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Articles

**The Effect of Latvian Pension Reform
on Savings and Government Budget**
Konstantīns Beņkovskis

**The Impact of Fiscal Policy on Prices: Does the
Fiscal Theory of Price Level Matter in Latvia?**
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**Inequality and the Transition:
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**Lithuania's Track to the Euro
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**Estonia, the New EU Economy.
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The Effect of Latvian Pension Reform on Savings and Government Budget¹

*Konstantīns Benkovskis*²

Abstract

This paper deals with pension reform's effect on Latvian savings. We are studying the reaction of total savings and their components on change in the fully funded pillar's share in the total pension system and on increase of the retirement age using overlapping generations model with many generations. The paper describes both the long-term and the short-term theoretical consequences of the changes in pension legislation. Finally, we evaluate the effect of Latvian pension reform on private savings, fully funded savings and government budget balance over the next 10 years. Model's simulations show that the increase of the retirement age improves budget balance and total savings, while the introduction of the fully funded pensions redistributes the tax payments from the social budget to fully funded savings.

Keywords: Pension reform, overlapping generations model, savings

JEL codes: D91, E21, H55

1. Introduction

Latvia has made significant efforts to implement the reform of the Soviet style pension system during the years of independence. The need for reforms was determined by unfavourable demographic changes, rising unemployment and lack of a strong link between contributions and benefits. The objective was to provide the stability and efficiency of the welfare system while maintaining an adequate social safety net. Although the impressive work has been done during the last ten years, the reform is not finished yet, and Latvian pension system is still in the process of transformation.

The reform of the pension system affects individuals, causing changes in overall welfare of the population, redistributing welfare between the generations, revising incentives for working and retiring, etc., but these are not the only effects. Pension reform also could have a significant impact on the private savings, government budget and thus also on the current account balance. The last two indicators are always in the focus of attention in Latvia: the low budget deficit is one of the requirements for successful entry into Economic and Monetary Union (EMU) and introduction of the euro, while the huge current account deficit is acknowledged as a significant risk factor for Latvian economy. That is why the analysis of the possible pension reform's influence on these macroeconomic variables is of great importance. In this paper we are interested in macroeconomic effect only and therefore our goal is limited to studying the consequences of the pension reform on Latvian total savings and their components.

There are several problems in analysing the changes in the pension system. The reform began only some years ago and data series are too short for using econometric methodology. Moreover, the reform is not finished and we are still in the transition period. That is why in this paper we are trying to investigate the impact of the pension reform by using theoretical model: an overlapping generations model with many generations for a small open economy, which reforms its pension system. We also evaluate the model's parameters and estimate the effect of Latvian pension reform on Latvian private savings, government budget and current account for the period between

¹The author wrote conducted this research while completing his doctorate at the University of Latvia and acknowledges funding from a EuroFaculty research grant.

²Email: benkovskis@inbox.lv.

1996 and 2015.

The next section describes the principles of Latvian pension system and main changes in it. The third section contains brief review of the related literature. In the fourth section we discuss the main principles and results of overlapping generations model. The fifth section shows the expected effect of Latvian pension reform on private savings, government budget and fully funded savings, while the last section concludes.

2. Pension Reform in Latvia

During the last ten years the pension reform was implemented in different dimensions, moving from unfunded to fully funded pension schemes, transforming from benefit defined to contribution defined scheme and allowing private management in the pension system. As a result, Latvian pension system currently has three pillars.

The first pillar also called Pay-As-You-Go (PAYG) pension scheme is the mandatory state pension scheme implemented in January 1996. The main principle here, as in any PAYG scheme, is the principle of the intergenerational solidarity, when tax contributions are used for financing current pension expenditures. Nevertheless, the scheme implemented in Latvia differs from PAYG approaches in most of the countries.

Retaining the principle of the intergenerational solidarity, the 1st pillar pension system scheme has been designed as the notional funded defined contribution PAYG scheme. Tax contributions are recorded in notional individual accounts that accumulate notional pension capital, while real contributions are used for financing current pension expenditure. There is a notional return on the notional pension capital, which is equal to the growth rate of total social contributions and therefore is determined by the changes in the working population and gross wage level. Pensions are calculated by dividing the capital accumulated in the notional account by the average number of years projected for the pension payouts at each specific age of retirement. In addition, there is a pension indexation, which takes into account changes in prices and wages (Ministry of Welfare of Latvia, 2002).

The second pillar also called Fully Funded (FF) pension scheme is the mandatory state pension scheme, where part of the social insurance contributions are channelled into individual pension accounts and invested. At retirement, the accumulated funded pension capital is added to the notional PAYG pension capital and then is used in pension calculations. The second pillar was introduced in July 2001 and at that moment the participation was mandatory for persons who were under the age of 30, and voluntary for persons who were in the age group between 30 and 49 (see Law On State Funded Pensions). The pension capital is invested in financial assets in Latvia and abroad (although with some limitations), therefore the return on funded pension capital depends on the situation in financial markets.

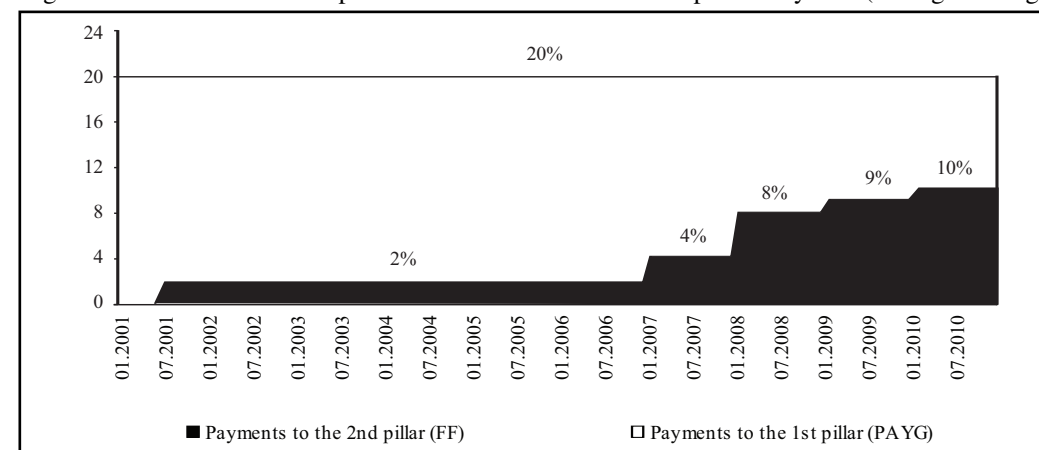
The third pillar is the voluntary private pension scheme, introduced in July 1998, which offers a possibility for private accumulations in pension funds. Although the transition from the state managed to private managed pension schemes is an important part of pension reform, we will not analyse this issue further and will ignore the existence of the 3rd pillar in Latvian pension system. The first reason for that is a small share of private pension funds in the total pension system. In 2004 the net contributions to the 2nd pillar were 26.8 millions of lats, while the net contributions to the 3rd pillar were only 5.3 millions of lats, mainly paid by employers (see Financial and Capital Market Commission (2005a, 2005b)). The second and more important reason is the voluntary basis of participation in private pension schemes that complicates the theoretical analysis of the 3rd pillar, as the modelling of agents' decision making is needed.

The impressive changes in Latvian pension system have been done during the last ten years, but

the reform is not finished yet, and system is still in the process of transformation. In this paper we are stressing two ongoing changes.

The first important and still ongoing change is an increase of the 2nd pillar's share in the total Latvian pension system. Contributions, reserved for the old-age pensions, are based on the contribution rate of 20% from the gross wage. Before the implementation of the FF scheme, all tax contributions were channelled to PAYG pension scheme. With the introduction of the 2nd pillar, the contribution rate for the 1st pillar is gradually decreasing, while contributions to the 2nd pillar are increasing. According to Law On State Funded Pensions contributions will reach the same proportion (10% of gross wage) for both pillars in 2010. It means that the implementation of the 2nd pillar does not require additional increase in the contribution rate, but just redistribution of the social tax payments between PAYG and FF schemes (see Figure 1).

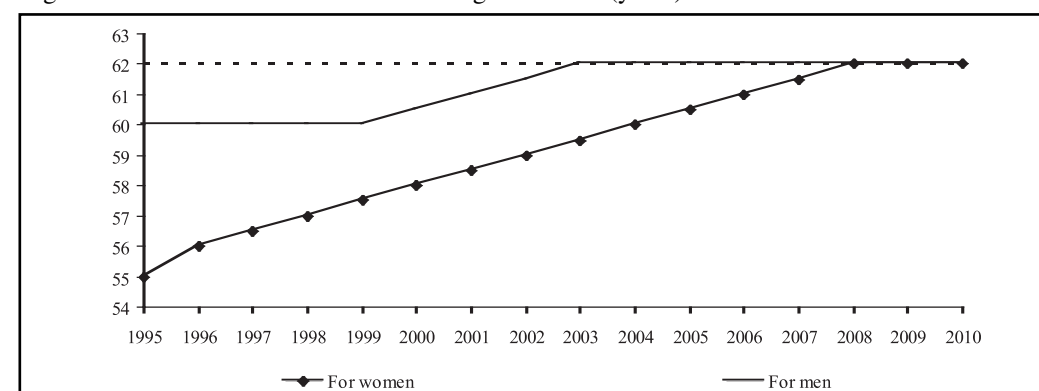
Figure 1. The increase of FF pillar's share in the total Latvian pension system (% of gross wage)



Source: Law On State Funded Pensions

The second significant change analysed in the paper is an increase of the retirement age. According to the Law on State Pensions, the minimum pension age is set at 62 for both men and women, that is significantly higher than the retirement ages effective before 1996: 55 years for women and 60 years for men. There is a transition period, however. The transition to the pension age of 62 is passing step-by-step – by six months each year, so, men reached the pension age of 62 in 2003 and women will reach it at 2008 (see Figure 2).

Figure 2. The increase of the retirement age in Latvia (years)



Source: likums "Par valsts pensijām" (Law On State Pensions)

There are several problems in analysing the effect of two abovementioned parts of the pension reform. Firstly, the reform began only some years ago (that is especially true for the increase of FF pillar's share) and therefore we have too short data series to analyse the effect of the pension reform using econometric methodology – it is impossible to disaggregate the impact of the pension reform on savings from other external and internal factors. The second problem occurs when we realize that reform is not finished yet and we are still in the transition period: the increase of the retirement age will be finished in 2008, but increase of FF pillar share will continue until 2010 with most changes during the last three years. That is why we are not using the econometric methodology, but trying to evaluate the impact of the pension reform using theoretical model.

3. Review of the Related Literature

The pension reform is a “hot” topic not only for the Baltic and Eastern Europe countries, therefore the list of recent publications is impressive and contains papers dealing with qualitative analysis as well as quantitative and model-oriented researches.

The discussion of the pension reform in the Baltic countries could be found in Branco (1998), Cangiano et. all (1998), Schiff et. all (2000), Raudla and Staehr (2003) and Koivu (2001). According to the latter the three pillar pension system implemented in the Baltics can deal with demographic changes, reduces labour market distortions, accelerates the development of financial markets, has greater transparency, reduces political risks as well as increases the national savings rates and capital accumulation (although the author recognizes that theoretical and empirical studies on this topic are ambiguous). The problems encountered are big transition costs, higher risks to pensioners, high administrative costs and preconditions to success.

Between more technical papers the majority deals with theoretical issues of the pension reform, but the number of econometric researches is modest. The representative econometric research is done by Samwick (2000), analyzing the effect of social security on saving using a panel of countries over twenty-five years. According to the paper results, countries with PAYG systems tend to have lower savings rates, and this effect increases with the coverage rate on the system.

The majority of the papers analyses the theoretical effect of the pension reform using the overlapping generations models. This type of the models is based on the overlapping generations model introduced by Auerbach and Kotlikoff (1987). The standard approach is to use two overlapping generations, like Leers et. all (1998), Schimmelpfennig (2000), but the number of generations can be more like in Börsch-Supan et. all (2001), who extend the analysis even further and use multi-country model, arguing that closed-economy models of pension reform are likely to miss quantitatively important effects of international capital mobility.

As various authors use various modifications of overlapping generations models and have different goals, the conclusions from the theoretical models also differ. Leers et. all (1998) conclude that in case of ageing in a small open economy with a PAYG system, the existence and the form of the institutional savings treatment is crucial for the political feasibility of a transition to a more savings based pension system, which is favourable for future generations. Bohn (1999) finds that in case of shocks to the birth rate, a benefit defined social security system is more efficient ex-ante than a contribution defined or privatizes system. Börsch-Supan et. all (2001) state that population ageing results, at least initially, in a higher capital stock, but when the baby boom generations will begin to consume their retirement savings, the capital stock will decrease.

Schimmelpfennig (2000) in his paper addressed the similar issue that we are doing in this research, studying the effect of the pension reform on private savings and current account. Using the overlapping generations model (with two generations) for a small and open economy which reforms its pension system Schimmelpfennig (2000) concludes that the impact of pension reform

(increase of FF pillar's share) on the domestic savings-investments balance and the current account balance depends on the behaviour of individuals. If individuals are forward looking, there will be a reduction in private savings and the current account will fall. If individuals are myopic, the pension reform leaves current account constant.

The model used by Schimmelpfennig (2000) is applicable to Latvian pension system with one exception. As there are only two generations in the model it is impossible to model the impact of changes in the retirement age. Therefore, in our further analysis we will notably extend Schimmelpfennig (2000) model to fit Latvian situation.

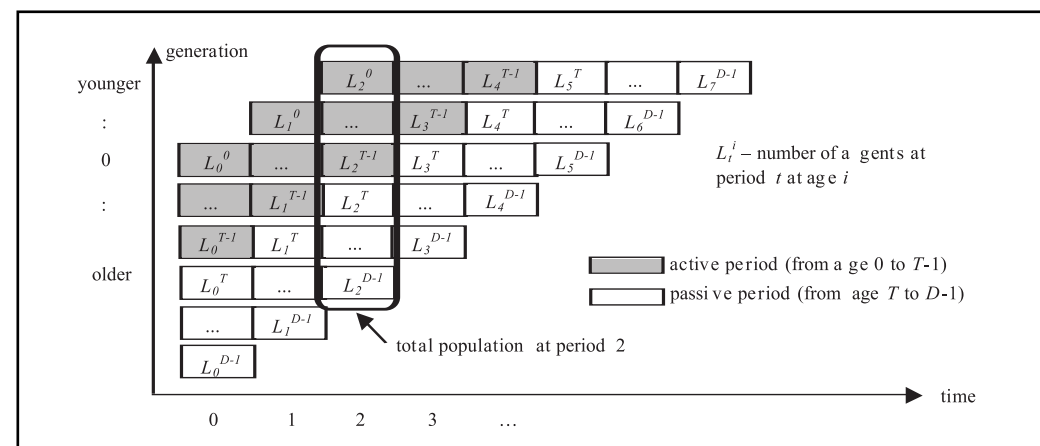
4. Overlapping Generations Model

To study the effect of Latvian pension reform on savings we need to develop the model which would describe savings as a function of other variables with share of the 2nd pillar's scheme and retirement age among them. Further we derive equations for total national savings and their components: private savings outside the pension system, government savings (or government budget balance) and fully funded savings (or savings in the 2nd pillar).

4.1 Overlapping Generations

The main difference of our model from the benchmark model of Schimmelpfennig (2000) is the number of generations. The latter uses two overlapping generations – “young”, or active, that is working, saving and paying taxes and “old”, or passive, that gets pensions. As it was mentioned before, it is not easy to model the changes in the retirement age when agents live only for two periods.

Figure 3. Overlapping generations



That is why in our model each agent lives for $D > 2$ periods and there are D generations in the economy. We assume that the agents are active during the first T periods of their life (for simplicity, there is no childhood period), and are passive during the last $D - T$ periods (see Figure 3). There is no probability to die before or possibility to live after D years for any agent. Population is not static and each next generation exceeds the previous by the growth rate n :

$$L_{t+1}^i = nL_t^i \quad (1)$$

where L is the number of agents at age i at the period t , n is the population growth rate.

The size of active part of population is equal to the sum of all generations aged from 0 to $T - 1$, but

the size of passive part is equal to the sum of all generations aged from T to $D-1$:

$$L_t^A = \sum_{i=0}^{T-1} L_t^i = \sum_{i=0}^{T-1} L_t^0 \left(\frac{1}{n}\right)^i = L_t^0 \frac{1 - \left(\frac{1}{n}\right)^T}{1 - \left(\frac{1}{n}\right)} \quad (2)$$

$$L_t^P = \sum_{i=T}^{D-1} L_t^i = \sum_{i=T}^{D-1} L_t^0 \left(\frac{1}{n}\right)^i = \frac{L_t^0}{n^T} \frac{1 - \left(\frac{1}{n}\right)^{D-T}}{1 - \left(\frac{1}{n}\right)} \quad (3)$$

where L^A and L^P are sizes of active and passive population, T is the retirement age and D is the length of life. Using equations (2) and (3) it is possible to model how the changes in the retirement age affect the distribution of population between active and passive parts.

4.2 The Maximization Problem of a Rational Agent

Before deriving equations for national savings and their components we should study the behaviour of a representative agent. It is assumed here that all country's inhabitants are rational, therefore each representative agent solves the same maximization problem. They are maximizing their life-time utility function (4) subject to the intertemporal budget constraint (5):

$$E(U_t) = \max_c \sum_{i=0}^{D-1} \frac{\beta^i (c_{t+i})^{1-\sigma}}{1-\sigma} \quad (4)$$

$$(1-\tau) \sum_{i=0}^{T-1} \frac{w_{t+i}}{(1+r)^i} + \sum_{i=T}^{D-1} \frac{\Pi_{t+i}}{(1+r)^i} = \sum_{i=0}^{D-1} \frac{c_{t+i}}{(1+r)^i} \quad (5)$$

where $E(U)$ – expected life-time utility of the agent, c – consumption, β – discount factor and σ – the elasticity of intertemporal substitution, τ is a social tax rate, w is wage rate and Π is a pension the agent will get after retirement in the passive period.

All prices are assumed to be stable in the model. By solving the agent's optimization problem we obtain:

$$c_{t+i} = c_t (\beta(1+r))^i \quad (6)$$

As life-time income includes not only wages but also pensions, we need to derive the equation for the expected pension:

$$\Pi_t^T = \frac{\sum_{i=0}^{T-1} (w_{t+i} (n\lambda)^{T-1-i} (1-\gamma) + \tau w_{t+i} (1+r)^{T-1-i} \gamma)}{D-T} \quad (7)$$

where Π^T – expected pension of the agent, which he/she will get after retirement (after T periods), γ is the share of FF pillar in the pension system, λ is a labour productivity growth. The level of the pension is defined by the accumulated pension capital (numerator) and the length of the passive period (denominator). Accumulated pension capital is formed by the social payments from wage income, and have rate of return equal to the growth rate of total social contributions in the 1st pillar ($n\lambda$) and real interest rate in the 2nd pillar ($1+r$).

Each year the pension is indexed by the growth rate of wage, equal to the labour productivity

growth:

$$\Pi_{t+i} = \Pi_t \lambda^i \quad \text{and} \quad w_{t+i} = w_t \lambda^i \quad (8)$$

By using (5), (6), (7) and (8) we obtain the equation for rational agent's consumption in the first period of life:

$$c_t^0 = \left((1-\tau) w_t \frac{1 - \left(\frac{\lambda}{1+r}\right)^T}{1 - \left(\frac{\lambda}{1+r}\right)} + \frac{\Pi_t^T}{(1+r)^T} \frac{1 - \left(\frac{\lambda}{1+r}\right)^{D-T}}{1 - \left(\frac{\lambda}{1+r}\right)} \right) \left(\frac{1 - \left(\frac{(\beta(1+r))^D}{1+r}\right)}{1 - \left(\frac{(\beta(1+r))^D}{1+r}\right)} \right) \quad (9)$$

The expression in the first brackets of (9) can be interpreted as total discounted life-time income from wage and pension, but the expression in the second brackets represents the distribution of this income during the D periods of life.

4.3 National Savings for the Case with Rational Agents

Knowing the behaviour of the individual representative agent we can derive the equations for gross domestic product, disposable income, consumption, government budget and thus also savings. Gross domestic product of the economy is equal to gross wage income of the active part of the population:

$$Y_t = w_t L_t^A \quad (10)$$

where Y is gross domestic product of the economy.

Disposable income is equal to gross domestic product minus social tax payments plus pensions received from the government:

$$Y_t^{DISP} = (1-\tau) w_t L_t^A + \sum_{i=T}^{D-1} L_t^i \Pi_t^{i,t} \quad (11)$$

where Y^{DISP} is disposable income.

Private consumption is the sum of the individual consumption of all living agents:

$$C_t = \sum_{i=0}^{D-1} L_t^i c_t^i \quad (12)$$

where C is private consumption.

To write down equations for government revenues and expenditures we should make some statements about the government activities. In the spirit of Schimmelpfennig (2000) we assume that government is engaged in no other activities but the pension system. Therefore, the government revenues contain only social tax revenues, but expenditures are represented by pension transfers to passive generations. This assumption gives us a possibility to separate the effect of the pension reform on the government budget. Moreover, we are constraining the government activity only by PAYG pillar scheme. Fully funded pension payments, although mandatory, are not included into the budget revenues and are managed outside the governments budget (it means that FF pensions are not included also in the government expenditures). The equation for the government revenues is the following:

$$GR_t = \tau w_t L_t^A (1-\gamma) \quad (13)$$

where GR are the government budget revenues. The tax base is equal to the gross wage income

of the active part of the population.

The government expenditures contain only PAYG pension payments, which are calculated from PAYG pension capital:

$$GE_t = \sum_{i=1}^{D-1} L_t^i \Pi_{PAYG_t}^{i,t} \quad (14)$$

where GE are the government budget expenditures, Π_{PAYG} is PAYG part of pension transfer to the passive agent.

As we subtracted FF pillar from the government budget, we need also the equation for the fully funded savings equal to agents' contributions to FF pension pillar minus FF pension payments to current pensioners. Analogically to (13) and (14) it is equal to:

$$SF_t = \tau w_t L_t^A \gamma - L_t^P \frac{\Pi_{FF_t}^{0,T}}{\lambda^T} \quad (15)$$

where SF are FF pension savings, but Π_{FF} is FF part of pension transfer to the passive agents.

Now we can derive equations for the total savings and their components: private savings outside the pension system, government savings and fully funded savings. The main problem with obtaining equations for savings is their complexity and therefore there are some problems with interpretation. To make the analysis easier and clearer we simplify the model on the basis of the fact that:

$$\lim_{x \rightarrow 1} \left(\frac{1-x^T}{1-x} \right) = T \quad (16)$$

Our simplification for the further analysis will not bring significant changes into the model if we assume that:

$n \rightarrow 1$ – population growth rate is close to 1, in other words population is almost stable;

$\lambda \rightarrow 1+r$ – real interest rate is close to real labour productivity growth;

$\beta \rightarrow 1$, $\sigma \rightarrow 1$ – discount factor and elasticity of intertemporal substitution are equal to 1.

