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FACULTY OF SOCIAL SCIENCES

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BACHELOR THESIS

Current account adjustment in the Baltic countries

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Abstract

In last twenty years, the Baltic countries have experienced turbulent develompents of their current accounts. Deficits on these accounts were often substantially above -10% of GDP and there was active discussion about their sustainibility. We will look in this work on the developments of the current accounts both from practical and theoretical point of view. The later is made with usage of an intertemporal model of representative agent, who maximazes his utility by optimizing his consumption profile over infinite time horizon. This model is then used in empirical part, where we compare estimated values of the current accounts with their real values. We assume that expectations about future values of key variables are realized by following the vector autoregression of order one. The results of this work suggest that big deficits in past were caused by high expectations about growth rates of the economies. Decreasing of this expectations then resulted in the adjustments of the current accounts.

JEL Classification	F21, F32, F41, F47
Keywords	current account adjustment, balance of payments, intertemporal model, Baltic countries

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Abstrakt

V posledních 20 letech jsme byli svědky turbulentního vývoje běžných účtů na území Pobaltských států. Deficity na těchto účtech často přesahovaly úroveň -10% HDP, což mělo za následek aktivní diskuzi ohledně jejich udržitelnosti. V této práci se podíváme na vývoj běžných účtů Pobalských států jak z praktického, tak z teoretického pohledu. K tomu využijeme intertemporální model reprezentativního agenta, jenž maximalizuje svůj užitek optimilizací spotřeby v nekonečném horizontu. Tento model později použijeme v empirické části, kde porovnáme odhad běžného účtu s jeho skutečnými hodnotami. Náš předpoklad je, že očekání o budoucích hodnotách klíčových proměnných jsou uskutečňována pomocí vektorové autoregrese prvního řádu. Výsledky této práce ukazují, že velké deficity v minulosti byly výsledkem vysokých očekávání ohledně tempa růstu ekonomik. Snížení těchto očekávání pak mělo za následek vyrovnání běžných účtů.

Klasifikace	F21, F32, F41, F47
Klíčová slova	přizpůsobení běžného účtu, platební bilance, intertemporální model, Pobaltské státy

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Declaration of Authorship

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Prague, May 5, 2014

Signature

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Bachelor Thesis Proposal

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Proposed Topic:

Current account adjustment in the Baltic countries

Topic Characteristics:

The aim of this thesis is analysis of processes causing deviations of the current accounts from balanced states and their subsequent adjustments in the Baltic countries. The first part of this work will be focused on the developments of individual components of the current and financial accounts in the Baltic region. The special attention will be given to the period during the Global Financial Crisis, when the Baltic countries substantially lowered their current account deficits. The second part will be devoted to dynamics of the current account from a theoretical point of view, which will be done with usage of an intertemporal model of the current account. This model will be used in empirical part, where we will estimate the current accounts over given period of time.

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1 Introduction

Over the last 18 years, we have witnessed dramatic evolution on the current accounts in the Baltic region. At the beginning of the period, high current account deficits were backed to a large portion by inflow from foreign direct investment. This situation has gradually changed, as still increasing current account deficits were more and more financed by money from taken loans. These sources were mainly used for financing deficits on balance of trade, caused exclusively by deterionating development on balance of goods. The biggest deficits on the current account was in Latvia, which had at the end of 2006 quarterly deficit reaching -30% of its GDP. Nevertheless, also Lithuania and Estonia were far from safe level of deficits up to -4% of GDP, a number reffered by the European Commission in the Extensive Imbalance Procedure (EIP) Scoreboard. Such developments created doubts about sustainibility of these current accounts and generated a great pressure on policy makers to take some action. Their solution were large internal devaluations, which throught painfull process for the citizens succeeded in restoring the balances of trade.

We explore in this work possible causes of realized development on the current accounts in the Baltic region. It is made with usage of an intertemporal model for the current account. These types of models nowadays represent standard approach between academics for modeling a dynamic behaviour on the current account. Altough there exists different models dealing with the currrent account dynamics (e.g. the Mundell-Fleming model), the development in current literature favours micro-based approach for its capability to explain people´s desire to smooth consumption over time, which can be seen as natural way in clarifying Friedman´s permanent income hypothesis suggested in 1957. The original model of an intertemporal current account was first published in seminal work of Sachs (1981) and Sachs (1982), later developed further by Persson & Svensson (1983) and Sheffrin & Who (1990).

It should be noted that the model has often been extended to incorporate a new development in fields such as consumption behaviour, financial markets, monetary policy and others. For this reason we can consider as the great contributors to the current account models works made by Campbell (1987), Hall (1988) or Rogoff (1992), originally intended as works on consumption behaviour. For an

extensive summary in the field, see Obstfeld & Rogoff (1996), the excelent textbook nowadays teached in courses engaged in international macroeconomics.

One of the major problems in the current account models is related to the expectations of representative agents. Usual approach is to assume that agent makes predictions by following the vector autoregression (VAR) of some given order. Classical version of the structural equation in the VAR, codified in Obstfeld & Rogoff (1996), contains the net output and the current account. Extension to this was provided by Bergin & Sheffrin (2000), who added consumer-based interest rate to the structural equation and tested it empirically for the United Kingdom´s,Canadian and Australian economy. This model was also used by Campa & Gavilán (2006), who tested it for the Western European countries. The model is also used in this work in order to see if the Baltic economies behave according to the theory or not.

The work is arranged as follows. Chapter 2 serves as a brief introduction into developments of the Baltic economies through presentation of selected stylized facts. First part of the chapter is focused on main figures about the economies, followed by part dedicated to breakdowns of the current accounts and financial accounts, for each country separately. Chapter 3 is then devoted to a step by step derivation of the model. The following Chapter 4 presents emirically testable model, discussion about data issues and a motivation behind selection of the parameter values. Results of the estimation procedure are then shown later in the separate Chapter 5. Chapter 6 describes the adjustment processes of the current accounts started at the beginning of the crisis, both from theoretical and practical perspective. The work as usual ends with concluding remarks in Chapter 7.

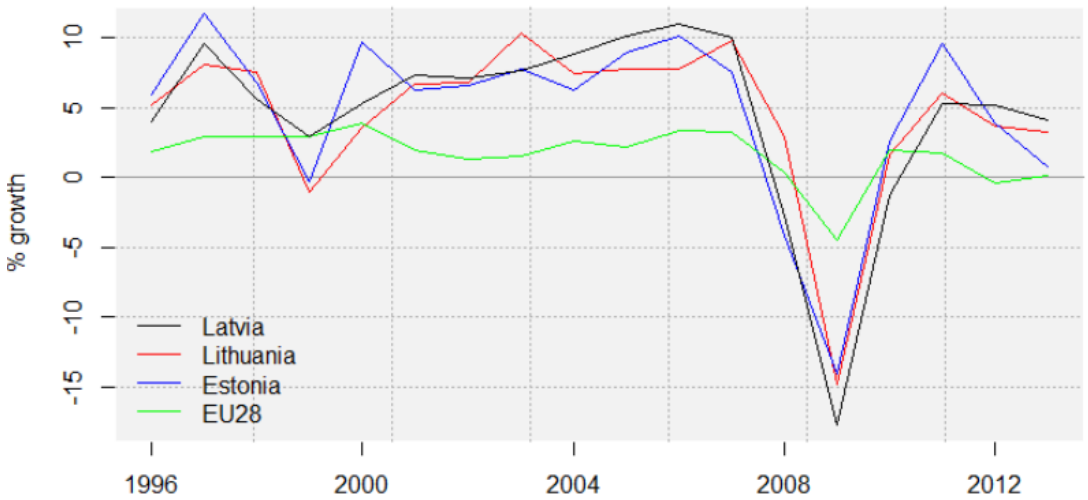
2 Stylized facts

2.1 General information

The Baltic states are small open economies counting together only slightly above 1% of total population in the European Union. They have adopted liberal democracy and market economy after they had left the Republics of the Soviet Union in the early 90s. Another important milestone for the countries is represented by the year 2004, which is the time when they became members of both the EU and the NATO. Despite the Global Financial Crisis, Estonia was able to meet the Maastricht convergence criteria and accepted euro as its oficial currency in 2011. The same goal was successfully acomplished also by Latvia, joining the euro area in 2014. It makes Lithuania to be the only state in the region with its own currency. Official name for it are the litas and it has been pegged to the euro since 2002 with conversion rate 1 euro for 3.4528 litas.

As can be seen from the graph 2.1.A below, all three countries have experienced extraordinary growth in period 1996-2007, often exceeding the EU-28 average growth rates by more than 5 percentage points. The only exception was the year 1999, when the Baltic states were pulled down by a financial crisis originated in Russia year ago. It caused -0.3% fall of GDP in Estonia and -1% fall of GDP in Lithuania. The subsequent years meant period of unprecedent growth for the region. It peaked in 2006, when both Estonia and Latvia had growth rates above 10% of GDP. But such growth was not supported by economic fundamentals, so it had only limited duration. Overheated economies combined with a great exposure to the world financial markets caused the Baltic states to experience the biggest drop of GDP during the Global Financial Crisis among all the EU states. In 2010, a positive growth rates were restored again for Estonian and Lithuanian economy, leaving Latvian economy to struggle with negative growth rates till 2011.

Graph 2.1.A % GDP growth from previous year



Source: Eurostat (2014)

As was often a case in the transitory economies, the Baltic states also experienced a period of high inflation during early stages of transition. Yet, in years 1999-2006, the inflation rates were slightly above an average of the EU and the situation seemed quite stabilized. Only Latvia had some difficulties with higher inflation rates, overcoming level of 6 percentage points each year since 2004. As was discused earlier, the Baltic countries showed various signs of overheated economies, and one of them was a substantial rise in inflation rates between years 2007-2008. High inflation rates were then brought down during the incoming recession and nowadays they are again comparable with rest of the EU.

Situation around gross debt of general government is very favourable in the region, all countries have these debts considerably bellow an average of the EU. The best position has Estonia whose government has been able to keep its debt under very pleasant level 10% of GDP. Slightly worse position have governments of Lithuania and Latvia, their debts are now exceeding 40% of GDP. It is worth noting that a large portion of these debts have been accrued since the beginning of the crisis as part of Latvian and Lithuanian efforts to restore their economies.

Before we will look at the current accounts in a great detail in the following sections, we make comparision of their developments here. As graph 2.1.B below suggests, the current accounts were very similar in magnitudes in the Baltic countries. Up to 2004, the deficits on the current accounts were oscilating around -10% of GDP. Their presence is common for the converging economies, yet by comparision with other countries from the Central and Eastern Europe, we can conclude that the

deficits in the Baltic countries were rather high. The situation got even worse in the subsequent years, as the deficits were increasing each year, driven by overheated economies. The turning point was for Estonia and Latvia in 2007, for Lithuania it was one year later, when the deficits started to fall fast. The current accounts got balanced practically at the same time, which was at the first quarter of 2009. Nowadays, the levels of the current accounts are oscilating around zero.

Graph 2.1.B Current accounts as % of GDP

Source: Eurostat (2014)

Different story is an unemployment in the region. All three states have traditionally high unemployment rates most of the time. When we look at an average unemployment rates last 13 years, we got the following numbers: Estonia 10.1%, Latvia 12.5%, Lithuania 12%. Development of unemployment in the region can be described by high rates at the beginning of the millenium, low rates during the economic boom in years 2004-2008, which was followed by a sharp increase of rates caused by the crisis and ended by a gradual reduction as situation in the economies improved. Nowadays, all the Baltic states have unemployment below their´s long-term averages.

Other serious concerns rise question about population development in the area, as the countries are forced to deal with a shrinking population each year. The reason of it does not just lies in the difference between number of people who are borned and die each year, there is also a great share of people emigrating from these countries. It creates pressure on the economies, since the most people leaving the countries are those who are capable of work. As table below indicates, according to the Eurostat projections, the situation is not expected to be any better in future.

Table 2.1: Population – estimated projections

Year	Lithuania	Latvia	Estonia
2000	3,512,074	2,381,715	1,401,250
2010	3,141,976	2,120,504	1,333,290
2020*	2,671,108	1,880,087	1,284,459
2040*	1,997,167	1,513,038	1,162,106
2080*	1,841,709	1,351,057	1,029,443

Source: Eurostat (2014), * stands for Eurostat estimated values

2.2 Estonia

2.2.1 Current account and structure of trade

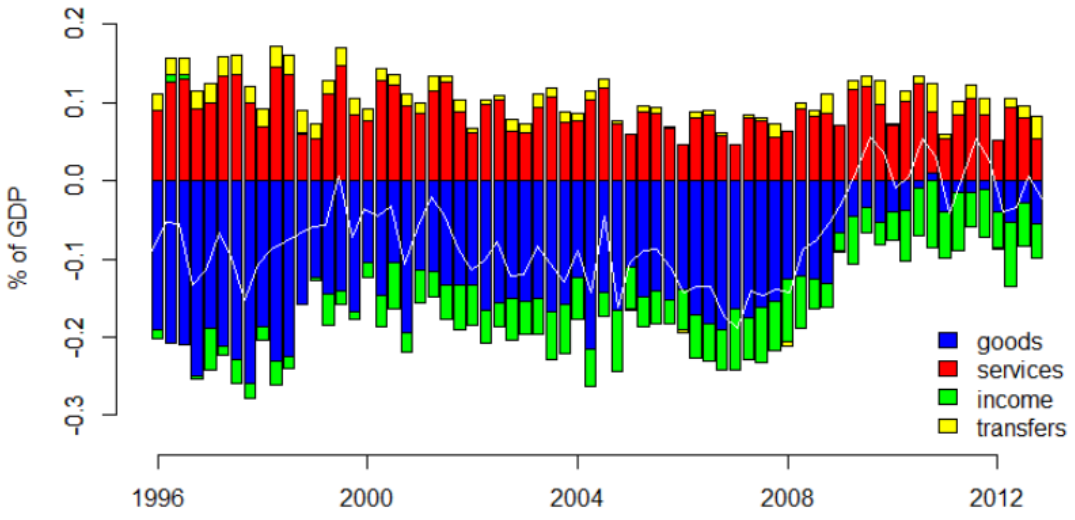
Estonia is considered to be the most developed country among all Baltic states, since it has the biggest share of people working in high skilled jobs and has also the highest GDP per capacita in the region, altought it counts only for 53,7% of the EU-28 average in 2013. If we take into consideration high expectations about growth rates and transition process of the economy, it seems natural that the state experienced long period of the current account deficit. Yet, its volumes were far from being inside the safe range up to -4% of a current account deficit, as was told earlier, a number reffered in the EIP Scoreboard as warning borderline. In 2007, its current account deficit reached -15% of GDP, pulled down by deficit almost touching -20% of GDP in Q1 2007. It represented the quarter with the highest deficit on the current account in modern history of Estonia. Following text looks deeper at the issue with attention to each component of the current account. Figures used there are from the Eesti Pank, the central bank of the Republic of Estonia, and the ECB.

