



LUND UNIVERSITY
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Capital Inflows to Emerging Economies

- Policy lessons from the Baltic boom-bust cycle 2004-2010

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Abstract

This study investigates the effects and policy lessons from the surge of capital inflows that the Baltic countries experienced during the period 2004-2008. We discuss the main risks and policy challenges involved with such an episode and assess what scope there was for policy makers to face these challenges. We also devote some attention to the area of measuring exchange rate pressure by application of the EMP index. Our main findings are that the Baltic countries were very limited in their policy options due to their lack of an independent monetary policy. Furthermore it seems as if it would have been very hard for them to take sufficient precautionary measures in time to avoid a deep recession following the global financial crisis, as this extreme event had a large impact all around the world. There was however some scope for better policies within the management of government finances and financial regulation. Regarding the measurement of exchange rate pressure we find that a new approach suggested by Klaassen & Jager (2011) seems to be valid from both an intuitive and practical perspective.

KEYWORDS: *Baltics, Capital Inflows, EMP, Emerging market policies*

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1. Introduction

At the regain of independence from the Soviet Union in 1991 the Baltic countries commenced a substantial transition moving from a system of central planning towards market economies. After some turbulent years, especially during the Russian crisis in 1998, the countries entered a prosperous path of stable and rapid convergence towards Western Europe. By 2004 all three countries had been granted membership in both the EU and NATO. During the following years growth increased even further as large levels of capital started to flow into the Baltic economies, mostly directed to the growing banking sector, and credit expanded extremely fast, to a large extent denominated in foreign currency. The easy access to credit boosted domestic demand, asset prices surged and GDP growth picked up further momentum. This development was however also accompanied by rising inflation which deteriorated competitiveness since all three countries were operating fixed exchange rate regimes. By 2007 the Baltic economies were overheated, and concerns regarding their future stability arose as they entered recessions. It was during this very fragile period that the global financial crisis emerged.

The Baltics suffered a dramatic bust and were to be the most severely affected region in the world as their economies contracted by some 20-25 percent from their peak levels. During the crisis credit markets dried up causing severe illiquidity problems, unemployment rose sharply and demand plummeted. Furthermore, Latvia was target of a serious speculative attack on its currency the Lats and both the Estonian Kroon and Lithuanian Litas came under severe pressure. Yet all three countries managed to maintain their pegs and an outright banking crisis was avoided through emergency lending from IMF, Nordic central banks and financing of foreign parent banks. Despite the devastating experience Estonia became a full member of the EMU in January 2011, while Latvia and Lithuania are still struggling to fully recover.

It is in the light of these extraordinary series of events that our study will attempt to give a more detailed understanding of the Baltic experience. We do this by initially reviewing some theoretical and empirical findings of the mixed blessing of large capital inflows. We also look in more detail at the potential implications of such periods on the receiving countries stability and crisis propensity, and investigate the policy toolkit available in dealing with such episodes. We then give an in-depth description of the boom-bust cycle in the Baltics where we devote significant attention to explore the means of measuring exchange rate pressure under fixed exchange rate regimes. Finally we evaluate what scope there was for the Baltic countries to avoid the devastating outcome by better policies.

1.1 Purpose

The overall purpose of this study is to investigate the risks associated with large capital inflows to emerging economies, in particular those operating fixed exchange rate regimes, and the policy options available when dealing with such inflows. The experience of the Baltic countries during the period 1998-2010 makes out a very good reference situation for this purpose and might give valuable policy lessons for other European countries entering the ERMII¹ with the ambition of eventually becoming full members of the EMU. There is hence need for an examination of available policy options and an assessment of the Baltic performance within this area. Since the EU prohibits obstacles to free capital movement and compliance of the Maastricht criteria² restricts larger currency fluctuation in the period before EMU accession, there might be very limited scope for stabilizing policies and it could be crucial that the few policy measures available are used efficiently. Finally, in order to gain in-depth knowledge of the Baltic countries' exchange rate regimes and the pressure put on them during the period we investigate the construction and application of an exchange market pressure (EMP) index, which to our best knowledge is the most frequently used measure for this purpose.

1.2 Method

To address our overall purpose with this study we use the most relevant parts of the vast literature of causes, risks and prevention of financial and currency crises. We pay special attention to two IMF Staff Position Notes from 2010 and 2011 respectively (authored by Ostry et al.) when investigating policy options in response to large capital inflows as these give a very structured and comprehensive treatment of the issue. We do however also discuss other authors' opinions on the topic. In order to obtain a complete set of relevant data, several different databases have been used. For the sake of consistency we have tried to rely primarily on the IMF database International Financial Statistics (IFS). There have however been numerous gaps and to fill these we have turned mainly to the databases of national central banks, Eurostat and BIS statistics.

In order to gain a detailed picture of the evolution of the three countries' exchange rates we employ a version of the Exchange Market Pressure index initially introduced by Girton & Roper (1977), and later revised by several different authors. Due to the rather large inconsistency between authors in the application of the index, we have put considerable time and attention in order to find the most appropriate application for our study. Our choice have been to follow the approach outlined by Klaassen & Jager (2011), as we find this to be the most intuitive and they convincingly show the advantages of it. In order to evaluate the robustness of this EMP measure, which has not been evaluated to any further extent, we will also present and examine three alternative and more established measures in accordance with previous research. All data for our EMP estimations are gathered from the IMF International Financial Statistics (IFS).

¹ European Exchange Rate Mechanism

² The Maastricht criteria are the rules governing full EMU membership.

1.3 Delimitations

During the global financial crisis there were several different country experiences of interest for our study within Central and Eastern Europe. However covering them all in detail would pose a far too extensive task for the scope of our study. We have therefore chosen to focus primarily on the Baltic countries since these were among the most affected countries and are easily compared with each other as they are very similar in terms of size, location and development over time. Since investigating financial sector regulation in detail would require a study of its own we confine ourselves with a slightly more general approach, leaving aside specific national and cross country legal issues. Our focus hence lies within the macroeconomic and financial sector stability and overall regulation rather than specific supervision and regulation on the individual bank level.

