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Financial Stability in the Baltics*

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Abstract
We test the hypothesis of procyclicality of banking sector results in the Baltic economies. Our estimates suggest that a slowdown in economic activity is likely to accelerate the growth of the nonperforming loan (NPL) ratio in the Baltics. They also support the hypothesis that a rapid growth of credit harms loan performance, most likely due to soft-loan constraints and macroeconomic overheating. Higher concentration in banking market coincides with relatively higher nonperforming loans. Compliance with the Basel core principles improves the quality of the loan portfolio.

1. Introduction

Changes in the macroeconomic environment translate into changes in the loan portfolio quality. Favorable macroeconomic conditions coincide with better capabilities in loan repayment, a lower probability of default, and a lower share of nonperforming loans (NPLs) in total gross loans (the NPL ratio). According to Schinasi (2005) and Kool (2006), common exposure to macroeconomic risk factors across banks is a source of systemic risk that influences the quality of a loan portfolio, which can be approximated by the NPL ratio. An increase in that ratio may signal a deterioration in banking sector results (Mörttinen et al., 2005). Credit expansion and the NPL ratio are likely to be procyclical (i.e., co-move with the economic cycle).

Our empirical contribution tests the hypothesis if the growth of credit and amount of available finance might harm banking performance and deteriorate NPL dynamics, most probably due to the overheating of economies, and if a slowdown in economic activity is likely to accelerate the growth of the NPL ratio.

There is a rapidly growing empirical literature on the macroeconomic factors influencing the NPL ratio and other indicators of loan portfolio quality (see, in particular, Blaschke and Jones, 2001; Quagliariello, 2003; Babouček and Jančar, 2005; Hoggarth, Logan and Zicchino, 2005; Fofack, 2005; De Nicoló et al., 2003; Čihák et al., 2007; Jakubík, 2007; Zeman and Jurča, 2008; Festić and Bekő, 2008; Männasoo, 2005; and Babihuga, 2007).

This article focuses on the Baltic countries (Estonia, Latvia, and Lithuania), which have experienced very rapid credit growth for several years in the runup to the global financial crisis. Loans to the private sector have been growing at a rapid pace in the Baltics in the period from 2004–2007 while the NPLs remained low. This rapid credit growth has been largely foreign-funded, as the banking sectors in the Baltics are primarily foreign-owned (mostly Swedish).

The NPL ratios in the Baltic economies were among the lowest in the so-called New European Union (EU) Member States (i.e., those that became EU mem-

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bers in or after 2004). The outlook for the banking sector results possibly reflects a favorable assessment of their economic growth in the period from 1999 to 2007. The increasing indebtedness of the private sector has become a cause for concern, due to the fact that the macroeconomic environment has deteriorated sharply after 2007. Broad-based contraction in economic activity, accompanied by the strong fall--off in exports as well as imports, already seen at the end of 2007 continued in 2008 and 2009. Considering the gloomy economic outlook for the rest of 2009, NPLs are likely to increase. This could arguably be seen as a price for the previous episode of rapid credit growth.

We analyze the relationships between the NPL ratio and macroeconomic/ /banking sector variables as a source of systemic risk in order to assess the banking sector's vulnerability to bad loan performance on a macroeconomic level. In the second section, we summarize the characteristics of the macroeconomic environment and the banking sector in the Baltic countries. In the third section, the theoretical background of the empirical analysis, data specification, methodology and the empirical results are explained. The implications of the empirical analysis are revisited in the conclusion.

2. The Banking Sector and the Macroeconomic Environment in the Baltics

2.1 Macroeconomic Environment

After the *Russian crisis* of 1998, favorable economic development and approaching EU membership increased investments (Ådahl, 2006). The Baltics have had the great volume of trade with Western, Central, and Eastern Europe. The positive impact of foreign direct investment (FDI), market-oriented structural reforms, and the import of capital goods on *economic growth* has been visible in the diversification of the foreign trade structure and the improvement of competitiveness in the *export* industries (Brandmeier, 2006). The productivity increases in the tradable sector in the 1990s induced significant adjustments via the Balassa-Samuelson effect (Chmielewski, 2003; Breuss, 2003), which however did not erode export competitiveness because higher gross fixed capital formation led to a rise in external competitiveness (Brandmeier, 2006).

After the EU accession, the Baltics faced the positive externalities of accession to the EU. Low interest rates, an ongoing credit boom (with the peak during 2004–2007), gains in productivity, the growth of private consumption, fixed capital formation as the major driving force of GDP growth in *Baltics,* a higher capacity to absorb EU investment grants and strong external demand have caused relatively high GDP growth rates. *Economic growth* has been high and widespread: *domestic demand*, boosted by a foreign-financed boom in bank lending, plummeting unemployment, real wage growth on the back of productivity gains; and *export growth* (between 2002 and 2007) have all contributed to GDP growth after the EU accession (*Table 1*).

The credit-fuelled domestic demand boom has moreover translated into upward price pressures in goods and labor markets (*Table 1*). An unabated consumption-led high import propensity has been coupled with moderate export growth due to a loss of competitiveness as a result of rising unit labor. A wage price-spiral, a tight labor market, an unabated credit boom, an emerging real-estate bubble, a skyrocketing current account deficit and rapidly rising external debt levels reflect an over-

Table 1 Macroeconomic and Banking Indicators in the Baltic Countries

Macroeconomic environment (2007/2008/2009^{forecast})*

	GDP % growth (yoy %, real)	Gross foreign debt (% GDP)	Inflation (ann. av. in %) (CPI)	Budget balance (% of GDP)	Public debt (% of GDP) 2007/2008	Current account (% of GDP)	FDI inflow (% of GDP)
Estonia	6.3/-3.5/-10.1	112.4/122.9/137.4	6.6/10.4/1.4	2.7/-2.2/-2.7	3.5/4.8	-18.1/-9.2/-3.8	5.3/3.7/2.0
Latvia	8.9/3.1/-9.2	72.0/77.2/83.0	5.7/11.0/5.5	-1.2/-1.9/-3.7	17.0/15.6	-14.6/-13.0/-3.7	3.6/2.4/1.1
Lithuania	10.0/-4.6/-14.5	135.1/127.0/137.6	10.1/15.5/4.7	0.1/-3.3/-6.8	9.0/19.5	-23.8/-13.2/-3.9	6.8/4.2/2.8

Banking sector indicators (for commercial banks, 2007/2008)**

	Asset share of foreign banks/ /states' share (in %)	Solvency ratio/ /Tier 1 ratio (2008)	Loans to GDP/ /Deposits to GDP (in %)	ROE/ROA (2008)	Costs (% of total income) (2008)	Loan to deposit ratio/ /FL to TL***	NPL (2007/ /2008)	Rating Moody's/ /S&P 2008	EBRD index of banking sector reform§
Estonia	97.3/0.0	10.53/8.21	100/50	15.98/2.17	-40.50	2.1/85.3	0.4/1.6	A1 negative A negative	3.7
Latvia	47.2/4.1	10.94/9.57	91/37	2.68/1.89	-54.03	2.8/89.3	0.4/2.2	Baa3 negative BB+ negative	3.7
Lithuania	95.6/0.0	10.72/8.38	64/32	11.39/1.61	-48.40	2.0/64.0	1.0/1.1	A3 negative BBB negative	3.0

Notes: * Exchange rate regime: ERM II since June 2004 in Estonia and Lithuania; and since May 2005 in Latvia.

