ACTA VŠFS

Economic Studies and Analyses
Ekonomické studie a analýzy

ACTA VŠFS

Editorial

MOJMÍR HELÍSEK

Dear Readers,

As usual, the first issue of ACTA VŠFS in 2014 brings four essays. The last of these essays is one of the winning papers in the fourth year of the biennale Prof. František Vencovský Awards, the results of which were announced in November 2013. Other winning papers will be published in the following issues. This issue of ACTA also includes one review of a new economic book.

The essay of Jaroslav Vostatek deals with the *Taxation of Public and Private Pensions*. Tax theory is not consentient when it comes to taxation of private pensions. Occupational pensions have become the second most important pension scheme pillar. In practice, there are increasing trends aimed at significant stimulation of pension savings and at ignoring any associated fiscal costs. The essay comes to a conclusion that the taxation and subsidising of pensions in the Czech Republic require a major reform.

Tomáš Pavlíček analyses the *Development of the Self-employed Sector in the Czech Republic in the Years 2006 – 2010*.
He estimates the flows between the sector of wage earners and the self-employment sector, assessing the development of the taxes actually paid with regard to two approximate estimates of the profit generated through self-employment – i.e. tax base and mixed income. More opportunities for using flat rate expenses have very likely played an important role in the increasing number of self-employed people.
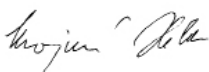
David Tisoň examines the *Impact of Non-cooperative Oligopoly of the Banking System on Its Pro-cyclicality in the Czech Republic* in his essay. He explains various actions of banks during recession and expansion, using several game theory models: The key one is the Bayesian game, which models an environment of a conflict situation with incomplete information. In its conclusion, the essay offers a solution in the form of open bank cartels (cooperative oligopoly) aimed at the strategy coordination.

The closing essay by Tomáš Klinger and Petr Teplý, *Modelling Interconnections in the Global Financial System in the Light of Systemic Risk*, focuses on the interconnection of the financial system with the public finance crisis via government aid provided to banks on the one hand, and exposure of banks to government debt on the other hand. In the short run, all measures aimed at the support of banks improve the system stability; on a longer basis; however, the effects brought about by the government aid depend on the model parameters.

The New Economic Literature section includes a review of a book by a controversial German author Thilo Sarrazin "*Europe Does Not Need the Euro*", written by the author of this Editorial.

All essays deal with current issues from the perspective of the Czech as well as the global economy. Therefore, I believe that you – our readers – will find them all very interesting.

Mojmír Helísek
Executive Editor
University of Finance and Administration

Vážení čtenáři,

první číslo ACTA VŠFS v roce 2014 vám nabízí jako obvykle čtyři statě. Poslední z těchto statí je jedna z vítězných prací čtvrtého ročníku soutěže o Cenu prof. Františka Vencovského, jejíž výsledky byly vyhlášeny v listopadu 2013. Další vítězné práce otiskneme v následujících číslech. V tomto čísle ACTA vám také nabízíme jednu recenzi nové ekonomické literatury.

Stať Jaroslava Vostatka se zabývá *Zdaněním veřejných a soukromých penzí*. Daňová teorie není jednotná v přístupu ke zdanění osobních penzí. Podnikové penze se staly jejich druhým nejvýznamnějším pilířem v penzijních systémech. V praxi jsou nemalé tendence k výrazné stimulaci penzijních úspor a k ignorování fiskálních nákladů s tím spojených. Stať dochází k závěru, že zdanění a dotování penzí v ČR vyžaduje zásadní reformu.
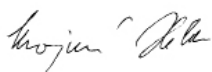
Tomáš Pavlíček analyzuje *Vývoj sektoru osob samostatně výdělečně činných (OSVČ) v České republice v letech 2006 – 2010*. Odhaduje toky mezi trhem námezdní práce a samostatnou podnikatelskou činností - sebezaměstnáním a hodnotí vývoj skutečně zaplacených daní ve vztahu k dvěma přibližným odhadům zisku ze sebezaměstnání – daňovému základu a smíšenému důchodu. Rozšíření možnosti paušálního uplatňování nákladů pravděpodobně sehrálo významnou roli v nárůstu počtu osob samostatně výdělečně činných.

David Tisoň zkoumá ve své stati *Vliv nekooperativního oligopolu bankovního sektoru na jeho procyklikalitu v České republice*. Stať vysvětluje chování bank v období recese a expanze, a to pomocí několika modelů teorií her. Hlavní z nich je Bayesovská hra, která modeluje prostředí konfliktní situace s nedokonalými informacemi. Závěr stati nabízí východisko v podobě otevřených bankovních kartelů (kooperujícího oligopolu) za účelem koordinace strategie.

Závěrečná stať autorů Tomáše Klingera a Petra Teplého *Modelování vazeb v globálním finančním systému z pohledu systémového rizika* se zaměřuje na propojenost finančního systému s krizí státních financí skrze státní pomoc bankám na jedné straně a expozice bank vůči státnímu dluhu na straně druhé. V krátkodobém horizontu veškerá opatření na podporu bank zlepšují systémovou stabilitu, v delším časovém horizontu závisí účinky státní podpory na parametrizaci modelu.

V rubrice Z nové ekonomické literatury se můžete seznámit s recenzí knihy kontroverzního německého autora Thilo Sarrazina *Evropa euro nepotřebuje*, kterou napsal autor tohoto Editorialu.

Všechny statě se zabývají aktuální problematikou z pohledu jak české, tak i světové ekonomiky. Věřím proto, že vás – naše čtenáře – všechny zaujmou.

Mojmír Helísek
výkonný redaktor
Vysoká škola finanční a správní, o.p.s.

Tax Treatment of Public and Private Pensions
Zdanění veřejných a soukromých penzí

JAROSLAV VOSTATEK

Abstract

Different approaches to taxing public pensions and to social security contributions can be explained by differences in emphasis on various social models in different countries and by inconsistencies in the implementation of social and fiscal reforms. The concept of funding of public health care is of essential importance as well. Occupational schemes acquired after the Second World War a significant role in pension systems and have become their second most important pillar. In a number of countries they have this status till today, despite modern pension theory tends to replace them by personal pensions, but these usually have a much higher overhead costs. Tax theory is not uniform in approach to the taxation of personal pensions, in practice there is a considerable tendency to stimulate significant retirement savings and ignore the fiscal costs associated with it. EU tax policy rejects taxation of personal pensions and other financial services by VAT on the basis of alleged technical problem with the taxing of margin. Taxation and subsidization of pensions in Czechia requires a fundamental reform. The paper may be a background for such a reform.

Keywords

public pensions, private pensions, occupational schemes, personal pensions, personal income tax, social security contributions, value added tax, social models

Abstrakt

Rozdílné přístupy ke zdanění veřejných penzí a k příspěvkům na sociální zabezpečení lze vysvětlit rozdíly v důrazu na různé sociální modely v jednotlivých zemích a také nedůsledností v provádění sociálních a daňových reforem. Podstatný význam hraje i koncepce financování veřejné zdravotní péče. Podnikové penze nabyly po druhé světové válce podstatnou roli v penzijních systémech a staly se jejich druhým nejvýznamnějším pilířem. V celé řadě zemí mají toto postavení dodnes, přestože moderní penzijní teorie má tendenci je nahradit osobními penzemi; ty ovšem obvykle mají podstatně vyšší režijní náklady. Daňová teorie není jednotná v přístupu ke zdanění osobních penzí, v praxi jsou nemalé tendence k výrazné stimulaci penzijních úspor a k ignorování fiskálních nákladů s tím spojených. Daňová politika EU odmítá zdanění osobních penzí a dalších finančních služeb DPH na základě údajného technického problému se zdaněním marže. Zdanění a dotování penzí v ČR vyžaduje zásadní reformu. Příspěvek má ambici být podkladem pro takovou reformu.

Klíčová slova

veřejné penze, soukromé penze, podnikové penze, osobní penze, daň z příjmů fyzických osob, příspěvky na sociální zabezpečení, daň z přidané hodnoty, sociální modely

Introduction

After the World War Two different pension systems emerged in the market economies, comprising public, occupational and personal pensions and pension savings. While most public social pension insurance systems resigned for the full or partial funding of these schemes for practical reasons in fifties, most occupational schemes maintained and developed the funding principle. In the latest two decades there were strong tendencies to privatize the earnings-related public pension schemes in Latin America and post-Communist countries, utilizing personal pensions of all types. In this varied pension world there are many contact points of the pensions to the personal income taxation, social security contributions and consumption taxation that influence the extent of use of the private (personal and occupational) pensions and thus the whole structure of the pension system in the respective countries. Several countries even utilize strong fiscal incentives for pension savings.

The aim of this paper is to review the parallel development of the tax theory and policy and of the pension theory and policy, concentrating on their intersections – on the tax and other fiscal treatment of different pension products under the different social models and systems. We mention also the EU policy in this area, which mainly affects the occupational schemes and indirectly also the area of value added tax – in taxation of financial services. In doing so, we will constantly pay attention to the current state of the problem in the Czech Republic and to the possible application of any comprehensive concept.

1   Taxation of Public Pensions

The OECD (2011) prepared an overview of tax treatment of pensions and pensioners. The key results are as follows: "The personal tax system plays an important role in old-age support. Pensioners often do not pay social security contributions. Personal income taxes are progressive and pension entitlements are usually lower than earnings before retirement, so the average tax rate on pension income is typically less than the tax rate on earned income. In addition, most income tax systems give preferential treatment either to pension incomes or to pensioners, by giving additional allowances or credits to older people" (p. 122). The extent of preferential treatment to pensioners compared to workers is shown by the OECD in Figure 1; the amount of the so-called full pensions is modelled here for workers with average earnings. Individual OECD and G20 member states are ranked based on the percentage of the model pension taxation, from the highest pension taxation rate in Denmark to zero taxation of the pensions in Mexico. Of the 42 countries in total, only 10 countries have zero taxation on pensions. Surprisingly, the Czech Republic is not included in this list of 10 countries in the Figure, in spite of the fact a pensioner would not pay any taxes in the standardized example (calculation of pension based on average nationwide earnings) according to the situation prevailing in 2008 (and to this date); according to the Figure in question, a pensioner would have to pay approximately 2% of pension.

The taxation of workers' average earnings, including the social security contributions, is shown as the total length of the column in the Figure, consisting of up to three sections. The average rate of this taxation of earnings in the OECD amounted to 26.4%, while

amounting to 12.8% in other G20 countries mentioned. The last section of the column for individual countries (the right section) shows the tax benefits of pensioners compared to workers. The hypothetical assumption here is that a pensioner has a pension of average nationwide earnings. The OECD average for the benefits should amount to 8.2% of gross earnings; therefore, an average OECD pensioner would pay an income tax and social security contributions at the total rate of 18.2% (difference of 26.4 and 8.2) on a pension amounting to average nationwide earnings. In relation to earnings, pensions are taxed considerably lower; the actual average taxation of the said model pensions in the OECD amounted to 11.8%. The difference of 18.2 and 11.8 thus illustrates the rate of preferential treatment of pensioners to workers in the area of taxation (OECD, 2011).

Figure 1: Personal income taxes and social security contributions paid by pensioners and workers (%)
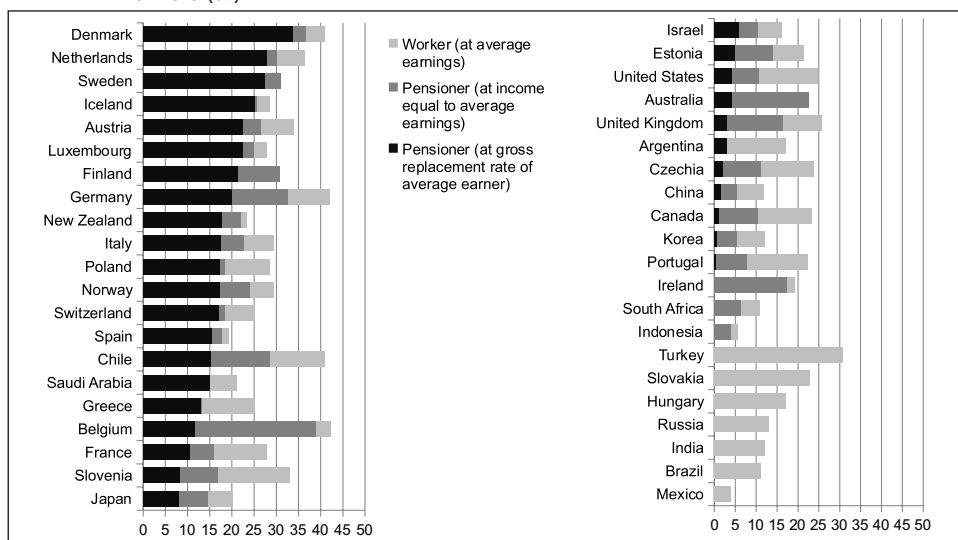
Source: OECD (2011)

Figure 1 contains not only public pension schemes, but also mandatory and quasi-mandatory private schemes. The tax regime of the (quasi-)mandatory pension schemes should normatively be identical, whereas this is considered as implied within foreign literature. If we were to attempt a normative conclusion with the use of the said OECD data, the only option would be to require uniform taxation of earnings and pensions; this is implied in terms of tax theory – and only political reasons could lead to lower taxation on pensions in most OECD/G20 countries, with zero taxation on pensions in 10 of those countries. Theoreticians should emphatically call attention to the rationality behind the tax regime consolidation – i.e. to implement a system of uniform taxation of earnings and pensions. Germany has a program of this tax unification by 2040 (starting from 2005), based on the constitutional equality of people in this regard (BMF, 2009). A single-stage transformation, associated with a major reform of Czech public pensions, is feasible in the Czech Republic. This could technically be carried out by simply increasing the current pensions by the tax amount to be imposed on such pensions. For this reason alone, it would be useful to have a relatively stabilized income tax construction, namely in terms of taxation of the so-called

super-gross salary – and associated taxes identified as social security contributions or public health insurance premiums.

Social security contributions are, both in Figure 1 and in other international overviews, consolidated with personal income tax – they are simply considered as taxation of income. These contributions represent one of the tax pillars, one of the components of the "tax mix" and internationally defined tax quota. There are undeniable advantages to this as well. However, when analysing tax and social systems in more detail, we also have to ask a question whether the existence of the "social security contributions" is justified, namely in respect to pensioners in this regard: should old-age pension beneficiaries contribute to "their" (or other?) pensions or to the social security sector in the broad sense, including healthcare?

From the perspective of a model, it is possible to distinguish 3 or 4 basic pension schemes. Under a modern liberal model, old residents receive a universal (flat) pension from the state or an income-tested benefit (pension), which increases the residents' income to the specified minimum, amounting to, for example 27.7% of average male nationwide earnings in Australia (CA, 2009). From the perspective of their model, both old-age pension concepts are tax-financed – therefore, in principle, no pension insurance premiums exist here.

The situation is opposite under the conservative pension model: insurance premium is the only source of funding of the social pension insurance. The system may either be fully-funded (FF) or utilize pay-as-you-go financing (PAYG). In this case, the insurance premium is thus implied and, from the perspective of a model, it is not a "pension tax" (as this budget revenue is labelled in the Czech Republic), but rather a product price. The pension insurance premium is paid from earnings, according to recommendations of international experts, up to the limit of 125-200% of average nationwide earnings. Under the modern model version, newly awarded old-age pension is calculated from the insurance premiums paid, using actuarial mathematics. In this model, pensioners without any income do not pay pension insurance premiums; they have already paid them, so to speak. On the other hand, pensioners with an earning pay the insurance premiums; however, from their actual earnings, whereas any insurance premiums paid are reflected in an increase of their pensions.

The lack of the pension insurance premium payments on pensions does not mean that it is not possible to impose insurance premium in respect of another social security area under the conservative model. The reason for this is the fact that the social health (sickness) insurance represents a standard part of the conservative social model, whereas the insurance premium payments on the part of pensioners are systemically justified. (At the same time, this concept /alternative/ may also be reflected in the amount of the granted pensions.) This is the case in Germany – pensioners pay sickness insurance premiums on pensions (without the right to claim a sick pay; however, with the healthcare as a sickness insurance benefit), similarly as workers. The second half of the insurance premiums is paid by their pension insurance institution.

The social-democratic pension model also comprises the social pension insurance, which is uniform for all workers. (The social insurance is fragmented for individual social groups under the conservative model.) The insurance premium is uniform; therefore, basically the

same principles apply as under the conservative model. The practical difference consists in the insurance premium payers; the best option for the social-democratic model represents insurance premium payments by employers only – this is not entirely the case in Sweden, as employees pay 7% of their wages; however, the construction of the insurance premiums as a whole is surprisingly complicated in this country. Under the conservative social insurance model, insurance premium payments have been "divided" (into halves) between employees and employers due to ideological reasons – to ensure that both parties to an employment contract take part in the social insurance funding, since they both have an interest in its existence. "Yet, as a matter of legislative intent, this sharing provision was introduced to "divide" the burden." (Musgrave, 1989).

Neoliberal policy requires or recommends, as appropriate, insurance premium payments to be made solely by employees, to ensure that it is clear the social security contributions are part of the labour costs, i.e. it is nothing workers would get for free. Based on the transparency requirement, the super-gross salary concept came into existence in the Czech Republic; however, the respective government did not attempt to implement it in the end. Nevertheless, it introduced the super-gross salary concept in advance, as the basis for the calculation of personal income tax. From the perspective of general economic theory, there is no significant difference between insurance premium payments made by employees or employers; however, the combination of both payers is generally economically illogical. Moreover, the Czech practice, with both employees and employers being "premium" payers in an absolutely incidental proportion – based on the computation results "received" during the tax reform of 1993 – cannot be explained at all. And we have to add that the Czech public "pension insurance" is mainly a payroll tax (and not an insurance premium) due to prevailing solidarity redistribution. Taking it into account we may, more or less, only analyse the tax burden shifting, e.g. under different market conditions (Musgrave, 1989).

The communist system of detailed central planning did not allow any room – either factual or ideological – for social insurance. For this reason, the national insurance premiums, paid by employees were integrated in 1953 – into a "uniform" income tax in Czechoslovakia. Furthermore, the taxation of wages as such, or the taxation of population in general, opposes the communist ideology. Therefore, the policy comprising a transition to a "tax-free state" – meaning no taxes paid by the population, with no income tax as a priority – was later declared in the Soviet Union. The taxation of wages, let alone the taxation of pensions, does not make any sense under the communist model. The state directly controls wages – there is no need to complicate it by taxation. The state budget revenue is covered from the transfers of profits by state-owned companies and from a turnover tax, defined as the difference of the two price levels set down by the government (wholesale and retail prices). It was also indicated that the turnover tax is not a tax (either), but a form of net income generated in the course of production. Ideological clichés aside, we can see the simplicity of the communist model – it is unnecessary to tax not only pensions, but also wages. In the Czechoslovak practice, a "special pension income tax" was implemented in the 1960s, as the government was forced to cut pensions as a result of unsuccessful economic policy. The aforementioned tax was successfully discontinued after a prolonged period of time and, consequently, we inherited a system of zero-taxation on pensions under the Velvet Revolution. No major reform has taken place in this area yet, whereas

no government has started preparing it. The "only" measure taken by the government, as part of the economical fiscal packages, was the introduction of taxation of relatively high pensions, together with taxation on pensions drawn in concurrence to earnings, and annulment of the right of wage-earning pensioners to claim the basic tax credit.

Let us, once again, go back to the social-democratic model. The universal healthcare, financed from public budgets without the use of insurance premium, is part of the model. Consequently, no health insurance premium is paid on pensions under this model. This allows even higher personal income tax or another tax. On the other hand, the neoliberal model of universal healthcare funding foresees that all residents – including pensioners – pay a flat rate insurance premium, independent of their income or health. At the same time, poorer residents receive a social allowance to such insurance premium, scaled according to their respective income level.

Overall, it is common in OECD countries to have a significant personal income tax and, in terms of modern theory, it is also necessary to fully apply such tax to public pensions and (quasi-)mandatory private pensions. The collection of health insurance premiums on pensions or from pensioners, as appropriate, makes sense for segmented social health insurance and mandatory private health insurance, i.e. within conservative and neoliberal healthcare financing models.

2   Taxation of Occupational Pensions

Occupational schemes came into existence as an analogy to the pensions of public officials – individual undertakings started with a voluntary provision of pensions to selected employees, to express recognition of their work and, at the same time, to provide additional motivation for remaining within the company. In fact, it was a promise of pension payments in return for their loyalty to the company. Therefore, this conceptually represented a postponed payment of part of the wage for a later, relatively long period of time. The initial tax treatment concept also corresponds to this: occupational schemes are subject to full taxation, similarly as standard earnings, naturally at the moment the pension payment is made. The entire problem pertaining to taxation was exhausted in this manner within the model example; the pension was paid by the company using its operating funds, no reserves were created – because it was not necessary and, moreover, it would unnecessarily limit the business in using its company assets. Consequently, there were no contributions for pension fund creation, because the fund did not exist. In fact, it is a simple analogy to the pay-as-you-go financing of public pensions.

The initial accounting standard applicable to occupational schemes has been subject to significant changes, particularly after the Second World War. Occupational pension funds were commonly being formed and occupational schemes significantly gained in importance under many pension schemes, to a point where occupational pension security started to be viewed as the second pension pillar in the majority of developed countries, a supplement to the first, public pillar, often in the form of a social pension insurance – whether conservative or social-democratic type. Furthermore, occupational schemes typically ceased to have a loyalty feature, partially also due to the fact that the effort aimed at lifelong employment in one company no longer made sense. On the contrary, economies

started to develop dynamically, change structures, and all this required a flexible labour market that could not be held back by the concept of occupational schemes. Conversely, it was being underlined that occupational funds must be transferable – in case of a job change. International institutions made substantial effort aimed at allowing the transferability of pension entitlements between individual countries as well. It seemed that only the taxation of pensions remained from the original concept of occupational schemes. This means that the basis for the tax treatment has been the taxation of occupational pensions paid out, as a component of total incomes of individual person and/or families.

The new concept of occupational schemes brought about the formation of occupational pension funds, in the form of employers' contributions or a combination of contributions made by employers and employees. Unless this area of occupational schemes financing is regulated by government or superior collective agreements, the potential involvement of employees in the funding of their occupational schemes as well as the form of such involvement is always subject to an agreement at the company level. One way or another, the tax treatment of any contributions made under occupational schemes must also be regulated. At the same time, it was possible to apply a typical system of tax treatment of social pension insurance premiums, which consists in the exemption of insurance premiums paid under such pension insurance. Specifically, the model treatment of the social insurance premiums has been as follows: any insurance premium paid by an employee represents an item deductible from an employee's income tax base, whereas any insurance premium paid by an employer does not enter the employee's income tax base and represents the company's eligible cost item. The same elementary principle is also applied to occupational pensions.

The area relating to tax treatment of contributions to occupational or supra-occupational pension funds is more complicated than the area of tax treatment of social pension insurance premium. The reason for this is, as a minimum, the potentially substantially higher variability of rates and constructions of the occupational scheme contributions. While the social insurance schemes, including the insurance premium rates, are regulated by law and, as a result of their economic nature alone, there is basically no room for, e.g., the payment of higher insurance premiums, the typical situation for occupational schemes is just the opposite. Moreover, in case a tax deduction or tax eligibility of insurance premium costs represents /could represent/ motivation to increasing pension fund contributions, there is no wonder governments set down limits for deductions or eligibility of contributions.

Specifically, the following basic concepts (principles) of tax treatment for occupational schemes are currently used in the reference countries (Hughes, 2001):
• EET principle (Exempt contributions, Exempt investment income and capital gains of the pension institution, Taxed benefits) is used by the vast majority of EU member states, as well as the United States, Canada, Switzerland, Norway, and others;
• ETT principle (Exempt contributions, Taxed investment income and capital gains of the pension institution, Taxed benefits) is applied by three EU member states (Denmark, Italy, Sweden);
• TTE principle (Taxed contributions, Taxed investment income and capital gains of the pension institution, Exempt benefits) is used by New Zealand;
• TET principle is applied in Iceland and Japan.

The accurate categorization of individual countries according to individual principles for the occupational schemes taxation is complicated, simply for the reason that there are several types of occupational pension schemes existing in parallel (this is typical for Germany); moreover, international overviews of occupational schemes are not prepared very often and, last but not least, conceptual changes take place, e.g. to partial or full transition to a personal pension scheme, whereas employers are "degraded" to "mere" payers of contributions to pension funds of employee's choice. This also includes the salary conversion schemes (unknown in the Czech Republic), where an employee is entitled to ask his employer to convert part of his salary to a contribution to a pension fund of the employee's own choice – at least partially.

No occupational pension scheme effectively exists in the Czech Republic, although the EU forced us to formally implement the so-called Pension Directive (Directive 2003/41/EC on the activities and supervision of institutions for occupational retirement provision /IORPs/). In the Czech Republic, the occupational pension scheme was already rejected by the Government of Václav Klaus at the beginning of the 1990s, for ideological reasons and due to concerns about frauds under prevailing insufficient infrastructure of government regulation of financial institutions. Liberals reject the existence of occupational pension funds, simply for the reason they are non-profit organizations, managed by the board, which is to act in the interest of clients. The main reason is the fact that individuals should make decisions regarding their pension security, not collectives or companies; otherwise these services are overused and result in inefficiency.

The objective of the Pension Directive of the EU was to develop the single market in the area of the pension funds, which operate under standard rules of comparable financial institutions – thereby contributing to the reduction of overhead costs. (Therefore, the Directive does not apply to, for example, the main German occupational pension scheme, under which companies only create book reserves.) According to the Directive, Pan-European pension funds were foreseen, e.g. at the level of large international groups of companies. The resulting effects of the Pension Directive are marginal – only about 85 Pan-European funds were established, though the IORP schemes cover about 25% of the working population of the EU (Chen, 2013). A revision of the Directive has been in the making for several years now. However, the problem may be more significant than the EU officials have admitted so far.