When investigating Exchange Market Pressure we would have liked to use daily data over the respective central banks operation but due to data limitations we have to confine ourselves to monthly observations. This is naturally a rather serious limitation if one wants to gain in-depth knowledge of the events of a particular speculative attack, since there can be drastic changes in very short periods of time. However our study is more interested in the development of the full boom-bust cycle and for this purpose we do not find the constraint of monthly data to be a decisive drawback. In fact Klaassen & Jager (2011) show that even though some information is lost monthly data is sufficient to obtain sufficient information of the overall development.

1.4 Disposition

The rest of this thesis is organized as follows. Chapter 2 reviews some theoretical and empirical findings related to capital inflows, where the determinants and characteristics of capital inflows are explained initially and the risks and policy responses are outlined after. Chapter 3 gives an overview of the Baltic development leading up to, and during the global financial crisis. We pay particular interest to the rapid credit expansion that took place. In chapter 4 we outline the theory behind EMP, construct and estimate our own measure and finally discuss our results. In Chapter 5 we evaluate the policies available in response to the large capital inflows and discuss the room for different policies. Finally we present our main conclusions in chapter 6.

2. Capital inflows to emerging economies: the lurking crisis

There is little doubt about the welfare improving potential of free capital movements within the theoretical economic literature. Global financial markets allow agents to allocate capital where it is most efficiently used, thereby achieving higher yields. Capital inflows from developed to developing countries can help finance investments and stimulate economic growth by accumulating capital of physical, financial and human form. However capital inflow surges are no unambiguous blessing. Many of the recent currency crises in emerging markets have been preceded by periods of large inflows of foreign capital which eventually come to a sudden stop or a sharp reversal, leading to severe recessions and often full blown currency and financial crises (Reinhart et al. 1996).

It is important to distinguish between different types of capital flows in order to understand the underlying determinants and different characteristics of them. For example it seems as if larger amounts of short-term debt increase both the likelihood and the severity of a crisis (Rodrik & Velasco 1999). In order to get a better understanding of the nature of international capital flows this section investigates the main drivers of international capital movements as well as the vulnerabilities that might arise in less developed markets during periods of large inflows.

2.1 Capital inflows: determinants, characteristics and risks

Over the last decades capital flows have been very volatile and looking especially at emerging countries there have been major changes over time. During the period between the late 1970s and early 1980s there were large capital inflows to emerging markets. With the Latin American debt crisis starting in 1982 these inflows however came to an abrupt halt and many Latin American economies entered severe recessions (Reinhart et al. 1994). During the early 1990's capital flows to the emerging market economies started again and increased dramatically over the 1986-1996 period (nominally about 11 times). However, new sudden stops occurred e.g. in 1997 when the Asian financial crisis created severe turmoil in the global capital market. This time the stops in capital flows were however more temporary and the inflow of capital to emerging economies resumed soon after (Carlson & Hernandez 2002).

Along with the change in the size of the flows throughout the 1990s, were also changes in the direction, composition and source of capital flows. There are many explanations to what has driven these changes. Some authors suggest changes in interest rates and growth in the developed world, others point at country specific factors in the receiving countries such as political stability, creditworthiness and location while yet others point out macroeconomic fundamentals such as GDP growth and interest rate differentials (Carlson & Hernandez 2002). Following the many observed financial and currency crises in the 1990's, triggered mainly by sudden stops or even reversals of the capital flows, a lot of attention was also given to the composition of capital flows as a determinant of whether the large capital inflows were beneficial or detrimental for emerging economies.

In the following section we first give a brief overview over the literature surrounding the main determinants of capital flows to emerging economies. We make a distinction between whether the changes in capital inflows are caused by conditions in the recipient economies (internal pull factors) or conditions in the investing countries (external push factors) in accordance with BIS (2009). Thereafter we take a look at the composition and characteristics of

short-term (short-term loans and portfolio flows) and long-term (FDI and long-term loans) capital flows. Lastly we briefly investigate the process of sudden stops and capital flow reversals.

Internal (pull) factors

As with any investments, international capital flows are driven by the search for high yields in relation to perceived risk. Domestic policies are central for what the perceived risk of a country is and work through several channels. A stable macroeconomic environment, with stable price development and sound fiscal policy, reduce the perceived risk and thereby create positive signals to international investors (Reinhart et al. 1994). Fernandez-Arias & Montiel (1995) examine determinants of the size of capital inflows to developing countries and find that the creditworthiness of a specific country is important in explaining both the timing and destination of capital inflows. The actions of a country or its government can therefore be of great importance as an increased credit rating might trigger large inflows of capital. Institutional and structural reforms such as liberalized capital markets are other examples of policies which might act as a positive signal of reduced risk as the impact of political uncertainty is reduced (Fernandez-Arias & Montiel 1995). Other policies that might induce capital inflows are tax credits, tax reductions or other measures that have a direct impact on the expected return of investments (Reinhart et al. 1994).

Besides policies there are other country specific factors that might have an impact on the size and composition of capital inflows such as endowment of natural resources or rapid productivity increases. Reinhart et al. (1996) found an interesting result suggesting that small countries can experience increasing capital inflows if they are situated in close proximity to larger countries receiving large capital inflows. There might thus be country specific or regional factors affecting capital flows which are outside a particular country's control. This result could also be interpreted as an indication of herding behaviour among international investors.

External (push) factors

It appears not to be sufficient to explain all capital inflows as a result of internal factors. Returning again to the Latin American example, as examined by Reinhart et al. (1992), there were countries that did not reform their systems but still received large inflows of capital. There were also countries that performed liberalizing reforms that did not see increased inflows. This makes external factors as part of the explanation likely, at least for that region and period. Excessive liquidity in the global markets is generally considered to be one important factor behind external capital inflows to emerging markets. Two measures which are believed to have a large impact on global liquidity are interest rates and money growth in developed countries (BIS 2009).