First we look at the components of the current account. As underneath graph suggests, the biggest contribution to the deficit in past was made by deficit in goods sector. Tradionally high positive figures in balance of services were not enough to counterbalance it, meaning negative balance of trade up to 2009. Deficit in the income balance has been made almost entirely by returns on the large foreign direct investmens in the country, as will be shown in section 2.2.2.

Altought the crisis brought huge drop in exports, namely a decrease by -7.1 percentage points counted as share of the GDP between years 2008-2009, the

Estonians were able to suppress their imports even more, which resulted in a positive balance of trade that year. Following years are a different story, yet with the same outcome. Since 2010, both exports and imports have been rapidly growing each year as the economy has been recovering from the crisis. Nowadays, the Estonian levels of imports and exports counted as a share of the GDP are one of the highest in the whole EU, which indicates mature stadium of Estonian integration into international markets.

Graph 2.2.1 Decomposition of Estonian current account



Source: Eurostat (2014), own computations

Estonia, being the northest country among the Baltic states, has strong bussiness ties with Sweden and Finland, which can be declared by the fact that export in these countries accounts to 30% of total exports. Other important trading partners are in descending order Germany, Russia, Latvia and Lithuania. Main trading article in Estonia is machinery and equipment, overcoming in both imports and exports 25% share. It is followed by mineral products, chemicals, timber and wooden products. The service sector is dominated by transport and travel services, making Estonia to be a great importer of transport vehicles.

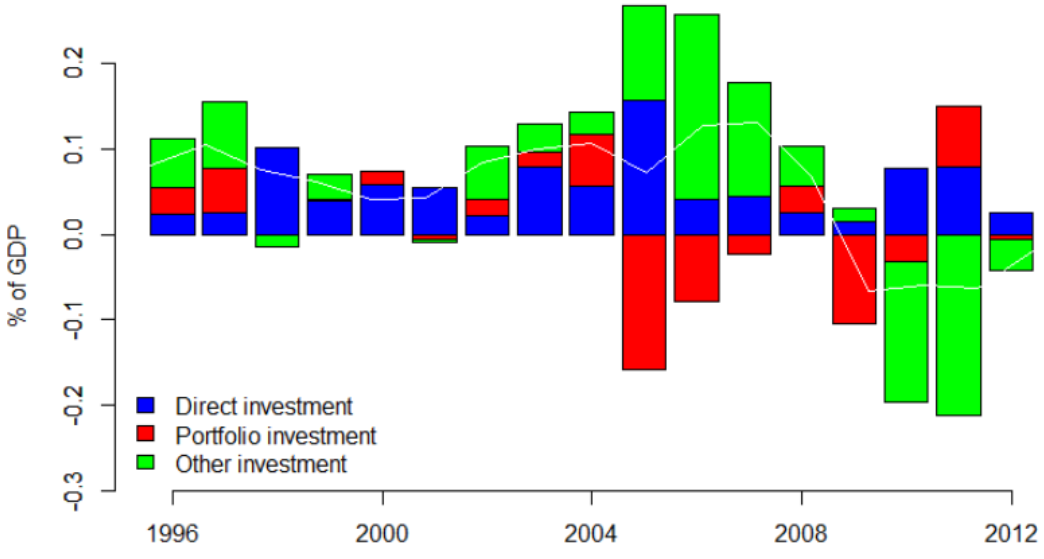
2.2.2 Financial account and international investment position

Balance of payments got its name due to the fact that all deficit/surplus on a current account must be reflected with opposite signs on a financial account combined with a capital account. As can be seen from the graph below, up to 2006, the deficit on the Estonian current account was largely financed throught foreign direct investments (FDI). In 2005, a extraordinary high balance of inward/outward FDI, together with a very low portfolio investment balance, was caused by foreign takeover of a bank

Hansapank, formerly accounted as portfolio investment. Following few years of low positive balance of the FDI had its roots in increased direct investments abroad rather than in a decreased FDI inflow. Tradionally the largest share of the FDI stood for financial and insurance activities, but we can see gradual change of this course. This can be declared by development in 2011, when Swedish investors drew back large part of capital in Estonian banking sector. However, in the same year Estonia withdrew capital from both Latvian and Lithuanian banking sector. These two events canceled out themselves, leaving direct investment balance nearly unchanged.

Development in the porfolio investment is mostly influenced by credit institutions. Thanks to advanced banking sector combined with very small Estonian economy and strong bussiness ties with credit institutions in Sweden, Finland, United Kingdom and other Baltic states, it is hard to see some clear patterns in the portfolio investment sheet both in assets or liabilities. Special attention deserves year 2009, when Estonia started to be after many years net lender vis-à-vis the rest of the world. The reason for that was mainly thanks to drop in liabilities, particularly when Estonian credit institutions repayed back debt securities to their United Kingdom counterparts. In the following two years, the portfolio investments were influenced by the central bank´s decrease in possession of debt securities. Up to the beginning of the crisis, large surpluses in the other investment balance were accounted to a great amount by loans provided from the Scandinavian banking sector.

Graph 2.2.2 Decomposition of Estonian financial account



Source: Eurostat (2014), own computations

Estonia has the biggest amount of total direct investments received from abroad, both in absolute and relative terms. It shows that Estonia is the most attractive market for investors among all Baltic countries. We get the same result if we look at the total amount of the direct investments abroad, i.e. investments make by Estonians to establish enterprises there. As inward FDI overcome outward FDI in the long term, Estonia´s net position in the direct investment has negative sign, namely -58% of GDP in 2012. International net investmest position was there in the same year -54% of GDP, which means that Estonia is net borrower vis-à-vis the rest of the world almost exclusively due to its position in the FDI.

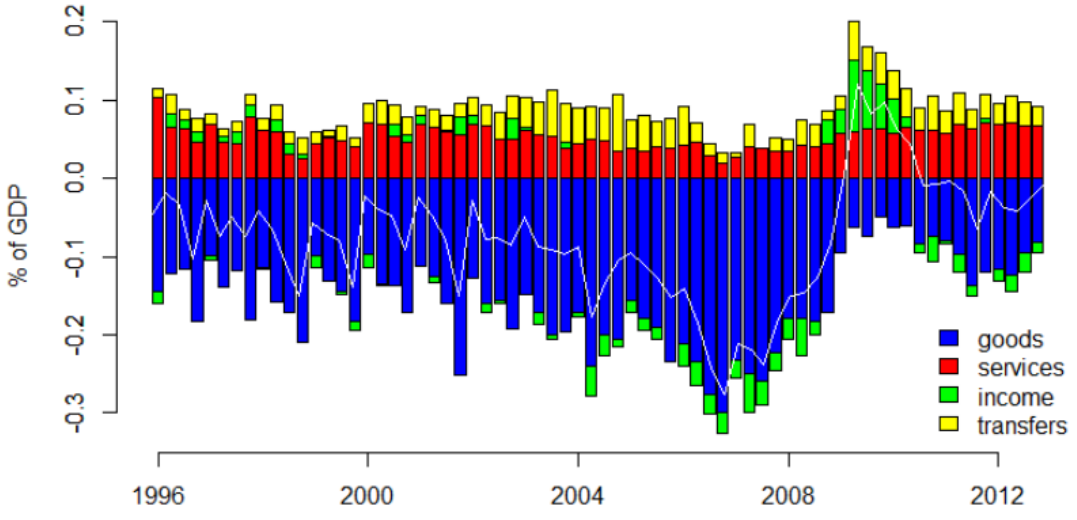
2.3 Latvia

2.3.1 Current account and structure of trade

Latvia belongs to a group of least developed countries in the European Union, its GDP per capacita does not reach even half of an average value in the EU. Before 2005, its current account oscilated around -10% of GDP, driven mainly by deficits in goods sector. As was discussed earlier, Latvia had the biggest growth rates in the region as well as the highest inflation rates, which indicated that the economy was substantially overheated. It made a great pressure on consumption behaviour, eventually causing extensive overconsumption. Extremely poor numbers in balance of trade before the crisis pulled down the Latvian current account to an unprecedent levels. In the worst quarter, namely fourth quartal of 2006, its current account deficit was near -30% of GDP. Figures used in this section are from the Bank of Latvia and the ECB.

While looking at the graph, we can see that the Latvian deficit was hold back thanks to the service sector, but also largely by received transfers from the rest of the world, pushing Latvia into position of net receiver in the balance of transfers. Unfavourable development of the current account before the crisis rised concerns about its sustainibility in a long term, which made Latvia to ask the EU, the IMF and the Nordic countries for providing credit to restore its balance of payments and banking sector. These loans to Latvia totaled €7.5 billion, from which €3.1 billion was provided by the European Community under the balance-of-payments assistence programme. During year 2009, the Latvian economy experienced rapid movement of its current account from red to green numbers. Development of this change was similar to Estonia and Lithuania, i.e. adjustment in balance of trade by substantial decrease in imported goods, but there was also a positive change in the balance of incomes, as severely depressed Latvian economy was not able to generate income for its foreign investors.

Graph 2.3.1 Decomposition of Latvian current account



Source: Eurostat (2014), own computations

Geographical position of Latvia makes its neighbours to be also its main trading partners. Their share on total Latvian exports are: Lithuania 16%, Estonia 13% and the Russian federation 11%. The Latvian exports are consisted mainly of wood and wooden products, base metals, machinery, electrical equipment, mineral products and processed food. The composition of imports is very similar to the exports, indicating middleman role of the Latvian economy.

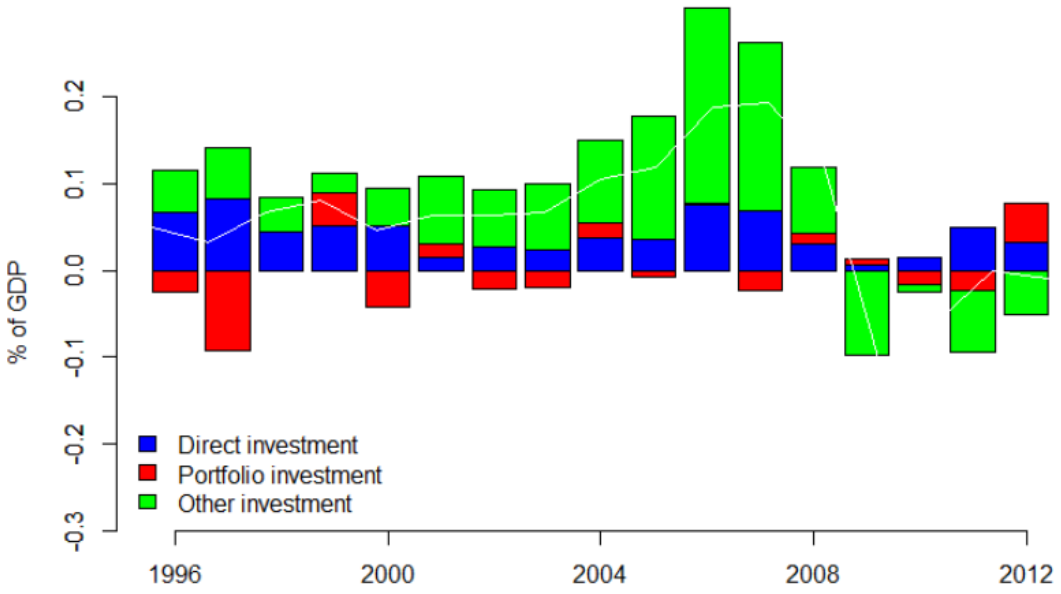
2.3.2 Financial account and international investment position

When we look at the financial account of Latvia, it is clear that deficits on the current account could not be fully paid by capital from direct investment. The only time when its inward direct investment overcame level 5% of GDP were few years before new millenium and the exceptional years of growth in 2006-07. Development of inward direct investment in abolute terms shows similar patterns as in Lithuania, so it seems that from primer investor perspective both Latvia and Lithuania represent equally attractive markets, which slightly favours smaller Latvian economy while looking at relative to GDP figures. The crises substantially influenced foreign direct investment coming into the country, the inward FDI was practically zero in 2009. We can say that Latvia has succesfully recovered from it, since in 2011, the economy attracted more foreign capital than Estonia did.