** Portfolio quality and loan classification categories: Estonia – standard, watch, doubtful, uncertain, loss; Latvia and Lithuania - standard, watch, substandard, doubtful, loss. Substandard loans are 91 to 180 days past due (and require provisioning between 15 and 40), doubtful loans are 181 to 365 days past due (and require provisioning between 40 and 99) and losses are not repaid (requiring 100% provisioning). In Estonia, loans overdue for 150 plus days have to be written off in Estonia. In Latvia, although the substandard classification covers loans 31–90 days overdue and provisioning levels are 10/30/60/100 percent, respectively.

*** FL to TL: foreign currency loans as % of total loans.

§ The ERBD indicators of banking sector reform are measured on a scale of 1 to 4+ (for 1997 and 2003): score 2: established internal currency convertibility, significant liberalized interest rates and credit allocation; score 3: achieved substantial progress in establishing prudential regulation and supervision framework; score 4: level of reform approximates the BIS institutional standards.

Sources: IMF (2009); BACA (2009); KBC AM (2008).

heating of the economy after 2006. In the *Baltics,* signals of economic *overheating* with a medium-term risk of a hard landing became evident in 2007. The deceleration of economic growth in the second half of 2008 was mostly due to a supply side shock and the unwinding of the boom in the EU economies in 2008. Looking at the structure of output growth, increasing domestic demand has also played a prominent role, since net exports were negatively affected by sluggish economic activity in Europe (KBC AM 2008). Structural dependence on external financing, which is in part a by--product of the effect of low levels of internal saving, have led to large current account deficits and financial instability.[1]

2.2. The Banking Sector

The rapid privatization of state-owned companies and improvements in legal infrastructure contributed to the development of the banking sector in the Baltics. While the Estonian and Lithuanian banking sector became truly consolidated, Latvia remained the exception, with a number of smaller niche banks oriented towards the Russian market and focusing on nonresident deposits (Eesti Pank, 2006). Estonia had privatized their last remaining large state-owned banks into foreign hands. In Latvia, the large amount of banks is partly explained by the fact that ten of the banks deal primarily with nonresident transactions, meaning investing Russian money in Western Europe. For many Latvian banks, receiving deposits from the CIS and reinvesting them in Western Europe is an important business activity. In 1998, Latvian banks suffered relatively large losses due to the Russian crises (Koivu, 2002). The Lithuanian banking sector is considerably smaller and its effectiveness has been lower than in Estonia or Latvia due to the state ownership, which lasted longer in Lithuania. Due to the fact that the banks have been risk-averse in Lithuania, the fact that loans granted to public sector have noticeably increased only in Lithiania, the fact that Lithuania suffered longer than its neighbors from the Russian crisis, the fact that many Lithuanians did not trust the local banking sector and kept their savings in cash, small- and medium-sized enterprises have been suffering from insufficient financing (Koivu, 2002).

Despite the fact that lending has been growing rapidly in the period from 2002 to 2007, recently banks have maintained adequate *solvency* buffers and they identified consolidation, the adaptation of organizational structures and regulatory incentives as significant drivers of change (Ådahl, 2006). The current account deficit during the boom period 2004–2007 was financed primarily by loans from foreign banks to their subsidiaries and other investment. An analysis of financial health EBRD indicators confirms generally, that capital adequacy in the banking sector has been sufficient (*Table 1*), banks enjoy adequate profitability (profits were also supported by continued cost-containment) and banks have benefited from an enhancing of asset quality (which allowed for reduced provisioning).

2.3. Banking Sector Lending

Already in the aftermath of the *Russian crisis* in the end of the 1990s, Estonia and Latvia experienced very rapid asset and deposit growth (the growth of loans was

[1] Given that investment levels exceeded domestic savings, the Baltics financed a part of their investment through foreign direct investment (FDI) and the huge current account deficits have been financed by a steady increase in the net-inflow of FDI, net portfolio investment and foreign currency loans (KBC AM 2007; KBC AM 2008), which is closely tied to the availability of bank finance.

faster than the growth of deposits between 2000–2002), while Lithuania lagged somewhat behind. Credit growth has picked-up in Estonia and Latvia in the second half of the 1990s, while in Lithuania, the credit to GDP ratio has been increasing slightly since 2001 (KBC AM, 2008). From 1999–2002, more than half of all loans were granted in foreign currencies and the majority in euros (*Table 1*). Much of the financing for the lending boom has come from the foreign parents companies of the major foreign banks to their local subsidiaries. As a result, loan to deposit ratios have been high in the Baltics.

The acceleration in domestic lending – in particular to households – was fuelled by strongly increasing foreign liabilities (Sopanha, 2006). Credit growth to the corporate sector lagged behind loans to households, which can be partly explained by the fact that an important share of investment by the nonfinancial corporate sector was financed by retained earnings, inter-company loans and foreign capital, including credits from banks in other countries and FDI in the period from 2002 to 2006.

Significant amounts of FDI have been related to the banking sector and nontradable sector (e.g., real estate business) that are closely tied to the availability of bank finance, which differentiates the Baltics from the central Europe, where most of capital inflows have taken the form of FDI into the tradable sector.

2.4. Nonperforming Loans

The transition economies shared a common problem: their banking sectors in the early 1990s were characterized by a relatively small number of large, state-owned institutions that had become burdened by large volumes of nonperforming loans. We can point to two reasons for this: first, these countries had to deal with the issue of a large amount of inherited NPL from the past, and second, new NPLs mounted up in the balance sheets of commercial banks due to a lack of experience, government intervention, inappropriate incentives for bank management and poorly designed privatization methods.

In the Baltics, the stock of NPLs dating back to government intervention in state-owned banks and companies in the early 1990s (Tang et al., 2000) was fully written off in recent years. Estonia and Latvia relied on a decentralized model, injecting capital into banks they considered viable and suitable for further privatization, while leaving it to the banks themselves to deal with their bad loans. Lithuania chose a centralized approach and set up a central agency to clean up the bad loans of selected banks and provide banks with government assets for recapitalization. To this effect, the government issued special bonds and transferred cash from the budget (Krzak, 1997).

Since the Russian crisis, NPLs have been reduced by half. Supervisory and regulatory authorities have proven their mettle in forcing the pace of *mergers* during the crisis and thereafter rapidly improving supervision. The crisis had the indisputably positive side effect in each country of prompting the adoption of prudent regulations, while the higher level of risk management led to an improved quality of outstanding credit. The banking sectors in the Baltics, supported by very favorable macroeconomic conditions, have recorded the lowest share of NPLs (*Table 1*).