Interest rates in developed countries are likely to have an impact on capital flows to emerging markets through three main channels. First, lower interest rates in developed countries are likely to increase capital inflows to the emerging markets. This is explained by the fact that investors are likely to search for investments offering higher yields which could be achieved through investing in emerging economies. This market condition is especially likely to attract investors with shorter investment horizons looking to take short-term advantage of the interest rate differential. Second, emerging countries are generally net debtors. Lower interest rates in net lender countries might thus increase emerging countries credit worthiness as their debt servicing costs are likely to be reduced. Finally, lower interest rates in the developed world can

induce borrowers in emerging countries to borrow in foreign currency instead of their own and hence pay lower yields on their loans (BIS 2009).

Money growth and the general business cycle in developed countries are also likely to have an impact on capital inflows although the effects are somewhat ambiguous. If developed countries are experiencing a recession it might induce investors to invest in the emerging markets in order to take advantage of investment opportunities and better market conditions. This relationship was found by Reinhart et al. (1992) for the Latin American region and by Reinhart et al. (1996) for emerging economies in both Latin America and Asia. As recessions in developed countries increase capital inflows to emerging markets, capital inflows move in the opposite direction of business cycles. However, the importance of the relationship seems to be weaker during periods where economic conditions in developed countries are improving (Reinhart et al. 1996).

One final external contributor worth mentioning is the fact that global investors are increasing portfolio diversification. Pension funds and insurance companies in the Euro Area, US, UK and Japan have recently been investing to a further extent in emerging markets in order to obtain diversification, partly because the financial markets in general are becoming more integrated (Reinhart et al. 1996).³

With the main findings of determinants of capital flows in mind we now turn to investigate the characteristics of the different types of capital inflows. We divide these into two main categories based on their investment horizon and volatility, short-term flows and long-term flows. Generally short-term assets can be withdrawn or mature in 12 months or less while long term assets have longer maturities.

Short-term flows

There are some studies showing that a large amount of short-term external debt is likely to increase both the likelihood and the severity of a crisis. Long-term external debt can instead be thought of as being associated with accumulation of capital.⁴ As some types of capital inflows are considered to be more reversible depending on their maturity we choose to make a distinction between short-term and long-term flows in accordance with Sula et al. (2006).⁵ Within short-term flows we make a distinction between portfolio flows and short-term loans while long-term flows are divided into foreign direct investments (FDI) and long-term loans.

The general result of previous work looking at short-term flows is that these flows are mainly driven by market forces which are characteristic for the state of the economy in the country subject to the flows (Carlson & Hernandez 2002). Portfolio flows are important to look at because they are one of the main contributors of capital inflows to emerging countries. Bond flows, one version of portfolio flows, have been found to be largely affected by secondary market prices and credit ratings. This is intuitive because secondary market prices and the secondary

³ See also BIS (2009)

⁴ Capital in this sense can be in the form of either physical capital or human capital (which can encourage economic development), Frankel & Rose (1996).

⁵ Sula et al. (2006) do not have the distinction between short-, and long-term loans but we consider the distinction between them to make things more clear. Hegerty (2009) makes a similar distinction although he separates capital inflows into FDI and non-FDI where non-FDI consists of portfolio investments and other investments (mainly short-, and long-term loans).

market in general are important for the possibility of trading bonds. The credit rating of a country is also important as this determines the yield on bonds and the risk associated with the bonds in the country. Equity flows, another version of portfolio flows, tend to be more sensitive to interest rates, price-earnings ratios and rates of return on domestic stock markets (Chuhan et al. 1998). Again this is intuitive because with changes in interest rates the relative attractiveness of equities changes. When the interest rate increases, the relative attractiveness of the alternative investment i.e. equity, decreases. Price-earnings ratios and rates of return on the domestic stock market also affect the incentive for investing in foreign markets. Portfolio flows are highly liquid assets and can be sensitive to herd behaviour and information problems. As a result these investments can easily and quickly be withdrawn at signs of problems in markets or economies.

The intuition behind short-term loans is in many ways similar to that of portfolio flows. As they have shorter maturity than long-term loans they are easier to “withdraw” from a country by not renewing the loan upon maturity. If there are excessive amounts of short-term loans this might be an indication, or at least a perception in the market, of an oncoming crisis and this can also increase the severity of a potential crisis (Calvo 1998).

In summary the determinants of short-term flows are the same as the determinants for FDI, but with the opposite impact (Carlson & Hernandez 2002). One issue of importance relating to short-term loans is how these are in turn financed by the lenders, most often banks. If domestic banks finance their lending by borrowing e.g. short-term in foreign currency it can create mismatches in both currency and maturities.⁶

Long-term flows

Foreign Direct Investments, FDIs, are generally considered to be the most stable version of capital inflows. FDIs mainly consist of fixed assets and are therefore quite illiquid and more difficult to sell in the emergence of a crisis (Sula et al 2006). By the same logic they are also less likely to contribute to a crisis and are generally made with a longer investment horizon. High levels of capital transaction restrictions and less developed financial markets have actually been found to increase FDI (Montiel & Reinhart 1999, Hausmann & Fernandez-Arias 2000). If there are more restrictions on the opportunity of placing capital in a country or if the less developed financial market makes it more difficult, FDI is an alternative way of placing capital. For domestic firms one way of finding financing, yet avoiding restrictive capital markets, is to allow foreign investors to purchase shares of their company, thus increasing FDI. The impact that FDI have on a country and its economy is generally more long-term than e.g. portfolio inflows and the investment decision is made to a larger extent with focus on the fundamentals of a country than on speculative interests. Rather than being associated with increased consumption it is assumed to increase domestic capital formation (BIS 2009).