Portfolio investment in Latvia has been oscilating around zero, which leaves Latvia having neutral position with rest of the world. The main driver of final sign of portfolio investment are credit institutions and their changes in assets of debt securities. It left the deficits on the current account to be paid by other investment,

namely by accepted loans from foreign credit institutions. This changed at the beginning of the crisis, as Latvia started to decrease its liabilities to foreign institutions and has been gradually improving its net international investment position.

Graph 2.3.2 Decomposition of Latvian financial account



Source: Eurostat (2014), own computations

Latvia has the worst international net investment position among all the Baltic states. In 2012, it was -66% of GDP. This number could be even larger, if Swedish banks would not write-off a large amount of loans provided to Latvia´s households. Without it, the net position in other investment would be -52% of GDP in 2012. It would mean together with its position -43% of GDP in direct investment and practically balanced position in portfolio investment that international investment position would actually be over -90% of GDP. Nevertheless, recent developments in the country indicates a gradual improvement of its investment position thanks to the development in other investment.

2.4 Lithuania

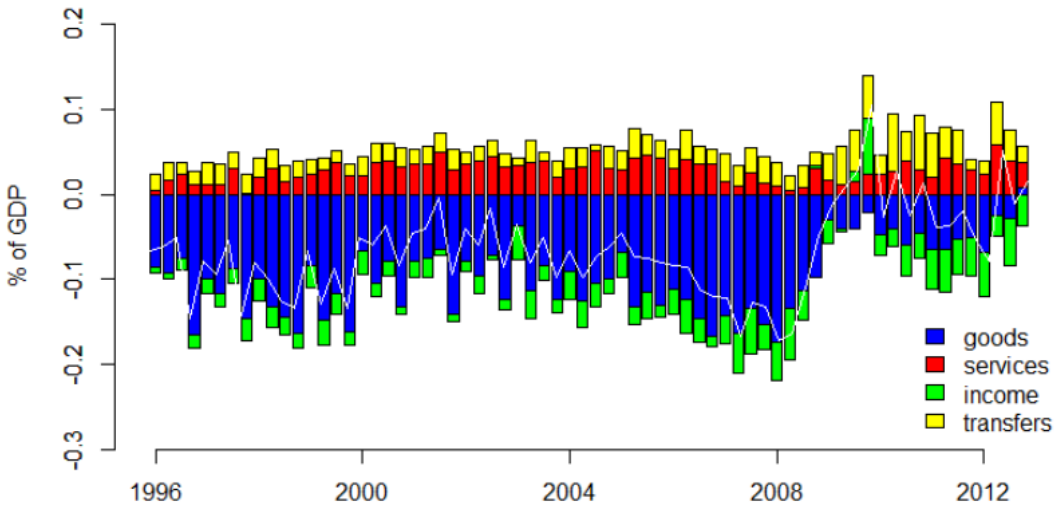
2.4.1 Current account and structure of trade

Lithuania with its population around 3 million represents the largest economy in the region. It has also experienced a long-lasting period of high current account deficits, frequently overcoming -10% of GDP. Development of its current account shows very

similar paterns as in the other Baltic countries, yet there are still some differences worth noting. Data are from the ECB and the Bank of Lithuania.

If we look at the graph below, we can notice that the Lithuanian balance in goods sector has also been in deficit for a long time, but its magnitude is slightly lower when compared to Estonia and Latvia. This has been partially compensated by lower surpluses in service sector, but Lithuania still possess the lowest current account deficit on average among the Baltic states during period 1996-2012. Years before the crisis were signalling worsening situation around the current account stability, led by deepening deficits of the balance of trade. The following adjustment process was caused mainly by two factors, the first was restoration of balance of trade thanks to better figures in goods sector, and the second was increased funds given to Lithuania from international institutions and especially from the EU.

Graph 2.4.1 Decomposition of Lithuanian current account



Source: Eurostat (2014), own computations

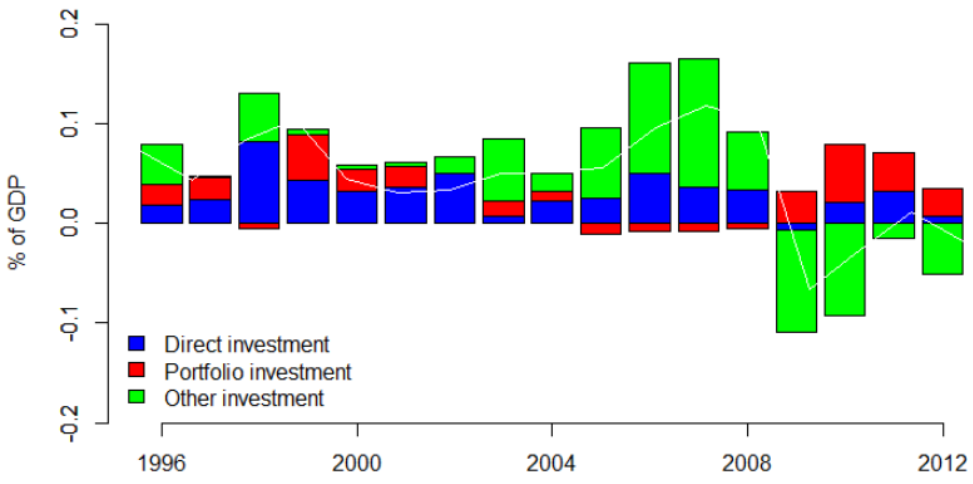
The major trading partner to Lithuania is the Russian Federation. Its share on exports and imports amounted 16% and 26% in 2013, respectivelly. Other significant destinations for the Lithuanian exports are in descending order Latvia, Estonia, Poland, Germany and Belarus. Disregarding Russia, the imported goods come mainly from Germany and Poland, but also to a large portion from Latvia and the Netherlands. Its composition of trade consists mainly of mineral products, machinery equipment and chemicals. Low share of final goods on total exports and high share of transport on services makes Lithuania to be mediator of trade between its neighbours. The biggest company in the country is rafinery AB, the national champion contributing by 10% to Lithuanian´s GDP.

2.4.2 Financial account and international investment position

Up to 2002, Lithuania was able to cover all deficits on the current account by a inflow of direct investment and portfolio investment. This changed substantially after 2002, there was a decrease in inward foreign direct investment as well as demand for its securities and Lithuania was forced to cover its deficits by taking loans from foreign countries. Altought absolute levels of loans taken were far below Latvia, Lithuania did not provide loans to other economies as much as Latvia did, so the resulting balance in other investment was not so different when compared to Latvia.

As other Baltic countries, also Lithuania stopped taking more loans since the beginning of the crisis and has improved its yearly position with rest of the world from net borrower to net lender. Solid positive numbers in portfolio investment can not be attributed to any particular institution, the main driver is high demand of foreign private investors for Lithuanian securities, especially for shares of above mentioned company AB.

Graph 2.4.2 Decomposition of Lithuanian financial account



Source: Eurostat (2014), own computations

Lithuania´s net international investment position was -53% of GDP in 2012, which is practically the same number as in case of Estonia, but unlike it, Lithuania has not got such number solely from foreign direct investment, which accounts for only -30% of GDP. Additional contributor to its position is portfolio investment standing for -24% of GDP. As the other Baltic states, also Lithuania was in trouble due to adverse development in other investment. It changed at the beginning of the crisis, partially thanks to repayment of its debts and partially thanks to writing them off.

3 Model description

3.1 Intro

In this section we derive the intertemporal model of the current account for small open economies that can borrow and lend with the world economy at time-varying real interest rate. The great advantage of this model lies in its micro-foundation, where changes in overall economic indicators are explained by behavioral patterns of representative households optimizing their utility. There are also other reasons why this approach is suitable for the Baltics. The converging economies are usually experiencing large movements of relative price levels of non-tradeble goods. It is made by gains in productivity in sector of traded goods, where in line with Balassa-Samuelson effect, this should corresponds with increasing relative price levels of non-tradebles expressed in tradebles. It can be well captured by allowing the households to consume two types of goods, tradebles and non-tradebles. Their chosen levels of these goods are influenced by their relative price levels as well as the household´s preferences over them. From usual macro-based approach, large deficits of the current accounts are consequences of the overheated economies. Our chosen approach, even though it lacks nominal rigidities, is also able to capture this dimension to some extent, as overly large deficits are created in the intertemporal consumption model by too optimistic expectations about future growth rates, which is something often seen in overheated economies.

In following pages we derive model originally developed by Bergin & Sheffrin (2000) in order to achieve empirically testable model that we later use for the Baltic countries´ current accounts. It will underpin a better understanding of the processes behind the development of the current accounts in the region.

3.2 Set up

The representative agent is facing the following optimization problem:

$$max\, E_0 \sum_{t=0}^{\infty} \beta^t U(C_{Tt}, C_{Nt}),\ \beta \in (0,1)$$

$$U(C_{Tt}, C_{Nt}) = \frac{\left(C_{Tt}^{\gamma} C_{Nt}^{1-\gamma}\right)^{1-\sigma}}{1-\sigma}, \gamma \in (0,1), \sigma \neq 1, \sigma > 0$$

$$s.t.\ Y_t - (C_{Tt} + p_t C_{Nt}) - I_t - G_t + r_t B_t = B_{t+1} - B_t$$

Utility function is denoted by U, consumption of the traded goods by C_T and consumption of the non-traded goods by C_N. Further, Y_t represents output in period t, p_t is relative price of home non-tradables expressed in traded goods, I_t stands for investments in given period, G_t are goverment expenditures, B_t are net foreign claims over period t and r_t is the world real interest rate.

In the model, a representative agent is maximazing his lifetime utility from now to infinite time horizon, i.e. we are dealing with model of infinetely lived agent. The crucial assumption of the model lies in a constant intergenerational altruism, which represents distinction from other types of models (e.g. Overlapping generations model). When it is true that people care about welfere of their offsprings as much as they care about themselves, we can then model optimization problem as if there is infinitely lived agent. To express people´s preference in current over future consumption, β is assumed to be in range (0,1).

In such setup, it is possible for an individual to roll over his debt to levels which would be impossible for him to repay. His lifetime consumption could therefore overcome its lifetime income at someone else expense. Of course lenders would not allow such type of behaviour, so we need to add transversality condition to our model, namely

$$\lim_{T\to\infty} (1+r)^{-T} B_{t+T+1} = 0$$

Strictly speaking, the transversality condition ensures that present value of country´s output in all periods is equal to present value of its consumption.

3.3 Intratemporal substitution

In order to solve the optimization problem mentioned above, we first need to derive demand functions for consumption of traded and non-traded goods given some budget, i.e.

$$maxU(C_T, C_N)\ s.t. Z = C_T + pC_N,$$

where Z is given budget expressed in traded goods for consumption purposes over some period of time. The utility function from section 3.2 can be easily rewriten as

$$U(C_N) = \frac{\left[(Z - pC_N)^{\gamma} C_N^{1-\gamma}\right]^{1-\sigma}}{1-\sigma}$$

First order condition of this problem yields

$$\left[(Z-p_tC_N)^{\gamma}C_N^{1-\gamma}\right]^{-\sigma}\left[-p\gamma(Z-p_tC_N)^{\gamma-1}C_N^{1-\gamma}+(1-\gamma)C_N^{-\gamma}(Z-p_tC_N)^{\gamma}\right]=0$$

Note that the first part of the equation is allways bigger than 0 and therefore can be disregarded. If we substitute expression $Z-p_tC_N$ back to consumption in traded goods C_T, we get after some rearrangements the following equation:

$$\frac{C_T}{C_N}=p\frac{\gamma}{1-\gamma}$$

This equation shows important relationship, the intratemporal substitution between C_T and C_N. There are two factors influencing the substitution, a relative weight of C_T and C_N from market perspective given by price p and from subjective perspective given by parameter γ. Now by substituting C_T expressed in terms of C_N in budget constraint, we get

$$Z=\frac{\gamma}{1-\gamma}pC_N+pC_N$$

From this equation we can finally get demand for C_N, given value of Z. Demand for C_T can be obtained by applying the same procedure, but this time we substitute pC_N from the equation $\frac{C_T}{C_N}=p\frac{\gamma}{1-\gamma}$ into the budget constraint. The two resulting demands are then:

$$C_N^*=\frac{Z(1-\gamma)}{p};\ C_T^*=\gamma Z$$

3.4 Real consumption

In further text it will be convenient to work with index of total consumption (or equivalently, real consumption) defined as

$$C=\Omega(C_T,C_N)=C_T^{\gamma}C_N^{1-\gamma}$$

and with consumption-based price index P defined as minimum expenditure on consumption Z for which $C=1$. To derive price index P in terms of relative price index p, we substitute C_N and C_T in $\Omega(C_T,C_N)$ for their intratemporal demands, so we get

$$\Omega(Z)=(\gamma Z)^{\gamma}\left(\frac{Z(1-\gamma)}{p}\right)^{1-\gamma}$$

Now by replacing Z by P and letting $\Omega(P) = 1$ we get

$$(\gamma P)^{\gamma}\left(\frac{P(1-\gamma)}{p}\right)^{1-\gamma} = 1,$$

which after rearrangement gives

$$P = p^{1-\gamma}\gamma^{-\gamma}(1-\gamma)^{-(1-\gamma)}$$

Because small letter p stands for relative price of non-traded goods in terms of traded goods, the consumption-based price index P is actually price of one unit of consumption expressed in traded goods. It is worth noting that price for one unit of consumption is increasing in p, so countries with the lowest p are the ones for which consumption is relatively cheap. According to Balassa-Samuelson effect, these countries should have low productivity in traded sector, i.e. they level of development is rather low.