Using the simplification (16) and equations (1)-(15) we obtain the simplified equations for total savings and their components:

$$st_t = \frac{Y_t - C_t}{Y_t} = \tau \left(1 - \frac{(n\lambda)^{T-1} (1-\gamma) + (1+r)^{T-1} \gamma}{(n\lambda)^T} \right) \quad (17)$$

where st is total savings ratio to gross domestic product.

$$sp_t = \frac{Y_t^{DISP} - C_t}{Y_t} = \tau \left((n\lambda)^{T-1} (1-\gamma) + (1+r)^{T-1} \gamma \right) \left(\frac{1}{(n\lambda)^T} - \frac{1}{(1+r)^T} \right) \quad (18)$$

where sp is private savings (outside the pension system) ratio to gross domestic product.

$$sg_t = \frac{GR_t - GE_t}{Y_t} = \tau (1-\gamma) \left(1 - \frac{1}{n\lambda} \right) \quad (19)$$

where sg is government savings (budget balance) ratio to gross domestic product.

$$sf_t = \frac{SF_t}{Y_t} = \tau \gamma \left(1 - \frac{(1+r)^{T-1}}{(n\lambda)^T} \right) \quad (20)$$

where sf is fully funded savings ratio to gross domestic product.

4.4 National Savings for the Case with Myopic Agents

Equations (17)-(20) were obtained using the assumption of agents' rationality. In other words agents maximize their life-time utility function by using all available information about their future wage and pension. On the other hand, it is fairly possible that agents are myopic and are not optimizing their behaviour on the base of all available information, but use some other, simpler algorithm. In this paper we study also the second case with myopic agents, which choose their consumption on the base of their disposable income and some constant marginal propensity to consume:

$$C_t^{myopic} = \alpha Y_t^{DISP} \quad 0 < \alpha < 1 \quad (21)$$

where C^{myopic} is private consumption of the myopic agents and α is the propensity to consume.

Using (21) we derive alternative equations for total and private savings ratios to GDP:

$$st_t^{myopic} = 1 - \alpha \left((1-\tau) + \tau \frac{((n\lambda)^{T-1} (1-\gamma) + (1+r)^{T-1} \gamma)}{(n\lambda)^T} \right) \quad (22)$$

$$sp_t^{myopic} = (1-\alpha) \left((1-\tau) + \tau \frac{((n\lambda)^{T-1} (1-\gamma) + (1+r)^{T-1} \gamma)}{(n\lambda)^T} \right) \quad (23)$$

where st^{myopic} and sp^{myopic} are total and private savings ratios to gross domestic product when agents' behaviour is not rational and is determined by (21). Equations (19) and (20) for government and FF savings remain unchanged.

4.5 The Long-term Effect of the Pension Reform

From equations (17)-(20) and (22)-(23) it is obvious that savings depend on both λ and T and are affected by the pension reform. In the Table 1 we show the signs of the first derivatives of (17)-(20) and (22)-(23) that represent the direction of the pension reform impact on the savings. If the sign is positive, the reform increases savings. All effects were calculated under the condition that real interest rate and GDP growth are strictly positive ($r>0$, $n\lambda>1$).

The results state that the sign of the effect on savings depends on the relative size of interest rate ($1+r$) and GDP growth ($n\lambda$), in other words, relative return on FF and PAYG pension capital. Let us briefly explain the results for private savings ratio to GDP (the reasoning behind the results for other components is rather similar).

The effect of the pension reform on private savings for the case with myopic agents is straightforward. As consumption and savings of myopic agent are constant parts of disposable income, all we should do is to analyse the reaction of disposable income.

The increase of FF pillar has a positive effect on disposable income and private savings if interest rate is higher than GDP growth (see Table 1). If the return on FF capital is higher and FF pillar share is growing, there is an increase of overall return on pension capital and higher pensions in the passive period. The augmented effectiveness of the pension system and higher pensions in the passive period mean higher disposable income and private savings. These results differ from the results of Schimmelpfennig (2000) where private savings of the myopic agents were neutral to the changes in FF pillar's share. The difference is determined by the fact that we are using the overlapping generations model with many generations and therefore savings are possible even in the passive period.

Table 1. The theoretical impact of pension reform in the long run

	Increase of FF pillar		Increase of retirement age	
	Rational agents	Myopic agents	Rational agents	Myopic agents
Total savings to GDP	< 0 if $1+r > n\lambda$	< 0 if $1+r > n\lambda$	> 0 if $1+r > n\lambda$	< 0 if $1+r > n\lambda$
Private savings to GDP	> 0 if $1+r < n\lambda$	> 0 if $1+r < n\lambda$	< 0 if $1+r < n\lambda$	> 0 if $1+r < n\lambda$
Government savings to GDP	< 0		$=0$	
FF savings to GDP	< 0 if $(1+r)^{T-1} > (n\lambda)^T$ > 0 if $(1+r)^{T-1} < (n\lambda)^T$		< 0 if $1+r > n\lambda$ > 0 if $1+r < n\lambda$	

Source: equations (17)-(20) and (22)-(23), author's calculations

An increase of retirement age positively affects disposable income and private savings of the myopic agents in the absolute terms. But it also augments GDP, and the long-term effect on private savings to GDP is positive only if interest rate (return on FF savings) exceeds GDP growth.

The case with rational agents is more complicated. When we are analysing the impact of an increase of the 2nd level's share in the total pension system we are always dealing with two opposite effects. Assume that the return on FF pension capital is higher than the return on PAYG pension capital. If the share of FF pillar is increased, agents have bigger pension in the passive period and higher life-time income. On the one hand, the increase of the income in the passive period should reduce the incentive to save in the active period. On the other hand, if the interest rate is high, the incentive to save is increasing. The model's results state that when the interest rate exceeds the GDP growth, the second effect is stronger (see Table 1).

Our results diverge from the results of Schimmelpfennig (2000) where private savings of the rational agents decreased, when the interest rate exceeded GDP growth and FF pillar's share in the pension system increased. We explain this difference by the fact that overlapping generations model with only two generations underestimates the direct effect of the interest rate on private savings.

Speaking about the impact of the retirement age on private savings of the rational agent, it can be mentioned that here the direct impact of the interest rate on savings prevails. If the interest rate exceeds GDP growth, then there is an additional incentive to save extra life-time income from the longer working period.

Finally, it should be stressed that results in Table 1 represent only the long-term effect of the pension reform, namely we compare the situation before the moment when the pension reform influences the agents with the moment when the reform is totally implemented and all agents receive pensions based only on contributions made under the new pension legislation. For Latvian case we are speaking about approximately 50 years period, as at least 5 years needed to complete

the reform, but only after ~45 years all pensions will depend on the tax contributions done after the reform period.

4.6 Dynamic Properties of the Model

The previous subsections represent the steady state of the model and the long-term effect of the pension reform. Although these results may be interesting from the theoretical point of view, their practical relevance is questionable, as in this case we are speaking about the 50 years period. The precise valuation of the pension reform impact over such a long horizon is problematic, as all parameters of the model will be unstable and highly sensitive to various unpredictable factors like migration, demographic shifts, etc. That is why we should look at the dynamic properties of the model and the short-term consequences of the pension reform. This will give us additional knowledge about the functioning of the pension system. Moreover, the estimations of the dynamic effect for Latvia will be more precise, as parameters of the model are stable in the short run.

The main difference between steady state and dynamics of the model is the following: in the dynamic solution, the pension payments to passive generations could depend on tax payments made both before and after the implementation of the pension reform. Therefore the dynamic solution depends not only on the parameters of the model, but also on time passed from the implementation of the pension reform.

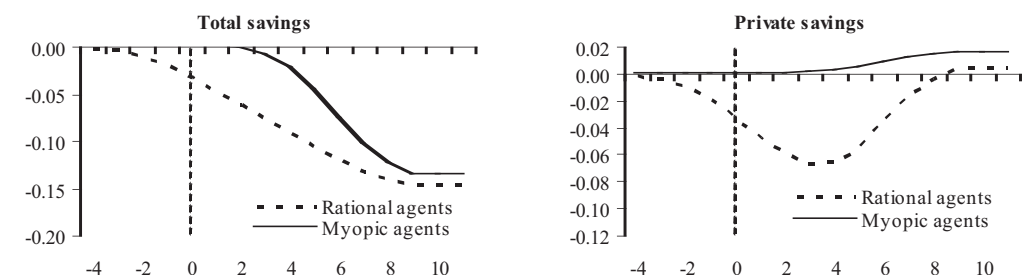
We use numerical simulations of the overlapping generations model on the basis of equations (1), (2), (3), (6), (7), (8), (10), (11), (12), (13), (14) and (15). Here we are not using simplification (16) to obtain precise reaction on pension reform.

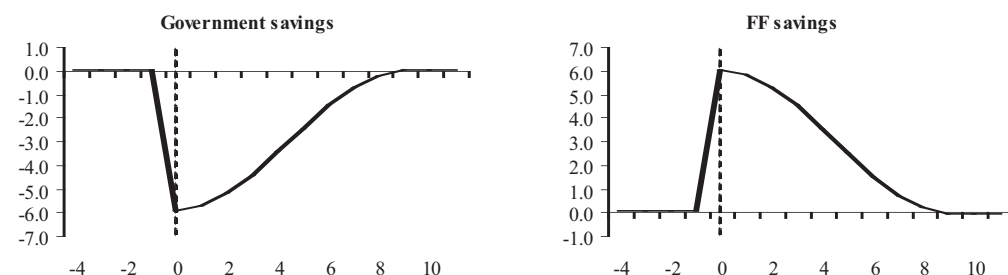
When modelling rational agents' behaviour, two variants of the pension reform should be distinguished. In the first variant the pension reform is pre-announced, so agents know it in advance and could take it into account while making their consumption decision even before the reform practically occurs. The second variant is an unexpected pension reform, when agents get to know about the reform only after its implementation. In this case the behaviour of the rational agents is more complicated as they need to re-maximize their intertemporal utility function each time the reform takes place. That is why we are limiting our simulations to the case of expected reform.

In the case with myopic agents it is obvious that inhabitants are indifferent, whether the reform is expected or unexpected. According to the model, consumption of the myopic agent is a constant part of disposable income, which in its turn changes only after the implementation of the reform.

Figure 4 shows the dynamic reaction of total savings and their components to the increase of FF pillar. The parameters were arbitrary chosen to be $n=0.995$, $r=0.020$, $\lambda=1.015$ (so the interest rate exceeds the GDP growth), $\alpha=0.9$, $D=10$, $T=6$, $\gamma=0.2$ and $\tau=0.2$, to demonstrate the dynamic properties of the model. In the first simulation we increase γ from 0.2 to 0.5.

Figure 4. Reaction of total savings and their components to the 30 percentage points increase of FF pillar in the total pension system (% of GDP)





Source: author's calculations

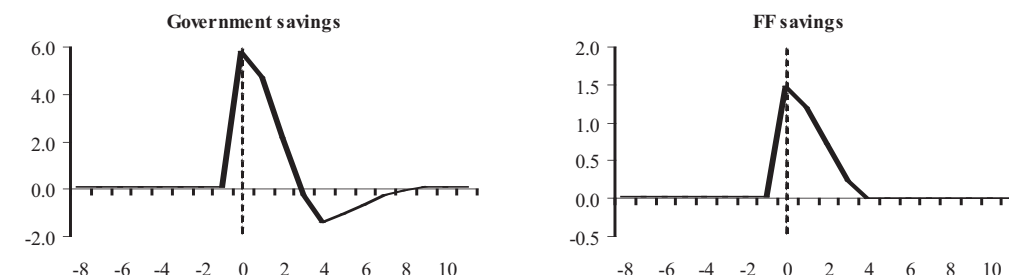
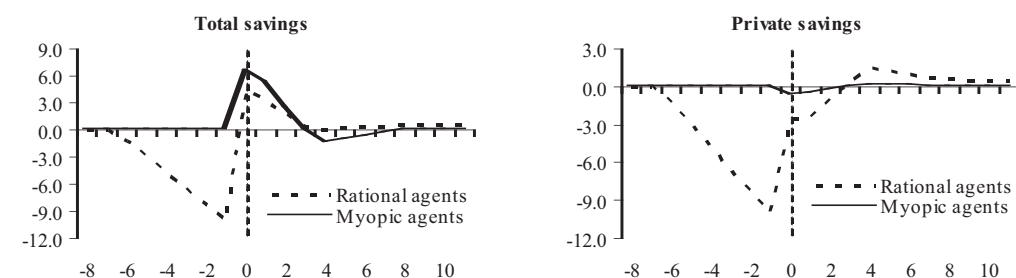
Myopic agents react to the pension reform only after the changes in pension system and private savings have a gradual increase. On the other hand, rational agents react to the pension reform in advance, and their reaction can be divided into two parts. Firstly, private consumption increases (due to the expected growth of pensions), and this process begins before the changes in pension legislation. Secondly, the level of pensions and thus disposable income are going up after the date of the pension reform. It should be noted that the estimated reaction of private savings is insignificant relative to the reaction of government and FF savings (regardless, whether agents are rational or myopic).

The government budget is significantly worsened after the implementation of the reform due to the immediate diminishing of PAYG payments to government budget. The budget balance is gradually improving and converging to the steady state level afterwards, as PAYG pension transfers to passive generations are lowering. The reaction of FF savings is the opposite. There is an immediate jump in FF tax payments, but only gradual growth of FF pension obligations.

The overall effect on government and FF savings is almost zero and decrease of total savings is insignificantly small. So, the only significant result from introduction of FF pillar is redistribution from government budget to FF savings in the short run.

Figure 5 represents the short-term responses of savings to a change in the retirement age. The parameters of the model are the same as in the previous simulation and we are increasing T from 6 to 7. The reactions of rational and myopic agents significantly differ again. The reaction of myopic agents to the changes of the retirement age is very low and happens only during the few periods after implementation of the reform. The reaction of the rational agents is much more volatile. Private savings decrease significantly before the reform that is determined by the fact that expected life-time income increases (while GDP is still unchanged) and there is less incentive to save for consumption smoothing. After the reform there is a shift in the GDP level as an immediate growth of the working population occurs, therefore the effect of the pension reform adjusts to the long-term level, which depends on the relative size of interest rate and GDP growth (see Table 1).

Figure 5. Reaction of total savings and their components to the increase of the retirement age by 1 year (% of GDP)



Source: author's calculations

The reaction of government budget and FF savings to the increase of the retirement age is positive immediately after the reform as higher retirement age means higher active population and thus more tax payments (both PAYG tax payments for budget and FF tax payments for FF savings), while the pensions are not changing. Still, the pension obligations of the government go up in the long run and the effect on government budget and FF savings is close to zero.

For the case of myopic agents, the reaction of total savings is determined by the positive effect on government and FF savings in the short run, while for the case of rational agents the overall effect on total savings is mostly driven by the reaction of private savings.

5. The Effect of Latvian Pension Reform

Now we evaluate the pension reform effect on Latvian savings, using the overlapping generations model described in the previous section. To do this we should quantify the parameters of the developed theoretical model.

We evaluate Latvian pension reform effect only in the short run. Although the impact of current events on the economy 50 years later is interesting, the impact during the next 5-10 years has more practical importance, as it can be estimated with higher degree of accuracy because parameters of the model are more stable in the short run.

In addition to constraining the time horizon, we are forced to make one more limitation in our analysis assuming that Latvian inhabitants are myopic (in the sense of our model) and do not take all available information into account to maximize their life-time consumption. As it was mentioned above, our model is build for the case when the pension reform is announced in advance. Although Latvian pension reform was pre-announced, it was not known about when currently passive generation made its consumption decisions. Moreover, large part of the current population projected their life-time consumption at the time of Soviet planned economy, though for them the pension reform (and many other reforms) was unexpected. Unfortunately, we have no theoretical model for this case and all we can do is to assume that Latvian inhabitants are myopic. We argue that this assumption is realistic as it is widely acknowledged, that people in the transition economies have tendency to heavily discount their life-time consumption, mostly carrying about the current consumption.

To study the impact on Latvian savings correctly we need to do some minor, but necessary modifications to our model. In equation (10) we stated that gross domestic product of the economy is equal to the gross wage income of the active part of the population. In reality the GDP contains not only compensation of employees, but also taxes on production and imports, subsidies (with minus sign) as well as operating surplus and mixed income. Fortunately, the share of compensation of employees in total GDP is stable and for the period from 1998 to 2004 is equal to 0.42 (the GDP statistics by income approach is available only from 1998, see Central Statistical

Bureau of Latvia). Therefore, for Latvia:

$$Y_t = \frac{w_t L_t^A}{0.42} \quad (24)$$

where wL^A is compensation of employees.

While calculating the disposable income we should remember the following things. In addition to gross wages, compensation of employees contain also employers' social contributions. Therefore, to get the total net wage income we should multiply the compensation of employees by $1 - 0.19 = 0.81$ (as 0.19 is the average share of employers' social contributions in compensation of employees between 1998 and 2004) and not forget to multiply it by 0.91 and 0.75 (as 9% is social tax for employees and 25% is income tax). To complete the calculation of the disposable income we should add the operating surplus and mixed income, which average share in GDP during the sample period is 0.47 (and not forget to subtract the income tax). So, the disposable income for Latvia is:

$$Y_t^{DISP} = \left(0.91 \cdot (1 - 0.19) w_t L_t^A + 0.47 \frac{w_t L_t^A}{0.42} \right) \cdot 0.75 + \sum_{i=t}^{D-1} L_i^I \Pi_i^{I,t} \quad (25)$$

Now we can quantify the parameters of the model to describe Latvian situation. Table 2 shows the values of the parameters as well as the comments on how these values were obtained.

Table 2. The parameters of the overlapping generations model for Latvia

Parameter	Value	Comments
n	0.990	The value of n is equal to the average growth rate of total Latvian population during 1998-2004.
λ	1.060	The value of λ is equal to the average growth of labour productivity in Latvia during 1998-2004.
r	0.028	The value of r is equal to the average long term deposit interest rates in lats deflated by the CPI during 1998-2004
α	0.91	The value of α is equal to the average ratio of private consumption to the disposable income between 1998 and 2004. The disposable income was calculated using (25)
τ	0.162	According to the pension law, the ratio of pension contributions to the gross wage rate is 0.2. The gross wage income average ratio to total contribution of employees between 1998 and 2004 is 0.81. Therefore the effective rate of pension contributions to total contribution of employees is $0.162 = 0.2 * 0.81$.
γ	0.00	The share of the 2 nd pillar's scheme in total Latvian pension system before the pension reform was 0.
T	42.5	Before the reform the retirement age was 55 years for women and 60 years for men. Assuming that the proportion of women and men in active part of the population is half on half, the average retirement age is 57.5 years. By subtracting the childhood (15 years) from the active period we get that the average active period for Latvian inhabitant before the reform is 42.5 years.
D	57	The expected length of life in Latvia was 77.2 for women and 67.1 for men in 2004. Taking average and excluding childhood period we obtain $D \approx 57$.

Source: Statistical Bureau of Latvia, likums "Par valsts pensijām" (Law On State Pensions), author's calculations

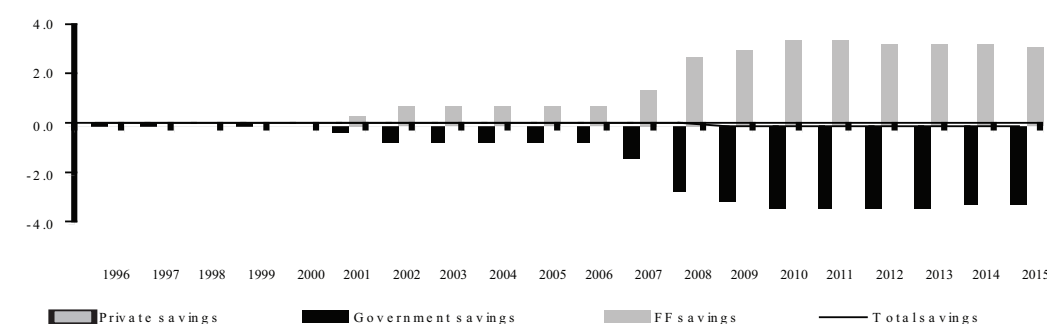
Using these evaluations for Latvia and the overlapping generations model described in section 4 we now estimate the effect of the pension reform on Latvian savings. To do this we are implying two simultaneous changes:

- γ is increasing from 0.00 to 0.50 following the schedule described in section 2 (see Figure 1): γ is equal to 0.00 before 2001, equal to 0.05 in 2001 (as the change was implemented from the July, 1), equal to 0.10 from 2002 to 2006, equal to 0.20 in 2007, equal to 0.40 in 2008, equal to 0.45 in 2009 and equal to 0.50 after 2009.
- T is increasing from 42.5 to 47 following the schedule described in section 2 (see Figure 2): T is equal to 42.5 before 1996, increasing by 0.25 each year between 1997 and 1999 and between 2004 and 2010, increasing by 0.5 in 1996 and between 2000 and 2003.

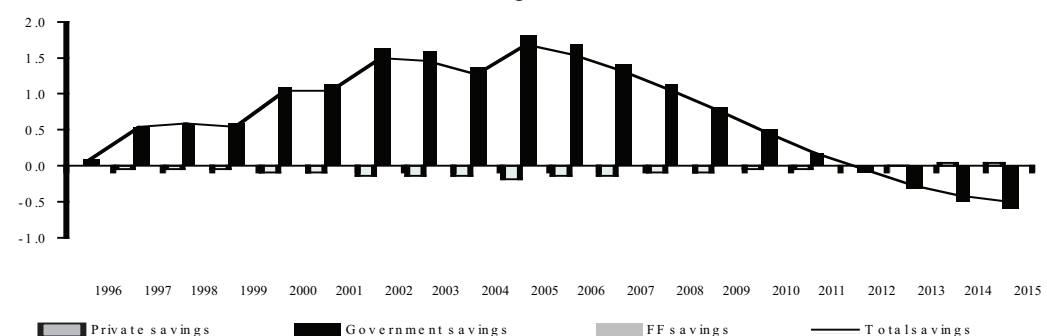
The estimated effects on Latvian private savings, government budget and fully funded savings are presented in Figure 6(a)-(c).

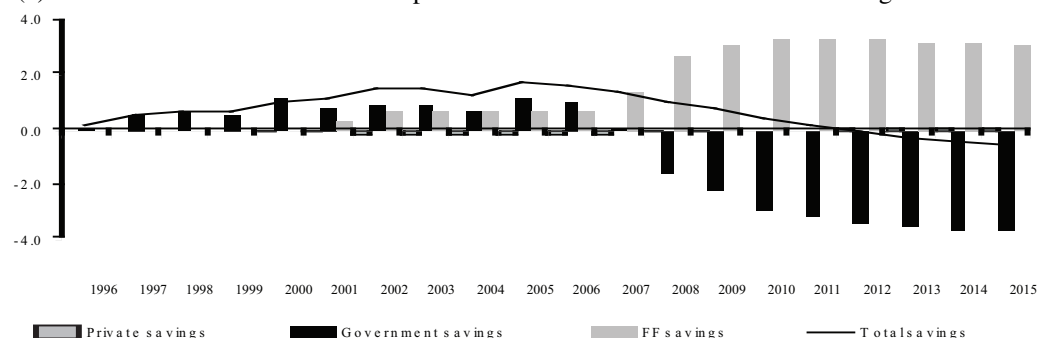
Figure 6. Reaction of Latvian total savings and their components to the pension reform (% of GDP)

(a) reaction to the increase of the 2nd pillar share in the total pension system



(b) reaction to the increase of the retirement age



(c) reaction to the increase of the 2nd pillar share and the increase of retirement age

Source: author's calculations

Figure 6(a) states, that the only significant effect from the increase of the FF pillar share in Latvian pension system is redistribution between government budget and FF savings. These conclusions are in line with our previous theoretical results (see section 4.6, Figure 4). The 2nd pension pillar was introduced in 2001, reducing the government revenues (as FF payments are not included into the government budget), but leaving the government PAYG obligations unchanged. Nevertheless, this effect is not large before 2007 and budget deficit worsened by less than 0.7% of GDP, because the share of FF pillar in the total pension system between 2001 and 2007 is rather small (see section 2, Figure 1). The significant redistribution between government and FF savings begins after 2010, as the share of FF pillar in total pension system reaches 50%. The average decline of the budget balance between 2010 and 2015 is estimated to be 3.3% of GDP along with the similar positive effect on FF savings.