Although generally considered as the most stable component of capital inflows there are objections regarding how stable FDIs actually are as there are other flows and activities that can be associated with them. Even though capital inflows might enter a country as FDI, they can flow out from a country through different accounts (Sula et al. 2006). FDIs can be used by creating physical assets such as buildings and factories which are subsequently used as security to obtain loans, where the funding from the loan is placed abroad (Bird & Rajan 2002). In this sense FDI

⁶ A further discussion regarding such mismatches is given in section 2.2.

could foster short-term effects in a similar manner as short-term debt. Furthermore, all equity investments above 10 percent of total company value are considered FDI according to IMF classification. If such equity investments are made in the financial sector and used to finance short-term lending, the FDI inflow effectively has the same properties as short-term loans (Sula et al. 2006)

Long-term loans are obviously less reversible than short-term loans as there are costs associated with redemption. They are often used to finance projects of longer term and are therefore less vulnerable to higher interest rates or changed perception of risks (BIS 2009). In this sense they provide a quite stable version of capital inflows although still less stable than FDI.

Sudden stops and reversals of capital flows

Sudden reversals of capital flows have often been mentioned in the literature as sudden stops. A theoretical treatment of the phenomenon is given in Calvo (1998). In short a sudden stop occurs as access to financing through international capital markets is lost and repayment of short-term loans is demanded by external lenders. If the receiving country has become dependent on capital inflows this loss of financing is likely to have a large effect on the recipient country's operational liquidity. The resulting illiquidity reduces aggregate demand which, given sticky prices, brings about a fall in output and employment thus triggering a recession. The crisis could be further deepened by financial weaknesses arising from borrower's inability to repay their debts as a result of lower incomes or complete insolvency if asset prices decrease sharply. As non-performing loans increase, banks become more cautious and cut their loans which further aggravate the declining demand. In worst case banks might even turn insolvent and need rescue from governments that might not be able to finance such rescues (Calvo & Reinhart 2000).

Sudden stops are no rare phenomenon. Cardarelli et al. (2009) find that more than one third of episodes of large capital inflows end with a sudden stop or full blown currency crisis. The vulnerability of a country to a sudden stop should to some part depend on the amount of short-term debt that needs to be rolled over. This is also the conclusion of Rodrik & Velasco (1999) who examined a set of emerging countries during the 1990's. They found that large amounts of short-term external debt in relation to reserves affected both the likelihood and severity of a crisis. Their result is however not confirmed by Frankel & Rose (1996) who studied a different set of countries over an earlier time period. A possible explanation is that the latter authors used short-term debt in relation to GDP instead of reserves.

2.2 Capital inflows – risks and policy responses

It has become apparent during the last decades that capital flows to emerging markets often are accompanied by periods of widespread turmoil as the capital flows reverse and currency and financial crisis emerge. This section discusses these effects of capital movements and what scope there is for policymakers to manage episodes of large capital inflows.

Implications and policy responses

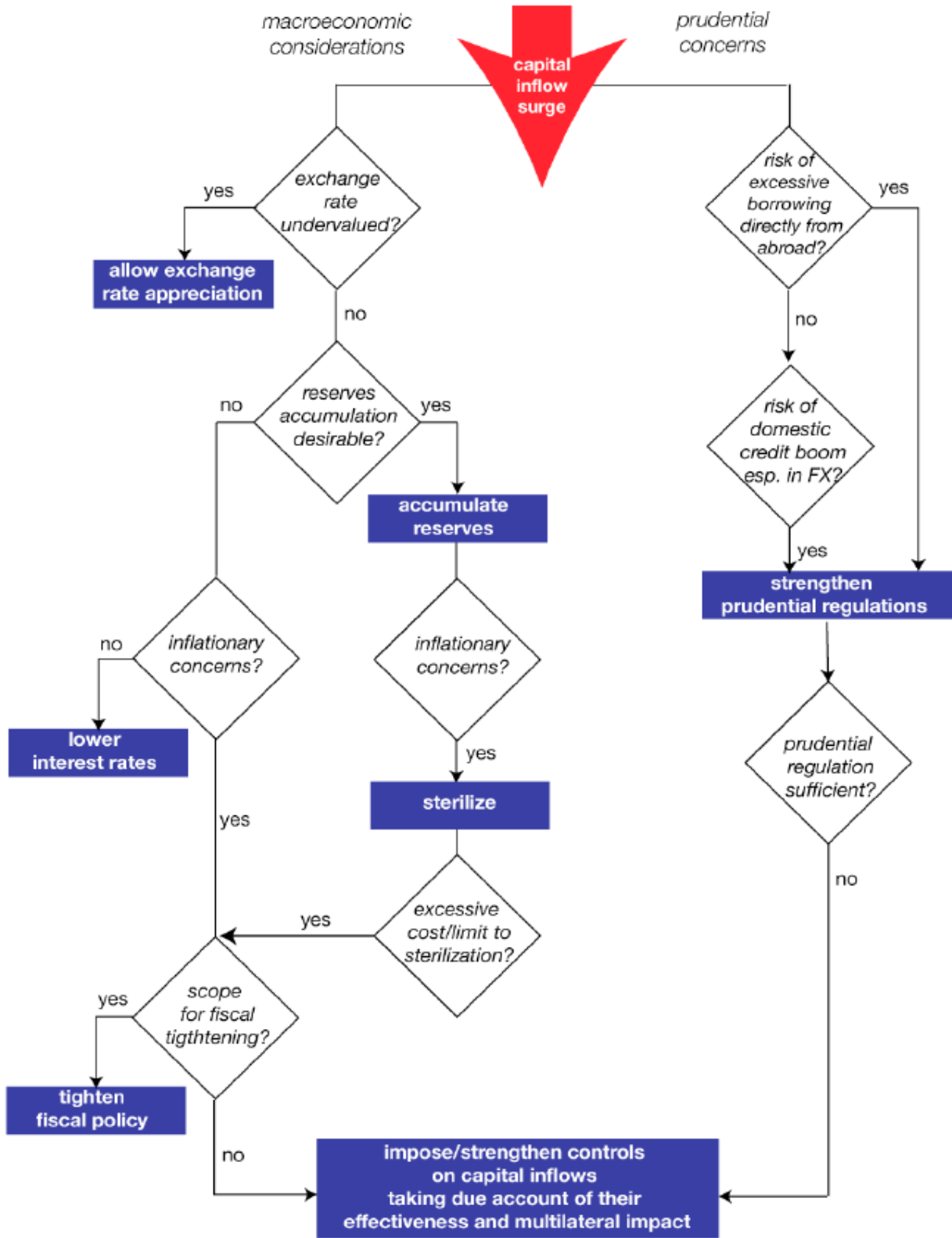
An increasing inflow of foreign capital can come as a blessing to emerging economies previously not able to finance temporary deficits while trying to improve their economic performance. Large capital inflows have generally been associated with increasing GDP growth thus spurring the economic development of the receiving country. However there is a downside