3.5 Intertemporal substitution

After we defined index of total consumption and consumption-based price index, we can redefine optimization problem as

$$max\sum_{t=0}^{\infty}\beta^{t}u(C_t)\ s.t. Y_t - P_tC_t - I_t - G_t + r_tB_t = B_{t+1} - B_t$$

with the same transversality condition $\lim_{T\to\infty}(1+r)^{-T}B_{t+T+1} = 0$. By rewriting the budget constraint in terms of consumption, we get

$$C_t = \frac{(1+r_t)B_t - B_{t+1} + Y_t - I_t - G_t}{P_t}$$

Substituting this into utility function gives

$$\sum_{t=0}^{\infty}\beta^{t}u\left[\frac{(1+r_t)B_t - B_{t+1} + Y_t - I_t - G_t}{P_t}\right]$$

First order condition with respect to B_{t+1} yields following Euler equation:

$$-\frac{1}{P_t}u'(C_t) + \beta u'(C_{t+1})\frac{1+r_{t+1}}{P_{t+1}} = 0$$

Recall that $u(C_t) = \frac{(C_t)^{1-\sigma}}{1-\sigma}$, so $u'(C_t) = (C_t)^{-\sigma}$. The equation then can be easily transformed as

$$(1+r_{t+1})\frac{P_t}{P_{t+1}}\beta\left(\frac{C_t}{C_{t+1}}\right)^{\sigma}=1$$

Now we use results from previous sections in order to modify this equation in terms of relative price levels p and consumption expenses Z. Particularly, we use the result $P_t = {p_t}^{1-\gamma}\gamma^{-\gamma}(1-\gamma)^{-(1-\gamma)}$ together with the result $C_t = (\gamma Z_t)^{\gamma}\left(\frac{Z_t(1-\gamma)}{p_t}\right)^{1-\gamma}$ and substitute them into this equation. After some rearrangements, we get the crucial equation for the optimization problem:

$$(1+r_{t+1})\left(\frac{p_t}{p_{t+1}}\right)^{(1-\gamma)(1-\sigma)}\beta\left(\frac{Z_t}{Z_{t+1}}\right)^{\sigma}=1$$

Taking logarithms gives

$$\log\beta+\log(1+r_{t+1})+\sigma(\log Z_t-\log Z_{t+1})+(1-\gamma)(1-\sigma)(\log p_t-\log p_{t+1})=0$$

After defining $\Delta z_{t+1}=\log Z_{t+1}-\log Z_t$, $\Delta p_{t+1}=\log p_{t+1}-\log p_t$ and also using commonly applied approximation $\log(1+r_{t+1})\approx r_{t+1}$, our equation can be rewriten as

$$\Delta z_{t+1}=\frac{1}{\sigma}[r_{t+1}-(1-\sigma)(1-\gamma)\Delta p_{t+1}+\log\ \beta]$$

Or as

$$\Delta z_{t+1}=\frac{1}{\sigma}r^*_{t+1},$$

where $r^*_{t+1}=r_{t+1}-(1-\sigma)(1-\gamma)\Delta p_{t+1}+\log\ \beta$ is consumer-based real interest rate. Altought we assume that small economies take real interest rate r as given, according to the theory their consumption behaviour depends on their´s own interest rates, which can differ thanks to relative price levels p, preferences over future cunsumption evaluated today (i.e. β) and preferences of consumption of traded goods relative to consumption of non-traded goods (i.e. γ).

3.6 Intertemporal budget constraint

In optimum the present value of consumption has to be equal the present value of net output defined as $\sum_{t=0}^{\infty}\left(\frac{1}{1+r}\right)^t NO_t=\sum_{t=0}^{\infty}\left(\frac{1}{1+r}\right)^t(Y-I-G)_t$ plus its initial foreign asset position. It formally means the relation

$$\sum_{t=0}^{\infty}\left(\frac{1}{1+r}\right)^{t} C_t = \sum_{t=0}^{\infty}\left(\frac{1}{1+r}\right)^{t} NO_t + B_0$$

If we let $\Phi_0 = \sum_{t=0}^{\infty}\left(\frac{1}{1+r}\right)^{t} C_t$, then by applying the law of motion gives the following relationship:

$$\Phi_{t+1} = (1+r)(\Phi_t - C_t)$$

By dividing both sides by Φ_t and taking logarithms we get

$$\phi_{t+1} - \phi_t = \log(1+r) + \log\left(1 - \frac{C_t}{\Phi_t}\right)$$

Where $\log \Phi_t = \phi_t$. Now if we define $\log \mathrm{C}_t = c_t$, then we can express the last term of the equation as

$$\log\left(1 - \frac{C_t}{\Phi_t}\right) = \log\left[1 - \exp\left(c_t - \phi_t\right)\right]$$

This term can be approximated using log-linearization around point $[c_0, \phi_0]$ as

$$\log(1 - \exp(c_t - \phi_t))$$

$$\approx \log(1 - \exp(c_0 - \phi_0)) + \left[\frac{-\exp\left(c_0 - \phi_0\right)}{1 - \exp\left(c_0 - \phi_0\right)}\right]\left[(c_t - \phi_t) - (c_0 - \phi_0)\right]$$

After defining $\rho = 1 - \exp(c_0 - \phi_0)$, the equation can be equivalently rewritten as

$$\log(1 - \exp(c_t - \phi_t)) \approx \log\rho - \left(1 - \frac{1}{\rho}\right)\log(1-\rho) + \left(1 - \frac{1}{\rho}\right)(c_t - \phi_t)$$

Let k be a constant that $k = \log\rho - \left(1 - \frac{1}{\rho}\right)\log(1-\rho)$ and use approximation $\log(1+r) \approx r$. Then our initial equation becomes

$$\phi_{t+1} - \phi_t \approx r + k + \left(1 - \frac{1}{\rho}\right)(c_t - \phi_t)$$

Now if we realize that $\phi_{t+1} - \phi_t = \Delta c_{t+1} + (c_t - \phi_t) - (c_{t+1} - \phi_{t+1})$, it is easy to see that it can be expressed as

$$c_{t+1} - \phi_{t+1} \approx \frac{1}{\rho}(c_t - \phi_t) + \Delta c_{t+1} - r - k$$

This difference equation can be solved with usage of repeated iterations where we put $c_0 - \phi_0$ on the one side and gradually increase time periods on the other side,

i.e. $c_0 - \phi_0 = \rho(c_1 - \phi_1 - \Delta c_1 + r + k) = \rho[\rho(c_2 - \phi_2 - \Delta c_2 + r + k) - \Delta c_1 + r + k] = \ldots$ so we get

$$c_0 - \phi_0 \approx \lim_{t\to\infty} \rho^t (c_t - \phi_t) + \sum_{t=1}^{\infty} \rho^t (r - \Delta c_t) + \sum_{t=1}^{\infty} \rho^t k$$

Which can be equivalently written as

$$c_0 - \phi_0 \approx \sum_{t=1}^{\infty} \rho^t (r - \Delta c_t) + const.$$

Let $\sum_{t=0}^{\infty} \left(\frac{1}{1+r}\right)^t NO_t = \Psi_0$, $\psi_0 = \log \Psi_0$, $no_0 = \log \mathrm{NO}_0$ and $\lambda = 1 - \exp(no_0 - \psi_0)$. Analogically we derive

$$no_0 - \psi_0 \approx \sum_{t=1}^{\infty} \lambda^t (r - \Delta no_t) + const.$$

3.7 Current account

Thanks to the definitions given above we can write budget constraint in the form $\Phi_0 - B_0 = \Psi_0$. Now by assuming initial level of foreign asset to be zero (i.e. $B_0 = 0$) and taking logarithms of budget constraint, we get equation $\phi_0 = \psi_0$. Now we should notice that after such assumption the constant terms in the last two equations are actually equal since $\rho = 1 - \exp(c_0 - \phi_0) = 1 - \exp(no_0 - \psi_0) = \lambda$ and budget constraint can be rewriten as

$$no_0 - \sum_{t=1}^{\infty} \rho^t (r - \Delta no_t) \approx c_0 - \sum_{t=1}^{\infty} \rho^t (r - \Delta c_t)$$

From now we will use straight equal sign instead of the wavy one. It does not mean that the following equations are exact, altought their accuracy is incresing as they come near to the point around which we log-linearize. The last equation can be rearranged as

$$no_0 - c_0 = -\sum_{t=1}^{\infty} \rho^t (\Delta no_t - \Delta c_t)$$

The equation represents very important relationship because we can see left hand side as the optimal level of the current account in the initial period with no burdens from the past. This motivated Bergin & Sheffrin (2000) to define CA_t^* as $no_t - c_t$ and we

will follow their approach here. Notice also that in section 3.5 we have expressed the change in consumption for comprehensibility by Δz_t and now we are using the expression Δc_t. As these variables are identical, they can be changed equivalently and the results derived for one variable can be used also for the other. Since the consumers cannot foresee the future, they have to rely on their expectations of the future values so it will be appropriate to work with expected values from now:

$$CA_t^* = -E_t \sum_{i=1}^{\infty} \rho^i \left(\Delta no_{t+i} - \frac{r_{t+i}^*}{\sigma} \right)$$

Several implications can be drawn from the equation given above. Firstly, we can see that ceteris paribus a rise in expected net output at any point of time would result in a decrease in the current account balance. The interpretation of it is that in line with permanent income hypothesis people tend to smooth their consumption over time, resulting in need to consume some part of the future welfare already at present. Secondly, a rise in interest rates would cause increase in consumer-based interest rate, which would then drive the actual current account upwards. Reasoning behind is that higher interest rates favour lenders at the expense of borrowers, producing intentions to save more or to dissave less. Thirdly, an increase in the expected relative price levels decreases the current account throught change in the consumer-based interest rate. Now the explanation is that relative rise in prices of non-traded goods causes the real consumption to be more expensive (recall that P is increasing function of p), which makes real income to be smaller and the smoothening feature of the people´s behaviour makes the current account to fall.

4 Empirical part

4.1 Testable model

Remaining question to have a testable model is to decide how an expectations about future values of Δno and r^* are made. One possibility would be to take the naive expectation in the form $E_t \Delta no_{t+i} = \Delta no_t$, where $i = 1, \dots$. Other possibility would be to make regression of time series of order p. We use here the same approach applied for the current account model by Woo & Sheffrin (1990), Obstfeld & Rogoff(1996), Bergin & Sheffrin(2000) or Campa & Gavilán (2006). Namely, we estimate the values using VAR of order one in the following form:

$$\begin{bmatrix} \Delta no \\ CA^* \\ r^* \end{bmatrix}_t = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} . \begin{bmatrix} \Delta no \\ CA^* \\ r^* \end{bmatrix}_{t-1} + \begin{bmatrix} u_1 \\ u_2 \\ u_3 \end{bmatrix}_t$$

which can be rewritten as

$$z_t = A z_{t-1} + u_t,$$

where u_t is 3-dimensional vector with zero conditional mean and homoscedastic errors. Lets $h_1 = [1 \quad 0 \quad 0]$ and $h_2 = [0 \quad 0 \quad 1]$. If the theory and assumptions are correct, then the current account should be estimated as

$$\widehat{CA}_t^* = -\sum_{i=1}^{\infty} \rho^i \left(h_1 - \frac{1}{\sigma} h_2 \right) E_t(z_{t+i})$$

Further, as expectations are assumed to follow VAR(1) process, then $E_t(z_{t+i}) = A^i z_t$ and the estimation becomes

$$\widehat{CA}_t^* = -\sum_{i=1}^{\infty} \rho^i \left(h_1 - \frac{1}{\sigma} h_2 \right) A^i z_t$$

According to the Neumann series $\sum_{j=0}^{\infty} A^j = (I - A)^{-1}$, or equivalently $\sum_{j=1}^{\infty} A^j = A(I - A)^{-1}$. This help us to rewrite the equation in a more convenient way:

$$\widehat{CA}_t^* = -\left(h_1' - \frac{1}{\sigma} h_2' \right) \rho A (I - \rho A)^{-1} z_t$$

Which can be after defining $[\Lambda_{\Delta no} \quad \Lambda_{CA^*} \quad \Lambda_{r^*}] = -\left(h_1' - \frac{1}{\sigma}h_2'\right)\rho A(I - \rho A)^{-1}$ simplified to

$$\widehat{CA}_t^* = [\Lambda_{\Delta no} \quad \Lambda_{CA^*} \quad \Lambda_{r^*}].z_t$$

In order to have $CA_t^* = \widehat{CA}_t^*$, then should $[\Lambda_{\Delta no} \quad \Lambda_{CA^*} \quad \Lambda_{r^*}] = [0 \quad 1 \quad 0]$. Now we have finally derived the model which is able to provide empirical predictions for the current accounts, following the work of Bergin & Sheffrin (2000).

4.2 Data

In following pages we discus data issues and parameter values used for calibration. The estimation procedure described in previous section is made using quarterly data in period 1996-2012 in case of Latvia and Lithuania and in period 2001-2012 in case of Estonia. The shorter period of time in Estonia is motivated by the lack of a data for quarterly inflation for goods and services separately, which we use later as proxies for the relative price differentials. All the data are gathered mostly from Eurostat and in some cases also from IMF and OECD datasets.

The first issue was to create a time series for the world interest rate. The method of determining the world interest rate was explored by Barro & Sala i Martin (1990), later also used by Bergin & Sheffrin (2000). We collect data on major developed countries represented by G7, consists of Canada , United States, United Kingdom, Japan, Italy, France and Germany. For each country its real interest rate is computed using the equation $r_{t+1} = \frac{1+i_t}{1+\pi_{t+1}} - 1$, where i stands for the nominal interest rate and π for the inflation. The world interest rate is then computed as arithmetic average of these values, meaning the final outcome a time series starting in Q2 1996 and ending in Q4 2012.

