
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	15.348	15.348		5.507	5.507	5.895	15.348				
D'Agostino normality test, P-val	0.000	0.000		0.064	0.064	0.052	0.000				
Breusch-Pagan test	2.770										
Breusch-Pagan test, P-val	0.015										
Quasi-time-demeaned-data test of ser. corr.	1.243										
Quasi-time-demeaned-data test of ser. corr., P-val	0.214										
Relevance/redundancy of FE test					2.051						
Relevance/redundancy of FE test, P-val					0.021						
Hausman test							.				
Hausman test, P-val							.				
Cor.Pred.Crisis - In sample	0.359	0.359		0.564	0.564	0.436	0.359	0.385	0.359	0.282	
aNtS - In sample	0.317	0.317		0.121	0.121	0.365	0.317	0.266	0.348	0.483	
CPR - In sample	0.724	0.724		0.819	0.819	0.717	0.724	0.740	0.717	0.685	
Absolute Utility - In sample	0.123	0.123		0.248	0.248	0.138	0.123	0.141	0.117	0.073	
AUROC - In sample	0.767	0.767		0.879	0.879	0.690	0.767	0.768	0.770	0.769	
First year out of sample	2017										
Cor.Pred.Crisis - Out sample	.	.		.	.	.	.	.	.	.	
aNtS - Out sample	.	.		.	.	.	.	.	.	.	
CPR - Out sample	.	.		.	.	.	.	.	.	.	
Absolute Utility - Out sample	.	.		.	.	.	.	.	.	.	
AUROC - Out sample	.	.		.	.	.	.	.	.	.	
Cor.Pred.Crisis - Out sample (first year only)	.	.		.	.	.	.	.	.	.	
aNtS - Out sample (first year only)	.	.		.	.	.	.	.	.	.	
CPR - Out sample (first year only)	.	.		.	.	.	.	.	.	.	
Absolute Utility - Out sample (first year only)	.	.		.	.	.	.	.	.	.	
AUROC - Out sample (first year only)	.	.		.	.	.	.	.	.	.	

Note: The table presents estimated models for crisis variable for non-euro area countries, using two year lag of all explanatory variables. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.34 **Out-of-sample econometric results for the non-EA, two year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	-0.010	-0.010		0.124	0.124	0.124	0.040	-0.046	-0.105		
	(0.929)	(0.840)		(0.319)	(0.602)	(0.132)	(0.697)	(0.686)	(0.333)		
NIIP	0.065	0.065		-0.131	-0.131	-0.131	0.046	0.115	0.002		
	(0.535)	(0.699)		(0.128)	(0.617)	(0.200)	(0.641)	(0.226)	(0.981)		
EMS	0.131	0.131		0.222	0.222	0.222	0.108	0.086	0.126		
	(0.518)	(0.327)		(0.549)	(0.375)	(0.203)	(0.612)	(0.597)	(0.477)		
NULC	0.027	0.027		-0.116	-0.116	-0.116***	-0.006	0.041	0.130		
	(0.834)	(0.700)		(0.366)	(0.516)	(0.000)	(0.959)	(0.675)	(0.345)		
REER	0.205	0.205***		0.316**	0.316*	0.316***	0.255*	0.163	0.161		
	(0.190)	(0.000)		(0.017)	(0.072)	(0.000)	(0.056)	(0.181)	(0.183)		
PSD	-0.187	-0.187		-0.280**	-0.280	-0.280**	-0.227*	-0.108	-0.202		
	(0.195)	(0.109)		(0.011)	(0.357)	(0.015)	(0.078)	(0.371)	(0.190)		
PSCF	-0.040	-0.040		-0.040	-0.040	-0.040	-0.046	-0.048	-0.102		
	(0.830)	(0.701)		(0.831)	(0.810)	(0.636)	(0.803)	(0.777)	(0.624)		
HPI	-0.096	-0.096		0.051	0.051	0.051	-0.029	-0.073	-0.090		
	(0.355)	(0.412)		(0.647)	(0.745)	(0.663)	(0.762)	(0.376)	(0.253)		
GGSD	0.082	0.082		0.201	0.201	0.201***	0.094	0.101	0.046		
	(0.644)	(0.220)		(0.258)	(0.577)	(0.004)	(0.568)	(0.507)	(0.748)		
UR	-0.281**	-0.281***		-0.383**	-0.383*	-0.383***	-0.302**	-0.329**	-0.351**		
	(0.039)	(0.003)		(0.023)	(0.084)	(0.000)	(0.014)	(0.017)	(0.013)		
TFSL	0.003	0.003		-0.038	-0.038	-0.038	-0.018	-0.031	0.577***		
	(0.978)	(0.982)		(0.766)	(0.821)	(0.478)	(0.867)	(0.777)	(0.000)		
AR	-0.070	-0.070		-0.129	-0.129	-0.129	-0.065	-0.005	-0.073		
	(0.702)	(0.279)		(0.374)	(0.470)	(0.210)	(0.695)	(0.971)	(0.570)		
LTUR	0.164	0.164		0.100	0.100	0.100	0.139	0.210	0.199		
	(0.418)	(0.173)		(0.595)	(0.636)	(0.241)	(0.462)	(0.188)	(0.271)		
YUR	-0.071	-0.071		-0.016	-0.016	-0.016	-0.034	-0.085	-0.114		
	(0.752)	(0.517)		(0.948)	(0.928)	(0.793)	(0.879)	(0.652)	(0.575)		
constant	0.355**	0.355*		0.389	0.125	0.389**	0.328**				
	(0.020)	(0.066)		(0.136)	(0.765)	(0.031)	(0.031)				
R-sqr	0.174	0.174	0.000	0.234	0.448					0.000	0.000
Within.R-sqr				0.234		0.234	0.207				
Over.R-sqr				0.098			0.165				
Betw.R-sqr				0.034			0.049				
Pseud.R-sqr								0.446	0.301		
No. of observations	80	80	242	80	80	80	80	80	80	242	242
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	9.725	9.725		2.823	2.823	13.101	7.442				
D'Agostino normality test, P-val	0.008	0.008		0.244	0.244	0.001	0.024				
Breusch-Pagan test	1.609										
Breusch-Pagan test, P-val	0.130										
Quasi-time-demeaned-data test of ser. corr.	1.022										
Quasi-time-demeaned-data test of ser. corr., P-val	0.307										
Relevance/redundancy of FE test					1.556						
Relevance/redundancy of FE test, P-val					0.126						
Hausman test							277.927				
Hausman test, P-val							0.000				
Cor.Pred.Crisis - In sample	0.292	0.292		0.750	0.750	0.333	0.292	0.375	0.292		
aNtS - In sample	0.367	0.367		0.190	0.190	0.268	0.429	0.286	0.367		
CPR - In sample	0.713	0.713		0.825	0.825	0.738	0.700	0.738	0.713		
Absolute Utility - In sample	0.092	0.092		0.304	0.304	0.122	0.083	0.134	0.092		
AUROC - In sample	0.770	0.770		0.900	0.900	0.653	0.759	0.821	0.778		
First year out of sample	2013										
Cor.Pred.Crisis - Out sample	0.267	0.267		0.333	0.333	0.000	0.133	0.267	0.200		
aNtS - Out sample	0.703	0.703		0.938	0.938	.	0.938	0.703	1.563		
CPR - Out sample	0.638	0.638		0.574	0.574	0.574	0.638	0.638	0.532		
Absolute Utility - Out sample	0.040	0.040		0.010	0.010	-0.078	0.004	0.040	-0.056		
AUROC - Out sample	0.570	0.570		0.616	0.616	0.586	0.576	0.451	0.386		
Cor.Pred.Crisis - Out sample (first year only)	0.250	0.250		0.375	0.375	0.000	0.125	0.250	0.250		
aNtS - Out sample (first year only)	1.000	1.000		0.000	0.000	.	2.000	1.000	2.000		
CPR - Out sample (first year only)	0.417	0.417		0.583	0.583	0.250	0.333	0.417	0.333		
Absolute Utility - Out sample (first year only)	0.000	0.000		0.188	0.188	-0.125	-0.063	0.000	-0.125		
AUROC - Out sample (first year only)	0.563	0.563		0.750	0.750	0.750	0.563	0.594	0.406		

Note: The table presents estimated models for crisis variable for non-euro area countries, using two year lag of all explanatory variables, which are represented as indicator variables for the cases when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.35 **In-sample econometric results for the non-EA, three year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.003	0.003		0.073	0.073	0.073	0.003	0.004	-0.001	0.002	-0.010
	(0.980)	(0.972)		(0.670)	(0.603)	(0.272)	(0.979)	(0.973)	(0.994)	(0.982)	(0.920)
NIIP	-0.009	-0.009		-0.124	-0.124	-0.124	-0.009	-0.014	-0.037	-0.019	-0.041
	(0.928)	(0.957)		(0.255)	(0.571)	(0.482)	(0.926)	(0.895)	(0.741)	(0.838)	(0.664)
EMS	0.198	0.198***		0.290	0.290*	0.290***	0.198	0.239	0.225	0.241	0.236
	(0.267)	(0.001)		(0.140)	(0.074)	(0.005)	(0.249)	(0.185)	(0.179)	(0.127)	(0.108)
NULC	0.071	0.071		-0.052	-0.052	-0.052	0.071	0.055	0.074	0.066	0.090
	(0.565)	(0.501)		(0.677)	(0.706)	(0.681)	(0.556)	(0.647)	(0.508)	(0.558)	(0.388)
REER	-0.083	-0.083		-0.044	-0.044	-0.044	-0.083	-0.060	-0.049	-0.052	-0.053
	(0.682)	(0.295)		(0.846)	(0.743)	(0.688)	(0.677)	(0.768)	(0.820)	(0.744)	(0.750)
PSD	-0.267**	-0.267**		-0.422*	-0.422	-0.422**	-0.267***	-0.309**	-0.323**	-0.313**	-0.320***
	(0.021)	(0.017)		(0.094)	(0.116)	(0.010)	(0.010)	(0.044)	(0.034)	(0.011)	(0.008)
PSCF	0.118	0.118		0.155	0.155	0.155	0.118	0.101	0.088	0.094	0.089
	(0.520)	(0.387)		(0.359)	(0.302)	(0.180)	(0.510)	(0.544)	(0.586)	(0.549)	(0.554)
HPI	0.073	0.073		0.098	0.098	0.098	0.073	0.081	0.098	0.086	0.103
	(0.589)	(0.436)		(0.527)	(0.483)	(0.186)	(0.581)	(0.572)	(0.486)	(0.480)	(0.383)
GGSD	0.011	0.011		-0.037	-0.037	-0.037	0.011	0.064	0.075	0.067	0.070
	(0.939)	(0.904)		(0.852)	(0.862)	(0.837)	(0.938)	(0.694)	(0.609)	(0.647)	(0.607)
UR	-0.396***	-0.396***		-0.572**	-0.572***	-0.572***	-0.396***	-0.525***	-0.514***	-0.509***	-0.499***
	(0.001)	(0.000)		(0.018)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
TFSL	-0.164*	-0.164		-0.169*	-0.169	-0.169	-0.164**	-0.138	-0.094	-0.142	-0.110
	(0.067)	(0.341)		(0.071)	(0.261)	(0.140)	(0.049)	(0.260)	(0.477)	(0.108)	(0.244)
AR	0.124	0.124		0.022	0.022	0.022	0.124	0.095	0.093	0.095	0.098
	(0.481)	(0.287)		(0.892)	(0.862)	(0.841)	(0.470)	(0.501)	(0.514)	(0.483)	(0.453)
LTUR	-0.016	-0.016		-0.108	-0.108	-0.108	-0.016	-0.019	-0.014	-0.038	-0.032
	(0.916)	(0.880)		(0.448)	(0.473)	(0.342)	(0.915)	(0.877)	(0.905)	(0.749)	(0.781)
YUR	0.114	0.114		0.289**	0.289**	0.289***	0.114	0.118	0.133	0.133	0.150
	(0.448)	(0.224)		(0.026)	(0.038)	(0.000)	(0.436)	(0.347)	(0.324)	(0.264)	(0.223)
constant	0.361***	0.361*		0.465**	0.291	0.465*	0.361***				
	(0.000)	(0.055)		(0.012)	(0.381)	(0.093)	(0.000)				
R-sqr	0.189	0.189	0.000	0.279	0.388						
Within.R-sqr				0.279		0.279	0.246				
Over.R-sqr				0.159			0.189				
Betw.R-sqr				0.017			0.007				
Pseud.R-sqr								0.194	0.237		
No. of observations	116	116	242	116	116	116	116	116	116	116	116
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	40.457	40.457		12.087	12.087	56.046	40.457				
D'Agostino normality test, P-val	0.000	0.000		0.002	0.002	0.000	0.000				
Breusch-Pagan test	3.393										
Breusch-Pagan test, P-val	0.004										
Quasi-time-demeaned-data test of ser. corr.	1.557										
Quasi-time-demeaned-data test of ser. corr., P-val	0.119										
Relevance/redundancy of FE test					1.785						
Relevance/redundancy of FE test, P-val					0.054						
Hausman test							.				
Hausman test, P-val							.				
Cor.Pred.Crisis - In sample	0.324	0.324		0.595	0.595	0.378	0.324	0.351	0.378	0.351	0.378
aNtS - In sample	0.390	0.390		0.128	0.128	0.569	0.390	0.396	0.435	0.432	0.401
CPR - In sample	0.698	0.698		0.819	0.819	0.655	0.698	0.698	0.690	0.690	0.698
Absolute Utility - In sample	0.099	0.099		0.259	0.259	0.082	0.099	0.106	0.107	0.100	0.113
AUROC - In sample	0.760	0.760		0.904	0.904	0.728	0.760	0.742	0.750	0.743	0.749
First year out of sample	2017										
Cor.Pred.Crisis - Out sample	.	.		.	.	.	.	.	.	.	.
aNtS - Out sample	.	.		.	.	.	.	.	.	.	.
CPR - Out sample	.	.		.	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.		.	.	.	.	.	.	.	.
AUROC - Out sample	.	.		.	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.		.	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.		.	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.		.	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.		.	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.		.	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for non-euro area countries, using three year lag of all explanatory variables. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.36 **Out-of-sample econometric results for the non-EA, three year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	-0.085	-0.085		-0.005	-0.005	-0.005	-0.085	-0.414	-1.243		
	(0.674)	(0.492)		(0.981)	(0.986)	(0.935)	(0.668)	.	.		
NIIP	0.099	0.099		-0.220	-0.220	-0.220	0.099	0.530	0.087		
	(0.517)	(0.470)		(0.250)	(0.425)	(0.159)	(0.507)	.	.		
EMS	0.117	0.117		-0.252**	-0.252	-0.252**	0.117	1.110	0.455		
	(0.629)	(0.103)		(0.018)	(0.417)	(0.028)	(0.621)	.	.		
NULC	0.060	0.060		-0.283	-0.283	-0.283**	0.060	0.551	1.131		
	(0.695)	(0.654)		(0.170)	(0.165)	(0.014)	(0.690)	.	.		
REER	-0.157	-0.157		-0.175	-0.175	-0.175	-0.157	-0.790	-0.644		
	(0.432)	(0.153)		(0.401)	(0.366)	(0.192)	(0.420)	.	.		
PSD	-0.366*	-0.366***		-0.554	-0.554	-0.554***	-0.366**	-0.294	-0.357		
	(0.064)	(0.000)		(0.112)	(0.127)	(0.000)	(0.046)	.	.		
PSCF	0.167	0.167		0.082	0.082	0.082	0.167	0.040	0.133		
	(0.430)	(0.206)		(0.618)	(0.621)	(0.583)	(0.417)	.	.		
HPI	-0.017	-0.017		0.071	0.071	0.071**	-0.017	0.135	-0.079		
	(0.888)	(0.852)		(0.563)	(0.655)	(0.040)	(0.886)	.	.		
GGSD	-0.046	-0.046		0.257	0.257	0.257	-0.046	-0.309	0.299		
	(0.793)	(0.835)		(0.433)	(0.526)	(0.241)	(0.789)	.	.		
UR	-0.531**	-0.531***		-0.883***	-0.883***	-0.883***	-0.531***	-3.611	-3.090		
	(0.021)	(0.000)		(0.000)	(0.001)	(0.000)	(0.010)	.	.		
TFSL	-0.122	-0.122		-0.331***	-0.331**	-0.331***	-0.122	0.191	0.186		
	(0.163)	(0.433)		(0.009)	(0.050)	(0.001)	(0.142)	.	.		
AR	-0.065	-0.065		0.117	0.117	0.117	-0.065	0.427	-0.158		
	(0.808)	(0.470)		(0.678)	(0.562)	(0.631)	(0.805)	.	.		
LTUR	-0.082	-0.082		-0.349	-0.349	-0.349**	-0.082	-0.316	-1.499		
	(0.633)	(0.687)		(0.252)	(0.216)	(0.016)	(0.626)	.	.		
YUR	0.156	0.156		0.200	0.200	0.200**	0.156	0.367	0.879		
	(0.525)	(0.368)		(0.444)	(0.377)	(0.015)	(0.515)	.	.		
constant	0.510***	0.510**		0.981***	0.988**	0.981***	0.510***				
	(0.000)	(0.012)		(0.003)	(0.037)	(0.000)	(0.000)				
R-sqr	0.230	0.230	0.000	0.416	0.589					0.000	0.000
Within.R-sqr				0.416		0.416	0.243				
Over.R-sqr				0.117			0.230				
Betw.R-sqr				0.005			0.104				
Pseud.R-sqr								0.457	0.549		
No. of observations	67	67	242	67	67	67	67	67	67	242	242
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	10.550	10.550		0.959	0.959	5.487	10.550				
D'Agostino normality test, P-val	0.005	0.005		0.619	0.619	0.064	0.005				
Breusch-Pagan test	2.802										
Breusch-Pagan test, P-val	0.016										
Quasi-time-demeaned-data test of ser. corr.	0.945										
Quasi-time-demeaned-data test of ser. corr., P-val	0.345										
Relevance/redundancy of FE test					1.278						
Relevance/redundancy of FE test, P-val					0.266						
Hausman test							.				
Hausman test, P-val							.				
Cor.Pred.Crisis - In sample	0.682	0.682		0.864	0.864	0.545	0.682	0.636	0.727		
aNtS - In sample	0.326	0.326		0.077	0.077	0.570	0.326	0.279	0.275		
CPR - In sample	0.746	0.746		0.910	0.910	0.642	0.746	0.761	0.776		
Absolute Utility - In sample	0.230	0.230		0.398	0.398	0.117	0.230	0.229	0.264		
AUROC - In sample	0.802	0.802		0.962	0.962	0.701	0.802	0.836	0.849		
First year out of sample	2013										
Cor.Pred.Crisis - Out sample	0.467	0.467		0.400	0.400	0.400	0.467	0.333	0.333		
aNtS - Out sample	0.693	0.693		0.662	0.662	0.588	0.693	0.971	0.618		
CPR - Out sample	0.612	0.612		0.633	0.633	0.653	0.612	0.571	0.653		
Absolute Utility - Out sample	0.072	0.072		0.068	0.068	0.082	0.072	0.005	0.064		
AUROC - Out sample	0.641	0.641		0.550	0.550	0.641	0.641	0.561	0.587		
Cor.Pred.Crisis - Out sample (first year only)	0.625	0.625		0.625	0.625	0.500	0.625	0.375	0.625		
aNtS - Out sample (first year only)	0.640	0.640		0.000	0.000	0.400	0.640	1.067	0.320		
CPR - Out sample (first year only)	0.615	0.615		0.769	0.769	0.615	0.615	0.462	0.692		
Absolute Utility - Out sample (first year only)	0.113	0.113		0.313	0.313	0.150	0.113	-0.013	0.212		
AUROC - Out sample (first year only)	0.675	0.675		0.775	0.775	0.725	0.675	0.525	0.725		

Note: The table presents estimated models for crisis variable for non-euro area countries, using three year lag of all explanatory variables, which are represented as indicator variables for the cases when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.37 **In-sample econometric results for the non-EA, one year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	-0.007	-0.007		-0.015	-0.015	-0.015	-0.008
	(0.345)	(0.233)		(0.370)	(0.321)	(0.281)	(0.259)
NIIP	0.002	0.002		0.006**	0.006***	0.006***	0.002
	(0.401)	(0.173)		(0.037)	(0.003)	(0.000)	(0.392)
EMS	0.002	0.002		-0.002	-0.002	-0.002	0.002
	(0.382)	(0.479)		(0.166)	(0.494)	(0.534)	(0.400)
NULC	0.005	0.005**		0.002	0.002	0.002	0.005
	(0.320)	(0.016)		(0.671)	(0.614)	(0.403)	(0.340)
REER	-0.005	-0.005		0.003	0.003	0.003	-0.005
	(0.485)	(0.231)		(0.711)	(0.581)	(0.536)	(0.477)
PSD	0.001	0.001		0.008**	0.008***	0.008***	0.001
	(0.494)	(0.159)		(0.014)	(0.002)	(0.000)	(0.484)
PSCF	-0.002	-0.002		0.001	0.001	0.001	-0.002
	(0.679)	(0.585)		(0.930)	(0.929)	(0.933)	(0.707)
HPI	-0.015**	-0.015***		-0.012**	-0.012***	-0.012***	-0.015***
	(0.010)	(0.001)		(0.036)	(0.008)	(0.006)	(0.004)
GGSD	0.004	0.004		0.007	0.007*	0.007**	0.003
	(0.317)	(0.209)		(0.105)	(0.083)	(0.048)	(0.308)
UR	-0.003	-0.003		-0.002	-0.002	-0.002	-0.001
	(0.880)	(0.878)		(0.948)	(0.953)	(0.904)	(0.942)
TFSL	-0.002	-0.002		0.006*	0.006	0.006	-0.002
	(0.649)	(0.547)		(0.057)	(0.150)	(0.125)	(0.648)
AR	-0.056**	-0.056***		-0.047***	-0.047*	-0.047**	-0.055***
	(0.011)	(0.003)		(0.008)	(0.057)	(0.010)	(0.004)
LTUR	0.006	0.006		-0.015	-0.015	-0.015	0.003
	(0.905)	(0.854)		(0.709)	(0.657)	(0.465)	(0.958)
YUR	0.005	0.005		0.012	0.012	0.012**	0.006
	(0.743)	(0.430)		(0.360)	(0.192)	(0.020)	(0.695)
constant	0.181	0.181		-0.783*	-0.705	-0.783***	0.169
	(0.451)	(0.400)		(0.062)	(0.121)	(0.000)	(0.480)
R-sqr	0.383	0.383	0.000	0.443	0.554		
Within.R-sqr				0.443		0.443	0.349
Over.R-sqr				0.094			0.383
Betw.R-sqr				0.007			0.389
No. of observations	137	137	242	137	137	137	137
Pesaran cross-sectional dependence test				.			.
Pesaran cross-sectional dependence test, P-val				.			.
D'Agostino normality test	10.201	10.201		2.612	2.612	3.686	9.372
D'Agostino normality test, P-val	0.006	0.006		0.271	0.271	0.158	0.009
Breusch-Pagan test	2.559						
Breusch-Pagan test, P-val	0.023						
Quasi-time-demeaned-data test of ser. corr.	0.106						
Quasi-time-demeaned-data test of ser. corr., P-val	0.916						
Relevance/redundancy of FE test					2.890		
Relevance/redundancy of FE test, P-val					0.001		
Hausman test							445.266
Hausman test, P-val							0.000
Cor.Pred.Crisis - In sample	0.619	0.619		0.762	0.762	0.476	0.595
aNtS - In sample	0.119	0.119		0.069	0.069	0.729	0.124
CPR - In sample	0.832	0.832		0.891	0.891	0.599	0.825
Absolute Utility - In sample	0.273	0.273		0.355	0.355	0.064	0.261
AUROC - In sample	0.888	0.888		0.951	0.951	0.701	0.885
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.		.	.	.	.
aNtS - Out sample	.	.		.	.	.	.
CPR - Out sample	.	.		.	.	.	.
Absolute Utility - Out sample	.	.		.	.	.	.
AUROC - Out sample	.	.		.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.		.	.	.	.
aNtS - Out sample (first year only)	.	.		.	.	.	.
CPR - Out sample (first year only)	.	.		.	.	.	.
Absolute Utility - Out sample (first year only)	.	.		.	.	.	.
AUROC - Out sample (first year only)	.	.		.	.	.	.