Emerging Europe's long-term real convergence story ran head first into the global slowdown in the last quarter of 2008, with the region's economic sentiment indi-

cators deteriorating at a faster pace in the last quarter of 2008 than they did in 1998 following the Russian crisis. Against the backdrop of a sharp deterioration in global and regional indicators, consensus forecasts for the global and regional economic growth in 2009 were cut significantly in the latter half of 2008. Considering the gloomy outlook for 2009, as well as the rapid growth in the denominator of the NPL ratio during the boom period, the NPLs are set to increase.

3. Empirical Analysis: Background, Methodology, Results, and Discussion

To assess the banking sector's vulnerability, we analyzed the relationship between the NPL ratio and macroeconomic and banking sector variables. The empirical findings presented in the literature are an important source of the hypothesis when it comes to the responsiveness of the NPL ratio on macro/banking factors.

Various financial prices may give valuable direct indicators towards the degree of risk perceived by markets; monetary data, inflation, nominal GDP projections and information on financial liberalization (such as capital flow, foreign direct investment) are needed. The quality of a loan portfolio in the banking sector is also determined by the macroeconomic environment that influences the values of external indicators, such as credit relative to GDP, the net open position in foreign currency to capital, foreign direct investment in financial sector, the geographical distribution of loans to total loans as well as foreign-currency-denominated loans to total loans (Schinasi, 2005). Information on the legal framework needs to be taken into consideration and qualitative data on easing financial regulations that could provoke high-risk behavior. Complementing financial data and overall macroeconomic data are required in order to assess the current state of the cycle (Borio and Lowe, 2002).

As regards the impact of the macroeconomic environment on the NPL ratio, the literature has identified the following patterns. If economic expansion is associated with rapid credit growth, large increases in asset prices, a high level of investment, export/employment growth and excessive capital accumulation, the level of credit risk is higher because risk is built up in a boom but materializes in the downturn (Borio and Lowe, 2002). The economic background can be described by GDP and export growth, the rate of unemployment, private consumption, asset prices, and the regional and global development of the economy. In the household sector, the macroeconomic consequences of a boom are declining unemployment and rising real wages, while in the corporate sector, a consequence of a boom is an increasing market for products. The corporate sector's credit demand rises in order to accommodate growing consumer demand. Households also want to borrow out more, in order to purchase capital goods or to follow growing real estate prices or to engage in advance consumption. Banks are prepared for the possibility that some of their loans will be nonperforming due to defaults by the private sector in a recession. For this reason, the impact of business cycle variables on banks' credit risk positions turns out to be pro-cyclical (Sirtaine and Skamnelos, 2007).[2]

[2] Some empirical studies have confirmed that the NPL ratio deteriorates if credit growth is accelerated to unsustainable levels (Kiss et al., 2006). Banking system crises (e.g., in the Scandinavian countries, the United States, Japan, and other Asian countries) were preceded by a rapid expansion of lending in an overheated economy.

Further, a sudden withdrawal of bank deposits, leaving domestic banks illiquid, might take place after a period of large inflows of foreign short-term capital when domestic interest rates fall, when depreciation is expected or when confidence in the economy wavers, when disruption on financial markets or balance of payments crises is expected and when there are a high share of loans denominated in a foreign currency (Calvo and Mendoza, 2000). Limited growth prospects in export-oriented industries can ultimately lead to economic contraction with direct implications on loan performance, owing to the fact that bank lending surveys have shown that loans granted to enterprises are partly hedged by their export proceeds (Kaminsky and Reinhart, 1999). Large deficits are typical for emerging markets and do not pose a problem for loan quality as long as they are caused by the import of capital goods, and future export growth is strong enough to reimburse debt. And, an unexpected depreciation of the domestic currency might increase the NPL ratio, if banks borrow in a foreign currency and lend in domestic currency due to higher debt burdens in the private sector (Borio and Lowe, 2002).

Applying soft budget constraints prevalent in many transition countries for credits to enterprises may also lead to a higher NPL ratio due to considerable losses in the corporate sector, when investments turn out to be counterproductive (Berglöf and Roland, 1995). It can be argued that growth in the amount of available finance may precipitate financial crises and harm economic development due to soft budget constraints (Lardy, 1999).

There is a great deal of empirical literature on macroeconomic/banking sector factors influencing the NPL. The factors such as inflation, gross domestic product, purchasing power parity, liberalization of banking sector, financial deepening, loans to assets ratio, deposits to loans ratio, compliance with the Basel core principles, market concentration, compensation to employees, and household demand have been identified as relevant determinants of the loan portfolio quality in the literature (*Table 2*).

3.1. Methodology

Based on the studies of the determinants of the NPL ratio, we constructed a data set of explanatory variables that are usually employed in models (see *Appendix*). The NPL variable is specified as the share of all nominal loans that are at least 90 days past due. It is important to note, however, that cross-country variation in asset quality indicators (IMF, 2008) can also be explained by differences in loan classification rules (see notes to *Table 1*). The usual definition is that NPLs are defined as loans that are more than 90 days past due, as was used in our case.

Some authors (for instance, Jakubík, 2007a) emphasize the better performance of NPL inflow variables in empirical estimates. The NPL ratio could be problematic to use, where outflow is given by one-off NPL write-offs. This ratio can be driven by purely administrative measures. So, for example, in the New EU Member States, a significant portion of defaulted loans were removed from banks and substituted with government bonds. Since we could not provide the NPL inflow time series,[3] we

[3] The data on NPL inflow can be estimated as the ratio between non-payed interest and interest. The second possibility is the recovery rate dynamics and the loan loss reserves dynamics that could be used as a proxy for the estimation of NPL inflows and outflow dynamics (Bole, 2007).