to this development. Large capital flows have also come to be associated with risks of overheating, substantial current account deficits, real exchange rate appreciations, creation of asset price bubbles, excessive expansions of domestic credit and as the receiving economies get dependent of large capital inflows they become increasingly vulnerable to a reversal of these flows potentially resulting in a currency crisis (Cardarelli et al. 2009).

Following the recent financial crisis the view of rational investors and blessing of free capital movements have been reconsidered. As a result the use of capital controls and other prudential policies have gained renewed support even from the IMF, illustrated by two papers (Ostry et al. 2010 and Ostry et al. 2011) discussing the role of such policies as a complement to macroeconomic policies in managing massive capital inflows. There are two main areas of concern that can be identified following massive capital inflows; macroeconomic implications and financial fragility. The macroeconomic concerns are related to exchange rate appreciation, following increased demand for the domestic currency, which may lead to a loss of competitiveness in the tradables sector, growing external imbalances and likely large (although hard to measure) adjustment cost following exchange rate volatility. There is also substantial risk of overheating and high inflation following rapid demand growth driven by increased access to credit. As foreign investments increase there are also several concerns with the financial stability. Quickly rising asset prices may create bubbles which could be further fuelled by credit booms. Rapidly expanding lending could pose a severe risk by itself, especially if credit is denominated in foreign currency and given to un-hedged borrowers (like households) who underestimate the currency risk. Such financial fragilities are especially pronounced when inflows are of a short-run nature (Ostry et al. 2010).

In an IMF paper from 2010 Ostry et al. put forward a neat flow chart guiding the policy response to a surge in capital inflows. It gives a very comprehensible view of the policy options available and what factors one must take into account when considering what policies to implement in response to the macroeconomic and financial concerns. We will use this flow chart as a framework when discussing the different policy options available in general and then apply it to the Baltic countries in the next section where we examine what policy options that were available to them during their episode of capital inflows.

Figure 1 - Flow chart of policy responses to capital inflow surges



Source: Ostry et al. 2010 p. 7

Exchange rate policy

The first consideration is exchange rate policy and the fear of excessive exchange rate appreciation. There are several ways of dealing with appreciation pressure and the available options depend on the exchange rate regime. Ostry et al. (2011) emphasize the importance of carefully assessing the current exchange rate before laying out a strategy to resist an appreciation, and that such an assessment should be based on the expected medium-term evolution of macroeconomic fundamentals on a multilateral level. The thoroughness needed in the assessment is motivated by the possibility that large capital flows, if persistent, could have an impact on the equilibrium exchange rate. The exchange rate must then be allowed to adjust to this new equilibrium level before intervention can be pursued sustainably. It might thus be feasible to allow for some appreciation to occur despite its potentially damaging effect on the competitiveness of the tradable sector.

As long as the country does not already have a freely floating regime one option to deal with appreciation pressure is to allow for more exchange rate flexibility, either by revaluing the exchange rate or by increasing the flexibility of it or both at once. Reinhart & Reinhart (1998) acknowledge many advantages with such policy actions. Revaluation allows insulation of the money supply, domestic credit and the banking system from the inflows and their possible reversal. Furthermore nominal appreciation reduces inflationary pressure. Increased flexibility could dampen capital inflows through the increased risk perception of investors caused by greater exchange rate volatility. Despite these benefits, Reinhart & Reinhart (1998) note that exchange rate adjustment has historically been a rather uncommon response to surging capital flows. A possible reason for this could be that a high degree of volatility in the exchange rate, as could be the result of large fluctuations in capital flows, could impose great (although hard to measure) adjustment cost for the economy which makes policy makers less inclined to adopting such policies. Cardarelli et al. (2009) point out that during the inflow period of the 1990's many countries (except emerging Asia) actually faced depreciation pressure. This pressure, which was due to large current account deficits, was not resisted strongly and many currencies were allowed to depreciate. Yet, the authors also note that there was some accumulation of foreign reserves during the same period. These contradicting facts suggest, according to the authors, that monetary authorities might have intervened during periods of appreciation pressure but not against depreciation pressure. The latter period of capital inflows to emerging markets (2004-2007) has instead proven to be accompanied by nominal appreciation of several emerging countries currencies, although there has been significant resistance by central banks, who did accumulate foreign reserves, showing the widespread desire to limit exchange rate appreciation among emerging countries (Cardarelli et al. 2009).

Reserve accumulation and Sterilization

According to Ostry et al. (2010) excessive appreciation pressure might give the monetary authorities a welcome opportunity to accumulate foreign reserves. The reasons for central banks to accumulate reserves is to be able to protect the domestic banking sector and credit markets in general by acting as a lender of last resort and at the same time have resources to resist a currency run (Obstfeld et al. 2008). If inflation is a concern during such accumulation Ostry et al. (2010) further suggest that the FX interventions are sterilized.