Both Begin & Sheffrin (2000) and Campa & Gavilán (2006) are using the real exchange rate as a proxy for p_t, following the seminal work of Rogoff (1992). The reasoning is that real exchange rate movements are caused by movements in price of non-traded goods expressed in traded goods due to productivity shocks in line with Balassa-Samuelson effect. Rogoff (1992) in his work pointed out to the role of smoothing beahaviour of consumers with empirical applications to real exchange rates. We use slightly different approach here, Δp_t is calculated as a difference between inflation of non-traded goods and traded goods. For this purpose we collect monthly inflation rates for each country and caltulate their quarterly average. As a

proxy for traded sector, we use monthly inflation rates of goods and as a proxy for non-traded sector monthly inflation rates of services.

The quarterly data for the net output are made using the equation $NO_t = Y_t - G_t - I_t$, where Y_t is taken as gross domestic product in market prices, $G_t$as expenditure of general government and I_t as gross capital formation. Further, C_t is represented by final consumption time series for each of the states. All these values are seasonally adjusted and also adjusted according to working days in particular quarter.

4.3 Parameters

The most problematic part is determination of parameters in the model, particularly values of γ, ρ and σ. We suppose that parameter σ is the same for each country, while the parameters γ and ρ vary for each state. Reason behind is subjective nature of γ and ρ, where the first term is key factor in determining real consumption unit and tells about relative preferences of non-traded goods over traded goods, and the second term define a country specific discount factor. There is no reason why these preferences should be the same for country´s representative agents. As a proxy for γ we choose share of goods in the economy for each period. It is made by using data from the Eurostat, where we can found this statistic on a yearly basis. Unfortunately, using yearly data would be inappropriate for our dataset, so we created quarterly dataset using an interpolation, where average accruals for each quarter were computed. For determining the parameter ρ, Bergin & Sheffrin (2000) suggested assuming that this parameter is equal to β, for which they used equation $\beta = \frac{1}{1+\bar{r}}$, where $\bar{r}$ is a mean value of the world real interest rates. This would make a single value of ρ used for each country, but since discussion about differences of these parameters make important part of this work, we will not use their approach here.

Alternative method was suggested by Campa & Gavilán (2006). They also accepted the assumption that $\rho = \beta$ and used the same equation for determining β as Bergin & Sheffrin (2000), but they denote $\bar{r}$ as a mean value of a country´s real interest rate, producing different values of β or ρ for each state. Altought it is not unlikely that there exist the connection between state time-preference factor and its real interest rate, which can be seen as a proxy for autarky interest rate (theoretical interest rate set in a country without access to international markets), there are some economic facts related to development in the Baltic area that make such approach inappropriate. Firstly, the data for interest rates in Lithuania and Latvia are not accessible on public databases before 1999, and moreover, in Estonia there are not set

the interest rates for government bonds (public budget in Estonia is nearly balanced). Secondly, there has been turbulent transformation process in the area due to collapse of the Soviet Union creating detoriations of real interest rates without necessary counterpart in the changes in time- preferences. The same line of argument can be applied for high interest rates during the Global Financial Crisis in the area.

There is another aspect that makes interpreting ρ as time-preference factor β inappropriate. According to our results we show later in the work, the lower values of ρ corresponds to the smaller detoriations of the current accounts. If we would equalize β and ρ, then it would mean that less patient agents have smaller current account deficits (or surpluses) than more patient ones. Such conclusion would be in a sharp contradiction with the theory of the current account, so we will not replace ρ by any other parameter. Further discussion about this issue will be given in Chapter 6.

For reasons suggested above, we choose for both σ and ρ a neutral approach, where we first check the results for $\frac{1}{\sigma}$ taken values 0.025, 0.05, 0,075 and 0.1, following the suggestion of Hall (1988) that the $\frac{1}{\sigma}$ should be less than 0.1. Then the same thing is made for ρ, where we show graphical representation of fitted values for ρ equal to 0.5; 0.7; 0.8; 0.9; 0.95 and 0.99. The final estimate of ρ for each country is then made by equalization of standard deviations of true values and estimated fitted values of the current accounts. Comparision of the results and optimization according to the standard deviations bring parameters that we use later in the work as follows: $\frac{1}{\sigma} = 0.05, \rho_{Estonia} = 0.911, \rho_{Lithuania} = 0{,}856$ and $\rho_{Latvia} = 0{,}884$.

4.4 Descriptive statistics

This section presents summary statisctics for the main variables in the model. Particularly, table 2.1. provides mean values and standard deviations for each variable of interest. All data are rounded to three decimals. It will be useful now to look deeper at the variables of our interest. We get from the well known equation of the output $Y_t = C_t + G_t + I_t + NX_t$ that the net output is equal to the consumption and the net exports, i.e. $NO_t = C_t + NX_t$. Since we have this variable in logaritms and we are interested in its change from the previous period, we are actually calculating a percentage change of the net outputs for each period. The highest mean value in Lithuania therefore corresponds to the highest growth rates of this variable. We can similarly describe another variable, the optimal current account CA^*. Its definition is $CA^* = no - c$, so it is equal to $log\left(\frac{NO_t}{C_t}\right)$, or put it differently using

again the equation for the output, $log\left(1+\frac{NX_t}{C_t}\right)$. If the net exports are negative, then this variable is also negative and vice versa. As the logaritm is an increasing function and we take into consideration size of the economy by controlling for the consumption C_t, the variable is revealing how much trouble a country has with managing its balance of trade. The most difficulties with balance of trade can be found in Latvia, which is something we already know from Chapter 2. Interesting results brings consumer-based interest rate r^*. All three countries have mean value of this statistic less than zero, which encourages to prefer even more current consumption over future consumption.

Table 4.4: Descriptive statistics

Variable	**Lithuania**		**Latvia**		**Estonia**	
	Mean	SD	Mean	SD	Mean	SD
Δno	0.029	0.055	0.025	0.057	0.027	0.091
CA^*	-0.118	0.076	-0.177	0.113	-0.098	0.18
r^*	-0.028	0.070	-0.046	0.086	-0.044	0.076
$1-\gamma$	0.206	0.053	0.252	0.048	0.256	0.062

Source: author's computations.

5 Results

5.1 VAR estimates

Now we can move to results from VAR of order one. For the computational purposes, the econometrical software R is used (attached code can be found in Apendix). Numbers are rounded to three decimals. Results:

Table 5.1: VAR estimates

Estonia

Variable	Coefficient	Std. error	t value	P(>|t|)
$\Delta no: lag\ \Delta no$	-0.230	0.137	-1.683	0.1
$\Delta no: lag\ CA^*$	-0.179	0.063	-2.870	0.006
$\Delta no: lag\ r^*$	-0.011	0.148	-0.077	0.939
$CA^*: lag\ \Delta no$	-0.262	0.117	-2.249	0.030
$CA^*: lag\ CA^*$	0.919	0.053	17.256	0.000
$CA^*: lag\ r^*$	0.163	0.126	1.293	0.203
$r^*: lag\ \Delta no$	-0.388	0.125	-3.110	0.003
$r^*: lag\ CA^*$	-0.053	0.057	-0.925	0.360
$r^*: lag\ r^*$	0.218	0.135	1.610	0.115

Lithuania

Variable	Coefficient	Std. error	t value	P(>|t|)
$\Delta no: lag\ \Delta no$	-0.184	0.108	-1.708	0.093
$\Delta no: lag\ CA^*$	-0.259	0.047	-5.508	0.000
$\Delta no: lag\ r^*$	-0.102	0.084	-1.206	0.232
$CA^*: lag\ \Delta no$	-0.306	0.101	-3.017	0.004
$CA^*: lag\ CA^*$	0.889	0.044	20.160	0.000
$CA^*: lag\ r^*$	-0.062	0.079	-0.780	0.439
$r^*: lag\ \Delta no$	-0.017	0.160	-0.104	0.917
$r^*: lag\ CA^*$	0.045	0.070	0.646	0.521
$r^*: lag\ r^*$	0.181	0.125	1.442	0.154

Latvia

Variable	Coefficient	Std. error	t value	P(>|t|)
$\Delta no: lag\ \Delta no$	-0.198	0.114	-1.729	0.089
$\Delta no: lag\ CA^*$	-0.173	0.036	-4.765	0.000
$\Delta no: lag\ r^*$	0.026	0.078	0.330	0.743
$CA^*: lag\ \Delta no$	-0.275	0.108	-2.742	0.008
$CA^*: lag\ CA^*$	0.935	0.032	29.301	0.000
$CA^*: lag\ r^*$	0.038	0.069	0.557	0.579
$r^*: lag\ \Delta no$	0.067	0.185	0.362	0.718
$r^*: lag\ CA^*$	0.202	0.059	3.437	0.001
$r^*: lag\ r^*$	0.111	0.127	0.877	0.384

Source: author's computations.

What conclusions can be drawn from the results? Firstly, ceteris paribus change in net output causes an opposite change in the current account and this evidence is found in all three states at 5% significance level. Hypothesis about a consumer smoothing his consumption over time is cornerstone in the theory, so this evidence is usefull in its defense. Secondly, also changes in the current accounts have reverse impact on net output at convincing 1% significance level. This is what the theory predicts as well since the current account itself should incorporate all expected changes in net output and so should serve as the best predictor of future movements of net output.

Ambiguous evidence is given to relevance of consumer-based interest rate in predicting the current account. According to the theory, a positive change in consumer-based interest rate should cause a rise in the current account. Nevertheless, it doesn´t correspond to the evidence found in Lithuania with negative sign in $CA^*: lag\ r^*$, altought the coefficient is not statistically different from zero. The coefficient in Latvia is posittive, yet still not statistically different from zero. The best result can be found in Estonia, it has the highest positive coefficient, altought it is also statisticaly insignificant even at 15% significance level.

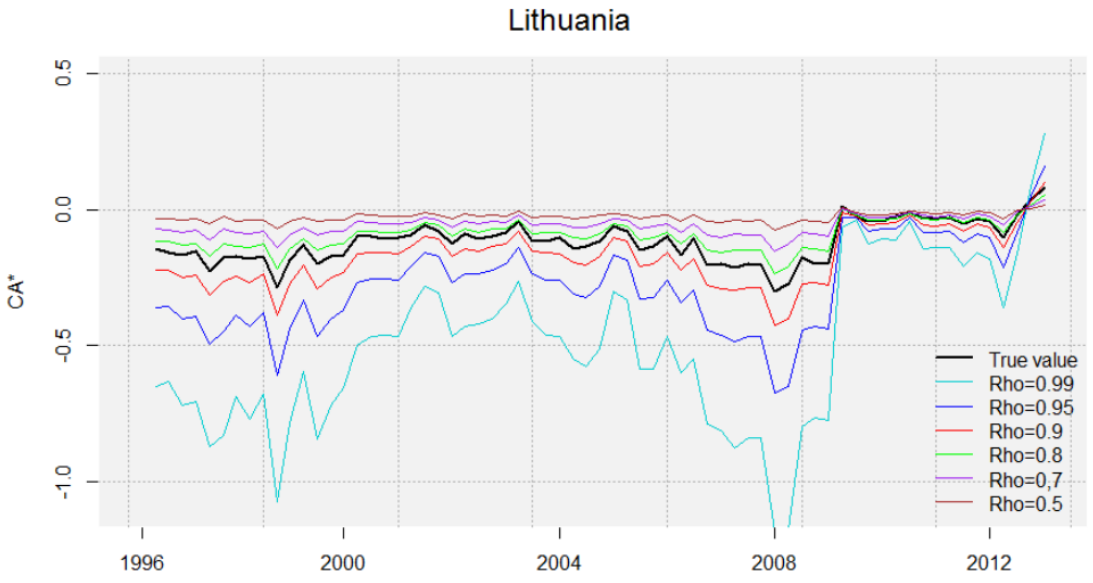
Highly persistent behaviour is found in $CA^*: lag\ CA^*$. All three countries have the coefficient near to 1 with suspision about having unit root. It would mean serious problem when looking at impulse response function since as was shown by Gospodinov, Maynard & Pesavento (2011), small deviations from unit root can produce very different and misleading results regarding the impulse response function. Altought the null hypothesis about unit root is rejected at 5% significance

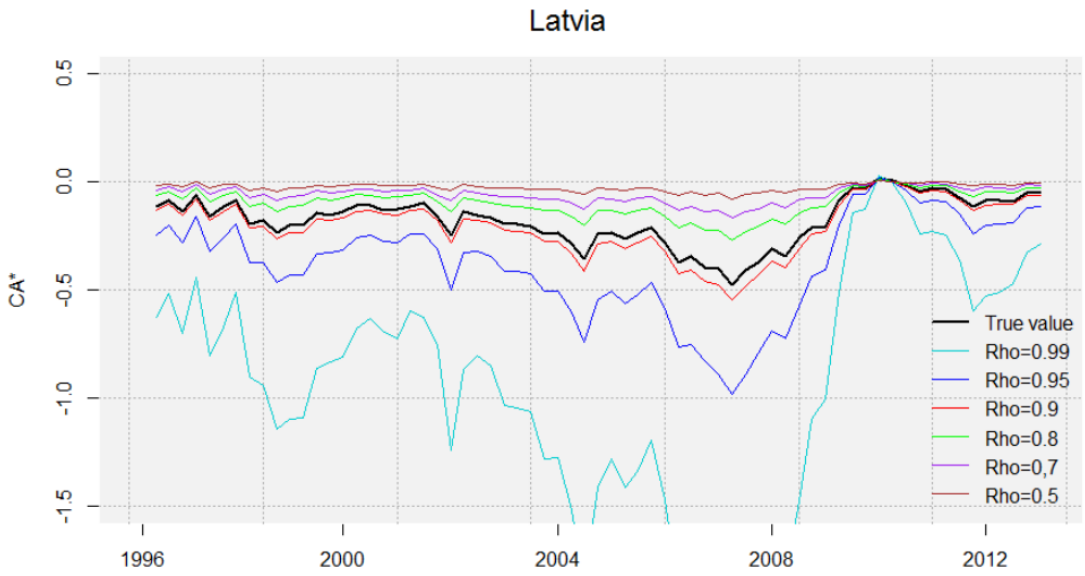
level in Latvia and Lithuania, the null can not be rejected in Estonis even at 10% significance level. For these reasons we will not derive the impulse response function here.