The impact of the higher retirement age on total savings is clearly positive that is determined by increasing budget balance, while the effect on private savings is slightly negative (it is small because of our assumption about the myopic agents). The positive effect on total savings is mainly determined by the diminishing dependency ratio. In other words the ratio of the passive to the active agents becomes lower that reduces the PAYG pension payments and therefore improves the budget situation. According to our calculations, the average improvement of the budget during the increase of retirement age (between years 1996 and 2008, see section 2, Figure 2) is 1.4% of GDP. The small decrease of government savings after 2011 is explained by higher notional return on PAYG pensions (due to increasing quantity of tax payers) and higher pension expenditures of the government.

The overall effect of the pension reform is just a sum of two abovementioned effects. The total impact of the pension reform on Latvian savings can be separated into three periods:

- In the first period before 2001 the impact of the pension reform on total Latvian savings is clearly positive and is determined by the improving budget balance. That is due to the increase of the retirement age and diminishing dependency ratio. According to our calculations, the average effect on the government social budget and total savings in 1996-2000 was 0.6% of GDP.
- In 2001 the 2nd pension scheme was introduced, reducing the government budget and increasing FF savings. However, this effect is not significant until 2007 and the negative impact on government budget is outweighed by further increase of the retirement age. According to the model's simulations, the average effect on total Latvian savings in this period is approximately 1.4% of GDP. It is higher than in the previous period because of faster changes in the retirement age during 2000-2003.

- After 2008 the situation with the government budget will change. The share of the 2nd pension scheme will grow significantly, reducing government budget. On the basis of our model we expect the following scenario. Firstly, the pension reform will worsen the social government budget by more than 3% of GDP after 2010 that will mainly be determined by the decrease of PAYG payments to the budget. At the same time we expect the significant growth of FF savings. The positive effect on total savings will diminish and even turn to negative after 2011.

The important question is how robust is estimated impact of pension reform to changes in the parameters of the model? To answer this question we make some sensitivity tests by changing three important parameters: growth of population (n), growth of labour productivity (γ) and real interest rate (r). These parameters were changed out of sample: in our experiment the growth rate of population and labour productivity were decreased by 1 percentage point beginning from the year 2005, while real interest rate – increased by 1 percentage point beginning from the year 2005. To find out sensitivity of the results we compare the estimated impact of pension reform on Latvian savings in 2015 with the baseline scenario presented in Figure 6.

Table 3. Sensitivity test of the pension reform's impact on Latvian economy

(the reaction of Latvian savings to pension reform, comparing with baseline scenario, in percentage points of GDP, in the year 2015)

	Changes in parameters		
	$\Delta n = -0.01$	$\Delta \lambda = -0.01$	$\Delta r = 0.01$
Private savings	0.01	0.01	0.00
Government savings	-0.06	-0.08	-0.04
FF savings	0.00	-0.01	-0.01
Total savings	-0.05	-0.08	-0.05

Source: author's calculations

The results of the sensitivity test (see Table 3) show that the effect of Latvian pension reform on savings is rather stable to changes in population growth, labour productivity or real interest rate. The only component of savings, which reaction on pension reform is somewhat sensitive to changes in parameters are government savings. The negative reaction of government savings to pension reform is enlarged by 0.06 percentage points of GDP when population growth is declining, by 0.08 percentage points in the case of lower productivity growth and by 0.04 percentage points in the case of higher interest rate.

We can conclude that according to the model, the effect of Latvian pension reform on savings is for the most part determined by the degree of changes in pension system, but not by the economic and demographic situation in the country. Partly this is determined by the design of the model, as many important variables like productivity growth, labour supply, interest rates, etc. are treated as exogenous. In addition, Latvian pension system is contribution defined; therefore, it links benefits to previous income, providing stability to the government budget.

6. Concluding Remarks

The paper discusses the effect of increasing the FF pillar's share and the retirement age on Latvian total savings and their components: private savings, government budget and fully funded savings. We are not implementing the econometric methodology to analyse this effects as the reform began only some years ago and we have short data series to separate the effect of the reform from the other effects; moreover, the reform is not finished yet. Instead of econometric methodology we use the overlapping generations model with many generations for a small open economy which reforms its pension system.

We derive equations for total national savings and their parts: private savings outside the pension system, government budget balance and fully funded savings using the model. According to the results obtained, savings depend on the share of the 2nd pillar's scheme in the total pension system and on the retirement age, therefore savings are affected by the pension reform.

Model's simulations for Latvia show that introduction of the 2nd pillar scheme and simultaneous increase of the retirement age has different consequences on Latvian savings. The increase of the retirement age improves budget balance and fully funded savings as dependency ratio is diminishing. On the other hand, the introduction of fully funded pensions redistributes the tax payments from social budget to fully funded savings, therefore in the short run the budget balance is worsened, but fully funded savings increase. The reaction of private savings on changes in the pension systems turned out to be insignificant, that can be partly explained by the assumption about myopic behaviour of agents.

According to the model, before 2008 the effect on total savings is dominated by the positive effect from the growing retirement age – the average impact is around 1.4% of GDP in 2001-2007. Afterwards, the increase of the 2nd pillar's share will worsen budget deficit (by more than 3% of GDP after 2010), simultaneously increasing fully funded savings. The positive effect on total savings will diminish and even turn negative after 2011.

Sensitivity tests show that the effect of Latvian pension reform on savings is for the most part determined by the degree of changes in pension system, but not by the economic and demographic situation in the country.

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The Impact of Fiscal Policy on Prices: Does the Fiscal Theory of Price Level Matter in Latvia?

Olegs Tkachevs³

Abstract:

The paper studies the indirect impact of fiscal policy on prices. Exploring VAR in two variables, primary balance ratio to GDP and public debt ratio to GDP, and calculating the impulse response functions to innovations in the former variable, it supposes an evidence of the exogeneity of Latvian general government budget balance. Borrowing from the recently developed Fiscal Theory of Price Level (FTPL) it implies that deterioration of the budget balance may lead to an upward price adjustment needed to assure fiscal solvency.

Keywords: Fiscal policy, budget balance

JEL codes: E31, E62

1. Introduction

Assessing the impact of fiscal policy on prices is an important economic issue in countries, which either belong to a monetary union with common monetary policy or are expected to join it. Participants of the Economic and Monetary Union (EMU) in spite of the existence of the Stability and Growth Pact (SGP) still have some room for implementation of the nationally defined fiscal policy. If there is an impact of fiscal policy on country's price level and this impact is more or less strong, then the way national fiscal policy is defined and implemented is of particular concern not only at the national level, but at the EMU level as well since country's pursued loose fiscal policy may undermine price stability in the whole Euro Area. ECB may response with higher Union's interest rate, thus negatively influencing growth prospects in all EMU Member States. Any country, which is on the way towards the EMU, must also be aware of this impact because of the Maastricht criteria on inflation it has to fulfil before entering. Thus the issue is important for Latvia in the context of the EMU accession.

The impact of fiscal policy on prices can be studied in different ways. Three channels through which fiscal policy may affect prices are: seigniorage, aggregate demand and aggregate supply.

As to the *first channel*, monetarists argue that if fiscal authorities determine the level of budget deficit and then assign the budget shortfall to the Central Bank, which then creates money to cover this deficit, it leads to an increase in the monetary base and thus creates inflationary pressure. Therefore, according to the monetarist view, inflation is purely a monetary phenomenon and the problem can be easily solved if the independence of the Central Bank is assured and printing money to cover the budget deficit is not allowed. However, nowadays in developed economies central banks are legally provided with independence from their fiscal authorities, so that it is not possible to use the seigniorage opportunity⁴.

As to the *second channel*, fiscal policy can affect prices via its effect on the aggregate demand. According to the proponents of the Fiscal Theory of Price Level (FTPL) in the non-Ricardian setting "an increase in the deficit causes a net increase in the permanent income of the private sector and, given that the total available resources of the economy has not changed, the new

³ Faculty of Economics and Business Administration, University of Latvia, Riga, Latvia. Email: otkachev@one.lv.

⁴ There is no room for seigniorage channel in Latvia according to the "Law on the Bank of Latvia", Art.13, Art.36

equilibrium requires an increase in the price level (Cos, Momigliano (2003))". In such a case there is an impact even if the monetary policy rule is absolutely independent upon fiscal shocks. That is independent Central Bank is not a panacea against fiscal policy backed inflation and not sufficient to ensure price stability. Independence of the Central Bank should be accompanied with the fiscal policy rule. The proponents of this theory stress that "unless special steps are taken to ensure that appropriate fiscal policies are taken, the goal of price stability may remain elusive regardless of how tough and independent the Central Bank is (Christiano, Fitzgerald (2000))". It has to be stressed here that the relevance of this channel is highly disputed since it relies on many assumptions. The most disputed is the assumption that budget deficit is an exogenous parameter, determined by a political process that takes no account of the level of the debt.

As regards the *third channel*, fiscal policy can affect price level through its impact on the aggregate supply. There is a direct impact of fiscal variables on prices stemming from higher (or lower) indirect tax (e.g. Value Added Tax) rates as well as employer's rate of social security contributions.

This paper deals with the *indirect impact of fiscal policy* on prices since it is assumed to bring about important policy implications. Furthermore it is generally assumed to be at work (if at all) from a long-term perspective, what is usually more relevant for research investigation, while the direct impact is more relevant in the short-term technical analysis. The paper studies the FTPL and tests for its plausibility exploring VAR in two variables: primary balance ratio to GDP and public debt ratio to GDP and calculating the impulse response functions to innovations in the former variable. As we shall see it is possible to discriminate between the FTPL and monetarist view based on the response of the public debt ratio to an innovation in the primary balance.

According to its purpose the paper is divided into five sections: Section 2 explains the difference between the monetarist (based on Ricardian fiscal policy regime) doctrine and the FTPL (based on non-Ricardian fiscal policy regime) as well as discusses the efficiency of the EU common fiscal policy rules in avoiding the FTPL. Section 3 provides a literature review of the empirical research conducted so far in this field. In Section 4 the relevance of FTPL is tested. Finally, Section 5 concludes.

2. Theoretical Foundations of the Fiscal Theory of Price Level

The key defining characteristic of the Fiscal Theory of Price Level (FTPL) is the non-Ricardian fiscal policy regime in contrast to conventional or monetarist view which is based on the Ricardian fiscal policy regime⁵. The features of Ricardian and non-Ricardian fiscal policy regimes can be explained in terms of the government budget constraint:

$$B_t = (T_t - G_t) + (M_{t+1} - M_t) + \frac{B_{t+1}}{(1 + i_t)} \quad (1)$$

M_t and B_t are, respectively, the stock of base money and the government debt at the beginning of period t . $T_t - G_t$ is the primary budget balance during period t , where T_t denotes for total revenues and G_t denotes for primary expenditures. i_t is the interest rate for period t . The equation above says that the existing debt can be repaid in three ways:

1) by running positive budget balance (primary budget surplus);

⁵ One of the first advocates of the FTPL were Leeper (1991), Woodford (1994) and Sims (1994), whereas the classic statements of the monetarist view stem from Sargent and Wallace (1981). FTPL was heavily criticized by McCallum (1999), Buiter (1999) and Bassetto (2001)

2) by issuing base money;

3) by refinancing.

The government budget constraint can be represented alternatively after dividing by nominal GDP ($P_t y_t$) both sides of (1) and rearranging as follows:

$$\frac{M_t + B_t}{P_t y_t} = \left[\frac{T_t - G_t}{P_t y_t} + \left(\frac{M_{t+1}}{P_t y_t} \right) \left(\frac{i_t}{1 + i_t} \right) \right] + \left(\frac{y_{t+1}/y_t}{(1 + i_t)(P_t/P_{t+1})} \right) \left(\frac{M_{t+1} + B_{t+1}}{P_{t+1} y_{t+1}} \right) \quad (2)$$

or simplifying and taking conditional expectations it can be represented as:

$$w_t = s_t + \alpha_t E_t w_{t+1} \quad (3)$$

where w_t denotes for the government liabilities to GDP ratio, s_t is the primary surplus to GDP ratio and w_t is the discount factor. After equation (3) is iterated forward and "no-Ponzi" game condition is considered⁶ the *intertemporal government budget constraint*, which equates the present value of the current and expected future surpluses and the initial debt, is obtained:

$$w_t = s_t + E_t \sum_{j=t+1}^{\infty} \left(\prod_{k=t}^{j-1} \alpha_k \right) s_j \quad (4)$$

It says us that current government liabilities are to be fully offset by current and present value of future budget surpluses. The alternative way of writing the intertemporal government budget constraint is in the form of transversality condition:

$$\lim_{T \rightarrow \infty} E_t \left(\prod_{k=t}^{T+t-1} \alpha_k \right) w_{t+T} = 0 \quad (5)$$

which more clearly states, that there is no debt "in the end".

The way in which the intertemporal government budget constraint (4) gets satisfied, i.e. different interpretations of how the adjustment takes place reflects whether agents' expectations are Ricardian or non-Ricardian.

Under *Ricardian* fiscal policy regime monetary authority sets money supply influencing price level through the quantitative relation of money. Primary balances (s_t) are endogenous and move automatically to ensure fiscal solvency for any real government liabilities or alternatively for any price level. Technically, P_t enters the left hand side (LHS) of the intertemporal government budget constraint (4) thus raising or lowering real government liabilities (w_t). Fiscal authority responds by adjusting the right hand side (RHS) with accordingly higher or lower primary balance (s_t). If economic agents, when forming their expectations, suppose that their government is Ricardian (i.e. there are Ricardian fiscal policy regime expectations), then in case government runs primary deficit in a current year agents expect it will react in future by raising taxes or reducing expenditures in order to meet budget constraint no matter what the price level path is, thus there are no changes in the present value of current and future primary balances. There is no link between fiscal policy and inflation and Central Bank's commitment to price stability is

⁶ O'Connell and Zeldes (1988) demonstrate that "no-Ponzi" condition must hold in equilibrium, assuming that the number of economic agents is finite, their behaviour is rational and their utility is a positive function of their consumption.

feasible to avoid high inflation. As it is pointed out by Leeper (1991) Treasury follows a passive strategy and the Central Bank follows an active strategy, implying that the Ricardian fiscal policy regime is a “regime of *monetary dominance*”.

Under *non-Ricardian* fiscal policy regime budget deficit is an exogenous factor, determined by a political process, but real government liabilities are endogenous that means that if some or all debt is nominal and thus predetermined, then price level must respond to the expected value of present and future budget balances (Wren-Lewis(2002)). Or, technically, if s_t is a politically set factor, it exogenously determines the movements of the RHS of the intertemporal budget constraint (4). In order for the constraint to be restored in equilibrium, price level P_t and thus real government liabilities w_t must move together with s_t . If agents believe that the government is non-Ricardian (i.e. there are non-Ricardian fiscal policy regime expectations), then in case government runs primary deficit in a current year, agents do not expect that it will adopt later contractionary fiscal policy and the price adjustment is crucial in order for the intertemporal government budget constraint to get satisfied, since there is a decrease in the present value of current and future primary balances. Fiscal solvency is ensured automatically through changes in price level rather than by government's actions. Under this regime fiscal policy, rather than monetary policy, determines the price level. Monetary policy can only influence prices through seigniorage. In this case money supply is endogenous factor and just adjusts to new price level. Thus in Leeper's words Treasury is acting actively in this case, while the Central Bank carries out a passive policy that is a sign of a “regime of *fiscal dominance*”.

Both regimes are supposed to be theoretically plausible. Proponents of the FTPL argue that non-Ricardian fiscal policy regime is feasible as governments might neglect fiscal solvency which has to be restored then automatically through price adjustments. Christiano and Fitzgerald (2000) compare non-Ricardian government, neglecting fiscal solvency, with a pedestrian at a cross-walk “who crosses a street expecting that oncoming automobiles, seeing the commitment to cross regardless of consequences, will stop rather than suffer the horror of an accident”. They stress that “the non-Ricardian government is banking on the idea, that the market abhors non-equilibrium price level as much as drivers abhor hitting pedestrians”. Furthermore, advocates of FTPL usually stress that “raising taxes or cutting spending to stabilize debt may be politically unpopular, at least amongst the interest groups that matter politically”. Agents realize it and take it into account when forming their expectations.

The basic economic mechanism of the impact of fiscal policy regime expectations on price level determination is as follows: if expansionary fiscal policy is implemented in a current year (or is anticipated) and agents do not expect that government will react by increased taxation in future (*non-Ricardian fiscal policy expectations*) then they feel wealthier as they start to realize that their intertemporal disposable income has increased (i.e. their intertemporal budget constraint has soften). This creates inflationary pressure through excess demand for goods and services. If, on the contrary, they expect the government response will be contractionary fiscal policy in future, increased taxation or reduced expenditures (*Ricardian expectations*), their intertemporal disposable income (intertemporal budget constraint) stays unchanged, thus having no effect on aggregate demand and prices. Actually, current increase in budget deficit, brought about by, e.g. tax reductions, in such a case is simply offset one for one by an increase in private saving, leaving total aggregate demand and therefore the price level unchanged.

So, there are two different solutions to inflation problem under Ricardian and non-Ricardian fiscal policy regimes. If monetarist doctrine holds then Central Bank's credible commitment to price stability goal and implementation of appropriate monetary policy ensures stable path of price level. Ricardian expectations “are thus the basis for the current conventional view that to achieve

a stable price level it is sufficient to have a tough, independent Central Bank which is focused on prices” (Christiano, Fitzgerald (2000)). If FTPL matters then even in case a Central Bank commits itself to price stability there is a need for government commitment not to raise budget deficit.

One of the ways to automatically ensure Ricardian expectations, proposed by Wren-Levis (2002), is to establish an external agency, which would be provided with the stabilization role. The goal of this external agency would be price stability. According to Wren-Levis (2002) decisions about the detailed structure of taxation and control over the long-run level of all taxation would be delegated to fiscal authority, while external agency would be provided with the control over a limited number of tax instruments including temporary changes in sales taxes to induce short term changes in demand or (what is assumed to be even more powerful) delaying (bringing forward) spending on investment. According to Wren-Levis (2002) government spending could unlikely be delegated to the external agency.

Do the provisions of the Maastricht Treaty and the Stability and Growth Pact (SGP) constitute a good framework to ensure Ricardian expectations?

It has already been shown that Non-Ricardian fiscal policy expectations result in equilibrium in which fiscal policy rather than monetary policy determines the price level. In a monetary union fiscal policy is the only policy tool available to fight asymmetric shocks and achieve macroeconomic stability. It contributes to possibility that non-Ricardian expectations can arise. Furthermore exogeneity of budget deficit in a member state of a monetary union is quite likely as a member state does not fully internalise inflation costs since part of these costs constitute negative externalities faced by other member states. Thus possible exogeneity of budget deficit and thus path of unsustainable debt in at least one member state leads to price level instability in the whole union if other member states do not implement budget surplus to cover growing debt of the indebted country (that is politically impossible).

The above provides an explanation of why the common fiscal policy rules are so important in the EU. A debate has recently arisen whether the existing EU fiscal policy framework (Stability and Growth Pact (SGP) together with the Maastricht criteria on budget balance and public debt) is able to ensure solvency of each government in the EU or not.

Accordingly to the existing EU common fiscal policy rules any EU Member State's:

budget deficit ratio to GDP should not exceed 3% reference value (“unless it has fallen substantially and comes close to the reference value or when the excess over the reference value is only exceptional and temporary and the ratio remains close to the reference value”);

public debt ratio to GDP should not exceed 60% reference value (“unless the ratio is sufficiently diminishing and approaching the reference value at a satisfactory pace”);

cyclically adjusted budget balance (CABB), that reflects government's pursued discretionary fiscal policy, *has to be in the range between -1% of GDP (for low debt/high potential growth countries) and zero or surplus (for high debt/low potential growth countries) or the adjustment path has to be appropriate in order to meet this requirement in the medium term*⁷.

On the one hand, these provisions are even more inflexible than requirements for Ricardian expectations. Under Ricardian fiscal policy regime there is a possibility that a government runs a series of large deficits and then returns the debt to its initial level only very gradually, but under the Maastricht Treaty and the SGP even such an increase in deficit may not be feasible because of 3% ceiling and the requirement for the CABB to be in the range defined. On the other hand, *these rules have to be fully credible* in order to bring about Ricardian fiscal policy regime

⁷ If the first two rules imply sanctions (fines) in case a country breach them, then the balanced budget requirement imply only “early warning mechanism” when no fine can be imposed.

expectations. If agents do not believe in the EU common fiscal policy rules, they are no longer relevant in ensuring Ricardian fiscal policy expectations. Credibility of these rules can be negatively influenced by the consistency with which decisions are currently made in the EU. Recent changes in SGP, that soften its provisions as well as the ECOFIN Council decision to postpone the deadline for the correction of Germany's and France's excessive deficit, that left excessive deficit procedure in abeyance, undermine the credibility of the fiscal policy framework in the EU. Furthermore, only some countries have so far followed the CABB rule, especially taking into account that breaching the rule has no serious consequences.

If member state's public debt ratio to GDP is far below the 60% ceiling (like it is in Latvia), then it has a room for implementation of expansionary fiscal policy (below 3% per annum) for a longer period of time without any expected reversal in future. It gives us a reason to argue that the bigger is the public debt, the smaller is the fiscal authorities' room for manoeuvre, thus the better the Maastricht Treaty can serve as a useful framework for ensuring Ricardian expectations. We suppose the effectiveness of EU fiscal policy rules is higher in countries with debt level close to 60% ceiling.

In light of all said above there are reasons to suggest that non-Ricardian fiscal policy regime is practically *plausible* in any EU member state in spite of the existence of the common fiscal policy rules. In the fourth section the author intends to test whether fiscal policy implemented by Latvia's government can be treated as consistent with Ricardian regime or not, but, before that, in the third section, the short literature overview of different testing procedures applied so far in empirical investigations together with the results of these investigations is provided.

3. Literature Overview of the Fiscal Policy Regime Testing Procedure

In assessing the FTPL for a particular time period and a particular country's fiscal policy a key issue is the plausibility of the non-Ricardian expectations. Monetarists argue that "governments are usually ready to adjust fiscal policy when the debt explodes" (Christiano, Fitzgerald (2000)), thus non-Ricardian fiscal policy expectations in their view are not likely to arise. Proponents of FTPL in their turn argue that "for the FTPL to be a positive theory it is not necessary that it *always* holds. As emphasized by Woodford (1998a) "it may provide a useful characterization of actual policies in some contexts even if it doesn't in others". Fiscal policy in USA in 1960-s and 1970-s and Brazilian fiscal policy in the late 1970-s and early 1980-s are argued to be examples of non-Ricardian fiscal policy regimes⁸.