Unfortunately Ostry et al. (2010) do not give any guidance as to what a desirable level of foreign reserves is or how to measure it and we must hence turn to some other theoretical and

empirical findings regarding previous crisis periods and the relation between the magnitude of the crises and the level of reserves. In an IMF paper from 2006, Jeanne & Rancière present a model to determine the optimal level of international reserves. As a general result they find that a reserve-to-GDP ratio around 10 percent is adequate for middle income countries. They find that the level of reserves proposed by their rather sophisticated model of optimal reserve determination is very much in line with the basic rule of thumb known as the Greenspan-Guidotti rule which suggest a level of reserves equal to gross short-term external debt (Jeanne & Rancière 2006). Rodrik & Velasco (1999) investigates in particular the ratio of short-term external debt (STED)⁷ to reserves and find strong support in favour for both that higher levels of this ratio is associated with higher probability of a crisis and a greater magnitude of the crisis. More specifically, by investigating 32 emerging economies over the period 1988-1998, they find that countries with a STED/Reserve ratio value greater than unity were three times more likely to experience a crisis and. The main intuition behind the relevance of the STED/Reserve ratio has to do with liquidity. During crisis periods debt rollovers might become very difficult and borrowers might hence be forced to repay, which creates a rapid drain of foreign reserves. Their results are partially consistent with the results of Aizenmann et al. (2010), who find that countries with a high level of short-term debt inflows before the 2008-09 crisis experienced higher exchange market pressure during the crisis period.

Obstfeld et al. (2008) instead argues that neither short term debt nor trade deficits are relevant when assessing reserve adequacy. They argue that reserve drains through debt repayments or trade deficit financing are rather slow and hence do not correspond to the panics observed during currency crises. Instead they suggest using the ratio of reserves to the size of domestic financial liabilities that can potentially be converted into foreign currency, i.e. M2. They do however not suggest an appropriate reserve-to-M2 ratio. In order to provide some guidance as to what an appropriate ratio might be one can use the authors' review of the Argentinean experience during the Mexican crisis in 1995 where about one-eighth of M2 was exchanged for central bank reserves over the space of a few weeks before IMF financing managed to restore confidence (Obstfeld et al. 2008).

In order to avoid rising inflation following foreign reserve accumulation, interventions might need to be sterilized. However a commonly mentioned paradigm in open economy macroeconomics is the "impossible trinity" or "policy trilemma" which states that it is impossible to successfully target the exchange rate, have monetary policy autonomy and allow full capital mobility at the same time. The usual conclusion of the paradigm is that in a world of freely moving capital, countries must choose between exchange rate control and an autonomous monetary policy. However, given imperfect capital markets, where different risk premiums are assigned to different bonds depending on which country they are issued in, this paradigm may not hold. Because of this, many countries have tried to sterilize exchange market interventions in attempt to achieve both exchange rate stability and low inflation. The basic outline of the policy action is that as monetary authorities accumulate foreign assets in order to defend the exchange rate, they decrease their holdings of domestic assets thereby keeping the monetary base constant.⁸ In order to induce private actors to hold the extra domestic assets interest rates usually must rise. Furthermore there might be a cost attached to sterilizations as the central

⁷ Short-term debt is liabilities with a maturity less or equal to one year.

⁸ See BIS 2009 for a thorough discussion of the different designs available for sterilized interventions as a response to appreciation pressure.

bank exchange high-yield domestic assets for low-yield foreign assets. Such costs might make sterilization a temporary solution only, which has been observed for many countries during the 1990's and early 2000's (Cardarelli et al. 2009).

Even though sterilization might make intuitive sense, such actions have at times proven to be accompanied by unintended effects. A stable short-run exchange rate (through intervention), in combination with high domestic interest rates (following the contraction in the domestic money market), could actually induce even larger short-term capital inflows as investors are attracted by safer (due to exchange rate stability) and higher yields (Reinhart & Reinhart 1998). According to Cardarelli et al. (2009) this unintended effect could be the reason why sterilized interventions have been shown to be inefficient at reducing real appreciation. Instead, the authors suggest that sterilized interventions are associated with higher inflation and that countercyclical monetary policy seems to be associated with greater real exchange rate appreciation.

BIS (2009) add to the discussion surrounding sterilization as they notice that there might not be need to sterilize exchange rate interventions. They point out an example in the experience of many Asian economies during the period of 2002-2005, where the countries managed to combine an accumulation of foreign reserves with low policy rates without facing high inflation. They argue that this situation was due to the substantial excess capacity within these economies which, in combination with a growing manufacturing capacity in other countries, kept world prices of tradables low. However they also note that inflation eventually started to rise in these countries in 2006 which might suggest that escaping the policy dilemma might only be possible during shorter periods of negative output gaps.

Monetary and fiscal policy

If previously policy options are exhausted another macroeconomic policy option available to affect the exchange rate given by Ostry et al. (2010) is lowering interest rates in order to reduce the incentives for capital inflows. However, as the authors note surges in capital inflows are often associated by inflation pressure which is likely to reduce the attractiveness of this policy option. In such a case they suggest a tightening of fiscal policy.

There are two main fiscal policy options in response to capital inflows; reducing public expenditures and increasing taxes. The aim of both is reducing aggregate demand but the efficiency of them could differ. If public consumption is more tilted towards non-traded goods than private consumption, reducing public expenditure is likely a more efficient policy action than tax increases for the private sector in relieving real exchange rate pressure. This is since reducing public consumption under such circumstances will have a relatively larger impact in cooling the overheating economy. Furthermore increasing taxes during periods of heavy capital inflows could be off-set by looser private credit which is often associated with periods of capital inflows. If this is the case, and particularly if the tax increase is perceived as temporary, the fall in disposable income might to a large degree be compensated for by private borrowing. The main problem with fiscal policy actions is that they are generally not suitable for short-term and fast adjustment since they usually are sensitive political issues. Hence, such policy actions might be too slow to implement and because of this they run the risk of becoming pro-cyclical. Furthermore public expenditure is generally focused at medium- to long-term objectives such as infrastructure improvements or social spending, two things that might be especially important

in emerging economies. It might thus be hard to reduce them without also sacrificing long-term growth (Reinhart & Reinhart 1998).