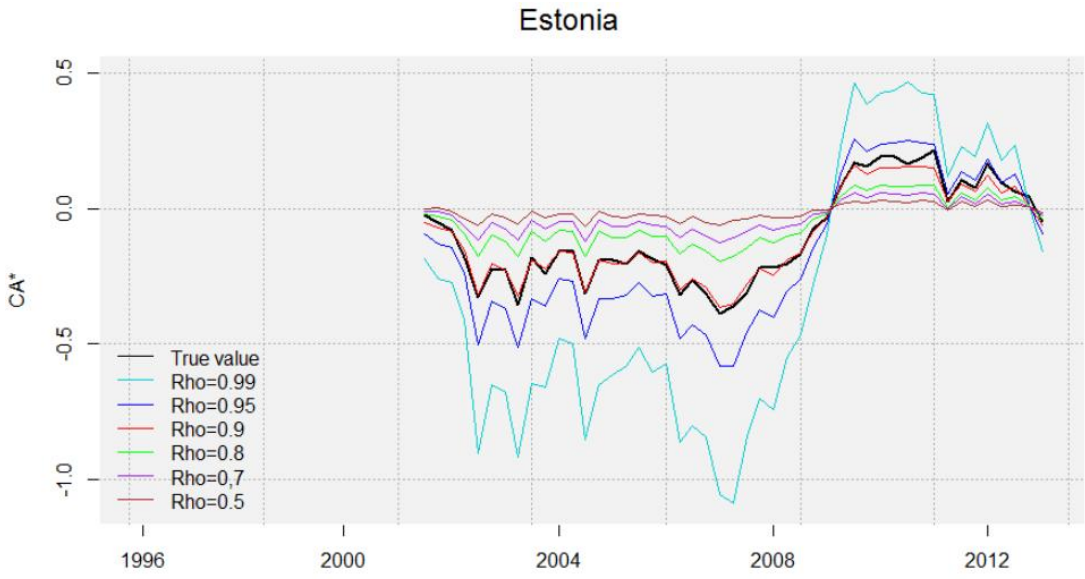
5.2 Fitted values

This section presents fitted values of optimal current accounts as defined in section 4.1. As was pointed out earlier, ideal case would mean $[\Lambda_{\Delta no} \quad \Lambda_{CA^*} \quad \Lambda_{r^*}] = [0 \quad 1 \quad 0]$. Our results can be compared to it in order to get initial intuition about precision of the estimates. Another option is to look at the fitted values of the optimal current accounts and compare them with the true values. We make this by plotting the fitted values for several different values of ρ. Its selection is rather arbitrally, but as we point out earlier, the choice of ρ for our final model is made by equalization of standard deviations for fitted and true values.

Graph 5.2 Fitted values of the current accounts







Source: author´s computations

We can see that the model is doing well in predicting the current account. It should be noted that similar results were achieved by Bergin & Sheffrin(2000) and Campa & Gavilán (2006), who were using data from different countries within distinct periods of time. As we can see, the higher ρ causes the higher varinace of the fitted values. Country which wants to lower its deficits or surpluses therefore should promote certain behaviour corresponding to the lower ρ. It is the opposite behaviour we should seen if ρ would be replaced by β as suggested by Bergin & Sheffrin(2000) and Campa & Gavilán (2006). Remaining question is then what is the interpretation of ρ? We have defined this parameter as $\rho = 1 - \exp(c_0 - \phi_0) = 1 - \exp(no_0 - \psi_0)$, where the later equation emerged after we have assumed that $\Phi_0 = \Psi_0$. Such assumption states that present value of future consumption and present value of

future net outputs have to equal in order to avoid the Ponzi scheme, so it is another way how to define the transversality condition. If we developed ρ further, we get

$$\rho = 1 - \frac{NO_0}{\sum_{t=0}^{\infty} \left(\frac{1}{1+r}\right)^t NO_t}$$

Country with high expectations about its future welfare $E_0 \sum_{t=0}^{\infty} \left(\frac{1}{1+r}\right)^t NO_t$ have ρ near to 1 and vice versa. As was told earlier, such country has intentions to consume more nowadays, so we should witness high deficits on the balance of goods in this country. It corresponds to our findings, since the higher ρ creates the larger deficits/surpluses on the current accounts. Recall from Chapter 4 that our choice about the parameter was computed by equalization of standard deviations for fitted and true values, which bring the folloving parameters: $\rho_{Estonia} = 0.911, \rho_{Lithuania} = 0{,}856$ and $\rho_{Latvia} = 0{,}884$. According to our analysis, it means that the highest value of ρ for Estonia indicates the most positive prospects about its economy development.

6 Adjustment process

The adjustment process started at the beginning of the crisis, as the current accounts deficits changed direction and started to fall. Since 2010, the current accounts in all three countries have been fluctuating around zero and none of them has quarterly exceeded range +/- 10% of GDP. There have been two issues in adjusting the current accounts in the Baltic states. First has been determining an optimal value of the current accounts by given information and tastes. What we actually did in chapter 5 was that we took the actual Baltic current accounts and seek under what parameters and expectations would be such current accounts optimal. As model indicates, a sharp improvement of the current accounts at the beginning of the crisis could be assigned to dramatic reassessment of expected growth rates. We explore this issue further in section 6.1. Second problem in adjustment process is rather practical one. Once is an optimal current account reassessed, what should be done to move from old to new optimal current account? We look at this question in section 6.2.

6.1 Expected and realized values of the net outputs

Substantial overshooting in expectations can be very costly when presumed optimal current account is too far from “ideal” optimal current account. While proper analysis about how a representative agent sets its expectation is beyond the scope of this work, we can still outline some fragments of the issue. Expectations are made using all available information at the moment and important part of it are realized past values. But rapid development in the Baltic region (tranzition process, pegging their currencies, joining the EU and the Eurozone, etc.) make it very hard to predict future values from past. In other words, there is question how much relevance should be given to periods of time when the Baltic economies did not have fully developed markets. Further, from a theoretical point of view, the current account contains all available information at the moment and therefore also serve as the best predictor of future growth. This hypothesis was confirmed as lagged values of the current accounts significantly improved estimation of the net outputs. The current account therefore serve for investors and households as indicator of future welfere. Problem can arise when predictions are far from true values and the current account stimulates overheating of the economies by serving as self fulfilling prophecy.

Another angle how to look at the issue is assuming that estimated values are correct, but stochastic processes behind the net outputs have too much variance, which causes large detoriations of the current accounts. To see that this might be the case, remind that the Baltic states are very tiny and open economies with large banking sectors and mediator roles in international trade. It makes their economies to be extremely sensitive to development in foreign markets. Possible way out is to change portfolio of export articles and their weights to achieve less variance of trade balance. It would practically mean for example less dependence on oil prices and a bigger share of final products in exports. Policy makers can also moderate variance of the net outputs (remind that $NO_t = Y_t - G_t - I_t$) by following certain strategy of government expenditures in order to reduce a difference between expected and realized values.

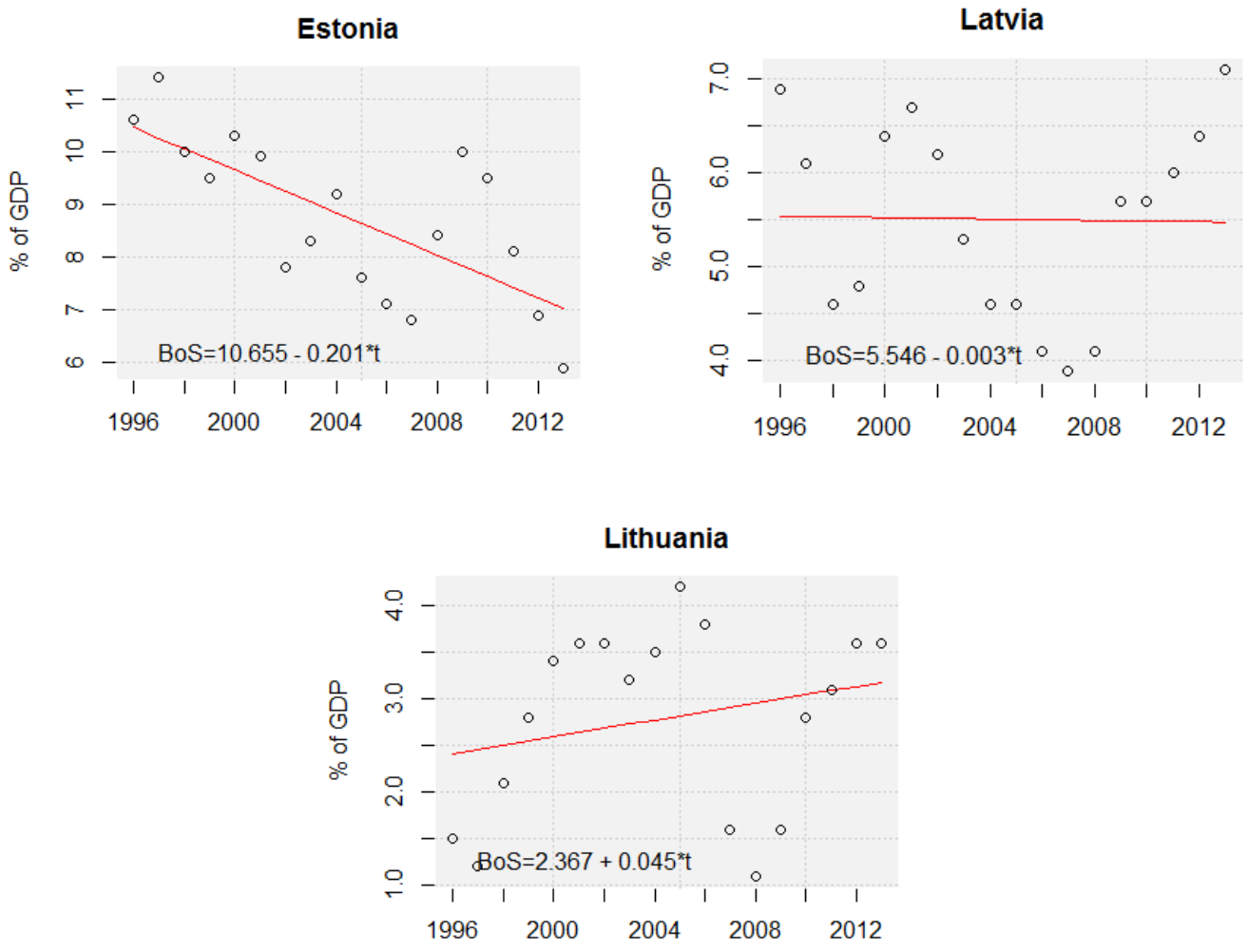
6.2 Adjustment process and sustainability

As a current account consists of four componenents, each adjustment has to mean change of one or more componets. We show in this section that experience in the Baltic countries is such that adjustment process and its sustainibility is tightly connected with development in balance of goods. Current transfers and income show persistent behaviour and policy makers have only very limited power over it. Moreover, these components tend to eliminate themselves in the Baltic region. It is therefore apparent that the most convenient way how to adjust and preserve the current accounts lies in equalization of imports and exports, which also corresponds to the experience for the Baltic countries during the crisis.

6.2.1 Balance of services

Further analysis reveals that service sector also represents stable component in the current accounts. If we express import of services as percentage of GDP, we would see that the indicator shows very gentle increase each year in all three states. The same line of arguments hold for export of services expressed as percentage of GDP. Therefore the balance of services played only minor role in the adjustment process. Remaining question in this regard is sustainibility and future course.To evaluate this, it will be convenient to make simple regression of balance of service. We focus our attention to trend in the balance to spot potential threat for the current accounts. Data are from Eurostat (2014). Time period taken into consideration is 1996-2013 and for determination of trend we replaced year 1996 for 1, 1997 for 2, and so on. We present here only graphical representation of fitted values:

Graph 6.2.1 Balance of services



Source: Eurostat (2014), author´s computations

Estonia has a decreasing trend statistically different from zero at significance level 5%. Thanks to large surpluses at past Estonia should not be worried, we can see a decreasing trend as rebalancement of initial high values rather than indicator of troubles in the future. Latvia´s trend is statistically indifferent from zero, so at this moment there is no evidence for some substantial detoriation in near future. Lithuania shows a positive trend, but similarly as Latvia, it is not statistically different from zero.