Together with the major change of the concept of voluntary occupational schemes, with employers degraded to payers of contributions to their employees' pension accounts, the key purpose/reason for existence of occupational schemes should be newly formulated. Personal pensions are capable of fully taking over their role, at least from the technical and legal perspectives. Only one potential reason remains for the existence of occupational schemes: the potential advantage of occupational schemes, compared to personal pensions, consists in the costs: the occupational schemes are – ceteris paribus – associated with substantially lower overhead costs, as there are no selling and similar costs as well as no profit margin. In addition to corresponding governance, it is also necessary to aggregate the relevant pension funds at an industry or nationwide level, e.g. according to the Dutch or Swedish example, to capitalize on the potential benefits of occupational

schemes. If this is the case, we will arrive at a system, which is closer or basically equal to segmented social pension insurance.

A different, opposite, approach was taken in Australia: In 1992, mandatory occupational pension savings were introduced, with an employers' contribution of 3% of wages. At the same time a schedule for increasing this rate up to 9% was declared. In 2005, a major reform took place consisting in the fact that most employees gained the right to select either a pension fund or a retirement savings account, i.e. products offered by banks, life insurance companies, and other financial institutions. A transformation of occupational pensions to personal pensions thus basically took place; to be accurate, we should refer to it as to occupational or personal retirement savings, because it is not required to purchase annuity for the savings in Australia – and only about 10% of clients purchase it in practice. To my surprise, the reform led to an increase in the number of the providers of such products – amounting to 427,000 in March of 2010. We shall see how the situation develops further; so far, the contribution rates have been gradually increasing, up to the new level of 12% in 2019/2020. Apparently, people in Australia are happy with the mandatory pension savings scheme, with an exclusive contribution of an employer (however, employees may also "add" their own funds). The Australians have also recommended the system to the British, who continue in the implementation of the "soft compulsion" scheme on the basis of an automatic enrolment and, in the interest of reducing the very high costs of the private sector, they even established a low-cost state-owned pension company NEST Corporation, which is to offer the administration/management of pension funds to companies, particularly for poorer employees, who cannot afford the high overhead of the private financial sector.

Let us, once again, go back to the taxation systems, such as EET, TTE, etc. So far, we have concluded by stating the EET principle is usually applied to occupational schemes, consistently with the typical tax treatment for the social pension insurance. Let us put a question, how this stands in compliance with the concepts of tax theory and policy. For illustration, we will use simple examples created by Whitehouse (2005) – see Table 1. It looks at a contribution of 100 made 5 years before retirement, with a proportional tax of 25% and annual returns of 10% a year. The first column shows the EET system, income for the given rate amounts to 61, the final fund then amounts to 161, of which 40 is allocated to taxes and the amount of 121 represents the resulting net pension. The second column represents the TEE system, with only the contribution subject to taxation; the resulting net pension is the same as in case of the EET system. The following two columns illustrate the TTE and ETT systems, with "double" taxation, whereas the resulting net pension is lower than in case of the EET and TEE systems. The question is: Which of the two pairs of pension taxation is the "right one"? Dealers only find the EET system to be suitable of the four options, because they are able to easily demonstrate the great effect resulting from the deferred income tax; in doing so, they somehow "forget" the final taxation itself. Consequently, they actually demonstrate the effects of compound interest – which is not really obvious in Table 1, as the funds bear interest for the period of 5 years only.

Table 1: Possible pensions´ tax regimes

	EET	TEE	TTE	ETT
Contribution	100	100	100	100
Tax	-	-25	-25	-
Fund	100	75	75	100
Returns	61	46	33	44
Final fund	161	121	108	144
Tax	-40	-	-	-36
Net pension	121	121	108	108

Source: Whitehouse (2005)

We have derived the logic of the EET system for occupational schemes from the interpretation of pension as a deferred wage. However, is it an income tax logic? A pension represents an income – and if we stem from an assumption that the government wishes to tax the residents' income in the form of a personal income tax, the taxation of pensions is all right. The issue is, however, the approach to not taxing the contributions to occupational schemes and to not taxing investment income of pension funds. The same problem also relates to the tax treatment of the social insurance premiums as well as the investment income in case of existing social pension insurance funds.

Income tax became the "queen of taxes" in the 20th century, as it had been considered as the "best" tax by Liberals even prior to that, whereas its rate should have been proportional not to modify the income relations. A progressive income tax became predominant in the practice of developed countries. The selection of the basic tax mix component is the matter of public choice, with lobbyists and theoreticians involved in such choice. Since the mid-20th century, Neo-Liberals strived to replace the taxation of income by taxing consumption in various forms. Friedman proposed a progressive spendings tax as the best source of revenue to meet critical national objectives in an article in 1943 (Frank, 2006). The strengthening role of a value added tax is also in line with this ideological movement. In this regard, we find the following relevant: it is also possible to enforce a consumption taxation concept by using deductibles for an income tax base. This form of a consumption tax tends to be referred to as an expenditure tax. The EET tax regime may be labelled as a "classical expenditure tax", with the TEE regime referred to as a pre-paid expenditure tax (Whitehouse, 2005). Whitehouse is not the only one to consider the expenditure tax as the most appropriate benchmark for taxing pensions, as this tax is neutral between consuming now and consuming in the future.

For example, the neoclassical economics refuses the exclusion of savings from the income taxation. „The major argument for replacing an income by a consumption tax is that savings would no longer be taxed. A consumption tax, its advocates assert, would tax consumption and not savings. The fact that this argument is generally advanced by free-market economists, in our day mainly by the supply-siders, strikes one immediately as rather peculiar. For individuals on the free market, after all, each decide their own allocation of income to consumption or to savings. This proportion of consumption to savings, as Austrian economics teaches us, is determined by each individual's rate of time preference, the degree by which he prefers present to future goods. For each person is

continually allocating his income between consumption now, as against saving to invest in goods that will bring an income in the future. And each person decides the allocation on the basis of his time preference. To say, therefore, that only consumption should be taxed and not savings is to challenge the voluntary preferences and choices of individuals on the free market, and to say that they are saving far too little and consuming too much, and therefore that taxes on savings should be removed and all the burdens placed on present as compared to future consumption. But to do that is to challenge free-market expressions of time preference, and to advocate government coercion to forcibly alter the expression of those preferences, so as to coerce a higher saving-to-consumption ratio than desired by free individuals." (Rothbard, 2012).

The TTE and ETT tax regimes are often referred to as two alternatives of a comprehensive income tax. If an income tax is to exist in a country, one of the aforementioned tax regimes must be the benchmark. It is possible to take into account potential weakness of income taxation in the course of implementation, e.g. a problem of taxing nominal interest and investment income or depreciation of savings as a result of inflation, as appropriate. The TTE tax regime means that pensions are not subject to taxation – and if we wish to tax pensions, we must opt for the ETT regime, currently applied by three member states of the EU. The TTE tax regime was fully implemented in New Zealand in 1990, as the implementation of the principle of "tax neutrality" of all savings vehicles. Occupational schemes in New Zealand may not receive any preferential treatment compared to other forms of savings, including the banking sector. It is a rigorous tax policy. We will return to New Zealand in another section of the paper.

The relation of the social insurance premiums and the contributions to occupational pension funds represents an associated issue. In case the social insurance premiums represent a deductible item for personal income tax base, the contributions to occupational schemes should be subject to the same tax regime.

The area of occupational schemes may be considered controversial in the sense that, after the Second World War, the development of these pensions resulted in the creation of a fundamental, second pension pillar, with a significant role of non-profit occupational pension funds. On the other hand, there is a trend regarding the transferability of pension entitlements as well as the transformation of occupational schemes to funded systems, managed according to the same principles as in case of private financial institutions; this trend ultimately leads to the replacement of occupational schemes by employers' contributions to personal pensions. The factual nonexistence of occupational schemes in the Czech Republic is a plus in this regard. Investment income and overhead costs of pension companies will be crucial moving forward. The results of the entire sector are significantly affected by tax policy, specifically by the tax regime selection for public pensions, occupational pensions, and personal pensions. The ETT and TTE tax regimes correspond to the comprehensive income tax concept.

3   Taxation of Personal Pensions

The taxation of personal pensions is, from a systemic point of view, mainly the derivation of the taxation of income generated from financial products, i.e. interest, investment in-

come, etc. It is also possible to express it by stating that an income is a nonrecurring and recurring payment, received from a financial institution, with possible deduction of costs of acquisition of the relevant product. Therefore, in case of a simple termination of pension savings, all savings contributions are deducted from the one-off benefit. In case the contributions were subject to an income tax, it represents the TTE tax regime, i.e. competitively neutral comprehensive income taxation. The ETT tax regime represents alternative model income taxation; however, it is difficult to implement if clients make contributions that had already been subject to income taxation. For the purpose of these model deliberations, we have left aside the consequences of any changes to income taxation in the course of pension or other savings.

When taxing personal pensions paid out throughout the insured's life (lifelong annuities), it is necessary to take into account the expected term of the annuity payments according to mortality tables under the TTE regime, whereas the theoretical taxation construction is thus approximated here. According to the Czech Act on Income Taxes, the tax base for the private pension insurance – i.e. consideration in the form of an agreed pension – is the pension derived from such insurance, reduced by "any insurance premium paid, evenly distributed to the period of drawing on the pension. In case the period of drawing on the pension is not defined, it is set down as the life expectancy of a participant according to the mortality tables of the Czech Statistical Office at the time he/she draws on the pension for the first time" (Section 8(7) of the Act).

The application of the income taxation theory to personal pensions is thus relatively simple. The TTE tax regime results in even taxation of personal pensions – in relation to the taxation of savings products as a whole, in the application of the same regime. However, the reality in the world is quite different – as characterized by Table 2. The categorization of individual countries must be "taken with a pinch of salt": input data are likely to be older than 10 years; moreover, it concerns all funded pensions (i.e. not just personal pensions), and, furthermore, several parallel systems exist in a number of countries.

Table 2: Pensions´ taxation in practice

| better than expenditure tax	expenditure tax		between expenditure and comprehensive income tax	worse than comprehensive income tax
Australia	Argentina	Netherlands	Denmark	Belgium
Austria	Canada	Poland	Finland	Iceland
Czech Republic	Chile	Spain	France	Japan
Hungary	Colombia	Switzerland	Norway	New Zealand
Ireland	Costa Rica	United States	Sweden	
Korea	Germany	Uruguay		
Portugal	Luxembourg			
United Kingdom				

Source: Whitehouse (2005)

According to Table 2, a worse regime than the comprehensive income tax is applied in four countries, whereas five countries apply something in between such regime and the expenditure tax regime. Thirteen states apply the taxation of funded pensions in the sense of expenditure tax, while eight countries have even more beneficial regime than the expenditure tax; the latter group also includes the Czech Republic. The author of the figure states the following: "The expenditure tax is the most appropriate benchmark for taxing pensions. The comprehensive income tax treats savings as if they are like any other good or service. But savings are a means to future consumption, and this is particularly obvious when savings are deferred to provide retirement income. The expenditure tax is neutral between consuming now and consuming in the future." (Whitehouse, 2005, p. 2). This is a typical, purposeful argumentation, as the previous analysis shows. Funded pensions are declared to be exceptional products – and, therefore, standard income tax is not to be applied to them. Obviously, such arguments are positively received by pension companies that provide personal pensions or mere retirement savings without lifelong annuities or the combination of both, as appropriate – in the given country, based on local legislation. In terms of economics, it is a neoliberal deformation of the entire pension system. Tax or other benefits represent the major argument for acquiring personal pensions. However, tax expenditure and direct state contributions are not free – that is only the fiscal illusion. Someone has to cover their costs, e.g. in the form of a higher personal income tax rate. In case all people acquire a very profitable personal pension product (this is an ideal situation, since it is profitable), we will actually pay the costs of the state support of personal pensions to ourselves.

The Czech system of state support of supplementary pension insurance and the so-called private life insurance is not really standard. The state contribution to supplementary pension insurance came into existence with the introduction of the product, offered exclusively by "pension funds" – in fact specialized life insurance companies; however, without the standard license for the provision of life insurance, as currently required in the EU. The state contribution to the "supplementary pension insurance" had a specific construction, as the absolute amount of the contribution ranged from CZK 50 to CZK 150 a month (participant's contribution of CZK 100 to CZK 500 per month); however, the relative amount declined – from 50% to 30% of the participant's contribution. Furthermore, the pension lobby put a tax support through as of 1999, in the form of a deductible item from the participant's income tax base, provided he/she saves more than CZK 500 a month (or CZK 6,000 a year, as appropriate); it is possible to deduct up to CZK 12,000 a year. A year later, a parallel analogical tax support was enacted for the so-called private life insurance, offered by life insurance companies, applicable to insurance premiums of up to CZK 12,000 a year. As of 2008, a state support was introduced in the Czech Republic – without any special publicity – for the employers' contributions to employees' supplementary pension insurance and private life insurance; this support consists in the tax deductions of contributions of up to the total of CZK 24,000 per year for both types of products. The deductions also apply to the assessment base for the social security contributions. As of 2013, the annual limit was increased to CZK 30,000 (from CZK 24,000). In any case, this is systemically illogical – as both of the aforementioned products receive the same benefits in terms of the tax and fiscal treatment, provided the contribution is paid by an employer; on the other hand, the supplementary pension insurance receives substantially higher benefits than the "private life insurance" – as for contributions paid by participants.

According to the 2006 international comparison of the OECD, the relative amount of the state contribution to the supplementary pension insurance in the Czech Republic was the highest in the world – see Figure 2. The later introduced state support of employers' contributions to the supplementary pension insurance/private life insurance is even higher – amounting to 95% of the notional equivalent of the employee's contribution (it expresses the preference of the contribution to the wage payment). The state support was introduced without any prior effectiveness analysis. Moreover, no follow-up analyses have taken place either. Besides, the three forms of state support have no mutual logical links: the supplementary pension insurance and the private life insurance actually compete in case of the employer's contribution, as only one joint limit applies. With regard to the tax support of the participant's contributions, the supplementary pension insurance has a specific limit, while the private life insurance, representing many different products with an endowment component, has a separate limit as a whole. No one is even trying to explain why the supplementary pension insurance receives significantly preferential treatment, by means of the state contribution, in relation to the private life insurance. The situation still remains, even after the execution of a major supplementary pension insurance reform, which excluded the guarantee of the nominal savings value and insurance elements of the products, thereby depreciating the product to an investment savings product. New products of new pension companies are commonly sold investment products (and not only by investment companies, but also by life insurance companies); only the construction of the state contribution is new. The state contribution to the existing supplementary pension insurance and to the newly constituted "supplementary pension savings" is currently provided at the amount of CZK 90-230 a month (participant's contribution of CZK 300-1,000 per month), i.e. the relative amount ranges from 30% to 23% of the participant's contribution. Consequently, only the participant's contributions exceeding CZK 12,000 per year are deducted from the income tax base.

Figure 2: Tax incentives for pension saving
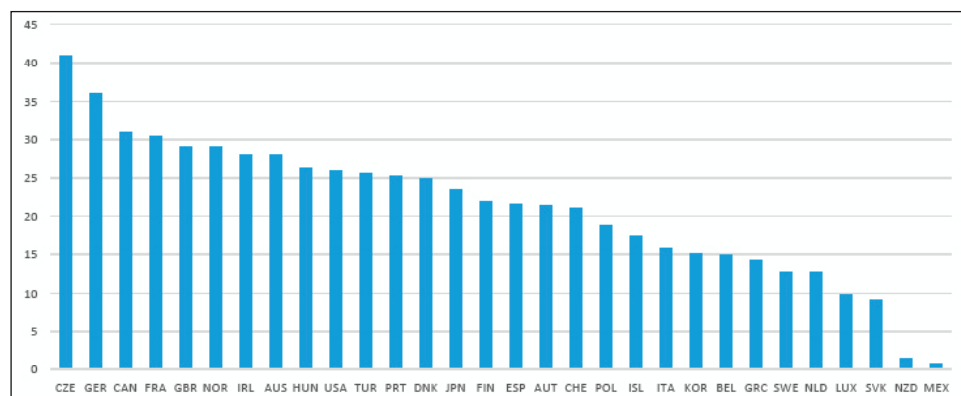
Source: Whitehouse (2006)

In reality, the Czech supplementary pension insurance, supplementary pension savings, and similar products offered by life insurance companies do not even represent pension products – almost all the participants opt for a one-off settlement instead of a pension. To a large extent, this is partly natural, common behaviour of people and, moreover, the of-

fered pensions are relatively expensive, which already results from the entire management system of private insurance/pension companies. Retirement savings in pension funds and other financial institutions are associated with relatively high overhead costs, especially compared to the public pension system: the cost handicap amounts to 2-3% of assets, representing 40-60% of the insurance premiums when converted using an internationally recognized ratio of assets and contributions (insurance premiums). This amount also comprises higher costs of the private sector in respect of lifelong annuities. (The reported costs of Czech pension funds amount to 1.45% of assets.) In addition, if we consider the state support of some 23-95% of the contribution, we will arrive at a rather horrifying illustration of efficiency of the "supplementary pension insurance".

The hypertrophy of the Czech supplementary pension insurance is more than obvious and it is significantly aided by the state support. In terms of economic theory, the only principal solution is the discontinuation of any state support provided to the supplementary pension insurance/private life insurance. In part, it is not a significant social-political instrument and, in part, the state support results in substantial distortion of the relevant markets. These radical steps were taken in Slovakia: state support for the participant's contributions to pension savings was annulled as of 2011; the Minister of Finance even proposed the annulment of the state support for employer's contributions to pension savings; however, he did not succeed.

The entire pension system in New Zealand is very interesting. In the previous section, we mentioned the neutral tax regime TTE for occupational schemes. The main pillar is a liberal, flat old-age pension (NZ Superannuation, NZS), the relative amount of which is maintained between 65% and 72.5% of average full-time net earnings, after taxation (for couples). With regard to people living alone, the pension is 32% higher than one half of the couple's pension (OECD, 2011). This is the highest flat pension in the world. In 2007, a major modification of the pension policy in New Zealand took place, with the introduction of the KiwiSaver product. The product does not concern genuine personal pensions – the annuity market does not exist in New Zealand at all (St John, 2009). The product is a combination of pension savings (investments), savings for the acquisition of one's first house, whereas the product funds may also be utilized in case a client runs into serious financial problems (e.g. in case of an disease or disability). The savings combo-product KiwiSaver is described as an employment-based or work-based product; however, it is basically not an occupational scheme. Nevertheless, an employer is required to contribute to an employee, provided such employee takes part in the KiwiSaver scheme. Moreover, the employers are also required to provide their employees with technical assistance. An auto-enrolment system is applied, under which new employees of the given institution are enrolled automatically; however, they may apply for annulment from the start – after 2 weeks of contribution payments, but only for a relatively short period of the next 6 weeks. They may not exit the system otherwise. Systems of this kind are considered "soft-compulsion" systems; liberal advocates of these constructions appreciate the possibility not to participate in the system, usually underlining the social aspect – specific poor employees or citizens may not be able to afford the product. At the same time, KiwiSaver was in principle intended for the middle class. "The target group is implicitly middle-income earners, given that NZS provides an adequate replacement rate for low-income earner, while those in the upper three income

deciles typically have substantial retirement wealth." (Coleman, 2010). Poor old people are relatively well provided for by the flat pension in New Zealand.

Originally, the employer's contributions were optional, while the participant's contribution initially amounted to 4% of earnings, with the possible increase to 8%. Several amendments later, also affected by the economic crisis, a mandatory contribution of an employer was set down as of April 2013, amounting to 3% of earnings, whereas the minimum contribution of employees amounts to 3% of earnings as well. KiwiSaver is subject to the TTE tax regime, i.e. contributions are made using taxed funds. The state also provides substantial support: each person is given a kick-start payment of $1,000 and, in particular, the regular state contribution. The state originally matched the member contributions up to $20 per week in the form of a 100% tax credit. The tax credit for employee contributions was reduced from July 2012 to 50% up to a maximum equivalent to $10 per week. The reduction of the state contribution took place as a result of fiscal pressures; the product sales were extremely successful. There is no wonder – given the huge state subsidies and mandatory contributions of employers. The government originally expected 680 thousand members in mid-2014 (25% of the population at the age of 18-64 years); in reality, there were 2.1 million members as of March 2013, i.e. 64% of the population at the age of 18-64 years (Gaynor, 2013). In 2013, the market is being serviced by 14 providers offering 134 products. In any case, New Zealand replaced the Czech Republic as the leader in subsidizing personal pensions according to Figure 2. The principal quantitative problem is; however, that it does not concern (personal) pensions either in New Zealand or in the Czech Republic, but only pension savings.

On the other hand, the state-subsidized personal pensions in Germany and Austria represent true pensions; they comprise the obligation to convert the savings/investments into a lifelong pension – unless genuine old-age pension insurance is arranged right away. In Austria, it is also possible to agree on a contract for 10 years only; in case a client does not continue with the state-supported product (called "security for the future with a bonus"), one half of the state contribution is returned and the capital income is subject to taxation. The state contribution ("bonus") in Austria currently amounts to (mere!) 4.25% of the member contributions; it is in the form of a refundable tax credit provided to each resident, who is subject to Austrian taxes, without any limitations. Approximately 1.5 million contracts for the given product have been concluded in Austria. The product is likely to be the subject of the election campaign – trade unions and association of pensioners criticize the low benefits for clients, product differentiation with individual providers, as well as the high overhead amounting to 30% of contributions (Blecha, 2013). The cost handicap – compared to public pensions – is also present in the German product "Riester-Rente", which is specific by its fixed-amount state contributions – for the member as well as his/her children. In principle, the member contribution always amounts to 4% of earnings, whereas the state support reduces the factual absolute amount of the contribution, resulting in a significant support of low-income families of up to 92% of the total member contribution. On average, the state subsidies amount to 30-50%. This is also the reason why Germany ranked second in Figure 2, behind the Czech Republic.

The provision of high state contributions to personal pensions – in one form or another – is a typical phenomenon in the majority of developed countries. It results from the im-

pact of neoliberal theory and policy as well as the impact of the relevant lobby. In many countries, the extent of the state support of financial products exceeds the framework of a unilateral concept of expenditure tax. Several countries have proceeded to reduce the state support of personal pensions as part of the money saving fiscal packages. Practical experience with the systems and products corroborates rather high overhead costs of the private financial sector; they should not, in fact, be covered by state contributions to clients. This provides some room for government regulation of the pension companies' overhead; a major or even total unification of the product terms and conditions, which would eliminate the room for fabulations of financial intermediaries, could also help. For more general reasons, some countries banned the provision of commissions to financial advisors by the financial product providers. The cost problems are significantly concentrated within the annuity stage of personal pensions; the private sector does not stand a chance without effective major government regulation. Although the "solution" to this problem consisting in limiting personal pensions to mere pension investments (savings) leads to overhead savings, the resulting product is no longer a real pension, which totally undermines the meaningfulness of state support for such product.

The role of personal pensions is not to be the private security at any costs, from the perspective of clients and the government. State subsidies are not free; they must be fully integrated within the analyses of all financial products that seek such support. Personal pensions as well as other financial products (e.g. contractual savings systems for housing in the Czech Republic) must be beneficial for clients even without any state support. A system without state support refers to the TTE tax regime for personal schemes, without any exceptions – even for other financial products. This also applies to employers' contributions to financial products negotiated by employees.

4   Value Added Tax

One of the defects of the existing value added tax (VAT) system is the treatment of financial services, where such services are in principle exempt from the VAT. This also results in, among others, the inability to deduct the tax included in the price of products purchased by the relevant businesses. The different approach to financial services is explained by the financial services specifics. According to this approach, financial institutions may charge the following for their services: a) explicit fees and commissions; and b) implicit fees in the form of a margin.

The application of VAT to "explicit" fees and commissions is considered to be trouble-free, per se; it is possible to apply the basic VAT construction. However, according to the EU, a problem exists for margin-based financial services, which represent approximately 2/3 of all financial services. This very much complicates the introduction of the existing type of VAT in this regard (EC 2010). Margins themselves, e.g. interest differences, actually represent added value. But the elementary problem is, apparently, the margin "allocation" to the part pertaining to the transaction with suppliers (deposits) and with clients (loans). The basic problem of this approach is, however, the mere existence of this approach to financial services. The present VAT taxes (or does not tax) individual transactions, irrespectively of whether it concerns the sale of products representing real final consumption or the "mere" sale of financial services.

In case of margin-based financial services under the conditions of the existing general VAT construction, it is possible and downright useful and practical to abandon the model approach, according to which the relevant companies "live off" the margin, to replace it by a more realistic model for the provision of individual services, where banks separately provide loans and other individual services, including deposits. After all, this is the common practice.

The remuneration for loan services is in the form of interest and fees, whereas the current standard VAT may be imposed on both of the prices. After all, interest may be viewed as a fee for the loan provision. In case it is not a problem to tax a standard bank fee, the same must apply to a fee calculated in the form of interest. The fee calculation method is not relevant.

The approach to insurance services may be analogical. The principle of equal terms for all deposit and similar services implicates that all deposit/investment services must be excluded from life/nonlife insurance for the sole reason of the VAT taxation. Besides, this will also be necessary in the course of further intensifying regulation of the insurance sector under the Solvency program. The exclusion of deposit services is also desirable in terms of the transparency of insurance services; in practice, it will disclose and hopefully even suppress the provision of downright disadvantageous savings/investment products. The VAT will also be used to tax individual fees as well as risk insurance premiums, including fees, whereas revenue on investments will be subject to income taxation. All this is applicable in respect of private pensions as well.