The importance of countercyclical fiscal policies in emerging countries during periods of large capital inflows is shown in Cardarelli et al (2009). They find that countries with a high growth of public expenditures during the inflow period experienced a sharper fall in GDP growth in the post-inflow period.⁹ They also find that such pro-cyclical fiscal policies are associated with higher real appreciation. Reinhart & Reinhart (2008) clearly show how prone emerging countries have been to treat the temporary good times of large capital inflows as a permanent phenomenon inducing them to expand public expenditures during the boom phase. Such policy actions acts to further destabilize the economy and causes a need for dramatic fiscal tightening once the bust strikes. In Reinhart & Reinhart (1998) the authors reaches similar conclusions and emphasize that conservative fiscal policy during the boom phase in combination with careful supervision of the financial sector at all times (i.e. not only once problems have emerged) are the strongest lessons to be learnt from the crises in the 90's. This brings us to the next policy area; prudential policies and capital controls.

Prudential policies and capital controls

While the earlier mentioned policies are implemented mainly out of macroeconomic reasons with the objective to reduce the volume of aggregate inflows, prudential policies (and to some extent capital controls) are mainly used to address concerns over the financial stability i.e. the composition of capital inflows. Prudential policies are intended to strengthen the financial sector's ability to deal with increased risk or to prevent it from incurring excessive risk. Examples of such policies are capital requirements, caps on credit growth and limits on banks' open FX position. Capital controls in a broad sense are measures meant to affect cross-border movements of capital e.g. taxes on inflows from non-residents or unremunerated reserve requirements (URRs) on foreign inflows. Sound prudential policies of non-discriminatory character¹⁰ have long been an accepted and encouraged measure to ensure financial stability. In contrast discriminatory prudential policies and capital controls have by some authors¹¹ been seen as distortions to market efficiency and barriers to productive investments, despite some support of their effectiveness¹², and the use of them has been limited through several multilateral agreements (Ostry et al. 2011).

While not being the optimal policy measures for affecting the size of capital inflows, both prudential policies and capital controls are likely to at least temporarily have some volume effect. They might thus be used for this purpose as a last resort when other policy options are exhausted (Ostry et al. 2011). A different approach to meet the size of capital inflows is to remove controls on capital outflows thereby decreasing the net inflows. This could be done by allowing domestic investors to acquire foreign assets given that there are binding existing controls in place. Such a strategy builds on the assumption that liberalizing outflows will not have an effect on inflows which is questionable on both theoretical and empirical grounds. It actually seems as if lifting restrictions on capital outflows act as a positive signal, attracting even more inflows. In addition this policy option builds on the presumption that domestic investors

⁹ The authors use the term "hard-landing" to describe such experiences.

¹⁰ i.e. prudential regulation that does not distinguish between foreign and domestic capital.

¹¹ See e.g. Mishkin (2000) or Summers (2000).

¹² See Magnud, Reinhart & Rogoff (2005) for a comprehensive discussion.

have an incentive to shift into foreign assets, which might be unlikely during times of high domestic interest rates. As mentioned earlier a likely result of sterilized interventions and other policy actions to limit inflation is to keep domestic interest rates above global levels during times of large capital inflows (Reinhart & Reinhart 1998).

Ostry et al. (2011) notices that the design of measures often reflects country specific institutional constraints rather than differences in the intention of them i.e. to reduce aggregate or specific inflows. Within less sophisticated financial markets with limited prudential framework, authorities might need to rely primarily on capital controls while prudential policies are a good alternative when financial markets work well and the use of capital controls is constrained by international agreements. However the authors emphasize the importance of exhausting macroeconomic and non-discriminatory prudential policies before turning to capital controls or prudential policies directed at certain capital flows. The discriminatory character of capital controls has made such measures subject to international regulation through different multilateral treaties. For example, EU members are only allowed to impose temporary restrictions on cross-border capital flows since such policies are in conflict with the fundamental EU principle of free capital movement (Ostry et al. 2011).

When designing prudential policies and capital controls it is important to distinguish between flows that are intermediated through domestically regulated financial institutions (RFIs)¹³ and flows that are not. The authors identify three areas that need particular attention in the case of RFI-intermediated inflows:

- Excessively risky external liability structure of domestic banks – heavy reliance on short-term funding to finance long-term loans, like mortgages.
- Excessively risky bank asset – FX associated credit risk arising from un-hedged ultimate borrowers or currency risk from open FX positions.¹⁴
- Bank lending that is amplifying macroeconomic risks – credit boom and/or asset price bubbles.

To meet these concerns the authors suggest policy measures like currency-dependent liquidity requirements and limits on banks' external borrowing to address banks' external liability structure. Higher capital requirements on banks FX loans, limits or prohibition of loans in FX to borrowers without a natural hedge and tighter limits on open FX position in relation to bank capital, could be used to address concerns of bank asset riskiness. In order to slow credit growth¹⁵ (through higher bank lending rates) and asset price inflation the authors suggest prudential policies like counter-cyclical capital requirements, lower loan-to-value ratios or higher reserve requirements.

At a first glance it might seem like relying heavily on prudential policies would be the obvious choice when attempting to reduce financial risks, after all that is what they are designed

¹³ Typically banks.

¹⁴ The difference between the two are that FX associated credit risk arise when banks lend in foreign currency to borrowers with income in domestic currency while an open FX position arise when banks borrow in foreign currency but lend in domestic thus creating a currency mismatch between its own income and liabilities.