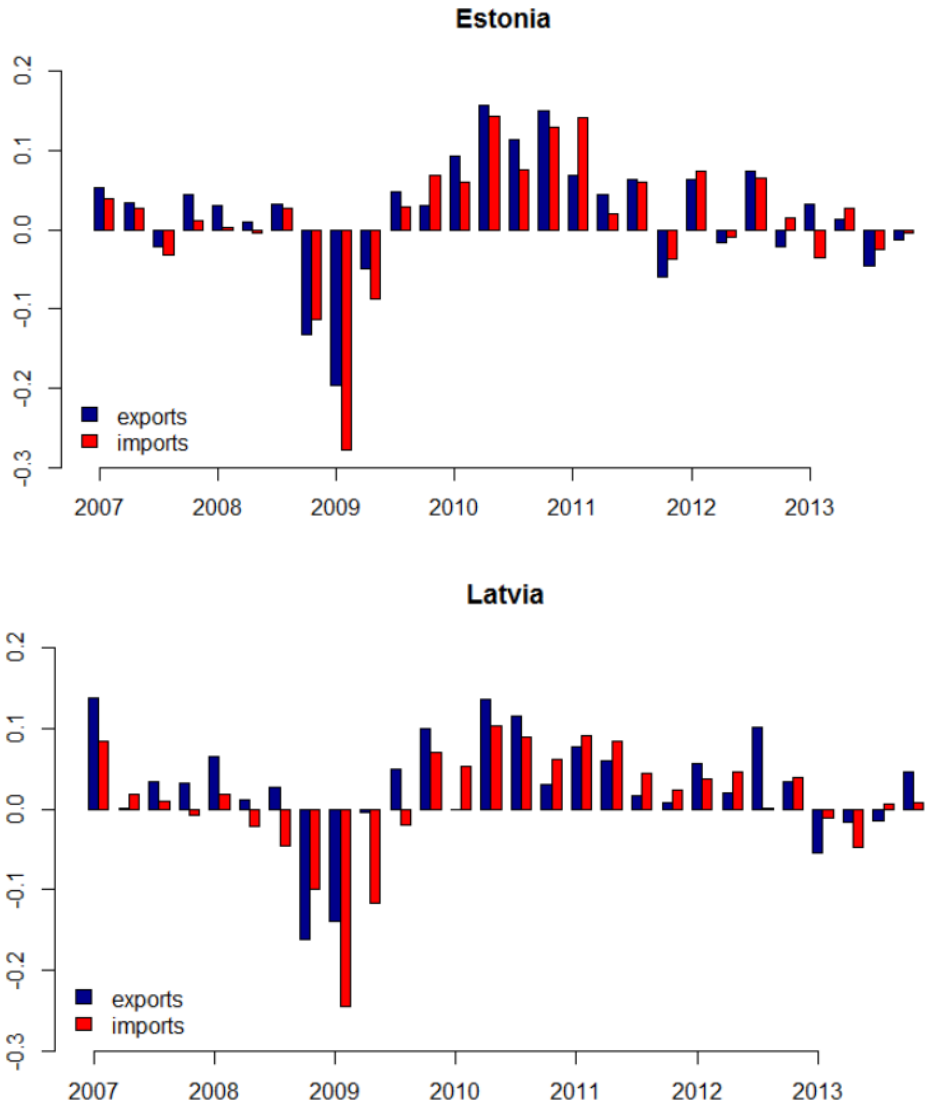
6.2.2 Balance of goods

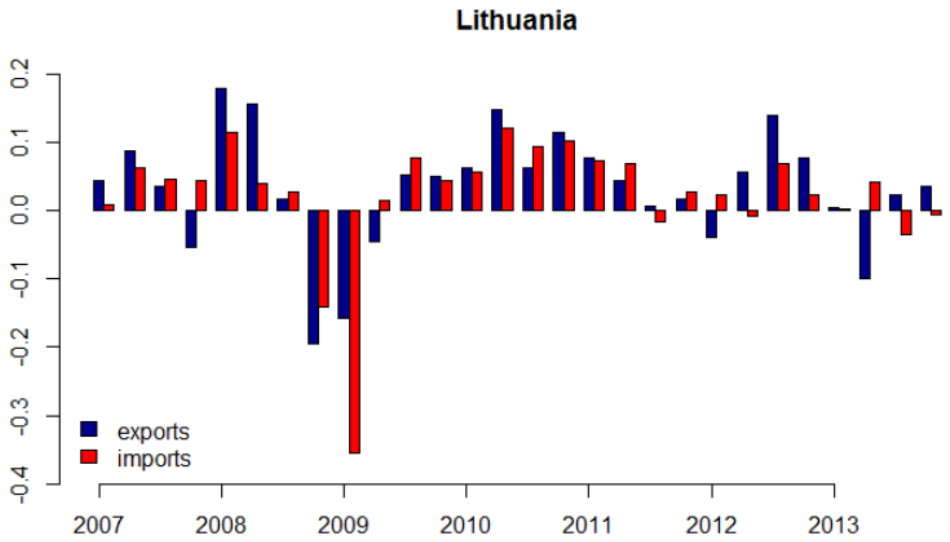
Balance of goods represents the most volatile and historically also the greatest component of the current accounts in the Baltic countries. It is therefore logical that it has been main player in adjustment process since the beginning of the crises. The

countries improved significantly the balance by imposing large internal devaluations on themselves. It was done by huge drops of wages in public sector, decrease of pensions and increase of VAT. Result was declined overall consumption, which directly lowered imports. Further, small domestic and external demand forced private sector to reduce wages as well, causing decrease of real unit labour costs, which enhanced exports.

As graphs below suggests, the exports and imports are tightly connected together. It corresponds to the fact, as was told in Chapter 2, that a large portion of international trade in the Baltic countries is made by resale of products from one country to another, so a drop in imports is immediately detected in decreased exports. Nevertheless, we can spot adjustment of balances of goods in the first quarter of 2009, which is the period when the internal devaluations took place.

Graph 6.2.2.A Exports and imports of goods, % change from previous period

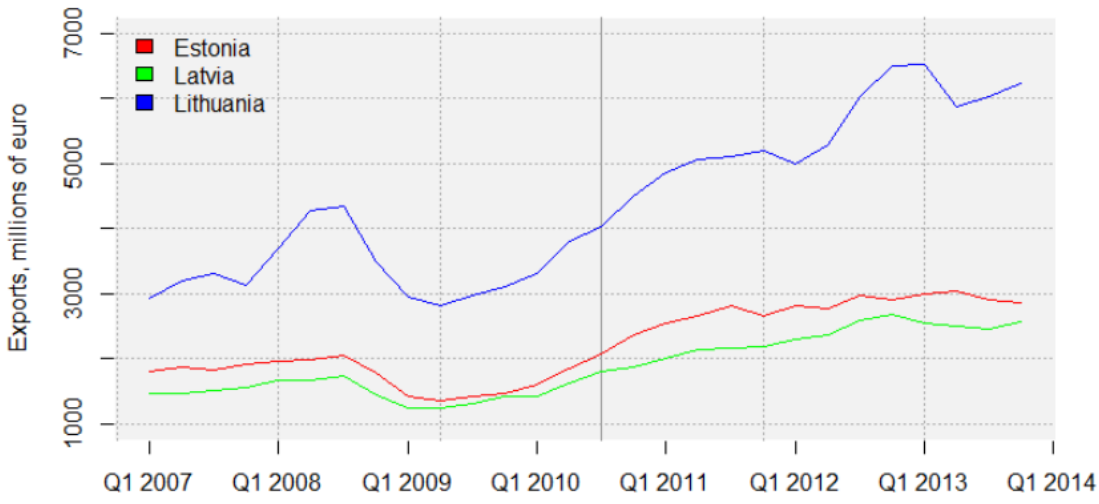


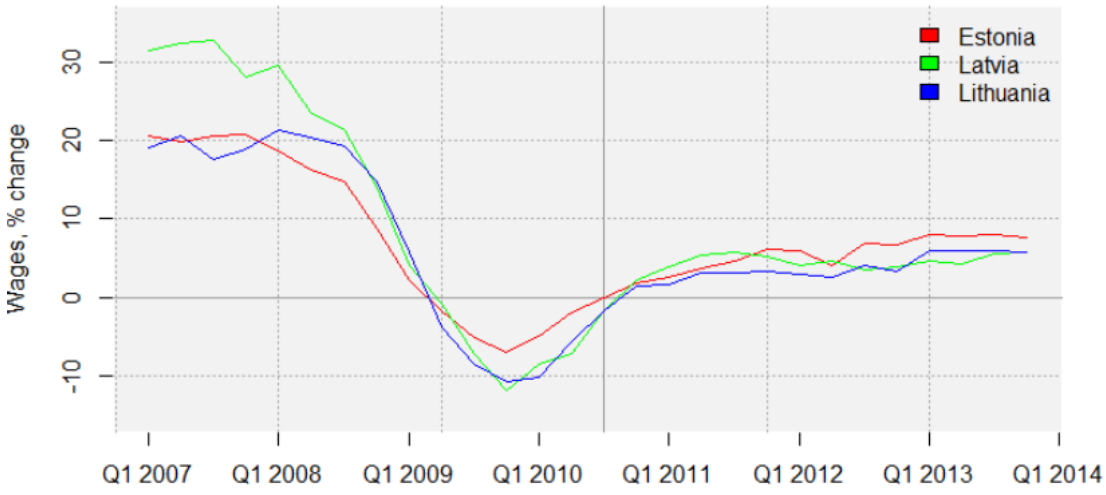


Source: Eurostat (2014)

We can also see an effect of reducing wages by comparing them explicitly with development of exports. We make this by plotting exports of the Baltic countries and compare them with development of wages in the region. Exports are in absolute values in order to not be influenced by development of GDP.Wages are taken from industry, construction and service sectors in corresponding country and we plot percentage change from the same period of previous year.

Graph 6.2.2.B Exports and wages





Source: Eurostat (2014)

As we can see, in the second quarter of 2009, the wages started to fall and at the same time exports bounced from the bottom. Another significant event represents the third quarter of 2010, when wages started to rise again. The exports were still rising that time, but notice that speed of its growth rates slowed down, in other words, the second derivation turned negative. As wages have continued to rise, the speed of growth has been diminishing. We should note that altought wages in other countries in the European Union have been rising, their growth rates have been around 2% each year, which is much less than in the Baltic countries.

One caveat should be mentioned in this place. Altought we can see that the adjustments of the balances of goods were made at the same time as the internal devaluations took place, this work does not try to express its impact numerically. The absolute levels of exports are also largely influenced by developments of foreign demands, which make evaluation of the impact of the internal devaluation very difficult.

7 Conclusion

This work has shown that recent models of the current account are able to clarify a lot of dynamics finds on the current accounts in the Baltic region. A great desire of the agents to smooth their consumption is present in all three countries and it causes a great exposure of the current accounts to expectations about future growth rates. It is threfore crucial for healthy development in the region to have realistic expectations. We have seen from the empirical results that increasing deficits before the crisis can be to a large extent explained by high growth rates that time. Following adjustment process was then caused by mixture of cooling down the overheated economies, revision of expectations and large internal devaluations (all three things related together). We can conclude that the adjustment process is a success story in the short-term, altought there are concerns about sustainibility in the medium and long-term, as the wages, and therefore competitiveness, rise faster when compared to the other countries in the EU.

From a perspective of the theory, the consumer based interest rate should be important part influencing the current account. Nevertheless, its statistical significance was not found in the Baltic countries, especially Latvia´s and Lithuania´s current accounts seems to be untouched by its development. Other interesting results are differences in the parameter ρ. While the parameter in case of Estonia is rather high, the opposite is true for the remaining countries. We have shown that ρ closer to 1 corresponds to larger detoriations in the balance of trade, which is the most important part of the current accounts in the Baltic countries. Another discussion was made about a success of the adjustment processes. Policy makers chose the internal devaluation as an instrument for restoring the balance of trade in the region. We can conlcude that this goal was successfully accomplished, altought the true effect of the internal devaluation is unclear. Our model takes into account consumption of traded and non-traded goods, but we can of course distinguish consumption further by allowing other specifics. A further investigation of this issue could be great course for a next research.