The principal idea behind the previous VAT deliberations was to show the tax may also be applied in respect of private and even public pensions. There is no major reason against the application of general taxation on consumption in the area of pensions. The fact that financial services, and thereby also pensions, are not subject to VAT in the EU represents a one-sided advantage of financial services to the detriment of the entire economy and also to the detriment of the overall effectiveness of the economy. The failure to apply the VAT to pensions represents an indirect subsidizing of pensions, which is both economically and politically unjustifiable.

Conclusions

Prior to our Velvet Revolution, communist countries were inclined to introduce a state without taxes (on population); however, the implementation of the idea was prevented by major economic problems of the system. Radical, paradigmatic reforms of the entire social system are not easy to implement under democratic conditions. Nevertheless, there are certain trends in the world towards the full inclusion of public pensions in the comprehensive income taxation and the reform of this type is also feasible in the Czech Republic.

There was a significant expansion of occupational schemes in a number of western countries in the post-war period, but – at the same time – those schemes underwent a major conceptual change, consisting in the gradual implementation of the requirement for transferability of retirement entitlements between companies and states or in their transformation to personal pensions, as appropriate. In this regard, it is actually beneficial that occupational schemes were not introduced in the Czech Republic – due to the liberal Government of Václav Klaus. These schemes may be replaced by employers' contributions

to the personal pension schemes; however, there is a risk of even significant increase in administrative costs. Therefore, many governments strive for an establishment of low-cost public pension institutions.

The growing importance of personal pensions stems not only from the influence of the relevant financial institutions, but also from the strong effect of neoliberal concepts on the structuring of entire pension systems. The elementary general problem of the market system of the provision of personal pensions is the level of overhead costs; the unification of pension products, associated with the provision of state support to even one private pension product, may partially help. The high neoliberal state support for personal pensions basically results in a situation, where such support in fact finances high overhead of the private sector. The government should not support products that do not comprise the provision of a lifelong annuity. The basic alternative to taxing personal pensions is the payment of contributions from taxed personal income as well as the taxation of investment revenue during the accumulation stage. The replacement of well-constructed and well-managed public pension schemes by considerably more costly personal pension schemes is economically inefficient. No pension system is ideal; however, it is always necessary to consider both the overhead and fiscal costs.

The social security contributions represent an important part of the public revenue and they are also reflected in the pension taxation concepts. Under a modern liberal pension system, they are redundant, unsystematic. Moreover, the construction of the "pension tax" type, which exists in the Czech Republic, among others, is also unsystematic, as the collected insurance premiums are redistributed, to an extreme extent, among the system participants. In this regard, the theory recommends the system partition – to, for example, a tax-financed flat pension and fully equivalent insurance pension, financed via insurance premiums, deductible from an income tax base.

The exemption of financial services from the value added tax in the EU relies on the false technical arguments and may be perceived as a result of lobbying of the financial sector. The reason for this consists in the fact that the current VAT is applied to the sale of products; however, not to the margins of financial institutions. The VAT is replaced by separate taxation of selected financial products in most western countries; however, this results in market distortions. A radical VAT reform is possible. The failure to apply the VAT to pensions represents an unjustified state support.

Acknowledgment

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Contact address

prof. Ing. Jaroslav Vostatek, CSc.
University of Finance and Administration / Vysoká škola finanční a správní
Head of CESTA (Center for Economic Studies and Analyses) / Vedoucí oddělení CESTA
(Centrum pro ekonomické studie a analýzy)
(jaroslav.vostatek@vsfs.cz)

The Development of the Self-employed Sector in the Czech Republic in the Years 2006 - 2010

Vývoj sektoru osob samostatně výdělečně činných v ČR v letech 2006 - 2010

TOMÁŠ PAVLÍČEK

Abstract

The aim of the article is to analyse the short term economic factors behind the growth in the number of self-employed in the Czech Republic in the period from 2006 to 2010. The article describes the main legislature changes, which affected self-employment, estimates the flows between the self-employment and the wage labour market and evaluates the development of paid tax revenue in relation to the two profit indicators - tax base and mixed income. It is shown that the economic downturn in 2009 negatively influenced the profits, however the main reason for the fall in income tax revenue is the change in legislature. In this context the two hypotheses about the short term motives for self-employment are discussed - the tax optimization and the second choice in difficult labour market situation. Based on macro level analysis the rate of unemployment is suggested as a dominant short term factor in the observed period. The change in effective tax rate does not correspond with the short term change of the self-employed numbers - the difference in the burden between employed and self-employed has a long term effect. However the changes in the rules for costs declared by percentage likely played a role as an administrative barrier removal. The article does not consider long term and non-economic factors as well as the difficult to measure tax and labour law enforcement which are suggested for further analysis.

Keywords

self-employment, self-employed, labour market, unemployment, tax revenue, economic downturn

Abstrakt

Cílem článku je analyzovat krátkodobé ekonomické faktory, které ovlivňovaly nárůst počtu sebezaměstnaných v ČR v letech 2006 až 2010. Článek popisuje hlavní legislativní změny, které ovlivňovaly situaci sebezaměstnaných, odhaduje toky mezi trhem námezdní práce a sebezaměstnáním a hodnotí vývoj skutečně zaplacených daní ve vztahu k dvěma přibližným odhadům zisku ze sebezaměstnání – daňovému základu a smíšenému důchodu. Je dokumentováno, že ekonomický propad v roce 2009 nepříznivě ovlivnil hospodářské výsledky, hlavním důvodem propadu ve výběru daně z příjmu z podnikání je však změna legislativy. V tomto kontextu jsou diskutovány hypotézy o dvou krátkodobých motivech pro sebezaměstnání – motivu daňové optimalizace a motivu nouzové nebo druhé volby při ztíženém uplatnění na trhu práce. Na základě rozboru údajů na makro úrovni je jako dominantní krátkodobý faktor pro výkyvy v počtu sebezaměstnaných ve sledovaném období identifikována míra nezaměstnanosti. Změna průměrné efektivní daňové sazby časově s krátkodobým vývojem počtu sebezaměstnaných nekoresponduje – rozdíl

v zatížení mezi zaměstnanci a sebezaměstnanými je spíše dlouhodobým faktorem. Nicméně rozšíření možnosti paušálního uplatňování nákladů pravděpodobně sehrálo významnou roli jako odstranění administrativní bariéry. Článek nezohledňuje dlouhodobé a neekonomické vlivy a obtížněji měřitelnou vynutitelnost daňového a pracovního práva, které by tak měly být jedním z témat dalšího zkoumání.

Klíčová slova

sebezaměstnání, sebezaměstnaní, trh práce, nezaměstnanost, daňový výnos, ekonomická recese

JEL Codes

J4, H3

Introduction

The self-employment as a specific form of labour organization seems to play more important role in Czech economy (see Figure 1). The political opinions on the issue range from optimistic worshiping of self-employment as a solution to unemployment and labour market rigidities to condemning it for being a mere tool for tax evasion. Although this paper doesn't accept the challenge of deciding which attitude is closer to the truth it may shed some light on the problem by providing a broader context of short term economic influences behind the growth of the self-employment sector – namely the situation on the labour market and the average effective tax rates. The analysed period of 2006-2010[1] is interesting by including the changes in legislature as well as a major turn in the economic performance on macro level. The period also directly follows the previous thorough analysis summed in several publications by RILSA which ends with 2006.

The aim of the article is thus to identify the short term economic factors behind the growth in the number of self-employed in the Czech Republic in the period from 2006 to 2010. The considered short term influences are the changes in legislature and following change in tax burden along with the situation in the labour market represented by the rate of unemployment. The article describes the main legislature changes, which affected self-employment, estimates the flows between self-employment and the wage labour market and evaluates the development of paid tax revenue in relation to the two profit indicators - tax base and mixed income. In this context the two hypotheses about the short term motives for self-employment are considered - the tax optimization and the second choice in difficult labour market situation. This is done by comparing and analysing the data from the ministry of finance and surveys of Czech statistical office. The text documents two main trends in self-employment: the growth of their absolute numbers and its correlation with the unemployment rate and the simultaneous drop in the development of income tax revenue and its relation to the legislature changes.

The article cannot form a general model explaining the development of self-employment rate as it focuses on the short term development and narrowly selected set of factors.

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1 The available information from General tax directorate was limited by 2010, more recent data from other sources are used and discussed where appropriate.

For stronger and more general conclusions an inclusion of the long term factors, non-economic factors and a longitudinal analysis would be necessary and should follow. The text is meant to be read as an introduction to the situation with the identification of the most important trends and dependencies and with suggestions for more in-depth research along the way.

The first section after the literature summary defines the group and introduces the basic methodological context. The description begins with the summary of the relevant legislature followed by the summary of market context and reported business results. Next section of the paper concludes the developments in the numbers of self-employed and compares them to the data on unemployment and employment discussing the influence of unemployment rate on self-employment. The data summary of changes in tax and mandatory contributions revenue follow discussing the tax related motivations for self-employment.

1   Existing Literature

The situation in the self-employed segment in the Czech Republic from the beginning of the 90s until 2006 has been analysed thoroughly. A dedicated chapter about the development in the sector can be found in (Kotýnková 2006). Research Institute of Labour and Social Affairs (RILSA) conducted a thorough study in 2006 which included a dedicated survey (Průša, Bičáková, et al. 2008; Průša, Baštýř, et al. 2008; Vlach 2008). Novák published a series of articles on the topic in Statistika (Novák 2006, 2007, 2008, 2009). A study based on SILC and OECD data including the international perspective is in (Benáček et al. 2010), the book section also includes a longitudinal comparison. In general terms the studies document a dramatic rise in small entrepreneurship after 1990 and slower but continuous rise ever since. (Průša et al. 2009) identifies Voluntary, Economic and traditional motivation factors with the voluntary or intellectual being dominant in the Czech economy before 2006. On international level (Torrini 2002) identifies the public sector size, the product and labour market regulations and the corruption perception index as significant factors for self-employment rate inter-country differences. All these factors however would have rather longitudinal impact while we focus more on the short term development in our observed period.

This article follows up on a preliminary presentations from May 2012(Pavlíček 2012) and (Pavlíček 2013). The complex problem of measuring the income situation of the self-employed is omitted here.

2   Data and Methodology

As the ambition of the article is to provide a broader picture of the situation it combines data from different sources. The article works with the data from Labour force survey (LFS) (Czech statistical office) and the Czech social security administration(Czech social security administration). These numbers differ but the trends are similar. The social security has hard evidence of all people who engaged in self-employment for even a small portion of a year. The data from LFS are based on a survey but they allow the distinction between different subgroups and control for duplicity of statuses through the main and only oc-

cupation statistics. More on the methodological issues in determining the numbers of the self-employed can be found in (Novák 2006). The data on tax bases and percentage declared costs (PDCs) were kindly provided by the General tax directorate. Even though I find these data useful for providing a general picture of the situation it is obvious that for more detailed modelling an access to the microdata would be necessary. The data are also confronted with the information from the System of national accounts(Czech Statistical Office) namely the net mixed income (MI) indicator. The MI is an estimated value but incorporates a correction for underreporting and the usage of PDCs. To have some independent measures of business results the information about number of SE registered as unemployed and the number of SE declaring a loss(data provided by the General tax directorate) are used as supplementary performance indicators - as in (Pavlíček 2013).

The combination of these data allows to describe the general picture and to draw some interesting conclusions specifically about the connection between unemployment and self-employment and about the factors behind the tax revenue drop. A more detailed modelling based on data from other available surveys like the SILC has to be left for further studies.

3   The Definition and Theoretical Concepts

The self-employment can be defined as any independent economic activity, where the person providing the work input is also the owner of the company who bears the risks and collects the profits. In reality to draw a distinct line between employment and self-employment even on theoretical level is not very easy. On an unregulated market a very broad range of organization forms between a strict owner who hires others for work to people completely dependent on some formal organization in terms of job and economic activity exists. The range includes business owners who partially participate in the management of companies, people who are employed but occasionally work for other subjects as contractors and people who switch between closer and more exclusive cooperation with one client and a broader client base, depending on project and situation on the market. Some foreign studies consider the owners of limited companies to be self-employed – e.g. (Engström, Holmlund 2009). I assume that due to an advantageous tax regime for the unincorporated SE, only the larger and potentially growing businesses profiting from the levels of limited liability move to the incorporated segment. These incorporated businesses represented mainly by the small limited companies under the Czech law are not part of the analysis here. Some studies also distinguish between the real entrepreneurs and the self-employed based on the criterion of employing other people (Lukeš 2013) – such a division is relevant for the motivations however the criterion itself is very imprecise.

For practical reasons of our analysis I choose to stick with the definition derived from the Czech legal system which draws a line much more precise than the continuous natural range which would be found on the free market. The Czech law recognizes a so called "person performing an independent earning activity" – "OSVČ"[2](Czech law No. 155/1995, §9).This definition is particularly useful for the tax system analysis as the subgroup corresponds with people with income from independent activity defined in the §7 of Czech

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2   *„Osoba samostatně výdělečně činná"– „OSVČ"- further in the text referred to as OSVC.*

Income tax law. [3,4] This definition does not include the limited companies owners and corresponds thus with the unincorporated self-employment. As opposed to the international definitions and also Labour force survey guidelines the work of the members of a cooperative is considered dependent work and therefore we exclude them from the self-employed category here. The existence of a so-called bogus self-employment constitutes a significant problem but its estimation is not part of this article.

4   The Legislature Changes

The legislature concerning the OSVC underwent some significant changes in the course of the observed period. The tax regime changed couple of times and the legal definition of self-employment in the labour law has been altered effective from 2007. I shortly sum below the changes I consider significant - a list can be found in Table 1.

Table 1: Summary of major legislature changes concerning self-employment

Effective year	Measure
2006	Mandatory contributions opt-out changed to 50%
2007	New labour code
2008	Major tax reform: flat tax rate 15%, no common marriage tax, Tax discount per payer more than tripled from 7200 to 24800, mandatory contributions not discounted from tax base
2009	Major change in PDCs, special write-offs, exempt from advanced payments
2010	reintroduction of the 40% PDC, special write-offs

Source: author.

In general the Czech OSVC benefit from couple of advantages in comparison to the employees and incorporated businesses – the percentage declared costs and the 50% reduction in tax base for mandatory contributions purposes.

As the OSVC realize the so called mixed income, the state enables them to divide their business earnings and use only 50% as a base for mandatory contributions to social and health security systems calculation. The 50% left as a profit is not taxed by company tax. An example calculations of the net income comparison between employee and self-employed can be found in (Průša, Bičáková, et al. 2008). This option did not change throughout the observed period but constitutes a long term differential between employees and self-employed most importantly allowing a significant opt-out from the pension system. The existence of this major tax incentive then makes the other parametric changes of tax burden less significant.

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3   *Some deviations from these definitions are stated in the text. In most cases in our analysis the OSVC status corresponds with the term Self-employed (SE).*

4   *Distinction based on the definition of self employed as a person with positive declared income from self-employment which is bigger than the declared income from employment, which would precisely copy the labour force survey category was not available at the time of publishing.*

Further they are allowed to opt-out from tax costs accounting and declare their expenses as a percentage of revenue – percentage declared costs (PDCs). The changes in the definitions of these percentages came to effect from tax year 2006, 2009, 2010 and 2011. The change was lowering the tax burden – the OSVC were able to deduce more – in 2006 and 2009, there was a light correction in 2010 and 2011. The resulting changes in usages between the different percentages between 2006 and 2010 can be seen in Table 2. The enhancement of this option stimulates self-employment in two ways – it may lure some employees into self-employment on a pure tax minimization motive but it also makes the self-employment administration less scary and more appealing even if considered tax neutral. We can assume that at least some of the new PDCs users were new entrepreneurs but the exact number is not available to the author at the moment.

Table 2: The number of people declaring their costs by fixed percentage

Year	Number of subjects				
	PDC percentage				Total
	40	50	60	80	
2006	34,740	167,652	65,966	7,181	275,539
2007	37,495	189,096	76,849	7,687	311,127
2008	40,310	218,191	90,507	7,965	356,973
2009	**29**	**156**	**312,735**	**119,310**	**432,230**
2010	44,399	0	288,934	130,196	463,529

Source: General tax directorate.

Furthermore there was a big change in the accelerated deducting of property amortization, which was effective in 2009 and 2010 and influenced the year 2010 in a major way – the total deduction for all individual tax reports (which are mainly our self-employed) changed from 20,276 mil. CZK in 2009 to 64,296 mil. CZK in 2010.

Effective from 2008 there was a major change in tax legislation - introduction of flat tax and changing the personal tax discount from 7200CZK to 24,800CZK – see Table 3. This does not affect only self-employed but proves critical for tax revenue as I will show bellow.

Table 3: Minimum unconditional untaxable amount by relevant taxation period

2006	2007	2008	2009	2010	2011	2012
7,200 CZK	**7,200 CZK**	**24,840 CZK**	**24,840 CZK**	**24,840 CZK**	**23,640 CZK**	**24,840 CZK**

Source: §35ba of the income tax law.

The opportunity for labour cost optimization connected with the OSVC status leads to certain formal shift from standard employment. The labour law prohibits such an administrative step calling it the "bogus self-employment" or "concealed employment relationship"[5], but the legislature and legal practice concerning the issue has developed throughout the

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5   *In Czech context sometimes referred to as the so called „Švarc system" named after an entrepreneur convicted for general usage of this model in the mid-1990s.*

years. For the sake of our period it is important to know that the labour code novelized in 2006 and effective from 2007 loosens the definition of prohibited concealed employment relationship. This more benevolent description stayed stable for the whole period until a recent change effective from 2012. The actual level of enforcement, which is likely more important, is unfortunately very hard to measure.

5   The Business Results and the Macro-economic Context

Finding a qualitative measure of the self-employed businesses is not straightforward as most reports are biased by underreporting mainly due to tax reasons and directly by some legislature changes - more on the topic in (Pavlíček 2013). The declared profits as a qualitative measure of self-employment businesses (reported to the ministry of finance) can be seen in Table 4. It is important to note that the sudden rise in 2008 is a mere administrative move – the mandatory contributions were no longer deduced from the tax base.

Table 4: Macro-economic context

Year:	2006	2007	2008	2009	2010
Total cumulative number of OSVC registered as unemployed (CZK)	28,398	22,270	22,276	41,487	53,662
y/y%		-21.58%	0.03%	86.24%	29.35%
Number of OSVC subjects reporting a loss	117,660	111,402	89,843	95,453	96,111
y/y%		-5.32%	-19.35%	6.24%	0.69%
Average §7 tax base for subjects with +SE income and 0 income from employment	147,368	157,981	218,744	166,805	160,437
y/y%		7.20%	38.46%	-23.74%	-3.82%
Average mixed income(b3.n) per person as measured by CZSO	417,781	437,150	429,175	435,454	419,299
y/y%		4.64%	-1.82%	1.46%	-3.71%
GDP at purchaser prices (mil. CZK)	3,352,599	3,662,573	3,848,411	3,739,225	3,775,237
y/y%		9.25%	5.07%	-2.84%	0.96%

Source: General Tax Directorate, Ministry of Labour and Social Affairs, CZSO, indexes by author.

The most important change in trend is thus the significant tax base drop in 2009, accompanied by the rise in the number of OSVC declaring a loss and by the rise in the number of OSVC registering as unemployed. Both these supplemental indicators follow the development of GDP. The fact that the number of losing and closed businesses grew suggests that the OSVC segment was actually hit by the economic slump – GDP dropped by 2.84% in 2009. It is interesting to note that the total product numbers in National Accounts System indicates the opposite as the total mixed income indicator, which is sometimes used as a measure of self-employment performance, actually grew even in this period and even when considering the average to account for the growth in total number. The fact that over the whole period the growth of the average mixed income has been lower than that of the general GDP implies that the growth in SE numbers was not in general driven by profit opportunities.

6 The Total Number of Self-employed and the Labour Market Statistics

This chapter summarizes the development of the SE numbers and discusses its relation to the situation on the labour market.

The development of the number of self-employed from two sources is shown in Table 5. The Czech Social Security Administration (Czech abbreviation CSSZ) counts all people required to report their activity by the law while the LFS calculates the number based on answers of respondents in the surveyed sample. The most dynamic year according to LFS has been 2010. The own account workers grew most rapidly as opposed to the falling numbers of employers.

Table 5: Number and basic structure of the self-employed sector, in thousands of people

	2006	2007	2008	2009	2010	2011
The number of self-employed according to CSSZ	904	918	938	956	977	1,002
y/y%		1.55%	2.21%	1.85%	2.24%	2.53%
The total number of self-employed according to LFS	779	796	806	827	866	880
y/y%		2.16%	1.32%	2.58%	4.66%	1.57%
Employers according to LFS	196	184	179	184	178	176
y/y%		-6.08%	-2.87%	2.75%	-3.00%	-1.17%
Own account workers according to LFS	551	582	596	614	658	678
y/y%		5.71%	2.42%	3.00%	7.18%	2.96%

Source: CZSO Labour force survey, CSSZ.

Figure 1 shows that the number of registered OSVC in the Czech Republic relative to the work force grows in the long term seemingly irrespective of the business cycle. We can note here that the proportion of self-employed grew by almost three percentage points from 2006 to 2012 and that the most dynamic period has been the year 2010 during which the share grew by more than 1 percentage point.

Figure 1: Share of self-employed on labour force (employed, self-employed and unemployed)
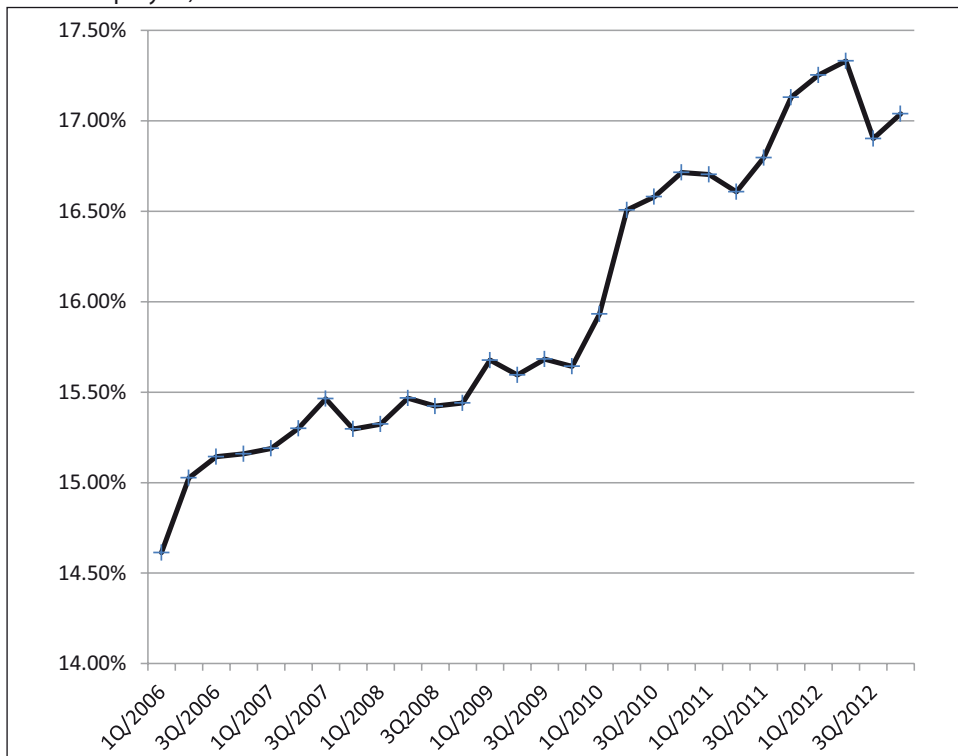
Source: own calculation based on CZSO Labour force survey⁶.

There are two short term economic factors which contributed to this development - the opportunity for tax optimization and the danger of unemployment along the diminishing of quality jobs on the labour market. I will talk about the development of the effective tax rate in the next chapter and focus on the labour market relation in next few paragraphs.

Some people switch from employment because it does not offer the quality of jobs and self-satisfaction the self-employment can. These may be the experienced workers who strive to start their own business because it was always their plan or just because the labour market did not offer them the advancement in career they expected. This motivation would be connected to times of optimistic market sentiments. At the same time when the labour market offers top quality jobs in booming times less people would choose self-employment as an option.

The other part would be the people who were forced off the labour market by the danger of unemployment. They could be either unemployed trying to start their own business or people opening their own business as a backup plan who gradually moved to it once

6   *Similar graphical comparison for the period from 1999 to 2009 can be found in (Benáček et al. 2010).*

their position at work became less stable. Then there would be people who actually were forced to SE by their employers who under the cost cutting pressure and in tougher prod-uct market situation prefer to hire contractors instead of employees. The added flexibility of a contractor compared to an employee will be a more important asset in tough unpre-dictable markets. In time of an economic slump the bargaining power of the employees diminishes as the demand goes down and thus the would-be employees are forced to ac-cept self-employment as a job of lesser quality. Some of the economically inactive people may choose a flexible form of employment as a means to strengthen the family budget in times when the other family member is unemployed or in danger of losing a job. These motives should be highly related to rate of unemployment.

That means that there are two different non-tax economic motivations for SE – the pro-gressive, forward looking entrepreneurial optimism which would be thriving in time of expected positive economic outcomes and the self-employment as a second choice which would be more important in times of economic crisis. Both these motives would then be strengthened by the tax difference between employees and SE.

Figure 2 shows the development of Self-employment (own account and employers) in context of the classical labour market (of employed and looking for employment – i.e. unemployed). The values represent the change over last 4 quarters (YD stands for yearly difference).The data for last four periods mean that the point 4Q /2009 describes the whole year 2009, this form allows us to abstract from the strong seasonality. All the data are based on Labour force survey of Czech statistical office and people are counted based on their declared main or only occupation to prevent duplicities.