Table 2 Overview of Literature on Determinants of NPLs

Explanatory variable(s)	Reference	Explanation of theoretical background
GDP/export/ gross fixed capital formation	Borio et al., 2001	The majority of studies have confirmed that GDP/export/gross fixed capital formation is a major challenge to loan portfolio quality and the dynamics of the NPL have been proven to be pro-cyclical with respect to economic growth. Periods of economic growth and strong demand for a country's exports have a positive effect on the domestic corporate and household sectors.
(Net) foreign currency assets and exchange rate	Edwards, 2001	The empirical record associated with an explicit analysis of the (net) foreign currency assets and exchange rate to NPL relationship is mixed, partly as a result of economies` different degrees of foreign trade openness, as well as with dissimilar (foreign currency) debt exposure in individual sectors. The worsening of banking sector mismatches and NPL ratio could occur – when borrowers borrow in foreign currency (or their loans are nominated in foreign currency) and payback credit in domestic currency – due to the shortage of foreign currency assets and domestic currency depreciation that threatens the NPL performance and increases the debt burdens.
Real ex-change rate, (net) foreign currency assets	Kaminsky and Reinhart, 1999	Appreciation of the real exchange rate (as the result of the higher net foreign currency assets of the banking sector or export growth or Balassa--Samuelson effect) could contribute to the build-up of a crisis through shifts in international competitiveness coupled with terms of trade deterioration and with direct implications on loan performance as can be seen in the fact that bank lending surveys show that loans granted to enterprises are partly hedged by their export proceeds.
Foreign direct investment (FDI), capital inflows	Calvo and Mendoza, 2000; Eichengreen et al., 1999	Capital inflows (and FDI in financial intermediation and real estate) could result in an expansion of domestic credits; and a sudden withdrawal of bank deposits leaving domestic banks illiquid might take place after a period of large inflows of foreign short-term capital when domestic interest rates fall, when depreciation is expected or when confidence in the economy wavers, when disruption on financial markets or balance of payments crises is expected.
Bank capitalization, savings with banks	Jappelli and Pagano, 1994; Lardy, 1999	Low bank capitalization (and low savings with banks) often lead to the adoption of imprudent lending strategies with direct implications for banks' loan portfolios, which tend to be heavily skewed toward high risk projects; and the NPL could increase.
Liabilities to income ratio	Berglöf and Roland, 1995; Kiss et al., 2006	Applying soft budget constraints, prevalent in many transition countries for credits to enterprises or households, may lead to considerable losses in the economy when investments turn out to be counterproductive or when the household's liabilities/income ratio is extremely high.
Compensation of employees to demand of households ratio	Sirtaine and Skamnelos, 2007	Higher demand of households could increase the debt burdens, and if the indebtedness of households is higher (lower compensation of employees to demand of households ratio as a proxy), the NPL could increase.
Loans to assets ratio	D'Avack and Levasseur, 2007; Männassoo, 2005	The share of banks' loans to the private sector in total banking assets is considered as a proxy of risk taken by the banks. Loan-assets ratio is positively correlated with banking problems, increasing NPL ratio and (in)solvency is a result of bank long-term mismanagement.
Deposits to loans ratio	Cândida, 2009	The ratio between deposits of the private sector to (private sector) loans is used as a rough measure of the profitability of the deposit money or as a proxy for national savings with banks as a rough measure of banking sector reserves. Increasing deposit/loan ratio might be an indicator of decreasing the NPL ratio.
Market concentration, Basel core principles	Babihuga, 2007	A higher quality of supervision is associated with lower NPLs. Heterogeneity across economies might prove different relationship between asset quality and the business cycle. The higher the banking sector concentration, the more FDI in financial sector comes from abroad and higher the financial sector depth, the more possibilities the banks have for offering more credits and creating lower capital adequacy.

had to rely on the use of an NPL series as nominal loans that are at least 90 days past due. The dependent variable was the ratio of NPLs to total loans to private sector (with both the numerator and the denominator expressed in billions of domestic currency, deflated by the consumer price index).

We relied on the internal database of the BACA (2009), EIPF (2009), and the databases of central banks in individual countries. The quarterly time series (seasonally adjusted by the X-12-ARIMA method) were used for the period from the first quarter of 1998 to the third quarter of 2008.

There are good reasons for analyzing the three Baltic economies jointly. They are relatively homogenous, have similar institutions and economies, and their banking sectors have important commonalities (Tang et al., 2000; Koivu, 2002; Adahl, 2006; KBM, 2008).

The methods used in different estimations that look for the empirical evidence of a relationship between financial stability, asset quality indicators and macro-economic variables are mainly: co-integration analysis, correlations, cross-country regressions and panel regressions (Beck and Katz, 1995). According to the relatively short time series and similarities between the analyzed economies, we decided to use panel regression (cross section weights) (Hsiao, 2003), and obtain more information on the analyzed parameters (Wooldridge, 2002). The method allows one to control for omitted variables that are persistent over time and, by including lags of regressors, may alleviate measurement errors and endogeneity bias (Maddala and Hu, 1996, Baltagi, 2001). The advantage of the applied method is that it lowers co-linearity between explanatory variables (Davidson and MacKinnon, 1993) as well as dismisses heterogenous effects (Western, 1998). Panel estimation techniques allow the cross country differences to be treated as unobserved time invariant characteristics (Babihuga, 2007). We analyzed the model with permanent effects, which controls the impact of neglected and changing variables among observed units that are constant within a time period, and the random effects model as well (Arellano and Bond, 1991).

Moffatt and Salies (2003) have demonstrated that logarithmic approximation is only accurate if the rates of change in variables are reasonably small. Since the movements in the NPL ratio are sometimes large, this approximation would produce a significant downward bias in the simulation; therefore, all the time series were transformed into the percentage change of the variables in the original time series.[4] By using the growth rate variables expressed as percentage changes the problem of spurious regression was avoided. The stationarity of all the transformed (percentage change) time series was obtained at a 1% significance level (Dickey and Fuller 1979; Esaka 2003) and proven by the ADF-Fischer Test (*Table 3*). The selected variables are integrated of different orders. Some of the variables are already stationary in the level form, whereas the majority were integrated of order 1 (*Table 3*). Cointegration analysis for all the variables could not be performed due to different levels of integration but only for the variables integrated of the same order (we found 4 co-integrating equations among the set of I(1) variables, see the *accompanying Excel file* on the web page of this journal). A long-term relationship for all the variables could

[4] The same specification was also used by Babouček and Jančar (2005), Čihák, Heřmánek and Hlaváček (2007), Jakubík and Heřmánek (2007) and Pesola (2001).

Table 3 Stacionarity Tests (ADF – Fisher Chi-square)

Variable	Level	D(x)*
Asset (total)	0.00771 (0.9786)	59.1676 (0.0000)
Deposits	0.02582 (0.8025)	57.3669 (0.0000)
Loans	18.7795 (0.0046)	33.3762 (0.0000)
Net foreign assets to net assets ratio	13.0351 (0.0425)	76.9654 (0.0000)
Loan asset ratio	75.0808 (0.0000)	100.451 (0.0000)
Deposit loan ratio	75.6387 (0.0000)	91.9021 (0.0000)
Nonperforming loans	0.78364 (0.9925)	56.2488 (0.0000)
Nonperforming loans ratio (% of total loans)	15.9837 (0.0613)	153.598 (0.0000)
Compensation_employees/domestic demand (households)	23.7845 (0.0000)	105.078 (0.0000)
Export of goods and services	3.97094 (0.6806)	46.5812 (0.0000)
Foreign direct investment (financial intermediation)	0.94447 (0.9876)	49.8967 (0.0000)
Gross domestic product (gdp)	1.24571 (0.9746)	96.1566 (0.0000)
Gross fixed capital formation to gdp ratio	16.7855 (0.0457)	85.8163 (0.0000)
Basel Core Principles	7.40380 (0.2851)	83.7851 (0.0000)
Market concentration	13.1582 (0.0005)	106.349 (0.0000)

Notes: D(x) denotes the percentage change of the variable (as measured in percentage point); *Probabilities for ADF – Fisher Test are computed using the asymptotic Chi-square distribution.

not be proven probably due to the transformational changes that occurred in the Baltics or to quite specific events on the credit market and banking sector during the transition period. Variables were seasonally adjusted by the X-12 ARIMA seasonal adjustment method (EViews 6) on the basis of quarter on quarter data. The lag length selection in the specified model was based on Akaike and Hannan-Quinn information criterion.