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Apendix – code in R

```
library(foreign)
library(gls)
library(forecast)
```

World interest rate (only Canada – other countries analogous)

```
infdata <-
read.csv("C://Users//Vostřáci//Plocha//Inflation.csv",sep=";")
PCanada <- gsub(",",".", infdata$PCanada , fixed=TRUE)
PCanada <- as.numeric(PCanada)
tsPCanada <- ts(PCanada, start=c(1996,1), end=c(2012,4),
frequency=4)
intratdata <-
read.csv("C://Users//Vostřáci//Plocha//Interestrates.csv",sep=";")
Rcan <- gsub(",",".", intratdata$RCanada , fixed=TRUE)
Rcan <- as.numeric(Rcan)
tsRcan <- ts(Rcan, start=c(1996,1), end=c(2012,4), frequency=4)
tsRcan1 <- tsRcan/400
rCan <- (1 + tsRcan1[-68])/(1 + tsPCanada[-1]/100) - 1
WorldR <- (rUs + rUk + rFr + rGer + rIt + rJap + rCan)/7
```

Consumer-based R (Latvia)

```
cpi <- read.csv("C://Users//Vostřáci//Plocha//(1-a)pt.csv",sep=";")
cpilat <- gsub(",",".", cpi$Latvia , fixed=TRUE)
cpilat <- as.numeric(cpilat)
tscpilat <- ts(cpilat, start=c(1996,1), end=c(2012,4), frequency=4)
tscpilat <- tscpilat*0.03
consumerRlatvia <- WorldR + ((1-0.05)/0.05)*tscpilat[-1] - 0.05
```

Change in net output (Latvia)

```
Data <-
read.csv("C://Users//Vostřáci//Plocha//Maindataset.csv",sep=";")
Ylat <- gsub(",",".", data$YLatvia , fixed=TRUE)
Ylat <- gsub(" ","", Ylat , fixed=TRUE)
Ylat <- as.numeric(Ylat)
Ylat <- ts(Ylat, start=c(1996,1), end=c(2012,4), frequency=4)
Glat <- gsub(",",".", data$GLatvia , fixed=TRUE)
Glat <- gsub(" ","", Glat , fixed=TRUE)
Glat <- as.numeric(Glat)
Glat <- ts(Glat, start=c(1996,1), end=c(2012,4), frequency=4)
Ilat <- gsub(",",".", data$ILatvia , fixed=TRUE)
Ilat <- gsub(" ","", Ilat , fixed=TRUE)
Ilat <- as.numeric(Ilat)
Ilat <- ts(Ilat, start=c(1996,1), end=c(2012,4), frequency=4)
CAlat <- gsub(",",".", data$CALatvia , fixed=TRUE)
CAlat <- gsub(" ","", CAlat , fixed=TRUE)
CAlat <- as.numeric(CAlat)
CAlat <- ts(CAlat, start=c(1996,1), end=c(2012,4), frequency=4)
NOlat <- Ylat - Glat - Ilat
lagNOlat <- NOlat[-68]
llagNOlat <- log(lagNOlat)
NOlat1 <- NOlat[-1]
lNOlat <- log(NOlat1)
difNOlat <- lNOlat – llagNOlat
```

Consumption and optimal current account (Latvia)

```
Consump <-
read.csv("C://Users//Vostřáci//Plocha//Consumption.csv",sep=";")
Clat <- gsub(",",".", consump$CLatvia , fixed=TRUE)
Clat <- gsub(" ","", Clat , fixed=TRUE)
Clat <- as.numeric(Clat)
Clat <- ts(Clat, start=c(1996,1), end=c(2012,4), frequency=4)
lClat <- log(Clat)
lClat1 <- lClat[-1]
mCAlat <- lNOlat - lClat1
```

VAR estimation and impulse response function (Latvia)

```
dflat <- data.frame(difNOlat,mCAlat, consumerRlatvia)
library(vars)
var_lat <- VAR(dflat, p=1,type="none")
summary(var_lat)
Alat                =                matrix(c(-0.211,-0.07,0.013,-
0.291,0.973,0.034,0.105,0.097,0.103),nrow=3,ncol=3, byrow="true")
I = matrix(c(1,0,0,0,1,0,0,0,1),nrow=3,ncol=3, byrow="true")
v1 <- matrix(c(1,0,0), nrow=1, ncol=3)
v2 <- matrix(c(0,0,1),nrow=1, ncol=3)
showtime1 <- -(v1- 0.05*v2)%*%(0.95*Alat)%*%solve(I-0.95*Alat)
B <- as.matrix(dflat)
B1 <- t(B)
resultlat <- showtime1%*%B1
resultlat <- t(resultlat)
time <- 1:67
time2 <- data$X
timeseries <- time2[2:68]
timeseries
plot(timeseries, resultlat, ylab="CA*")
title(main="Latvia", outer=T, font.main=1.5, cex.main=1.5, line=1)
lines(timeseries, resultlat, lwd=1.5)
lines(timeseries, mCAlat, col="red", lwd=1.5)
legend("topleft",            c("Estimate","True            value"),
lty=c(1,1),lwd=c(1.5,1.5),col=c("black","red"), bty='n')
plot(irf(var_lat, n.ahead=4, ci=0.95, runs=100))
```

Descriptive statistics

```
mean(difNOlat)
mean(mCAlat)
mean(consumerRlatvia)
sd(difNOlat)
sd(mCAlat)
sd(consumerRlatvia)
```

Development of GDP

```
gdpdata <- read.csv("C://Users//Vostřáci//Plocha//gdp.csv",sep=";")
gdpest <- gsub(",",".", gdpdata$Estonia , fixed=TRUE)
gdpest <- as.numeric(gdpest)
gdplit <- gsub(",",".", gdpdata$Lithuania , fixed=TRUE)
gdplit <- as.numeric(gdplit)
gdplat <- gsub(",",".", gdpdata$Latvia , fixed=TRUE)
gdplat <- as.numeric(gdplat)
gdpeu   <-   gsub(",",".",   gdpdata$European.Union..28.countries.   ,
fixed=TRUE)
gdpeu <- as.numeric(gdpeu)
year <- 1996:2013
plot(year, gdplat, ylab="% growth", type="l")
u <- par("usr")
rect(u[1], u[3], u[2], u[4], col = "gray95", border = "white")
```

```
grid(col = "gray82", lty = "dotted",lwd = par("lwd"), equilogs =
TRUE)
abline(h=0, col="grey78")
lines(1996:2013, gdplit, lwd=1.5, col="red")
lines(1996:2013, gdpest, lwd=1.5, col="blue")
lines(1996:2013, gdpeu, lwd=1.5, col="green")
lines(1996:2013, gdplat, lwd=1.5, col="black")
legend("bottomleft",  c("Latvia","Lithuania",  "Estonia",  "EU28"),
lty=c(1,1),lwd=c(1.5,1.5),col=c("black","red","blue","green"),
bty='n')
```

Decomposition of the current account

```
ca <- read.csv("C://Users//Vostřáci//Plocha//CA.csv",sep=";")
lcalat <- gsub(",",".", ca$CALatvia , fixed=TRUE)
lcalat <- as.numeric(lcalat)
calat <- read.csv("C://Users//Vostřáci//Plocha//CAlat.csv",sep=";")
caglat <- gsub(",",".", calat$CAGLatvia , fixed=TRUE)
caglat <- as.numeric(caglat)
caglat1 <- ifelse(caglat>0, caglat, 0)
caglat2 <- ifelse(caglat<0, caglat, 0)
caslat <- gsub(",",".", calat$CASLatvia , fixed=TRUE)
caslat <- as.numeric(caslat)
caslat1 <- ifelse(caslat>0, caslat, 0)
caslat2 <- ifelse(caslat<0, caslat, 0)
cailat <- gsub(",",".", calat$CAILatvia , fixed=TRUE)
cailat <- as.numeric(cailat)
cailat1 <- ifelse(cailat>0, cailat, 0)
cailat2 <- ifelse(cailat<0, cailat, 0)
catlat <- gsub(",",".", calat$CATLatvia , fixed=TRUE)
catlat <- as.numeric(catlat)
catlat1 <- ifelse(catlat>0, catlat, 0)
catlat2 <- ifelse(catlat<0, catlat, 0)
calatpos <- data.frame(caglat1,caslat1,cailat1,catlat1)
calatneg <- data.frame(caglat2,caslat2,cailat2,catlat2)
barplot(t(calatneg), col=c("blue","red","green","yellow"), ,ylim=c(-
0.35,0.2), ylab="% of GDP")
legend("bottomright",c("goods", "services", "income", "transfers"),
bty="n", fill=c("blue","red","green","yellow"))
bp  <-  barplot(t(calatpos),  col=c("blue","red","green","yellow"),
add=T)
axis(side=1,at=bp[1+c(0,17,34,50,67)],labels=c("Q1          1996","Q2
2000","Q3 2004","Q4 2008","Q4 2012"))
par(new=TRUE)
plot(1:68,lcalat,xlim=c(1,68),type="l",col="white",axes=FALSE,ylim=c
(-0.35,0.2),ann=FALSE)
```

Decomposition of the financial account

```
FAlat                                                          <-
read.csv("C://Users//Vostřáci//Plocha//FALatvia.csv",sep=";")
falat <- gsub(",",".", FAlat$FLatvia , fixed=TRUE)
falat <- as.numeric(falat)
dlat <- gsub(",",".", FAlat$DLatvia , fixed=TRUE)
dlat <- as.numeric(dlat)
dlat1 <- ifelse(dlat>0, dlat, 0)
dlat2 <- ifelse(dlat<0, dlat, 0)
plat <- gsub(",",".", FAlat$PLatvia , fixed=TRUE)
plat <- as.numeric(plat)
plat1 <- ifelse(plat>0, plat, 0)
plat2 <- ifelse(plat<0, plat, 0)
olat <- gsub(",",".", FAlat$OLatvia , fixed=TRUE)
olat <- as.numeric(olat)
```

```
olat1 <- ifelse(olat>0, olat, 0)
olat2 <- ifelse(olat<0, olat, 0)
falatpos <- data.frame(dlat1,plat1,olat1)
falatneg <- data.frame(dlat2,plat2,olat2)
barplot(t(falatneg), col=c("blue","red","green"), ,ylim=c(-0.3,0.2),
ylab="% of GDP")
legend("bottomleft",c("Direct investment", "Portfolio investment",
"Other investment"), bty="n", fill=c("blue","red","green"))
bp <- barplot(t(falatpos), col=c("blue","red","green"), add=T)
axis(side=1,at=bp[1+c(0,4,8,12,16)],labels=c("1996","2000","2004","2
008","2012"))
par(new=TRUE)
plot(1:17,falat,xlim=c(1,17),type="l",col="white",axes=FALSE,ylim=c(
-0.3,0.2),ann=FALSE)
```

Balance of services

```
BoS <- read.csv("C://Users//David//Desktop//BoServices.csv",sep=";")
boslat <- gsub(",",".", BoS$Latvia , fixed=TRUE)
boslat <- as.numeric(boslat)
xt <- 1:18
bosdata2 <- data.frame(boslat, xt)
regboslat<- lm(boslat~xt, data=bosdata2)
summary(regboslat)
fitboslat <- fitted(regboslat)
plot(1996:2013, boslat, ylab="% of GDP", xlab="", xaxt="n")
axis(1, at = seq(1996, 2013, by = 2))
title(main = "Latvia", line = 1, outer = FALSE)
u <- par("usr")
rect(u[1], u[3], u[2], u[4], col = "gray95", border = "white")
grid(col = "gray82", lty = "dotted",lwd = par("lwd"), equilogs =
TRUE)
lines(1996:2013, fitboslat, lwd=1.5, col="red")
points(1996:2013, boslat)
legend("bottomleft", c("BoS=5.546 - 0.003*t"), bty='n',cex = 1)
```

Exports and imports

```
expimp                                                            <-
read.csv("C://Users//Vostřáci//Plocha//ExpImp.csv",sep=";")
laexp <- gsub(",",".", expimp$LaExports , fixed=TRUE)
laexp <- as.numeric(laexp)
laimp <- gsub(",",".", expimp$LaImports , fixed=TRUE)
laimp <- as.numeric(laimp)
laexpimp <- data.frame(laexp,laimp)
laexpimp <- t(laexpimp)
bp1 <- barplot(laexpimp, col=c("darkblue", "red"),beside=T, ylim=c(-
0.3,0.2), main="Latvia")
axis(side=1,at=bp1[1+c(0,8,16,24,32,40,48)],labels=c("2007","2008","
2009","2010","2011","2012","2013"))
```

Export

```
Export_LCI                                                        <-
read.csv("C://Users//David//Desktop//ExportandLCI.csv",sep=";")
expest <- gsub(",",".", Export_LCI$Estonia , fixed=TRUE)
expest <- gsub(" ","", expest , fixed=TRUE)
expest <- as.numeric(expest)
explat <- gsub(",",".", Export_LCI$Latvia , fixed=TRUE)
explat <- gsub(" ","", explat , fixed=TRUE)
explat <- as.numeric(explat)
explit <- gsub(",",".", Export_LCI$Lithuania , fixed=TRUE)
explit <- gsub(" ","", explit , fixed=TRUE)
explit <- as.numeric(explit)
```

```
expplot <- plot(1:28, expest, ylim=c(1000,7000), xaxt="n", xlab="",
ylab="Export, millions of euro")
axis(1, at=c(1,5,9,13,17,21,25,29), labels=c("Q1 2007","Q1 2008","Q1
2009","Q1 2010","Q1 2011","Q1 2012","Q1 2013","Q1 2014"))
u <- par("usr")
rect(u[1], u[3], u[2], u[4], col = "gray95", border = "white")
grid(col = "gray82", lty = "dotted",lwd = par("lwd"), equilogs =
TRUE)
abline(v=15, col="grey78")
lines(1:28, expest, lwd=2, col="red")
lines(1:28, explat, lwd=2, col="green")
lines(1:28, explit, lwd=2, col="blue")
legend("topleft",c("Estonia",   "Latvia",   "Lithuania"),   bty="n",
fill=c("red","green","blue"))
```

Wages

```
Export_LCI                                                          <-
read.csv("C://Users//David//Desktop//ExportandLCI.csv",sep=";")
lciest <- gsub(",",".", Export_LCI$LEstonia , fixed=TRUE)
lciest <- as.numeric(lciest)
lcilat <- gsub(",",".", Export_LCI$LLatvia , fixed=TRUE)
lcilat <- as.numeric(lcilat)
lcilit <- gsub(",",".", Export_LCI$LLithuania , fixed=TRUE)
lcilit <- as.numeric(lcilit)
expplot <- plot(1:28, lciest, ylim=c(-15,35), xaxt="n", ylab="Wages,
% change", xlab="")
axis(1, at=c(1,5,9,13,17,21,25,29), labels=c("Q1 2007","Q1 2008","Q1
2009","Q1 2010","Q1 2011","Q1 2012","Q1 2013","Q1 2014"))
u <- par("usr")
rect(u[1], u[3], u[2], u[4], col = "gray95", border = "white")
grid(col = "gray82", lty = "dotted",lwd = par("lwd"), equilogs =
TRUE)
abline(h=0, col="grey78")
abline(v=15, col="grey78")
lines(1:28, lciest, lwd=2, col="red")
lines(1:28, lcilat, lwd=2, col="green")
lines(1:28, lcilit, lwd=2, col="blue")
legend("topright",c("Estonia",   "Latvia",   "Lithuania"),   bty="n",
fill=c("red","green","blue"))
```