Figure 2: Yearly changes of Self-employment and Standard labour market[7], thousands of people per last 4 quarters
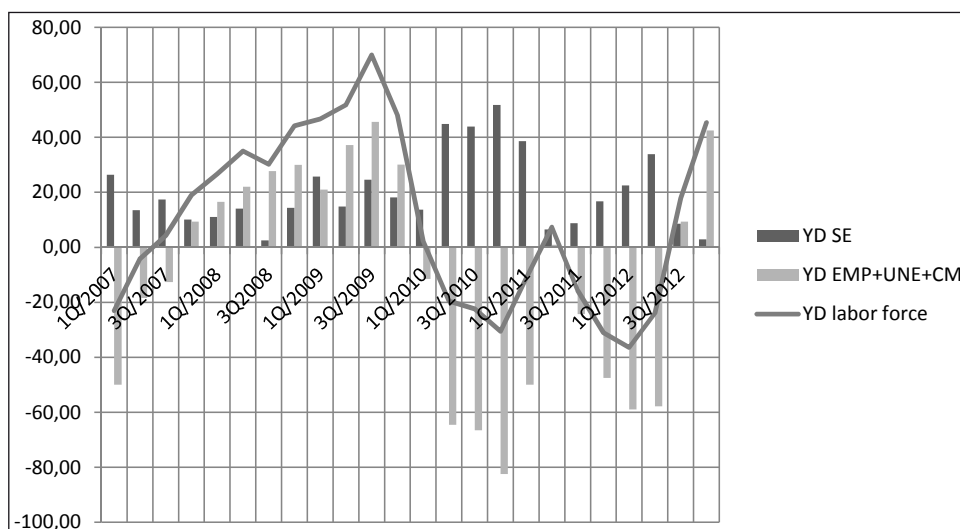
Source: Author's calculation based on CZSO Labour force survey.

7   *Defined here as a simple sum of employed and unemployed.*

The number of self-employed has been rising for the whole period except the end of 2008 while the development of the standard labour market is rather cyclical. Even in the periods where both groups were growing, the total growth of the self-employed numbers is higher than their proportion as suggested in Figure 1. The only exception is the period from 4q/2007 to 3q/2008. We can see that in the periods where the labour market numbers were falling most rapidly, the growth in the number of self-employed accelerated suggesting a direct move from classical labour market to self-employment.

The presented data on the number of unemployed, employed and OSVC suggest that during the prosperity periods the number of OSVC grows by pulling some of the employees to the business based on optimism and tax optimization motives while in the period of economic slump the OSVC status is also a safe-haven for many who would otherwise end up in the unemployment statistics or exit the labour force. Further analysis of the development of the demographical and industrial structure of the group is needed to confirm the direct move and to determine how much of the change is caused by new entrants and retired.

The comparison of employed and would-be employed against the self-employment is chosen for analytical purpose but it does not represent a clear distinction between the classical labour market and the self-employment. The main problem with this approach is that the unemployment is a potential status common for both employed and self-employed, even the self-employed may become inactive and turn unemployed – for illustration see first row of Table 4. Unfortunately the data for the moves into unemployment are registered and not the other way around.

To further elaborate on the development we'll use the unemployment rate as another indicator of the labour market situation. It represents the competition that the workers face and as explained above should be correlated with higher moves to self-employment due to the flexibility and second option motive. Figure 3 shows that there indeed has been a moderate positive relationship between the change in self-employment and the unemployment rate in the observed period. The statistics of employers and own account workers is showed in the graph. The correlation is weaker if we count also helping family members. That is expectable – there is less opportunities for the family members to be involved in family businesses in times of crisis. The correlation is weaker also when we don't count the employers which is caused by unsystematic flow between the own account and employers subgroups mainly in 2007.

Figure 3: The correlation between the change to number of SE and the rate of unemployment, 4Q moving averages, 2006-2011
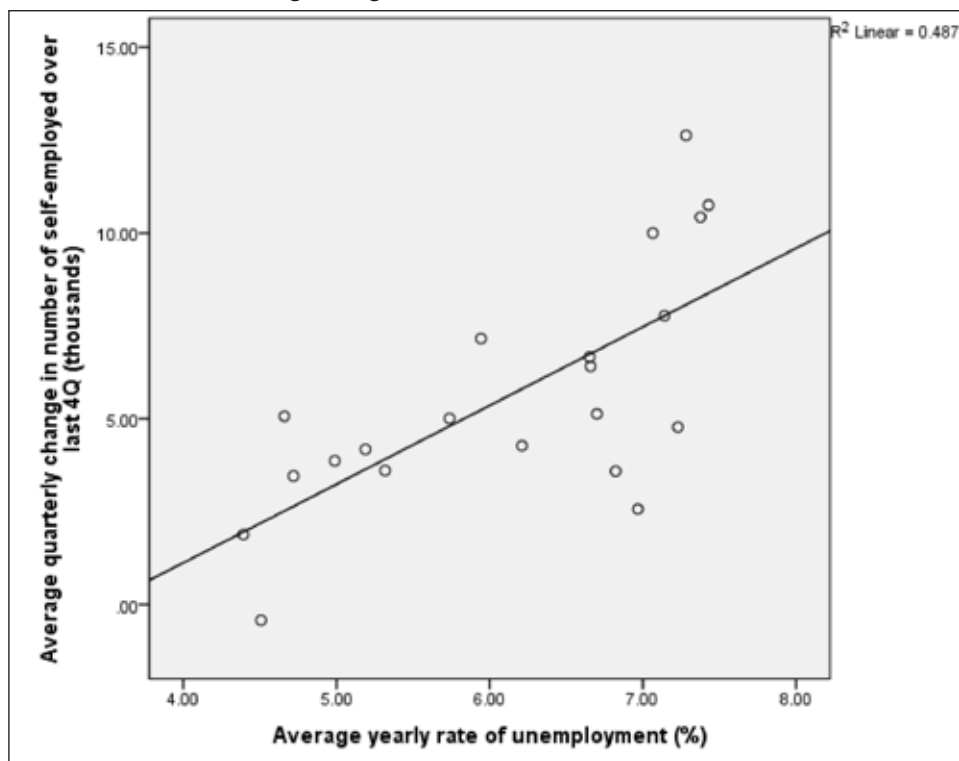
Source: CZSO LFS, author.

It is important to note, that in 2012 the latest data do not confirm this relationship as the unemployment reached very high numbers while the total number of SE dropped. The reasons for the drop in 2012 are yet to be analysed but the suggested causes may lay in stronger state repression towards "Švarc system" and tightening of related tax policy. The level of law enforcement is likely a very important factor here as it determines the amount of illegal or semi-legal tax optimization as well as administration costs but it is very hard to measure. It is also possible that the room for self-employment on the market was saturated after a long period of sustained growth. Our analysis above assumes that there actually is a demand for the SE work which seems obvious looking at the data but may not always be the case. We omitted the demographic factor which may come into play as well. As the number of economically active people goes down – people retire or go on maternity leave, some of them may use the self-employment as a flexible transitive solution. It is documented that the SE retire slightly later than employees – the SE rate in older age groups is thus higher than in the lower ones. On the other hand large numbers of small entrepreneurs who entered the business in the 90's are growing to the retirement age now. The demographic structure thus is a necessary topic for further analysis.

Thus the relationship described above however interesting is of a mere descriptive value in relation to the specific period 2006-2011. To draw any more general conclusions the model would have to include variables for other factors discussed and be based on more observations but I believe that the rate of unemployment is a good candidate for addition and testing in the models for describing the factors behind self-employment rate development.

7   The Taxes Paid

This chapter summarizes the revenue from social security contributions (SSC) and personal income tax (PIT) from self-employed and discusses the hypothesis of tax related motives for self-employment. The development of tax revenue is shown in the first row of Table 6.

Table 6: The total tax and social security paid

	2006	2007	2008	2009	2010
Total income tax paid (bil. CZK)	17.8	17.0	18.1	7.5	9.3
Social security contributions paid (bil. CZK)	17.8	21.6	21.1	27.4	22.3
MI ETR = tax+social security / net mixed income	9.42%	9.62%	9.72%	8.38%	7.74%
TB ETR = tax+social security / tax base	29.32%	29.72%	20.72%	23.56%	22.24%

Source: statistical yearbooks of CZSO for respective years, CZSO - national accounts, author's calculation.

While between 2006 and 1008 the situation is stable, the most dramatic development is to be seen in fiscal year 2009. As explained in the previous sections, this is the year of a major macroeconomic slump, growing unemployment and a period affected by self-employment friendly change in tax rules in 2008 and 2009. Normally the results of any change in tax system or tax bases would be observed in the next term so only the 2008 change would be a factor but the government actually lowered the compulsory advanced PIT payments in expectations of worse business results in 2009 (and was proven right in their estimation according to the general tax directorate annual report for 2010 (General tax directorate 2011) – the saldo actually carried over to 2010 was very small). The fall is thus influenced by two legislature factors – the correctly expected drop in the tax base in 2009 and the change in tax calculation effective from the previous tax period.

The opposite direction of change for SSC (2nd row Table 6) in 2009 reflects the solid results of the year 2008. The reason why the tax revenue dropped to one half between 2008 and 2010 and the contributions stayed relatively stable or even grew stems from the progressivity of the income tax and the degressivity of the contributions. There is a minimum untaxable amount while there is minimum contribution defined by the law. The contributions are thus much less sensitive to drops in performance indicators. The health insurance payments unfortunately weren't available for the analysis however their dynamics should be similar to social security. The drop in SSC in 2010 then reflects the actual drop in tax bases between 2008 and 2009.

The „effective tax rates"(ETR) calculated in next two rows of Table 6 compare the two income measures with actual payments of PIT and SSC in a given year.[8] The different sensitivities of the two payments components and the different periods which they are based mean that they work against each other in the overall effect. The overall burden thus was indeed dropping but less than the criticism based only on income tax revenue (see 1st row of Table 9) would suggest. The actual change would be even less significant if we included also the mandatory contributions to health system which follow the same pattern as the SSC.

The ETR relative to the tax base was growing in 2009 because the contributions grew while the tax base dropped. The TB values for 2006 and 2007 are less relevant as the method for calculation of TB was much different. The ETR relative to mixed income was dropping consistently from 2008. The comparison of the two income measures used can be found in Table 7.

Table 7: Spread between the mixed income as part of a GDP and the tax base from §7 in millions of CZK

Year:	2006	2007	2008	2009	2010
Total household net mixed income in national accounts (b.3n)	377,651	401,297	402,680	416,146	409,684
y/y%		6.26%	0.34%	3.34%	-1.55%
Total tax base from §7	121,386	129,868	188,854	147,978	142,473
y/y%		6.99%	45.42%	-21.64%	-3.72%

Source: CZSO - Annual national accounts, author's calculation based on General tax directorate data.

To better understand the effect that the tax changes could have had on self-employment we need to analyse the causes of the above described revenue development. To do that, we start with the analysis of the development of the tax base. As mentioned above the tax base calculation method changed in 2008 – the social and health system contributions were no longer subtracted which is the reason for the 45% rise in 2008. There are several explanations for the following drop in tax base in 2009. Firstly the PDCs structure changed for tax year 2009 allowing much more costs to be declared this way – see Table 8. However we can see that the significant drop in total tax base, which happened in 2009, could not have been caused solely by the PDCs. The absolute growth of PDCs is smaller than the actual drop and it is important to understand that not all growth of PDCs means actual growth of costs – this would be true only if the actual costs replaced by PDCs were zero. That said, it is important to look for the reasons for the tax base drop elsewhere.

Table 8: The change in tax base and the change in costs declared by percentage

Year:	2006	2007	2008	2009	2010
Change in §7 tax base Y-Y		8,482	58,986	-40,876	-5,505
Change in total PDCs Y-Y		9,778	11,159	36,804	3,982

Source: author's calculation based on General tax directorate data.

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8   This „cash-flow" approach is used as an approximation because of data availability.

Another explanation would be the drop in performance – see Table 4. However this explanation is not supported by the rise in mixed income calculated by the CZSO in the mixed income indicator which should include a correction for the underreporting. Considering the approximate character of the MI indicator and considering the supplement indicators mentioned in Table 4 I think that the drop in performance was partially responsible for part of the drop in tax base. This is also supported by the corresponding development of the corporate income tax (see 2nd row of Table 9) which was not a subject to the change in the PDCs but was subject to the same macroeconomic influence in 2009.

Table 9: Revenue from SE income tax

	2006	2007	2008	2009	2010	2011	2012
SE share on income tax revenue	13.02%	11.22%	12.60%	5.86%	7.13%	3.37%	3.39%
Y/Y%corporate income tax revenue		17.38%	12.74%	-32.23%	1.93%	-4.84%	8.40%
Y/Y% self-employment income tax revenue		-4.58%	6.20%	-58.64%	25.17%	-51.80%	3.17%

Source: author's calculation based on CZSO Statistical yearbooks and UFIS system.

The moves in the tax base alone however do not explain the drop in income tax revenue by itself –the average TB actually grew in 2008 and the drop in tax base in 2009 has been about 21% while the income tax revenue dropped to more than one half. The difference has to be attributed to another change in the legislature - namely the introduction of the flat 15% tax along with the rise of minimum untaxable amount shown in Table 3. Figure 4 shows the distribution of tax bases between 2007 and 2009. All people with non-zero §7 TB are counted. The dashed line marks the interval containing the minimum untaxable amount in 2007 and the full line marks the interval with the minimum untaxable amount in 2008. As explained in the respective section, this amount more than tripled putting most of the SE in the no tax zone (see Table 3). From the limited detail data on distribution available we can assume this change by itself would result in a significant drop in tax revenue with the actual drop in tax bases only stimulating the effect.

Figure 4: The distribution of §7 tax base with the minimum untaxable amounts shown, Y axis shows the number of people in given interval, X axis determines the §7TB interval
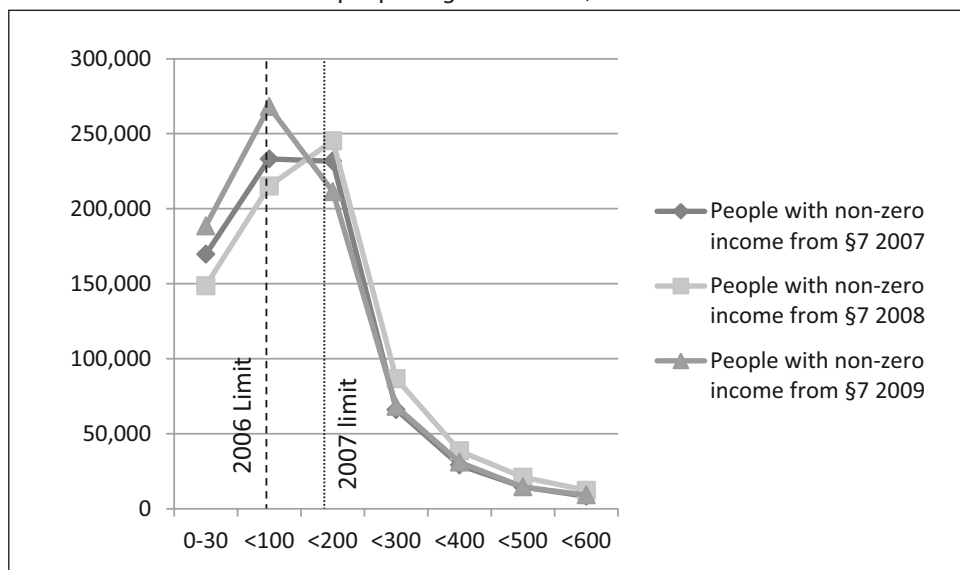
Source: author's calculation based on General tax directorate data.

The big progressivity of the income tax with a very high threshold implies a very high sensitivity of the revenue to the change in tax base when the majority of the subjects is condensed around this threshold. This was confirmed also in 2011 when the prolonged recession halved the revenue again (see last row of Table 9).

To have our analysis of fiscal effect of self-employment correct and complete we would need to estimate the amount of taxes and contributions the people moving from employment to self-employment would pay as employees and estimate the amount of cost of support for people who chose self-employment as an alternative to registering as unemployed.

We can conclude that the lowering of the average effective tax rate which we can observe in 2009 (third row of Table 6) might be one of the impulses behind the growth of the proportion of the self-employed on the labour market especially in the long but on aggregate while accounting for the mandatory contributions as well as income tax it cannot explain the sudden dynamic changes. The changes in average effective income tax rate are relatively minor to the stable advantage provided by the 50% TB for SSC and health insurance. Also the change in effective tax rate was to a large extent caused by the theoretically neutral rise in tax threshold for tax year 2008. The benevolent reporting policy expressed in the PDCs shown in rising numbers of people using them is another factor to be blamed but without the exact number of new SE using them it is difficult to quantify. Time wise – the LFS statistics registers the major growth in the numbers of self-employed in 2010, while the PDCs changes were effective from tax year 2009 and the change in the untaxable amount was effective even from 2008. Only the coincidence of these changes with the

growth of unemployment throughout the second half of 2009 is thus to be blamed for the sudden rise in the SE proportion in 2010 rather than the tax motives alone.

An important factor identified in the previous studies was the level of legislature enforcement on the labour market and in tax collection. This is only partially captured in the effective tax rate. The construction of a more complex measure of the legal enforcement is methodologically difficult but should be added to the analysis in the future. Further, as explained above, the self-employed generally pay smaller mandatory payments for social security expecting lower retirement benefits. Their choice of SE can thus be interpreted as cut on retirement savings in times of crisis which allows them to offer their work at lower price while retaining the same levels of consumption. The sentiment towards state run pension system can thus be another valid factor and the ongoing controversial pension reform may undermine it.

Conclusions

The article discussed the connections between the growth in the number of self-employed and the changes in legislature, tax burden and development on the labour market. We offered different hypotheses to be followed in the explanation of the growth of the OSVC segment for the Czech economy between 2006 and 2010. The data presented suggest that the tax system changes and the unemployment rate both influenced the growth in the numbers of OSVC with the unemployment rate being the dominant short term factor. The moderate correlation between the rise in numbers of self-employed and the rate of unemployment supports the hypothesis that the self-employment status can be a safe haven for people who are threatened by unemployment or who are forced to this status by tax optimizing employers on a low demand market. The rising difference in effective tax rates between SE and employees is a suggested long term factor for the rise in SE ratio in the labour market. The effect of the tax change could be prolonged, delayed and would be influenced by the level of law enforcement which is not measured here.

Our analysis is based on average numbers and a macro perspective though and it is likely that for specific subgroups the tax motive may have been the dominant one. Also the correlation between unemployment rate and the growth of self-employment in the limited time series, even though interesting and in line with our hypothesis, is not a proof of causality. Other factors effective especially in the long run such as demography, technological and structural change and cultural development were omitted. Both effects should thus be subjected to a further research using both longitudinal and more detailed structural data.

Besides that, we showed that the changes in tax system led to a drop in average effective tax rate. Part of the drop in tax bases has to be attributed also to business performance corresponding with the macroeconomic situation and part is caused by the extended usage of PDCs but the main cause of the drop in income tax revenue is the coincidence of a very high tax discount introduced in 2008 and the actual distribution curve of the §7 tax bases. The changes introduced between 2007 and 2010 thus did not have a dominant immediate impact on the number of self-employed but certainly impacted the SE income tax revenue.

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Contact address

Ing. Tomáš Pavlíček
University of Economics, Prague / Vysoká škola ekonomická v Praze
Department of Economic and Social Policy / Katedra hospodářské a sociální politiky
(tomas.pavlicek@vse.cz)

Appendix

Used Acronyms:
CZSO – Czech Statistical Office
LFS – Labour Force Survey
MI – Mixed Income
OSVČ – Person Earning Money Independently (osoba samostatně výdělečně činná)
PDCs – Percentage Declared Costs
PIT – Personal Income Tax
RILSA – Research Institute of Labour and Social Affaires
SE – Self-employed, Self- employment
SSC – Social Security Contributions
TB – Tax Base

Impact of Non-cooperative Oligopoly of the Banking System on Its Pro-cyclicality in the Czech Republic

Vliv nekooperativního oligopolu bankovního sektoru na jeho procyklikalitu v České republice

DAVID TISOŇ

Abstract

Irrational behavior of banks in the form of excessive credit expansions or contractions, as appropriate, in the course of an economic cycle, together with the subsequent intoxication of bank assets, has become the subject of many controversial regulatory measures since the 1990s. The study simulates this phenomenon using the Bayesian game, which models environment of a conflict situation with incomplete information based on historical data of the past decade in the Czech Republic. The results imply that the dominant banking strategy is – irrespectively of the behavior of other players – the strategy with inadequate risk aversion, with excessive (inadequate) optimistic or pessimistic expectations, as appropriate, depending on the economic cycle stage. The reason for this behavior that contradicts the Pareto efficiency principle is the lack of information about the portfolio strategy of other players and their mutual rivalry in terms of market share increase. The conclusions of the study bring a solution in the form of open bank cartels (cooperative oligopoly) aimed at the coordination of their strategy. The objective of this measure would be the self-regulation of the banking sector credit policy, with acceptable profits and risks for banks and tolerable terms for debtors, reflecting the given economic cycle stage.

Abstrakt

Neracionální jednání bank v době ekonomického ochlazení ve formě nezdravé redukce úvěrů pro reálnou ekonomiku se stalo v poslední době diskutovaným tématem. Podle dostupných studií může být toto jednání následkem předešlých nadměrných úvěrových expanzí v době ekonomické prosperity. Navazující úvěrová kontrakce prodlužuje ekonomickou depresi se zpětnými negativními efekty do úvěrových portfolií bank. Studie popisuje tento fenomén pomocí několika modelů teorií her, z nichž ústřední je Bayesovská hra, která modeluje prostředí konfliktní situace s nedokonalými informacemi. Výsledek implikuje, že dominantní bankovní strategií, bez ohledu na jed-

nání ostatních hráčů, je právě agresivní strategie s nízkou averzí k riziku a tedy volba rizikovějšího, nicméně potenciálně výnosnějšího, portfolia v době ekonomické prosperity. Příčinou tohoto nepareto-optimálního jednání je neznalost informací o portfoliové strategii ostatních hráčů a jejich vzájemná rivalita v navýšení tržního podílu. Tedy vedle již známých příčin procyklikality, vstupuje do hry taktéž rivalita oligopolistů. Závěr práce nabízí východisko v podobě otevřených bankovních kartelů (kooperujícího oligopolu) za účelem koordinace strategie. Cílem by mohla být volba vhodné úvěrové expanze celého bankovního sektoru (vice versa úvěrové restrikce) s přijatelným ziskem a rizikem pro banky a únosnými podmínkami pro dlužníky vhodné pro daný ekonomický cyklus.

Klíčová slova

úvěrové portfolio, procyklické chování, oligopol, Baeysovská hra, Nashova-Bayesova rovnováha, smíšené strategie

Introduction

The objective of the game theory models is to examine the behavior of an intelligent player (rational entity) in conflict situations and to seek a balanced solution, which does not always have to comply with the Pareto efficiency principle. Nevertheless, a bank – as a key player in developed markets – appears not to act rationally in terms of pro-cyclical behavior, destabilizing economy and, by return, intoxicating bank assets. The real and optimal shares of individual loan categories within the portfolio of Czech banks were examined in the study of Podpiera and Weill (2010), which discovered remarkable deviations from an optimal, where the banking sector could have generated higher returns by maintaining the risk level (in the period of 2005-2008). The data about returns and risks of the aforementioned aggregated credit (loan) portfolios became the basis for the applied game theory simulation models presented in this study.

The pro-cyclical behavior[1] of the banking sector during the period of economic prosperity is characterized by excessive credit expansion within the real economy. It seems that such support of consumption and investments positively extends economic growth; however, it also finances ineffective investments and inadequate capital structure, which is subsequently corrected during the period of economic depression, with the need to discontinue a lot of the production capacities (Rothbard 1975, Holman, Ševčík et al. 2005). Economic shocks are usually followed by the aforementioned credit shocks, manifested by intense reduction of loans for the real sector, which – according to available studies – may unhealthily intensify the crisis and prolong the recovery process (Geršl, Jakubík 2010, p. 108).

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1   *The pro-cyclicality of the banking sector refers to its ability to amplify the cyclical fluctuations of economic activity via the provision of loans and other activities of financial institutions, resulting from the feedback between the macroeconomic development and the financial system (Frait, Komárková 2011, p. 98).*

The effectiveness of traditional transmission channels of the central authority's monetary policy appears to be very weak in such critical situations (Komárek, Komárková 2012). The limited impact of existing macro-prudential instruments[2] on banking portfolio excesses is viewed similarly (Frait, Komárková 2011, p. 105). In terms of game theory, a bank basically selects a new dominant strategy in the period of economic uncertainties, which consists in a sharp reduction of the credit portfolio – irrespectively of the behavior of other market players – which further deepens the credit assets intoxication within the banking sector via macroeconomic destabilization and increasing systemic risks (Geršl, Seidler 2012, p. 97).

The aim of this work is to verify the hypothesis that is the adverse effect of the banks' rivalry on pro-cyclical behavior under prevailing oligopolistic market structure, manifested in the form of inadequate risk aversion in terms of credit policy. Therefore, it is intuitively possible to arrive at a conclusion that cooperative banking oligopoly, which coordinates its strategies in terms of the output volume and interest rate level[3], may be beneficial for the credit market and health of the financial system. In such case, the price of banking services may ultimately be higher; however, with the compensation of a healthy financial system and shorter economic depressions.