We contributed to the existing empirical evidence on the impact of the macroeconomic environment on NPL ratio dynamics in the following way: we used panel estimates to explain NPL ratio dynamics by introducing macroeconomic and banking sector variables. Using panel data model we decided between OLS estimators, fixed and random effects estimator (Arrelano and Bond, 1991; Babihuga, 2007).[5]

Using fixed effects within the estimation, we could assume a slope common to each of the countries (b) (Beck and Katz, 2004). The fixed effects could be included to account for possible unobserved heterogeneity across nations. Our results (see, *Table 4*) reject the H_0 hypothesis (H_0 = the fixed effects are all equal to each other). According to the results of the Cross-section F-test with p-values lower than 0.05, the system could respond well within the fixed effects estimations (*Table 4*).

A random effects model assumes that the individual country intercepts are drawn from a common distribution.[6] The Hausman test estimates the null hypothesis

[5] The potential bias in the estimation arises from the correlation between the vector of explanatory variables and autoregressive terms in the error term; or whether the vector of explanatory variables is exogenous weakly, strictly or contemporaneously (Arellano and Bond, 1991). The fixed effects estimator requires strict exogeneity and it is thus inconsistent in the presence of lagged dependent variable and endogeneity from any other explanatory variables. There could be a potential endogeneity of loan to asset ratio and deposit to loan ratio in our models. But we confirmed that our models do not suffer from endogeneity problem, and the instrumental variables were not required.

that the coefficients estimated by the efficient random effects estimator are the same as the ones by the consistent fixed effects estimator (Hausman 1978). Given the high p-values, the null hypothesis of the Hausman test could not be rejected and we could confirm the random effects specification of the model(s); therefore both fixed effects and random effects produce consistent estimators, but fixed effects are inefficient (*Table 4*).

To account for the heterogeneity, we introduced interaction terms between the business cycle and dummy variables controlling for cross-country differences in market concentration (proxied by the assets of three big banks relative to total banking sector assets); and the business cycle and the quality of regulatory supervision (proxied by index of the compliance with the Basel Core Principles) in order to present how a business cycle might impact quality of loan portfolio depending on differences between economies (Babihuga, 2007).[7]

We included the time dummy variable, with a breakpoint in the first quarter of 2002, when significant credit growth in the Baltics started. Q-statistics (in the *accompanying Excel file* on the web page of this journal) were employed to check autocorrelation in the residuals. We accepted the hypothesis of no autocorrelation of residuals, due to low values of Q-statistics (Iwaisako, 2004). We estimated (using Eviews 6.0) the following equation:

$$D(npl)_t = c + b_1 D(lar)_{t-n} + b_2 D(dlr)_{t-n} + b_3 D(nfa)_{t-n} + b_4 D(fdi_f)_{t-n} + b_5 D(export)_{t-n} + \\ + b_6 D(cfe/dd)_{t-n} + b_7 D(gfcf/gdp)_{t-n} + D_8(bcp\_cycle)_{t-n} + D_9(mc\_cycle)_{t-n} + \\ + dummies + \varepsilon_t$$

where $D(x)$ denotes the percentage change of the variable, *npl* are the nonperforming loans as the share of total loans to private sector, *lar* is the ratio between bank loans to private sector and total banking sector assets, *dlr* are deposits of private sector as a share of loans (given by banks to private sector), *nfa* is the ratio of net foreign assets to net assets of the banking sector, fdi_f is the foreign direct investment in financial sector and real estate, *export* is the real export of goods and services, *cfe/dd* is the compensation of employees as a ratio to domestic demand of households, *gfcf/ /gdp* is a ratio of gross real fixed capital formation to GDP, *bcp* is an index of compliance with the Basel Core Principles, *mc* is market concentration, approximated by the assets of three big banks relative to total banking sector assets, *dummies* are time dummies of the explanatory variables, and ε_t is the error term.

To ensure that the model is well specified, many variables were introduced, the Hausman test and the Cross section F-test have been performed. An analysis of the residuals shows (see *accompanying Excel file* on the web page of this journal) that the results of the panel estimation are unbiased and suggests that the models have been correctly specified. Our regression coefficients are statisticaly significant and F-statistic of the model is highly significant (*Table 4*). The Chow Forecast test (performed by STATA) proved the stability of the models. We therefore accepted the presented specification of the models.

[6] For the estimates of the random effects model to be consistent, the individual intercepts cannot be correlated with independent variables (Arellano and Bond, 1991).

[7] Only the significant interaction terms are discussed and reported in *Table 4*. Dummy variables were definied as low, middle, and high.

The empirical analysis could be limited due to the fact that linear approximation of relationships are sometimes nonlinear and there could be probably threshold effects.

3.2. Results and Discussion

Under the conditions of increasing competition and similar macroeconomic conditions, the banking sector performance have contributed in a similar way to NPL ratio dynamics, despite the fact that the banking sector of these countries have faced different consequences, while adapting to new conditions during the EU integration process.

The obtained results confirmed the influence of the chosen explanatory variables on the dynamics of the NPL ratio. As expected, we found evidence of a positive influence by the loan/asset ratio (with a coefficient in the interval from 0.31 to 0.56). Foreign direct investment in financial intermediation and real estate business increased the available finance and contributed to the worsening of NPL ratio growth (with a coefficient in the interval from 0.42 to 0.47 percentage points) in the first observed period. Domestic loans have primarily been financed by domestic deposits and external sources. The banks' ability to fund loan expansion was boosted by strong capital inflows through the banking system, amid high global liquidity. The acceleration in domestic lending – in particular to households – was fuelled by strongly increasing foreign liabilities (Sopanha, 2006). Much of the financing for the lending boom has come from the foreign parents companies of the major foreign banks. Excessive credit lending and the amout of available banking finance are associated with decreasing capital ratios, financial soundness and deterioration of loan portfolio quality according to Dell'Ariccia and Marquez (2006).

Increased deposits with banks could contribute to the ample liquidity of the banking sector and the amount of available finance, which in our case did not deteriorate the NPL ratio in the case of the Baltics. We confirmed evidence of the negative effects of the deposit/loan ratio (with a coefficient in the interval from -0.99 to -1.37 percentage points). The Baltics had stimulated savings in domestic currency (as the part of anti-inflationary approach) by offering attractive real interest rates on deposits, which stimulated also savings with domestic banks (also from abroad), at the fact that labor productivity enabled the increase of (real) compensation to employees.