Note: The table presents estimated models for crisis variable for non-euro area countries, using one year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.38 **Out-of-sample econometric results for the non-EA, one year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	-0.006	-0.006		0.021	0.021	0.021	-0.002
	(0.648)	(0.320)		(0.405)	(0.373)	(0.154)	(0.879)
NIIP	0.000	0.000		0.004	0.004	0.004*	0.000
	(0.936)	(0.945)		(0.356)	(0.156)	(0.088)	(0.890)
EMS	0.005**	0.005*		0.003	0.003	0.003	0.005**
	(0.043)	(0.063)		(0.380)	(0.495)	(0.392)	(0.021)
NULC	0.005	0.005***		0.004	0.004	0.004**	0.004
	(0.146)	(0.000)		(0.300)	(0.523)	(0.037)	(0.161)
REER	-0.006	-0.006*		0.005	0.005	0.005	-0.002
	(0.418)	(0.071)		(0.584)	(0.500)	(0.348)	(0.786)
PSD	0.002	0.002***		0.009**	0.009***	0.009***	0.002
	(0.241)	(0.010)		(0.015)	(0.005)	(0.000)	(0.194)
PSCF	-0.003	-0.003		0.002	0.002	0.002	0.000
	(0.622)	(0.584)		(0.809)	(0.787)	(0.747)	(0.975)
HPI	-0.013**	-0.013***		-0.009*	-0.009*	-0.009**	-0.014***
	(0.013)	(0.006)		(0.052)	(0.067)	(0.045)	(0.005)
GGSD	0.006	0.006**		0.017**	0.017***	0.017***	0.008**
	(0.131)	(0.027)		(0.017)	(0.001)	(0.000)	(0.025)
UR	-0.005	-0.005		-0.009	-0.009	-0.009	0.011
	(0.810)	(0.769)		(0.682)	(0.826)	(0.800)	(0.661)
TFSL	-0.001	-0.001		0.001	0.001	0.001	-0.002
	(0.552)	(0.133)		(0.672)	(0.745)	(0.374)	(0.385)
AR	-0.030	-0.030*		0.004	0.004	0.004	-0.017
	(0.240)	(0.058)		(0.860)	(0.915)	(0.780)	(0.451)
LTUR	0.001	0.001		-0.078	-0.078	-0.078***	-0.032
	(0.992)	(0.986)		(0.120)	(0.110)	(0.000)	(0.569)
YUR	0.004	0.004		0.011	0.011	0.011	0.007
	(0.830)	(0.575)		(0.496)	(0.382)	(0.311)	(0.702)
constant	-0.182	-0.182		-1.387***	-1.096*	-1.387***	-0.469
	(0.595)	(0.348)		(0.001)	(0.059)	(0.000)	(0.181)
R-sqr	0.471	0.471	0.000	0.545	0.676		
Within.R-sqr				0.545		0.545	0.457
Over.R-sqr				0.063			0.449
Betw.R-sqr				0.012			0.431
No. of observations	92	92	242	92	92	92	92
Pesaran cross-sectional dependence test				.			.
Pesaran cross-sectional dependence test, P-val				.			.
D'Agostino normality test	5.096	5.096		6.116	6.116	3.023	10.290
D'Agostino normality test, P-val	0.078	0.078		0.047	0.047	0.221	0.006
Breusch-Pagan test	1.252						
Breusch-Pagan test, P-val	0.231						
Quasi-time-demeaned-data test of ser. corr.	-0.061						
Quasi-time-demeaned-data test of ser. corr., P-val	0.952						
Relevance/redundancy of FE test					2.619		
Relevance/redundancy of FE test, P-val					0.005		
Hausman test							88316.859
Hausman test, P-val							0.000
Cor.Pred.Crisis - In sample	0.667	0.667		0.852	0.852	0.519	0.630
aNtS - In sample	0.046	0.046		0.018	0.018	0.712	0.098
CPR - In sample	0.880	0.880		0.946	0.946	0.598	0.848
Absolute Utility - In sample	0.318	0.318		0.418	0.418	0.075	0.284
AUROC - In sample	0.929	0.929		0.972	0.972	0.671	0.914
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.067	0.067		0.733	0.733	0.533	0.267
aNtS - Out sample	1.000	1.000		0.636	0.636	0.625	0.750
CPR - Out sample	0.644	0.644		0.600	0.600	0.622	0.622
Absolute Utility - Out sample	0.000	0.000		0.133	0.133	0.100	0.033
AUROC - Out sample	0.698	0.698		0.633	0.633	0.640	0.624
Cor.Pred.Crisis - Out sample (first year only)	0.125	0.125		0.625	0.625	0.500	0.250
aNtS - Out sample (first year only)	0.000	0.000		0.000	0.000	0.000	0.000
CPR - Out sample (first year only)	0.417	0.417		0.750	0.750	0.667	0.500
Absolute Utility - Out sample (first year only)	0.063	0.063		0.313	0.313	0.250	0.125
AUROC - Out sample (first year only)	0.750	0.750		0.938	0.938	0.906	0.813

Note: The table presents estimated models for crisis variable for non-euro area countries, using one year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.39 **In-sample econometric results for the non-EA, two year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	-0.013	-0.013***		-0.030*	-0.030	-0.030***	-0.013*
	(0.117)	(0.003)		(0.079)	(0.113)	(0.002)	(0.096)
NIIP	0.001	0.001		0.007**	0.007***	0.007***	0.001
	(0.680)	(0.583)		(0.030)	(0.009)	(0.000)	(0.675)
EMS	0.002	0.002		0.001	0.001	0.001	0.002
	(0.508)	(0.377)		(0.720)	(0.750)	(0.769)	(0.498)
NULC	0.009	0.009***		0.002	0.002	0.002	0.009
	(0.176)	(0.000)		(0.779)	(0.720)	(0.580)	(0.155)
REER	-0.016***	-0.016***		-0.015**	-0.015**	-0.015***	-0.016***
	(0.009)	(0.000)		(0.016)	(0.026)	(0.003)	(0.003)
PSD	0.001	0.001		0.007**	0.007**	0.007***	0.001
	(0.625)	(0.283)		(0.027)	(0.027)	(0.000)	(0.617)
PSCF	-0.002	-0.002		-0.007	-0.007	-0.007*	-0.002
	(0.750)	(0.558)		(0.285)	(0.334)	(0.055)	(0.745)
HPI	-0.006	-0.006**		-0.002	-0.002	-0.002	-0.006
	(0.123)	(0.015)		(0.593)	(0.659)	(0.517)	(0.102)
GGSD	0.002	0.002		0.006	0.006	0.006*	0.002
	(0.607)	(0.422)		(0.351)	(0.242)	(0.082)	(0.599)
UR	-0.029	-0.029		-0.068	-0.068	-0.068**	-0.029
	(0.166)	(0.194)		(0.190)	(0.110)	(0.044)	(0.146)
TFSL	-0.003	-0.003		0.004	0.004	0.004*	-0.003
	(0.482)	(0.390)		(0.342)	(0.442)	(0.063)	(0.471)
AR	-0.074**	-0.074***		-0.051*	-0.051*	-0.051*	-0.074**
	(0.039)	(0.005)		(0.099)	(0.089)	(0.077)	(0.024)
LTUR	-0.002	-0.002		-0.000	-0.000	-0.000	-0.002
	(0.974)	(0.967)		(0.992)	(0.991)	(0.983)	(0.973)
YUR	0.006	0.006		0.009	0.009	0.009	0.006
	(0.662)	(0.515)		(0.513)	(0.387)	(0.183)	(0.656)
constant	0.420*	0.420**		0.054	0.180	0.054	0.420*
	(0.088)	(0.038)		(0.879)	(0.744)	(0.857)	(0.068)
R-sqr	0.304	0.304	0.000	0.353	0.468		
Within.R-sqr				0.353		0.353	0.263
Over.R-sqr				0.087			0.304
Betw.R-sqr				0.001			0.456
No. of observations	127	127	242	127	127	127	127
Pesaran cross-sectional dependence test				.			.
Pesaran cross-sectional dependence test, P-val				.			.
D'Agostino normality test	8.576	8.576		4.285	4.285	4.293	8.576
D'Agostino normality test, P-val	0.014	0.014		0.117	0.117	0.117	0.014
Breusch-Pagan test	3.362						
Breusch-Pagan test, P-val	0.005						
Quasi-time-demeaned-data test of ser. corr.	-0.444						
Quasi-time-demeaned-data test of ser. corr., P-val	0.657						
Relevance/redundancy of FE test					2.082		
Relevance/redundancy of FE test, P-val					0.019		
Hausman test							.
Hausman test, P-val							.
Cor.Pred.Crisis - In sample	0.487	0.487		0.718	0.718	0.462	0.487
aNtS - In sample	0.140	0.140		0.111	0.111	0.640	0.140
CPR - In sample	0.795	0.795		0.858	0.858	0.630	0.795
Absolute Utility - In sample	0.209	0.209		0.319	0.319	0.083	0.209
AUROC - In sample	0.842	0.842		0.917	0.917	0.709	0.842
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.		.	.	.	.
aNtS - Out sample	.	.		.	.	.	.
CPR - Out sample	.	.		.	.	.	.
Absolute Utility - Out sample	.	.		.	.	.	.
AUROC - Out sample	.	.		.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.		.	.	.	.
aNtS - Out sample (first year only)	.	.		.	.	.	.
CPR - Out sample (first year only)	.	.		.	.	.	.
Absolute Utility - Out sample (first year only)	.	.		.	.	.	.
AUROC - Out sample (first year only)	.	.		.	.	.	.

Note: The table presents estimated models for crisis variable for non-euro area countries, using two year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.40 **Out-of-sample econometric results for the non-EA, two year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	-0.011	-0.011		-0.004	-0.004	-0.004	-0.011
	(0.439)	(0.279)		(0.902)	(0.910)	(0.777)	(0.426)
NIIP	-0.003	-0.003**		0.003	0.003	0.003*	-0.003
	(0.153)	(0.011)		(0.464)	(0.489)	(0.081)	(0.132)
EMS	0.004	0.004		0.003	0.003	0.003	0.004
	(0.144)	(0.154)		(0.504)	(0.564)	(0.526)	(0.123)
NULC	0.007	0.007***		0.001	0.001	0.001	0.007
	(0.200)	(0.001)		(0.899)	(0.888)	(0.851)	(0.180)
REER	-0.015**	-0.015***		-0.006	-0.006	-0.006	-0.015**
	(0.024)	(0.000)		(0.213)	(0.528)	(0.370)	(0.012)
PSD	0.001	0.001*		0.009**	0.009**	0.009***	0.001
	(0.456)	(0.067)		(0.010)	(0.033)	(0.000)	(0.444)
PSCF	-0.008	-0.008***		-0.010	-0.010	-0.010**	-0.008
	(0.319)	(0.004)		(0.248)	(0.252)	(0.031)	(0.303)
HPI	-0.004	-0.004		-0.001	-0.001	-0.001	-0.004
	(0.289)	(0.249)		(0.899)	(0.935)	(0.879)	(0.272)
GGSD	0.004	0.004		0.017***	0.017**	0.017***	0.004
	(0.302)	(0.159)		(0.004)	(0.028)	(0.000)	(0.285)
UR	-0.050**	-0.050*		-0.045	-0.045	-0.045	-0.050**
	(0.041)	(0.069)		(0.483)	(0.486)	(0.548)	(0.025)
TFSL	0.001	0.001		0.002	0.002	0.002	0.001
	(0.873)	(0.813)		(0.552)	(0.658)	(0.315)	(0.871)
AR	-0.015	-0.015		0.047	0.047	0.047	-0.015
	(0.726)	(0.149)		(0.342)	(0.327)	(0.168)	(0.721)
LTUR	0.022	0.022		-0.068	-0.068	-0.068***	0.022
	(0.787)	(0.549)		(0.432)	(0.343)	(0.010)	(0.783)
YUR	-0.006	-0.006		-0.004	-0.004	-0.004	-0.006
	(0.828)	(0.611)		(0.877)	(0.828)	(0.807)	(0.825)
constant	0.219	0.219		-1.116*	-1.032	-1.116*	0.219
	(0.553)	(0.525)		(0.053)	(0.262)	(0.070)	(0.544)
R-sqr	0.366	0.366	0.000	0.414	0.578		
Within.R-sqr				0.414		0.414	0.269
Over.R-sqr				0.033			0.366
Betw.R-sqr				0.031			0.645
No. of observations	80	80	242	80	80	80	80
Pesaran cross-sectional dependence test				.			.
Pesaran cross-sectional dependence test, P-val				.			.
D'Agostino normality test	5.595	5.595		6.581	6.581	4.444	5.595
D'Agostino normality test, P-val	0.061	0.061		0.037	0.037	0.108	0.061
Breusch-Pagan test	2.134						
Breusch-Pagan test, P-val	0.051						
Quasi-time-demeaned-data test of ser. corr.	-0.823						
Quasi-time-demeaned-data test of ser. corr., P-val	0.411						
Relevance/redundancy of FE test					1.690		
Relevance/redundancy of FE test, P-val					0.088		
Hausman test							.
Hausman test, P-val							.
Cor.Pred.Crisis - In sample	0.583	0.583		0.792	0.792	0.458	0.583
aNtS - In sample	0.153	0.153		0.045	0.045	0.740	0.153
CPR - In sample	0.813	0.813		0.912	0.912	0.600	0.813
Absolute Utility - In sample	0.247	0.247		0.378	0.378	0.060	0.247
AUROC - In sample	0.863	0.863		0.942	0.942	0.630	0.863
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.267	0.267		0.467	0.467	0.533	0.267
aNtS - Out sample	0.352	0.352		1.138	1.138	0.586	0.352
CPR - Out sample	0.702	0.702		0.468	0.468	0.638	0.702
Absolute Utility - Out sample	0.086	0.086		-0.032	-0.032	0.110	0.086
AUROC - Out sample	0.606	0.606		0.538	0.538	0.596	0.606
Cor.Pred.Crisis - Out sample (first year only)	0.500	0.500		0.500	0.500	0.625	0.500
aNtS - Out sample (first year only)	0.000	0.000		0.000	0.000	0.000	0.000
CPR - Out sample (first year only)	0.667	0.667		0.667	0.667	0.750	0.667
Absolute Utility - Out sample (first year only)	0.250	0.250		0.250	0.250	0.313	0.250
AUROC - Out sample (first year only)	0.781	0.781		1.000	1.000	0.938	0.781

Note: The table presents estimated models for crisis variable for non-euro area countries, using two year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.41 **In-sample econometric results for the non-EA, three year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	-0.014	-0.014***		-0.027	-0.027	-0.027***	-0.014
	(0.233)	(0.008)		(0.164)	(0.196)	(0.000)	(0.214)
NIIP	-0.001	-0.001		0.005**	0.005*	0.005***	-0.001
	(0.739)	(0.674)		(0.050)	(0.061)	(0.002)	(0.734)
EMS	0.000	0.000		-0.000	-0.000	-0.000	0.000
	(0.952)	(0.927)		(0.913)	(0.908)	(0.903)	(0.952)
NULC	0.012*	0.012***		0.005	0.005	0.005	0.012**
	(0.054)	(0.000)		(0.389)	(0.363)	(0.211)	(0.037)
REER	-0.024***	-0.024***		-0.024***	-0.024***	-0.024***	-0.024***
	(0.000)	(0.000)		(0.002)	(0.001)	(0.000)	(0.000)
PSD	-0.000	-0.000		0.009**	0.009***	0.009***	-0.000
	(0.899)	(0.826)		(0.029)	(0.009)	(0.000)	(0.897)
PSCF	0.000	0.000		-0.008	-0.008	-0.008**	0.000
	(1.000)	(1.000)		(0.196)	(0.258)	(0.035)	(1.000)
HPI	0.012**	0.012***		0.019***	0.019***	0.019***	0.012***
	(0.018)	(0.000)		(0.000)	(0.000)	(0.000)	(0.008)
GGSD	-0.000	-0.000		-0.003	-0.003	-0.003	-0.000
	(0.911)	(0.840)		(0.619)	(0.532)	(0.451)	(0.909)
UR	-0.057***	-0.057***		-0.065	-0.065	-0.065***	-0.057***
	(0.006)	(0.007)		(0.297)	(0.130)	(0.005)	(0.001)
TFSL	-0.008*	-0.008*		-0.005	-0.005	-0.005	-0.008**
	(0.053)	(0.058)		(0.321)	(0.272)	(0.373)	(0.035)
AR	-0.079**	-0.079***		-0.047**	-0.047	-0.047***	-0.079**
	(0.023)	(0.000)		(0.049)	(0.149)	(0.004)	(0.011)
LTUR	-0.002	-0.002		-0.047	-0.047	-0.047*	-0.002
	(0.964)	(0.944)		(0.389)	(0.269)	(0.094)	(0.963)
YUR	0.011	0.011***		0.022	0.022**	0.022***	0.011
	(0.301)	(0.005)		(0.138)	(0.038)	(0.000)	(0.284)
constant	0.800***	0.800***		0.139	0.032	0.139	0.800***
	(0.002)	(0.000)		(0.786)	(0.955)	(0.705)	(0.000)
R-sqr	0.349	0.349	0.000	0.454	0.536		
Within.R-sqr				0.454		0.454	0.354
Over.R-sqr				0.100			0.349
Betw.R-sqr				0.000			0.364
No. of observations	116	116	242	116	116	116	116
Pesaran cross-sectional dependence test				.			.
Pesaran cross-sectional dependence test, P-val				.			.
D'Agostino normality test	10.760	10.760		3.701	3.701	2.942	10.760
D'Agostino normality test, P-val	0.005	0.005		0.157	0.157	0.230	0.005
Breusch-Pagan test	3.096						
Breusch-Pagan test, P-val	0.008						
Quasi-time-demeaned-data test of ser. corr.	0.395						
Quasi-time-demeaned-data test of ser. corr., P-val	0.693						
Relevance/redundancy of FE test					2.415		
Relevance/redundancy of FE test, P-val					0.007		
Hausman test							.
Hausman test, P-val							.
Cor.Pred.Crisis - In sample	0.486	0.486		0.730	0.730	0.514	0.486
aNtS - In sample	0.260	0.260		0.069	0.069	0.592	0.260
CPR - In sample	0.750	0.750		0.879	0.879	0.638	0.750
Absolute Utility - In sample	0.180	0.180		0.340	0.340	0.105	0.180
AUROC - In sample	0.866	0.866		0.948	0.948	0.701	0.866
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.		.	.	.	.
aNtS - Out sample	.	.		.	.	.	.
CPR - Out sample	.	.		.	.	.	.
Absolute Utility - Out sample	.	.		.	.	.	.
AUROC - Out sample	.	.		.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.		.	.	.	.
aNtS - Out sample (first year only)	.	.		.	.	.	.
CPR - Out sample (first year only)	.	.		.	.	.	.
Absolute Utility - Out sample (first year only)	.	.		.	.	.	.
AUROC - Out sample (first year only)	.	.		.	.	.	.

Note: The table presents estimated models for crisis variable for non-euro area countries, using three year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. *Source*: Authors' calculations based on data from the EC and Eurostat.

Table F.42 **Out-of-sample econometric results for the non-EA, three year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	-0.021*	-0.021***		-0.025	-0.025	-0.025	-0.021**
	(0.056)	(0.000)		(0.459)	(0.579)	(0.121)	(0.038)
NIIP	-0.005*	-0.005***		0.001	0.001	0.001	-0.005**
	(0.055)	(0.005)		(0.681)	(0.805)	(0.612)	(0.037)
EMS	-0.004	-0.004***		-0.007*	-0.007	-0.007***	-0.004
	(0.153)	(0.007)		(0.094)	(0.233)	(0.000)	(0.133)
NULC	0.014**	0.014***		0.015**	0.015	0.015***	0.014**
	(0.048)	(0.000)		(0.044)	(0.152)	(0.000)	(0.031)
REER	-0.027***	-0.027***		-0.018	-0.018	-0.018***	-0.027***
	(0.000)	(0.000)		(0.191)	(0.210)	(0.000)	(0.000)
PSD	-0.003*	-0.003**		0.003	0.003	0.003	-0.003*
	(0.087)	(0.012)		(0.501)	(0.606)	(0.305)	(0.067)
PSCF	0.000	0.000		-0.000	-0.000	-0.000	0.000
	(0.966)	(0.957)		(0.993)	(0.995)	(0.987)	(0.965)
HPI	0.016***	0.016***		0.020***	0.020**	0.020***	0.016***
	(0.001)	(0.000)		(0.000)	(0.031)	(0.000)	(0.000)
GGSD	0.000	0.000		0.022***	0.022	0.022***	0.000
	(0.895)	(0.915)		(0.002)	(0.103)	(0.000)	(0.893)
UR	-0.082***	-0.082***		-0.010	-0.010	-0.010	-0.082***
	(0.002)	(0.000)		(0.924)	(0.923)	(0.821)	(0.000)
TFSL	-0.004	-0.004		-0.003	-0.003	-0.003	-0.004
	(0.269)	(0.281)		(0.587)	(0.601)	(0.555)	(0.251)
AR	-0.037	-0.037**		0.044	0.044	0.044	-0.037
	(0.264)	(0.012)		(0.490)	(0.506)	(0.280)	(0.245)
LTUR	0.041	0.041		0.019	0.019	0.019	0.041
	(0.498)	(0.335)		(0.855)	(0.881)	(0.694)	(0.488)
YUR	0.017	0.017***		0.002	0.002	0.002	0.017
	(0.232)	(0.002)		(0.939)	(0.950)	(0.779)	(0.213)
constant	1.124***	1.124**		-0.838	-0.937	-0.838	1.124***
	(0.000)	(0.036)		(0.433)	(0.565)	(0.117)	(0.000)
R-sqr	0.450	0.450	0.000	0.455	0.616		
Within.R-sqr				0.455		0.455	0.325
Over.R-sqr				0.028			0.450
Betw.R-sqr				0.162			0.741
No. of observations	67	67	242	67	67	67	67
Pesaran cross-sectional dependence test				.			.
Pesaran cross-sectional dependence test, P-val				.			.
D'Agostino normality test	3.145	3.145		6.899	6.899	1.080	3.145
D'Agostino normality test, P-val	0.207	0.207		0.032	0.032	0.583	0.207
Breusch-Pagan test	1.489						
Breusch-Pagan test, P-val	0.162						
Quasi-time-demeaned-data test of ser. corr.	-1.500						
Quasi-time-demeaned-data test of ser. corr., P-val	0.134						
Relevance/redundancy of FE test					1.098		
Relevance/redundancy of FE test, P-val					0.391		
Hausman test							.
Hausman test, P-val							.
Cor.Pred.Crisis - In sample	0.682	0.682		0.818	0.818	0.545	0.682
aNtS - In sample	0.163	0.163		0.000	0.000	0.652	0.163
CPR - In sample	0.821	0.821		0.940	0.940	0.612	0.821
Absolute Utility - In sample	0.285	0.285		0.409	0.409	0.095	0.285
AUROC - In sample	0.911	0.911		0.963	0.963	0.629	0.911
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.533	0.533		0.667	0.667	0.733	0.533
aNtS - Out sample	0.717	0.717		0.926	0.926	0.561	0.717
CPR - Out sample	0.592	0.592		0.469	0.469	0.633	0.592
Absolute Utility - Out sample	0.075	0.075		0.025	0.025	0.161	0.075
AUROC - Out sample	0.641	0.641		0.508	0.508	0.606	0.641
Cor.Pred.Crisis - Out sample (first year only)	0.625	0.625		0.750	0.750	0.750	0.625
aNtS - Out sample (first year only)	0.640	0.640		0.533	0.533	0.000	0.640
CPR - Out sample (first year only)	0.615	0.615		0.692	0.692	0.846	0.615
Absolute Utility - Out sample (first year only)	0.113	0.113		0.175	0.175	0.375	0.113
AUROC - Out sample (first year only)	0.600	0.600		0.775	0.775	0.900	0.600