The application part of this study tries to simulate the portfolio strategy of banking oligopolists with the use of game theory models, specifically with the use of conflict situation model of banking duopoly, which best illustrates the situation within an oligopolistic market. The first two presented models simulate theoretical knowledge of the opponent's risk aversion as well as the resulting optimal credit portfolio. Next is the Bayesian game model (Harsanyi 1968), which simulates more rigorously the real situation with incomplete information about the competitors' strategies. The resulting equilibrium situation (Nash equilibrium – see Chapter 4) differs from the Pareto-optimal equilibrium via the preference of aggressive credit strategy with low risk aversion. This implies the benefits of banking cooperation within an oligopolistic market in setting a credit portfolio strategy as well as the harmful nature of rivalry that may promote the banking sector pro-cyclicality.

In the first part, the study addresses available literature in the area of banking sector market structures, pro-cyclical behavior, interest revenue, and game theory models. The application part comprises presentation of all three simulation models and the process of acquiring the input data from the banking sector in the Czech Republic.

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2   *It is based on the central bank's macro-prudential policy, which is aimed at preventing the occurrence and spreading of systemic risks of the financial sector, thereby reducing the probability of emerging financial crises with significant losses for the economy as a whole in terms of its real output (during such crises, GDP is declining, on an average basis, for the period of about two years, not returning to its original trend for about four years) (Frait, Komárková 2011, p. 97).*

3   *Analogically, the coordination is beneficial to natural (network) monopoly, without which the effective management of energy networks would not work (Hon 2008).*

1   Specificity of Market Structures and the Structure of the Banking Market in the Czech Republic

Can open cooperation of banks reduce the pro-cyclical behavior of the banking sector? It intuitively seems like valid hypothesis, since an open cartel or cooperative oligopoly, if you will, prefers long-term profits, market stability, and smooth supply to ensure than consumers do not look for substitutes. It is possible to find analogy to this in a key international open cartel OPEC[4], the long-term strategy of which is to ensure stable supply of oil to the world at a fair price, without fluctuations in deliveries with potential adverse effects on the economy of consuming nations (OPEC Statute, Chapter 1, Article 2).

In reality, perfect competition markets only exist in theory, while real markets tend to show attributes of imperfect competition, which changes its market structure based on circumstances. High number of sellers is not sustainable in the long run, always converging to clustering – i.e. combination of companies into individual cartels that compete with one another under a concentrated structure similar to oligopoly (Aumann 2000). The banking market is characterized by virtually all known characteristics of imperfect competition, with oligopolistic or monopolistic structure, as appropriate, mainly given by barriers to market entry (e.g. registered capital, central authority's permission), economies of scale for branch network, as well as by legal regulation and qualification requirements or product differentiation (given by, for example, credit standards on the basis of risk tolerance). Strategic decision-making of oligopolists is interconnected, since each of such entities may affect the market price through its output. Therefore, oligopolists are the price makers, unlike the perfect competition market entities, which are the price takers, without the ability to affect the price through its production (Hořejší, Soukupová et al. 2010).

The standard approach relating to the benefits of competition for consumers may be incorrect when it comes to the credit (loan) market. In general, efforts aimed at establishing a perfect competition environment result in the restriction of consumer choice (differentiated products) and limited development of innovations, which are the precondition to economic growth (Heissler, Valenčík et al. 2010). Some studies mention information externalities, i.e. increased costs of monitoring the clients' financial standing in case of a high number of banks operating within the market (Cotorreli, Peretto 2000); in terms of game theory, it concerns the concept of the free rider model[5]. This may result in an emergence of a segment of clients selected on the basis of first-rate monitoring or, as appropriate, a segment of clients, who did not undergo the monitoring process and were selected randomly. Consequently, the well-known risk accumulation takes place as a result of increasing probability of credit defaults upon emerging cyclical recession.

According to a study published in the Financial Stability Report of the Czech National Bank (Podpiera, A. 2007), the Czech market was characterized by a sharp decline in the market

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4   *According to the declaration of an OPEC official (Yamani 1973), the reason for such approach may seem prosaic – i.e. that developed are not encouraged, through instability of deliveries and unbearable prices, to look for ways of doing without this commodity altogether.*

5   *Small banks use shared bank client databases about their financial standing – i.e. they eliminate costs of client screening; it is an information externality (Cotorreli, Peretto 2000).*

concentration during the 1990s, with many banks operating in the market, and its subsequent increase until the end of the period under review in 2005. The monopolistic competition was a sign of low market concentration, which converged to gradual oligopolization. This trend was associated with the banking sector stabilization, privatization of key banks in the country, and fixation of their respective market shares. The new decade, with the entry of internet banks and lower barriers to market entry (no need to develop a branch network), could lead to the monopolistic competition trend once again. The theory of contestable markets (Baumol 1982), where oligopolists are not interested in significant price increases not to attract other participants to the sector and start a price war, promotes the cooperative oligopoly and its long-term stability and benefits for some types of markets. The natural barriers to entry to the banking sector – particularly the branch network development – are currently becoming less significant due to internet-based banking, whereas oligopolistic banks act as if operating in a competitive market in this regard.

2   Reasons and Implications of the Pro-cyclical Behavior of the Banking Sector (not only) in the Czech Republic

The literature identifies five key factors for the banks' pro-cyclicality: herd behavior, information asymmetry, expectations, fluctuations in banks' balance sheet items, and financial innovations (Geršl, Jakubík 2010, p. 105). The first three causes fall within the study of behavior of economic entities and have previously been subject to a game theory analysis (Akerlof 1970, 1985, Geenwald and Stiglitz 1990, Bickchandani and Sharma 2001).

In case an increase in the market interest rates leads to lower profitability of banks (e.g. due to higher increase in reference rate or due to increasing risk premium as a result of regulatory measures), bank may react to this by increasing the supply of loans, with a view to maintain the profitability by expanding the banking portfolio (Geršl, Jakubík 2010 p. 106). This results in an increasing share of external funds of financial and nonfinancial institutions, leading to accumulation of systemic risks. During the economic recession stage, this is associated with sharp acceleration in the risk level and interconnected implications for the financial and nonfinancial sector in the period of insufficient financial reserves (Geršl, Jakubík 2010 p. 106). Banks react via interest rate restrictions, which may have adverse effects on the credit portfolio quality. Credit standards restriction is mainly manifested by increasing requirements for one's own funds for project financing or by imposing stricter requirements for loan security. This dynamically increases implied costs of investors in the form of higher costs of "expensive" equity (Kislingerová 2009). This actually results in the well-known adverse selection effect (Akerlof 1970, Geenwald and Stiglitz 1990), where risker projects, which can cover the interest rate through their expected returns, drive out more stable and less risky projects that generate lower returns and, consequently, cannot bear the interest burden, again with self-strengthening effects on systemic and credit risks[6]. This also postpones the natural economic recovery process.

Empirical data relating to the pro-cyclical behavior of Czech banks during the conjuncture are shown in the 2007 Financial Stability Report (Czech National Bank, FSR, pp. 47-59).

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6   *Systemic risk is given by the characteristics of national economy that may be reduced by the portfolio diversification on the international level. Credit risk is the risk of a loan default.*

Loans increased by 42% for nonfinancial enterprises and 37.5% for households. The total volume of client loans amounted to CZK 1.78 billion. The year-to-year growth rate of 26.4% was mainly recorded in the business segment. Defaulted loans amounted to 3.1% of business loans, i.e. higher than in case of households (2.7%). The Report also stated that housing loans had become the top component of the credit portfolio.

The results of stress tests for 2007 indicate that in case of the implementation of scenario A – safe approach – the rate of default would amount to 7.9% for business and 3.1% for households. Therefore, it would be much higher within the business sector, which is more sensitive to economic fluctuations due to the riskier nature of its projects.

3   Determinants of Clients' Interest Income and the Credit Portfolios in the Czech Republic

Clients' interest income is affected by internal and external factors (Černohorský, Teplý 2011, p. 110). Internal factors mainly include costs of a bank, client's risk assessment, loan maturity and security, etc. In addition to the macroeconomic environment of the given country and government bond returns, external factors also include the competition environment level. Therefore, generally speaking, higher competition pressures lead to lower interest rates on loans and higher interest rates on deposits. A bank's credit portfolio is used to diversify the risks for the sectors of businesses, households, and government, becoming the bank's key loan strategy. The publication of Podpiera and Weill (2010) evaluated the excessive risk of credit portfolios in relation to the revenues of the Czech banking sector as a whole in the period of January 2005 – February 2008 for the sector of businesses and households. The ascertained average excessive risk of 33% in the period under review meant that one third of the non-optimal risk could have been reduced while retaining the same revenue. The excessive risk was analyzed by comparing the optimal portfolio with real portfolio (Table 1). The share of business loans – i.e. operating, export and import loans – was 1% higher than the optimal share. This means that their reduction would have contributed to better risk position with the same revenue of the portfolio. Similarly, reduction of loans for acquisition of financial instruments by 1.5% and of consumer loans by 1.8% would have led to the overall portfolio risk reduction. Finally, an increase in real-estate loans (particularly housing loans) by 4% would have resulted in the reduction of excessive risk. The analysis documented some trends of pro-cyclical behavior of the banking sector and irrational behavior of banks during the period of economic growth, with the preference of riskier loans. It is interesting that the highest differences between the optimal and the real share of individual loan categories within the portfolio were identified for operating business loans and loans for acquisition of financial instruments – up to 23% and 28% of the specific bank's portfolio, respectively. Such cases indicate aggressive portfolio strategies.

Table 1: Analysis of banking loan strategies for the sector of businesses and households in the period of 2005-08 in the Czech Republic

	Businesses		Households	
Loan category:	Income (%)	Risk (%)	Income (%)	Risk (%)
1) Operating, export/import loans	4.3	0.51		
2) Real-estate loans	5.5	0.41	5.7	0.31
3) Loans for acquisition of financial instruments	5.76	0.94		
4) Consumer loans	5.8	1.35	6.9	0.74
Average:	**5.3**	**0.80**	**6.3**	**0.52**
Credit portfolio components	Businesses		Households	
	Shares (real)	Shares (optimal)	Shares (real)	Shares (optimal)
1) Operating, export/import loans	14.23	13.33		
2) Real-estate loans	17.18	19.12	30.8	33.06
3) Loans for acquisition of financial instruments	14.32	12.81		
4) Consumer loans	3.71	3.36	19.79	18.54
Total:	**49.44**	**48.62**	**50.59**	**51.60**

Note: Aggregated % income (weighted average of interest rate for individual loan categories) and risk position (standard deviation of incomes).

Source: Data were aggregated for individual sectors by the author based on the data obtained from the study (Podpiera and Weill 2010).

4 Strategic Decisions of Banking Institutions from the Perspective of Game Theory

Unlike single-round or limited-time game situations, the repeated game system that is similar to reality gradually leads to the cooperation of players (Aumann 2000). Intelligent players look for the Nash equilibrium solution[7], such solution that guarantees the highest winnings irrespectively of the strategy selected by other players - i.e. identification of the so-called dominant strategy (Nash 1951, Dlouhý and Fiala 2009). The banking market is forced, through regulation, to non-cooperative behavior and selection of dominant strategies, irrespectively of their Pareto-optimality. A cooperative strategy on the banking market is only possible if it brings higher guaranteed profits than noncooperation, at the expense of hidden cartels on the basis of collusion agreements, which significantly increase the costs of cooperation. Such cartels are unstable and their members tend to violate the collusion agreements, since no institutional framework for the enforcement thereof exists (Hořejší, Soukupová et al. 2010). Secretive cartel (collusion) agreements, by

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7   *A situation, where no player may improve his situation by changing the selected strategy; at the same time, it is a solution concept of a non-cooperative game involving two or more players. It was named after John Nash, who proved that each finite game has at least one such solution.*

nature aimed at short-term profits, naturally promote irrational behavior of banks and the pro-cyclicality of the entire sector.

The original model situations of game theory were based on interactions of two entities that pursue conflicting goals, with a set of strategies at their disposals to be used in order to attain their goals (Morgenstern and Neumann 1944, Dlouhý and Fiala 2009). In a normal form, a game represents a situation, where players have complete information – e.g. about the payoff matrix, which represents the overview of information about the payoffs of all players (utilities, preferences). Naturally, each player knows their own payoff function; however, he/she is unlikely to know the payoff functions of other players (e.g. a company does not know the cost functions of its competitors, an investor does not know the risk aversion of other investors, etc.).

The Cournot duopoly model (Cournot 1838), which is a special case of oligopoly, strived for equilibrium in finding the optimal product while maximizing profit, de facto becoming the first general concept of the Nash equilibrium solution. Analogically, it is the same as finding the optimal product of a bank in the form of optimal credit expansion while maximizing client interest rate adjusted for credit risk. The publication includes a model situation of non-cooperative oligopoly, expanded by the unfamiliarity with the competitor's risk aversion. This situation represents analogy to the category of games with incomplete information, such games being characterized by the unfamiliarity with private (proprietary) information. These games are also called Bayesian games in theory (Dlouhý and Fiala 2009).

The modelling of conflict situations with incomplete information was further developed by J. C. Harsanyi (1967-8) by introducing a prior move of an imaginary player (Nature), determining the type of each player. The player types, and consequently their preferences, result from the random variable selected by Nature. It simulates a situation, where players do not know the type of player to be selected. This lack of information is modelled with the same probability for the selection of type of each player.

Bayesian game is defined by:
1. Set of players: {1,2….N}
2. Set of strategy profiles: {X1,X2….,XN}; specific strategies are described as (x1,x2…,xN);
3. Set of player types: {T1,T2….,TN}. Type ti→Ti corresponds to certain payoff function, which can be utilized by player i. The player i know his type, but he does not know the types of other players.
4. Set of players' views: {p1,p2….,pN}. The view ppi represents the view of player i relating to the types of other players. The view of a player is captured in the model via a subject probability function.
5. Set of payoff functions: {f1 (x1,x2…,xN , t1,t2…tN),….,fN (x1,x2…,xN , t1,t2…tN)}. Payoff function is a two-place function of strategy profiles and player types; it depends not only on the specific player's decision, but also on the decisions of other players.

5   Data Base for Compiling the Model of the Banking Oligopoly in the Czech Republic

The case study deals with a version of non-cooperative banking oligopoly. The basis for the strategic decisions of oligopoly is the optimal portfolio distribution in terms of income and risks of individual loan categories. In order to simply the model, the credit portfolio asset structure was aggregated from the macroeconomic perspective under three main sectors of the economy, specifically: households, businesses, and government. In this study, the impact of the foreign sector was excluded for the time being.

Acquisition of government bonds by a bank does not represent a conventional financial loan; however, the income from such transactions represents a benchmark of risk-free income for conservative credit strategies. In case of an adjustment of interest rates for households and businesses, it is possible to compare the risk-free income of these sectors with the government bond returns (see Table 2).

Figure 1: Aggregated banking credit portfolio according to individual sectors of the Czech economy
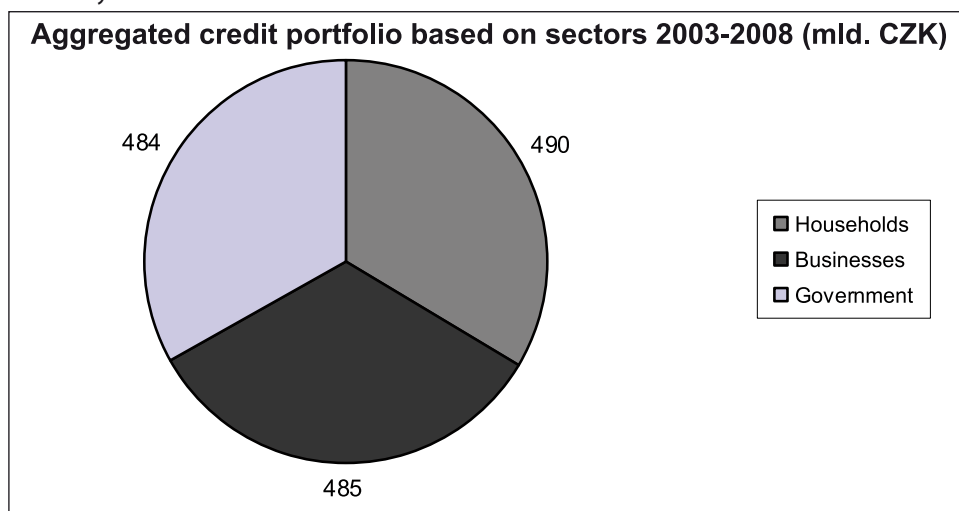
Source: Approximated by the author for the period under review of 2005-2008, based on the data from monetary and financial statistics of the Czech National Bank.

Surprisingly, domestic banks contributed, on an approximated basis, similar share to the government debt in the period under review. Therefore, the three-sector model of credit portfolio of financial institutions in the Czech Republic model is symmetrical (Figure 1).

Table 2 includes interest rates, which serve as the basis for determining the payoff function for individual sectors of bank's portfolio under a standard-form game. The interest rate is

adjusted for discount or premium, as appropriate, relating to transaction costs[8] of loan categories, showing some costs inefficiency for servicing individual sectors. This adjustment did not relate to the government sector due to its neutrality in terms of transaction costs. The last interest rate adjustment is the so-called risk-free income based on the "two sigma" quantitative rule for normal distribution of probability based on statistical analysis. In this case, it applies under normal distribution of the variable under review (i.e. loan income) that 95% of all values are within the interval of twice the standard deviation from the median. Consequently, it is possible to say – with 95% probability – that the income will not be less than 4.26% for the household sector and 4.7% for the business sector. However, the aforementioned income levels are still higher than the government bond income in the period under review and, consequently, banks prefer to finance projects of real sector and of households during the period of cyclical prosperity.

Table 2: Analysis of interest income from banking portfolios according to individual sectors in the period of 2004-08 in the Czech Republic

	Businesses	Households	Government
Approximated market interest rate on loans	5.3%	6.3%	3.5%
Transaction costs discount / premium	Plus 1%	Minus 1%	0%
Approximated interest rate after adjustment	6.3%	5.3%	3.5%
Risk – standard deviation	1.6%	1.04%	0%
Risk-free interest rate (interest rate adjusted for risk)	4.7%	4.26%	3.50%

Source: Approximated interest rate and standard deviation from the data of the study for the period of 2005-2008 (Podpiera and Weill 2010); model discount or premium, as appropriate, estimated by the author.

6   Construction of the Banking Duopoly Model

The market interest rates of individual economic sectors adjusted for transaction costs represent the basis for the game model of banking duopoly for the period under review in the Czech Republic. Higher number of enterprises (banks) within the industry does not change the principle of a duopoly model and is, under the given preconditions, also relevant in other cases of oligopoly (Dlouhý and Fiala 2009, Hořejší, Soukupová et al. 2010). In this case, the banking oligopoly is represented by a duopoly model with two banks, where one of the banks represents the remaining banking sector. This approach is based on the precondition that the behavior of one bank in the area of credit portfolio strategy is affected by the entire market and that neither bank has information about the strategy selected by the other bank.

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8   *Transaction costs represent any and all costs associated with arranging (ensuring) the given transaction – i.e. costs of the entire loan relation process in this specific case. Banks generate costs savings (economies of scale) for business loans, as the volume of individual loans tends to be higher compared to household loans. The impact of transaction costs is apparent by preference of corporate loans before household loans despite the lower interest rate and higher risk as is clear from the data shown in Table 1. The amount of the discount / premium model is established precisely to compensate for the gap between interest income and the risk of business loans and household loans.*

An intelligent player represents a player with complete information about the game and his behavior is aimed at maximizing the payoff function value. Non-antagonistic conflict distinguishes two situations, where players may / may not reach agreements on their choices prior to making such choices; based on this criterion, we distinguish a cooperative or non-cooperative game, as appropriate. We will find the optimal strategy of players in the game using the Nash equilibrium. The Nash equilibrium is attained by identifying the saddle point of a matrix[9]. Publicly known information is available to all players (e.g. competitor's client interest rate). In addition to the publicly known information, games with incomplete information also feature private/proprietary information, which is only available to some players (e.g. risk aversion). This initial private/proprietary information determines the so-called player type in the game – i.e. with aggressive or conservative strategy, as appropriate, in our case (Dlouhý and Fiala 2009).

The model is constructed under the following conditions: it comprises two economic entities: Bank 1 (representing the remaining banking sector) and Bank 2. The optimal portfolio strategy of Bank 2 is sought, whereas Bank 2 does not have the private information concerning the risk aversion level of Bank 1 (conservativeness or aggressiveness).

The model base of the credit market structure – i.e. of the entire banking sector portfolio – relies on the empirical data for the period under review 2005-2008 and it is divided into thirds with the corresponding share of loans in individual sectors: 1/3 businesses (B), 1/3 households (H), and 1/3 government (G) – see Figure 1.

Another determinant of the banking duopoly model is the elasticity of interest rate or payoff function, as appropriate, in case of banks' higher output – i.e. supply of loans in individual sectors – compared to the demand after such output under the given credit terms (interest rate, credit standards). The reaction is the output price reduction (i.e. reduction of interest rate) or increase in interest rate in case of lower money supply compared to the demand of individual sector.

The first two models (Model 1 and Model 2) foresee a simple matrix game in standard form, where players are familiar with the game structure – i.e. potential types of aggressive or conservative portfolios (as appropriate) of an opponent in our case but not with their final chosen portfolio. In other words, the players are familiar with their opponent's risk aversion.

The first banking duopoly model comprises to types of aggressive portfolio of Bank 1 in case of its aggressive strategy (according to the game theory terminology, it concerns the so-called Bank 1 type 1):
1) BBH – 1/3 businesses, 1/3 businesses, 1/3 households = 2/3 businesses and 1/3 households
2) BHH – 1/3 businesses, 1/3 households, 1/3 households = 1/3 businesses and 2/3 households

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9 *A saddle point is an element of the matrix which is both the largest element in its column and the smallest element in its row.*

Both portfolio selected in the model have lower risk aversion, focusing on more profitable sectors of businesses and households and doing without the so-called risk-free investments in government bonds. The first alternative of the portfolio, BBH, is more aggressive, with predominant share of more profitable, though riskier, business loans. The second alternative, BHH, shows dominant share of household loans with lower income, but – logically – with lower risks.

Bank 2 has three different portfolio strategies at its disposal, which will be subjected to testing under game model as follows:
1) BHG – 1/3 businesses, 1/3 households, 1/3 government – purely diversified portfolio
2) BBH – 1/3 businesses, 1/3 businesses, 1/3 households = 2/3 businesses and 1/3 households
3) BHH – 1/3 businesses, 1/3 households, 1/3 households = 1/3 businesses and 2/3 households

The first portfolio is purely diversified. The second portfolio, BBH, is aggressive (see Bank 1 type 1), whereas the third portfolio, BHH, is less aggressive, with focus on the household sector.

Model 1: The game matrix (normal form) in case of aggressive strategies of Bank 1 (Bank 1 type 1) and selected mix of portfolio strategies of Bank 2.

		Aggressive strategies of Bank 1 (Bank 1 type 1)			
		BBH		BHH	
Bank 2	BHG	(5.03)	[5.30]	(5.03)	4.97
	BBH	4.97	[4.97]	4.97	4.63
	BHH	4.63	[4.97]	4.63	4.63

Note: Input data from the monetary and financial statistics of the Czech National Bank and from the underlying study (Podpiera and Weill 2010). Source of final values: Own calculation.

The maximum values in each column for Bank 2 are shown in parentheses, whereas the maximum values in each row for Bank 1 are shown in brackets. The saddle point comprises two values shown in parentheses/brackets. Bank 2 identifies the dominant strategy of Bank 1, BBH, as it is familiar with the game structure – i.e. with potential types of aggressive portfolios, and selects its strategy accordingly – i.e. BHG. Moreover, this is the dominant strategy of Bank 2, meaning it would select it irrespectively of the Bank 1 strategy. The Nash equilibrium solution with dominant strategy applies in this case, where Bank 2 may only worsen its position by selecting another strategy (in this case BBH or BHH – the so-called dominated). The payoff function of 5.03 generated in case of the dominant strategy for Bank 2 is the same as the payoff function for the equilibrium in all sectors (5.03). This solution is also Pareto-optimal, i.e. neither of the players may improve their situation without one of the players being worse off. At the same time, zero-value of information exists in this game – Bank 2 would not change its strategy even if the strategy of Bank 1 is disclosed.

Model 2 foresees two conservative portfolios for Bank 1 in case of its cautious strategy (according to the game theory terminology, it concerns the so-called Bank 1 type 2):
BHG – 1/3 businesses, 1/3 households, 1/3 government – purely diversified portfolio
HHG – 1/3 households, 1/3 households, 1/3 government = 2/3 households, 1/3 government

The first portfolio, BHG, represents a purely diversified portfolio of assets distributed evenly among the three main economic sectors. The second portfolio, HHG, represents a super-conservative portfolio, with elimination of the riskiest component – i.e. business loans – in favor of the less risky household sector, with one share of risk-free investments in the form of government bonds. Once again, Bank 2 has a mix of three portfolio strategies at its disposal, similarly as in the first model.

Model 2: The game matrix (standard form) in case of conservative strategies of Bank 1 (Bank 1 type 2) and selected mix of portfolio strategies of Bank 2.

		Conservative strategies of Bank 1 (Bank 1 type 1)			
		BHG		HHG	
Bank 2	BHG	5.03	[5.03]	5.03	4.03
	BBH	(5.30)	[5.03]	(5.63)	4.37
	BHH	4.97	[5.03]	4.97	4.03

Note: Input data from the monetary and financial statistics of the Czech National Bank and from the underlying study (Podpiera and Weill 2010). Source of final values: Own calculation.

Once again, the saddle point comprises two values shown in parentheses/brackets. Again, Bank 2 identifies the dominant strategy of Bank 1 on the basis of the known game structure, selecting its optimal strategy (BBH) accordingly - this being the most aggressive strategy. The saddle point represents the Nash equilibrium solution with dominant strategy, where Bank 2 generates above-average income of 5.3 or 5.63 (as appropriate), if Bank 1 diverts from its dominant strategy BHG. In this case, the Nash solution is also the Pareto-optimal solution for the banks' incomes – as in the previous case.