The credit-fuelled domestic demand boom has moreover translated into GDP growth. The theory of procyclicality between exports and the NPL ratio (as well as procyclicality between gross fixed capital formation relative to the GDP and the NPL ratio) was proven with regression coefficients in the interval from -0.23 and -0.24 (and the regression coefficients in the interval from -0.08 to -0.09 percentage points). Our results also confirmed also that growth of compensation of employees to the demand of household ratio decreased the NPL ratio growth by 0.62 and 0.77 percentage points. The increased economic activity improved the loan portfolio quality of the banking sector. The GDP growth, investment opportunities and increased producitivity should be positively correlated with business cycle and increasing economic performance, which raises the quality of loan portfolio (Laeven and Majoni, 2003).

In *Estonia*, GDP growth after 2005 was favorable, especially due to favorable developments in the service sector and export growth. Export growth improved eco-

Table 4 Panel Regression Results for the Baltics

Dependent Variable: *D*(*NPL*), Cross-sections included: 3 (the first quarter of 1998 – the third quarter of 2008), *n* = 129

Variable	*PLS Fixed effects (cross section fixed/period fixed)*	*PLS Fixed effects (cross section fixed/period none)*	*PLS pooled (cross section random/period none)*	*PLS Random effects (cross section random/period random)*	*PLS Random effects (cross section random/period fixed)*	*PLS Fixed effects (cross section fixed/period random)*
C	-10.12413 (-9.72182) (0.0000)***	-10.53349 (-8.95214) (0.0000)***	-10.43831 (-4.131802) (0.0001)***	-10.23132 (-4.004155) (0.0001)***	-9.965527 (-8.919670) (0.0000)***	-10.33577 (-8.18031) (0.0000)***
$d(DLR)_{(-4\ to\ -6)}$	-1.369475 (-6.565558) (0.0000)***	-0.943506 (-4.191486) (0.0001)***	-0.867622 (-4.006108) (0.0001)***	-0.988178 (-4.129667) (0.0001)***	-1.216424 (-5.890028) (0.0000)***	-1.052501 (-4.267172) (0.0000)***
$d(FDI_f)_{(-1\ to\ -3)}$	0.422972 (4.635150) (0.0000)***	0.475179 (3.111933) (0.0025)**	0.471248 (3.090870) (0.0026)**	0.473549 (3.184910) (0.0020)**	0.429441 (4.774519) (0.0000)***	0.475988 (3.159309) (0.0022)**
$d(LAR)_{(-4\ to\ -7)}$	0.557250 (5.076056) (0.0000)***	0.309930 (4.901730) (0.0000)***	0.303734 (4.610481) (0.0000)***	0.387221 (3.715483) (0.0003)***	0.527390 (4.569444) (0.0000)***	0.388006 (3.843596) (0.0002)***
$d(NFA)_{(-2\ to\ -4)}$	-0.220089 (-3.391072) (0.0000)***	-0.167367 (-2.130689) (0.0358)**	-0.165676 (-2.081661) (0.0402)**	-0.181636 (-2.407540) (0.0181)**	-0.220332 (-3.399998) (0.0012)**	-0.180700 (-2.393071) (0.0188)**
$d(EXPORT)_{(-4\ to\ -5)}$	-0.232673 (-2.891855) (0.0055)**	-0.242486 (-4.259344) (0.0001)***	-0.236706 (-4.040156) (0.0001)***	-0.230089 (-3.432150) (0.0009)***	-0.217298 (-2.606775) (0.0116)**	-0.236894 (-3.691614) (0.0004)***
$d(GFCFGDPR)_{(-4\ to\ -6)}$	-0.082111 (-6.400893) (0.0000)***	-0.094289 (-5.088623) (0.0000)***	-0.092129 (-5.317358) (0.0000)***	-0.086038 (-6.183556) (0.0000)***	-0.078727 (-5.615884) (0.0000)***	-0.088454 (-5.925688) (0.0000)***
$d(CFEDDR)_{(-3\ to\ -5)}$	-0.773975 (-8.729920) (0.0000)***	-0.564712 (-7.07424) (0.0000)***	-0.551509 (-7.11368) (0.0000)***	-0.609435 (-8.68437) (0.0000)***	-0.727146 (-7.588215) (0.0000)***	-0.619688 (-9.82327) (0.0000)***
$d(DLR)_{(-4\ to\ -6)}$ *dum	0.201312 (3.447950) (0.0011)**	0.080245 (5.173045) (0.0000)***	0.081811 (4.876353) (0.0000)***	0.129719 (3.071017) (0.0028)**	0.203102 (3.427120) (0.0011)**	0.123620 (3.216924) (0.0018)**

$d(FDI_t)_{(-1\ to\ -3)}$*dum	-0.398910 (-6.185220) (0.0000)***	-0.451452 (-3.001200) (0.0035)**	-0.444622 (-2.964981) (0.0039)**	-0.444227 (-3.014460) (0.0033)**	-0.404381 (-6.245534) (0.0000)***	-0.448668 (-3.006532) (0.0034)**
$d(LAR)_{(-4\ to\ 7)}$*dum	0.115925 (5.777540) (0.0000)***	0.291089 (6.234747) (0.0000)***	0.288970 (6.370947) (0.0000)***	0.227245 (6.191181) (0.0000)***	0.116178 (4.895986) (0.0000)***	0.234917 (6.121460) (0.0000)***
$d(NFA)_{(-2\ to\ -4)}$*dum	0.216175 (3.674727) (0.0005)***	0.166953 (2.015851) (0.0468)**	0.165199 (1.971762) (0.0516)*	0.179771 (2.235598) (0.0278)**	0.216492 (3.672783) (0.0005)***	0.179027 (2.225480) (0.0285)*/
$d(EXPORT)_{(-4\ to\ -5)}$*dum	-0.422919 (-3.246000) (0.0020)**	-0.224698 (-6.374558) (0.0000)***	-0.227699 (-6.085776) (0.0000)***	-0.272783 (-5.035664) (0.0000)***	-0.407840 (-3.032725) (0.0036)***	-0.267178 (-5.570189) (0.0000)***
$d(GFCFGDPR)_{(-4\ to\ -6)}$*dum	-0.093217 (-7.91990) (0.0000)***	-0.077896 (-7.35048) (0.0000)***	-0.074375 (-8.649256) (0.0000)***	-0.077007 (-6.83592) (0.0000)***	-0.086312 (-9.057729) (0.0000)***	-0.079960 (-8.41210) (0.0000)***
$d(CFEDDR)_{(-3\ to\ -5)}$*dum	0.556139 (4.478378) (0.0000)***	0.323782 (8.210324) (0.0000)***	0.316763 (7.277949) (0.0000)***	0.399799 (5.366605) (0.0000)***	0.525937 (4.120350) (0.0001)***	0.401600 (5.585694) (0.0000)***
$d(BCP\_cycle)$	-0.741514 (-3.60450) (0.0000)***	-1.922054 (-3.486744) (0.0009)***	-1.708630 (-2.550654) (0.0130)**	-1.278361 (-1.468309) (0.0966)*	-0.663325 (-3.837853) (0.0004)***	-1.452576 (-1.872162) (0.0656)*
$d(MC3\_cycle)$	0.322044 (13.05786) (0.0000)***	0.180895 (1.740288) (0.0856)*	0.264668 (3.637677) (0.0005)***	0.296245 (9.305882) (0.0000)***	0.461170 (9.98180) (0.0000)***	0.233581 (4.950914) (0.0000)***
$d(MC2\_cycle)$	0.090719 (4.258612) (0.0001)***	0.033238 (3.616048) (0.0006)***	0.030539 (9.458743) (0.0000)***	0.061546 (3.929671) (0.0002)***	0.079726 (2.555414) (0.0146)**	0.059632 (3.218104) (0.0020)***
$d(MC1\_cycle)$	0.007681 (10.18687) (0.0000)***	-	-	-	0.008569 (7.27009) (0.0000)***	-
The 1st and the 2nd Period: till the end of the last quarter of 2001 and from the first quarter of 2002 on						
$d(DLR)$						
The *1s* period	-1.369475	-0.943506	-0.867622	-0.988178	-1.216424	-1.052501
The *2nd* period	-1.168163	-0.863261	-0.785811	-0.858459	-1.013322	-0.928881