Empirical literature on the relevance of Ricardian vs non-Ricardian fiscal regimes is rather scarce. In assessing empirically the plausibility of non-Ricardian expectations it is not enough with simple examining of the time series data since under both Ricardian and non-Ricardian expectations intertemporal budget constraint is in equilibrium. What makes these two kinds of expectations differ is the way in which this equilibrium gets satisfied that cannot be easily observed as we usually deal with time series data reflecting equilibrium.

As Christiano and Fitzgerald (2000) stress "if governments directly recorded in writing what their policy is, this would help us to discriminate between the two policy regimes". SGP in their view is one of the examples of such an arrangement, when governments commit themselves to particular fiscal policy regime. Nevertheless, as it was previously stated, lack of credibility can undermine the role of the SGP.

In spite of the difficulties described above there are some formal ways of testing for the fiscal policy regime. One of the few attempts is related to those of Canzonery et al. (1997, 2000), Melitz (2000), Cochrane (1999) and Afonso (2002). All approaches are quite similar, since they focus on the relationship between the primary balance and the government liabilities.

⁸ See Woodford (1998a, 1999) and Loyo (1999)

Canzonery et al. (1997, 2000) run a bivariate VAR model in the primary budget balance ratio to nominal GDP and the government liabilities (federal debt together with the money base) ratio to nominal GDP and interpret the response of both variables to shocks in the primary budget balance ratio in terms of Ricardian and non-Ricardian regimes:

If a positive shock in the primary budget balance ratio (s_t) leads to a decrease in the next period's level of government liabilities (w_{t+1}), then there are two possible explanations:

government uses budget surplus to pay off some of the debt and the level of government liabilities falls (Ricardian explanation);

there is a negative correlation between the current and future expected budget surpluses and current increase in s_t is expected to be more than offset by a decrease in s_{t+k} ($k=1, \dots, T$). It leads to the fall in the discounted sum of all current and expected budget surpluses. Prices adjust upwards leading to lower next period's government liabilities (non-Ricardian explanation).

An increase in the next period's government liabilities after a positive shock in the primary budget balance can only arise in non-Ricardian regime under a positive correlation between s_t and s_{t+k} ($k=1, \dots, T$). In this case agents do not anticipate reverse fiscal policy in future demanding for less goods and services, resulting in the downward pressure on prices and upward pressure on the next period's government liabilities.

Finally, if a positive shock in the primary budget balance does not have any impact on the next period's real government liabilities, then there is only non-Ricardian explanation why should this occur. It is based on the absence of any correlation between s_t and s_{t+k} ($k=1, \dots, T$) and no changes in the present value of future expected budget balances.

Summarizing, Canzonery et al. (2000) strategy of testing the hypothesis of a non-Ricardian fiscal policy regime is as follows:

Estimate VAR;

Impose a positive structural innovation upon s_t ;

If an increase in s_t leads to a decrease in w_{t+1} then one has to proceed with calculating $\text{cov}(s_t, s_{t+k})$ (using univariate autocorrelations or running impulse response function of shocks in s_t on s_{t+k}). If there is another relationship between s_t and w_{t+1} , then the most likely there is a non-Ricardian fiscal policy regime.

Using US annual data for the period 1951-1995, Canzonery et al. (2000) find that Ricardian explanation seems to be more coherent. This conclusion is in line with Cochrane's (1999) result who applied similar strategy to annual US data for the period 1960-1996.

In their earlier research Canzonery et al. (1997) also concluded that there is no any indicator of the existence of a regime of fiscal dominance in the OECD countries.

Melitz (2000) has also contributed to the empirical investigation of Ricardian vs non-Ricardian fiscal policy regime. He estimated reaction functions for the OECD countries and found that there is a positive response of primary budget balance to positive innovations in the government liabilities. It seems to be consistent with the Ricardian framework in which the level of budget deficit is determined by the fiscal authority with a view to meet intertemporal government budget constraint and not arbitrarily what the proponents of FTPL would suggest.

Finally Afonso (2002) uses the panel of EU-15 countries and runs the following regressions:

$$1) \quad s_{it} = \beta_i + \delta s_{i,t-1} + \theta b_{i,t-1} + u_{i,t} \quad (9)$$

where $s_{i,t}$ is the primary budget balance ratio in country i for the period t , $b_{i,t-1}$ is the public debt ratio to nominal GDP in country i for the period $t-1$. β_i denotes the individual effects to be estimated for each country.

$$2) \quad b_{i,t} = \alpha_i + \gamma s_{i,t-1} + \varphi b_{i,t-1} + v_{i,t} \quad (7)$$

where α_i is used to denote the individual effects.

The hypothesis of *fiscal dominance* might be accepted if in terms of equation (6) $\Theta=0$, i.e. budget balance doesn't respond to the level of public debt and is therefore exogenously set by the fiscal authority or in terms of equation (7) $\gamma>0$, i.e. an increase in the budget surplus leads to an increase in the real government liabilities through price level adjustment.

The hypothesis of *monetary dominance* might be accepted if in terms of equation (6) $\Theta=0$, i.e. the fiscal authority adjusts its policy in order to meet intertemporal government budget constraint, or in terms of equation (7) $\gamma>0$, i.e. the government uses budget surpluses to reduce public debt.

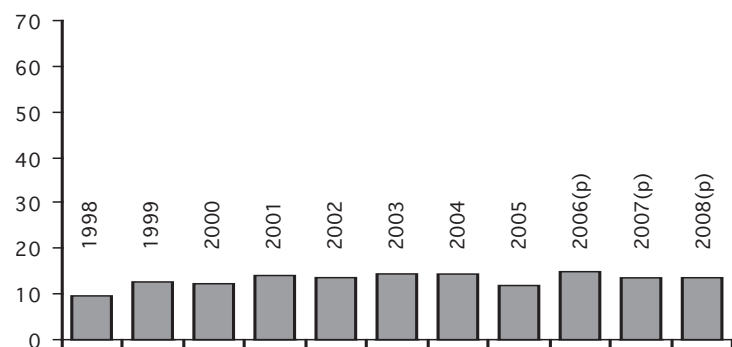
Both regressions run by Afonso (2002) end up in the coefficients consistent with Ricardian fiscal policy regime. He thus concludes that "there is no evidence that can be regarded as supporting the FTPL for this set of European countries".

Therefore, empirical investigations conducted so far for US, OECD and EU-15 countries have no much to say in favour of the relevance of the FTPL. Now we turn to the next section of this paper, which is devoted to the assessment of the fiscal policy regime in Latvia.

4. Empirical Assessment of Fiscal Policy Regime in Latvia

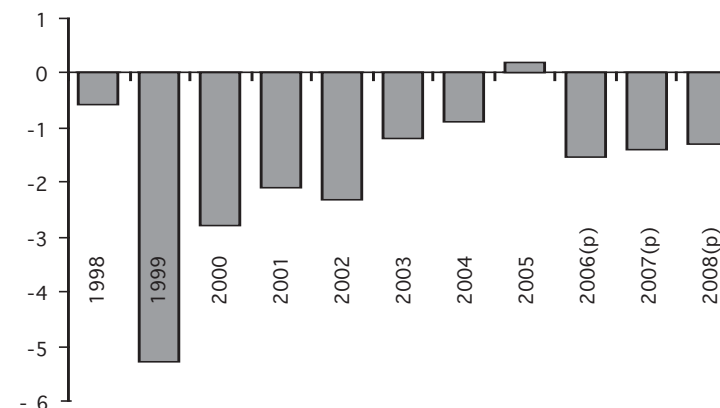
The ratio of public debt to GDP in Latvia is much lower than the 60% ceiling, defined in the Maastricht Treaty (see Figure 1). Budget balance ratio is also consistent with the EU rules (see Figure 2). According to the Update "Convergence programme 2005-2008", submitted in December 2005, Latvia's government commits itself to run budget deficits, not exceeding the reference value of 3% of GDP up to the last year covered by the program. However if during the last years Latvia's government shown some consolidation effort and even managed to record a surplus in 2005, then in 2006 it is to implement loose fiscal policy with no considerable consolidation announced for 2007-2008. Furthermore, there is no commitment to reach -1% of GDP in cyclically adjusted terms even in 2008, implying that the Ministry of Finance is reluctant to implement necessary measures to pursue an annual adjustment in cyclically adjusted terms of at least 0.5% of GDP, as it is required by the SGP.

Figure 1. Public debt in Latvia (as a ratio to nominal GDP, 1998-2005, with projections up to 2008)



Source: Central Statistical Bureau; projections are from Update "Convergence programme 2005-2008"

Figure 2. General government consolidated budget balances in Latvia (as a ratio to nominal GDP, 1998-2005, with projections up to 2008)



Source: Central Statistical Bureau; projections are from Update "Convergence programme 2005-2008"

Assessing empirically fiscal policy regime in Latvia we follow the above described approach of Canzonery et al. (2000). We estimate VAR in the primary balance ratio to GDP and the public debt ratio to GDP and then we assess the responses of both variables in the period $t+1$ to an innovation in the primary balance ratio in the period t . Impulse response functions allow us to discriminate between Ricardian and non-Ricardian fiscal policy regimes. As mentioned previously, only negative response of the public debt to a shock to the primary balance is consistent with Ricardian equivalence theory. In a non-Ricardian setting the response may be positive, zero or even negative, if there is significant negative autocorrelation in the primary balance ratio.

We run the following standard Vector Autoregression model:

$$\begin{cases} s_t = \alpha_{10} + \sum_{i=1}^k \alpha_{1i} s_{t-i} + \sum_{i=1}^k \beta_{1i} b_{t-i} \\ b_t = \alpha_{20} + \sum_{i=1}^k \alpha_{2i} s_{t-i} + \sum_{i=1}^k \beta_{2i} b_{t-i} \end{cases} \quad (8)$$

where s_t denotes for the primary balance ratio to nominal GDP and b_t is the public debt ratio. Since economic series on an annual basis in Latvia are too short to apply any econometric technique we explore seasonally adjusted⁹ quarterly data for the time period 1999Q1-2005Q3¹⁰. Since the data for the Republic of Latvia is quarterly, it is important to observe the response of the public debt ratio to a shock in the primary balance ratio up to reasonably long horizons. But interpreting results of different tests applied in this section we have to remember that the sample size is rather short, thus we have to treat them with a great portion of caution.

Since we are not confident which of the two variables is actually exogenous we estimate VAR, which treats each of the variables symmetrically. In order to choose the most appropriate lag length we run various tests that compare the unexplained part of the variables and the number of degrees of freedom. Naturally, increasing the lag length we raise the explanatory power of the model at the expense of increasing a number of regressors and decreasing a number of degrees of

⁹Both variables were seasonally adjusted using X12 method.

¹⁰Unfortunately quarterly data on the level of public debt are available only beginning with 1999.

freedom.

Testing results are summarized in Table 1, which indicates that the most popular test statistics end up in two different lag lengths (one lag and two lags).

Table 1. Lag length selection criteria

Lag	LR	AIC	SC
0	NA	7.430	7.526
1	42.095	5.973	6.261*
2	9.852*	5.821*	6.301
3	3.362	5.949	6.621
4	2.229	6.122	6.896

* indicates lag length selected by the criterion
 LR: sequential modified Likelihood-ratio test statistic
 AIC: Akaike information criterion
 SC: Schwarz information criterion

Thus we run the model with one lag and then add a second lag. The estimation results for VAR(1) and VAR(2) are shown in Table 2.

Table 2. VAR estimates*

Variables	VAR (1)		VAR (2)	
	s_t	b_t	s_t	b_t
s_{t-1}	0.251 (0.181) [1.392]	-0.045 (0.050) [-0.901]	-0.097 (0.190) [-0.508]	-0.003 (0.060) [-0.044]
s_{t-2}	-	-	0.118 (0.175) [0.675]	-0.073 (0.055) [-1.332]
b_{t-1}	0.872 (0.347) [2.511]	0.787 (0.095) [8.247]	-0.765 (0.622) [-1.228]	0.917 (0.196) [4.684]
b_{t-2}	-	-	1.980 (0.673) [2.941]	-0.145 (0.212) [-0.684]
c	-11.828 (4.493) [-2.633]	2.716 (1.235) [2.199]	-16.359 (4.276) [-3.826]	2.868 (1.344) [2.134]
R^2	0.311	0.744	0.531	0.772
Adjusted R^2	0.254	0.723	0.445	0.731
Sum sq. resids	95.972	7.251	65.400	6.458
S.E. equation	2.000	0.550	1.724	0.542
F-statistic	5.422	34.882	6.218	18.628
Log likelihood	-55.432	-20.564	-50.255	-18.999
Akaike AIC	4.328	1.745	4.093	1.778
Schwarz SC	4.472	1.889	4.333	2.018
Mean dependent	-0.988	12.788	-0.988	12.788
S.D. dependent	2.315	1.044	2.315	1.044
Log likelihood	-74.633		-68.587	
Akaike AIC	5.973		5.821	
Schwarz SC	6.261		6.301	

* Standard errors are reported in parentheses and t-statistics in square brackets.

Different diagnostic tests indicate that the models are specified properly since:

the stability condition is met (see Figure A1-1 in Appendix 1);

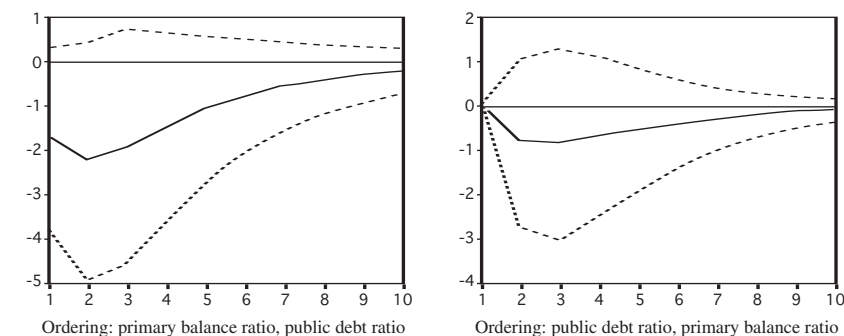
there is no serial correlation in residuals up to 8 lags (see Table A1-1 in Appendix 1);

the normality of residuals is secured (see Table A1-2 in Appendix 1).

Residual cross-equation correlation coefficient (0.31) in VAR(1) is deemed to be significant at conventional levels (5% level), thus indicating that structural innovations do not closely follow the residuals of the standard VAR(1) and reversing the ordering may have implications on the impulse response derived from VAR (1)¹¹.

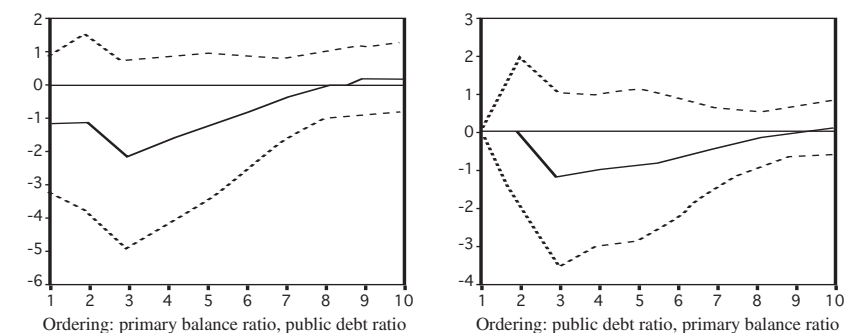
Figure 3 contains plots of the impulse response functions together with their confidence intervals of the VAR(1) computed for both orderings. Results indicate that regardless of the ordering chosen, there is no significant response of the public debt ratio in the periods that follow the innovation in the primary balance ratio since the bands of the 95% confidence interval take values of opposite signs up to 10 periods ahead. This is a feature of the non-Ricardian fiscal policy regime.

Figure 3. Response of the public debt ratio to shock in the primary balance ratio (VAR is estimated in *one* lag)



To increase robustness of the results impulse response functions were derived using VAR estimated in two lags. Plots of the impulse response functions together with confidence bands are given in Figure 4. Similar pattern of insignificantly different from zero response of the public debt ratio to a shock in the primary deficit ratio is observed, when VAR is run in two lags, contributing to our previous results.

Figure 4. Response of the public debt ratio to shock in the primary balance ratio (VAR is estimated in *two* lags)



¹¹ To test the null hypothesis that there is no cross equation correlation in residuals one usually uses a normal distribution with a mean of zero and a standard deviation of $T^{-0.5}$ (T is the number of observations).

Thus, the results are robust to the inclusion of the additional lag and do not depend on the ordering in Cholesky decomposition. In fact, the results are robust to other alternative specifications (with more lags) too.

The main findings can be summarized as follows:

A positive structural innovation in the primary balance ratio to GDP has no significant impact on the ratio of the public debt implying that primary surpluses are not used to reduce public debt burden. This is a sign of the exogeneity of the primary balance in Latvia, i.e. primary balances are set regardless of the level of the public debt and this gives us a reason to suppose that Latvia's fiscal policy regime can be treated as non-Ricardian.

However, one has to be very careful with such interpretation of the modelling outcome, since the confidence intervals in the impulse response functions are very large, possibly stemming from an unsatisfactory fit of VAR equations. The latter to some extent reflects small sample size problem. Therefore there is no clear cut answer to the question raised in the title of the paper. Nevertheless author supposes that if non-Ricardian fiscal policy regime cannot be ruled out and there are signs that Latvia's government pursued loose fiscal policy may contribute to an increase in price level, then *Latvia's government commitment to implement tighter fiscal policy could be one of the inflation reducing elements.*

5. Conclusions

This paper focused on the indirect impact of fiscal policy on prices through aggregate demand channel. According to the *Fiscal Theory of Price Level*, budget deficit is an exogenous factor, determined by political process that implies that fiscal policy regime is non-Ricardian. Alternatively, monetarists view budget deficit as an endogenous factor, which moves automatically to ensure fiscal solvency. If the FTPL matters then there is a clear link between the fiscal deficit and inflation and central bank's commitment to price stability is not enough to ensure it.

Recent empirical studies in this area conducted for developed economies have had no much to say in favour of the relevance of the FTPL. Nevertheless Latvia is taking a quite different position, e.g. with respect to the level of public debt. Furthermore it has been shown that a positive shock in the primary balance ratio to GDP turns out not to influence significantly the ratio of the public debt. Thus primary surpluses are not used to repay some part of the debt, meaning primary balance is not dependent from the level of the public debt, i.e. it is an exogenous factor. Therefore the study provides evidence supposing that fiscal policy regime in Latvia could be treated as non-Ricardian, implying that the indirect impact of fiscal policy on prices may exist.

Despite shortcomings stemming from small sample size, the paper brings about important policy implication: Latvia's government commitment to implement tight fiscal policy could be one of the inflation reducing policy elements.

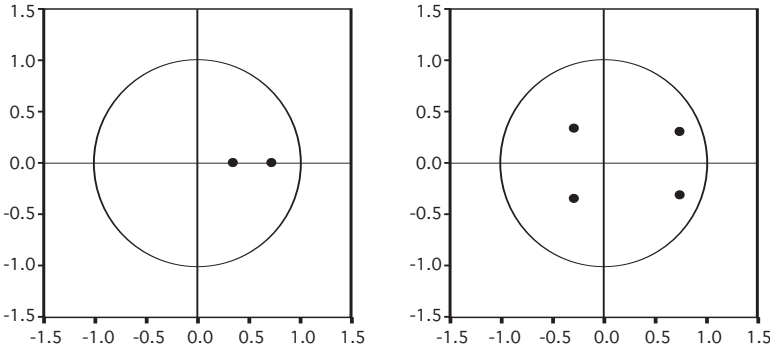
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Appendix 1. Diagnostic Tests of VAR Equations

Figure A1-1. Inverse Roots of AR Characteristic Polynomials in VAR(1) and VAR(2), *



* No root lies outside the unit circle, both VARs satisfy the stability condition

Table A1-1. VAR residual serial correlation multivariate LM test

Lags	VAR (1)		VAR (2)	
	LM-test statistic	Probability	LM-test statistic	Probability
1	10.104	0.039	2.860	0.582
2	3.445	0.486	4.043	0.400
3	1.046	0.903	1.281	0.865
4	2.489	0.647	1.287	0.864
5	3.379	0.497	3.180	0.528
6	1.585	0.812	4.018	0.404
7	1.124	0.890	0.683	0.953
8	3.009	0.556	1.391	0.846

Table A1-2. VAR residual multivariate normality tests

Joint	Probability	
	VAR(1)	VAR(2)
Skewness	0.775	0.744
Kurtosis	0.310	0.063
Jarque-Bera	0.583	0.189

Inequality and the Transition: Regional Development in Lithuania¹²

Larry Sawers¹³

Abstract: This research explores the substantial growth in regional inequality within Lithuania in the post-socialist era. A few regions, especially the capital city and its environs, have been able to attract substantial foreign investment, bolstering wages and employment and easing the move to a market-based economy. Isolated rural areas with few opportunities for formal or informal sector employment or even commercial farming have suffered the most, while smaller industrial cities with collapsing employment in manufacturing are in an intermediate position. The paper uses descriptive statistics as well as ordinary least squares and fixed-effects panel regressions to examine this issue.

Keywords: Transition, Inequality, Lithuania, Regional Development,

JEL codes: P 250

1. Introduction

This article explores the substantial growth in regional inequality within Lithuania in the postsocialist era. A few of the country’s regions, especially the capital city and its environs, experienced rising real incomes with only small declines in employment. Isolated rural backwaters suffered the most as real incomes and employment fell sharply during the early stages of the transition from socialism and have not regained their pre-1991 levels. Smaller industrial cities are in an intermediate position. The purpose of this paper is to describe the extent and character of these changes and offer an explanation for them.

The paper begins with a discussion of the changes in regional income inequality in the transition countries of Central and Eastern Europe as market-oriented economies replaced socialism. The purpose of that introduction is to show that the regional reconstruction of Lithuania replicates in many important ways the experience of neighboring countries. In order to explain the extraordinary speed and depth of Lithuania’s spatial reconfiguration, the paper then discusses the country’s wrenching restructuring of the economy in the 1990s. The third section of the paper undertakes a detailed examination of the economies of the three major cities and their surrounding districts, the smaller industrial cities, and then finally the districts in which small towns and farms predominate. Descriptive statistics are used to illuminate the extent and nature of those different regional experiences. In the fourth section of the paper, both ordinary least squares (OLS) and panel regressions are used to explore further why the different regions of Lithuania have followed such divergent paths since 1991. The paper concludes with a summary and a discussion of the policy implications of the findings.

¹²The inspiration for this research is found in the work of my colleague Mieke Meurs. This paper benefited from many helpful comments, suggestions, and conversations with Eileen Stillwaggon, Mark Chandler, Zuzana Brixiova, Šarunas Grigas, Aiste Grencevičiute, Mindaugas Leika, Ieva Noreikaite, Evaldas Burneika, Margarita Starkevičiute, Žymantis Svetikas, and Vladimir Rakčev. Jessica Todd estimated panel regressions for this paper.

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¹³Larry Sawers (lsawers@american.edu) is Professor of Economics at American University, Washington, DC 20016-8029, USA.