In the next case, the risk aversion of Bank 1 (i.e. its type) represents unknown information for Bank 2; i.e. Bank 2 does not know, which portfolio strategy will be selected by Bank 1 out of its set of available strategies. We say that Bank 2 does not have the private (proprietary) information about the type of Bank 1, unless we consider insider-trading or cooperative strategies. In practice, this means that the bank does not know the prevailing portfolio strategy within the banking sector. It is a typical game with incomplete information, because Bank 2 does not know whether Bank 1 prefers aggressive or conservative banking portfolio, while Bank 1 obviously has this proprietary information. We will convert the two-player game with incomplete information to a three-player game with imperfect information, involving Bank 2, Bank 1 type 1 (prefers aggressive portfolio), and Bank 1 type 2 (prefers conservative portfolio). Both banks know the probability of distribution of types (P = 0.5) prior to the Nature's move; however, only Bank 1 will find out the results of lottery that determines its type at the beginning of the game. Since Bank 2 does not know the current type of Bank 1, it must estimate the optimal actions of both types of Bank 1.

The strategy (BBH, BHG) will describe a situation, where Bank 1 type 1 selects portfolio BBH and Bank 1 type 2 selects portfolio BHG. The strategy (BBH, HHG) means that type 1 opts for BBH, while type 2 chooses HHG, and accordingly for other combinations between the strategies of Bank 1 type 1 / type 2 from Models 1 and 2. In this manner, we create the payoff matrix of three players, where the first value represents the payoff for Bank 2, the second value represents the payoff for Bank 1 type 1, and the third value represents the payoff for Bank 1 type 2. The payoff for Bank 2 for strategy BHG against the pair of strategies of Bank 1 (BBH, BHG) will be calculated as follows: 0.5 x 5.03 + 0.5 x 5.03 = 5.03. The payoff for Bank 1 type 1 is determined as the combination of strategies (BHG, BBH) from the first matrix, i.e. 5,03. The payoff for Bank 1 type 2 is determined as the combination of strategies (BHG, BHG) from the second matrix, i.e. 5. The remaining elements of the matrix will be determined accordingly – see Model 3.

Model 3: The game matrix (normal form) in case of mixed strategy of Bank 1 (Bank 1 type 1 and Bank 1 type 2) and selected mix of portfolio strategies of Bank 2.
Mixed strategy of Bank 1 (probability of application of aggressive or conservative strategy is 50%)

		BBH,BHG			BBH,HHG			BHH,BHG			BHH,HHG		
Bank 2	BHG	5.03	[5.30]	[5.03]	5.03	[5.30]	4.03	5.03	4.97	[5.03]	5.03	4.97	4.03
	BBH	(5.13)	[4.97]	[5.03]	(5.30)	[4.97]	4.37	(5.13)	4.63	[5.03]	(5.30)	4.63	4.37
	BHH	4.80	[4.97]	[5.03]	4.80	[4.97]	4.03	4.80	4.63	[5.03]	4.80	4.63	4.03

Source of final values: Own calculation.

We will find balanced (equilibrium) actions for all players as follows: Bank 2 seeks maximums of the first values in each column; Bank 1 type 1 seeks maximum of the second values in each row; and Bank 1 type 2 seeks maximum of the third values in each row.

In case we identify a trio shown in parentheses/brackets, it is the Bayesian-Nash equilibrium in pure strategies. The banking duopoly game with incomplete information has its equilibrium in the pure strategies {BBH (BBH, BHG)}. Bank 2 will select strategy BBH, i.e. the most aggressive credit portfolio focusing on the business sector, and waits for the strategy selected by Bank 1. In case Bank 1 opts for more aggressive strategies, Bank 2 gets lower returns than if Bank 1 chooses more conservative portfolio. However, Bank 2 generates above-average returns in all three cases, with 5.13 and 5.3, respectively, whereas Bank 1 only generates below-average returns ranging from 4.37 to 5.03. In case Bank 2 diverts from the dominant strategy, it will get less (see the Nash equilibrium solution). However, such solution is not Pareto-optimal – highlighted in grey. In case Bank 2 selects the dominated strategy BHG, both banks receive more compared to the Bayesian-Nash equilibrium with dominant strategy. The payoff function of Bank 2 could amount up to 5.19 (see Table 3), so that Bank 1 is still motivated to redistribute the income more. (Budinský, Valenčík 2009) Model no. 3 represents the Pareto-optimal solution for cooperation, to which repeated games of non-cooperative oligopoly widely converge. Table 3 compares adjusted incomes of Bank 2 in individual games with the risk-free income from government bonds. Bank 2 generates the second highest risk-free income with diversified strategy under the structure of aggressive type of Bank 1 (see Model 1). The mixed strategy leads to the lowest difference – specifically for the non-cooperative mixed strategy pursuant to Model 3,

on the contrary, the cooperative strategy leads to the highest risk-free income. This means that banks' rivalry aimed at achieving dominant position in more profitable segments is associated with negative effects typical of pro-cyclicality during the period of economic growth, i.e. reduction of interest rates (or risk premiums, as appropriate) and easing of credit standards, with consequent accumulation of credit risks (see the stress tests for the period under review in the 2007 FSR of the CNB mentioned in Chapter 3 of this Article).

Table 3: Income of Bank 2 for individual equilibria shown in Models 1 through 3 and subsequent risk-free income.

	Market interest rate of the portfolio	Portfolio risk	Risk-free interest rate of the portfolio	Excess income of the portfolio over the government bond income
Bank 2 in duopoly with information about the opponent's aggressive strategy	5.03 %	0.88 %	4.15 %	0.65 %
Bank 2 in duopoly with information about the opponent's conservative strategy	5.3 %	1.4 %	3.9 %	0.4 %
Bank 2 in non-cooperative duopoly with mixed strategy	5.13 %	1.4 %	3.73 %	0.23 %
Bank 2 in cooperative duopoly with mixed strategy	5.19 %	0.88 %	4.31 %	0.81 %

Source of final values: Author's own calculation based on the input data from Models 1-3 and Table 2.

Conclusions

The study indicates that rivalry of banks during favorable economic cycles promotes pro-cyclicality of the banking system (ceteris paribus based on the data used from the period of 2005-2008). In case private (proprietary) information about the banks' portfolio strategies is not disclosed, solutions may be selected that are not Pareto-optimal. This means that dominant strategies prefer more aggressive portfolio aimed at increasing the market share within the most profitable segments, particularly in the business segment followed by the household segment (and vice versa, the dominant strategy during recession may be the abandoning of risky sectors and dominating of conservative sectors, particularly within the government bond market). Repeated non-cooperative games converge to co-operative behavior (Aumann 2000; Dlouhý a Fiala 2009) – i.e. to various collusion agreements and formation of hidden cartels in case of oligopolistic markets, which are generally unstable. Available publications document (Hořejší, Soukupová aj. 2010; Dlouhý a Fiala 2009) that the dominant strategy of a secret cartelist is the output tampering, short-term profits, and adherence to agreements only in case of one-sided benefits, which may further promote pro-cyclicality. It is thus possible to deduce on the basis of a model that open cooperative oligopoly on a credit market could lead to a Pareto-optimal solution at the expense of higher, yet bearable interest rates and credit standards – i.e. optimal solution for banks as well as the market as a whole or, consequently, for the financial system without counter-effects on credit and systemic risks (accumulation of risks during the period of positive expectations), with causal excessive prolongation of cyclical recession.

Cooperation of banks could fittingly supplement the efforts of central authorities aimed at smoothing economic cycles, in addition to increasingly less effective transmission channels and controversial unconventional instruments of central banks' monetary policy.

Higher price of banking services, as the consequence of the proposed limitation of rivalry in case of the banks' cooperation, could become the compensation of the taxpayers' expenses associated with financial crises (government guarantees to banks for banking liabilities, capital injections to institutions at risk, etc.). Utilization of public funds for the recovery of the banking system's assets has become the implication of the last financial and, currently, debt crisis in Europe and in the United States. Sharing of information and coordination of credit strategies could create desired self-regulation of forefront banks, with immediate impact on the real economy – unlike external regulation by a central bank with the use of conventional and unconventional instruments, with varying effective date and effectiveness depending on hardly predicated changes in factors (Komárek, Komárková 2012).

The provision of information about the optimal output (product) may be ensured by a central bank, based on its expert analyses (share of loans in GDP and deviation from normal, gaps in asset prices and returns, etc.). Accordingly, the central authority may recommend the application of individual regulatory instruments, which are subject to macro-prudential policy (Frait, Komárková 2011), in addition to effects of monetary policy instruments that do not prevent rivalry, price wars, and collusion agreements in the banking market. Therefore, self-regulation – i.e. a type of banking self-administration within the industry – would operate in parallel to the supervision authority. Similarly as in case of the cartel of petroleum exporting countries – homogeneous commodity, essential for economy – credit facilities, which are an inevitable source of economic development, should be perceived in the same manner.

Acknowledgment

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Contact address

Ing. David Tisoň

University of Finance and Administration / Vysoká škola finanční a správní
Department of Economics and International Relations, Faculty of Economic Studies / Katedra ekonomie a mezinárodních vztahů, Fakulta ekonomických studií
(tison@vasebyty.cz)

Modelling Interconnections in the Global Financial System in the Light of Systemic Risk

Modelování vazeb v globálním finančním systému z pohledu systémového rizika

TOMÁŠ KLINGER, PETR TEPLÝ

Abstract

In this paper, we focus on the link between systemic risk and sovereign crises. We model how state support may influence a distressed financial system on an agent-based network model calibrated to 4Q 2011 data collected from several sources. Our model contributes methodologically to agent-based modelling of banking networks' systemic stability by adding the sovereign sector and the mechanisms of risk transfer between the banks and the sovereigns when state aid is initiated. The model implements two types of state support to banks, bailouts and asset relief. We show that these two have different effect on systemic stability, but both mitigate the systemic crisis in the short run. How the state aid measures are efficient in the long run depends on the model's parameterization.

Keywords

agent-based models, bailout, contagion, financial crises, financial stability, liquidity risk, network models, systemic risk

JEL Codes

C63, D85, G01, G21, G28

Abstrakt

Tento článek se zaměřuje na propojenost finančního systému s krizí státních financí. Za pomoci multiagentního síťového modelu zkoumáme, jak státní pomoc bankám ovlivňuje finanční systém v krizi. Model je následně kalibrován na dataset za 4Q 2011, poskládaný z různých zdrojů. Hlavním přínosem našeho modelu pro metodologii multiagentního modelování finanční stability je přidání sektoru jednotlivých států a mechanizmu přenosu rizika mezi bankami a státy v případě státní pomoci. Model implementuje dva základní typy státní pomoci, rekapitalizaci a odkup aktiv. Ukazujeme, že tyto dva typy mají různý efekt na stabilitu finančního systému, ale oba v krátkém období tlumí systémovou krizi. Účinek těchto opatření v dlouhém období pak závisí na parametrizaci modelu.

Introduction

The recent global crisis started as a crisis of the credit system, continued as a crisis of liquidity and with negative sentiment and overall market slowdown, it finally transformed into economic crisis. In the earlier stages, the sovereigns took an active role, supporting the economic system by bank aid, deposit guarantees, quantitative easing and economic stimuli packages. However, large state support for the financial system as well as for the economy represents a huge burden on government finances and in some cases, mainly in Europe, it has already resulted in sovereign debt crises. Moreover, losing their status of risk-free borrowers and facing increasing prices for credit, the sovereigns too are now significantly weakened and some are in threat of default. Since a large portion of sovereign debt is held by the banking system, there is a danger of the crisis feeding back to where it began in a vicious circle of transferring the toxic debt back and forth between the sovereign and the financial sector.

The overall aim of this paper is to contribute to the discussion on sovereign debt crises and bank crises, which has been recently going on both on the EU and the international level. The main research question is how the stability of the financial system is affected by state aid, how and when a systemic crisis can translate into sovereign crisis and how and when a sovereign crisis can feed back into the system through sovereign debt exposures. The main idea is that banks represented by their balance sheets form nodes in a financial network. Using a computational model, we simulate progression of shocks in the network given various types and levels of state aid. Our approach stems from the recent advances in agent-based network modelling of financial systems, mostly from Nier, et al. (2007).

The following second section will focus on the description of the link between the financial institutions and the sovereigns, mostly in regard to the recent financial crisis. The third section will present the used concepts, presenting a literature review of the modelling techniques that form the grounds for our analysis. In the fourth section, we construct an original model of a financial system which will be used for testing the impact of the sovereign assistance to banks and researching the feedback loops that may arise when such assistance weakens the sovereigns. In the sixth section, we calibrate it to a unique dataset collected from various sources in order to gain more insight into the current situation and outline some practical implications for setting new policies in case of a systemic banking crisis. Finally, we close the paper with a conclusion summarizing our research and findings.

1   The Current Financial Crisis

The true mark of the systemic crisis outbreak was the failure of Lehman Brothers on 15 September, 2008. Even though its bankruptcy meant a very significant shock to the interbank system, the other reason for the crisis to finally break out was psychological. Understanding that state aid is no longer guaranteed even for large, systemically important banks, the share prices of the banking sector plummeted as the investors were no longer

willing to consider financial institutions as an investment opportunity. Moreover, the market of bank debt funding froze and liquidity evaporated from the interbank market. The banking system thus found itself in a deadlock where it was not able to roll over the short-term debt it used to finance most of its operations, but at the same time, the individual institutions held unsettled overdue claims against each other. Moreover, due to the increased cost of lending and severe credit shocks, the banks' capital buffers did not suffice to prevent the system from collapse. Had they not been replenished, a large portion of the banking system would have failed.

Figure 1: Financial sector support in selected advanced economies, 2008 – Jul 2012

Panel A: Total direct support

Panel B: Unrecovered support – impact on public debt
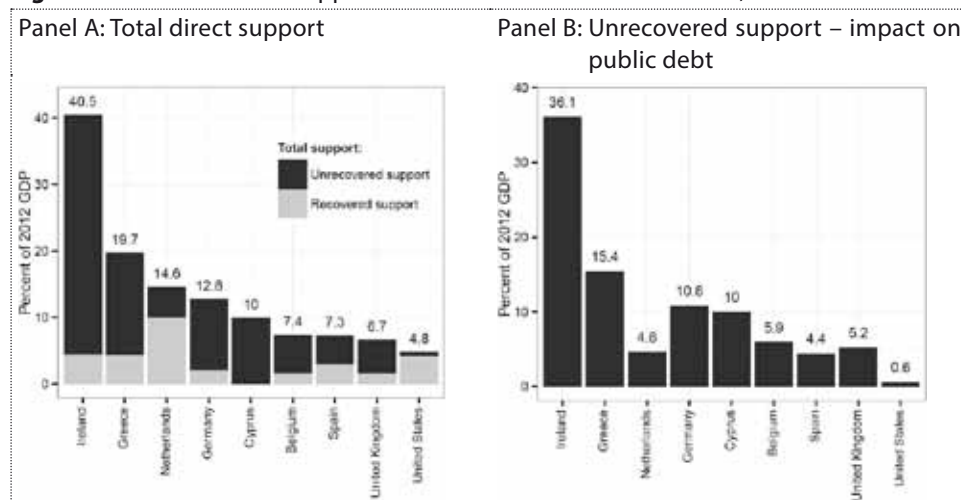
Source: IMF (2013a)

At this point, the states started playing an active role, introducing a number of measures to support the troubled financial institutions. Amongst these measures were strengthening of the deposit insurance, state guarantee schemes, outright bail-outs for bank recapitalisation or loans to alleviate the severe lack of liquidity (Liikanen, 2012). Mostly in Europe, several states introduced bad loan buy-outs or complete bank nationalizations (Petrovic & Tutsch, 2009).

Figure 1 shows the financial sector support in advanced countries as a fraction of the 2012 GDP along with its recovery values. The top rank in terms of GDP fraction belongs to Ireland followed by Greece. In March 2013, Cyprus bailed out its banks using the EUR 10 billion in funds provided by the European Central Bank and International Monetary Fund as the fifth European country to receive such assistance (ECB, 2013). In the short run, the support measures had a positive impact on systemic stability. Panetta, et al. (2009) states that the government support managed to lower the banks' credit default swap (CDS) premiums, which is the main indicator of failure risk. The first drop came when a support measure was announced and subsequently, the premiums fell even further when each of the measures was implemented. Moreover, the larger the amount of funds employed in a support measure, the sharper was the decrease of CDS premiums. Finally, there were

positive spill-over effects of these measures illustrated by falls of CDS premiums in countries other than the one deploying the measure.

However, the above-mentioned support actions proved to be very expensive and progressively, the situation started deteriorating for the sovereigns. As the balance sheet weaknesses moved from the banks to the sovereigns and the tax revenues dropped, the fiscal deficits began to surface. As the individual countries' creditworthiness crumbled and the rating agencies pointed out the associated risks, the investors began panicking and losing confidence even in the sovereign states. As a result, sovereign bond yields and CDS spreads rose and the access to new funding became increasingly more expensive. In a situation like this, when a sovereign guarantee is exercised or a large bank needs to be fully or partially bailed out and on top of that a country finds itself in an economic downturn, the public accounts are in serious trouble.

Unfortunately, the sovereigns did not prove to be anything else than other type of agents in the same financial system and thus by taking the risk on themselves, it did not vanish. Instead, it returned in form of feedback loops from the sovereigns back to the banks later when the sovereigns found themselves in crisis and their own balance sheets were deteriorating. In this manner, the risk and the losses oscillated between the privately-held banks and "publicly-held" sovereigns.

2   Modelling Approach

The modelling framework is based on two central concepts, network theory and agent-based modelling. Network theory is particularly useful for description of connected structures and the pattern of their relationships. A network is a set of nodes connected with edges.[10] Nodes may represent individual agents, for example servers and websites when we study computer networks or people in case of social networks. In the framework of finance, they may represent banks, sovereigns, depositors, companies or other entities in a financial system. Edges contain data on connection of any two particular nodes in the network, determining whether there is a link between two nodes and what is its value and direction. When the network theory is applied to modelling of financial systems, such properties allow us to define the creditor/debtor relationships as well as the size of the mutual claims of individual banks (Klinger, 2011). Network theory proved to be a particularly interesting means of studying impulse transmissions, which includes transmission of negative shocks. We use this methodology for simulating credit shocks in banking systems since when one bank fails and there are no supporting mechanisms such as bail-outs or state guarantees, the losses are transmitted to its creditor banks.

Agent-based modelling is a bottom-up approach that examines how numerous subjects that are each equipped with basic set of data and behavioural rules are interacting in a virtual environment. According to Tesfatsion (2006, p. 835), "[an agent] refers broadly to bundled data and behavioural methods representing an entity constituting part of a computationally constructed world". The individual agent's actions finally lead to certain ag-

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10 More rigorously, network is a graph defined as , where is a set of nodes, is a set of edges and is the mapping function which plots the edges onto individual pairs of nodes (Lewis, 2009).

gregate behavioural patterns on the systemic level. Probably the most well-known paper describing macro-level effects stemming from micro-level behaviour is the one by Schelling (1969), who described how a simple set of individuals' preference of the composition of their neighbourhood may lead to a pattern of segregation on a systemic scale. In our model, the agents represent individual financial institutions or sovereigns, the basic data they hold are their balance sheets and a set of behavioural rules such as when to default, when to sell of a particular amount of assets or when to bail out a certain institution.

Current research applying the previously mentioned methods to the field of financial or banking system stability divides into two main streams: empirical research and theoretical models. Several studies concentrate on the real-world interbank exposure modelling. For example Boss, et al. (2004), Upper & Worms (2004), Wells (2004), Van Lelyveld & Liedorp (2006) or Muller (2006) analyse the banking systems of Austria, Germany, the United Kingdom, the Netherlands and Switzerland respectively. Recently, Halaj and Sorensen (2013) tried to approximate a network of the banks who reported during the 2010 and 2011 EBA stress tests. However, most of the researchers face the problem of virtually non-existent reliable data on individual interbank exposures.

Theoretical models examine how system behaviour is influenced by its general characteristics. The first such model was constructed by Allen & Gale (2000) who studied contagion of funding liquidity shocks. Another early analysis was carried out by Freixas, et al. (2000), who studied contagion in systems where some banks were systemically important. Cifuentes, et al. (2005) and Shin (2008), add a market liquidity contagion channel decreasing the price of illiquid assets. Finally, there are studies that analyse systemic stability by simulation experiments on random networks such as Gai & Kapadia (2010), or Nier, et al. (2007). Finally, Klinger & Teply (2014) add regulatory aspects into this framework. This paper combines theory and empirics as the model is calibrated to the real-world data.

3   The Model

For each individual simulation, our model is defined in several steps. First, the network of banks and sovereigns is initialized together with the balance sheet data of individual agents. Second, the system is stressed by a credit shock, which may originate from a particular bank in the network. Following the initial shock, the stress propagates through the network and may trigger actions of the particular agents such as bank or sovereign defaults, asset fire-sales or state assistance to troubled banks. The simulation continues in several laps until the initial shocks completely dissolve and are no more transmitted further onto other agents.

First, the network is built from the calibration dataset. The total value of all assets in the system upon initialization is a sum of:
a) interbank assets, constituted by all the loans represented by the edges of the interbank network,
b) sovereign debt, constituted by individual banks' exposures towards their domestic sovereigns,
c) external assets, constituted by individual banks' exposures outside the network, e.g. loans to other entities (e.g. households, businesses or foreign sovereigns) or derivatives.

The final setting of banks' balance sheets is depicted in Table 1.

Table 1: Balance sheet variables of a modelled bank

...TOTAL ASSETS	... TOTAL LIABILITIES
...sovereign debt	...interbank liabilities
...interbank assets	...external liabilities (deposits)
...external assets	...equity (capital buffer)

Source: Authors

When the network is prepared, the system is inactive until we impose a shock event initiating the first simulation lap. Similarly, at the beginning of each next lap, each bank may receive a total asset-side shock of , where
- represents losses that banks incur due to default of another bank in the network to which they hold an exposure.
- represents losses that banks incur due to overall drop in asset prices caused by market liquidity effects.
- represents losses that banks incur due to default of a sovereign in the network to which they hold an exposure.

These individual components are described in detail on the following pages.

4 Shock Reaction and Contagion

If the banks affected by the primary shock do not have sufficient capital buffers, a process of cascade contagion effects may unfold, where in each lap of the simulation, the banks that default transmit the shock further onto other banks in the system. Figure 2 depicts the mechanism of shock propagation; the shock-transmitting banks are coloured grey whereas the failed banks are depicted in black.

Figure 2: Scheme of banking system contagion
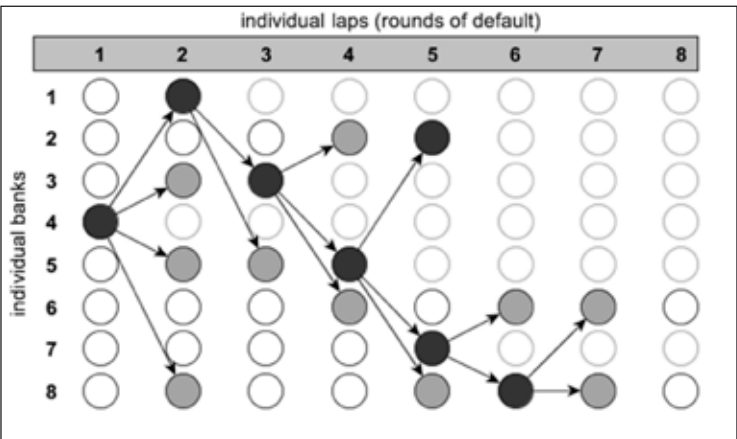
Source: Klinger (2011) inspired by Sell (2001)

Let us consider a bank that receives a shock. Whatever the shock type, it is reflected in the balance sheet and the bank loses a certain part of its assets. Since the sum of assets must

equal the sum of liabilities, the bank has to write off an equal value of liabilities. Firstly, the shocks are absorbed by owners' equity but if the capital buffers are not large enough, the banks default on claims of other creditors. If in lap the -th bank suffers an initial shock, its external behaviour depends on the shock size relative to its balance sheet structure:

a) At first, the shock hits the bank's capital buffer. If the shock is smaller than the bank's capital reserve which means that the bank is able to cover the losses by its own equity, then the capital buffer absorbs the shock completely and the bank does not send it further to other agents in the system.

b) If the capital reserve is not large enough, the residual shock overflows to the interbank liabilities, in which case its value up to the value of the interbank liabilities is uniformly divided into losses of all creditor banks which receive a CreditShock proportional to the size of their exposure to the failing bank. As the failing bank defaults, in the next lap it is removed from the system. Also, in the next lap of the simulation the creditor banks evaluate the received shock. The simulation finishes when there is a lap when no bank propagates the shock further.

c) Additionally, it holds that:

    i. If the shock is smaller than the sum of the bank's capital reserve and its interbank liabilities, it is absorbed completely by these two balance sheet items

    ii. If the shock is larger than the sum of the bank's capital reserve and its interbank liabilities, the shock overflows to external liabilities, meaning that the residual loss is covered by the depositors.