Note: The table presents estimated models for crisis variable for non-euro area countries, using three year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.43 **In-sample econometric results for the non-EA, one year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	0.016*	0.016*	-0.008	0.011	0.010	0.010
	(0.084)	(0.087)	(0.680)	(0.268)	(0.336)	(0.341)
NIIP	0.001*	0.001	0.050***	0.001	0.002**	0.001
	(0.090)	(0.207)	(0.000)	(0.365)	(0.041)	(0.111)
EMS	0.002	0.002	-0.010**	0.001	0.001	0.002
	(0.367)	(0.411)	(0.010)	(0.713)	(0.445)	(0.328)
NULC	0.005	0.005	0.020**	0.005	0.004	0.004
	(0.177)	(0.224)	(0.027)	(0.257)	(0.283)	(0.370)
REER	0.002	0.002	0.047***	0.005	0.002	0.001
	(0.719)	(0.727)	(0.002)	(0.339)	(0.682)	(0.766)
PSD	-0.000	-0.000	0.046***	-0.001	0.000	0.000
	(0.717)	(0.826)	(0.000)	(0.419)	(0.913)	(0.731)
PSCF	-0.004	-0.004	0.014*	0.004	-0.004	-0.002
	(0.455)	(0.557)	(0.062)	(0.500)	(0.460)	(0.659)
HPI	-0.029***	-0.029***	-0.061***	-0.023***	-0.031***	-0.030***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GGSD	0.005*	0.005**	0.016***	0.004*	0.005*	0.004
	(0.072)	(0.015)	(0.004)	(0.079)	(0.092)	(0.116)
UR	-0.024	-0.024	0.068*	-0.020	-0.019	-0.017
	(0.195)	(0.125)	(0.059)	(0.183)	(0.260)	(0.335)
TFSL	-0.000	-0.000	0.024***	-0.002	0.005*	0.001
	(0.898)	(0.924)	(0.001)	(0.607)	(0.072)	(0.624)
AR	-0.038**	-0.038*	-0.140***	-0.035*	-0.037***	-0.038**
	(0.027)	(0.082)	(0.007)	(0.090)	(0.009)	(0.025)
LTUR	0.050	0.050	0.233***	0.053	0.048	0.041
	(0.337)	(0.181)	(0.003)	(0.218)	(0.343)	(0.415)
YUR	-0.006	-0.006	-0.042***	-0.009	-0.006	-0.006
	(0.647)	(0.465)	(0.002)	(0.325)	(0.645)	(0.647)
L.DV				0.150**		
				(0.037)		
R-sqr	0.485					
No. of observations	137	137	137	125	137	137
Dynamic completeness test	5.076					
Dynamic completeness test, P-val	0.024					
Correlated random effects test			193.602			
Correlated random effects test, P-val			0.000			
State dependence tests				1.945		
State dependence tests, P-val				0.052		
State dependence tests (Robust)				2.428		
State dependence tests, P-val (Robust)				0.015		
Cor.Pred.Crisis - In sample	0.714	0.714	0.929	0.757	0.762	0.786
aNtS - In sample	0.133	0.133	0.034	0.120	0.138	0.134
CPR - In sample	0.847	0.847	0.956	0.864	0.854	0.861
Absolute Utility - In sample	0.310	0.310	0.448	0.333	0.328	0.340
AUROC - In sample	0.920	0.920	0.991	0.936	0.919	0.916
First year out of sample	2017					
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for non-euro area countries, using one year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.44 **Out-of-sample econometric results for the non-EA, one year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	0.007	0.007	.	0.017		
	(0.349)	(0.453)	.	(0.141)		
NIIP	0.000	0.000	.	-0.001		
	(0.629)	(0.744)	.	(0.480)		
EMS	0.005***	0.005**	.	0.005**		
	(0.000)	(0.018)	.	(0.041)		
NULC	0.006***	0.006	.	0.004		
	(0.006)	(0.189)	.	(0.467)		
REER	-0.003	-0.003	.	0.003		
	(0.439)	(0.502)	.	(0.629)		
PSD	0.001	0.001	.	0.001		
	(0.474)	(0.655)	.	(0.462)		
PSCF	-0.001	-0.001	.	0.003		
	(0.831)	(0.887)	.	(0.617)		
HPI	-0.020***	-0.020***	.	-0.017***		
	(0.000)	(0.000)	.	(0.004)		
GGSD	0.005**	0.005**	.	0.004		
	(0.022)	(0.020)	.	(0.139)		
UR	-0.031***	-0.031	.	-0.006		
	(0.003)	(0.226)	.	(0.815)		
TFSL	-0.001	-0.001	.	-0.002		
	(0.498)	(0.802)	.	(0.782)		
AR	-0.033**	-0.033	.	-0.027		
	(0.039)	(0.190)	.	(0.299)		
LTUR	0.070	0.070	.	-0.009		
	(0.152)	(0.157)	.	(0.895)		
YUR	-0.010	-0.010	.	0.005		
	(0.546)	(0.400)	.	(0.745)		
L.DV				0.051		
				(0.576)		
R-sqr	0.575					
No. of observations	92	92	92	84	242	242
Dynamic completeness test	0.511					
Dynamic completeness test, P-val	0.475					
Correlated random effects test			0.000			
Correlated random effects test, P-val			1.000			
State dependence tests				1.945		
State dependence tests, P-val				0.052		
State dependence tests (Robust)				2.428		
State dependence tests, P-val (Robust)				0.015		
Cor.Pred.Crisis - In sample	0.778	0.778	1.000	0.739		
aNtS - In sample	0.099	0.099	0.000	0.089		
CPR - In sample	0.880	0.880	1.000	0.881		
Absolute Utility - In sample	0.350	0.350	0.500	0.337		
AUROC - In sample	0.946	0.946	1.000	0.953		
First year out of sample	2013					
Cor.Pred.Crisis - Out sample	0.267	0.267	0.267	0.143		
aNtS - Out sample	0.125	0.125	0.875	0.519		
CPR - Out sample	0.733	0.733	0.600	0.659		
Absolute Utility - Out sample	0.117	0.117	0.017	0.034		
AUROC - Out sample	0.804	0.804	0.564	0.791		
Cor.Pred.Crisis - Out sample (first year only)	0.500	0.500	0.250	0.286		
aNtS - Out sample (first year only)	0.000	0.000	1.000	0.000		
CPR - Out sample (first year only)	0.667	0.667	0.417	0.545		
Absolute Utility - Out sample (first year only)	0.250	0.250	0.000	0.143		
AUROC - Out sample (first year only)	0.781	0.781	0.625	0.893		

Note: The table presents estimated models for crisis variable for non-euro area countries, using one year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.45 **In-sample econometric results for the non-EA, two year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	-0.005	-0.005	-0.047**	-0.006	-0.012	-0.020*
	(0.613)	(0.669)	(0.033)	(0.547)	(0.254)	(0.060)
NIIP	0.000	0.000	0.008***	-0.000	0.000	0.001
	(0.908)	(0.909)	(0.003)	(0.952)	(0.739)	(0.425)
EMS	0.002	0.002	0.003	0.002	0.005**	0.004*
	(0.291)	(0.267)	(0.214)	(0.371)	(0.031)	(0.059)
NULC	0.010**	0.010**	-0.006	0.006	0.012**	0.012**
	(0.039)	(0.022)	(0.341)	(0.148)	(0.031)	(0.029)
REER	-0.016***	-0.016***	-0.009*	-0.016***	-0.021***	-0.020***
	(0.001)	(0.002)	(0.100)	(0.004)	(0.000)	(0.000)
PSD	0.000	0.000	0.009***	0.000	0.001	0.001
	(0.949)	(0.953)	(0.005)	(0.948)	(0.417)	(0.380)
PSCF	-0.002	-0.002	-0.003	-0.000	-0.001	-0.001
	(0.716)	(0.729)	(0.620)	(0.998)	(0.922)	(0.846)
HPI	-0.006	-0.006	-0.002	0.001	-0.005	-0.006
	(0.108)	(0.230)	(0.658)	(0.851)	(0.121)	(0.150)
GGSD	0.003	0.003	0.006	0.001	0.003	0.004
	(0.352)	(0.261)	(0.198)	(0.575)	(0.319)	(0.297)
UR	-0.053**	-0.053***	-0.108***	-0.039**	-0.039**	-0.028
	(0.011)	(0.010)	(0.007)	(0.027)	(0.044)	(0.146)
TFSL	-0.002	-0.002	0.003	-0.003	-0.001	0.007
	(0.503)	(0.564)	(0.514)	(0.390)	(0.828)	(0.127)
AR	-0.068**	-0.068***	-0.014	-0.041*	-0.072***	-0.076***
	(0.011)	(0.004)	(0.614)	(0.054)	(0.007)	(0.001)
LTUR	0.029	0.029	0.062	-0.020	0.014	0.016
	(0.522)	(0.494)	(0.295)	(0.649)	(0.791)	(0.729)
YUR	0.001	0.001	0.003	0.009	0.004	0.002
	(0.942)	(0.928)	(0.803)	(0.358)	(0.748)	(0.848)
L.DV				0.286***		
				(0.000)		
R-sqr	0.301					
No. of observations	127	127	127	127	127	127
Dynamic completeness test	7.386					
Dynamic completeness test, P-val	0.007					
Correlated random effects test			1161.916			
Correlated random effects test, P-val			0.000			
State dependence tests				3.644		
State dependence tests, P-val				0.000		
State dependence tests (Robust)				3.467		
State dependence tests, P-val (Robust)				0.001		
Cor.Pred.Crisis - In sample	0.513	0.513	0.769	0.718	0.538	0.538
aNtS - In sample	0.199	0.199	0.089	0.127	0.211	0.232
CPR - In sample	0.780	0.780	0.882	0.850	0.780	0.772
Absolute Utility - In sample	0.205	0.205	0.351	0.314	0.212	0.207
AUROC - In sample	0.848	0.848	0.946	0.899	0.836	0.840
First year out of sample	2017					
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for non-euro area countries, using two year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.46 **Out-of-sample econometric results for the non-EA, two year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	-0.003	-0.003	-1.337	-0.006		
	(0.752)	(0.786)	(0.726)	(0.601)		
NIIP	-0.003***	-0.003	0.294	-0.002		
	(0.006)	(0.121)	(0.722)	(0.239)		
EMS	0.005***	0.005*	0.070	0.004		
	(0.003)	(0.076)	(0.722)	(0.189)		
NULC	0.007	0.007	-0.218	0.003		
	(0.157)	(0.186)	(0.648)	(0.563)		
REER	-0.019***	-0.019***	-0.074	-0.019**		
	(0.001)	(0.004)	(0.875)	(0.012)		
PSD	0.000	0.000	0.246	0.000		
	(0.830)	(0.832)	(0.684)	(0.878)		
PSCF	-0.005	-0.005	0.120	-0.006		
	(0.377)	(0.461)	(0.821)	(0.391)		
HPI	-0.006**	-0.006	-0.082	-0.001		
	(0.027)	(0.287)	(0.783)	(0.804)		
GGSD	0.002	0.002	0.762	0.003		
	(0.363)	(0.456)	(0.784)	(0.423)		
UR	-0.092***	-0.092***	0.275	-0.067**		
	(0.000)	(0.008)	(0.834)	(0.027)		
TFSL	-0.001	-0.001	0.046	-0.002		
	(0.777)	(0.842)	(0.736)	(0.641)		
AR	-0.007	-0.007	0.957	0.013		
	(0.798)	(0.819)	(0.673)	(0.658)		
LTUR	0.075	0.075	-1.095	0.014		
	(0.228)	(0.172)	(0.677)	(0.824)		
YUR	-0.011	-0.011	-0.197	-0.005		
	(0.518)	(0.424)	(0.878)	(0.674)		
L.DV				0.230**		
				(0.028)		
R-sqr	0.380					
No. of observations	80	80	80	80	242	242
Dynamic completeness test	2.922					
Dynamic completeness test, P-val	0.087					
Correlated random effects test			103384.813			
Correlated random effects test, P-val			0.000			
State dependence tests				3.644		
State dependence tests, P-val				0.000		
State dependence tests (Robust)				3.467		
State dependence tests, P-val (Robust)				0.001		
Cor.Pred.Crisis - In sample	0.625	0.625	0.875	0.667		
aNtS - In sample	0.114	0.114	0.061	0.054		
CPR - In sample	0.838	0.838	0.925	0.875		
Absolute Utility - In sample	0.277	0.277	0.411	0.315		
AUROC - In sample	0.869	0.869	0.989	0.897		
First year out of sample	2013					
Cor.Pred.Crisis - Out sample	0.267	0.267	0.800	0.467		
aNtS - Out sample	0.703	0.703	0.742	0.469		
CPR - Out sample	0.638	0.638	0.532	0.681		
Absolute Utility - Out sample	0.040	0.040	0.103	0.124		
AUROC - Out sample	0.644	0.644	0.580	0.758		
Cor.Pred.Crisis - Out sample (first year only)	0.375	0.375	0.750	0.625		
aNtS - Out sample (first year only)	1.333	1.333	0.000	0.000		
CPR - Out sample (first year only)	0.417	0.417	0.833	0.750		
Absolute Utility - Out sample (first year only)	-0.063	-0.063	0.375	0.313		
AUROC - Out sample (first year only)	0.625	0.625	0.875	0.969		

Note: The table presents estimated models for crisis variable for non-euro area countries, using two year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.47 **In-sample econometric results for the non-EA, three year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	-0.007	-0.011	-0.067**	-0.005	-0.009	-0.012
	(0.552)	(0.449)	(0.034)	(0.606)	(0.451)	(0.290)
NIIP	-0.002	-0.001	0.006*	-0.001	-0.002	-0.002
	(0.310)	(0.499)	(0.091)	(0.292)	(0.272)	(0.208)
EMS	0.001	0.001	0.004	0.000	0.001	0.001
	(0.785)	(0.708)	(0.104)	(0.947)	(0.710)	(0.570)
NULC	0.014***	0.013**	-0.004	0.009**	0.014**	0.013**
	(0.004)	(0.017)	(0.510)	(0.026)	(0.012)	(0.018)
REER	-0.026***	-0.028***	-0.022***	-0.021***	-0.027***	-0.028***
	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
PSD	-0.001	-0.000	0.011***	-0.001	-0.000	-0.000
	(0.581)	(0.808)	(0.002)	(0.319)	(0.680)	(0.842)
PSCF	0.001	-0.000	-0.008	0.004	0.001	0.002
	(0.708)	(0.950)	(0.257)	(0.444)	(0.731)	(0.593)
HPI	0.013***	0.013***	0.025***	0.014***	0.014***	0.016***
	(0.005)	(0.004)	(0.000)	(0.003)	(0.004)	(0.002)
GGSD	0.001	0.001	0.001	0.001	0.001	0.001
	(0.653)	(0.827)	(0.911)	(0.670)	(0.692)	(0.747)
UR	-0.087***	-0.087***	-0.114***	-0.063***	-0.086***	-0.076***
	(0.000)	(0.001)	(0.005)	(0.002)	(0.000)	(0.001)
TFSL	-0.011**	-0.010***	-0.007**	-0.010***	-0.011**	-0.010**
	(0.020)	(0.010)	(0.036)	(0.003)	(0.018)	(0.021)
AR	-0.080***	-0.070**	-0.011	-0.061**	-0.083***	-0.087***
	(0.001)	(0.021)	(0.727)	(0.015)	(0.000)	(0.000)
LTUR	0.004	-0.008	-0.047	-0.049	0.000	-0.009
	(0.913)	(0.875)	(0.444)	(0.290)	(0.995)	(0.786)
YUR	0.009	0.013	0.035**	0.020*	0.011	0.010
	(0.457)	(0.293)	(0.017)	(0.073)	(0.386)	(0.367)
L.DV				0.247***		
				(0.000)		
R-sqr	0.368					
No. of observations	116	116	116	116	116	116
Dynamic completeness test	5.341					
Dynamic completeness test, P-val	0.021					
Correlated random effects test			167.196			
Correlated random effects test, P-val			0.000			
State dependence tests				3.374		
State dependence tests, P-val				0.001		
State dependence tests (Robust)				3.374		
State dependence tests, P-val (Robust)				0.001		
Cor.Pred.Crisis - In sample	0.595	0.568	0.892	0.757	0.595	0.568
aNtS - In sample	0.170	0.223	0.043	0.100	0.192	0.201
CPR - In sample	0.802	0.776	0.940	0.871	0.793	0.784
Absolute Utility - In sample	0.247	0.220	0.427	0.340	0.240	0.227
AUROC - In sample	0.877	0.873	0.973	0.924	0.873	0.878
First year out of sample	2017					
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for non-euro area countries, using three year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.48 **Out-of-sample econometric results for the non-EA, three year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	-0.016*	-0.016	-0.018	-0.020		
	(0.079)	(0.294)	(0.995)	(0.200)		
NIIP	-0.006***	-0.006***	-0.007	-0.004**		
	(0.001)	(0.007)	(0.992)	(0.043)		
EMS	-0.003	-0.003	-0.018	-0.004		
	(0.108)	(0.329)	(0.852)	(0.153)		
NULC	0.013***	0.013**	0.040	0.012**		
	(0.007)	(0.019)	(0.753)	(0.024)		
REER	-0.034***	-0.034***	-0.057	-0.031***		
	(0.000)	(0.000)	(0.931)	(0.000)		
PSD	-0.003***	-0.003**	-0.017	-0.003***		
	(0.007)	(0.013)	(0.655)	(0.009)		
PSCF	-0.002	-0.002	-0.017	-0.002		
	(0.677)	(0.782)	(0.918)	(0.805)		
HPI	0.017***	0.017**	0.042	0.020***		
	(0.002)	(0.012)	(0.867)	(0.007)		
GGSD	-0.002	-0.002	0.034	-0.002		
	(0.541)	(0.659)	(0.790)	(0.564)		
UR	-0.111***	-0.111***	-0.060	-0.073**		
	(0.000)	(0.000)	(0.988)	(0.014)		
TFSL	-0.008***	-0.008*	-0.020	-0.010**		
	(0.007)	(0.083)	(0.835)	(0.042)		
AR	-0.013	-0.013	0.160	-0.017		
	(0.609)	(0.703)	(0.932)	(0.589)		
LTUR	0.127*	0.127	0.901	0.123		
	(0.096)	(0.138)	(0.897)	(0.175)		
YUR	0.006	0.006	-0.108	0.011		
	(0.674)	(0.733)	(0.955)	(0.497)		
L.DV				0.224**		
				(0.031)		
R-sqr	0.513					
No. of observations	67	67	67	67	242	242
Dynamic completeness test	4.911					
Dynamic completeness test, P-val	0.027					
Correlated random effects test			106.566			
Correlated random effects test, P-val			0.000			
State dependence tests				3.374		
State dependence tests, P-val				0.001		
State dependence tests (Robust)				3.374		
State dependence tests, P-val (Robust)				0.001		
Cor.Pred.Crisis - In sample	0.818	0.818	1.000	0.727		
aNtS - In sample	0.217	0.217	0.000	0.092		
CPR - In sample	0.821	0.821	1.000	0.866		
Absolute Utility - In sample	0.320	0.320	0.500	0.330		
AUROC - In sample	0.940	0.940	1.000	0.939		
First year out of sample	2013					
Cor.Pred.Crisis - Out sample	0.667	0.667	0.733	0.667		
aNtS - Out sample	0.882	0.882	1.243	0.882		
CPR - Out sample	0.490	0.490	0.286	0.490		
Absolute Utility - Out sample	0.039	0.039	-0.089	0.039		
AUROC - Out sample	0.602	0.602	0.346	0.662		
Cor.Pred.Crisis - Out sample (first year only)	0.750	0.750	0.875	0.750		
aNtS - Out sample (first year only)	0.800	0.800	1.143	1.067		
CPR - Out sample (first year only)	0.615	0.615	0.538	0.538		
Absolute Utility - Out sample (first year only)	0.075	0.075	-0.063	-0.025		
AUROC - Out sample (first year only)	0.525	0.525	0.313	0.562		

Note: The table presents estimated models for crisis variable for non-euro area countries, using three year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.49 **In-sample econometric results for the EU, one year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	0.011	0.002	0.012	-0.003	0.009	0.009	0.010
	(0.125)	(0.516)	(0.110)	(0.772)	(0.200)	(0.218)	(0.160)
NIIP	-0.000	-0.001	-0.001	-0.002	-0.001	-0.000	-0.000
	(0.576)	(0.261)	(0.275)	(0.181)	(0.440)	(0.566)	(0.512)
EMS	-0.003	-0.001	-0.003	-0.003	-0.002	-0.003	-0.002
	(0.128)	(0.245)	(0.110)	(0.230)	(0.220)	(0.108)	(0.146)
NULC	0.005	0.002	0.007*	0.007	0.004	0.005	0.006
	(0.269)	(0.244)	(0.053)	(0.101)	(0.208)	(0.288)	(0.191)
REER	0.000	0.001	0.001	-0.000	0.003	0.000	0.001
	(0.981)	(0.494)	(0.862)	(0.976)	(0.500)	(0.940)	(0.770)
PSD	0.001*	0.002*	0.001*	0.004**	0.001	0.001**	0.001**
	(0.090)	(0.095)	(0.053)	(0.013)	(0.125)	(0.047)	(0.031)
PSCF	-0.003*	-0.001	-0.002	-0.002	-0.001	-0.004**	-0.004*
	(0.097)	(0.227)	(0.246)	(0.138)	(0.442)	(0.045)	(0.052)
HPI	-0.034***	-0.007	-0.033***	-0.026***	-0.030***	-0.033***	-0.034***
	(0.000)	(0.216)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GGSD	-0.000	-0.001	0.000	-0.001	0.000	-0.000	-0.000
	(0.824)	(0.449)	(0.991)	(0.764)	(0.983)	(0.840)	(0.948)
UR	-0.007	-0.003	-0.012	0.000	-0.016	-0.005	-0.003
	(0.508)	(0.627)	(0.272)	(0.995)	(0.131)	(0.621)	(0.773)
TFSL	-0.001	-0.000	-0.001	0.001	-0.001	0.001	0.001
	(0.705)	(0.872)	(0.628)	(0.679)	(0.763)	(0.724)	(0.698)
AR	-0.023	-0.003	-0.016	-0.008	-0.016	-0.023	-0.026
	(0.286)	(0.614)	(0.376)	(0.699)	(0.354)	(0.285)	(0.248)
LTUR	0.054*	0.023	0.073**	0.066**	0.067**	0.058*	0.063**
	(0.089)	(0.277)	(0.013)	(0.037)	(0.022)	(0.061)	(0.030)
YUR	-0.008	-0.005	-0.011*	-0.010	-0.013**	-0.009	-0.011
	(0.353)	(0.274)	(0.091)	(0.169)	(0.045)	(0.308)	(0.170)
L.DV					0.151***		
					(0.006)		
R-sqr	0.399	0.585				0.368	0.358
No. of observations	310	271	310	310	286	310	310
Dynamic completeness test	13.423						
Dynamic completeness test, P-val	0.000						
Hausman test			1.289				
Hausman test, P-val			1.000				
Correlated random effects test				28.334			
Correlated random effects test, P-val				0.013			
State dependence tests					2.829		
State dependence tests, P-val					0.005		
State dependence tests (Robust)					2.774		
State dependence tests, P-val (Robust)					0.006		
Cor.Pred.Crisis - In sample	0.619	0.134	0.649	0.742	0.725	0.660	0.660
aNtS - In sample	0.106	0.035	0.108	0.095	0.127	0.107	0.100
CPR - In sample	0.835	0.726	0.842	0.871	0.850	0.845	0.848
Absolute Utility - In sample	0.276	0.065	0.290	0.336	0.316	0.295	0.297
AUROC - In sample	0.901	0.761	0.899	0.936	0.915	0.896	0.896
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for EU countries, using one year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.50 **Out-of-sample econometric results for the EU, one year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	0.019**	0.002	0.020**	-0.000	0.023**	0.013	0.010
	(0.033)	(0.749)	(0.023)	(0.986)	(0.013)	(0.186)	(0.287)
NIIP	-0.001	-0.000	-0.002	-0.004*	-0.002**	-0.001	-0.001
	(0.154)	(0.726)	(0.127)	(0.087)	(0.042)	(0.174)	(0.115)
EMS	0.000	0.000	0.001	-0.002	0.002	0.000	0.001
	(0.866)	(0.797)	(0.757)	(0.532)	(0.444)	(0.852)	(0.806)
NULC	0.009***	0.000	0.009**	0.004	0.007	0.008**	0.008**
	(0.008)	(0.751)	(0.042)	(0.565)	(0.109)	(0.028)	(0.028)
REER	-0.004	0.000	-0.001	0.006	0.002	-0.005	-0.005
	(0.461)	(0.720)	(0.773)	(0.309)	(0.707)	(0.357)	(0.307)
PSD	0.001	0.000	0.001	0.004	0.001	0.001	0.001*
	(0.335)	(0.715)	(0.186)	(0.133)	(0.156)	(0.163)	(0.087)
PSCF	-0.002**	-0.000	-0.002	-0.003	-0.002	-0.002	-0.001
	(0.016)	(0.730)	(0.183)	(0.152)	(0.189)	(0.163)	(0.451)
HPI	-0.027***	-0.002	-0.030***	-0.025***	-0.026***	-0.026***	-0.024***
	(0.000)	(0.740)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GGSD	0.002	0.000	0.002	0.008**	0.002	0.001	0.001
	(0.337)	(0.726)	(0.160)	(0.033)	(0.114)	(0.520)	(0.584)
UR	-0.007	-0.001	-0.010	-0.039	-0.011	-0.006	-0.006
	(0.657)	(0.853)	(0.576)	(0.316)	(0.549)	(0.729)	(0.731)
TFSL	0.000	0.000	-0.001	0.001	-0.001	0.002	0.001
	(0.973)	(0.743)	(0.801)	(0.726)	(0.861)	(0.468)	(0.644)
AR	-0.011	-0.003	-0.020	-0.003	-0.012	-0.010	-0.011
	(0.647)	(0.751)	(0.378)	(0.921)	(0.641)	(0.684)	(0.625)
LTUR	0.045	0.006	0.059*	0.083*	0.047	0.045	0.042
	(0.254)	(0.759)	(0.098)	(0.086)	(0.203)	(0.243)	(0.302)
YUR	-0.006	-0.002	-0.015	-0.023**	-0.013	-0.007	-0.007
	(0.588)	(0.740)	(0.143)	(0.049)	(0.188)	(0.551)	(0.545)
L.DV					0.080		
					(0.426)		
R-sqr	0.392	0.680				0.415	0.431
No. of observations	198	169	198	198	182	198	198
Dynamic completeness test	2.977						
Dynamic completeness test, P-val	0.084						
Hausman test			0.780				
Hausman test, P-val			1.000				
Correlated random effects test				19.383			
Correlated random effects test, P-val				0.151			
State dependence tests					2.829		
State dependence tests, P-val					0.005		
State dependence tests (Robust)					2.774		
State dependence tests, P-val (Robust)					0.006		
Cor.Pred.Crisis - In sample	0.571	0.107	0.625	0.696	0.608	0.607	0.607
aNtS - In sample	0.123	0.131	0.124	0.101	0.138	0.128	0.104
CPR - In sample	0.828	0.737	0.838	0.864	0.830	0.833	0.843
Absolute Utility - In sample	0.251	0.047	0.274	0.313	0.262	0.265	0.272
AUROC - In sample	0.897	0.672	0.890	0.937	0.900	0.895	0.897
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.561	0.146	0.585	0.756	0.625	0.439	0.366
aNtS - Out sample	0.176	0.481	0.217	0.447	0.250	0.192	0.154
CPR - Out sample	0.777	0.643	0.768	0.696	0.760	0.741	0.732
Absolute Utility - Out sample	0.231	0.038	0.229	0.209	0.234	0.177	0.155
AUROC - Out sample	0.827	0.654	0.820	0.753	0.847	0.811	0.804
Cor.Pred.Crisis - Out sample (first year only)	0.611	0.222	0.611	0.889	0.706	0.611	0.500
aNtS - Out sample (first year only)	0.164	0.450	0.164	0.450	0.157	0.164	0.200
CPR - Out sample (first year only)	0.714	0.464	0.714	0.786	0.769	0.714	0.643
Absolute Utility - Out sample (first year only)	0.256	0.061	0.256	0.244	0.297	0.256	0.200
AUROC - Out sample (first year only)	0.822	0.583	0.828	0.839	0.882	0.806	0.778