2. Regional Inequality in the European Transition

The transition from socialism to market economies in Central and Eastern Europe produced a sharp increase in income inequality. Under the socialist system, the distribution of wages and of transfer payments tended to be relatively equal (though nonwage employment benefits varied greatly), most people earned most or all of their income from wages, and there was little unemployment. The transition allowed some to profit dramatically from the new regime; wage inequality grew, some independent entrepreneurs and business leaders prospered, but others found their wages falling or could find no employment of any sort. The increase in income inequality was especially sharp in Lithuania. Of all European transition economies outside the CIS,¹⁴ Lithuania had the highest Gini coefficient on *per capita* income by the mid 1990s and the largest increase in the Gini coefficient between the late 1980s and that time. It also had the largest increase in head count poverty (Milanovic 1995: 14 and 1998: 41).

The growth in income inequality during the transition in Central and Eastern Europe had a strong regional dimension. During the socialist era, many of the countries in that region had engaged in aggressive efforts to disperse industrial development to medium-sized cities and bring schools and clinics to rural areas, thereby compressing spatial differentials in living standards. Once market forces were unleashed and government efforts to channel economic development were curtailed, spatial inequalities grew rapidly. Some regions found a place in the new order and prospered. Typically, major cities – especially capital cities – and their environs experienced the most growth and prosperity. Other regions, however, had played an economic role in the old centrally planned system, oriented toward Russia, that was not valued in the new market economy, linked to the West (Barjak 2001; Boeri and Terrell 2002: 63; see also Alam et al. 2005: 57–61).

Economic distress in European transition countries was most pronounced outside the cities. The incidence of poverty is highest in rural areas and villages and is lowest in the big cities (Milanovic 1998: 106).¹⁵ In all European transition countries except Romania, income in agriculture declined more than the income in other sectors in the early 1990s and rebounded less since the mid 1990s (Milanovic 1998: 57). The reasons for agriculture's distress are falling agricultural production, reduction or elimination of subsidies to inputs such as fertilizer, liberalization of food imports in some countries (including Lithuania), and the uncertainty associated with decollectivization (Milanovic 1998: 58). In most transition economies, the highest incidence of poverty within the working population is among farmers (Milanovic 1998: 93). Long-term unemployment and nonemployment (absence from the labor force) is greater in rural areas than elsewhere, especially among those who are less skilled (Boeri and Terrell 2002: 59, 62–63; Milanovic 1998: 96).

The lower average income and greater incidence of poverty in rural areas mask a wide variety of outcomes. In Bulgaria, for example, Meurs et al. (2002: 3–41) found that about half of a sample of rural households maintained their formal sector employment through the 1990s or developed new entrepreneurial activities. About a fifth had 'repeasantized' and returned to subsistence agriculture or had become economically inactive. The rest were somewhere in the middle. Unequal outcomes among Bulgaria's agricultural areas were magnified by the fact that households with better access to formal sector employment were more likely to live in the parts of the country with greater opportunities for informal economic activities. Inequality, thus, is not just a rural-urban issue since the impact of the transition on rural areas has varied widely.

¹⁴ The CIS is the Confederation of Independent States, which includes all of the former republics of the USSR except for the three Baltic Republics of Estonia, Latvia, and Lithuania.

¹⁵ The only exception is the Ukraine, due to prevalence in that country of consumption of home-produced goods (Milanovic 1998: 106–107).

3. Lithuania's Transition

The restructuring of the Lithuanian economy was exceptionally intense and that helps to explain the unusually rapid growth in income inequality. Most transition economies had substantial commercial and financial ties to the West before 1991 or maintained important links to Russia after that date. In contrast, Lithuania's economy had been almost completely integrated into that of the Soviet Union before the transition and the country had only weak links to the West. In 1991, only 2 percent of Lithuania's exports went to the EU, and only 3 percent of its imports came from the EU (Abdelal 2001: 100). In that same year, CIS countries took 86 percent of Lithuania's exports – Russia alone took 57 percent – and accounted for 84 percent of its imports. By 2001, however, the CIS purchased less than 20 percent of Lithuania's exports, and less than 30 percent of the country's imports came from the CIS (Statistics Lithuania, *Statistical Yearbook of Lithuania* 2002).

The thoroughgoing reorientation of the economy required an extraordinarily far-reaching and rapid restructuring. That helps to explain why, of the thirteen transition economies of Eastern Europe, Lithuania had the second (after Latvia) sharpest decline in real GDP in the early 1990s (Svejnar 2002: 9; Berengaut and Elborgh-Woytek 2005: 18). Between 1989 and 1994, industrial production fell 70 percent, more than in any other European transition country (De Broeck and Koen 2000: 10). The transition pulled the rug out from under the old economy before a new one could be built in its place.

Lithuania's conflictive relations with Russia in the first few years of independence made the transition especially difficult. Lithuania's early and contentious struggle to break free from the Soviet Union played an important role in the latter's disintegration, heightening Russian animosity toward the new republic. In late 1989, the Lithuanian Communist Party became the first party among the Soviet Union's republics to split away from the parent body. In March 1990, Lithuania was the first Soviet republic to declare its independence. In retaliation, the Soviets imposed an economic blockade, inflicting severe hardship on Lithuania. Early the following year, Soviet troops attacked civilian demonstrators and border guards, killing 21. The fallout from those confrontations played an important role in Gorbachev's ouster in mid 1991. The new leadership soon acknowledged Lithuania's independence, but relations between the two countries remained strained for years, complicating an already demanding transition process. In short, Lithuania's transformation went further and faster than that of almost all transition countries in Eastern Europe and faced greater animosity from Russia than any other country that had hopes of joining the EU.

In its eagerness to erase quickly every trace of the former communist system, Lithuania made choices that later impeded the country's transition. As in the Czech Republic and to a lesser extent in Slovakia, Lithuania's initial privatization program was carried out by equal-access vouchers (Svejnar 2002: 6). This produced a rapid (and superficially egalitarian) privatization, but left companies in private hands before management skills and supportive institutions could be developed. This technique also failed to produce the badly needed new funds (from foreign or national investors) that would have helped undercapitalized firms get on their feet, and it allowed widespread asset stripping, leaving firms worse off after privatization. In contrast, Poland and Slovenia privatized gradually, retaining state ownership while allowing semi-independent advisory boards to manage enterprises. Poland was also the most successful transition economy in spurring the formation of new enterprises (McMillan and Woodruff 2002: 156). Estonia and Hungary also proceeded cautiously, selling off enterprises one at a time. The method used by Lithuania to privatize its formerly state-owned enterprises led to widespread business failures that exacerbated what was already a difficult transition.

4. Regional Inequality in Lithuania’s Transition

Little has been written about the growth of regional inequality in Lithuania.¹⁶ Regional disparities in development became a concern of the government only when the country applied for accession to the EU in the late 1990s. In order to take advantage of EU subsidies to underdeveloped regions, Lithuania was required to generate the appropriate regional data and develop the tools for regional policy making (Maniokas 2000: 19–20; see also Marcou 2002: 18). The newly acquired interest in regional issues led to the first efforts to draft a regional plan in 1999. In 2002, a new law mandated that a regional plan be developed by the national government based on plans produced by county governments, but the law will not be implemented until 2006 after the county plans have been prepared.¹⁷

An examination of real GDP *per capita* across Lithuania’s ten counties shows a steep rise in the regional dispersion in incomes. As can be seen from the last column of Table 1, real GDP *per capita* in 2001 in Lithuania’s most prosperous county was two and a half times the level in the least affluent county, even though the figure had been only 60 percent greater in 1996 (when GDP data by county were first published). The standard deviation of *per capita* real GDP across the ten counties of Lithuania grew every year between 1996 and 2001. By the end of that period, it was 2.2 times the figure six years earlier (Calculated from Statistics Department, *Counties of Lithuania*, 2001: 411).

Table 1. Real GDP *per capita* by County, 1996-2001

County	Real GDP per capita compared with 1996						Real GDP per capita compared with the national average					
	1996	1997	1998	1999	2000	2001	1996	1997	1998	1999	2000	2001
Lithuania	1.00	1.08	1.14	1.11	1.15	1.23	1.00	1.00	1.00	1.00	1.00	1.00
Alytus	1.00	1.07	1.09	1.06	1.07	1.12	0.85	0.84	0.81	0.82	0.79	0.77
Kaunas	1.00	1.12	1.17	1.12	1.14	1.24	0.96	0.99	0.98	0.97	0.95	0.97
Klaipeda	1.00	1.04	1.12	1.11	1.16	1.21	1.11	1.06	1.08	1.11	1.11	1.09
Marijampole	1.00	1.09	1.14	0.94	1.02	1.06	0.79	0.80	0.78	0.67	0.70	0.68
Panevezys	1.00	1.07	1.07	0.93	0.99	1.03	1.01	1.01	0.95	0.85	0.87	0.85
Šiauliai	1.00	1.06	1.01	0.96	0.96	0.98	0.90	0.88	0.79	0.78	0.74	0.71
Tauraga	1.00	0.93	0.92	0.86	0.92	0.94	0.74	0.64	0.60	0.58	0.59	0.57
Telšiai	1.00	1.04	1.09	1.04	1.10	1.19	0.91	0.87	0.87	0.85	0.87	0.88
Utena	1.00	1.04	1.11	1.06	1.07	1.08	0.93	0.90	0.91	0.90	0.87	0.82
Vilnius	1.00	1.11	1.25	1.28	1.36	1.48	1.18	1.21	1.29	1.36	1.38	1.41

Source: Calculated using GDP and population data from Department of Statistics, *Counties of Lithuania*, 2002, 432; GDP deflator calculated from nominal and real GDP statistics from Department of Statistics, *Statistical Abstract 2002*.

As in most European countries in transition, the major Lithuanian cities and their adjacent communities fared the best. Their better developed infrastructure and agglomeration economies attracted direct foreign and domestic investment. Cities and regions whose products have been

¹⁶ The best overview of regional development is Starkevičiūtė (2000), though this report says little about agriculture and rural areas.

¹⁷ Interview with Dr. Žymantis Svetikas (who helped draft the law) of Vilnius University, in Vilnius, June 2, 2003.

able to penetrate export markets have survived the transition process far better than those unable to attract foreign consumers. While some areas have received new investment, including direct foreign investment, other communities have been hit hard by the failure of enterprises that had once brought a measure of prosperity. Between 1992 and 2001, formal sector employment in Lithuania fell by 18 percent.¹⁸ It rose in only two of Lithuania’s 60 districts, both of which were suburbs of major industrial cities. Employment in industry fell by about a third, shrinking or stagnating in almost all of the country’s districts. (Some suburbs of major industrial cities benefited from the movement of industry to outlying areas within the metropolitan region.) Nonindustrial employment fell by over 10 percent for the country as a whole and rose in only a dozen of the country’s districts. Informal sector employment has most likely made up some of this loss in formal sector jobs, but without published statistics, one cannot say by how much.



¹⁸ Unless otherwise noted, the discussion in this section of the paper relies on data from Statistics Lithuania, *Counties of Lithuania* published annually from 1994 through 2002. From those publications, one can find data on formal sector employment, employment in industry, average earnings and average earnings in industry for the counties and districts of Lithuania. By subtraction, we know nonindustrial employment and nonindustrial average earnings. These publications also give GDP by county. From those data, I was able to compute *per capita* real GDP by county, which is presented in Table I. *Counties of Lithuania* also provides data on fixed investment, direct foreign investment, exports, unemployment rates, and a wide variety of measures of agricultural production. In the following section of this paper, I discuss problems with the data, including measurement errors and difficulties posed by changing district and county boundaries.

Lithuania's major highway and rail arteries link the three largest industrial and commercial cities, Vilnius, Kaunas, and Klaipėda, reinforcing their dominant position in the national economy. The location of the national government in Vilnius – in which 16 percent of the country's population lives – also give that city an edge. The government not only invested more in the city than elsewhere, but externalities associated with the government favored the private sector as well.¹⁹ In addition, direct foreign investment *per capita* in Vilnius between 1994 and 2001 was the highest in the country and was also substantial in the suburban district that surrounds Vilnius. Many of the country's large infrastructure enterprises were privatized in sales to foreign investors. The new owners tended to locate their headquarters in Vilnius, closing down branch offices around the country and thereby magnifying the regional disparities that the transition process produced (Starkevičiūtė 2000: 30). Vilnius and the jurisdictions that surround it (Vilnius district, Trakai and Elektrenai), had the second highest average nonindustrial earnings in 2001. Between 1996 and 2001, *per capita* real GDP in the county in which Vilnius is located grew by half, by far the most of any county. Even in the wake of the Russian financial crisis in 1998, *per capita* real GDP in Vilnius County continued to grow, contrasting with the lingering recession in the rest of the country. Despite these important gains, formal sector employment in Vilnius fell by 26,000 (an 8 percent decline) between 1993 and 2001; most of this decline was caused by the contraction of industrial employment. Vilnius district (which surrounds Vilnius city) gained more nonindustrial workers (about four thousand) and more industrial workers (over 1300) than any other district in the country in that period.

During Soviet times, the industrial sector of Kaunas (the capital in the interwar period) was nearly as large as that of Vilnius, but between 1993 and 2001, the city's industrial employment fell by over 26,000 (a 42 percent drop) with only a small increase in nonindustrial employment, so total employment fell by 14 percent. Average earnings in Kaunas remained at about the national average in recent years. Kaunas county had the second greatest volume of exports, but direct foreign investment (DFI) *per capita* in Kaunas city was only about a quarter of the amount that went to Vilnius city. Between 1996 and 2001, *per capita* real GDP in the county in which Kaunas is located grew by 24 percent and hovered between 95 and 99 percent of the national average.

The country's third city, Klaipėda, even though it is the only substantial Baltic seaport in the country, lost 13 percent of its formal sector jobs between 1993 and 2001. Almost all of the decline was in industrial jobs. Klaipėda and the district of the same name that surrounds it received about half as much DFI *per capita* as did Vilnius. Between 1996 and 2001, Klaipėda county's real GDP *per capita* grew by about one fifth and remained about 10 percent more than the national average.

In addition to the three major industrial cities, Lithuania has four other industrial centers. (This contrasts with Latvia and Estonia where most industry is in the capital city). The country's most important petroleum refinery in Mažeikiai brought a measure of prosperity to that city – average earnings of industrial workers there were nearly double the national average. Because of the refinery, employment in the city was essentially unchanged between 1993 and 2001, but the unemployment rate was one of the highest in the country by 2001. The county where the refinery is located (Telšiai County) had the greatest volume of exports in 2001 of any county, and the refinery's district was also an important recipient of direct foreign investment. (The refinery's

majority owners are Russian.) The income generated by the refinery has not spread to the rest of the county, where earnings have been well below the national average. The county's *per capita* real GDP remained 10 or 12 percent under the national average between 1996 and 2001.

Alytus, Šiauliai, Panevėžys have or used to have important food processing or beverage industries and garment and/or textile industries. The largest two of those industrial centers also employed many workers in other industries, such as metal fabrication, machinery, and construction materials. The three cities have been battered by the transition. Industrial employment fell by 25, 48, and 31 percent respectively between 1993 and 2001. At the end of that period, industrial employment as a share of formal sector employment was between 16 and 32 percent. Šiauliai and Alytus Counties are two of the four poorest in the country; Šiauliai County is one of only two in which *per capita* real GDP fell between 1996 and 2001. The three cities received between 10 and 30 percent as much direct foreign investment *per capita* as Vilnius and export little to the rest of the world.

Another district where a single enterprise brought substantial gains to the local economy is Ignalina where the country's nuclear power generator is located. Ignalina had by far the highest nonindustrial average earnings of any district in the country. How long this will last is in question. As a condition of EU accession, the country must shut down its Chernobyl-style reactors. Whether or not a new reactor will be built at the site is still not decided.

The decline in agricultural production during the transition has exacerbated the growth in regional inequality. Average farm size, land devoted to grain cultivation, and milk sold by farms, for example, all declined by about one quarter from the early 1990s to 2002. In 2001, 11 percent of the urban population in Lithuania and 8 percent of those in major cities were poor by official measures, but 27 percent of the rural population and 35 percent of farmers were poor (Statistics Lithuania, *Social Trends* 2002: 46; Jalinskiene and Stanikūnas 2003: 96).²⁰ The rural share of Lithuania's population actually grew during the 1990s as some urban residents gave up trying to find a job in the city, dropped out of the modern economy, and reverted to subsistence agriculture (Jalinskiene and Stanikūnas 2003: 81, 95).

The poorest counties in Lithuania are Taurage and Marijampole. In the former, real *per capita* GDP fell 6 percent between 1996 and 2001, from three quarters to 57 percent of the national average. Marijampole is the second poorest county in Lithuania, with a GDP *per capita* only two-thirds of the national average. The two counties had the smallest amount of exports among the country's ten counties and the smallest amounts of direct foreign investment *per capita*. They are the only counties where a majority of the population lives in rural areas: 59 percent in Taurage and 50.5 percent in Marijampole. The two counties have the lowest proportion of the population of working age (between 15 and 60) in Lithuania. There are other poor, largely rural districts outside of these two counties. For example, there are six districts along the Belarus border with very high proportions of the rural population above the working age (31 to 35 percent) and very high proportions of farms worked by people aged 60 and over (59 to 65 percent).

Official data on income and employment can be misleading since people find ways to cope with the transition in creative ways that are not reflected in the published statistics. Druskininkiai

¹⁹ Public expenditure at the district level has magnified the uneven development of the economy (Starkevičiūtė 2000: 32). In the poorer districts, governments have been forced to spend more on social services, including providing tax abatements to those in need. Where the economy was strong, local government was able to divert a larger share of the budget to economic development. Public investment expenditure *per capita* by the national government has been even more unevenly distributed, with Vilnius receiving double the national average and more than four times the level in less favored districts. Despite the apparent importance of public expenditure in understanding regional inequality in Lithuania, I was unable to develop useful variables for the present research from government publications.

²⁰ The analysis of regional disparities in economic development in Lithuania is hampered by an acute lack of useful information about agriculture. For each of Lithuania's sixty districts, the government publishes data about the number of eggs or pigs produced, for example, but does not measure the number of farmers, the number of people supporting themselves with income from agriculture, off-farm income of farmers, gross agricultural output, net farm income, household income of farms or similar summary measures that would permit the researcher to get a fix on the problems faced by agriculture. In 2003, the government conducted a special survey of agriculture, but found that many farmers were unwilling to be counted or give other information, since many feared greater tax liabilities might result from participating in the survey.

district, for example, is a part of Alytus County. The unemployment rate in the rest of the county was 14 percent in 2001, not far above the 12.5 percent national average. Druskininkiai, in contrast, had the highest unemployment rate in the country – 28 percent. Many legal residents of Druskininkiai live and work in neighboring Poland even though they register as unemployed with the Lithuanian government. They rent out their apartment or house that they own, thanks to privatization, and return only once a month to collect the rent. To be sure, the breakup of the Soviet Union has turned them into economic refugees, but the published data overstate their economic problems.²¹ As another example, Marijampolė has developed a thriving business reconditioning automobiles from Western Europe and selling them to Belarusians. Exactly how the vehicles are obtained in the West is obscure, but it is clear that the growth of the used car industry has cushioned the decline in formal sector employment experienced by the county during the transition.

5. Regression Analysis

The foregoing section of the paper examined regional inequality in Lithuania by describing the different experiences of the country's cities, districts, and counties during the transition to a market-oriented economy. That discussion, based largely on tabular and descriptive data from *Counties of Lithuania*, looked at regional differences in earnings and *per capita* real GDP and their association with employment, unemployment, foreign direct and fixed investment, exports, and agricultural production. Those variables have played prominent roles in earlier works on the subject, most especially Starkevičiūtė's (2000) chapter on regional inequality in Lithuania and the literature on other transition countries in Eastern and Central Europe. The next step is to use multivariate regression analysis to measure the importance of the variables woven into the narrative in the previous section of the paper. Regression analysis can enhance our understanding of the relationship among these variables by offering more convincing measures of statistical significance and statistical importance in a multivariate rather than bivariate format.

The data used in the regression analysis are drawn from publications by the statistical office of the Lithuanian government, *Counties of Lithuania: Economic and Social Development* from 1994 to 2001.²² This is the only source of data on Lithuania's districts for the period in question. Those data are problematic for a number of reasons. Employment data, for example, exclude farmers and workers without formal contracts, such as consultants, temporary workers, and anyone in the 'invisible economy' outside the government's bureaucratic reach. Unemployment data are for those who register at government employment offices and thus exclude discouraged workers or anyone who thinks the government could not help them in their search for employment. Those who are officially unemployed might include those who are actually working in the invisible economy (or who emigrated to another country) but would like the government to help them find a formal sector position in their home town. The few household surveys that have tried to estimate unemployment at the national level find much higher levels than the official data indicate. Earnings data refer to contractual wages or salaries, but many companies are in arrears in salary payments, and still others pay more than the contractual amount in order to avoid taxes. Furthermore, since people move about the country looking for work, they might be considered unemployed in the city where they have registered at the employment bureau, but are employed or looking for work in another city. There are no published data by region on worker productivity; the only data available are gross sales (not valued added) of industrial workers (not all workers). Lastly, annual data on the population during the 1990s were calculated by taking the previous

²¹ Interview with Zuzana Brixiova, June 16, 2003, in Vilnius.

²² The 2002 edition of the publication discontinued some data series appearing in earlier editions and altered the way other data series were presented. That made it impossible to extend the regression analysis beyond 2001.

year's figure, adding births, and subtracting deaths. The census in 2001, however, found a population about 6 percent smaller than expected. Of course, 6 percent of the population did not vanish in a year, but melted away year by year, apparently through migration. So the published data for population increasingly overestimate the true figure after 1994 and until 2001.

Most of the data in *Counties of Lithuania* are presented by district as well by county. The first volume in this series appeared in 1994. The author constructed a panel of data for each year from 1994 to 2001 by district, of which there were 60 in 2001. A variety of adjustments were required in order to make the data comparable from year to year. All financial variables were in current units of the national currency, so the author adjusted all earnings and investment data by a published price index. As the country matured, it kept rearranging the pattern of districts it had inherited from the Soviet Union. In cases in which territory was merely taken from one district and given to an adjoining one or in which a single district was split into two smaller districts, the districts in question could simply be added together to form larger units whose boundaries had not changed over the study period. There were four districts whose boundaries were changed extensively and in complicated ways and three others missing crucial data so that they had to be dropped from the analysis. This left 46 districts (5 of which were composite districts) whose boundaries were the same or virtually the same from 1994 to 2001. Lastly, some of the variables used in the analysis were calculated on a *per capita* basis, so the published population data had to be corrected. Since the data for 1994 and 2001 were reasonably good estimates, but the data for the intervening years were incorrect, the author interpolated between 1994 and 2001 to construct a new data series assuming a constant rate of decline in the population. The new series is clearly wrong, but is more accurate than the published data.