4.1 Market Liquidity Risk Modelling

Market illiquidity, described firstly by Kyle (1985), represents a situation when transactions in which the assets are sold have a negative impact on the asset prices.[11] Along with Gai & Kapadia (2010), we assume that in case a bank is in default, it has to liquidate all of its assets before it is removed from the system. While the sovereign debt is assumed to be more liquid and hence is liquidated in full value, the low market depth may limit the capacity to absorb the external and interbank assets. As a result, these cannot be sold for the price for which they are kept in the bank's books. Following Cifuentes, et al. (2005), we assume an inverse demand function for the external assets, which takes the form of

$$P(\boldsymbol{x})_t = \exp\left(-\frac{\alpha}{E} \sum_{i=1}^{N^b} x_{i,t} \right),$$

Where is the number of banks in the system, is the total value of assets (external and interbank) sold by the -th bank in the system in the current lap, represents the market illiquidity (i.e. the speed at which the asset price declines) and is the new discounted price

11 *Market liquidity is usually measured by indicators such as market depth, resiliency, tightness, and volatility. These indicators may be aggregated into liquidity indices, which then can be used to quickly compare markets in time and cross-sectionally. Examples of market liquidity indices are found e.g. in Gersl & Komarkova, (2009) or Teply, et al. (2012).*

of external assets calculated in each lap.[12] The additional losses caused by the asset sales are then added to the initial shock on -th bank in the current lap and transmitted accordingly. Furthermore, assuming marking to market accounting, at the end of each lap the external assets of each bank are revalued such that

$$e_{i+1} = e_{i,t}P(\boldsymbol{x})_t.$$

Hence, the losses stemming from such price adjustment result in a price shock of to all banks.

4.2 The Role of Sovereigns

As a means of a sovereign to support its domestic banks, we introduce two possibilities of sovereign assistance. These include:

a) Bailouts and recapitalization (BR) – the sovereigns may pay for losses incurred by the banks to replenish their capital buffers and keep them in business. In this case when a bank receives a shock of , the sovereign covers , adding this value to the bank's external assets. Again, the amount of is then added to the external debt of the -th banks' domestic sovereign as the domestic government needs to find external financing for this rescue measure.

b) Asset relief (AR) – the sovereigns may buy what assets their domestic banks need to sell in fire sales. In this case, in each round every bank sells assets as described in the basic model definition, but only is sold on the market since is bought-out by the bank's domestic government. Assuming fixed across all banks and all sovereigns, Equation 1 is replaced by:

$$P(\boldsymbol{x})_t = \exp\left(-\alpha(1 - k^{AR})\sum_{i=1}^{N^b} x_{i,t}\right),$$

The amount of is then added to the external debt of the -th banks' domestic sovereign as the domestic government needs to find external financing for this rescue measure.

As we mentioned previously, sovereign assistance may work very well for short-term banking system stabilization, but it puts significant pressure on the intervening sovereigns. According to Acharya, et al. (2012), state assistance to banks requires that the sovereigns immediately issue new debt to finance such measures, which results in immediate increase in the sovereigns' credit risk through the liability side of their balance sheets. In the model, any type of sovereign assistance to the banks results in an increase of the debt of the domestic sovereign. The extra budget deficit resulting from the aid measures is the main driver of a credit risk increase in the model.

The sovereign credit risk in the model is represented by probability of default, which under a certain assumed recovery rate may be roughly approximated from the CDS spreads.

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12 *Upon the system's initialization, the price is set to*

Credit default swaps are contracts insuring against credit events on bonds in case the counterparty defaults. The buyer pays periodically to the seller until either the CDS matures or until a credit event occurs, in which case the buyer of the insurance is entitled to sell to the seller of the insurance the insured bonds for their face value (Hull, 2008). As our model is of short-term character and later on, we calibrate it to yearly data, we chose to implement the probability that a given sovereign defaults in one year. Although strictly speaking, the extraction of this probability from the available 5-year CDS spreads would require diligent modelling of both the default state and the no-default state cash flows, we can simplify the calculation by assuming a flat CDS spread curve and implement the widely used approximation according to J.P. Morgan and Company & RiskMetrics Group (1999):

$$
p_{k,t}^{default} = \zeta \left(1 - \frac{1}{\left(1 + \frac{CDS_{k,t}}{1 - RR} \right)^{\tau}} \right),
$$

Where is the probability that a given sovereign defaults in one year, is the annual CDS spread, is the recovery rate and is the number of years for the cumulative default probability calculation (in our case, and in line with common practice,).

The link between sovereign deficits and credit risk is documented by econometric studies such as Attinasi, et al. (2009) or Cottarelli & Jaramillo (2012). We use the following equation to update the sovereign CDS spreads at the end of each simulation lap (parameter is later on referred to as the CDS sensitivity):

$$
CDS_{k,t+1} = CDS_{k,t} + \beta \frac{deficit_{k,t}}{GDP_k}.
$$

Putting the previous points together, at the end of each lap the model collects the total amount of each sovereign's deficit and feeds it into Equation 3 which is then plugged into Equation 4. At the beginning of each simulation lap, a sovereign may default with probability . In that case, each creditor bank receives a equal to the size of exposure to the defaulting sovereign multiplied by . The sovereign debt on its balance sheet is then revalued accordingly.

5   Empirical Analysis

In the following chapter, we calibrate our model to the real-world banking data in order to contribute to the current debate on systemic stability and the link between banks and sovereigns. As documented by many authors (e.g. Mistrulli, (2011)), the data on individual banks' mutual exposures is not available. Therefore, we resort to proxy data inferred from available sources to build the interbank network. Instead of individual banks, the agents in our study represent banking systems of countries which report their banking positions to BIS (referred to as subsystems since they are all part of the global banking system) and these agents' balance sheets are composed of aggregated figures of all banks reporting in

their domestic countries. The "interbank" exposure data are complemented with banking system data collected from several sources to provide a complete picture of the global banking system.

5.1 Data Definition

To calibrate the model to the real-world figures, we collected data from several sources. Table 2 shows the main items which we describe further in greater detail.

Table 2: Banking system balance sheet with data sources

TOTAL ASSETS (EBF Database, Central banks)	
Government debt (Arslanalp & Tsuda (2012), IMF IFS Database)	External liabilities (Calculated)
Interbank assets (BIS International Statistics)	Interbank liabilities (BIS International Statistics)
External assets (Calculated)	Equity (BankScope)

+GDP (World Bank), CDS Spreads for the individual countries (Bloomberg)

Source: Authors

5.1.1 Interbank Assets and Liabilities

The interbank exposure dataset describes the interlinkages in the global banking system. These are collected from the banking section of BIS International Financial Statistics (BCBS, 2013), where the central banks report compiled national aggregates calculated from data on individual banks' in their jurisdiction. To form the interbank exposure matrix, we employ data from the consolidated statistics of foreign claims on immediate borrower basis. The consolidated data provides information on exposures of domestically-owned parent banks on the highest consolidation level and hence they include external exposures of own foreign offices and exclude all internal inter-office positions in the consolidation group (BCBS, 2009). The selection of countries whose banking sectors we included in the analysis was based on data availability and includes Australia, Austria, Belgium, Brazil, Canada, Denmark, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.[13]

Nevertheless, it is not possible to obtain directly the pure bank-to-bank exposures between the individual countries' banking sectors, and some level of approximation is inevitable. To estimate the bank-to-bank exposures from the reporting banking sectors' pool of total claims, we employ another dataset of the BIS statistics, which is the total claims on each country's banking sector by all the reporting sectors, grouped by the type of the debtor institution (i.e. whether it is a bank, public sector or a non-bank private sector). By taking a fraction of bank debt on the total debt, we obtain proxy variables for individual counterparties. Finally, we multiply the whole column of the exposure matrix representing the given counterparty's debts by this variable to calculate the estimated interbank network.

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13 *Czech Republic was not included in the analysis as it does not report its international banking exposures to BIS.*

When the network is created, it can be plotted as in Figure 3. For better readability, we provide two different views for the same dataset. In Panel A, we show the edges of the network (interbank exposures) coloured according to the source of the funds (i.e. the creditor, the bearer of the risk). These visualizations provide an efficient overview of the situation and a quick grasp of the basic relationships. For example, in the centre of the network, we see the "core" sectors, (highly interlinked nodes such as the United States, the United Kingdom, Japan, France, Germany or Switzerland) and around them there are more "peripheral" banking systems. Also, as the visualization algorithm[14] takes into account the relationships in the network and places the nodes accordingly, we can see patterns that are in line with our anticipation based on the individual countries' location or cultural relationships. Note for example the pairs of countries being placed together, such as Sweden and Denmark or Turkey and Greece. Also, the clusters of related countries are placed logically together, such as Italy, Spain and Portugal forming the Southern Europe cluster with proximity to Brazil. Also note that after its default, Greece is placed on the edge of the network with very low connection to other banking systems.

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14 *The visualizations were prepared in Gephi software. For the calculation of the node layout, we used the Force Atlas algorithm, which places the nodes in the graph according to the values of edges in the network matrix. While the scientific article on Force Atlas algorithm is still awaiting acceptance and publication, more information on graph clustering and layouting may be found in Noack (2007).*

Figure 3: Interbank network of the selected countries as of Q4 2011
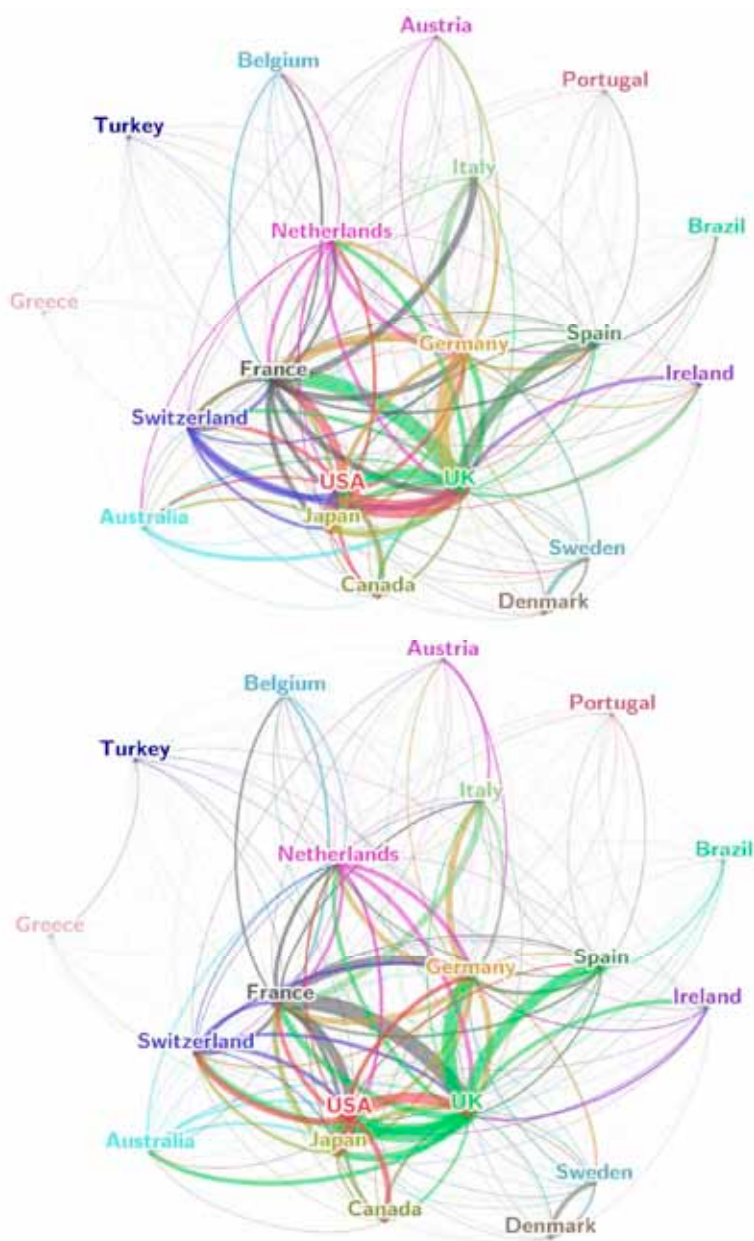
Source: Authors based on data from BIS International Financial Statistics
Note: Panel A shows the edges shaded by the creditor node (e.g. exposure of Switzerland against the United States has the same shade as Switzerland on the chart) whereas in Panel B, they are shaded according to the debtor node (e.g. exposure of Germany against the United Kingdom has the same shade as the UK node)

It is necessary to mention that this dataset provides information only on interbank lending and not on external financing of banks by sovereigns or central banks, which may be quite significant, especially in the Eurosystem. On the same note, these data do not provide information on balances in the TARGET2 system, which has been lately discussed in Cecchetti, et al. (2012) and which now form a significant part in the mutual exposures of the Eurosystem banks. The above-mentioned facts mean that Figure 3 does not provide the entirely complete picture of the global banking system. However, in our model, bank financing of these different types is captured in the external assets part of the bank's balance sheet.

5.1.2   Sovereign Debt to Banks

To introduce the link between banks and sovereigns into the banks' balance sheets, we collected two sovereign debt datasets which were then added together. These are exposures to the domestic banking system, collected mainly from Arslanalp & Tsuda (2012) and supplemented by data from the IMF IFS database (IMF, 2012), and exposures to other banking systems, collected from the BIS International Financial Statistics (BCBS, 2013).

While the first dataset collection is straightforward, in case of the second one we have to employ a similar calculation as in the case of interbank assets. Again, the data is taken from the consolidated statistics of foreign claims on immediate borrower basis. To estimate the banks' exposures to sovereigns from the reporting banking sectors' pool of total claims, we multiply the whole column of the exposure matrix representing the given state's debts by the fraction of its sovereign debt on the total debt. The same approach was used in Arslanalp & Tsuda (2012) for the calculation of foreign banking sector holdings of sovereign debt. However, we must note that this data provide information only on the individual sovereigns' debt towards the banking sectors in our sample. Thus it does not describe the countries' total debt positions.

Figure 4 visualizes the figures for each sovereign's debt to the foreign as well as to the domestic banks. We see that for all banking systems except of the United Kingdom and the Netherlands, there is a relatively strong bias towards the domestic banks (note the logarithmic scale of the chart). This phenomenon already documented in Pisani-Ferry (2012), Merler & Pisani-Ferry (2012) or Acharya, et al. (2012), results in a strong link between sovereigns and their domestic banks through balance sheet exposures and is one of the reasons why sovereign risk translates through feedback loops into the domestic banks' risk.
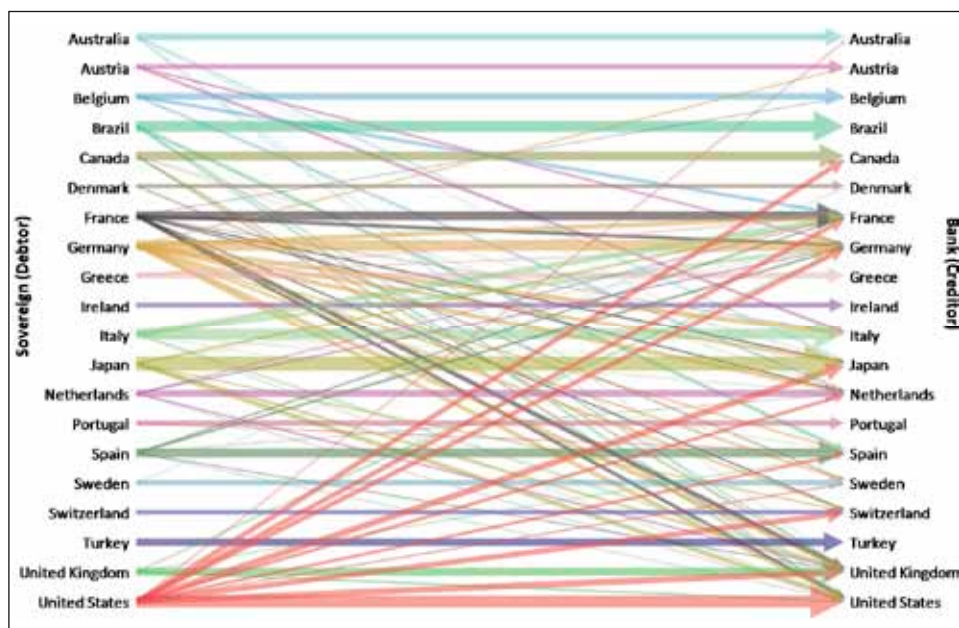
Figure 4: Selected banking systems' exposures to sovereign debt as of Q4 2011
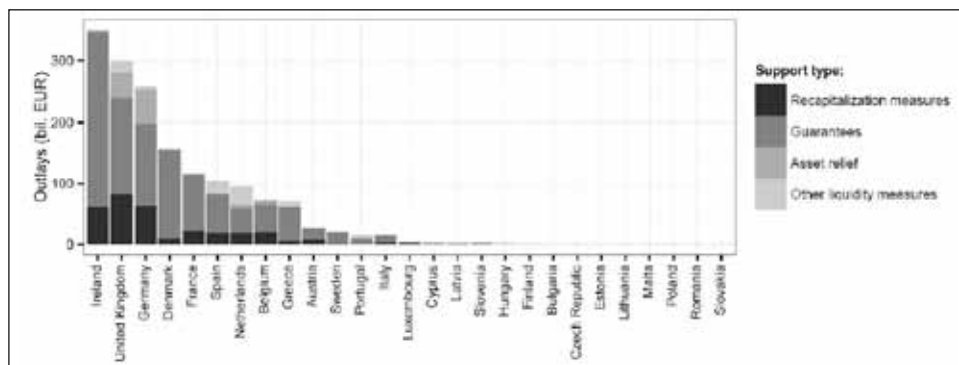
Source: Authors' calculations based on data from Arslanalp & Tsuda (2012), IMF International Financial Statistics and BIS International Financial Statistics

For better insight into the interlinkages between banks and sovereigns, one has to study also the individual exposures. Figure 5 presents this data as a plot of the bipartite network of sovereigns and banking systems in our sample. Similar to Figure 3, the edges represent the sovereign debt towards the individual banking system. Here we see the home bias phenomenon as the largest links are always to the domestic banking system. Also for the individual countries, interesting patterns emerge where the debt to foreign banks is determined largely by geographical or cultural proximity of the individual countries.

Figure 5: Detailed banking systems' exposures to sovereign debt as of Q4 2011

Source: Authors' calculations based on data from Arslanalp & Tsuda (2012), IMF International Financial Statistics and BIS International Financial Statistics

Note: The edges are shaded by the debtor node. The edges' thickness represents the exposure size on a natural log scale and all exposures amounting to less than USD 5 billion were filtered out for better readability.

5.1.3 Other Data

The banking systems' total assets represent another important input into the model as it is used for calculation of capital, external assets and external liabilities of the individual banking sectors. Despite it being an important variable for comparison of banking systems in time as well as in cross-section, the data on sums of total assets is not readily available and vary significantly across data sources.[15] To keep our dataset as consistent as possible, the main source we used is the Banking Sector Statistics database of the European Banking Federation (EBF, 2013), which provides data on all European countries in the sample. The data on countries not represented in this primary source were taken from the databases of the individual central banks.

The size of the capital buffers is the main determinant of the stability of the individual banks as well as the whole system. In contrast to the total assets data, in case of banking sector capitalization, we are interested in the proportion of capital to total assets rather than the total sum and hence, the capital ratios were taken from the BankScope database.

Besides balance sheet data for the individual countries' banking systems, the model requires two more datasets for a complete calibration: GDP and CDS spreads of the individual sovereigns. The gross domestic product data was collected from the World Bank database (World Bank, 2013), data on 5-year credit default swap spreads were obtained from Bloomberg.

5.2 Model Calibration

Put all together, the collected data provide a complex picture of the modelled global banking system according to Table 2. The internal assets of individual subsystems are calculated as the sum of their exposures to other subsystems; the sovereign assets as the sum of their exposures to sovereigns and the external assets as the total assets minus the internal and the sovereign assets. Similarly, capital is calculated as the collected capital ratios times the total assets of the individual subsystems; their internal liabilities are sums of their debt towards other subsystems, and the external liabilities are total assets minus capital and the internal liabilities.

Figure 6 provides the final overview of the calibrated balance sheets which are loaded into the model. As we can see on Figure 6A, the external assets constitute the majority of the bank's balance sheets, in fact around 80%, while the sovereign assets account for 12% and the interbank assets only for 8%. Similarly on the liability side depicted in Figure

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15 *E.g. taking the same data from BankScope, the differences in some cases were significant. We explain this by the fact that BankScope is not the best source for total sums of variables for individual banking sectors (Bhattacharya 2003), and resort to the aggregated data from EBF and the central banks.*

6B, external liabilities form an overwhelming 86% of the total liabilities while the banks' equity accounts for 6% and the interbank liabilities for 8%. The fact that the interbank network forms only a small portion of the total banking assets value is the main shortcoming of the pure credit contagion approach. It points at the fact that without oversimplified extrapolation of the interbank network to the rest of the banking system, it is difficult to draw any conclusions from works such as Chan-Lau (2010) that study only the effects of the direct contagion and funding shocks and relies solely on the BIS interbank network data. In fact, our finding stresses the significant gap in the knowledge of banking exposures and demands further data collection which would enable us to break the external assets into more detail.

Figure 6: Balance sheets of the calibrated model as of Q4 2011

Panel A: Banks' assets

Panel B: Banks' liabilities
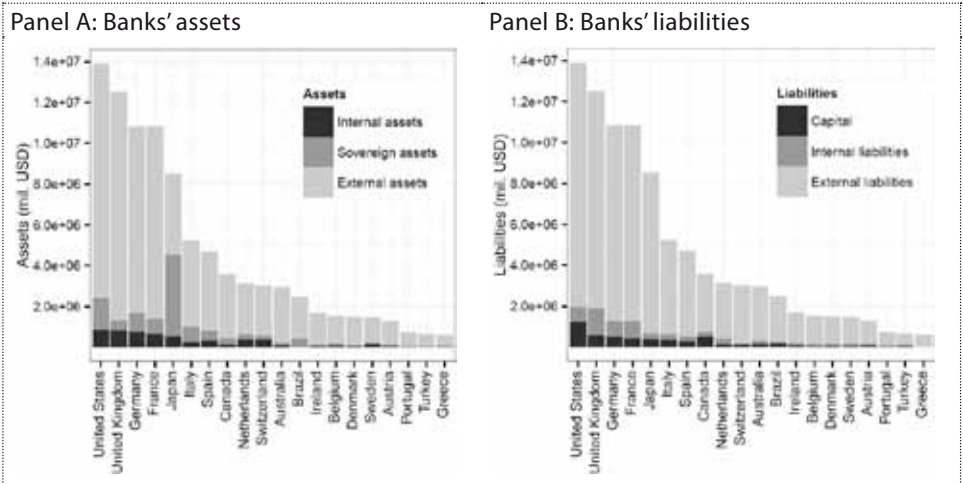
Source: Authors' calculations

As opposed to Chan-Lau (2010), we incorporate the full size of the banking system and the indirect channel of contagion through market liquidity as described by Brunnermeier, et al. (2009) and Cifuentes, et al. (2005). Given the amount of external assets, we expect that the liquidity channel will play a significant role for systemic stability. This channel is recognized also by authors focusing on the direct credit contagion, as documented by Upper (2011).

5.3 Effects of Sovereign Assistance

In this section, we will explore the effects of sovereign assistance on the calibrated global banking system. We will describe the impact and costs of the two support measures. Please note that in this phase the mechanism of risk transmission from the sovereigns back to the financial system (feedback loops) is not yet implemented.

**Figure 7:** Bailouts and recapitalization effects

Panel A: Total defaults
- Alpha vs. Bailouts ratio

Panel B: Total cost
– Alpha vs. Bailouts ratio
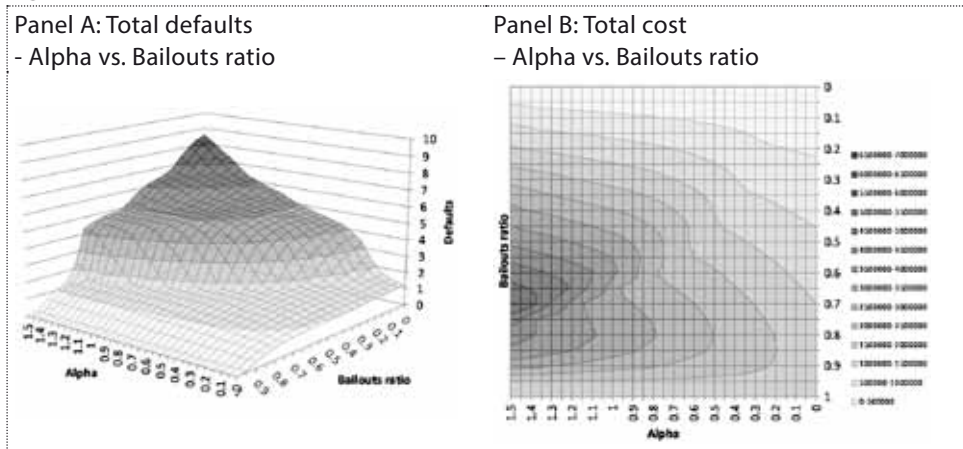
Source: Authors

We first look at the bailouts support measure. Figure 7A depicts the number of bankrupt banking subsystems given various levels of market illiquidity (, referred to as alpha) and various intensities of state support (, referred to as bailouts ratio). The positive effects of this measure are clearly visible and with maximum bailout support, no bank defaults as the shock is captured right at its origin. We see that at low values of alpha, the effect of state aid is very low and almost linear. However, with growing illiquidity, the state support is increasingly important and at maximum alpha, we see a "step-like" dependence where a very small increase in state support may prevent default of three banking subsystems. As to the sovereign deficits caused by this measure, Figure 7B demonstrates that at very low levels of alpha, the costs increase almost linearly with the support intensity. However, for low capitalized systems, under high levels of alpha, the costs rise only until some level of support intensity beyond which they fall sharply. This is caused by the support measure effectively blocking the contagion through market liquidity channel and corresponds to the sharp drop of defaults in Figure 7A.