Note: The table presents estimated models for crisis variable for EA countries, using one year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.51 **In-sample econometric results for the EU, two year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	-0.006	-0.023	-0.019**	-0.051***	-0.011	-0.007	-0.008
	(0.446)	(0.255)	(0.046)	(0.000)	(0.111)	(0.424)	(0.364)
NIIP	-0.001	-0.001	-0.001	-0.002	-0.000	-0.000	-0.000
	(0.606)	(0.363)	(0.603)	(0.193)	(0.960)	(0.656)	(0.647)
EMS	0.000	0.001	0.001	0.001	0.000	0.002	0.002
	(0.966)	(0.505)	(0.615)	(0.562)	(0.881)	(0.401)	(0.386)
NULC	0.010*	0.001	0.008**	0.002	0.006*	0.013**	0.013**
	(0.053)	(0.570)	(0.037)	(0.603)	(0.051)	(0.022)	(0.023)
REER	-0.021***	-0.013	-0.023***	-0.024***	-0.019***	-0.023***	-0.022***
	(0.001)	(0.242)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PSD	0.001	0.003**	0.001**	0.005***	0.000	0.001	0.001*
	(0.195)	(0.046)	(0.030)	(0.004)	(0.347)	(0.147)	(0.093)
PSCF	0.002**	-0.000	0.001	-0.000	0.002	0.002*	0.001
	(0.024)	(0.967)	(0.544)	(0.816)	(0.131)	(0.065)	(0.200)
HPI	-0.011***	-0.004	-0.011***	-0.009***	-0.003	-0.011***	-0.010***
	(0.002)	(0.301)	(0.006)	(0.008)	(0.450)	(0.005)	(0.009)
GGSD	-0.001	-0.003	-0.001	-0.006**	-0.001	-0.000	-0.000
	(0.680)	(0.278)	(0.386)	(0.045)	(0.493)	(0.882)	(0.936)
UR	-0.012	-0.003	-0.021	-0.005	-0.012	-0.007	-0.006
	(0.439)	(0.826)	(0.169)	(0.837)	(0.236)	(0.629)	(0.705)
TFSL	-0.002	-0.001	-0.002	-0.001	-0.002	-0.001	0.001
	(0.299)	(0.544)	(0.366)	(0.646)	(0.416)	(0.633)	(0.569)
AR	-0.051**	-0.008	-0.038*	-0.020	-0.033*	-0.056**	-0.058**
	(0.040)	(0.551)	(0.062)	(0.325)	(0.064)	(0.027)	(0.024)
LTUR	0.025	0.020	0.038	0.044	0.007	0.032	0.032
	(0.442)	(0.458)	(0.194)	(0.178)	(0.766)	(0.357)	(0.346)
YUR	0.003	0.000	0.001	0.000	0.004	0.001	0.001
	(0.729)	(0.905)	(0.934)	(0.960)	(0.551)	(0.852)	(0.878)
L.DV					0.315***		
					(0.000)		
R-sqr	0.234	0.437				0.274	0.279
No. of observations	282	247	282	282	271	282	282
Dynamic completeness test	30.430						
Dynamic completeness test, P-val	0.000						
Hausman test			19.231				
Hausman test, P-val			0.156				
Correlated random effects test				39.151			
Correlated random effects test, P-val				0.000			
State dependence tests					5.871		
State dependence tests, P-val					0.000		
State dependence tests (Robust)					5.816		
State dependence tests, P-val (Robust)					0.000		
Cor.Pred.Crisis - In sample	0.538	0.054	0.538	0.699	0.707	0.559	0.548
aNtS - In sample	0.138	0.295	0.217	0.129	0.158	0.170	0.183
CPR - In sample	0.798	0.677	0.770	0.840	0.827	0.791	0.784
Absolute Utility - In sample	0.232	0.019	0.211	0.304	0.297	0.232	0.224
AUROC - In sample	0.830	0.788	0.818	0.915	0.868	0.816	0.812
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for EU countries, using two year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.52 **Out-of-sample econometric results for the EU, two year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	0.002	-0.000	-0.000	-0.073***	-0.003	-0.002	-0.006
	(0.855)	(0.906)	(0.980)	(0.003)	(0.762)	(0.814)	(0.522)
NIIP	-0.003**	-0.000	-0.003**	-0.005*	-0.002*	-0.003**	-0.003**
	(0.012)	(0.906)	(0.044)	(0.058)	(0.093)	(0.033)	(0.023)
EMS	0.003	0.000	0.003	0.003	0.003	0.004**	0.004*
	(0.170)	(0.905)	(0.154)	(0.435)	(0.131)	(0.041)	(0.089)
NULC	0.007	-0.000	0.006	-0.014**	0.003	0.009*	0.009
	(0.164)	(0.906)	(0.143)	(0.028)	(0.505)	(0.081)	(0.116)
REER	-0.025***	-0.000	-0.025***	-0.023***	-0.024***	-0.026***	-0.027***
	(0.000)	(0.908)	(0.000)	(0.006)	(0.000)	(0.000)	(0.000)
PSD	0.001	0.000	0.001	0.011***	0.001	0.001	0.001
	(0.315)	(0.904)	(0.156)	(0.002)	(0.274)	(0.125)	(0.111)
PSCF	0.000	-0.000	-0.000	-0.004	0.001	-0.000	0.000
	(0.829)	(0.931)	(0.916)	(0.225)	(0.639)	(0.888)	(0.684)
HPI	-0.009***	-0.000	-0.010**	-0.010**	-0.004	-0.007*	-0.007*
	(0.006)	(0.905)	(0.022)	(0.022)	(0.357)	(0.089)	(0.079)
GGSD	-0.000	0.000	0.000	0.001	0.000	-0.000	-0.000
	(0.985)	(0.897)	(0.812)	(0.774)	(0.944)	(0.946)	(0.909)
UR	-0.029	-0.000	-0.035	-0.075	-0.029*	-0.022	-0.021
	(0.202)	(0.922)	(0.123)	(0.142)	(0.097)	(0.322)	(0.335)
TFSL	-0.004*	-0.000	-0.004	0.001	-0.005	-0.002	-0.001
	(0.052)	(0.935)	(0.200)	(0.817)	(0.120)	(0.288)	(0.839)
AR	0.009	0.000	0.012	0.052*	0.013	0.011	0.014
	(0.704)	(0.906)	(0.671)	(0.086)	(0.596)	(0.654)	(0.552)
LTUR	0.032	0.000	0.046	0.069	0.015	0.010	0.005
	(0.559)	(0.915)	(0.307)	(0.180)	(0.711)	(0.858)	(0.923)
YUR	-0.007	-0.000	-0.011	-0.019	-0.006	-0.001	0.000
	(0.633)	(0.907)	(0.330)	(0.141)	(0.555)	(0.931)	(0.984)
L.DV					0.280***		
					(0.000)		
R-sqr	0.252	0.613				0.334	0.369
No. of observations	170	147	170	170	163	170	170
Dynamic completeness test	8.092						
Dynamic completeness test, P-val	0.004						
Hausman test			12.374				
Hausman test, P-val			0.576				
Correlated random effects test				17.256			
Correlated random effects test, P-val				0.243			
State dependence tests					5.871		
State dependence tests, P-val					0.000		
State dependence tests (Robust)					5.816		
State dependence tests, P-val (Robust)					0.000		
Cor.Pred.Crisis - In sample	0.462	0.096	0.500	0.731	0.608	0.519	0.500
aNtS - In sample	0.239	0.176	0.237	0.081	0.132	0.196	0.203
CPR - In sample	0.759	0.712	0.765	0.876	0.822	0.782	0.776
Absolute Utility - In sample	0.176	0.040	0.191	0.336	0.264	0.209	0.199
AUROC - In sample	0.823	0.790	0.818	0.911	0.859	0.837	0.840
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.415	0.073	0.463	0.488	0.829	0.293	0.293
aNtS - Out sample	0.645	0.962	0.577	0.693	0.288	0.722	0.770
CPR - Out sample	0.616	0.616	0.634	0.598	0.787	0.607	0.598
Absolute Utility - Out sample	0.074	0.001	0.098	0.075	0.295	0.041	0.034
AUROC - Out sample	0.653	0.665	0.660	0.628	0.811	0.543	0.535
Cor.Pred.Crisis - Out sample (first year only)	0.444	0.000	0.500	0.556	0.778	0.444	0.444
aNtS - Out sample (first year only)	0.675	.	0.600	0.540	0.286	0.675	0.450
CPR - Out sample (first year only)	0.536	0.321	0.571	0.607	0.778	0.536	0.571
Absolute Utility - Out sample (first year only)	0.072	-0.050	0.100	0.128	0.278	0.072	0.122
AUROC - Out sample (first year only)	0.656	0.606	0.633	0.761	0.802	0.644	0.689

Note: The table presents estimated models for crisis variable for EA countries, using two year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.53 **In-sample econometric results for the EU, three year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	-0.007	-0.031***	-0.017*	-0.055***	-0.004	-0.006	-0.007
	(0.511)	(0.000)	(0.079)	(0.000)	(0.642)	(0.538)	(0.539)
NIIP	-0.002	-0.003***	-0.002	-0.004**	-0.001	-0.002	-0.002*
	(0.124)	(0.005)	(0.153)	(0.011)	(0.149)	(0.100)	(0.085)
EMS	-0.001	0.000	-0.001	-0.002	-0.001	-0.000	0.001
	(0.643)	(0.974)	(0.795)	(0.350)	(0.624)	(0.911)	(0.721)
NULC	0.014***	0.011**	0.013***	0.014**	0.010**	0.014***	0.016***
	(0.008)	(0.026)	(0.003)	(0.018)	(0.011)	(0.006)	(0.005)
REER	-0.025***	-0.024***	-0.027***	-0.031***	-0.017***	-0.025***	-0.026***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)
PSD	0.001	0.000	0.001	0.001	0.000	0.001	0.001
	(0.371)	(0.633)	(0.148)	(0.415)	(0.721)	(0.301)	(0.282)
PSCF	0.002**	0.000	0.001	0.000	0.002	0.003**	0.003**
	(0.017)	(0.704)	(0.502)	(0.835)	(0.444)	(0.019)	(0.020)
HPI	0.010**	0.007**	0.010***	0.011***	0.013***	0.010***	0.012***
	(0.010)	(0.031)	(0.008)	(0.007)	(0.001)	(0.002)	(0.001)
GGSD	-0.001	-0.006***	-0.002	-0.012***	-0.001	-0.001	-0.000
	(0.711)	(0.002)	(0.184)	(0.000)	(0.678)	(0.753)	(0.827)
UR	-0.022	0.007	-0.027	0.020	-0.019	-0.021	-0.017
	(0.313)	(0.673)	(0.121)	(0.468)	(0.134)	(0.346)	(0.444)
TFSL	-0.003*	-0.002	-0.003	-0.003	-0.002	-0.003*	-0.003
	(0.100)	(0.262)	(0.228)	(0.252)	(0.402)	(0.099)	(0.169)
AR	-0.043*	-0.015	-0.039*	-0.041*	-0.027	-0.049**	-0.055**
	(0.088)	(0.318)	(0.070)	(0.069)	(0.170)	(0.049)	(0.029)
LTUR	-0.026	-0.014	-0.020	-0.037	-0.034	-0.022	-0.018
	(0.479)	(0.536)	(0.541)	(0.308)	(0.251)	(0.541)	(0.638)
YUR	0.022**	0.019***	0.022***	0.030***	0.021***	0.021**	0.020**
	(0.029)	(0.001)	(0.008)	(0.000)	(0.010)	(0.031)	(0.035)
L.DV					0.278***		
					(0.000)		
R-sqr	0.221	0.497				0.208	0.263
No. of observations	254	223	254	254	254	254	254
Dynamic completeness test	39.767						
Dynamic completeness test, P-val	0.000						
Hausman test			15.625				
Hausman test, P-val			0.337				
Correlated random effects test				33.528			
Correlated random effects test, P-val				0.002			
State dependence tests					4.706		
State dependence tests, P-val					0.000		
State dependence tests (Robust)					4.773		
State dependence tests, P-val (Robust)					0.000		
Cor.Pred.Crisis - In sample	0.506	0.146	0.472	0.742	0.697	0.517	0.528
aNtS - In sample	0.228	0.166	0.257	0.123	0.165	0.211	0.218
CPR - In sample	0.752	0.685	0.736	0.850	0.819	0.760	0.760
Absolute Utility - In sample	0.195	0.061	0.175	0.325	0.291	0.204	0.206
AUROC - In sample	0.819	0.786	0.811	0.911	0.872	0.823	0.822
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for EU countries, using three year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.54 **Out-of-sample econometric results for the EU, three year time lag (logit setting)**

	PLLOGIT	FELOGIT	RELOGIT	RELOGITCHAM	RELOGITD	PLMNLOGIT	PLMNLOGITR
CA	0.000	-0.000	0.000	-0.056*	0.001	-0.001	-0.004
	(0.979)	(0.912)	(0.987)	(0.062)	(0.911)	(0.923)	(0.714)
NIIP	-0.004***	-0.000	-0.005**	-0.010***	-0.004**	-0.004***	-0.004***
	(0.001)	(0.913)	(0.010)	(0.004)	(0.027)	(0.001)	(0.000)
EMS	0.001	-0.000	0.001	-0.004	0.000	0.001	0.001
	(0.819)	(0.913)	(0.787)	(0.394)	(0.997)	(0.820)	(0.795)
NULC	0.010*	-0.000	0.011**	0.008	0.009*	0.010*	0.011*
	(0.088)	(0.917)	(0.037)	(0.287)	(0.072)	(0.085)	(0.087)
REER	-0.036***	-0.000	-0.038***	-0.046***	-0.030***	-0.036***	-0.038***
	(0.000)	(0.914)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PSD	0.000	0.000	0.000	0.002	0.000	0.000	0.001
	(0.683)	(0.907)	(0.725)	(0.412)	(0.964)	(0.587)	(0.451)
PSCF	0.001	0.000	0.001	0.005	0.001	0.001	0.001
	(0.118)	(0.912)	(0.734)	(0.269)	(0.678)	(0.169)	(0.256)
HPI	0.011**	0.000	0.011**	0.019**	0.013**	0.011**	0.012**
	(0.038)	(0.911)	(0.026)	(0.015)	(0.011)	(0.028)	(0.012)
GGSD	-0.001	0.000	-0.001	0.006	-0.001	-0.001	-0.002
	(0.540)	(0.913)	(0.674)	(0.405)	(0.622)	(0.494)	(0.360)
UR	-0.047**	0.000	-0.053**	-0.097	-0.038*	-0.047**	-0.043*
	(0.041)	(0.901)	(0.029)	(0.159)	(0.068)	(0.036)	(0.069)
TFSL	-0.009***	-0.000	-0.009**	-0.003	-0.008**	-0.009***	-0.009***
	(0.004)	(0.914)	(0.015)	(0.347)	(0.035)	(0.008)	(0.005)
AR	-0.004	0.000	-0.001	-0.019	-0.008	-0.007	-0.002
	(0.872)	(0.911)	(0.982)	(0.608)	(0.765)	(0.776)	(0.921)
LTUR	-0.010	-0.000	-0.001	-0.015	-0.003	-0.018	-0.025
	(0.859)	(0.995)	(0.982)	(0.832)	(0.952)	(0.770)	(0.702)
YUR	0.013	0.000	0.013	0.027	0.015	0.014	0.017
	(0.296)	(0.914)	(0.299)	(0.131)	(0.216)	(0.248)	(0.201)
L.DV					0.200***		
					(0.005)		
R-sqr	0.317	0.620				0.303	0.363
No. of observations	142	122	142	142	142	142	142
Dynamic completeness test	5.394						
Dynamic completeness test, P-val	0.020						
Hausman test			127.531				
Hausman test, P-val			0.000				
Correlated random effects test				15.045			
Correlated random effects test, P-val				0.375			
State dependence tests					4.706		
State dependence tests, P-val					0.000		
State dependence tests (Robust)					4.773		
State dependence tests, P-val (Robust)					0.000		
Cor.Pred.Crisis - In sample	0.646	0.063	0.688	0.729	0.688	0.688	0.688
aNtS - In sample	0.247	0.340	0.248	0.088	0.186	0.201	0.232
CPR - In sample	0.775	0.669	0.782	0.866	0.810	0.803	0.789
Absolute Utility - In sample	0.243	0.021	0.259	0.333	0.280	0.275	0.264
AUROC - In sample	0.860	0.611	0.856	0.923	0.881	0.865	0.865
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.512	0.195	0.634	0.780	0.854	0.512	0.561
aNtS - Out sample	0.770	0.794	0.666	0.722	0.445	0.632	0.628
CPR - Out sample	0.571	0.607	0.598	0.563	0.705	0.616	0.616
Absolute Utility - Out sample	0.059	0.020	0.106	0.109	0.237	0.094	0.104
AUROC - Out sample	0.641	0.585	0.653	0.694	0.793	0.655	0.676
Cor.Pred.Crisis - Out sample (first year only)	0.667	0.222	0.778	0.889	0.833	0.722	0.722
aNtS - Out sample (first year only)	0.600	0.450	0.514	0.563	0.480	0.554	0.554
CPR - Out sample (first year only)	0.643	0.464	0.714	0.750	0.750	0.679	0.679
Absolute Utility - Out sample (first year only)	0.133	0.061	0.189	0.194	0.217	0.161	0.161
AUROC - Out sample (first year only)	0.717	0.606	0.694	0.861	0.839	0.706	0.717

Note: The table presents estimated models for crisis variable for EA countries, using three year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled logit model (PLLOGIT), fixed effects logit model (FELOGIT), random effects logit model (RELOGIT), Chamberlain's logit model (RELOGITCHAM), Dynamic logit model (RELOGITD), pooled multinomial logit model (PLMNLOGIT), and pooled multinomial logit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.55 **In-sample econometric results for the EU, one year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	0.002	0.002	-0.004	-0.020**	-0.020**	-0.020**	-0.003
	(0.778)	(0.744)	(0.568)	(0.017)	(0.038)	(0.026)	(0.734)
NIIP	-0.001	-0.001	-0.001	0.000	0.000	0.000	-0.000
	(0.645)	(0.329)	(0.125)	(0.786)	(0.711)	(0.729)	(0.809)
EMS	-0.001	-0.001	-0.002	-0.003*	-0.003	-0.003	-0.001
	(0.772)	(0.766)	(0.356)	(0.052)	(0.146)	(0.128)	(0.681)
NULC	0.009	0.009***	0.008**	0.007*	0.007*	0.007***	0.008
	(0.131)	(0.002)	(0.015)	(0.058)	(0.065)	(0.003)	(0.140)
REER	-0.003	-0.003	0.003	0.001	0.001	0.001	-0.003
	(0.561)	(0.456)	(0.517)	(0.877)	(0.845)	(0.791)	(0.568)
PSD	0.001*	0.001***	0.001	0.004**	0.004**	0.004***	0.001**
	(0.085)	(0.001)	(0.164)	(0.043)	(0.015)	(0.000)	(0.033)
PSCF	-0.003***	-0.003***	-0.002**	-0.003**	-0.003*	-0.003***	-0.003***
	(0.001)	(0.000)	(0.047)	(0.012)	(0.084)	(0.000)	(0.000)
HPI	-0.017***	-0.017***	-0.016***	-0.012**	-0.012***	-0.012***	-0.016***
	(0.001)	(0.000)	(0.000)	(0.011)	(0.001)	(0.000)	(0.000)
GGSD	-0.001	-0.001	-0.000	0.002	0.002	0.002	-0.000
	(0.682)	(0.533)	(0.953)	(0.511)	(0.353)	(0.512)	(0.808)
UR	0.006	0.006	-0.007	0.017	0.017	0.017	0.008
	(0.651)	(0.658)	(0.575)	(0.451)	(0.365)	(0.199)	(0.547)
TFSL	-0.001	-0.001	-0.001	0.001	0.001	0.001	-0.001
	(0.678)	(0.680)	(0.638)	(0.606)	(0.626)	(0.383)	(0.634)
AR	-0.042**	-0.042**	-0.017	-0.020	-0.020	-0.020	-0.037**
	(0.036)	(0.011)	(0.447)	(0.286)	(0.292)	(0.329)	(0.037)
LTUR	0.040	0.040*	0.067***	0.019	0.019	0.019	0.033
	(0.239)	(0.068)	(0.001)	(0.617)	(0.438)	(0.209)	(0.328)
YUR	-0.001	-0.001	-0.007	0.004	0.004	0.004	-0.000
	(0.909)	(0.809)	(0.252)	(0.738)	(0.587)	(0.439)	(1.000)
constant	0.133	0.133	0.210	-0.535*	-0.588**	-0.535***	0.063
	(0.497)	(0.354)	(0.232)	(0.079)	(0.019)	(0.009)	(0.757)
R-sqr	0.334	0.334	0.313	0.363	0.481		
Within.R-sqr				0.363		0.363	0.328
Over.R-sqr				0.218			0.330
Betw.R-sqr				0.086			0.357
No. of observations	310	310	310	310	310	310	310
Pesaran cross-sectional dependence test				6.094			6.768
Pesaran cross-sectional dependence test, P-val				0.000			0.000
D'Agostino normality test	22.563	22.563	22.013	8.052	8.052	4.601	18.672
D'Agostino normality test, P-val	0.000	0.000	0.000	0.018	0.018	0.100	0.000
Breusch-Pagan test	3.976						
Breusch-Pagan test, P-val	0.000						
Quasi-time-demeaned-data test of ser. corr.	2.413						
Quasi-time-demeaned-data test of ser. corr., P-val	0.016						
Relevance/redundancy of FE test					2.800		
Relevance/redundancy of FE test, P-val					0.000		
Hausman test							269.072
Hausman test, P-val							0.000
Cor.Pred.Crisis - In sample	0.505	0.505	0.485	0.784	0.784	0.577	0.515
aNtS - In sample	0.130	0.130	0.165	0.108	0.108	0.260	0.118
CPR - In sample	0.800	0.800	0.784	0.874	0.874	0.765	0.806
Absolute Utility - In sample	0.220	0.220	0.202	0.349	0.349	0.214	0.227
AUROC - In sample	0.876	0.876	0.862	0.922	0.922	0.786	0.868
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for EU countries, using one year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.56 **Out-of-sample econometric results for the EU, one year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	0.012	0.012**	0.007	0.002	0.002	0.002	0.009
	(0.201)	(0.017)	(0.281)	(0.923)	(0.924)	(0.857)	(0.396)
NIIP	-0.002	-0.002***	-0.002	0.000	0.000	0.000	-0.001
	(0.193)	(0.001)	(0.131)	(0.970)	(0.971)	(0.931)	(0.320)
EMS	0.003	0.003**	0.002*	-0.001	-0.001	-0.001	0.003
	(0.267)	(0.028)	(0.092)	(0.688)	(0.731)	(0.424)	(0.254)
NULC	0.010**	0.010***	0.007**	0.006*	0.006	0.006***	0.009**
	(0.035)	(0.000)	(0.036)	(0.076)	(0.240)	(0.000)	(0.049)
REER	-0.006	-0.006*	0.004	0.008	0.008	0.008***	-0.002
	(0.367)	(0.069)	(0.484)	(0.265)	(0.187)	(0.008)	(0.723)
PSD	0.002*	0.002**	0.002**	0.005***	0.005***	0.005***	0.002**
	(0.099)	(0.020)	(0.014)	(0.003)	(0.008)	(0.000)	(0.013)
PSCF	-0.003***	-0.003***	-0.003***	-0.004***	-0.004**	-0.004***	-0.004***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.021)	(0.000)	(0.000)
HPI	-0.015***	-0.015***	-0.016***	-0.013***	-0.013***	-0.013***	-0.016***
	(0.001)	(0.000)	(0.000)	(0.006)	(0.002)	(0.002)	(0.000)
GGSD	0.001	0.001	0.002	0.011**	0.011***	0.011***	0.003
	(0.537)	(0.481)	(0.235)	(0.010)	(0.002)	(0.000)	(0.135)
UR	0.008	0.008	0.011	0.028	0.028	0.028**	0.019
	(0.695)	(0.652)	(0.279)	(0.342)	(0.366)	(0.040)	(0.394)
TFSL	-0.001	-0.001	-0.001	0.001	0.001	0.001	-0.000
	(0.630)	(0.662)	(0.596)	(0.486)	(0.621)	(0.218)	(0.784)
AR	-0.018	-0.018	-0.014	0.008	0.008	0.008	-0.016
	(0.322)	(0.215)	(0.619)	(0.739)	(0.747)	(0.698)	(0.423)
LTUR	0.013	0.013	0.032	-0.019	-0.019	-0.019	-0.002
	(0.783)	(0.597)	(0.261)	(0.646)	(0.594)	(0.468)	(0.968)
YUR	-0.002	-0.002	-0.010	-0.006	-0.006	-0.006	-0.002
	(0.901)	(0.834)	(0.316)	(0.653)	(0.565)	(0.661)	(0.876)
constant	-0.099	-0.099	-0.250	-1.256***	-1.443***	-1.256***	-0.395
	(0.748)	(0.735)	(0.264)	(0.001)	(0.000)	(0.000)	(0.225)
R-sqr	0.335	0.335	0.432	0.426	0.550		
Within.R-sqr				0.426		0.426	0.362
Over.R-sqr				0.095			0.314
Betw.R-sqr				0.004			0.277
No. of observations	198	198	198	198	198	198	198
Pesaran cross-sectional dependence test				.			.
Pesaran cross-sectional dependence test, P-val				.			.
D'Agostino normality test	14.596	14.596	13.285	16.280	16.280	5.459	15.603
D'Agostino normality test, P-val	0.001	0.001	0.001	0.000	0.000	0.065	0.000
Breusch-Pagan test	1.289						
Breusch-Pagan test, P-val	0.208						
Quasi-time-demeaned-data test of ser. corr.	1.147						
Quasi-time-demeaned-data test of ser. corr., P-val	0.252						
Relevance/redundancy of FE test					2.762		
Relevance/redundancy of FE test, P-val					0.000		
Hausman test							93.005
Hausman test, P-val							0.000
Cor.Pred.Crisis - In sample	0.464	0.464	0.446	0.714	0.714	0.536	0.482
aNtS - In sample	0.137	0.137	0.142	0.030	0.030	0.486	0.146
CPR - In sample	0.803	0.803	0.798	0.904	0.904	0.682	0.803
Absolute Utility - In sample	0.200	0.200	0.192	0.347	0.347	0.138	0.206
AUROC - In sample	0.876	0.876	0.850	0.932	0.932	0.685	0.850
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.439	0.439	0.390	0.756	0.756	0.659	0.463
aNtS - Out sample	0.257	0.257	0.253	0.633	0.633	0.513	0.243
CPR - Out sample	0.723	0.723	0.714	0.607	0.607	0.661	0.732
Absolute Utility - Out sample	0.163	0.163	0.146	0.139	0.139	0.160	0.175
AUROC - Out sample	0.766	0.766	0.753	0.706	0.706	0.683	0.740
Cor.Pred.Crisis - Out sample (first year only)	0.444	0.444	0.389	0.667	0.667	0.611	0.389
aNtS - Out sample (first year only)	0.225	0.225	0.000	0.300	0.300	0.327	0.000
CPR - Out sample (first year only)	0.607	0.607	0.607	0.714	0.714	0.679	0.607
Absolute Utility - Out sample (first year only)	0.172	0.172	0.194	0.233	0.233	0.206	0.194
AUROC - Out sample (first year only)	0.767	0.767	0.767	0.867	0.867	0.739	0.783