Based on prior studies of regional inequality in Lithuania and elsewhere and on the evidence presented in the previous section of the paper, it was expected that employment rates and average earnings across regions would vary positively with investment and inversely with unemployment rates. Since industrial employment in most districts has fallen sharply and fallen more than nonindustrial employment, labor market distress, other things equal, is likely to be greater in districts with a high share of industry. Thus, employment rates are expected to be inversely correlated with the share of industrial employment. Highly urbanized districts are expected to have higher employment rates and higher earnings because of regional variation in the cost of living, the greater level of infrastructure and agglomeration economies in urban areas, and the higher levels of educational attainment and educational quality. Earnings should also vary positively with the workers' productivity, though the data allow us to measure only gross sales per worker in industrial firms.²³

The first column of Table 2 presents an OLS regression on the share of the population that was employed in 2001 across 47 districts of Lithuania for which there were usable data. The second column presents a panel regression with fixed effects on the same dependent variable for the years 1994–2001. (Coefficients on the year dummies are not shown, but none of them is significant at

²³ Worker's productivity depends at least in part on various dimensions of human capital. The only data available by district that measure human capital are the educational attainment of the population and the educational attainment of school teachers (as an indicator of the quality of education). All of these variables were highly collinear with the proportion of the population that lived in urban areas. For example, the simple correlation (R) across Lithuania's districts of the urban share of the population with the proportion who graduated from college was 0.97, with the proportion who graduated from basic or primary school, 0.84, and with the proportion of school teachers with university degrees, 0.92. The various human capital variables were also highly collinear with each other. The urban share variable captures the effects of agglomeration economies and (for the earnings equations) the price level in addition to variations among districts in human capital, so the more inclusive variable (level of urbanization) instead of a human capital variable was used in estimating the regressions. Another set of variables that are of great interest in the present context has to do with public spending. Nevertheless, a consistent set of measures of public spending by district between 1994 and 2001 could not be developed from available data sources.

the .05 level.) The independent variables include the real direct foreign investment *per capita* in Litai and the real total fixed investment *per capita*. (For the OLS regression, the investment variables measure the total for 1996 through 2001.) Other independent variables are the proportion of the district's population that reside in an urban area, the unemployment rate (in percent of the labor force), and the proportion of the district's employees who work in industry.

Table 2. OLS and Panel Regressions on Employment Rate 1994-2001, for Districts in Lithuania: Regression coefficients and t values.

Dependent Variable: Proportion of Population Employed		
Independent Variables	OLS Regression for 2001	Panel Regression with Fixed Effects for 1994-2001
Real Foreign Direct Investment per capita	0.0000015 (1.58)	-0.000003 (-1.64)
Real Fixed Investment per capita	0.00000016 (1.48)	0.000003*** (2.80)
Proportion of Population that is Urban	0.001*** (3.38)	0.006*** (3.09)
Proportion of the Population Employed in Industry	-0.262** (-2.16)	-0.672*** (-9.17)
Unemployment Rate	-0.003** (-2.33)	-0.004*** (-5.73)
Constant	0.381*** (13.77)	0.227** (2.27)
R-squared	.666	0.407
Observations	46	368
Number of Districts	46	46

** Significant at the .05 level

***Significant at the .01 level

The regressions presented in Table 2 confirm the broad outlines of the analysis in the first part of this paper. As expected, in both the OLS and panel regressions, the employed share of the population is significantly (at the .01 level) and positively correlated with the urban share of the population.²⁴ It is significantly (at either the .01 or .05 level) and negatively correlated with the proportion of the working population in industry and with the unemployment rate.²⁵ The regression coefficients in 2001 indicate substantial impacts of these independent variables on the employment share. Other things equal, the employment rate was nearly 9 percentage points

²⁴ The unemployment rate does not correlate significantly with urbanization in any of many multivariate regressions estimated by the author on the unemployment rate using varying combinations of independent variables. The unemployment rate, then, is not significantly lower in cities even though the employment rate is higher.

²⁵ Note that the unemployment rate and the share of the working force in industry are uncorrelated (the R between the two is .073), confirming the expectation that both variables independently produce labor market distress that leads to low rates of employment.

higher in districts that were 100 percent urban such as Vilnius compared with the district with the lowest level of urbanization (11 percent). The employment rate was 8 percentage points higher in the least industrialized district (3 percent of workers in industry) compared with the most industrialized district (one third in industry). The employment rate was nearly 17 percentage points higher in the district with the lowest unemployment rate (5 percent) compared with the district with the highest (24 percent). The regression coefficients on these three variables in the panel regression were even higher than in the OLS regression. In the panel regression, employment share was positively and significantly correlated with the level of fixed investment *per capita*.

Table 3 has a format similar to Table 2, but the dependent variable in the regressions is the average monthly earnings of industrial workers.²⁶ (The coefficients on the year dummies in the panel regression are not shown, but most were highly significant.) The most significant independent variable (at the .001 level in all three regressions) is the output per worker. Not surprisingly, industrial enterprises with high revenues share the bounty with their employees while impecunious firms skimp on the wage bill. The other independent variable that is statistically significant in all four regressions is direct foreign investment *per capita*. Other things equal, industrial earnings in 2001 are 137 litai per month (31 percent of the average wage) higher in the district with the highest *per capita* foreign investment compared to the district with the least. In the panel regression, the level of fixed investment is also significantly correlated with industrial worker's wages.

Table 3. OLS and Panel Regressions on Industrial Earnings in Litai, 1994-2001, for Districts in Lithuania: Regression coefficients and t values.

Dependent Variable: Real Monthly Gross Earnings for Industrial Workers			
Independent Variables	OLS Regression for 2001	OLS Regression for 2001	Panel Regression with Fixed Effects for 1994-2001
Real Foreign Direct Investment per capita	0.005*** (2.89)	0.003** (2.06)	0.008** (2.37)
Real Fixed Investment per capita	-0.002 (-1.12)	-0.001 (-.62)	0.005** (2.54)
Proportion of Population that is Urban	-0.910 (-1.64)	1.075** (2.27)	4.575 (1.58)
Unemployment Rate	-1.325 (-.570)	0.193 (.096)	0.654 (0.55)
Output per Worker	0.002*** (8.89)	0.004*** (7.74)	0.002*** (11.94)
Dummy for Outlier		-703.9*** (-4.08)	
Constant	323.3*** (7.52)	231.3*** (5.40)	-3.3 (-0.02)
R-squared	.765	.835	0.692
Observations	45	45	368
Number of Districts	45	45	46

** Significant at the .05 level

***Significant at the .01 level

²⁶ The OLS regressions for 2001 omit the one district with no industrial workers in that year.

In the regression presented in the first column of Table 3, the coefficient on the proportion of the population that is urban is insignificant. The highest industrial wages in the country in 2001 and the largest of the equation's residuals were in Mažeikiai. As noted earlier, a large oil refinery is located in the district, which is less than 70 percent urban. It was suspected that this high-wage, partially rural district was biasing the results, so a dummy (1, 0) variable was added to the equation that took the value of 1 only for the district in question. As expected, the coefficient in the second column of Table 3 on the dummy variable for Mažeikiai was highly significant and the regression coefficient on the level of urbanization was now positive and significant at the .03 level. Other things equal, industrial workers in 2001 in the most urbanized districts earn on average 96 litai (22 percent of the average wage) more than those in the least urbanized district. In the panel regression, the coefficient on the urban share was not significant. The unemployment rate was not significantly correlated with industrial workers' earnings even though it was correlated with the employment share.

Table 4 presents regressions in which average monthly earnings of nonindustrial workers are the dependent variable. (The coefficients on the year dummies in the panel regression are not shown, but all were highly significant.) As in the regressions on industrial earnings, the independent variable that consistently correlates significantly with the earnings of nonindustrial worker is direct foreign investment *per capita*. In 2001, earnings in the district with the highest *per capita* direct foreign investment, other things equal, averaged 183 litai (46 percent of average earnings) higher than in the district with the least foreign investment. Nonindustrial wages were also significantly and positively correlated with the proportion of the district's population living in cities in the OLS regressions (but not in the panel regression). The difference in average nonindustrial wages from the least to the most urbanized district was 70 litai (18 percent of average earnings). The unemployment rate and the level of fixed investment were not significantly correlated with nonindustrial earnings.

Table 4. OLS and Panel Regressions on Nonindustrial Earnings in Litai, 1994-2001, for Districts in Lithuania: Regression coefficients and *t* values.

Dependent Variable: Real Monthly Gross Earnings for Nonindustrial Workers

Independent Variables	OLS Regression for 2001	OLS Regression for 2001	Panel Regression with Fixed Effects for 1994-2001
Real Foreign Direct Investment per capita	.004*** (4.42)	.004*** (8.35)	0.003** (2.07)
Real Fixed Investment per capita	-.001 (-.963)	-.001 (-1.40)	0.001 (1.38)
Proportion of Population that is Urban	.790** (2.47)	.520*** (2.64)	0.316 (0.25)
Unemployment Rate	.283 (.221)	-.166 (-.212)	0.105 (0.21)
Dummy for Outlier		207.2*** (8.52)	
Constant	338.8*** (13.57)	351.6*** (23.04)	300.5*** (4.50)
R-squared	.535	.832	0.890
Observations	46	46	368
Number of Districts	46	46	46

** Significant at the .05 level

***Significant at the .01 level

The second highest average nonindustrial wages in the country were in the (composite) district where the nuclear power plant is located, a district that is about 70 percent urban. The second column in Table 3 presents a regression estimation that is the same as in the first column except that a dummy variable for the district with the nuclear power plant is added. Not surprisingly, controlling for this outlier dramatically raises the R-squared statistic and the level of significance of the coefficients on direct foreign investment *per capita* (the power plant pays high wages but gets little if any foreign investment) and the degree of urbanization (since the power plant is located in a partially rural district).

The OLS regressions for 2001 in Tables 3 and 4 show that residence in a city, other things equal, is associated with substantially higher earnings. Regressions for 1998, 1999, and 2000 (not shown) indicate, if anything, a stronger association between earnings and urbanization than in 2001. In contrast, the two panel regressions do not show a correlation between urbanization and earnings. The panel regressions used a fixed-effects model, so the regression coefficients are working with the variance that remains after all variance associated with the district as a district over the eight years of the panel has been 'claimed' by the fixed effects coefficient. The level of urbanization in each district hardly changed over the eight years of the panel, so the fixed effects should have picked up most of the variance associated with the level of urbanization. Accordingly, it is probably the case that those living in cities are more likely to have higher earnings, but the regressions do not tell a consistent story.

6. Summary and Policy Implications

This article argues that Lithuania's transition from socialism to a market economy was accompanied by an unusually large jump in income inequality and that a major but neglected dimension of that growing inequality reflects the very diverse ways that the different regions of the country have been affected by the economy's restructuring. The country's capital city and nearby suburbs have survived the transition in reasonably good shape and the second and third largest cities are not too far behind. Nevertheless, small industrial cities have suffered and the country's towns, villages, and rural areas have had a still more difficult experience. The issue has received little attention by academics; only a single study has examined regional inequality in Lithuania in any depth. That paper plus an array of articles and books that address the growth in regional inequality in other European transition countries have pointed to several potential explanatory variables: investment (especially foreign investment), unemployment, the level of urbanization, and the uneven distribution of industrial collapse. The present research more thoroughly utilizes the available data and employs more sophisticated statistical estimations than previous studies. This research largely confirms the importance of the variables identified in earlier investigations of the growth in regional inequality during the transition from socialism.

This paper finds that residence in a city, other things equal, leads to a greater chance of being employed and almost surely to substantially higher average earnings. Residence in a district with a low unemployment rate or small proportion of the labor force in industry makes it easier to find a job, but does not lead to higher average wages. An enterprise's acquisition by a foreign firm often brings mixed blessings – higher wages for those who keep their jobs, but no job at all for those who are downsized. Not surprisingly, this study finds that those who live in districts of Lithuania with substantial foreign investment have significantly higher average wages, but are no more likely to be employed than those who live in districts with less foreign investment.

The statistical analysis presented here reinforces the notion that low earnings and lack of employment are primarily a result of market forces. Two variables that play a prominent role in the statistical estimations are the level of urbanization and direct foreign investment. As noted,

the country's three largest cities have survived the transition in the best shape, but those three cities and the districts that surround them received 84 percent of the country's direct foreign investment between 1996 and 2002. Vilnius alone received 59 percent. Letting the market continue to work its way will surely produce more of the same. Factories that had been integrated into the Soviet industrial system were especially likely to fail during the restructuring, leaving high levels of unemployment and economic hardship in their wake. The present analysis confirms that districts with high concentrations of industry and high levels of unemployment not unexpectedly suffer from low levels of employment. All of these conclusions suggest that poverty and joblessness in distressed areas are unlikely to dissipate by themselves in the coming years.

The transition has left behind the working poor, those who have been more or less permanently expelled from the labor force, and those living in rural backwaters. Among the ways to ameliorate their condition are income transfers, direct and muscular efforts to redirect investment to distressed areas, infrastructural spending, migration subsidies, or other policies that will surely occur to the reader. The present research emphasizes the importance of investment, especially foreign investment. If attempting to channel private investment to disadvantaged areas is deemed unacceptable, then income transfers can serve as a short-term palliative and public investment can be redirected. At present, government spending in Lithuania magnifies regional inequality. Obviously, the government can choose to counter rather than reinforce regional inequality.

Policy makers should pay attention to the issues raised in this paper. Moving away from one's family and community is difficult and costly, especially for those who have already established themselves in the local economy. The ability to move is especially limited for those without skills needed by the restructured economy and by older individuals with a short time horizon over which to amortize the moving costs. Geographic immobility exacerbates regional inequality and complicates the effort to find solutions to problems posed by declining industries and sectors. Geographic immobility tends to make poverty invisible to the new centers of economic and political power.

Poverty in transition countries results not so much from unemployment per se, but from extended periods of unemployment or dropping out of (or never entering) the labor force. Withdrawal from paid employment compels disengagement from society in other ways. For example, without a job and thus with little money, one cannot buy a car. Public transportation has deteriorated rapidly in Lithuania in the last 15 years, so without a car, it is difficult to take one's children to the clinic in town or register as unemployed at a government office. One cannot easily look for work or get to work even if a job could be found. In the most extreme cases, people have reverted to subsistence agriculture in Lithuania and in other transition economies.

It used to be accepted as axiomatic that rising inequality was a necessary accompaniment to economic growth and the notion of 'growth poles' was once embedded in both regional economics and development economics. Supporters and dissenters of that proposition have debated the issue over the years. Without addressing those arguments, I shall only point out that one cannot build the new economy on a foundation of poverty, poor health, ignorance, and alienation. Ill fed, poorly educated, angry people do not make good workers or good citizens. Throwing away a generation of people who cannot find a role in the new economy risks economic as well as political disaster. The political disaffection that grows out of the desperation of poverty and forced idleness threatens to slow or even reverse the political and economic transition that now appears so firmly on course. Ignoring the large and growing regional inequality in Lithuania risks undermining the entire effort to transform the country.

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Lithuania's Track to the Euro and the Endogeneity Hypothesis

*Jurgita Jurgutyte**

Abstract: This paper analyses the business cycle synchronization between Lithuania and the Euro area using the structural vector autoregression (SVAR) model with Blanchard and Quah decomposition. The analysis includes experiences both before and after Lithuania pegged its currency to the Euro in the beginning of 2002. The present calculations give positive correlation coefficients for the period 2002-2005 and show that the Lithuanian business cycle becomes more synchronized with the business cycle in the Euro area. Compared with earlier calculations, this result gives a positive outlook and thus corroborates the endogeneity hypothesis of the Optimum Currency Area (OCA) theory in the Lithuanian case. Adoption of the Euro for Lithuania should therefore be of less concern than previously anticipated based on experiences from the years before the Lithuanian currency was fixed to the US dollar.

Keywords: business cycle, optimal currency area

JEL codes: F33, E30

1. Introduction

Ten countries joined the European Union (EU) on 1st May 2004. All of them are expected sooner or later to entry in the third stage of the Economic and Monetary Union (EMU), adopting the Euro. Therefore, a number of articles discuss when the EMU should be extended to the new EU members.

A part of the debate is focused on the nominal convergence of the candidate country, specifically the fulfilment of the nominal Maastricht convergence criteria: price stability, low budget deficit and level of government debt, stable exchange rates, and convergence of long-term interest rates.

According to the Convergence Report 2004 of the European Central Bank (ECB, 2004), in 2004 Lithuania fulfilled the nominal convergence criteria with respect to price stability, long-term interest rates budget deficit, and government debt. Due to this fact, Lithuania together with two other Central and Eastern European countries (CEEC's), namely Estonia and Slovenia, were among the first joining the Exchange Rate Mechanism II (ERM II) from 28 June 2004. It should be noted, however, that Slovenia was the only country allowed to adopt the Euro since the beginning of 2007²⁷.

Another part of discussion about the EMU enlargement is related to real convergence, which is usually defined as catching-up of income levels and the economic structures so they were in line with those of the Euro area. The real convergence criteria are not obligatory for the candidate country; however, as it focuses on the differences in economic dynamics, the real convergence is centred to analyze the gains and losses of a common currency area. The differences in economic structures are considered as one of the main costs in a single currency union. Differences of economic structure makes it more costly is to forsake the independent monetary policy because of low effects of asymmetric (country-specific) shocks. The real convergence problem is the main issue in the Optimal Currency Area (OCA) theory; see e.g. Tavlas (1993) for a recent survey of this theory.

* Economics Department, Bank of Lithuania, Totoriu 4, LT-01121 Vilnius, Lithuania. Email: jjurgutyte@gmail.com. The author is deeply indebted to Jorgen-Drud Hansen and Virmantas Kvedaras for their valuable remarks and suggestions.

²⁷ Lithuania slightly exceeded the Maastricht inflation criteria: its 12-month average rate of HICP inflation stood at 2.7, while the Maastricht reference value was 2.6 (ECB, 2006). Estonia did not apply for early assessment in 2006.

The theory opens some questions and discussions relevant to the Euro area extension. For example, the growing number of research papers surveys how similar the economic structures and how correlated the business cycles are between the new EU countries and the members of the Euro zone. More specifically, it is analysed how similar aggregate supply, demand, and monetary shocks are comparing accession and current EMU countries. Next, how costly or beneficial is the opt out of the national monetary policy for the new members.

Additionally, there is a consensus that the adoption of single currency and, therefore, common monetary policy will lead to an increase in trade with other members of the area. However, two different views exist about the impact of closer trade integration, see Krugman and Obstfeld (2003) for a more extensive presentation of the two views. One of them is called the *endogeneity of OCA* criteria hypothesis. Its basic argument is that even for poorly synchronized countries, the institutions and behaviour will adapt and the correlations of national business cycles will increase eventually. This is also stated in a sense of Lucas critique that the direct application of the OCA criteria historical evidence can be misleading, as they are more likely to be satisfied after the country enters the monetary union.

Another view is the *Krugman specialization hypothesis*. It claims that closer trade integration will lead to less synchronization among the countries in the monetary union. According to Krugman view, more integrated countries will become more specialized in the production of those goods and services for which they have a comparative advantage under the assumption of reduced transportation costs. Hence, more diversified member countries will be less synchronized. Unfortunately, there is no common consensus, which hypothesis is more plausible, and the results of different empirical studies are not robust. There is some evidence supporting the endogeneity view, e.g. Frankel and Rose (1998), Rose (2000), but these results confront criticism. One of them, for example, the work of Kalemli-Ozcan *et al.* (2001) argues that trade integration may lead to specialization, and higher specialization in production translates into less symmetry of output fluctuations. The main result of their study was that higher specialization induces greater asymmetry.

The objective of this paper is to contribute to the ongoing debate about the single currency area enlargement, namely to Lithuania. Previous studies have pessimistically concluded that the correlation between the Lithuanian and the Euro area was mainly negative. From the perspective of the Euro area, the diversification between the EU economies helps to stabilize the union. However, this paper focuses on the perspective of Lithuania that has a less positive view on the diversification: concerns exist that a swift adoption of the Euro could be quite dangerous for the country. Earlier empirical studies mainly rest on the experiences before Lithuania switched its peg from US dollar to the Euro in the early 2002. The step should not be disregarded because together with the EU membership from 2004 it signals a credible commitment for to a later full membership of the EMU and the Currency Board Arrangement, based on a complete fixed exchange rate of Euro, established a quasi monetary union between Lithuania and the Euro area. The recent experiences therefore invites for a reassessment of the synchronization of business cycles between Lithuania and Euro area development since 2002, when the base currency of the Lithuanian fixed exchange rate regime was changed to the Euro. For this purpose, the endogeneity hypothesis of the OCA theory for Lithuania will be raised to discuss whether Lithuania is ready to adopt the Euro disregarding the asymmetric shocks that are experienced by Euro area and Lithuania. The econometric framework applied for this discussion is structural vector autoregression (SVAR) model, which examines the short-term cyclical movements. The study is thus limited to short-term business cycles and longer cycles are disregarded.

The paper is organized as follows. Section 2 describes the main points of the AD-AS model and

reviews the two-variable SVAR model. Next, the paper reviews the surveys on Lithuanian business cycle analysis and presents their main results in the Section 3. Section 4 discusses the validity of endogeneity hypothesis for Lithuania and presents the estimation results. The final section concludes.

2. The Methodology

2.1 AS-AD Model

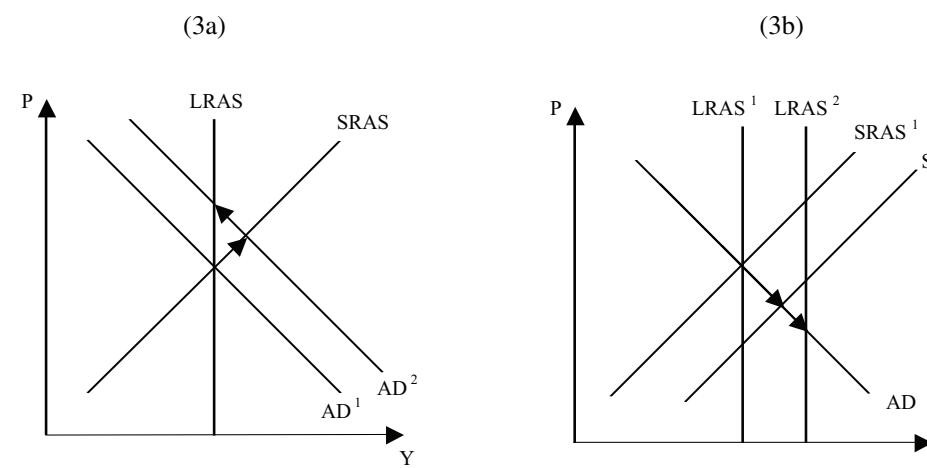
One of the most commonly used approaches to measure the business cycle synchronization is the correlation analysis of supply and demand shocks between the country and the currency area. The technical framework of identifying the shocks is a well-known aggregate supply and aggregate demand (AS-AD) model (Bayoumi and Eichengreen, 1992).

The aggregate demand curve (labelled AD) shows the relationship of the aggregate quantity of output demanded Y and the price level P . AD curve has a negative slope in the price-output graph, reflecting that demand increases with lower prices. The aggregate supply curve slopes upward in the short run but is vertical in the long run. The short run aggregate supply schedule (SRAS) denotes that aggregate amount of supplied output increases with higher prices because the wages are assumed to be sticky (thus higher prices imply lower real wages). The long run supply curve (LRAS) is vertical because the real wages adjust to price changes in the long run.

The left panel in Figure 1 shows a positive demand shock that will shift the AD curve to the right from AD^1 to AD^2 . As the other curves remain unchanged, the original equilibrium moves to the new intersection of AD^2 and SRAS curves and raises both output and prices. In the long run, the AS curve becomes vertical, and the equilibrium output returns to its initial level. However, the price level increases further along the AD curve until the system reaches a new equilibrium. Therefore, the permanent and positive demand shock is responded by a short-term increase in output, which is followed by a gradual return to its initial level, and a permanent rise in prices.