d(*FDI*$_t$) The 1^s period	0.422972	0.475179	0.471248	0.473549	0.429441	0.475988
The 2nd period	0.024062	0.023727	0.026626	0.029322	0.025060	0.027320
d(*LAR*) The 1^s period	0.557250	0.309930	0.303734	0.387221	0.527390	0.388006
The 2nd period	0.673175	0.601019	0.592704	0.614466	0.643568	0.622923
d(*NFA*) The 1^s period	-0.220089	-0.167367	-0.165676	-0.181636	-0.220332	-0.180700
The 2nd period	-0.003914	-0.000414	-0.000477	-0.001865	-0.003840	-0.001673
d(*EXPORT*) The 1^s period	-0.232673	-0.242486	-0.236706	-0.230089	-0.217298	-0.236894
The 2nd period	-0.655592	-0.467184	-0.464405	-0.502872	-0.625138	-0.504072
d(*GFCFGDPR*) The 1^s period	-0.082111	-0.094289	-0.092129	-0.086038	-0.078727	-0.088454
The 2nd period	-0.175328	-0.172185	-0.166504	-0.163045	-0.165039	-0.168414
d(*CFEDDR*) The 1^s period	-0.773975	-0.564712	-0.551509	-0.609435	-0.727146	-0.619688
The 2nd period	-0.217836	-0.240930	-0.234746	-0.209636	-0.201209	-0.218088
d(*BCP_cycle*)	-0.741514	-1.922054	-1.708630	-1.278361	-0.663325	-1.452576
d(*MC*3_*cycle*)	0.322044	0.180895	0.264668	0.296245	0.461170	0.233581
d(*MC*2_*cycle*)	0.090719	0.033238	0.030539	0.061546	0.079726	0.059632
d(*MC*1_*cycle*)	0.007681	-	-	-	0.008569	-
Weighted Statistics						
R-squared	0.709132	0.407170	0.382656	0.406148	0.691378	0.429616
S.E. of regression	5.074035	5.662796	5.649279	4.976587	5.074262	5.053812
F-statistic	2.578645	3.636135	3.801706	4.194725	2.553844	3.987548
Prob(*F*-statistic)	0.000334	0.000032	0.000032	0.000008	0.000355	0.000008

S.D. dependent var	6.745208	6.745208	6.667018	5.988178	6.666612	6.137120
Durbin-Watson stat	1.973022	2.135405	2.109019	2.089934	1.925184	2.119675
Random and Fixed Effects Tests (Prob.)						
Hausman Random Effects Test	-	-	(0.8972)	(0.8861)	(0.8927)	(0.8745)
Redundant Fixed Effects Test	Cross-section F=0.0002 (0.0000)	Cross-section F=0.0001 (0.0000)	-	-	(0.0031)	(0.0000)
Effects Specification (Rho)						
Cross-section random	-	-	0.3938	0.3959	0.4260	-
Idiosyncratic random	-	-	0.6062	0.4635	0.5740	0.7959
Period random	-	-	-	0.1402	-	0.2041
Stability Test: Chow Forecast Test (Prob.)						
1999:03–2001:03	(0.8248)	(0.7812)	(0.9425)	(0.8964)	(0.6942)	(0.7062)
2002:03–2007:03	(0.7558)	(0.7429)	(0.9075)	(0.8377)	(0.7286)	(0.6812)

Notes: Symbols: *D*(), denotes the percentage change of the variable (as measured in percentage point), *NPL*: the share of nonperforming loans (as loans more than 90 days past due) to total bank loans, *DLR*: deposit to loan ratio as deposits of the private sector share of total loans to the private sector, *LAR*: loan to asset ratio as the ratio between bank loans to private sector to banking sector assets, *NFI*: net foreign assets (of the banking sector) to net assets ratio, *FDI*: foreing direct investment (in fin. sector and real estate), *EXPORT*: export of goods and services, *GFCFGDPR*: gross fixed capital formation relative to GDP, CFEDDr: compensation of employees relative to domestic demand of households, BCP: Basel Core Principles (measured as index of compliance with Basel Core Principles); *MC*: market concentration (proxied by the assets of three big banks relative to total banking sector assets) and divided into three categories (low, middle and high).

*** significant at 1%; ** significant at 5%; * significant at 10% level.

The time lag of an individual coefficient is given in subscripts; (*t*-Statistics) are in brackets and (probabilities)*** are in brackets below (*t*-Statistics).

economic conditions in Estonia from 1998 to 2007, most likely due to strong productivity growth and increasingly diversified export and import structures that have reduced vulnerability in terms of trade deterioration (export growth mainly exceeded import growth in *Estonia* in the period from 1999 to 2006). Since 2000, *Latvia* has experienced rapid growth in investments, which encouraged the modernization of production and introduction of new technologies. In Latvia, the investment to GDP ratio might have risen to maintain strong economic growth and a healthy banking sector has helped to allocate savings to the most productive investments. In *Lithuania*, economic growth has been stimulated by the expanding internal market after the accession to the EU and favorable export conditions, as well as household incomes rising since 2001, bringing economic growth to the general population.

The interaction terms between the business cycle and (banking) market concentration provide some interesting results, which differs across the countries depending on the level of (banking) market concentration. The higher market concentration coincides with higher NPLs during the economic downturns, relative to low market concentration economies (this results rise a number of questions, which are out of the scope of this study). According to De Nicoló et al. (2004) the evidence of increased risk profiles for the largest banks and concentration might coincide with a higher level of systemic risk potential for more concentrated banking system. Meanwhile the compliance with the Basel core principles relative to economic cycle improves the quality of the loan portfolio (*Table 4*). Barth et al (2004) proved that banking system with greater regulation and supervision may be more stable. According to Schaeck and Čihák (2007), banks tend to hold higher capital buffers when operating in a more competitive sector environment.