Note: The table presents estimated models for crisis variable for EU countries, using one year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.57 **In-sample econometric results for the EU, two year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	-0.009	-0.009	-0.023***	-0.037***	-0.037***	-0.037***	-0.013
	(0.315)	(0.162)	(0.000)	(0.000)	(0.002)	(0.000)	(0.145)
NIIP	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.712)	(0.674)	(0.873)	(0.954)	(0.940)	(0.943)	(0.799)
EMS	0.000	0.000	0.001	0.001	0.001	0.001	0.000
	(0.898)	(0.890)	(0.726)	(0.792)	(0.791)	(0.853)	(0.845)
NULC	0.010	0.010***	0.003	0.005	0.005	0.005	0.009
	(0.108)	(0.000)	(0.558)	(0.360)	(0.238)	(0.101)	(0.124)
REER	-0.018***	-0.018***	-0.018***	-0.019***	-0.019***	-0.019***	-0.019***
	(0.001)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
PSD	0.001	0.001***	0.001	0.004**	0.004**	0.004***	0.001
	(0.180)	(0.002)	(0.181)	(0.035)	(0.033)	(0.004)	(0.109)
PSCF	0.002**	0.002	0.002	0.000	0.000	0.000	0.002**
	(0.031)	(0.124)	(0.127)	(0.873)	(0.932)	(0.879)	(0.033)
HPI	-0.009***	-0.009***	-0.011***	-0.007*	-0.007*	-0.007**	-0.009***
	(0.005)	(0.000)	(0.000)	(0.082)	(0.088)	(0.023)	(0.003)
GGSD	-0.001	-0.001	-0.001	-0.003	-0.003	-0.003	-0.001
	(0.671)	(0.289)	(0.517)	(0.573)	(0.346)	(0.468)	(0.654)
UR	-0.005	-0.005	-0.018	0.003	0.003	0.003	-0.006
	(0.727)	(0.702)	(0.212)	(0.912)	(0.885)	(0.888)	(0.683)
TFSL	-0.002	-0.002	-0.001	-0.001	-0.001	-0.001	-0.002
	(0.342)	(0.321)	(0.534)	(0.612)	(0.632)	(0.442)	(0.300)
AR	-0.058**	-0.058**	-0.039*	-0.043**	-0.043**	-0.043	-0.057***
	(0.014)	(0.017)	(0.071)	(0.048)	(0.046)	(0.157)	(0.006)
LTUR	0.015	0.015	0.011	0.007	0.007	0.007	0.013
	(0.670)	(0.593)	(0.674)	(0.862)	(0.814)	(0.807)	(0.699)
YUR	0.005	0.005	0.003	0.006	0.006	0.006	0.005
	(0.553)	(0.539)	(0.685)	(0.530)	(0.399)	(0.464)	(0.554)
constant	0.240	0.240	0.424**	-0.135	-0.065	-0.135	0.231
	(0.282)	(0.121)	(0.042)	(0.701)	(0.817)	(0.618)	(0.298)
R-sqr	0.257	0.257	0.213	0.299	0.431		
Within.R-sqr				0.299		0.299	0.265
Over.R-sqr				0.186			0.255
Betw.R-sqr				0.112			0.246
No. of observations	282	282	282	282	282	282	282
Pesaran cross-sectional dependence test				6.460			7.545
Pesaran cross-sectional dependence test, P-val				0.000			0.000
D'Agostino normality test	16.640	16.640	26.562	7.518	7.518	1.043	15.540
D'Agostino normality test, P-val	0.000	0.000	0.000	0.023	0.023	0.594	0.000
Breusch-Pagan test	4.563						
Breusch-Pagan test, P-val	0.000						
Quasi-time-demeaned-data test of ser. corr.	2.466						
Quasi-time-demeaned-data test of ser. corr., P-val	0.014						
Relevance/redundancy of FE test					2.731		
Relevance/redundancy of FE test, P-val					0.000		
Hausman test							243.837
Hausman test, P-val							0.000
Cor.Pred.Crisis - In sample	0.484	0.484	0.409	0.731	0.731	0.516	0.516
aNtS - In sample	0.153	0.153	0.285	0.087	0.087	0.308	0.154
CPR - In sample	0.780	0.780	0.727	0.869	0.869	0.734	0.787
Absolute Utility - In sample	0.205	0.205	0.146	0.334	0.334	0.179	0.218
AUROC - In sample	0.825	0.825	0.794	0.908	0.908	0.774	0.823
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for EU countries, using two year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.58 **Out-of-sample econometric results for the EU, two year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	0.004	0.004	-0.012	-0.022	-0.022	-0.022	0.002
	(0.705)	(0.153)	(0.237)	(0.349)	(0.298)	(0.111)	(0.854)
NIIP	-0.003**	-0.003***	-0.002	-0.002	-0.002	-0.002**	-0.003***
	(0.016)	(0.000)	(0.212)	(0.462)	(0.471)	(0.040)	(0.009)
EMS	0.003	0.003*	0.004***	0.003	0.003	0.003	0.003
	(0.239)	(0.081)	(0.003)	(0.349)	(0.386)	(0.329)	(0.201)
NULC	0.008	0.008***	0.001	0.000	0.000	0.000	0.007
	(0.152)	(0.001)	(0.862)	(0.979)	(0.974)	(0.962)	(0.204)
REER	-0.020***	-0.020***	-0.017***	-0.013*	-0.013*	-0.013**	-0.019***
	(0.001)	(0.000)	(0.000)	(0.072)	(0.094)	(0.026)	(0.000)
PSD	0.001	0.001**	0.002	0.005***	0.005**	0.005***	0.002*
	(0.143)	(0.038)	(0.123)	(0.000)	(0.015)	(0.000)	(0.062)
PSCF	-0.000	-0.000	0.000	-0.001	-0.001	-0.001**	-0.000
	(0.833)	(0.860)	(0.960)	(0.150)	(0.451)	(0.012)	(0.589)
HPI	-0.009**	-0.009***	-0.011***	-0.008***	-0.008	-0.008**	-0.009***
	(0.012)	(0.002)	(0.000)	(0.010)	(0.110)	(0.013)	(0.005)
GGSD	0.000	0.000	0.001	0.009*	0.009*	0.009***	0.001
	(0.952)	(0.947)	(0.548)	(0.087)	(0.063)	(0.001)	(0.742)
UR	-0.012	-0.012	-0.014	-0.019	-0.019	-0.019	-0.012
	(0.584)	(0.554)	(0.160)	(0.703)	(0.682)	(0.365)	(0.609)
TFSL	-0.004	-0.004**	-0.003***	0.001	0.001	0.001	-0.003
	(0.118)	(0.014)	(0.002)	(0.825)	(0.870)	(0.267)	(0.142)
AR	-0.007	-0.007	-0.002	0.019	0.019	0.019	-0.008
	(0.738)	(0.650)	(0.920)	(0.574)	(0.562)	(0.457)	(0.691)
LTUR	0.012	0.012	0.020	-0.001	-0.001	-0.001	0.011
	(0.814)	(0.493)	(0.491)	(0.984)	(0.984)	(0.966)	(0.822)
YUR	-0.007	-0.007	-0.016*	-0.011	-0.011	-0.011	-0.008
	(0.637)	(0.375)	(0.084)	(0.371)	(0.402)	(0.136)	(0.571)
constant	0.149	0.149	0.123	-0.886*	-1.052**	-0.886**	0.054
	(0.623)	(0.685)	(0.588)	(0.065)	(0.022)	(0.020)	(0.866)
R-sqr	0.265	0.265	0.280	0.316	0.467		
Within.R-sqr				0.316		0.316	0.252
Over.R-sqr				0.088			0.262
Betw.R-sqr				0.023			0.458
No. of observations	170	170	170	170	170	170	170
Pesaran cross-sectional dependence test				.			.
Pesaran cross-sectional dependence test, P-val				.			.
D'Agostino normality test	12.707	12.707	13.475	10.074	10.074	0.048	11.888
D'Agostino normality test, P-val	0.002	0.002	0.001	0.006	0.006	0.976	0.003
Breusch-Pagan test	2.128						
Breusch-Pagan test, P-val	0.043						
Quasi-time-demeaned-data test of ser. corr.	0.788						
Quasi-time-demeaned-data test of ser. corr., P-val	0.431						
Relevance/redundancy of FE test					1.798		
Relevance/redundancy of FE test, P-val					0.016		
Hausman test							81.805
Hausman test, P-val							0.000
Cor.Pred.Crisis - In sample	0.346	0.346	0.423	0.692	0.692	0.462	0.365
aNtS - In sample	0.245	0.245	0.320	0.073	0.073	0.459	0.278
CPR - In sample	0.741	0.741	0.729	0.871	0.871	0.688	0.735
Absolute Utility - In sample	0.131	0.131	0.144	0.321	0.321	0.125	0.132
AUROC - In sample	0.824	0.824	0.799	0.914	0.914	0.686	0.816
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.317	0.317	0.317	0.634	0.634	0.537	0.293
aNtS - Out sample	0.489	0.489	0.489	0.533	0.533	0.604	0.433
CPR - Out sample	0.652	0.652	0.652	0.652	0.652	0.625	0.661
Absolute Utility - Out sample	0.081	0.081	0.081	0.148	0.148	0.106	0.083
AUROC - Out sample	0.668	0.668	0.632	0.695	0.695	0.641	0.683
Cor.Pred.Crisis - Out sample (first year only)	0.389	0.389	0.278	0.611	0.611	0.556	0.333
aNtS - Out sample (first year only)	0.514	0.514	0.720	0.000	0.000	0.360	0.600
CPR - Out sample (first year only)	0.536	0.536	0.464	0.750	0.750	0.643	0.500
Absolute Utility - Out sample (first year only)	0.094	0.094	0.039	0.306	0.306	0.178	0.067
AUROC - Out sample (first year only)	0.711	0.711	0.678	0.889	0.889	0.689	0.711

Note: The table presents estimated models for crisis variable for EU countries, using two year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.59 **In-sample econometric results for the EU, three year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	-0.007	-0.007	-0.020***	-0.043***	-0.043***	-0.043***	-0.017
	(0.488)	(0.198)	(0.007)	(0.000)	(0.001)	(0.000)	(0.130)
NIIP	-0.002	-0.002	-0.001	-0.002	-0.002	-0.002	-0.001
	(0.160)	(0.246)	(0.497)	(0.437)	(0.224)	(0.158)	(0.291)
EMS	-0.001	-0.001	-0.001	-0.002	-0.002	-0.002	-0.001
	(0.655)	(0.342)	(0.701)	(0.344)	(0.351)	(0.317)	(0.612)
NULC	0.014***	0.014***	0.012***	0.012***	0.012**	0.012***	0.013***
	(0.007)	(0.000)	(0.001)	(0.007)	(0.011)	(0.000)	(0.004)
REER	-0.023***	-0.023***	-0.025***	-0.027***	-0.027***	-0.027***	-0.025***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PSD	0.001	0.001	0.000	0.003	0.003*	0.003	0.001
	(0.375)	(0.157)	(0.325)	(0.202)	(0.091)	(0.103)	(0.164)
PSCF	0.002**	0.002	0.001	0.000	0.000	0.000	0.001**
	(0.027)	(0.182)	(0.480)	(0.904)	(0.925)	(0.905)	(0.038)
HPI	0.009***	0.009***	0.008***	0.013***	0.013***	0.013***	0.010***
	(0.009)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
GGSD	-0.001	-0.001	-0.002*	-0.010**	-0.010***	-0.010***	-0.002
	(0.667)	(0.273)	(0.091)	(0.036)	(0.001)	(0.003)	(0.444)
UR	-0.018	-0.018	-0.035**	0.023	0.023	0.023	-0.019
	(0.340)	(0.218)	(0.014)	(0.465)	(0.355)	(0.193)	(0.282)
TFSL	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003**	-0.003*
	(0.122)	(0.287)	(0.161)	(0.156)	(0.221)	(0.029)	(0.098)
AR	-0.053*	-0.053**	-0.055***	-0.054***	-0.054**	-0.054***	-0.055**
	(0.052)	(0.045)	(0.001)	(0.001)	(0.019)	(0.003)	(0.010)
LTUR	-0.024	-0.024	-0.009	-0.044	-0.044	-0.044***	-0.028
	(0.450)	(0.394)	(0.743)	(0.239)	(0.149)	(0.002)	(0.372)
YUR	0.021**	0.021***	0.015**	0.025**	0.025***	0.025***	0.021**
	(0.028)	(0.002)	(0.017)	(0.015)	(0.001)	(0.000)	(0.013)
constant	0.319	0.319	0.572***	0.084	0.378	0.084	0.334
	(0.190)	(0.132)	(0.001)	(0.821)	(0.233)	(0.778)	(0.141)
R-sqr	0.252	0.252	0.258	0.350	0.488		
Within.R-sqr				0.350		0.350	0.311
Over.R-sqr				0.145			0.245
Betw.R-sqr				0.072			0.136
No. of observations	254	254	254	254	254	254	254
Pesaran cross-sectional dependence test				4.619			6.487
Pesaran cross-sectional dependence test, P-val				0.000			0.000
D'Agostino normality test	23.943	23.943	21.156	3.044	3.044	0.523	15.492
D'Agostino normality test, P-val	0.000	0.000	0.000	0.218	0.218	0.770	0.000
Breusch-Pagan test	4.347						
Breusch-Pagan test, P-val	0.000						
Quasi-time-demeaned-data test of ser. corr.	2.645						
Quasi-time-demeaned-data test of ser. corr., P-val	0.008						
Relevance/redundancy of FE test					3.618		
Relevance/redundancy of FE test, P-val					0.000		
Hausman test							121.567
Hausman test, P-val							0.000
Cor.Pred.Crisis - In sample	0.461	0.461	0.438	0.798	0.798	0.562	0.472
aNtS - In sample	0.224	0.224	0.263	0.129	0.129	0.485	0.244
CPR - In sample	0.744	0.744	0.728	0.862	0.862	0.669	0.740
Absolute Utility - In sample	0.179	0.179	0.162	0.347	0.347	0.145	0.178
AUROC - In sample	0.819	0.819	0.800	0.923	0.923	0.722	0.812
First year out of sample	2017						
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for EU countries, using three year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.60 **Out-of-sample econometric results for the EU, three year time lag (LPM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS
CA	0.000	0.000		-0.021	-0.021	-0.021	0.000
	(0.969)	(0.896)		(0.400)	(0.435)	(0.164)	(0.984)
NIIP	-0.004***	-0.004***		-0.005*	-0.005*	-0.005***	-0.004***
	(0.002)	(0.002)		(0.057)	(0.090)	(0.004)	(0.000)
EMS	0.000	0.000		-0.002	-0.002	-0.002	0.000
	(0.963)	(0.951)		(0.491)	(0.576)	(0.439)	(0.978)
NULC	0.010*	0.010***		0.009	0.009	0.009***	0.010*
	(0.086)	(0.000)		(0.311)	(0.253)	(0.000)	(0.077)
REER	-0.030***	-0.030***		-0.033***	-0.033***	-0.033***	-0.030***
	(0.000)	(0.000)		(0.000)	(0.001)	(0.000)	(0.000)
PSD	0.001	0.001		0.002	0.002	0.002	0.001
	(0.448)	(0.462)		(0.279)	(0.359)	(0.107)	(0.418)
PSCF	0.001	0.001		0.000	0.000	0.000	0.001
	(0.143)	(0.481)		(0.820)	(0.912)	(0.765)	(0.145)
HPI	0.009**	0.009***		0.015***	0.015**	0.015***	0.009**
	(0.033)	(0.003)		(0.001)	(0.012)	(0.000)	(0.021)
GGSD	-0.001	-0.001		0.008	0.008	0.008***	-0.001
	(0.548)	(0.574)		(0.214)	(0.267)	(0.007)	(0.554)
UR	-0.037	-0.037**		-0.060	-0.060	-0.060***	-0.037
	(0.132)	(0.017)		(0.271)	(0.348)	(0.006)	(0.120)
TFSL	-0.007***	-0.007***		-0.003	-0.003	-0.003	-0.007***
	(0.008)	(0.000)		(0.204)	(0.330)	(0.119)	(0.004)
AR	-0.013	-0.013		-0.004	-0.004	-0.004	-0.014
	(0.616)	(0.565)		(0.920)	(0.925)	(0.839)	(0.581)
LTUR	-0.023	-0.023*		-0.002	-0.002	-0.002	-0.022
	(0.649)	(0.059)		(0.960)	(0.972)	(0.879)	(0.645)
YUR	0.010	0.010		0.013	0.013	0.013***	0.010
	(0.337)	(0.388)		(0.245)	(0.416)	(0.005)	(0.314)
constant	0.520**	0.520		-0.105	-0.392	-0.105	0.513**
	(0.043)	(0.192)		(0.838)	(0.484)	(0.682)	(0.034)
R-sqr	0.322	0.322	0.000	0.355	0.531		
Within.R-sqr				0.355		0.355	0.305
Over.R-sqr				0.136			0.321
Betw.R-sqr				0.075			0.435
No. of observations	142	142	441	142	142	142	142
Pesaran cross-sectional dependence test				.			.
Pesaran cross-sectional dependence test, P-val				.			.
D'Agostino normality test	10.559	10.559		5.132	5.132	0.071	10.092
D'Agostino normality test, P-val	0.005	0.005		0.077	0.077	0.965	0.006
Breusch-Pagan test	1.493						
Breusch-Pagan test, P-val	0.148						
Quasi-time-demeaned-data test of ser. corr.	1.180						
Quasi-time-demeaned-data test of ser. corr., P-val	0.238						
Relevance/redundancy of FE test					1.654		
Relevance/redundancy of FE test, P-val					0.039		
Hausman test							107.509
Hausman test, P-val							0.000
Cor.Pred.Crisis - In sample	0.604	0.604		0.750	0.750	0.500	0.625
aNtS - In sample	0.194	0.194		0.057	0.057	0.426	0.187
CPR - In sample	0.789	0.789		0.887	0.887	0.690	0.796
Absolute Utility - In sample	0.244	0.244		0.354	0.354	0.144	0.254
AUROC - In sample	0.856	0.856		0.935	0.935	0.736	0.856
First year out of sample	2013						
Cor.Pred.Crisis - Out sample	0.439	0.439		0.829	0.829	0.585	0.439
aNtS - Out sample	0.577	0.577		0.577	0.577	0.674	0.577
CPR - Out sample	0.634	0.634		0.634	0.634	0.598	0.634
Absolute Utility - Out sample	0.093	0.093		0.175	0.175	0.095	0.093
AUROC - Out sample	0.652	0.652		0.728	0.728	0.659	0.654
Cor.Pred.Crisis - Out sample (first year only)	0.556	0.556		0.833	0.833	0.667	0.556
aNtS - Out sample (first year only)	0.720	0.720		0.480	0.480	0.300	0.720
CPR - Out sample (first year only)	0.571	0.571		0.750	0.750	0.714	0.571
Absolute Utility - Out sample (first year only)	0.078	0.078		0.217	0.217	0.233	0.078
AUROC - Out sample (first year only)	0.756	0.756		0.889	0.889	0.767	0.750