The right graph in Figure 1 lays out the responses to the supply shock. A positive supply shock will shift both short and long run AS curves to the right by the same amount to $LRAS^2$ and $SRAS^2$. The short run intersection of AD and $SRAS^2$ curves implies higher output but lower prices. Furthermore, the AS curve turns vertical over time, resulting in the following output growth and price reduction. Hence, the supply shock had a permanent effect on both output and prices.

Figure 1. Demand (3a) and supply (3b) shocks



To sum up, the effects of demand and supply innovations have different impact on output and prices. A positive supply shock permanently reduces the prices although permanently enhances the output. On the other hand, a positive demand shock permanently raises the prices but only temporary increases the output. This statement is summarized in Table 1. According to the effects on output, two types of shocks can be identified. This feature is used in an econometric technique, proposed by Blanchard and Quah (1989) that decomposes the effects to the variable into permanent and temporary shocks.

Table 1. Effects of demand and supply shocks

Variable \ Shocks	Output	Prices
Supply	permanent	permanent
Demand	temporary	permanent

Different factors affect supply and demand curves. Usually it is claimed that the AS curve reacts to the structural changes in the economy. Such changes can be technology shocks or the factors that shift the full-employment level of output, e.g. an increase in labour force (Abel, Bernanke, 2005, p. 337-338). Two types of factors can move the AD curve. The first group of factors is called real demand shocks as they originate from real side of the economy as the private or government spending, changes in taxes, wealth or expected future output. The other group of factors stem from the monetary policy or shocks in foreign exchange markets, for example, changes in the nominal money supply, nominal interest rate on money, expected inflation, etc. (Abel, Bernanke, 2005, p. 337).

Mathematically, the AS-AD model can be written in the following form:

$$\begin{aligned} y_t^s &= y_{t-1} + \alpha(p_t - p_{t-1}) + u_t^s, \quad \alpha > 0. \\ (y_t + p_t)^d &= (y_{t-1} + p_{t-1})^d + u_t^d \\ y_t^s &= y_t^d \end{aligned} \quad (1)$$

In the above equation y_t is the logarithm of output during period t , and y_{t-1} is the logarithm of output expected given the information available at the end of period $t-1$. Similarly, p_t is the logarithm of the price level during period t , and p_{t-1} is the logarithm of expected price level given the information available at the end of period $t-1$. The superscripts s and d represent supply and demand respectively. Serially uncorrelated random disturbances u_t^s and u_t^d indicate the structural aggregate supply and aggregate demand shocks respectively. The first aggregate supply equation is the Lucas (1972) AS curve where output increases to unexpected increases in the price level and positive supply shock u_t^s . The middle equation points out the AD relationship; here nominal aggregate demand equals its expected value and the demand shock u_t^d .

As the supplied and demanded outputs are equal, the equations can be solved for output and the price level and written in the matrix form:

$$\begin{bmatrix} y_t \\ p_t \end{bmatrix} = \begin{bmatrix} y_{t-1} \\ p_{t-1} \end{bmatrix} + \begin{bmatrix} \alpha & 1 \\ \frac{1}{1+\alpha} & \frac{1}{1+\alpha} \\ \frac{1}{1+\alpha} & -\frac{1}{1+\alpha} \end{bmatrix} \begin{bmatrix} u_t^d \\ u_t^s \end{bmatrix} \quad (2)$$

Hence, the equilibrium in the economy changes due to both demand and supply shocks. Several modifications derive the following equation (see Appendix 1 for details):

$$\begin{bmatrix} \Delta y_t \\ \Delta p_t \end{bmatrix} = \sum_{i=0}^{\infty} \begin{bmatrix} b_{11,i}(L) & b_{12,i}(L) \\ b_{21,i}(L) & b_{22,i}(L) \end{bmatrix} \begin{bmatrix} u_t^d \\ u_t^s \end{bmatrix} \quad (3)$$

It was noted in Table 1 that the supply and demand shocks have different (permanent and temporary) effects on output changes. An econometric technique that decomposes output into its temporary and permanent components was suggested by Blanchard and Quah (1989) and will be discussed in the following section.

2.2 SVAR Analysis

The literature review presented quite a few methods that can be used to evaluate whether the country is suitable for the membership in the single currency area. This paper will use the SVAR analysis introduced by Bayoumi and Eichengreen (1992), which became a standard in similar studies. The framework of Bayoumi and Eichengreen was extended according to Blanchard and Quah (1989) procedure and is based on the aggregate demand and aggregate supply (AD-AS) model. In line with the theoretical model, demand and supply shocks between a joining country and the currency area are a measure of business cycle synchronization between the countries; a positive correlation is a sign of symmetric shocks and, therefore, suitability for the membership in the currency area. It was also mentioned that the effects of demand and supply disturbances are measured for two macroeconomic variables, output and prices, and the disturbances have different effects on them. Both supply and demand shocks have permanent effect for price level changes, while they have different effects on output. For the latter, the demand shocks have temporary, and supply shocks have permanent impact. Consequently, a technique that would decompose output into its temporary and permanent components should be used.

Blanchard and Quah (1989) suggested a bivariate VAR and showed a unique way how to decompose the output variable, and their procedure was later used by Bayoumi and Eichengreen (1992). The Blanchard and Quah decomposition technique requires both variables to be in a stationary form, thus Bayoumi and Eichengreen implied that both output and prices are integrated I(1) series and used their first differences, Δy_t and Δp_t respectively.

The starting point of the Blanchard and Quah decomposition is the infinite order MA representation of the structural VAR, analogous to Equation 3. The form of equation denotes the main idea of the model: all the shocks in the model come through the residuals, specifically, through u_{st} if the supply shock is in effect, or through u_{dt} if the demand shock is present.

Therefore, the equation indicates the output and price variables are directly affected by supply and demand shocks.

The model also indicates that demand shocks have only temporary effects on output, thus the next step is to implicate such influence. Blanchard and Quah (1989) simply restricted the permanent effect to zero or, in other words, looked for certain coefficients that eliminate the accumulated demand-shock impact:

$$\sum_{i=0}^{\infty} b_{11,i} = 0 \quad (4)$$

Since the structural shocks cannot be directly observed, the aim is to estimate them from the reduced VAR form model. The link between structural and reduced-form shocks is derived in the Appendix 1, it concludes that the reduced residuals are the composites of real structural shocks:

$$\begin{bmatrix} e_{yt} \\ e_{pt} \end{bmatrix} = \begin{bmatrix} b_{11,0} & b_{12,0} \\ b_{21,0} & b_{22,0} \end{bmatrix} \begin{bmatrix} u_t^d \\ u_t^s \end{bmatrix} \quad (5)$$

The real structural shocks could be recovered from the reduced shocks if the four b coefficients in Equation 5 were known. In other words, four restrictions are needed, and Blanchard and Quah show that the model has exactly four restrictions: two restrictions are the variances of structural shocks that are set equal to unity, $\text{var}(u_{dt}) = \text{var}(u_{st}) = 1$, the third one comes from the covariance of the reduced VAR residuals, and the last one is the long-run restriction in Equation 4.

3. Literature Review

The empirical discussion on the membership in the currency area is based on the degree of economic integration and business cycle synchronization measurement analysis. Several methods are used to estimate the similarity of macroeconomic fluctuations. However, despite the methodological differences, most surveys conclude that Lithuanian economic structure is very different from Euro zone countries and its economic integration trail behind other CEE countries. As Fidrmuc and Korhonen (2004) claim, "the studies report on average a negative correlation of business cycle only for Lithuania". Therefore, as the objective of this paper is to re-estimate the business cycle synchronization for Lithuania, the literature review will present the earlier correlation results for this particular country.

One of the most popular methods to measure business cycle symmetry is based on a simple AS-AD model, described in the previous section. The assumption of two kinds of shocks, the ones that affect the AD curve, and the shocks that have impact on the AS curve, is presumed. It is claimed that the loss of the independent monetary policy will be the more beneficial for the candidate country the more the shocks are positively correlated with the single currency area. On the contrary, highly asymmetric shocks indicate that there is a potential economic disparity between the country and the members of the currency union. Studies, which include Lithuania into such correlation analysis, are Fidrmuc and Korhonen (2001, 2003), Fidrmuc and Korhonen (2004), and Horvath and Ratfai (2004). Fidrmuc and Korhonen (2001, 2003), analyzing real GDP growth and GDP deflator data for the years 1995-2000, estimate that the highest correlation between the Euro area and CEEC is in Hungary and Estonia. The lowest supply and demand shock correlations were found in Lithuania, they were negative in all their studies. The results of Horvath and Ratfai (2004) were a bit more erratic. Correlations of supply shocks for Lithuania and three EMU countries were the lowest among all examined CEE countries and all negative, while the correlation of demand shocks showed better results, e.g. the correlation with Germany was the highest among eight estimated new EU members.

Ramos and Suriñach (2004) research besides the common two-shock model expands it to allow for monetary policy shocks described in the previous section as well. They use two cases of three-shock framework, and the third variable is the real interest rate in the first case and real effective exchange rate in the second one. However, only the first case with monetary shock as the unexplained real interest rate disturbances was evaluated for Lithuania. The correlation coefficients of two-shock model for Lithuania were again the lowest for demand and second lowest for supply shocks. Calculated coefficients of expanded model are higher, however, the correlation of the real interest rate shock is again the lowest. The results of all discussed papers are presented in Table 2.

Table 2. Correlation result summary for Lithuania.

	Supply shocks	Demand shocks	Monetary shocks ²⁸
Fidrmuc, Korhonen (2001,2003) Time period: 1995 -2000, reference: Euro area	-0.11	-0.49	
Fidrmuc, Korhonen (2004)** Time period: 1995 -2002, reference: Euro area	~ -0.35	~ -0.32	
Horvath and Ratfai (2004) Time period: 1993 -2000q3, reference: Germany France Italy	-0.22 -0.34 -0.11	0.23 0.15 -0.02	
Ramos and Suriñach (2004) Time period: 1998 -2002; reference: Euro area 1 st case, supply and demand shocks 2 nd case, supply, demand, and monetary shocks	-0.49 0.12	-0.07 -0.22	0.06

* Inflation was measured by GDP deflator except for Ramos and Suriñach paper, where inflation is assessed as CPI.

** In Fidrmuc, Korhonen (2004) the results were presented in the graph. Therefore, the given values are not precise.

As there is no confirmed correlation coefficient benchmark that defines business cycle similarity of the country as acceptable for the currency area, it is difficult to interpret the obtained coefficient values for Lithuania and assess whether they raise concern. Different studies²⁹, which analyse demand and supply shock correlation between new Member States and Euro area in 1995-2003, present very broad interval of correlation coefficient values. Excluding Lithuania, the lowest value of supply shocks among the studies is -0.69 for Poland (Frenkel, Nickel, 2002) while the highest value reaches 0.73 for Hungary (Frenkel, Nickel, 2002). The demand-shock spread is slightly narrower, the lowest value is -0.49 for Latvia (Fidrmuc, Korhonen, 2001, 2003), and the highest value amounts to approximately 0.50 for Hungary (Süppel, 2003). The results²⁹ of the correlation between new Member States and Germany are erratic as well. The lowest and the highest supply-shock correlation coefficient values are -0.49 and 0.43, and demand-shock correlation values spread from -0.30 to 0.60. On the other hand, the correlation estimates of the so-called "periphery" member states (e.g. Greece, Italy, Portugal, Spain, Ireland) in the early stage of EMU can be considered as an approximate benchmark for the new Member States. Four studies³⁰ that present the "periphery" correlation results with Germany indicate a narrower interval for both supply and demand shocks in the period of 1960-1988. The supply-shock correlation ranges from -0.25 to 0.31 while demand-shock correlation values diverges from -0.25 to 0.31. Under the benchmark of "periphery" countries, Lithuanian results presented in the Table 2 seem to be worrying. The conclusions of the authors confirm the negative disposition towards Lithuania.

Fidrmuc and Korhonen (2004) conclude that Lithuania is in the group of "candidate countries with a low similarity of both price and GDP development", as it is structurally different from most European countries, and continues to be quite dependent on trade with Russia³¹ and other CIS countries and note that from April 1994 to February 2002, the Lithuanian currency was pegged to

²⁸In their paper Ramos and Suriñach (2004) used the extended AS-AD model that recognizes two different sources of demand shocks: real demand and nominal (or monetary) demand shocks. Therefore, the extended model allows the monetary policy influence using a monetary policy variable, e.g. interest rate or real exchange rate.

²⁹The studies mentioned are the following: Backé et al (2004); Frenkel, Nickel (2002); Fidrmuc, Korhonen (2001, 2003); Fidrmuc, Korhonen (2004); Ramos, Suriñach (2004); Süppel (2003).

³⁰Includes the following studies: Horvath, Ratfai (2004); Frenkel et al (1999); Frenkel, Nickel (2002); Fidrmuc, Korhonen (2003).

³¹Includes Bayoumi, Eichengreen (1993), Funke (1997), Artis (1999), Verhoef (2003).

the US dollar. Horvath and Ratfai summarize that according to their results, shocks among CEE and three EMU countries, in particular Germany, tend to be uncorrelated; "these results may imply that proceeding with the union could be quite costly for the participants. On the other hand, they may simply highlight the importance of non-economic factors in creating viable currency unions."

Korhonen (2001) applies a different definition of the business cycle and as a proxy uses industrial production data, but the correlation between the new EU members and Euro area is assessed in a demand and supply-shock framework as well. The correlation results of impulse responses show that only for Romania, a non-member of the EU, the impact is negative. For Lithuania the ratio is 0.12, "clearly smaller than a unity" and similar to Slovakia, while for all other countries is "fairly close to one" (with exception for Latvia where short-term effect of the shock is over 100% higher than in the Euro area).

Other studies apply different methodologies, however, the low and mostly negative results for Lithuania prevail. For example, the work of Demanyk and Volosovych (2004), use a measurement called a utility-based asymmetry measure³³. The evaluated GDP asymmetry between Lithuania and EU-15 was 18.55, the very top one, compared to the second highest result of Estonia 7.80 and the third one of Latvia 6.97. As all three Baltic countries have the highest asymmetry evaluations, the authors make a conclusion that Estonia, Latvia, and Lithuania would, on the one hand, benefit the most from joining the new 25-country EU, and, on the other hand, they would facilitate all other countries in the Union to benefit in terms of diversifying their shocks.

Artis et al (2004) considered two concepts of the economic cycles³⁴. Despite different methods used to calculate the correlation coefficients, the estimations were generally high between Hungary and Poland, but again the lowest or the second lowest for Lithuania. As quite low results were evaluated for all Baltic countries, the authors conclude they have been in the past less correlated with the Euro area, and more correlated with Russia.

A dynamic factor model was estimated by Darvas and Szapáry (2004), who considered a broader approach of business cycle correlation and investigated not only GDP or industrial production synchronization, but also the major expenditure and sectoral components of GDP. However, similar to previous results, Darvas and Szapáry classify the Baltic States into the group, which is not correlated with the Euro area members at all. Another survey paper that tried to identify the homogenous group among CEECs is Boreiko (2002). The correlation in business cycles is measured as a cross-correlation of differenced industrial production indices between CEECs and Germany. Different from Darvas and Szapáry estimations, according to this study, the correlation development for Lithuania seems to be improving over the years: it was estimated as -0.34 in the whole period 1993-2001, but the last five years (1997-2001) show a slightly positive correlation of 0.04. Furthermore, Boreiko implies a cluster algorithm and forms several groups of countries according to business cycle correlation, real exchange rate volatility, trade openness, and inflation differential criteria. Among the best performing countries are Czech Republic, Estonia, Hungary, and Slovenia, while Lithuania is usually attributed in one cluster with Latvia and a non-EU member Romania. Therefore, the author concludes that among currency board countries (Estonia, Lithuania, and Romania) Lithuania shows considerable nominal convergence but only Estonia is

³³ The interpretation of asymmetry measure is based on the logic that countries with "counter-cyclical" output provide insurance to other countries by stabilizing aggregate output and such countries are compensated accordingly in the risk sharing agreement. Hence, the higher the variance of country's GDP, the higher the asymmetry measure value is and the more the country will benefit from sharing risk with other countries.

³⁴ The first concept is the classical business cycle definition, where the business cycle is a sequence of continuing expansions and recessions of the aggregate economic activity. The second concept is referred to as a growth, or deviation, cycle, where the fluctuations are relative to a trend or potential value.

leading in economic convergence as well.

Several methodologies of measuring economic integration were applied by Süppel (2003) and Backē et al (2004). They both apply five different estimation methods: Theil's inequality coefficient and correlations of de-trended GDP, industrial production, broad cyclical trend, and already discussed demand and supply shocks. Again, the estimations are not encouraging for Lithuania because it is always among the three or four least synchronized countries. Therefore, Backē et al summarize that the only robust finding of cycle correlation analysis with Euro area was Lithuania's low or negative correlation across all applied methods. Süppel explains it by "rather different economic structures and the relatively low degree of trade integration with the Euro area".

The article of Fidrmuc and Korhonen (2004) imply a very different approach for business cycles correlation analysis. The authors apply meta-analysis, used to classify or somehow transform the reported correlation coefficient estimates. Their result can be seen as a generalized statistics. They find positive and significant correlation of business cycles with the Euro area for all CEECs, but again, the Lithuanian correlation is the lowest one, while the highest is found for Hungary.

In summary, the literature reviewed gives a clear and robust conclusion of significant Lithuanian business cycle difference from Euro area. Moreover, the results also indicate that Lithuanian business cycle correlation with Euro area is lower than the estimations on other new Member States.

4. New Evidence on Lithuania

The endogeneity hypothesis of the OCA in the case of Lithuania arises the assumption that high asymmetry with the Euro area can be a result of its exchange rate regime, when Lithuanian litas was fixed to U.S. dollar and improved since the change of the peg to the Euro. Hence, two different sub-samples were estimated to evaluate the possible changes in correlation after February 2002, when it changed the base currency. The expected improvement of the business cycle correlation between Lithuania and Euro area in 2002-2005 would confirm the endogeneity hypothesis under the assumption that current Lithuanian currency board and the third stage in EMU are comparable. Of course, the complete monetary integration ensures the important gains of the abolishment of the transaction costs and reduction of the interest rates due to the currency risk elimination. However, some parallels exist between the two exchange rate regimes. Lithuanian litas is already fixed to Euro with zero fluctuation bands, and Lithuania does not pursue an active monetary policy since the establishment of the currency board. Moreover, a part of the fiscal policy goals that concerns the fulfilment of the Maastricht criteria are similar to those in Euro zone as well. Besides, Lithuania fulfils the criteria since 2000 except the exchange rate criteria because it did not take part in ERM II (Vetlov, 2004)³⁵. Consequently, the assumption that the two exchange rate regimes are comparable and the endogeneity hypothesis for the last four-year period can be tested.

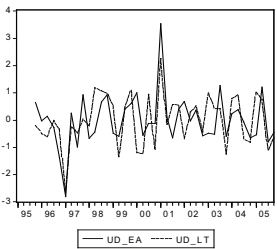
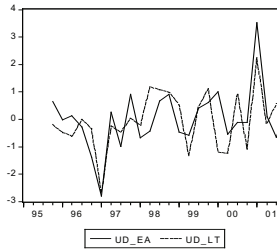
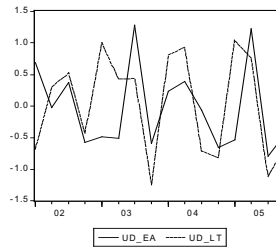
In this paper, the quarterly data was used covering the period of 1995-2005. The data for the Euro zone and Lithuania were obtained from the Eurostat database. GDP was used for output, GDP deflator - for inflation data. The logarithms of both GDP and GDP deflator following the SVAR modelling examples of Fidrmuc and Korhonen (2001, 2004) and Horvath and Ratfai (2004) were evaluated.

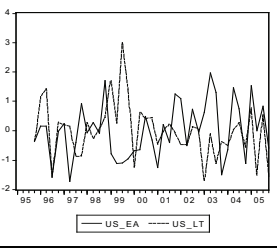
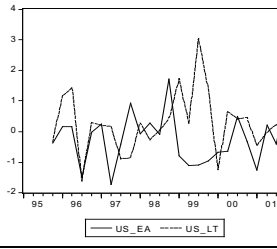
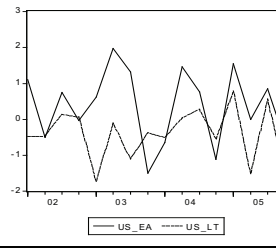
The stationarity analysis and VAR model tests are presented in the 1 and 2 appendixes respectively. The information criteria and lag reduction test were used to set the optimal lag length for all the models, and then the model residuals were tested. The only problem was observed in

³⁵ According to exact calculations, Lithuania exceeded the Maastricht inflation criteria by 0.07 percentage points in 2006.

the Euro area VAR case as the hypothesis of normal distribution of the residuals was rejected at 5% significance level. However, the other tests did not show any more problems, thus the obtained SVAR models were estimated. The correlations of supply and demand shocks are presented in the Table 3. It should be noted that Fidrmuc and Korhonen (2003, 2004) covered time periods (see Table 2) very similar to the first sub-sample of this study, but the correlation coefficients, especially those of demand shocks, diverge. One of the possible explanations is the longer data sample used in this study to estimate the correlation of the shocks³⁶. Another explanation is the measurement problem as very short estimation sample considerably lowers the significance level of the correlation coefficients. Finally, the difference could also emerge due to the statistical revisions of the data.

Table 3. The correlation of demand and supply shocks between Lithuania and the Euro area.

Demand shocks			
Period	1995–2005	1995–2001	2002–2005
Graph			
Corr ¹	0.59	0.65	0.40
Min ²	0.35	0.43	0.11
Max ³	0.76	0.80	0.63

Supply shocks			
Period	1995–2005	1995–2001	2002–2005
Graph			
Corr ¹	-0.03	-	0.05 0.34
Min ²	-0.33	-	0.35 0.02
Max ³	0.28	0.26	0.57

¹Correlation coefficient, ²Minimum value of correlation coefficient at 95% significance level, ³Maximum value of correlation coefficient at 95% significance level.

The estimations show positive correlation between demand shocks for the whole 1995-2005 period, while the correlation coefficient between supply-side innovations is negative. Besides, an opposite dynamic direction is perceptible: demand shock asymmetry between Euro area and Lithuania increased since the change of the base currency from US dollar to Euro, but the convergence of the supply shocks is observed.

The demand shock divergence is in line with I. Vetlov (2005) observations that the asymmetric

³⁶In this study, the SVAR model was estimated using the sample of 11 years (1995-2005), and only the obtained supply and demand shock series were split into two sub-samples to calculate the correlation coefficients.

correlation since 2002 was driven by domestic demand in Lithuania. The domestic demand rises because of the credit boom as a result of growing competition in the bank sector in Lithuania. Secondly, it can be explained by optimistic prospects and growing income expectations due to the membership in the EU and third stage of EMU.