After the last quarter of 2001, only the intensity of the explanatory variables' impact on the NPL ratio changed. The impact of export and gross fixed capital formation to GDP ratio improved the NPL ratio more intensively than in the period before the first quarter of 2002 (with the coefficients in the second observed period in the interval from -0.46 to -0.66 for the explanatory variable export and from -0.16 to -0.17 percentage points for the explanatory variable gross fixed capital formation relative to GDP).

The results for the first period seem to coincide with those for the entire period. The impact of the *Russian crisis* in 1998 on these economies brought the differing pace of structural adjustment back into focus but did not reverse the trend. After the Russian crisis, favorable economic development and approaching EU membership increased investments, export and GDP growth (Ådahl, 2006).

The Baltics grew strongly on the back of strong household spending, accelerating investment growth and FDI. Sizeable productivity increases and moderate wage growth, as well as cuts in social security contributions, contributed to the external competitiveness. Buoyant growth rode on the back of robust consumption spending together with accelerating investments - as a result of reconstruction activities and a large number of programmes co-financed by the EU.

On the other hand, the loans to asset ratio deteriorated more intensively the NPL dynamics at the fact that loans to the private sector have been growing at a rapid pace in the period from 2004–2007. Deposits to loans ratio improved the NPL ratio less intensively in the second period. And the impact of compensation of em-

ployees to domestic demand improved the NPL ratio dynamics less intensively than in the first period.

Net foreign assets improved the NPL ratio less intensively in the second period (with the coefficient in the interval from -0.004 and -0.0005 percentage points). And the impact of foreign direct investment (as the amount of available finance) became less intensive in deteriorating the NPL dynamics (with a coeficient in the interval from 0.024 to 0.029 percentage points). With foreign borrowing becoming important, the net foreign asset position of the banking system deteriorated (Naraidoo et al., 2008) and the increase of domestic savings did not keep up with the lending activities in the Baltics after 2002 (Sopanha, 2006). The net foreign asset balances of commercial banks (due to the fact that banks become net external debtors) have highlighted the need for demand restraint to improve the saving-investment balance and slow down the debt accumulation of the private sector after 2006.

Estonia, after 2004, domestic savings with banks started to augment, which is explainable by the substantially increased income of households and enterprises. But increasing available deposits with banks (as the amount of available finance and credit potential) did not contribute to NPL ratio deterioration. In *Estonia*, the favorable developments in the service sector contributed considerably to favorable movements in the employment rate and purchasing power of households after 2005. The rapid growth of private consumption was also fostered by low loan interest rates and favorable loan conditions.

In *Latvia*, rapid credit growth appears to have been contained by high domestic savings (and deposit accumulation) after 2000, and higher net private savings were needed to contribute to moderate credit growth. On the other hand, the inflow of foreign capital contributed to significant growth in liquidity, and surplus liquidity created an additional supply of loans. The strong domestic demand (only partially financed by FDI and net portfolio investment) and productivity adjusted wage growth relative to trading partners have highlighted the need for demand restraint to improve the saving-investment balance and slow down the debt accumulation of the private sector after 2006.

In *Lithuania*, after 2004, the decrease of personal income taxes affected private savings positively. In the beginning of 2008, despite the strong pace of exports the current account deficit was higher than in the same period in 2007, because FDI and cross-border financing started showing signs of weakness (and flagging economic growth would likely be expected to trigger an adjustment in the current account deficit in Lithuania).

The inflow of foreign capital contributed to a significant growth in liquidity and the surplus liquidity created an additional supply of loans in the Baltics. Higher net foreign direct investment inflows in tradable sector, gross fixed capital formation, favorable export growth and net foreign assets of the banking sector expanded the capability of a country to service foreign debt (Wu, 2004). Higher economic growth contributed to improvement in NPLs in the Baltics and the slowdown in economic activity is likely to accelerate the NPL dynamics in the Baltics (Égert, Backé, and Žumer, 2006; Kiss et al., 2006).

The credit-led domestic demand growth was accompanied by macroeconomic imbalances like overleveraged households and external imbalances. The significantly

greater increase in domestic demand over overall growth implies the mounting negative growth contribution from net exports mirrored in a ballooning current account deficit. Due to the fact that the analysed EU Baltics have channeled a significant part of its FDI into the nontradable sector (real estate and services) and because of its high current account deficit, there is a risk that FDI contributed to export capacities and raised the risk of sustainability in the balance of payments.

4. Conclusion

We demonstrated that the loan to asset ratio and FDI (in financial intermediation and real estate) contributed to an increase in the dynamics of the NPL ratio within the observed economies. Our estimates for the Baltics therefore support the hypothesis that the growth of loans might harm banking performance, most probably due to soft-loan constraints (conditioned by the growth of available finance) and overheating of economies. Our results do support the hypothesis that gross fixed capital formation in the selected economies contributed to an increase in economic activity and lower NPL ratios. Since we confirmed that the boost in the export activity of these economies improved the NPL ratio, the eventual weakening of growth in export-oriented industries could lead to economic contraction with a direct impact on the sustainability of banking-sector results in these countries.

We can also state that strong economic growth and a decelerating NPL ratio, within the context of the procyclicality theory, can be interpreted as a signal for economic overheating and therefore as a potential threat to banking sector performance. A slowdown in economic activity and export is likely to deteriorate NPL ratio dynamics in the Baltics.

APPENDIX

Data

Originally, the following time series for economic activity were utilized: the real export of goods and services (in billion of domestic currency in real terms, the deflator is export prices), the real GDP (in billion of domestic currency deflated by GDP deflator), gross real fixed capital formation in the nonfinancial sector (in billion of domestic currency deflated by gross fixed capital formation deflator), foreign direct investment in financial intermediation and real estate (in billion of domestic currency deflated by appropriate deflator), disposable income and compensation for employees (deflated by consumer price index) and the domestic demand of households (in billion of domestic currency deflated by consumer price index). Net foreign assets (of the banking sector) as the share of net (banking) assets were utilized as an indicator of the net open foreign currency position. The banks' loans to the private sector (i.e., loans to households and corporations, as obtained from banks in the country, in billion of domestic currency deflated by consumer price index) as share of total banking assets (in billion of domestic currency deflated by consumer price index), considering this variable as a proxy of risk taken by the banks; and the deposits of the private sector (in billion of domestic currency deflated by consumer price index) as a share of loans (in bn domestic currency deflated by consumer price index), as a rough measure of the profitability of the deposit money, were employed.

The variables controlling for cross-country differences as market concentration (approximated by the assets of three big banks relative to total banking sector assets; and used in regression as dummy variable divided into three categories: low, middle and high) and compliance with the Basel Core Principles (measured by an index of compliance with the Basel Core Principles) were employed.

All the nominal variables expressed in national currencies were corrected by an individual country's appropriate deflators (the third quarter of 2008 as the base) and transformed into EUR by using the exchange rate of the third quarter of 2008.

The accompanying Excel file (on the web page of this journal) provides information on the autocorrelation of the residuals, The time series statistics, and the cointegration test results.

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