Note: The table presents estimated models for crisis variable for EU countries, using three year lag of all explanatory variables, which are represented as indicator variables obtaining value one when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), and random effects linear probability model (REOLS on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.61 **In-sample econometric results for the EU, one year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.088	0.088**	0.026	0.106	0.106*	0.106**	0.100	0.089	0.089	0.090	0.092
	(0.285)	(0.022)	(0.613)	(0.173)	(0.100)	(0.018)	(0.188)	(0.235)	(0.235)	(0.222)	(0.209)
NIIP	0.072	0.072	0.170**	0.176	0.176	0.176**	0.102	0.070	0.069	0.066	0.069
	(0.420)	(0.130)	(0.028)	(0.118)	(0.210)	(0.032)	(0.241)	(0.419)	(0.423)	(0.422)	(0.402)
EMS	0.219**	0.219**	0.160**	0.249**	0.249***	0.249***	0.230***	0.209***	0.208***	0.203***	0.199***
	(0.014)	(0.020)	(0.031)	(0.012)	(0.000)	(0.000)	(0.007)	(0.007)	(0.007)	(0.007)	(0.009)
NULC	0.005	0.005	0.043	0.073	0.073	0.073**	0.031	-0.008	0.004	-0.009	-0.003
	(0.947)	(0.922)	(0.560)	(0.361)	(0.289)	(0.017)	(0.679)	(0.924)	(0.967)	(0.906)	(0.968)
REER	0.089	0.089	0.081	0.137**	0.137**	0.137***	0.116**	0.086*	0.097*	0.091*	0.104**
	(0.149)	(0.141)	(0.206)	(0.019)	(0.033)	(0.002)	(0.035)	(0.099)	(0.069)	(0.080)	(0.039)
PSD	0.004	0.004	0.062	0.002	0.002	0.002	0.014	0.003	-0.000	-0.001	-0.005
	(0.962)	(0.920)	(0.325)	(0.985)	(0.985)	(0.964)	(0.856)	(0.963)	(0.997)	(0.993)	(0.939)
PSCF	-0.049	-0.049	-0.085	-0.031	-0.031	-0.031	-0.046	-0.059	-0.041	-0.058	-0.040
	(0.474)	(0.543)	(0.212)	(0.591)	(0.711)	(0.557)	(0.417)	(0.482)	(0.629)	(0.463)	(0.610)
HPI	-0.300***	-0.300***	-0.203***	-0.266***	-0.266***	-0.266***	-0.276***	-0.007	-0.423***	0.100	-0.406***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)	(0.960)	(0.005)	(0.373)	(0.000)
GGSD	-0.157*	-0.157***	-0.009	0.137	0.137	0.137	-0.018	-0.147*	-0.147*	-0.151**	-0.149**
	(0.060)	(0.000)	(0.928)	(0.277)	(0.168)	(0.442)	(0.842)	(0.057)	(0.058)	(0.040)	(0.044)
UR	0.016	0.016	-0.015	0.100	0.100	0.100**	0.054	0.008	0.012	0.009	0.012
	(0.849)	(0.674)	(0.804)	(0.253)	(0.225)	(0.025)	(0.460)	(0.915)	(0.881)	(0.907)	(0.875)
TFSL	-0.040	-0.040	-0.026	-0.015	-0.015	-0.015	-0.044	-0.044	-0.045	-0.028	-0.041
	(0.657)	(0.669)	(0.720)	(0.848)	(0.869)	(0.833)	(0.586)	(0.745)	(0.718)	(0.812)	(0.707)
AR	0.060	0.060	0.011	0.019	0.019	0.019	0.040	0.055	0.056	0.058	0.060
	(0.344)	(0.345)	(0.888)	(0.726)	(0.786)	(0.742)	(0.451)	(0.282)	(0.281)	(0.246)	(0.233)
LTUR	0.150*	0.150**	0.142**	0.145*	0.145*	0.145	0.151**	0.132*	0.130*	0.144**	0.134*
	(0.091)	(0.015)	(0.034)	(0.071)	(0.058)	(0.109)	(0.048)	(0.069)	(0.076)	(0.047)	(0.069)
YUR	0.007	0.007	-0.029	0.004	0.004	0.004	0.005	-0.010	-0.010	-0.022	-0.019
	(0.930)	(0.910)	(0.630)	(0.956)	(0.959)	(0.906)	(0.945)	(0.864)	(0.871)	(0.724)	(0.771)
constant	0.193**	0.193	0.084	-0.055	-0.210	-0.055	0.085				
	(0.032)	(0.115)	(0.395)	(0.631)	(0.171)	(0.610)	(0.346)				
R-sqr	0.200	0.200	0.153	0.245	0.385						
Within.R-sqr				0.245		0.245	0.236				
Over.R-sqr				0.134			0.180				
Betw.R-sqr				0.010			0.047				
Pseud.R-sqr								0.201	0.191		
No. of observations	310	310	310	310	310	310	310	310	310	310	310
Pesaran cross-sectional dependence test				8.889			8.682				
Pesaran cross-sectional dependence test, P-val				0.000			0.000				
D'Agostino normality test	46.317	46.317	52.215	8.537	8.537	17.669	15.286				
D'Agostino normality test, P-val	0.000	0.000	0.000	0.014	0.014	0.000	0.000				
Breusch-Pagan test	5.488										
Breusch-Pagan test, P-val	0.000										
Quasi-time-demeaned-data test of ser. corr.	2.513										
Quasi-time-demeaned-data test of ser. corr., P-val	0.012										
Relevance/redundancy of FE test					2.984						
Relevance/redundancy of FE test, P-val					0.000						
Hausman test							33.882				
Hausman test, P-val							0.002				
Cor.Pred.Crisis - In sample	0.464	0.464	0.330	0.619	0.619	0.443	0.454	0.443	0.454	0.443	0.443
aNtS - In sample	0.182	0.182	0.157	0.144	0.144	0.286	0.217	0.244	0.238	0.222	0.222
CPR - In sample	0.774	0.774	0.755	0.819	0.819	0.739	0.761	0.752	0.755	0.758	0.758
Absolute Utility - In sample	0.190	0.190	0.139	0.265	0.265	0.158	0.178	0.168	0.173	0.172	0.172
AUROC - In sample	0.786	0.786	0.756	0.878	0.878	0.704	0.761	0.787	0.785	0.786	0.781
First year out of sample	2017										
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for EU countries, using one year lag of all explanatory variables. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.62 **Out-of-sample econometric results for the EU, one year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.016	0.016	0.095	0.186*	0.186*	0.186**	0.081	0.015	0.011		
	(0.873)	(0.698)	(0.160)	(0.070)	(0.067)	(0.043)	(0.393)	(0.871)	(0.907)		
NIIP	0.083	0.083*	0.170**	0.318**	0.318**	0.318***	0.132	0.106	0.113		
	(0.463)	(0.055)	(0.032)	(0.037)	(0.040)	(0.000)	(0.248)	(0.329)	(0.287)		
EMS	0.059	0.059	0.020	0.165	0.165*	0.165***	0.096	0.053	0.052		
	(0.523)	(0.171)	(0.797)	(0.159)	(0.080)	(0.000)	(0.302)	(0.513)	(0.521)		
NULC	0.066	0.066	0.052	0.064	0.064	0.064*	0.037	0.037	0.043		
	(0.452)	(0.146)	(0.456)	(0.511)	(0.411)	(0.059)	(0.661)	(0.626)	(0.581)		
REER	0.011	0.011	0.075	0.136*	0.136*	0.136***	0.072	0.002	0.004		
	(0.909)	(0.885)	(0.258)	(0.073)	(0.081)	(0.001)	(0.375)	(0.987)	(0.968)		
PSD	0.040	0.040	0.107	0.009	0.009	0.009	0.038	0.045	0.049		
	(0.647)	(0.443)	(0.305)	(0.953)	(0.951)	(0.641)	(0.683)	(0.569)	(0.518)		
PSCF	-0.156*	-0.156***	-0.149**	-0.113	-0.113	-0.113***	-0.146*	0.188	0.391***		
	(0.068)	(0.002)	(0.022)	(0.124)	(0.228)	(0.003)	(0.061)	(0.141)	(0.005)		
HPI	-0.313***	-0.313***	-0.239***	-0.305***	-0.305***	-0.305***	-0.309***	-0.137	-0.478**		
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.515)	(0.015)		
GGSD	-0.091	-0.091	0.106	0.533***	0.533***	0.533***	0.079	-0.070	-0.066		
	(0.342)	(0.227)	(0.380)	(0.000)	(0.000)	(0.000)	(0.481)	(0.349)	(0.377)		
UR	0.032	0.032	0.046	0.137	0.137	0.137	0.046	0.011	0.011		
	(0.783)	(0.582)	(0.557)	(0.199)	(0.199)	(0.211)	(0.651)	(0.918)	(0.920)		
TFSL	0.004	0.004	-0.002	-0.024	-0.024	-0.024	-0.029	0.402***	0.050		
	(0.956)	(0.962)	(0.966)	(0.793)	(0.809)	(0.679)	(0.709)	(0.002)	(0.598)		
AR	0.010	0.010	0.039	-0.012	-0.012	-0.012	0.037	0.002	0.010		
	(0.844)	(0.870)	(0.729)	(0.845)	(0.889)	(0.791)	(0.476)	(0.967)	(0.835)		
LTUR	0.113	0.113	0.022	0.019	0.019	0.019	0.074	0.118*	0.117*		
	(0.120)	(0.226)	(0.763)	(0.830)	(0.843)	(0.717)	(0.303)	(0.086)	(0.092)		
YUR	-0.092	-0.092	-0.064	-0.038	-0.038	-0.038	-0.070	-0.118	-0.121		
	(0.269)	(0.219)	(0.254)	(0.623)	(0.693)	(0.347)	(0.366)	(0.130)	(0.106)		
constant	0.314***	0.314**	0.098	-0.169	-0.441**	-0.169	0.182*				
	(0.001)	(0.029)	(0.482)	(0.157)	(0.030)	(0.118)	(0.065)				
R-sqr	0.161	0.161	0.170	0.304	0.454					0.000	0.000
Within.R-sqr				0.304		0.304	0.252				
Over.R-sqr				0.044			0.129				
Betw.R-sqr				0.012			0.000				
Pseud.R-sqr								0.219	0.232		
No. of observations	198	198	198	198	198	198	198	198	198	441	441
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	46.484	46.484	22.754	15.611	15.611	6.121	15.239				
D'Agostino normality test, P-val	0.000	0.000	0.000	0.000	0.000	0.047	0.000				
Breusch-Pagan test	2.728										
Breusch-Pagan test, P-val	0.011										
Quasi-time-demeaned-data test of ser. corr.	1.629										
Quasi-time-demeaned-data test of ser. corr., P-val	0.103										
Relevance/redundancy of FE test					3.097						
Relevance/redundancy of FE test, P-val					0.000						
Hausman test							416.943				
Hausman test, P-val							0.000				
Cor.Pred.Crisis - In sample	0.107	0.107	0.196	0.661	0.661	0.446	0.304	0.286	0.304		
aNtS - In sample	0.592	0.592	0.359	0.043	0.043	0.615	0.278	0.370	0.371		
CPR - In sample	0.702	0.702	0.722	0.884	0.884	0.646	0.742	0.722	0.722		
Absolute Utility - In sample	0.022	0.022	0.063	0.316	0.316	0.086	0.110	0.090	0.095		
AUROC - In sample	0.761	0.761	0.717	0.896	0.896	0.619	0.724	0.770	0.770		
First year out of sample	2013										
Cor.Pred.Crisis - Out sample	0.122	0.122	0.268	0.683	0.683	0.585	0.439	0.293	0.390		
aNtS - Out sample	0.693	0.693	0.210	0.392	0.392	0.818	0.225	0.385	0.433		
CPR - Out sample	0.625	0.625	0.696	0.714	0.714	0.545	0.732	0.670	0.670		
Absolute Utility - Out sample	0.019	0.019	0.106	0.208	0.208	0.053	0.170	0.090	0.111		
AUROC - Out sample	0.697	0.697	0.647	0.734	0.734	0.636	0.733	0.707	0.663		
Cor.Pred.Crisis - Out sample (first year only)	0.111	0.111	0.222	0.611	0.611	0.500	0.389	0.278	0.278		
aNtS - Out sample (first year only)	3.600	3.600	0.000	0.327	0.327	0.800	0.514	1.440	1.440		
CPR - Out sample (first year only)	0.286	0.286	0.500	0.679	0.679	0.536	0.536	0.393	0.393		
Absolute Utility - Out sample (first year only)	-0.144	-0.144	0.111	0.206	0.206	0.050	0.094	-0.061	-0.061		
AUROC - Out sample (first year only)	0.464	0.464	0.492	0.789	0.789	0.525	0.636	0.508	0.481		

Note: The table presents estimated models for crisis variable for EU countries, using one year lag of all explanatory variables, which are represented as indicator variables for the cases when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.63 **In-sample econometric results for the EU, two year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.145	0.145**	0.109*	0.177**	0.177**	0.177***	0.164*	0.142*	0.141*	0.145*	0.143*
	(0.136)	(0.021)	(0.082)	(0.049)	(0.021)	(0.000)	(0.057)	(0.086)	(0.084)	(0.081)	(0.082)
NIIP	0.047	0.047	0.113	0.152	0.152	0.152	0.070	0.043	0.046	0.049	0.052
	(0.624)	(0.530)	(0.170)	(0.308)	(0.342)	(0.161)	(0.488)	(0.634)	(0.607)	(0.565)	(0.543)
EMS	0.168*	0.168*	0.058	0.104	0.104	0.104	0.134	0.166*	0.166**	0.163*	0.164*
	(0.073)	(0.067)	(0.496)	(0.335)	(0.207)	(0.318)	(0.163)	(0.052)	(0.047)	(0.059)	(0.053)
NULC	-0.006	-0.006	-0.074	-0.028	-0.028	-0.028	-0.028	-0.012	-0.010	-0.019	-0.014
	(0.938)	(0.869)	(0.324)	(0.750)	(0.717)	(0.545)	(0.717)	(0.885)	(0.898)	(0.811)	(0.866)
REER	0.039	0.039	0.035	0.042	0.042	0.042	0.039	0.041	0.045	0.038	0.041
	(0.535)	(0.679)	(0.616)	(0.529)	(0.568)	(0.553)	(0.532)	(0.491)	(0.454)	(0.513)	(0.462)
PSD	-0.069	-0.069*	-0.061	-0.130*	-0.130	-0.130	-0.071	-0.077	-0.078	-0.081	-0.081
	(0.425)	(0.058)	(0.336)	(0.096)	(0.331)	(0.289)	(0.317)	(0.370)	(0.359)	(0.344)	(0.343)
PSCF	0.072	0.072	0.077	0.057	0.057	0.057	0.065	0.106	0.119	0.101	0.111
	(0.444)	(0.249)	(0.250)	(0.491)	(0.546)	(0.361)	(0.436)	(0.239)	(0.157)	(0.248)	(0.181)
HPI	-0.231***	-0.231***	-0.127*	-0.209**	-0.209**	-0.209***	-0.206**	-0.223***	-0.152**	-0.229***	-0.176***
	(0.006)	(0.000)	(0.075)	(0.035)	(0.019)	(0.000)	(0.014)	(0.002)	(0.032)	(0.002)	(0.010)
GGSD	-0.165*	-0.165***	-0.098	-0.043	-0.043	-0.043	-0.110	-0.165**	-0.164**	-0.166**	-0.165**
	(0.051)	(0.000)	(0.264)	(0.767)	(0.718)	(0.824)	(0.214)	(0.037)	(0.041)	(0.032)	(0.033)
UR	-0.091	-0.091	-0.111*	-0.099	-0.099	-0.099	-0.106	-0.080	-0.078	-0.090	-0.086
	(0.316)	(0.210)	(0.089)	(0.424)	(0.304)	(0.229)	(0.265)	(0.355)	(0.366)	(0.290)	(0.311)
TFSL	-0.044	-0.044	-0.011	-0.087	-0.087	-0.087	-0.083	-0.022	-0.011	-0.017	0.000
	(0.705)	(0.617)	(0.889)	(0.453)	(0.399)	(0.200)	(0.468)	(0.850)	(0.929)	(0.875)	(0.998)
AR	0.125	0.125*	0.101	0.126	0.126	0.126**	0.131	0.117	0.124	0.117	0.123
	(0.208)	(0.085)	(0.204)	(0.245)	(0.110)	(0.039)	(0.197)	(0.138)	(0.120)	(0.158)	(0.133)
LTUR	0.112	0.112	0.115	0.110	0.110	0.110	0.116	0.113	0.119	0.109	0.121
	(0.227)	(0.300)	(0.118)	(0.214)	(0.213)	(0.325)	(0.168)	(0.157)	(0.157)	(0.192)	(0.160)
YUR	0.069	0.069	0.040	0.065	0.065	0.065	0.067	0.058	0.057	0.066	0.056
	(0.454)	(0.464)	(0.522)	(0.474)	(0.439)	(0.426)	(0.448)	(0.493)	(0.486)	(0.442)	(0.498)
constant	0.231**	0.231	0.204*	0.186	0.058	0.186	0.214**				
	(0.019)	(0.143)	(0.052)	(0.206)	(0.743)	(0.309)	(0.032)				
R-sqr	0.142	0.142	0.073	0.138	0.300						
Within.R-sqr				0.138		0.138	0.135				
Over.R-sqr				0.113			0.138				
Betw.R-sqr				0.074			0.158				
Pseud.R-sqr								0.128	0.154		
No. of observations	282	282	282	282	282	282	282	282	282	282	282
Pesaran cross-sectional dependence test				10.483			10.053				
Pesaran cross-sectional dependence test, P-val				0.000			0.000				
D'Agostino normality test	61.668	61.668	.	13.966	13.966	43.733	25.918				
D'Agostino normality test, P-val	0.000	0.000	.	0.001	0.001	0.000	0.000				
Breusch-Pagan test	5.501										
Breusch-Pagan test, P-val	0.000										
Quasi-time-demeaned-data test of ser. corr.	1.959										
Quasi-time-demeaned-data test of ser. corr., P-val	0.050										
Relevance/redundancy of FE test					2.006						
Relevance/redundancy of FE test, P-val					0.003						
Hausman test							18.251				
Hausman test, P-val							0.196				
Cor.Pred.Crisis - In sample	0.366	0.366	0.108	0.559	0.559	0.430	0.366	0.398	0.355	0.398	0.355
aNtS - In sample	0.261	0.261	0.246	0.180	0.180	0.295	0.275	0.253	0.328	0.279	0.298
CPR - In sample	0.727	0.727	0.688	0.787	0.787	0.727	0.723	0.734	0.709	0.727	0.716
Absolute Utility - In sample	0.135	0.135	0.041	0.229	0.229	0.152	0.133	0.149	0.119	0.143	0.125
AUROC - In sample	0.723	0.723	0.703	0.831	0.831	0.694	0.719	0.725	0.726	0.727	0.728
First year out of sample	2017										
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for EU countries, using two year lag of all explanatory variables. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.64 **Out-of-sample econometric results for the EU, two year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.022	0.022	0.073	-0.006	-0.006	-0.006	0.043	0.019	0.015	0.015	0.001
	(0.836)	(0.570)	(0.427)	(0.960)	(0.964)	(0.910)	(0.679)	(0.834)	(0.870)	(0.867)	(0.995)
NIIP	0.129	0.129**	0.148	0.277*	0.277	0.277***	0.167	0.138	0.142	0.145	0.157
	(0.277)	(0.024)	(0.121)	(0.063)	(0.143)	(0.000)	(0.155)	(0.199)	(0.180)	(0.162)	(0.128)
EMS	0.062	0.062	-0.036	0.038	0.038	0.038	0.055	0.068	0.067	0.071	0.067
	(0.585)	(0.461)	(0.764)	(0.815)	(0.749)	(0.779)	(0.659)	(0.515)	(0.510)	(0.483)	(0.493)
NULC	0.002	0.002	-0.070	-0.089	-0.089	-0.089	-0.054	-0.006	-0.003	-0.011	-0.004
	(0.982)	(0.960)	(0.363)	(0.315)	(0.366)	(0.179)	(0.528)	(0.937)	(0.968)	(0.887)	(0.956)
REER	-0.053	-0.053	-0.030	-0.024	-0.024	-0.024	-0.039	-0.065	-0.074	-0.069	-0.078
	(0.586)	(0.189)	(0.724)	(0.777)	(0.802)	(0.709)	(0.665)	(0.509)	(0.454)	(0.455)	(0.394)
PSD	-0.070	-0.070	-0.069	-0.340**	-0.340*	-0.340**	-0.094	-0.069	-0.063	-0.068	-0.056
	(0.428)	(0.143)	(0.660)	(0.016)	(0.071)	(0.012)	(0.326)	(0.416)	(0.459)	(0.414)	(0.502)
PSCF	-0.017	-0.017	0.004	-0.038	-0.038	-0.038	-0.018	-0.014	0.005	-0.010	0.001
	(0.882)	(0.710)	(0.969)	(0.720)	(0.731)	(0.395)	(0.866)	(0.899)	(0.960)	(0.921)	(0.988)
HPI	-0.222***	-0.222***	-0.110	-0.240*	-0.240**	-0.240***	-0.210**	-0.215***	-0.184***	-0.214***	-0.194***
	(0.005)	(0.001)	(0.283)	(0.055)	(0.022)	(0.000)	(0.021)	(0.000)	(0.002)	(0.001)	(0.002)
GGSD	-0.175**	-0.175**	-0.077	0.275**	0.275	0.275**	-0.102	-0.174***	-0.176***	-0.178***	-0.177***
	(0.023)	(0.029)	(0.459)	(0.015)	(0.204)	(0.013)	(0.187)	(0.008)	(0.007)	(0.008)	(0.006)
UR	-0.192	-0.192***	-0.161**	-0.222	-0.222*	-0.222**	-0.216*	-0.199	-0.196	-0.208	-0.203
	(0.158)	(0.009)	(0.025)	(0.106)	(0.098)	(0.035)	(0.076)	(0.138)	(0.132)	(0.109)	(0.106)
TFSL	-0.026	-0.026	-0.079	-0.125	-0.125	-0.125*	-0.075	-0.021	0.008	-0.024	0.010
	(0.778)	(0.757)	(0.118)	(0.299)	(0.288)	(0.067)	(0.441)	(0.821)	(0.926)	(0.780)	(0.905)
AR	0.006	0.006	0.125	0.148	0.148	0.148	0.073	0.004	0.014	-0.003	0.009
	(0.960)	(0.943)	(0.429)	(0.262)	(0.206)	(0.210)	(0.557)	(0.971)	(0.896)	(0.976)	(0.930)
LTUR	0.094	0.094	0.114	0.015	0.015	0.015	0.067	0.094	0.105	0.096	0.113
	(0.342)	(0.590)	(0.259)	(0.899)	(0.896)	(0.920)	(0.511)	(0.330)	(0.284)	(0.318)	(0.239)
YUR	-0.062	-0.062	-0.101	- 0.044	-0.044	-0.044	-0.046	-0.065	-0.069	-0.057	-0.066
	(0.594)	(0.443)	(0.133)	(0.714)	(0.695)	(0.290)	(0.684)	(0.568)	(0.550)	(0.596)	(0.542)
constant	0.421***	0.421**	0.330***	0.386*	-0.112	0.386**	0.400***				
	(0.000)	(0.016)	(0.008)	(0.060)	(0.684)	(0.030)	(0.000)				
R-sqr	0.102	0.102	0.097	0.162	0.347						
Within.R-sqr				0.162		0.162	0.123				
Over.R-sqr				0.018			0.089				
Betw.R-sqr				0.000			0.075				
Pseud.R-sqr								0.106	0.145		
No. of observations	170	170	170	170	170	170	170	170	170	170	170
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	45.661	45.661	43.562	10.126	10.126	11.358	27.270				
D'Agostino normality test, P-val	0.000	0.000	0.000	0.006	0.006	0.003	0.000				
Breusch-Pagan test	2.873										
Breusch-Pagan test, P-val	0.008										
Quasi-time-demeaned-data test of ser. corr.	0.991										
Quasi-time-demeaned-data test of ser. corr., P-val	0.322										
Relevance/redundancy of FE test					1.784						
Relevance/redundancy of FE test, P-val					0.017						
Hausman test							76.339				
Hausman test, P-val							0.000				
Cor.Pred.Crisis - In sample	0.173	0.173	0.077	0.558	0.558	0.404	0.173	0.173	0.173	0.173	0.192
aNtS - In sample	0.343	0.343	0.331	0.137	0.137	0.797	0.294	0.294	0.441	0.294	0.441
CPR - In sample	0.706	0.706	0.700	0.812	0.812	0.594	0.712	0.712	0.694	0.712	0.694
Absolute Utility - In sample	0.057	0.057	0.026	0.241	0.241	0.041	0.061	0.061	0.048	0.061	0.054
AUROC - In sample	0.692	0.692	0.667	0.855	0.855	0.572	0.679	0.692	0.694	0.691	0.691
First year out of sample	2013										
Cor.Pred.Crisis - Out sample	0.146	0.146	0.098	0.561	0.561	0.488	0.146	0.171	0.171	0.171	0.195
aNtS - Out sample	0.770	0.770	0.722	0.728	0.728	0.722	1.059	0.742	0.742	0.825	0.722
CPR - Out sample	0.616	0.616	0.625	0.580	0.580	0.589	0.589	0.616	0.616	0.607	0.616
Absolute Utility - Out sample	0.017	0.017	0.014	0.076	0.076	0.068	-0.004	0.022	0.022	0.015	0.027
AUROC - Out sample	0.562	0.562	0.602	0.626	0.626	0.549	0.630	0.572	0.565	0.567	0.560
Cor.Pred.Crisis - Out sample (first year only)	0.167	0.167	0.111	0.611	0.611	0.556	0.167	0.167	0.167	0.167	0.167
aNtS - Out sample (first year only)	1.200	1.200	1.800	0.655	0.655	0.900	1.200	1.200	1.200	1.200	1.200
CPR - Out sample (first year only)	0.393	0.393	0.357	0.607	0.607	0.536	0.393	0.393	0.393	0.393	0.393
Absolute Utility - Out sample (first year only)	-0.017	-0.017	-0.044	0.106	0.106	0.028	-0.017	-0.017	-0.017	-0.017	-0.017
AUROC - Out sample (first year only)	0.578	0.578	0.589	0.694	0.694	0.483	0.583	0.578	0.589	0.578	0.594