The supply shocks between Lithuania and Euro area, differently than demand shock, indicate an ongoing improvement. Usually the supply shocks are claimed to be corresponding to the structural side of the economy. The impulse for this improvement in Lithuania could be attributed to the Russian crisis that shifted Lithuanian foreign trade from CIS countries towards the EU; it was later complemented by the change of the base currency and, more recently, joining the EU. The obtained results indicate that after Lithuania and Euro zone was hit by the recent oil price supply-side shock, the responses of the economies were more similar than before and thus reflect continuously closer Lithuanian economy integration with the economies of the Euro zone.

Quite similar estimation results of bivariate structural VAR were obtained in the research of Ramos and Suriñach (2003), who split the considered time periods into different sub periods of 1996-1999 and 2000-2002. According to their calculations in terms of demand shocks, correlations have decreased, while the correlations in terms of supply shocks have clearly increased in nearly all CEE countries that joined the EU. The authors assume that "the economic slowdown has increased the heterogeneity of demand shocks". According to them, "this result shows that in the more recent years asymmetric shocks are related to factors controllable by national governments (demand) while those related to non controllable factors tended to decrease (supply), which can be interpreted as good news for the Accession countries".

5. Conclusion

This paper analysed the real convergence issue of Lithuania and Euro zone. Despite its good nominal convergence, previous studies showed that Lithuania is one of the least synchronized economies with Euro area among the ten new Member states. However, due to Lithuanian currency peg to Euro in early 2002, the endogeneity hypothesis of the OCA theory was tested and partly confirmed. Namely, the ongoing progress of the supply-side shocks convergence was evident. On the other hand, the demand-side innovations became less correlated after the peg to the Euro. It can be explained by different development path of Lithuanian economy, which experienced a growing competition in the banking sector, the credit boom, and highly optimistic expectations since the membership in the EU.

In general, the findings corroborate the improvement of the real Lithuanian economy convergence towards the Euro area. Therefore, the adoption of the Euro should be of less concern than it was previously assumed based on the results of the earlier studies.

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1 Appendix. SVAR derivation

Theoretical AS-AD model is solved for output and the price level and written in the matrix form:

$$\begin{bmatrix} y_t \\ p_t \end{bmatrix} = \begin{bmatrix} t_{-1}y_t \\ t_{-1}p_t \end{bmatrix} + \begin{bmatrix} \alpha & 1 \\ 1+\alpha & 1 \\ 1+\alpha & -1+\alpha \end{bmatrix} \begin{bmatrix} u_t^d \\ u_t^s \end{bmatrix} \quad (1)$$

Here $\begin{bmatrix} y_t \\ p_t \end{bmatrix}$ are output and prices. The unobserved structural residuals consist of demand (u_t^d) and supply (u_t^s) shocks.

The assumption is made that $t_{-1}y_t$ and $t_{-1}p_t$ are equal to linear combinations of their past observed values. Denoting coefficients as polynomials of order n in the lag operator L ³⁷ so that :

$$c_{ij}(L) = \sum_{k=1}^n c_{ij} L^k$$

$$\begin{bmatrix} t_{-1}y_t \\ t_{-1}p_t \end{bmatrix} = \begin{bmatrix} y_0 \\ p_0 \end{bmatrix} + \begin{bmatrix} c_{11}(L) & c_{12}(L) \\ c_{21}(L) & c_{22}(L) \end{bmatrix} \begin{bmatrix} y_t \\ p_t \end{bmatrix} \quad (2)$$

Equations (1) and (2) are combined to

$$\begin{bmatrix} y_t \\ p_t \end{bmatrix} = \begin{bmatrix} y_0 \\ p_0 \end{bmatrix} + C_i(L) \begin{bmatrix} y_t \\ p_t \end{bmatrix} + D \begin{bmatrix} u_t^d \\ u_t^s \end{bmatrix} \quad (3)$$

here matrixes $C_i(L)$ and D are simplified, $C_i(L) = \begin{bmatrix} c_{11}(L) & c_{12}(L) \\ c_{21}(L) & c_{22}(L) \end{bmatrix}$ and $D = \begin{bmatrix} d_{11} & d_{21} \\ d_{21} & d_{22} \end{bmatrix} = \begin{bmatrix} \alpha & 1 \\ 1+\alpha & 1 \\ 1+\alpha & -1+\alpha \end{bmatrix}$

Equation 3 can be inverted to obtain the Wold infinite order moving average (MA) representation of supply and demand shocks under the assumption that the vector $\begin{bmatrix} y_t \\ p_t \end{bmatrix}$ is stationary. However, the output and price data is not stationary in its levels. In order to obtain both variables in a stationary form, Bayoumi and Eichengreen (1992) implied that both output and prices are integrated I(1) series and used their first differences, and respectively. Hence, the infinite order MA representation of the structural VAR is represented below:

$$\begin{bmatrix} \Delta y_t \\ \Delta p_t \end{bmatrix} = \sum_{i=0}^{\infty} \begin{bmatrix} b_{11,i}(L) & b_{12,i}(L) \\ b_{21,i}(L) & b_{22,i}(L) \end{bmatrix} \begin{bmatrix} u_t^d \\ u_t^s \end{bmatrix}, \text{ or } Y_t = \sum_{i=0}^{\infty} B_i(L) u_t \quad (4)$$

Equation 4 is the starting point of the Blanchard and Quah decomposition procedure. The explanatory variable vector $Y_t = \begin{bmatrix} \Delta y_t \\ \Delta p_t \end{bmatrix}$ is the first-order differences of output and prices, $B_i(L) = \begin{bmatrix} b_{11,i}(L) & b_{12,i}(L) \\ b_{21,i}(L) & b_{22,i}(L) \end{bmatrix}$ is the coefficient matrix. The unobserved structural residuals $u_t = \begin{bmatrix} u_t^d \\ u_t^s \end{bmatrix}$ are assumed to be orthogonal, that is, they are assumed to be uncorrelated with each other, $\text{cov}(u_t^d, u_t^s) = 0$, and their variances are set to one, $\text{var}(u_t^d) = \text{var}(u_t^s) = 1$. In other words, their covariance matrix is an identity matrix, $E(u_t u_t') = 1$. This form of equation denotes the main idea of the model: all the shocks in the model come through the residuals, specifically, through u_t^s if the supply shock is in effect, or through u_t^d if the demand shock is present. Therefore, the equation indicates the output and price variables are directly affected by supply and demand shocks.

The model indicates that demand shocks have only temporary effects on output, thus the next step

³⁷ For a detailed lag operator explanation see Hamilton (1994), p. 26-27.

is to implicate such influence. Blanchard and Quah (1989) restricted the permanent effect to zero or, in other words, looked for certain coefficients that eliminate the accumulated demand-shock impact:

$$\sum_{i=0}^{\infty} b_{11,i} = 0$$

5

Since the structural shocks cannot be directly observed, the aim is to estimate them from the reduced VAR form that can be estimated by the econometric model:

$$Y_t = \sum_{i=0}^{\infty} A_i(L)e_t$$

6

here again, $Y_t = \begin{bmatrix} \Delta y_t \\ \Delta p_t \end{bmatrix}$ are endogenous variables, $A_i = \begin{bmatrix} a_{11,i} & a_{12,i} \\ a_{21,i} & a_{22,i} \end{bmatrix}$ is the coefficient matrix, and $e_t = \begin{bmatrix} e_{yt} \\ e_{pt} \end{bmatrix}$ are the observed reduced supply and demand-shock residuals. It should also be kept in mind that the in reduced-form VAR is an identity matrix.

Next, there are several methods to derive a relationship between the structural and reduced shocks. One of the easiest ways is to look at the one-step ahead forecast errors of autoregression (AR) model³⁷, which is:

$$\hat{f}_{t,1} \equiv x_{t+1} - E_t x_{t+1} = \varepsilon_{t+1}$$

7

Here $\hat{f}_{t,1}$ is one-step ahead forecast error, E_t - the conditional expectation of x_{t+1} given the information available at t , and error ε_{t+1} (it can be seen as the part of x_{t+1} that cannot be forecasted. In our bivariate MA representation of reduced-form VAR,

$$\begin{aligned} \Delta y_t - E_{t-1} \Delta y_t &= a_{11,0} e_{yt} + a_{12,0} e_{pt} = e_{yt} \text{ and} \\ \Delta p_t - E_{t-1} \Delta p_t &= a_{21,0} e_{yt} + a_{22,0} e_{pt} = e_{pt}, \end{aligned}$$

8

as it was defined that the matrix A_0 is an identity matrix. Similarly, the errors can be calculated for the structural VAR:

$$\begin{aligned} \Delta y_t - E_{t-1} \Delta y_t &= b_{11,0} u_t^d + b_{12,0} u_t^s \text{ and} \\ \Delta p_t - E_{t-1} \Delta p_t &= b_{21,0} u_t^d + b_{22,0} u_t^s. \end{aligned}$$

9

Since the left hand-side equations are equivalent, equations (9) and (10) can be combined and rewritten in a matrix form:

$$\begin{bmatrix} e_{yt} \\ e_{pt} \end{bmatrix} = \begin{bmatrix} b_{11,0} & b_{12,0} \\ b_{21,0} & b_{22,0} \end{bmatrix} \begin{bmatrix} u_t^d \\ u_t^s \end{bmatrix}$$

10

³⁷For more detailed discussion see Enders (1995), p. 99-100.

2 Appendix. Data stationarity analysis

The general data description is presented in the 1 Figure. According to the graphical analysis, all the variable levels are non-stationary, and their first lag differences are stationary. The augmented Dickey-Fuller (ADF) test (Table 1) confirms the first difference stationarity at 5% significance level.

1 Figure. Variable description and stationarity analysis

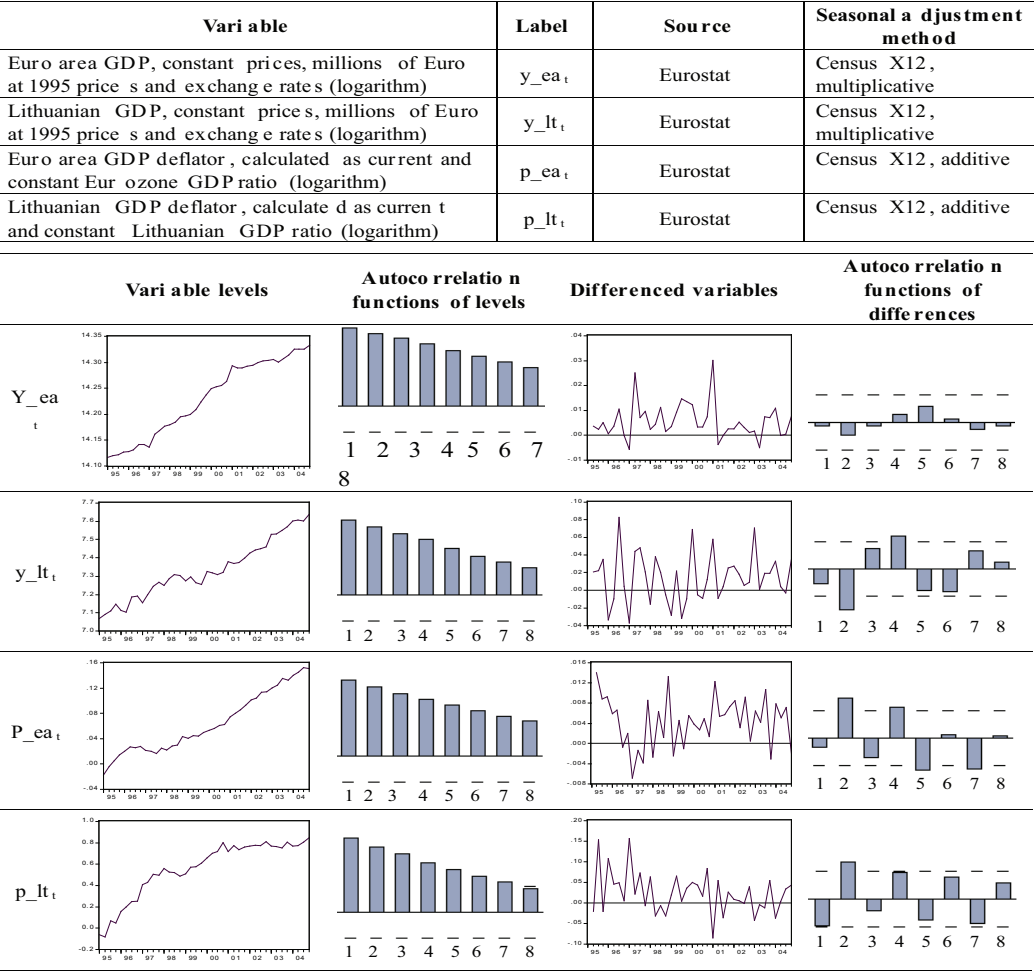


Table 1. ADF test results

Variable	Determined part	t-statistics	Variable	Determined part	t-statistics
y_ea _t	C	-0,70	Δy_ea _t	C	-6,27**
	C, T	-1,48		C, T	-6,24**
y_lt _t	C	0,83	Δy_lt _t	C	-8,22**
	C, T	-0,86		C, T	-8,29**
p_ea _t	C	0,70	Δp_ea _t	C	-3,01*
	C, T	-3,17		C, T	-3,24*
p_lt _t	C	-4,77**	Δp_lt _t	C	-3,21*
	C, T	-2,77		C, T	-10,35**

* - H0 is rejected with 5% statistical significance level
** - H0 is rejected with 1% statistical significance level

3 Appendix. Bivariate VAR lag order estimation and VAR residual test results

Euro area

The optimal lag number of two-variable VAR, using Euro area GDP and GDP deflator data, is two according to Table 2. The VAR residual analysis shows that the residuals are not normally distributed in Table 3. However, as there no other problems were found at 1% significance level, the second-order VAR model was evaluated.

Table 2. VAR lag number tests

Model	Obser vation number	Parameter number	Log likelihood	Schwarz	Hannan-Quinn	Akaike
VA R(1)	39	6	294.8789	-14.558	-14.722	-14.814
VA R(2)	39	10	302.8563	-14.592	-14.865	-15.018
VA R(3)	39	14	303.4388	-14.246	-14.62 9	-14.843
VA R(4)	39	18	305.6240	-13.982	- 74 4.4	-14.750

VAR lag number reduction test (1996:2 – 2005:4)

Lag reduction test	F test statistics
VA R(4)→VA R(3)	F(4,58) = 0.83 6 [0.508]
VA R(4)→VA R(2)	F(8,58) = 0.53 3 [0.827]
VA R(4)→VA R(1)	F(12,58) = 1.533 [0.139]
VA R(3)→VA R(2)	F(4,62) = 0.23 3 [0.919]
VA R(3)→VA R(1)	F(8,62) = 1.90 2 [0.076]
VA R(2)→VA R(1)	F(4,66) = 3.74 5 [0.008] **

H0: the significant information is not missed reducing the lags.

* - H0 is rejected with 5% statistical significance level

** - H0 is rejected with 1% statistical significance level

Table 3. VAR(2) specification tests (1996:2 – 2005:4)

	Variable equation residual tests				Model residual tests	
	AR 1-4 F(4,30)	NST $\chi^2(2)$	ARCH 1-4 F(4,26)	HT F(14,19)	AR 1-4 F(16,50)	
dy_ea _t	0.222 [0.924]	12.941 [0.002] **	0.259 [0.902]	0.415 [0.951]	NST $\chi^2(4)$	12.209 [0.016] *
dp_ea _t	1.659 [0.186]	0.929 [0.628]	0.166 [0.951]	0.292 [0.989]	HT F(4 2.51)	0.509 [0.987]

AR 1-4 – autocorrelation (lags 1 to 4) test, NST (Normality) – test of normal distribution, HT – heteroscedasticity (with squares and cross products) test. Numbers in brackets are p-values.

* - H0 is rejected with 5% statistical significance level

** - H0 is rejected with 1% statistical significance level

Lithuania

The optimal lag number of two-variable VAR, using Lithuanian GDP and GDP deflator data, is two according the Table 4. The VAR residual analysis did not indicate any problems, thus the second-order VAR for Lithuanian data was estimated.

Table 4. VAR lag number tests

Model	Obser vation number	Parameter number	Log likelihood	Schwarz	Hannan-Quinn	Akaike
VA R(1)	43	6	157.3569	-7.506	-7.67	-7.762
VA R(2)	43	10	167.6164	-7.656	-7.930	-8.083
VA R(3)	43	14	168.641	-7.333	-7.716	-7.930
VA R(4)	43	18	173.4351	-7.203	-7.696	-7.971

VAR lag number reduction test (1996:2 – 2005:4)

Lag reduction test	F test statistics
VA R(4)→VA R(3)	F(4,58) = 1.89 7 [0.123]
VA R(4)→VA R(2)	F(8,58) = 1.16 7 [0.335]
VA R(4)→VA R(1)	F(12,58) = 2.466 [0.011] *
VA R(3)→VA R(2)	F(4,62) = 0.41 3 [0.799]
VA R(3)→VA R(1)	F(8,62) = 2.60 0 [0.016] *
VA R(2)→VA R(1)	F(4,66) = 4.96 5 [0.002] **

* - H0 is rejected with 5% statistical significance level

** - H0 is rejected with 1% statistical significance level

Table 5. VAR(2) specification tests (1996:2 – 2005:4)

	Variable equation residual tests				Model residual tests	
	AR 1-4 F(4,30)	NST $\chi^2(2)$	ARCH 1-4 F(4,26)	HT F(14,19)	AR 1-4 F(16,42)	
dy_lt _t	2.369 [0.075]	3.364 [0.186]	0.893 [0.482]	0.766 [0.691]	NST $\chi^2(4)$	6.814 [0.146]
dp_lt _t	0.322 [0.861]	2.511 [0.28 5]	0.321 [0.861]	0.800 [0.660]	HT F(4 2.39)	0.746 [0.834]

AR 1-4 – autocorrelation (lags 1 to 4) test, NST (Normality) – test of normal distribution, HT – heteroscedasticity (with squares, because there was not enough observations for squares and cross products) test. Numbers in brackets are p-values.

* - H0 is rejected with 5% statistical significance level

** - H0 is rejected with 1% statistical significance level

Book Review

"Estonia, the New EU Economy. Building a Baltic Miracle?", Helena Hannula, Slavo Radošević and Nick von Tunzelmann eds., Ashgate, 2006. ISBN: 0-7546-4561-4

This book is a very timely collection of studies of economic development issues for Estonia, and by extension for several of the last wave of EU entrant countries. It is a result of a process that started with a workshop at the School of Slavonic and East European Studies in 2004. It thus brings together contributions both from Estonia and UK based scholars. Each chapter contains much detailed analysis but the chapters also fit together well, telling a compelling story about the core processes that govern growth in the Estonian economy.

The first chapter introduces us to a country that was ranked the 4th most liberal economy in the world by the 2005 Index of Economic Freedom. Part 2 of the book takes a broad macroeconomic view of development in Estonia and other countries in the region. Chapter 2 tells a fairly optimistic story, suggesting that it may be possible for countries such as Estonia to catch up with Western European income levels quite fast given the relatively high endowment of human capital. Chapter 3 looks at the macroeconomic environment for policy convergence, arguing that real convergence of the Estonian economy to EU norms may be more problematic than monetary convergence. Chapter 4 reports the results of a study of panel data on business finance. It finds that a somewhat dual economy may be created by the disparity between the financial constraints on small local businesses and the relative lack of constraints on larger firms with foreign investment.

Part 3 of the book goes beneath the macroeconomic level to look at the structural and organisational changes taking place in Estonia. Chapter 5 looks at employment changes from the late 1990s till 2001. It finds a decline in net changes but continued high rates of gross job flows by international standards. Another interesting finding is that the large number of jobs created by SMEs appears to be less permanent than the smaller number of jobs created by larger firms. Chapter 6 discusses the sources of innovation in the Estonian wood and paper sector and compares them with those in Finland. It finds less use of universities and research institutes in Estonia as sources of knowledge for innovation. Chapter 7 looks at conflict between the traditional values of Estonian society and those associated with modern Western nations. Estonian organisations, like those in the other two Baltic States, appear to rank family needs and security higher than those of society, which could be problematic for economic development. Chapter 8 then proceeds to examine how organisations changed during the course of the 1990s. It notes in particular the gradual spread of managerial capabilities.

Part 4 brings in the international perspective to the book. Chapter 9 presents seven case studies of the effect of foreign ownership on firms in Estonia. The case studies demonstrate some divergence from the current Vernon inspired "stage" models, and thus suggest that it would be helpful to consider more sophisticated forms of interaction between owners and firms. Chapter 10 takes an innovative look at the recent phenomenon of de-internationalisation in Estonia. Sometimes this is triggered by positive factors such as a resurgence of the domestic economy. Chapter 11 takes a sample of 5 CEE countries to examine the relationship between the level of autonomy of foreign subsidiaries and their performance. One of the interesting findings in this chapter is that non-high technology industries have higher productivity in these countries than high technology industries. Chapter 12 takes a network approach to examine the level of autonomy of foreign owned companies in Estonia, based on five case studies. The relationship between autonomy and performance appears to run in both directions in these cases, with high capability sometimes leading to more autonomy.

The concluding chapter makes several interesting points concerning the possible emergence of a Baltic economic miracle. Firstly, the impressive recent growth rates contrast with less outstanding growth if we look at the entire transition period, or even just the period from the 1990s nadir of recorded gdp. Secondly, the information technology revolution, with its tendency to network operations, creates a unique opportunity for Estonia and other countries to catch up with the West. And thirdly, Estonia needs to create a balance between foreign led and domestic led innovation if its fast growth is to be sustainable.

Mark Chandler

Stockholm School of Economics in Riga and Baltic International Centre for Economic Policy Studies (BICEPS).



"Latvia has a strong and active financial sector and as benefitted from the opportunity to participate in global markets. The capital city of Riga has the promising potential to become an important regional financial center."

Vaira-Vike Freiberga, President of Latvia, at "Liechtenstein Dialogue 2005"

**On behalf of the Banking Institution of Higher Education,
we have the pleasure to invite you to the**

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"Riga as an International Financial Center: Exploring Opportunities and Challenges"

12th & 13th October, 2006, Riga, Latvia

An outstanding group of experts from Switzerland, Great Britain, United States, Canada, Dubai, Latvia and other countries have been invited to investigate the potential for Riga, as the capital of a small open economy such as Latvia, to become an international financial center. The participants will include key decision makers from the financial industry, government agencies, consulting firms and academia. The conference purpose is to provide a forum to address the opportunities and challenges that Riga must deal with in order to develop into a regional/international financial center.

Looking forward to exploring with you how Latvia can develop more effectively into an international financial center.

Sincerely,

Dr. Tatjana Volkova
Rector
Banku augstskola

Dr. Arthur Lindemanis
Vice-Rector, Research
Banku Augstskola

Conference Deadlines:

Abstracts: **Sept. 30**

Registration: **Oct. 5**

Conference Fees:

150 € (incl. reception, lunch & dinner)

50 € graduate students

Conference Location:

The Banking Institution
of Higher Education
Kr. Valdemara St. 1b
Riga LV-1819, Latvia

Inquiries & Reistration:

Conference website: www.ba.lv

Tel: +371 732 26 05

Fax: +371 732 06 20

E-mail: conferenc@ba.lv

Dr. Arthur Lindemanis

Vice-Rector, Research
arthur.lindemanis@ba.lv

Inga Aleinikova

Assistant to Vice-Rector, Research
inga.aleinikova@ba.lv