Figure 8: Asset relief effects

Panel A: Total defaults
- Alpha vs. Bailouts ratio

Panel B: Total cost
- Alpha vs. Bailouts ratio
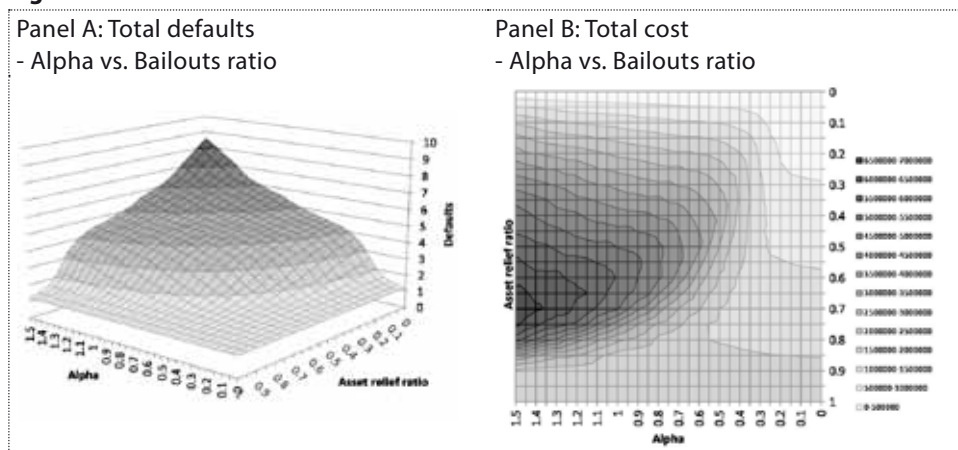
Source: Authors

Secondly, looking at the effects of asset relief programmes as depicted in Figure 8A, we see that they do not cause such sharp drops in numbers of failed banks as those of outright bailouts, but still are very significant. Because asset relief is tied to the liquidity channel, we see that the shape of the dependence of systemic stability on the support intensity () is similar to the shape of its dependence on . Also, in contrast to outright bailouts which may be targeted to the initial propagator, in case of asset relief, the banks which are hit by the primary shock always fail. Looking at the costs of this measure, Figure 8B shows that at the peak they are higher than those of the bailouts. Also, except for the area of support intensity of 0.8 to 0.9 where they are smoother, they have very similar shape as the costs of bailouts. The reason for asset relief to prove such efficiency is that external assets form a large portion of total assets of the system and hence the liquidity effects are very strong.

5.4 Effect of Feedback Loops

Finally, we implement the feedback loops of risk transmission back from the sovereigns to the banking system and study the effects of state aid on the complete model. The figures showing results of this analysis (in the appendix) depict the number of failed banking subsystems in dependence on state aid intensity and accounting for different levels of CDS sensitivity.

First, Figure 9 demonstrates the effects of bailouts and recapitalization. We see that the measure has large impact on the banking system stability, which may be both positive and negative depending on the initially shocked bank and CDS sensitivity setting. Generally, setting CDS sensitivity equal to zero represents a situation in which the sovereigns are not negatively affected by the state aid as increases in their deficits do not result in growth of their CDS spreads and hence also growth of their implied probabilities of default. With

non-zero CDS sensitivities,[16] the feedback loops are in their full function as higher deficit resulting from the state aid increases the default probabilities of sovereigns. In case of bailouts and recapitalization, when the CDS sensitivity is set to zero, the count of failed banking subsystems is a decreasing function of the support intensity.

When large subsystems having high systemic importance (France, Germany, the United States and the United Kingdom) are initially shocked, the effects of support come only at relatively high support intensity as the systemic break-down is prevented only at bailouts ratio exceeding 50%. Moreover, for these countries' subsystems, the number of defaults is never significantly higher with the state support than without it, even though at CDS sensitivities of 1.5 and 3 the positive effects come much later at higher support intensity levels. If other banking subsystems are targets of the initial shock, we see that at non-zero CDS sensitivities, the default count usually increases in the middle of the support intensity interval as the state aid is still insufficient to significantly support the banks but already weakens the sovereigns. This pattern is visible throughout the majority of the initially-hit banking systems. Also, even at non-zero CDS sensitivity levels, in case of almost all initial propagators, the system is better off with full state support than without it. The only exception is Belgium, Brazil and Greece, where state support clearly worsens the systemic crisis. The reason is that they are neither too large nor too interconnected systems and supporting them after they are initially hit only adds another channel of contagion through a sovereign crisis.

Third, Figure 10 shows the effect of asset relief. In case of zero CDS sensitivity, the positive effects of this measure are less significant than in the case of bailouts. On the other hand, as the CDS sensitivity progresses to higher values, the situation stays very similar and thus for high CDS sensitivity cases, this measure would seem as the most fitting one. However, we suppose that this result is somewhat biased because of the dataset employed. First, high portion of external assets in the system results in overestimating the measure's effectiveness. Moreover, the linkages between sovereigns and their non-domestic banks form a minor portion of the total sovereign assets and each country's banking system is aggregated into a single agent. As a result, even though the sovereign which is performing the asset relief programme is severely weakened, its default affects mainly its already failed domestic banking system. If an interbank dataset that more precisely captures the reality was available, we expect this measure to perform significantly worse than bailouts and recapitalization.

Conclusions

In this paper, we focused on the link between systemic risk and sovereign crises. We modelled how state support may influence a distressed financial system on a model calibrated to 4Q 2011 data collected from several sources. Our model contributes methodologically to agent-based modelling of systemic stability by adding the sovereign sector and the mechanisms of risk transfer between the banks and the sovereigns.

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16 *Our choice of CDS sensitivity values of 1.5 and 3 in the figures is in line with econometric studies such as Sand (2012) or Cottarelli & Jaramillo (2012).*

The model implements two types of state support to banks: bailout and asset relief. In the short run when the feedback loops are not yet implemented, the effects of both measure types are positive. In the longer run after implementation of the feedback loops through sovereign defaults on bonds held by the banks, we found that a support measure's real efficiency depends on the measure intensity and CDS sensitivity, i.e. the market perception of the increase in sovereign risk. These effects were the most pronounced in case of bailouts and recapitalization, which according to our simulations may significantly improve the systemic stability. However, with higher CDS sensitivity, it depends on which country is initially hit: in case of banking systems that are systemically important, bailouts are effective throughout the whole support intensity interval, whereas for the banks with lower systemic importance, the support may actually worsen the situation. Table 3 provides the complete overview of the feedback loops analysis.

In general, the model proves that in the short run without the feedback loops, state aid may significantly support the system and in the longer run with the feedback loop effects, it may be effective or harmful depending on the system's parameters. Moreover, the results are indeed different for each individual type of state aid.

Table 3: Impact of individual support measures on a calibrated model

Measure	Description

Bailouts and recapitalization	• At zero CDS sensitivity, the count of failed banks is a decreasing function of support intensity on its whole interval
	• For systemically important subsystems, state support always improves systemic stability, even though it is effective only at relatively high support intensity.
	• At higher CDS sensitivities and in the middle of the support intensity interval, the effects are:
	   - Negative when the initially failed subsystem has lower systemic importance
	   - Neutral when the initially shocked subsystem is systemically important, the effects come in the second half of the support intensity interval
	• At full support intensity, the measure has a positive effect for all countries except for Belgium, Brazil and Greece

Asset relief	• Efficient at the whole support intensity interval • At zero CDS sensitivity the effects are less pronounced than in case of bailouts but still significant • At non-zero CDS sensitivity levels, the positive effects stay significant • The model is likely to overestimate this measure's efficiency due to the dataset employed. However, currently there is no better data on interbank exposures available

Source: Authors

Also, we found that majority of the total assets in our system are constituted by external assets. This points out the shortcomings of studies that examine the systemic stability only on the BIS interbank network data such as Chan-Lau (2010), as this dataset amounts only to a small fraction of the total banking assets. It stressed the need for deeper analysis and more data availability on the structure of the interbank and state-bank exposures.

Finally, because of the agent-based modelling approach, we may extend our model in the future with other types of financial market agents such as large multinational institutions, pension funds, insurance companies or even individual depositors. Moreover, we may add

the real economy along with its input/output flows and observe the effects on individual sectors when one sector is hit by a credit crunch or a drop in output. The flexibility and extensibility of our modelling approach is another strong benefit, which may lead to many more conclusions in the future research.

Acknowledgment

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Contact address
**PhDr. Tomáš Klinger (corresponding author)**
Charles University in Prague / Univerzita Karlova v Praze
Institute of Economic Studies, Faculty of Social Sciences / Institut ekonomických studií, Fakulta sociálních věd
(tomas.klinger@seznam.cz)

PhDr. Petr Teplý, Ph.D.
University of Economics in Prague / Vysoká škola ekonomická v Praze
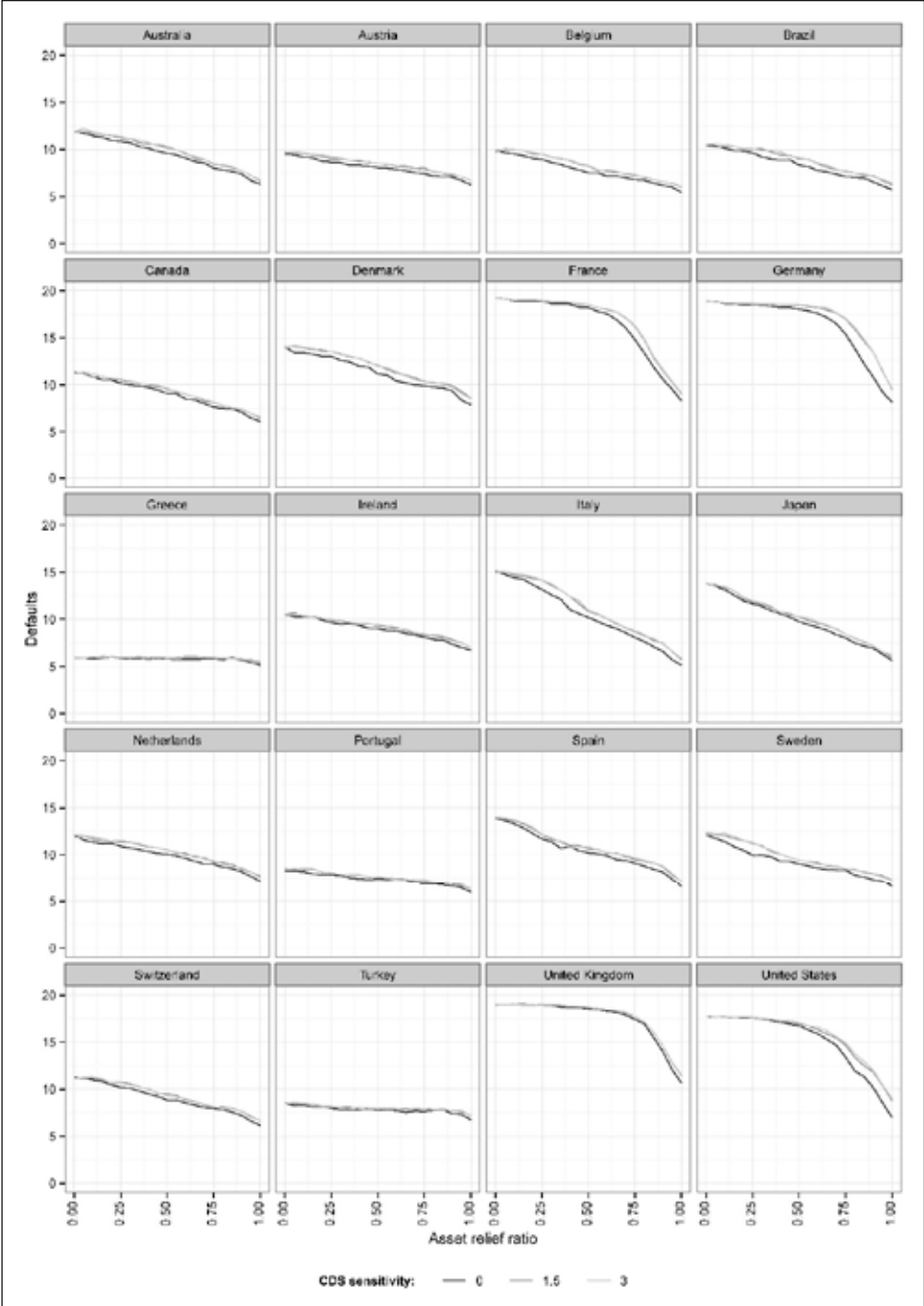Faculty of Finance and Accounting / Fakulta financí a účetnictví
(petr.teply@vse.cz)

Appendix

Figure 9: Bailouts and recapitalization with feedback loops
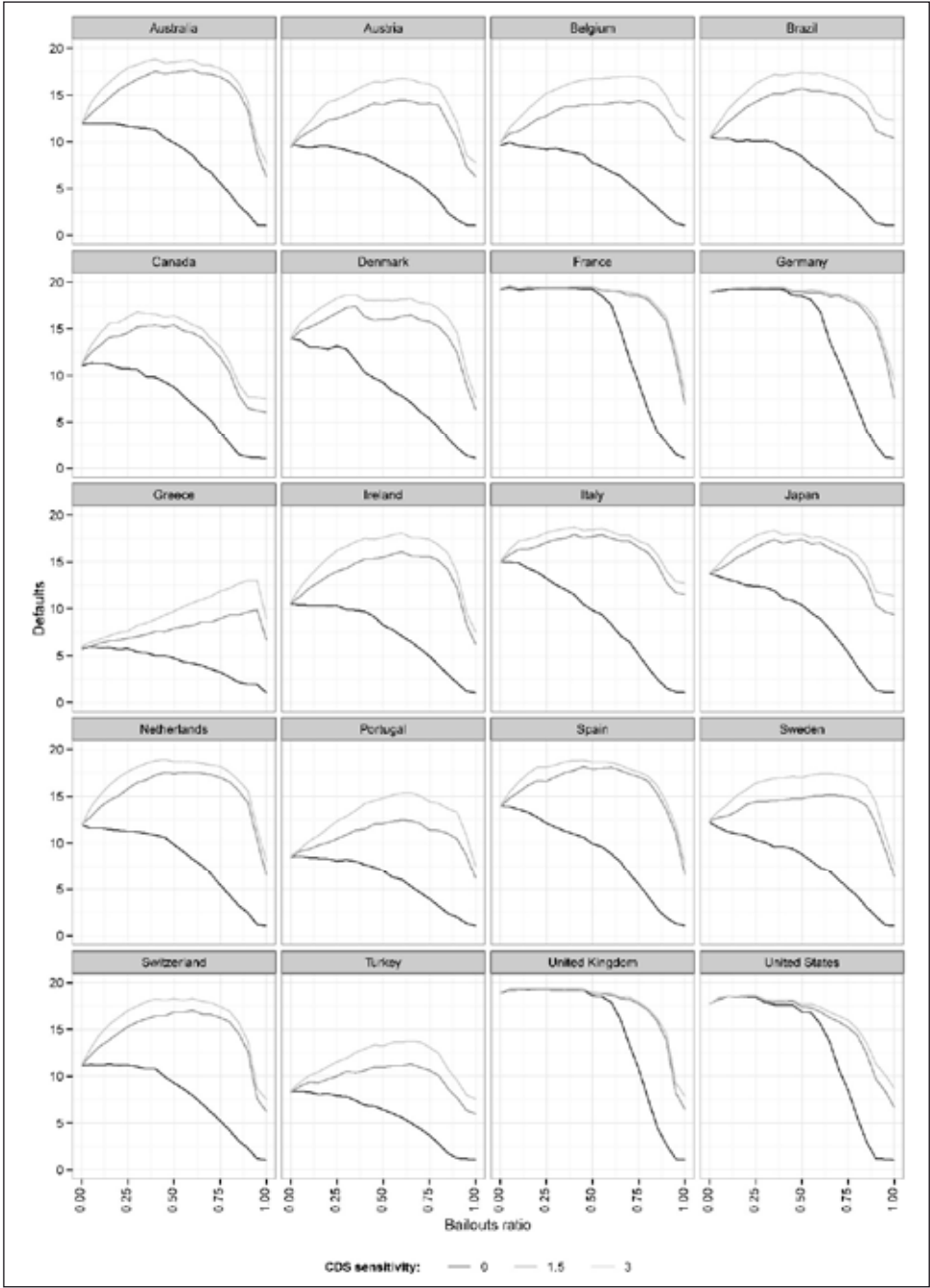
Source: Authors

Figure 10: Asset relief with feedback loops on the calibrated model

Source: Authors

Does Europe Need the Euro?
Potřebuje Evropa euro?

MOJMÍR HELÍSEK

Thilo Sarrazin: Europe Does Not Need the Euro. How political wishful thinking has plunged us into crisis (Europa braucht den Euro nicht. Wie uns politisches Wunschdenken in die Krise geführt hat. Deutsche Verlags-Anstalt, München 2012. 464 pages. ISBN 978-3-421-04562-1)

The famous German social-democratic politician, previously the Minister of Finance of the State of Berlin, and former Member of the Executive Board of the Deutsche Bundesbank, has written several books, in which he is not afraid to express controversial opinions.[1] T. Sarrazin is a consistent euro-pessimist. Also the reviewed book goes against the official position of the German government, which views the euro as a project that must be supported. In his book, he repeatedly rejects the view of Angela Merkel: "If the euro fails, Europe fails."

The first chapter entitled *From German Monetary Reform to the European Monetary System* represents an introduction to monetary integration. It explains the functioning of the Bretton Woods system, as well as the leading role of the Deutsche Mark and the leading role of the Deutsche Bundesbank in European monetary policy.

The origin of the single European currency is explained in the second chapter *Concept of the European Monetary Union and Its Hazards*. The author comments on the Maastricht Treaty and the convergence criteria, coming to a conclusion that "even from today's perspective, it is safe to say the Maastricht Treaty was well thought out" (p. 89). However, its weakness is that "in case any part drops out, because individual members, the entire Community or the Central bank, fail to comply with the contractual obligations, the entire system loses stability" (p. 89). Specifically, it concerns the failure to respect the requirements for cautious budgetary policy.

The third chapter is called *Formation of the European Monetary Union: What failed and why*. In this chapter, the author explains the roots of the prevailing debt crisis in some euro area countries. Following the euro introduction, financial markets started to assume that euro-denominated government bonds are not at risk of insolvency, that they are on a par with the financial standing of the bonds issued by the Federal Republic of Germany. What was the reason for this? "There may likely only be a psychological explanation: From the economic perspective, the euro introduction was nothing else than the provision of the

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1   T. Sarrazin also wrote the book *Germany Is Doing Away With Itself* (Deutschland schafft sich ab, 2010), in which the author warns that Germany is endangered by Muslim immigrants. The author has just published his new book *New terror of morale: about the limits of the freedom of speech in Germany* (Der neue Tugendterror: über die Grenzen der Meinungsfreiheit in Deutschland, 2014). He believes that any person that diverts from the mainstream ideas is persecuted in Germany.

Deutsche Mark to all euro area members. Many partner countries thus believed, similarly as market participants, that this act is associated with the commitment of the monetary area of the Deutsche Mark to be solidary with the newly accessing members" (p. 98).

Evaluation of economic results achieved by the euro area also represents an important part of the third chapter. The author compares the development of the real GDP in the EU – both in the euro area and in selected countries outside of the euro area. He concludes that "the common currency has a gradually increasing adverse effect on economic growth of the southern Union members" (p. 108). The main explanation of the fact is the loss of competitiveness due to the exchange rate accomodation. According to T. Sarrazin, these countries may now increase their competitiveness "solely through significant reductions of their labor costs […] It is a painful journey […] The monetary union has become a competition trap for the southern countries" (p. 117).

The fourth chapter discusses *The European Monetary Policy and Rescue Policy in the Period of 2009 through 2012*. He transparently explains the progress of the debt crisis in some euro area countries, starting with the first symptoms in the form of increasing returns on long-term government bonds (the "Orient-minded nation" on the outskirts of Europe, i.e. Greece as of the late 2008, Portugal from the early 2009, Italy from the early 2010). We must appreciate the unambiguous characteristics of the crisis processes: "it obviously did not concern a currency crisis, but a debt crisis of individual euro area countries" (p. 185[2]). The fact is that many authors are not certain in this regard. It is not surprising that T. Sarrazin is an uncompromising advocate of the "No-bail-out" principle, i.e. no assistance to indebted countries by other countries and insistence on the declaration of their insolvency. All this would be in compliance with the Maastricht Treaty. Moreover, he is a relentless critic of all rescue mechanisms that contradict the aforementioned principle. The only permissible exception – i.e. application of the "bail-out" principle – is a situation, where the lack of confidence in respect of any country's government bonds temps from other factors than the country's excessive debts. The establishment of the European Financial Stability Facility (EFSF) in 2010 and of the European Stability Mechanism (ESM) in 2012 legalized the "bail-out" policy. The aforementioned took place as a result of the argument that if any country were to abandon the single currency markets would lose their confidence in the future of such currency, i.e. of the euro.

Moreover, T. Sarrazin considers the plans for creating Eurobonds to be similarly unacceptable. They maximize the risk of moral hazard. Furthermore, he is not happy with the European Central Bank. The bank acts as a lender of last resort to commercial banks, and not to individual governments; however, since it purchases unlimited quantities of government bonds from commercial banks, it cannot ask the governments of such countries to declare insolvency, as it would strongly reduce the ECB's equity.[3]

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2   Similarly, the author also notes the following in the Introduction: "The state debt crisis of many countries is in the core of the monetary union crisis" (p. 26).

3   The author returns to the problem in Chapter 7. He explains again that, as of 9 May 2010, the European Central Bank "has been purchasing bonds of countries affected by the crisis on a large scale". However, in reality, such bonds are accepted as collateral.

The fifth chapter, *"Benefits" of the Monetary Union from the Fundamental Perspective*, tries to convince readers that the single European currency brought neither economic nor political benefits. The formation of the euro was a political project, promoted by France (in order to control Germany more effectively) and by Germany (in order to promote European political cooperation), as well as by other politicians – with a view to promote the position of Europe in the world. However, the euro did not lead expansion of mutual trade, since it eliminated the possible compensation of different price developments within individual countries of the monetary union. The euro failed to stimulate economic growth.

The author disregards the lower transaction costs, price transparency, or reduced costs associated with the exchange risk elimination. Furthermore, he does not cover the issue of whether the depreciation of indebted countries' currencies (Greece and other countries), provided such countries still had their national currencies, would lead to a currency war. He does not even bother with lower risks of currency crisis.

The sixth chapter is entitled *World Financial Crisis, Systemic Issue and Resulting Lessons*. It comprises the usual explanation of causes for the financial crisis, starting with the mortgage market crisis and the banking crisis in the US, all the way to the euro-crisis (Eurokrise – the author does not define this term, and uses it to describe uncontrolled indebtedness of some European governments).

The so-called anthropological constant of the financial sector – i.e. the starting point of the seventh chapter, *Role of State Budgets*, is worth noting; it means that the management of one's own money is always more efficient than the management of someone else's money. However, this problem cannot be resolved by the proposal of Warren Buffett: To just pass a law that says that anytime there is a deficit of more than 3 % of GDP, all sitting members of Parliament would be ineligible for re-election. Czech readers will be struck by appreciation expressed by Thilo Sarrazin for the former Prime Minister of the Czech Republic, Petr Nečas. In February 2012, he commented on the fact that GDP per capita in the Czech Republic and Greece is about the same; however, the minimum wage in Greece is more than twice the minimum wage in the Czech Republic. He recommended intensive structural reforms to Greece, similar to those implemented by former post-communist countries in the 1990s.

The eighth and final chapter is called *Monetary Union and the Future of Europe*. At the beginning of the chapter, we must appreciate the author's objectivity in assessing the existing progress of the euro as a currency. "Whatever has failed, it is not the euro. Solely the hope that the currency would bring more growth and employment and help the economically weaker countries has failed" (p. 374). Moreover, the euro did not succeed in weakening the dominant role of Germany in Europe through the elimination of the Deutsche Mark (France conditioned its consent to the unification of Germany by the expiration of the Deutsche Mark). On the contrary, increasing problems experienced by France in connection with the euro have led to higher economic influence of Germany. The chapter ends with a conclusion that if the European monetary union is to function well, it is necessary for individual national economies to operate according to German standards. In case any country cannot or does not wish to be restricted in this manner, it should have the freedom to revert to its original currency.

The book contains many things to think about. It is only a shame that T. Sarrazin does not also deal with the development of the euro's international role, particularly the share of the euro in foreign-exchange reserves of countries from all over the world and the share of the euro in the turnover of the global foreign exchange markets. Moreover, it is a shame he does not give attention to the development of the euro exchange rate (e.g. EUR/USD) and fails to assess the long-term trend of such development. From this perspective, the book is one-sided. Nevertheless, we must appreciate the author's thorough overview of the development of the European Union and euro area, not only on the basis of existing literature, but also based on the author's own experience. In this regard, the book is also beneficial for readers studying the European monetary integration.

Especially winning papers of Professor Vencovský Awards will be published in next issue of the journal ACTA VSFS: Job Market Polarization and Employment Protection in Europe; Linkages between the Financial and Real Sectors across Interest Rate Regimes: The Case of the Czech Republic; Consumption Tax Incidence: Evidence from the Natural Experiment in the Czech Republic. Another article deals with the Behavioral and Empirical Topics for Discussion on Economic Science Paradigms.

V následujícím čísle ACTA VŠFS budou publikovány zejména statě vítězů soutěže o Cenu prof. F. Vencovského: Polarizace trhu práce a ochrana zaměstnanosti v Evropě; Vazby mezi finančním a reálným sektorem v různých režimech úrokových sazeb: případ České republiky; Daňová incidence u spotřební daně: důkazy z přirozeného experimentu v České republice. Další stať se zabývá Behaviorálními a empirickými náměty do diskuse o paradigmatech ekonomické vědy.

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