Note: The table presents estimated models for crisis variable for EU countries, using two year lag of all explanatory variables, which are represented as indicator variables for the cases when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.65 **In-sample econometric results for the EU, three year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	0.136	0.136**	0.074	0.141*	0.141	0.141**	0.147**	0.133	0.129	0.129	0.128
	(0.120)	(0.036)	(0.224)	(0.080)	(0.106)	(0.014)	(0.036)	(0.104)	(0.107)	(0.101)	(0.105)
NIIP	0.028	0.028	0.075	0.014	0.014	0.014	0.035	0.025	0.024	0.022	0.023
	(0.752)	(0.749)	(0.345)	(0.912)	(0.930)	(0.947)	(0.714)	(0.771)	(0.784)	(0.785)	(0.784)
EMS	0.147	0.147**	0.032	0.100	0.100	0.100	0.122	0.142	0.136	0.150*	0.151*
	(0.134)	(0.039)	(0.735)	(0.343)	(0.248)	(0.273)	(0.203)	(0.132)	(0.147)	(0.100)	(0.091)
NULC	0.131*	0.131***	0.099	0.072	0.072	0.072	0.098	0.122*	0.125**	0.122*	0.125*
	(0.072)	(0.000)	(0.227)	(0.326)	(0.366)	(0.254)	(0.111)	(0.052)	(0.047)	(0.061)	(0.054)
REER	-0.112	-0.112	-0.089	-0.130	-0.130*	-0.130	-0.123	-0.109	-0.110	-0.104	-0.106
	(0.213)	(0.366)	(0.271)	(0.181)	(0.087)	(0.256)	(0.174)	(0.221)	(0.222)	(0.189)	(0.183)
PSD	-0.084	-0.084	-0.082	-0.173	-0.173	-0.173	-0.106	-0.085	-0.088	-0.087	-0.090
	(0.366)	(0.166)	(0.115)	(0.100)	(0.215)	(0.135)	(0.186)	(0.364)	(0.352)	(0.351)	(0.325)
PSCF	0.099	0.099	0.061	0.104	0.104	0.104	0.108	0.100	0.115	0.104	0.114
	(0.305)	(0.125)	(0.359)	(0.190)	(0.280)	(0.128)	(0.176)	(0.232)	(0.184)	(0.234)	(0.194)
HPI	-0.044	-0.044	-0.022	0.002	0.002	0.002	0.001	-0.033	-0.009	-0.044	-0.023
	(0.588)	(0.137)	(0.725)	(0.984)	(0.983)	(0.975)	(0.995)	(0.669)	(0.912)	(0.559)	(0.757)
GGSD	-0.154*	-0.154**	-0.133**	-0.101	-0.101	-0.101	-0.124	-0.146*	-0.148*	-0.152*	-0.154*
	(0.084)	(0.036)	(0.025)	(0.418)	(0.443)	(0.504)	(0.133)	(0.074)	(0.076)	(0.059)	(0.055)
UR	-0.187*	-0.187**	-0.257***	-0.292*	-0.292***	-0.292***	-0.237**	-0.177**	-0.175*	-0.175*	-0.173*
	(0.052)	(0.028)	(0.000)	(0.058)	(0.005)	(0.000)	(0.031)	(0.050)	(0.058)	(0.051)	(0.056)
TFSL	-0.119	-0.119	-0.122	-0.194**	-0.194*	-0.194***	-0.166*	-0.105	-0.099	-0.103	-0.103
	(0.201)	(0.137)	(0.178)	(0.036)	(0.067)	(0.001)	(0.059)	(0.215)	(0.268)	(0.219)	(0.226)
AR	0.099	0.099	0.095	0.087	0.087	0.087	0.094	0.088	0.094	0.087	0.090
	(0.333)	(0.315)	(0.185)	(0.455)	(0.290)	(0.268)	(0.381)	(0.308)	(0.278)	(0.319)	(0.302)
LTUR	0.013	0.013	0.057	-0.035	-0.035	-0.035	-0.013	0.010	0.014	0.005	0.009
	(0.872)	(0.849)	(0.479)	(0.667)	(0.706)	(0.527)	(0.859)	(0.896)	(0.853)	(0.941)	(0.900)
YUR	0.192*	0.192**	0.150**	0.262***	0.262***	0.262***	0.237***	0.184**	0.186*	0.198**	0.195**
	(0.055)	(0.019)	(0.022)	(0.005)	(0.003)	(0.000)	(0.007)	(0.048)	(0.053)	(0.030)	(0.035)
constant	0.241**	0.241	0.279***	0.318**	0.089	0.318	0.250**				
	(0.023)	(0.155)	(0.003)	(0.011)	(0.636)	(0.151)	(0.012)				
R-sqr	0.151	0.151	0.136	0.165	0.342						
Within.R-sqr				0.165		0.165	0.162				
Over.R-sqr				0.127			0.145				
Betw.R-sqr				0.038			0.100				
Pseud.R-sqr								0.112	0.130		
No. of observations	254	254	254	254	254	254	254	254	254	254	254
Pesaran cross-sectional dependence test				6.825			6.795				
Pesaran cross-sectional dependence test, P-val				0.000			0.000				
D'Agostino normality test	68.058	68.058	.	9.292	9.292	61.109	26.518				
D'Agostino normality test, P-val	0.000	0.000	.	0.010	0.010	0.000	0.000				
Breusch-Pagan test	5.361										
Breusch-Pagan test, P-val	0.000										
Quasi-time-demeaned-data test of ser. corr.	2.051										
Quasi-time-demeaned-data test of ser. corr., P-val	0.040										
Relevance/redundancy of FE test					2.288						
Relevance/redundancy of FE test, P-val					0.001						
Hausman test							22.383				
Hausman test, P-val							0.071				
Cor.Pred.Crisis - In sample	0.404	0.404	0.281	0.573	0.573	0.371	0.404	0.404	0.416	0.416	0.416
aNtS - In sample	0.285	0.285	0.345	0.201	0.201	0.360	0.375	0.315	0.292	0.306	0.292
CPR - In sample	0.717	0.717	0.685	0.776	0.776	0.693	0.693	0.709	0.717	0.713	0.717
Absolute Utility - In sample	0.145	0.145	0.092	0.229	0.229	0.119	0.126	0.139	0.147	0.144	0.147
AUROC - In sample	0.732	0.732	0.727	0.864	0.864	0.727	0.733	0.733	0.739	0.735	0.736
First year out of sample	2017										
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for EU countries, using three year lag of all explanatory variables. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with panel-corrected standard errors (PLPCSE), fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.66 **Out-of-sample econometric results for the EU, three year time lag (IM setting)**

	PLOLS	PLDK	PLPCSE	FEOLS	FEDVLS	FEDK	REOLS	PLMNLOGIT	PLMNLOGITR	PLMNPROBIT	PLMNPROBITR
CA	-0.018	-0.018		-0.171	-0.171	-0.171	-0.017	-0.063	-0.060	-0.079	-0.065
	(0.878)	(0.834)		(0.165)	(0.299)	(0.200)	(0.856)	(0.570)	(0.600)	(0.458)	(0.532)
NIIP	0.126	0.126		0.167	0.167	0.167	0.165	0.186	0.187	0.189*	0.187*
	(0.283)	(0.228)		(0.426)	(0.402)	(0.311)	(0.153)	(0.117)	(0.112)	(0.087)	(0.083)
EMS	0.061	0.061		-0.044	-0.044	-0.044	0.024	0.068	0.067	0.078	0.077
	(0.588)	(0.427)		(0.732)	(0.745)	(0.626)	(0.831)	(0.525)	(0.527)	(0.436)	(0.436)
NULC	0.133	0.133***		-0.029	-0.029	-0.029	0.057	0.114*	0.109	0.113*	0.102
	(0.101)	(0.000)		(0.723)	(0.788)	(0.679)	(0.459)	(0.095)	(0.114)	(0.082)	(0.113)
REER	-0.283**	-0.283***		-0.350***	-0.350***	-0.350***	-0.310***	-0.358***	-0.358***	-0.351***	-0.345***
	(0.016)	(0.000)		(0.007)	(0.001)	(0.000)	(0.005)	(0.003)	(0.004)	(0.001)	(0.001)
PSD	-0.183*	-0.183*		-0.429**	-0.429**	-0.429***	-0.206*	-0.164*	-0.171*	-0.168*	-0.177*
	(0.091)	(0.066)		(0.021)	(0.046)	(0.000)	(0.082)	(0.094)	(0.081)	(0.089)	(0.066)
PSCF	0.111	0.111		0.050	0.050	0.050	0.098	0.088	0.088	0.092	0.093
	(0.312)	(0.227)		(0.601)	(0.657)	(0.640)	(0.301)	(0.356)	(0.356)	(0.344)	(0.337)
HPI	-0.059	-0.059**		-0.038	-0.038	-0.038	-0.017	-0.076	-0.065	-0.090	-0.075
	(0.494)	(0.046)		(0.756)	(0.711)	(0.266)	(0.862)	(0.299)	(0.387)	(0.200)	(0.282)
GGSD	-0.283***	-0.283**		0.027	0.027	0.027	-0.216***	-0.281***	-0.285***	-0.288***	-0.283***
	(0.002)	(0.028)		(0.891)	(0.915)	(0.839)	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)
UR	-0.358**	-0.358***		-0.456**	-0.456***	-0.456***	-0.381**	-0.424**	-0.403**	-0.413**	-0.396**
	(0.030)	(0.000)		(0.026)	(0.003)	(0.000)	(0.022)	(0.017)	(0.033)	(0.011)	(0.021)
TFSL	-0.147	-0.147**		-0.282***	-0.282**	-0.282***	-0.209***	-0.131*	-0.128	-0.122*	-0.128*
	(0.104)	(0.012)		(0.003)	(0.016)	(0.000)	(0.009)	(0.082)	(0.113)	(0.097)	(0.090)
AR	-0.111	-0.111		0.005	0.005	0.005	-0.062	-0.149	-0.160	-0.161	-0.177
	(0.477)	(0.311)		(0.979)	(0.974)	(0.986)	(0.706)	(0.284)	(0.268)	(0.252)	(0.218)
LTUR	-0.025	-0.025		-0.172	-0.172	-0.172***	-0.101	-0.031	-0.027	-0.012	-0.011
	(0.834)	(0.553)		(0.246)	(0.234)	(0.000)	(0.406)	(0.765)	(0.796)	(0.898)	(0.906)
YUR	0.207	0.207*		0.280*	0.280**	0.280***	0.267**	0.227*	0.222*	0.240*	0.232*
	(0.149)	(0.080)		(0.054)	(0.031)	(0.000)	(0.043)	(0.091)	(0.091)	(0.053)	(0.057)
constant	0.506***	0.506***		0.719***	0.079	0.719***	0.521***				
	(0.000)	(0.004)		(0.001)	(0.798)	(0.000)	(0.000)				
R-sqr	0.219	0.219	0.000	0.274	0.472						
Within.R-sqr				0.274		0.274	0.239				
Over.R-sqr				0.063			0.203				
Betw.R-sqr				0.007			0.162				
Pseud.R-sqr								0.193	0.190		
No. of observations	142	142	441	142	142	142	142	142	142	142	142
Pesaran cross-sectional dependence test				.			.				
Pesaran cross-sectional dependence test, P-val				.			.				
D'Agostino normality test	21.062	21.062		2.143	2.143	8.462	9.199				
D'Agostino normality test, P-val	0.000	0.000		0.342	0.342	0.015	0.010				
Breusch-Pagan test	2.468										
Breusch-Pagan test, P-val	0.021										
Quasi-time-demeaned-data test of ser. corr.	1.151										
Quasi-time-demeaned-data test of ser. corr., P-val	0.250										
Relevance/redundancy of FE test					1.779						
Relevance/redundancy of FE test, P-val					0.021						
Hausman test							45.436				
Hausman test, P-val							0.000				
Cor.Pred.Crisis - In sample	0.500	0.500		0.771	0.771	0.458	0.542	0.458	0.479	0.479	0.458
aNtS - In sample	0.277	0.277		0.124	0.124	0.673	0.255	0.348	0.311	0.311	0.325
CPR - In sample	0.739	0.739		0.859	0.859	0.613	0.754	0.711	0.725	0.725	0.718
Absolute Utility - In sample	0.181	0.181		0.338	0.338	0.075	0.202	0.149	0.165	0.165	0.155
AUROC - In sample	0.798	0.798		0.917	0.917	0.641	0.793	0.797	0.795	0.795	0.791
First year out of sample	2013										
Cor.Pred.Crisis - Out sample	0.317	0.317		0.366	0.366	0.317	0.268	0.317	0.317	0.341	0.317
aNtS - Out sample	0.800	0.800		1.116	1.116	1.377	0.892	1.022	1.022	0.949	1.022
CPR - Out sample	0.589	0.589		0.509	0.509	0.473	0.580	0.545	0.545	0.554	0.545
Absolute Utility - Out sample	0.032	0.032		-0.021	-0.021	-0.060	0.014	-0.003	-0.003	0.009	-0.003
AUROC - Out sample	0.535	0.535		0.539	0.539	0.426	0.522	0.507	0.504	0.512	0.509
Cor.Pred.Crisis - Out sample (first year only)	0.444	0.444		0.500	0.500	0.389	0.444	0.444	0.444	0.500	0.444
aNtS - Out sample (first year only)	0.450	0.450		0.400	0.400	1.800	0.450	0.900	0.900	0.800	0.900
CPR - Out sample (first year only)	0.571	0.571		0.607	0.607	0.357	0.571	0.500	0.500	0.536	0.500
Absolute Utility - Out sample (first year only)	0.122	0.122		0.150	0.150	-0.156	0.122	0.022	0.022	0.050	0.022
AUROC - Out sample (first year only)	0.578	0.578		0.644	0.644	0.439	0.533	0.522	0.517	0.522	0.522

Note: The table presents estimated models for crisis variable for EU countries, using three year lag of all explanatory variables, which are represented as indicator variables for the cases when particular headline indicator issued a signal. Presented models are as following, pooled linear probability model (PLOLS), pooled linear probability model with Driscoll-Kray standard errors (PLDK), pooled linear probability model with (PLPCSE), panel-corrected standard errors fixed effects linear probability model (FEOLS), fixed effects dummy variable linear probability model (FEDVLS), fixed effects linear probability model with Driscoll-Kray standard errors (PLDK), random effects linear probability model (REOLS), pooled multinomial logit model (PLMNLOGIT), pooled multinomial logit with extended post-crisis period (PLMNLOGITR), pooled multinomial probit model (PLMNLOGIT), and pooled multinomial probit with extended post-crisis period (PLMNLOGITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.67 **In-sample econometric results for the EU, one year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	0.011*	0.011	-0.003	0.008	0.009	0.009
	(0.069)	(0.129)	(0.756)	(0.216)	(0.151)	(0.136)
NIIP	-0.001	-0.001	-0.002	-0.001	-0.001	-0.001
	(0.430)	(0.277)	(0.237)	(0.385)	(0.457)	(0.426)
EMS	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.209)	(0.174)	(0.303)	(0.329)	(0.179)	(0.237)
NULC	0.004	0.006*	0.007	0.004	0.004	0.006
	(0.297)	(0.078)	(0.107)	(0.271)	(0.314)	(0.206)
REER	0.001	0.002	0.002	0.004	0.002	0.003
	(0.806)	(0.647)	(0.679)	(0.362)	(0.729)	(0.584)
PSD	0.001*	0.001**	0.005***	0.001	0.001**	0.001**
	(0.080)	(0.046)	(0.004)	(0.127)	(0.035)	(0.017)
PSCF	-0.003*	-0.002	-0.003*	-0.001	-0.004**	-0.004**
	(0.095)	(0.213)	(0.095)	(0.431)	(0.046)	(0.047)
HPI	-0.032***	-0.033***	-0.025***	-0.029***	-0.033***	-0.034***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GGSD	-0.000	-0.000	-0.001	-0.000	-0.000	-0.000
	(0.880)	(0.983)	(0.808)	(0.970)	(0.877)	(0.960)
UR	-0.008	-0.012	-0.002	-0.015	-0.006	-0.005
	(0.438)	(0.297)	(0.939)	(0.121)	(0.546)	(0.669)
TFSL	-0.001	-0.001	0.001	-0.001	0.001	0.000
	(0.611)	(0.575)	(0.639)	(0.692)	(0.812)	(0.972)
AR	-0.031	-0.024	-0.015	-0.022	-0.031*	-0.031
	(0.103)	(0.193)	(0.408)	(0.190)	(0.099)	(0.105)
LTUR	0.053*	0.071**	0.071**	0.062**	0.059*	0.064**
	(0.088)	(0.012)	(0.016)	(0.029)	(0.060)	(0.031)
YUR	-0.009	-0.012*	-0.012*	-0.013**	-0.010	-0.012
	(0.325)	(0.069)	(0.080)	(0.043)	(0.251)	(0.134)
L.DV				0.172***		
				(0.002)		
R-sqr	0.393					
No. of observations	310	310	310	286	310	310
Dynamic completeness test	15.758					
Dynamic completeness test, P-val	0.000					
Correlated random effects test			34.673			
Correlated random effects test, P-val			0.002			
State dependence tests				3.069		
State dependence tests, P-val				0.002		
State dependence tests (Robust)				3.021		
State dependence tests, P-val (Robust)				0.003		
Cor.Pred.Crisis - In sample	0.598	0.649	0.753	0.703	0.639	0.639
aNtS - In sample	0.118	0.108	0.106	0.146	0.118	0.125
CPR - In sample	0.826	0.842	0.868	0.836	0.835	0.832
Absolute Utility - In sample	0.264	0.290	0.336	0.300	0.282	0.280
AUROC - In sample	0.900	0.899	0.935	0.914	0.894	0.894
First year out of sample	2017					
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for EU countries, using one year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.68 **Out-of-sample econometric results for the EU, one year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	0.019**	0.021**	0.003	0.023**	0.011	0.009
	(0.022)	(0.020)	(0.852)	(0.022)	(0.192)	(0.312)
NIIP	-0.001	-0.002	-0.004*	-0.002**	-0.001	-0.001
	(0.128)	(0.106)	(0.089)	(0.040)	(0.152)	(0.112)
EMS	0.001	0.001	-0.002	0.002	0.001	0.001
	(0.590)	(0.627)	(0.580)	(0.340)	(0.595)	(0.521)
NULC	0.009**	0.009**	0.004	0.007	0.007**	0.007**
	(0.011)	(0.042)	(0.592)	(0.124)	(0.031)	(0.035)
REER	-0.003	0.000	0.007	0.003	-0.004	-0.004
	(0.576)	(0.997)	(0.194)	(0.608)	(0.469)	(0.442)
PSD	0.001	0.001	0.005*	0.001	0.001	0.001*
	(0.282)	(0.156)	(0.092)	(0.149)	(0.120)	(0.051)
PSCF	-0.003**	-0.002	-0.003	-0.002	-0.003	-0.002
	(0.018)	(0.150)	(0.107)	(0.191)	(0.173)	(0.376)
HPI	-0.026***	-0.030***	-0.024***	-0.025***	-0.025***	-0.024***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
GGSD	0.002	0.002	0.008**	0.002	0.001	0.001
	(0.308)	(0.141)	(0.016)	(0.142)	(0.492)	(0.502)
UR	-0.008	-0.009	-0.037	-0.009	-0.006	-0.005
	(0.639)	(0.616)	(0.319)	(0.593)	(0.698)	(0.731)
TFSL	-0.000	-0.001	0.001	-0.001	0.002	0.000
	(0.812)	(0.780)	(0.657)	(0.815)	(0.559)	(0.894)
AR	-0.019	-0.027	-0.005	-0.014	-0.014	-0.012
	(0.362)	(0.242)	(0.858)	(0.561)	(0.479)	(0.534)
LTUR	0.047	0.064*	0.082*	0.044	0.047	0.042
	(0.232)	(0.070)	(0.069)	(0.240)	(0.219)	(0.281)
YUR	-0.009	-0.018*	-0.025**	-0.014	-0.010	-0.010
	(0.460)	(0.075)	(0.023)	(0.174)	(0.412)	(0.416)
L.DV				0.100		
				(0.387)		
R-sqr	0.388					
No. of observations	198	198	198	182	198	198
Dynamic completeness test	3.741					
Dynamic completeness test, P-val	0.053					
Correlated random effects test			21.802			
Correlated random effects test, P-val			0.083			
State dependence tests				3.069		
State dependence tests, P-val				0.002		
State dependence tests (Robust)				3.021		
State dependence tests, P-val (Robust)				0.003		
Cor.Pred.Crisis - In sample	0.571	0.625	0.661	0.627	0.607	0.589
aNtS - In sample	0.136	0.124	0.107	0.146	0.128	0.120
CPR - In sample	0.823	0.838	0.854	0.830	0.833	0.833
Absolute Utility - In sample	0.247	0.274	0.295	0.268	0.265	0.259
AUROC - In sample	0.896	0.887	0.937	0.900	0.895	0.894
First year out of sample	2013					
Cor.Pred.Crisis - Out sample	0.561	0.585	0.756	0.625	0.463	0.439
aNtS - Out sample	0.201	0.265	0.466	0.250	0.152	0.225
CPR - Out sample	0.768	0.750	0.688	0.760	0.759	0.732
Absolute Utility - Out sample	0.224	0.215	0.202	0.234	0.196	0.170
AUROC - Out sample	0.822	0.816	0.742	0.846	0.811	0.791
Cor.Pred.Crisis - Out sample (first year only)	0.611	0.611	0.889	0.706	0.611	0.556
aNtS - Out sample (first year only)	0.164	0.164	0.450	0.000	0.164	0.360
CPR - Out sample (first year only)	0.714	0.714	0.786	0.808	0.714	0.643
Absolute Utility - Out sample (first year only)	0.256	0.256	0.244	0.353	0.256	0.178
AUROC - Out sample (first year only)	0.817	0.817	0.828	0.889	0.800	0.739

Note: The table presents estimated models for crisis variable for EU countries, using one year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.69 **In-sample econometric results for the EU, two year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	-0.008	-0.019**	-0.049***	-0.010	-0.008	-0.009
	(0.380)	(0.045)	(0.000)	(0.127)	(0.362)	(0.294)
NIIP	-0.001	-0.000	-0.002	-0.000	-0.000	-0.001
	(0.639)	(0.648)	(0.294)	(0.952)	(0.659)	(0.639)
EMS	0.001	0.001	0.002	0.001	0.002	0.002
	(0.779)	(0.493)	(0.488)	(0.733)	(0.203)	(0.206)
NULC	0.009*	0.008*	0.002	0.005*	0.012**	0.012**
	(0.077)	(0.058)	(0.586)	(0.096)	(0.026)	(0.031)
REER	-0.020***	-0.022***	-0.022***	-0.019***	-0.023***	-0.022***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PSD	0.001	0.001**	0.006***	0.000	0.001	0.001*
	(0.193)	(0.032)	(0.003)	(0.419)	(0.112)	(0.069)
PSCF	0.002**	0.001	-0.000	0.003	0.002*	0.001
	(0.021)	(0.550)	(0.775)	(0.130)	(0.072)	(0.166)
HPI	-0.010***	-0.010***	-0.008**	-0.002	-0.010***	-0.010***
	(0.001)	(0.008)	(0.021)	(0.520)	(0.004)	(0.006)
GGSD	-0.001	-0.001	-0.006**	-0.001	-0.000	-0.000
	(0.684)	(0.367)	(0.023)	(0.483)	(0.891)	(0.948)
UR	-0.014	-0.022	-0.004	-0.013	-0.009	-0.007
	(0.377)	(0.150)	(0.874)	(0.186)	(0.562)	(0.638)
TFSL	-0.002	-0.003	-0.001	-0.002	-0.001	0.001
	(0.293)	(0.336)	(0.577)	(0.407)	(0.556)	(0.745)
AR	-0.050**	-0.039*	-0.020	-0.033*	-0.054**	-0.056**
	(0.036)	(0.060)	(0.314)	(0.064)	(0.023)	(0.021)
LTUR	0.027	0.039	0.042	0.007	0.033	0.032
	(0.398)	(0.182)	(0.188)	(0.768)	(0.311)	(0.330)
YUR	0.002	0.000	0.001	0.004	0.001	0.000
	(0.767)	(0.971)	(0.888)	(0.536)	(0.944)	(0.965)
L.DV				0.336***		
				(0.000)		
R-sqr	0.229					
No. of observations	282	282	282	271	282	282
Dynamic completeness test	32.373					
Dynamic completeness test, P-val	0.000					
Correlated random effects test			44.643			
Correlated random effects test, P-val			0.000			
State dependence tests				6.067		
State dependence tests, P-val				0.000		
State dependence tests (Robust)				5.997		
State dependence tests, P-val (Robust)				0.000		
Cor.Pred.Crisis - In sample	0.495	0.505	0.677	0.707	0.538	0.538
aNtS - In sample	0.139	0.220	0.102	0.166	0.187	0.177
CPR - In sample	0.787	0.762	0.848	0.823	0.780	0.784
Absolute Utility - In sample	0.213	0.197	0.304	0.295	0.219	0.221
AUROC - In sample	0.828	0.815	0.911	0.867	0.813	0.809
First year out of sample	2017					
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for EU countries, using two year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.70 **Out-of-sample econometric results for the EU, two year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	0.002	0.000	-0.072***	-0.003	-0.003	-0.007
	(0.846)	(0.963)	(0.004)	(0.764)	(0.753)	(0.458)
NIIP	-0.003**	-0.003**	-0.006**	-0.002*	-0.003**	-0.003**
	(0.012)	(0.036)	(0.042)	(0.090)	(0.039)	(0.030)
EMS	0.003	0.003	0.003	0.003	0.004**	0.004**
	(0.101)	(0.122)	(0.446)	(0.103)	(0.015)	(0.020)
NULC	0.006	0.006	-0.013**	0.002	0.008	0.007
	(0.180)	(0.162)	(0.034)	(0.591)	(0.106)	(0.139)
REER	-0.024***	-0.025***	-0.023***	-0.024***	-0.026***	-0.027***
	(0.000)	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)
PSD	0.001	0.001	0.010***	0.001	0.001	0.001*
	(0.288)	(0.159)	(0.002)	(0.222)	(0.117)	(0.073)
PSCF	0.000	-0.000	-0.004	0.001	-0.000	0.000
	(0.956)	(0.899)	(0.197)	(0.699)	(0.831)	(0.787)
HPI	-0.009***	-0.010**	-0.010**	-0.004	-0.008*	-0.007*
	(0.004)	(0.019)	(0.024)	(0.317)	(0.053)	(0.057)
GGSD	-0.000	0.000	0.001	0.000	-0.000	-0.000
	(0.962)	(0.864)	(0.809)	(0.937)	(0.869)	(0.860)
UR	-0.028	-0.033	-0.073	-0.028	-0.020	-0.018
	(0.196)	(0.132)	(0.141)	(0.111)	(0.336)	(0.387)
TFSL	-0.004**	-0.004	0.001	-0.005	-0.003	-0.001
	(0.037)	(0.169)	(0.829)	(0.106)	(0.172)	(0.824)
AR	0.007	0.009	0.052*	0.011	0.009	0.012
	(0.743)	(0.739)	(0.094)	(0.645)	(0.670)	(0.568)
LTUR	0.037	0.050	0.070	0.019	0.015	0.009
	(0.467)	(0.272)	(0.176)	(0.656)	(0.769)	(0.857)
YUR	-0.010	-0.013	-0.019	-0.008	-0.004	-0.003
	(0.485)	(0.241)	(0.126)	(0.430)	(0.759)	(0.841)
L.DV				0.288***		
				(0.000)		
R-sqr	0.254					
No. of observations	170	170	170	163	170	170
Dynamic completeness test	8.593					
Dynamic completeness test, P-val	0.003					
Correlated random effects test			18.757			
Correlated random effects test, P-val			0.174			
State dependence tests				6.067		
State dependence tests, P-val				0.000		
State dependence tests (Robust)				5.997		
State dependence tests, P-val (Robust)				0.000		
Cor.Pred.Crisis - In sample	0.462	0.500	0.692	0.608	0.519	0.519
aNtS - In sample	0.239	0.271	0.086	0.132	0.228	0.228
CPR - In sample	0.759	0.753	0.865	0.822	0.771	0.771
Absolute Utility - In sample	0.176	0.182	0.316	0.264	0.200	0.200
AUROC - In sample	0.820	0.819	0.910	0.859	0.833	0.839
First year out of sample	2013					
Cor.Pred.Crisis - Out sample	0.439	0.488	0.488	0.829	0.293	0.293
aNtS - Out sample	0.642	0.635	0.693	0.306	0.818	0.914
CPR - Out sample	0.616	0.616	0.598	0.778	0.589	0.571
Absolute Utility - Out sample	0.079	0.089	0.075	0.288	0.027	0.013
AUROC - Out sample	0.652	0.650	0.628	0.814	0.538	0.528
Cor.Pred.Crisis - Out sample (first year only)	0.389	0.500	0.556	0.778	0.444	0.444
aNtS - Out sample (first year only)	0.771	0.600	0.540	0.286	0.675	0.450
CPR - Out sample (first year only)	0.500	0.571	0.607	0.778	0.536	0.571
Absolute Utility - Out sample (first year only)	0.044	0.100	0.128	0.278	0.072	0.122
AUROC - Out sample (first year only)	0.644	0.628	0.767	0.802	0.667	0.667

Note: The table presents estimated models for crisis variable for EU countries, using two year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.71 **In-sample econometric results for the EU, three year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	-0.007	-0.018*	-0.057***	-0.004	-0.007	-0.007
	(0.497)	(0.065)	(0.000)	(0.669)	(0.490)	(0.513)
NIIP	-0.002	-0.002	-0.004**	-0.001	-0.002	-0.002
	(0.148)	(0.192)	(0.014)	(0.157)	(0.146)	(0.116)
EMS	-0.001	-0.000	-0.002	-0.001	-0.000	0.001
	(0.695)	(0.869)	(0.427)	(0.643)	(0.993)	(0.598)
NULC	0.013***	0.013***	0.013**	0.010**	0.014***	0.016***
	(0.006)	(0.004)	(0.018)	(0.010)	(0.005)	(0.003)
REER	-0.025***	-0.028***	-0.030***	-0.017***	-0.025***	-0.027***
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)
PSD	0.001	0.001	0.001	0.000	0.001	0.001
	(0.355)	(0.132)	(0.384)	(0.793)	(0.262)	(0.220)
PSCF	0.002**	0.001	0.000	0.002	0.003**	0.003**
	(0.011)	(0.499)	(0.805)	(0.416)	(0.025)	(0.029)
HPI	0.009***	0.010***	0.011***	0.013***	0.010***	0.012***
	(0.010)	(0.009)	(0.007)	(0.001)	(0.002)	(0.001)
GGSD	-0.001	-0.002	-0.012***	-0.001	-0.001	-0.000
	(0.693)	(0.174)	(0.000)	(0.641)	(0.743)	(0.844)
UR	-0.021	-0.026	0.022	-0.019	-0.019	-0.015
	(0.283)	(0.135)	(0.422)	(0.127)	(0.330)	(0.453)
TFSL	-0.003	-0.003	-0.004	-0.002	-0.003	-0.002
	(0.107)	(0.224)	(0.244)	(0.421)	(0.124)	(0.191)
AR	-0.043*	-0.039*	-0.040*	-0.027	-0.046*	-0.051**
	(0.090)	(0.076)	(0.081)	(0.187)	(0.062)	(0.039)
LTUR	-0.024	-0.021	-0.036	-0.031	-0.024	-0.019
	(0.475)	(0.531)	(0.319)	(0.286)	(0.468)	(0.567)
YUR	0.021**	0.023***	0.030***	0.021***	0.022**	0.020**
	(0.020)	(0.007)	(0.000)	(0.010)	(0.012)	(0.015)
L.DV				0.297***		
				(0.000)		
R-sqr	0.220					
No. of observations	254	254	254	254	254	254
Dynamic completeness test	42.385					
Dynamic completeness test, P-val	0.000					
Correlated random effects test			37.496			
Correlated random effects test, P-val			0.001			
State dependence tests				4.798		
State dependence tests, P-val				0.000		
State dependence tests (Robust)				4.786		
State dependence tests, P-val (Robust)				0.000		
Cor.Pred.Crisis - In sample	0.483	0.483	0.742	0.685	0.494	0.506
aNtS - In sample	0.238	0.251	0.123	0.177	0.221	0.228
CPR - In sample	0.744	0.740	0.850	0.811	0.752	0.752
Absolute Utility - In sample	0.184	0.181	0.325	0.282	0.193	0.195
AUROC - In sample	0.818	0.808	0.910	0.870	0.822	0.820
First year out of sample	2017					
Cor.Pred.Crisis - Out sample	.	.	.	.	.	.
aNtS - Out sample	.	.	.	.	.	.
CPR - Out sample	.	.	.	.	.	.
Absolute Utility - Out sample	.	.	.	.	.	.
AUROC - Out sample	.	.	.	.	.	.
Cor.Pred.Crisis - Out sample (first year only)	.	.	.	.	.	.
aNtS - Out sample (first year only)	.	.	.	.	.	.
CPR - Out sample (first year only)	.	.	.	.	.	.
Absolute Utility - Out sample (first year only)	.	.	.	.	.	.
AUROC - Out sample (first year only)	.	.	.	.	.	.

Note: The table presents estimated models for crisis variable for EU countries, using three year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2016. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data.
Source: Authors' calculations based on data from the EC and Eurostat.

Table F.72 **Out-of-sample econometric results for the EU, three year time lag (probit setting)**

	PLPROBIT	REPROBIT	REPROBITCHAM	REPROBITD	PLMNPROBIT	PLMNPROBITR
CA	-0.001	-0.001	-0.056*	0.000	-0.002	-0.006
	(0.951)	(0.946)	(0.061)	(1.000)	(0.813)	(0.565)
NIIP	-0.004***	-0.004**	-0.010***	-0.004**	-0.004***	-0.004***
	(0.001)	(0.010)	(0.004)	(0.019)	(0.001)	(0.000)
EMS	0.001	0.001	-0.004	0.000	0.001	0.001
	(0.620)	(0.654)	(0.378)	(0.860)	(0.506)	(0.462)
NULC	0.009*	0.010**	0.007	0.009*	0.009*	0.009*
	(0.081)	(0.042)	(0.345)	(0.069)	(0.087)	(0.096)
REER	-0.036***	-0.039***	-0.046***	-0.030***	-0.036***	-0.037***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PSD	0.000	0.000	0.002	0.000	0.000	0.001
	(0.658)	(0.709)	(0.422)	(0.914)	(0.512)	(0.356)
PSCF	0.001	0.001	0.005	0.001	0.001	0.001
	(0.115)	(0.743)	(0.307)	(0.675)	(0.197)	(0.323)
HPI	0.010**	0.011**	0.019**	0.013***	0.010**	0.011**
	(0.032)	(0.026)	(0.015)	(0.008)	(0.027)	(0.017)
GGSD	-0.001	-0.001	0.007	-0.001	-0.001	-0.001
	(0.553)	(0.670)	(0.338)	(0.633)	(0.511)	(0.407)
UR	-0.046**	-0.050**	-0.093	-0.038*	-0.046**	-0.042**
	(0.036)	(0.030)	(0.178)	(0.057)	(0.029)	(0.050)
TFSL	-0.009***	-0.010**	-0.003	-0.008**	-0.009***	-0.008***
	(0.002)	(0.010)	(0.319)	(0.027)	(0.004)	(0.004)
AR	0.001	0.003	-0.010	-0.006	0.002	0.008
	(0.959)	(0.912)	(0.786)	(0.827)	(0.926)	(0.769)
LTUR	-0.004	0.004	-0.002	0.002	-0.008	-0.014
	(0.935)	(0.935)	(0.979)	(0.960)	(0.879)	(0.800)
YUR	0.011	0.012	0.025	0.014	0.013	0.015
	(0.316)	(0.335)	(0.163)	(0.235)	(0.254)	(0.213)
L.DV				0.208***		
				(0.001)		
R-sqr	0.317					
No. of observations	142	142	142	142	142	142
Dynamic completeness test	5.779					
Dynamic completeness test, P-val	0.016					
Correlated random effects test			16.199			
Correlated random effects test, P-val			0.301			
State dependence tests				4.798		
State dependence tests, P-val				0.000		
State dependence tests (Robust)				4.786		
State dependence tests, P-val (Robust)				0.000		
Cor.Pred.Crisis - In sample	0.646	0.688	0.729	0.688	0.646	0.646
aNtS - In sample	0.264	0.248	0.073	0.186	0.264	0.264
CPR - In sample	0.768	0.782	0.873	0.810	0.768	0.768
Absolute Utility - In sample	0.238	0.259	0.338	0.280	0.238	0.238
AUROC - In sample	0.857	0.855	0.919	0.880	0.861	0.858
First year out of sample	2013					
Cor.Pred.Crisis - Out sample	0.512	0.659	0.780	0.854	0.537	0.634
aNtS - Out sample	0.825	0.684	0.758	0.462	0.709	0.577
CPR - Out sample	0.554	0.589	0.545	0.696	0.589	0.634
Absolute Utility - Out sample	0.045	0.104	0.094	0.230	0.078	0.134
AUROC - Out sample	0.640	0.648	0.684	0.789	0.654	0.669
Cor.Pred.Crisis - Out sample (first year only)	0.611	0.778	0.889	0.833	0.722	0.778
aNtS - Out sample (first year only)	0.655	0.514	0.675	0.480	0.554	0.514
CPR - Out sample (first year only)	0.607	0.714	0.714	0.750	0.679	0.714
Absolute Utility - Out sample (first year only)	0.106	0.189	0.144	0.217	0.161	0.189
AUROC - Out sample (first year only)	0.711	0.694	0.861	0.839	0.694	0.717

Note: The table presents estimated models for crisis variable for EU countries, using three year lag of all explanatory variables, with the exception of L.DV which stands for one-year-lagged dependant variable. Presented models are as following, pooled probit model (PLPROBIT), fixed effects probit model (FEPROBIT), random effects probit model (REPROBIT), Chamberlain's probit model (REPROBITCHAM), Dynamic probit model (REPROBITD), pooled multinomial probit model (PLMNPROBIT), and pooled multinomial probit with extended post-crisis period (PLMNPROBITR) on sample 2001-2012. The explanatory variables represent following headline indicators CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate. P-values of the marginal effects are reported in the brackets bellow the effect, which are highlighted by "*" in case they are statistically significant at level 0.1, 0.05, 0.01 with *, **, ***, respectively. Towards the end of the table correct prediction rate of crisis periods, adjusted noise to signal ratio (aNtS), correct prediction rate (CPR), absolute utility, and area under the receivers operating characteristic (AUROC) curve, are reported for in-sample and out-of-the sample data, as well as the first year of out-of-the sample data. The out-of-sample results are provided for period 2013-2016.
Source: Authors' calculations based on data from the EC and Eurostat.

Appendix G

Table G.1 **Correlation matrix for the EA, level variables**

	CA	NIIP	EMS	NULC	REER	PSD	PSCF	HPI	GGSD	UR	TFSL	AR	LTUR	YUR
CA	1													
NIIP	0,6263	1												
EMS	0,1571	0,0524	1											
NULC	-0,1266	0,3195	0,1794	1										
REER	-0,1059	0,1012	0,3538	0,5335	1									
PSD	0,0530	-0,2071	0,0271	-0,1214	-0,1747	1								
PSCF	-0,0051	0,0718	0,1651	0,1398	0,1140	0,2210	1							
HP	0,2762	0,2991	0,2928	0,1949	0,2149	-0,1204	0,2123	1						
GGSD	-0,3113	-0,2874	-0,4778	-0,4414	-0,3507	-0,1546	-0,2506	-0,3544	1					
UR	-0,2794	-0,5830	-0,1926	-0,5958	-0,2664	-0,1126	-0,2357	-0,2964	0,5062	1				
TFSL	-0,0699	0,0602	0,1999	0,2133	0,2191	0,1142	0,2766	0,3888	-0,3703	-0,3057	1			
AR	0,1001	0,2507	0,2765	0,2931	0,2499	-0,1068	0,1285	0,3417	-0,2747	-0,1792	0,2193	1		
LTUR	-0,1973	-0,3862	-0,3364	-0,5723	-0,3339	0,1908	-0,1645	-0,5318	0,4688	0,5994	-0,3166	-0,3293	1	
YUR	-0,3012	-0,3436	-0,3211	-0,2820	-0,1083	0,2303	-0,1726	-0,5888	0,3499	0,3557	-0,3069	-0,3111	0,8215	1

Note: Pair-wise Pearson correlation coefficients are presented in the table. The abbreviations in column and row names represent following headline indicators: CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate.
Source: Authors' calculations based on data from the EC and Eurostat.

Table G.2 **Correlation matrix for the EA, indicator variables**

	CA	NIIP	EMS	NULC	REER	PSD	PSCF	HPI	GGSD	UR	TFSL	AR	LTUR	YUR
CA	1													
NIIP	0,3484	1												
EMS	0,0152	-0,0435	1											
NULC	0,1662	0,2080	-0,1860	1										
REER	0,0840	0,0812	-0,0883	0,1868	1									
PSD	0,3279	0,0454	0,1544	0,1307	0,0256	1								
PSCF	0,2229	0,0983	-0,1274	0,1336	-0,0481	0,2352	1							
HP	0,0491	0,0288	-0,1539	0,1177	0,2049	-0,0434	0,3212	1						
GGSD	-0,0389	-0,0850	0,4424	-0,2674	0,0353	-0,0055	-0,1352	-0,1831	1					
UR	0,0799	0,5698	0,0134	-0,0396	0,0174	-0,0203	-0,1490	-0,0745	0,0427	1				
TFSL	0,1193	0,0139	-0,1173	0,1317	-0,0376	0,1264	0,4484	0,3133	-0,2547	-0,1056	1			
AR	0,0110	0,0528	0,2309	-0,0203	-0,0934	0,0615	-0,1134	-0,0398	0,0065	-0,0105	0,0719	1		
LTUR	0,1156	0,2475	0,2470	-0,2685	0,0976	0,1516	-0,2391	-0,0488	0,2368	0,3595	-0,1048	0,1287	1	
YUR	0,1405	0,2774	0,2088	-0,0811	0,0516	0,1485	-0,2161	-0,1333	0,1641	0,2727	0,0419	0,2208	0,6891	1

Note: Pair-wise Pearson correlation coefficients are presented in the table. The abbreviations in column and row names represent following headline indicators: CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate.
Source: Authors' calculations based on data from the EC and Eurostat.

Table G.3 **Correlation matrix for the non-EA, level variables**

non-EA	CA	NIIP	EMS	NULC	REER	PSD	PSCF	HPI	GGSD	UR	TFSL	AR	LTUR	YUR
CA	1													
NIIP	0,3212	1												
EMS	-0,5772	-0,1763	1											
NULC	-0,6390	-0,0191	0,4706	1										
REER	-0,3674	0,0503	0,3686	0,3910	1									
PSD	0,3167	0,0684	-0,5564	-0,1451	-0,1289	1								
PSCF	-0,3883	0,1999	0,2572	0,3012	0,2458	0,0695	1							
HP	0,0087	0,2573	0,1958	-0,0480	0,0269	-0,0539	0,5822	1						
GGSD	0,3531	-0,2606	-0,5799	-0,5422	-0,3625	0,4242	-0,3751	-0,2009	1					
UR	0,0569	-0,5213	0,0592	-0,3190	-0,2528	-0,1839	-0,2954	-0,0380	0,2732	1				
TFSL	-0,2705	0,2052	0,2935	0,2035	0,0761	-0,0449	0,6571	0,5541	-0,2570	-0,1687	1			
AR	-0,2554	-0,0342	0,1579	0,3202	0,1720	-0,2672	0,1961	0,0873	-0,2488	-0,0546	-0,0005	1		
LTUR	0,3313	-0,1493	-0,3951	-0,4304	-0,2361	0,2411	-0,3976	-0,4490	0,3353	0,3356	-0,4359	-0,3313	1	
YUR	0,1881	-0,1530	-0,2910	-0,2108	-0,0474	0,2033	-0,3986	-0,5886	0,2120	0,1624	-0,4052	-0,2958	0,8553	1

Note: Pair-wise Pearson correlation coefficients are presented in the table. The abbreviations in column and row names represent following headline indicators: CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate.

Source: Authors' calculations based on data from the EC and Eurostat.

Table G.4 **Correlation matrix for the non-EA, indicator variables**

non-EA	CA	NIIP	EMS	NULC	REER	PSD	PSCF	HPI	GGSD	UR	TFSL	AR	LTUR	YUR
CA	1													
NIIP	0,1834	1												
EMS	-0,1219	-0,3651	1											
NULC	0,4481	0,3518	-0,2815	1										
REER	0,1601	0,0764	-0,0654	0,1114	1									
PSD	0,0455	-0,5553	0,5884	-0,1536	0,1094	1								
PSCF	0,4371	0,0518	-0,0915	0,2048	-0,0656	-0,0220	1							
HP	0,2825	-0,0575	0,0010	0,0543	-0,0121	0,1192	0,4643	1						
GGSD	-0,1351	-0,0037	0,3888	-0,1351	-0,0013	0,0750	-0,1043	-0,1596	1					
UR	-0,0996	0,4314	-0,1541	0,0025	-0,1234	-0,3158	0,1353	0,0027	0,1036	1				
TFSL	0,3549	0,0074	-0,0317	0,1340	-0,0780	0,0337	0,6094	0,5080	-0,0182	0,0667	1			
AR	0,1277	-0,0302	0,1715	0,0494	0,0322	-0,0064	0,0218	-0,0651	0,0814	-0,0195	0,0031	1		
LTUR	-0,1464	0,2388	0,0732	0,0250	0,0163	-0,0168	-0,2703	-0,3997	0,2433	0,2669	-0,2872	0,1540	1	
YUR	-0,0260	0,0294	0,1562	0,0548	0,1028	0,1950	-0,2755	-0,2953	0,1793	0,0469	-0,2187	0,2049	0,7156	1

Note: Pair-wise Pearson correlation coefficients are presented in the table. The abbreviations in column and row names represent following headline indicators: CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate.

Source: Authors' calculations based on data from the EC and Eurostat.

Table G.5 **Correlation matrix for the EU, level variables**

EU	CA	NIIP	EMS	NULC	REER	PSD	PSCF	HPI	GGSD	UR	TFSL	AR	LTUR	YUR
CA	1													
NIIP	0,5576	1												
EMS	-0,3523	-0,1306	1											
NULC	-0,4579	0,0189	0,4695	1										
REER	-0,2635	0,0139	0,3605	0,4081	1									
PSD	0,2134	0,0158	-0,3489	-0,1333	-0,1347	1								
PSCF	-0,1142	0,0851	0,1775	0,1632	0,1277	0,1817	1							
HP	0,0758	0,2249	0,2236	0,0070	0,0564	-0,0757	0,3156	1						
GGSD	0,0086	-0,1486	-0,5456	-0,4478	-0,2906	0,0814	-0,2459	-0,2357	1					
UR	-0,1538	-0,5542	-0,0555	-0,3660	-0,2032	-0,1572	-0,2301	-0,1294	0,3929	1				
TFSL	-0,1992	0,0835	0,2837	0,2191	0,1126	0,0155	0,3677	0,4726	-0,3346	-0,2329	1			
AR	-0,1001	0,0664	0,1963	0,2788	0,1802	-0,1503	0,1228	0,1259	-0,2131	-0,0909	0,0844	1		
LTUR	0,0779	-0,2767	-0,3645	-0,4712	-0,2721	0,2252	-0,2372	-0,4332	0,4285	0,5098	-0,3803	-0,2923	1	
YUR	-0,0304	-0,2527	-0,2940	-0,2397	-0,0718	0,2246	-0,2423	-0,5588	0,2949	0,2806	-0,3636	-0,2737	0,8323	1

Note: Pair-wise Pearson correlation coefficients are presented in the table. The abbreviations in column and row names represent following headline indicators: CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate.

Source: Authors' calculations based on data from the EC and Eurostat.

Table G.6 **Correlation matrix for the EU, indicator variables**

EU	CA	NIIP	EMS	NULC	REER	PSD	PSCF	HPI	GGSD	UR	TFSL	AR	LTUR	YUR
CA	1													
NIIP	0,2637	1												
EMS	-0,0873	-0,2543	1											
NULC	0,2762	0,2508	-0,2484	1										
REER	0,0910	0,0390	-0,0733	0,1455	1									
PSD	0,1738	-0,2668	0,3236	-0,0080	0,0554	1								
PSCF	0,3159	0,0723	-0,1390	0,1574	-0,0687	0,1006	1							
HP	0,1709	0,0153	-0,1431	0,0726	0,0626	-0,0160	0,3920	1						
GGSD	-0,1308	-0,1774	0,4507	-0,2263	0,0502	0,0581	-0,1514	-0,2686	1					
UR	-0,0163	0,4903	-0,0770	-0,0360	-0,0483	-0,1633	-0,0302	-0,0429	0,0349	1				
TFSL	0,2435	0,0343	-0,1245	0,1221	-0,0796	0,0349	0,5289	0,4543	-0,2178	-0,0210	1			
AR	0,0570	0,0117	0,1711	0,0015	-0,0571	0,0063	-0,0525	-0,0451	-0,0141	-0,0248	0,0380	1		
LTUR	-0,0280	0,1909	0,1748	-0,1702	0,0640	0,0758	-0,2742	-0,2581	0,2387	0,3060	-0,2238	0,1186	1	
YUR	0,0432	0,1383	0,1625	-0,0437	0,0576	0,1447	-0,2610	-0,2304	0,1334	0,1612	-0,1088	0,2006	0,6892	1

Note: Pair-wise Pearson correlation coefficients are presented in the table. The abbreviations in column and row names represent following headline indicators: CA - current account balance, NIIP - net international investment position, EMS - export market shares, NULC - nominal unit labour cost, REER - real effective exchange rates, PSD - private sector debt, PSCF - private sector credit flow, HPI - house prices, GGSD - general government sector debt, UR - unemployment rate, TFSL - total financial sector liabilities, AR - activity rate, LTUR - long-term unemployment rate, YUR - youth unemployment rate.

Source: Authors' calculations based on data from the EC and Eurostat.