¹⁵ This objective is usually pursued by raising the policy interest rate but since this could potentially encourage even larger capital inflows it might not be a desirable action.

to accomplish. However, according to Ostry et al. (2011) there are some potential limitations to their efficiency. First, prudential policies rely on effective supervision which might not be present in some emerging economies. Second, prudential policies only apply to the domestically regulated financial institutions and might hence be intermediated through other channels e.g. direct borrowing from foreign banks. A last factor to bear in mind is the potentially unbalanced effect prudential policies and capital controls might have on large versus small and medium sized companies. Since smaller firms are generally more dependent on bank financing and less able to borrow from abroad than larger firms, prudential policies might affect them disproportionately. The authors thus argue that capital controls might pose a better alternative despite also noticing that some studies have shown that such controls can make access to financing more difficult for small and domestic firms.

We now turn to the risks and available policy responses when inflows bypass the regulated financial institutions. The particular risks pointed out by Ostry et al. (2011) are:

- Excessively risky external liability structures of the nonfinancial sector – Risk of maturity mismatches that arise when short-term borrowing is used to finance long-term investments.
- Excessive currency risk of private actors balance sheets – FX denominated borrowing create currency mismatches as income and liabilities of borrowers are of different currency.
- Direct borrowing from abroad create asset price inflation and potential bubbles

As seen these risks are very similar to those aforementioned. The difference lies in the potential policy responses. Since capital inflows in this case are not intermediated through domestic RFIs, regular prudential policies are not effective. While the authors point out that prudential regulation on borrowing of the non-financial sector could be applied in principle, they also argue that such policies are likely too slow to implement and too costly to administer. Instead they acknowledge the role of capital controls when dealing with such inflows. Possible measures include capital controls to discourage debt instruments or FX borrowing by un-hedged entities or discriminatory prudential policies to prevent non-financial borrowers from borrowing in FX for certain assets e.g. mortgages.

Since the issue of financial regulation has received a lot of attention and been subject to widespread debate in the aftermath of the financial crisis we now turn to a more detailed discussion regarding the proper design of prudential policies and capital controls and the empirical experience of such in the past.

Designing prudential policies and capital controls

Before turning to the policy design we briefly review some empirical results regarding the effectiveness of them. Cardarelli et al. (2009) note that there are large difficulties involved when assessing the effects of capital controls mainly due to selection biases¹⁶. When trying to take such biases into account they find that the use of capital controls does not seem to be associated with lower real appreciation (following smaller net inflows) or softer landings. By examining the experience during the 2008-09 crisis Ostry et al. (2011) however find that countries with capital

¹⁶ i.e. the empirical problem that capital controls might be more common in countries with weaker macroeconomic fundamentals which might give rise to spurious results.

controls or prudential measures in place before the crisis displayed greater resilience in GDP growth. In particular capital controls and macroeconomic prudential measures seem to be of importance as both displays a simultaneous significant effect while FX-related prudential measures seem to work as a substitute for capital controls. The authors further find that capital controls seem to be associated with reduced FX lending, and external debt but not reduced lending booms in general. The same can be observed for FX-related prudential measures. On the contrary macro-prudential policies limit banks' general lending while they do not seem to have any effect on FX lending.

We now turn to the design of the policies. Ostry et al. (2011) mentions two objectives to be achieved; effectiveness (policies achieve their designated objective and are not easily circumvented) and efficiency (policies minimize distortions and scope for non-transparent enforcement). The authors argue that capital controls should mainly be used in response to temporary surges in capital flows while the exchange rate should be allowed to adjust if inflows are of a more persistent nature. Prudential policies can be used whenever there is concern over the stability within the financial sector. When targeting the volume of capital inflows (i.e. out of exchange rate related concerns), controls need to be applied broadly and when the target is instead altering the composition of inflows (risk reduction), a more narrow approach directed at certain types, e.g. short-term FX debt, is more appropriate. However the more narrow the policies are designed the easier it might be to circumvent them. There is thus need for careful consideration before specifying the measures. Circumvention can be accomplished in many ways. For example if controls are not imposed on national expatriates' homebound transactions, there is scope for transactions abroad between non-residents and residents, thus channelling inflows through the expatriate remittances. Another option is to mask flows as FDIs e.g. through equity investments in local subsidiaries which later are transformed to debt (Ostry et al. 2011).

Finally there is the question of quantity- (administrative) vs. price-based (taxes or URRs) controls. In support of price-based controls the authors argue that they generate tangible revenues for governments and that they might be easier to adjust and administer.¹⁷ The authors therefore argue that price-based controls are generally to prefer, but the information asymmetry involved regarding e.g. the creditworthiness of ultimate borrowers could make quantitative measures more appropriate for prudential purposes in the financial sector.

¹⁷ However it should be noted that the opposite could also be true under uncertainty regarding the private sectors response, making price-based controls hard to calibrate.

3. The Boom and Bust in the Baltic countries

When joining the EU in 2004 the Baltic countries seemed to be at a fast and steady convergence path towards Western Europe. EU accession also brought with it an expanded room for public spending, as the countries were now eligible for EU grants. The prospect of future Euro adoption in combination with rapid economic growth raised income expectations and attracted foreign capital, giving rise to a rapid credit boom financed mainly by Nordic banks. By 2007 the economies were overheated and substantial external balances had arisen and when the global financial crisis evolved in 2008, the Baltic countries were subject to a severe sudden stop in capital inflows as financial institutions attempted to deleverage their exposure to the region. In this section we investigate the evolution of the boom phase and the crisis that followed in order to acquire a more detailed picture of the course of events. We start off at the time of independence from the Soviet Union.

3.1. Post-Soviet Union period

At the regain of independence from the Soviet Union 1991 the Baltic countries commenced a substantial transition, moving from a system of central planning towards market economies. The initial development of the countries' economies were however not entirely smooth. Following the breakdown of the central planning system disruptions in inflation, output and external balances arose. The countries experienced terms-of-trade shocks as prices of Russian energy and raw materials reached world market prices at higher levels, causing a deterioration of the terms-of-trade of about 20 percent of GDP, which also implied a sharp decline in real income. The Baltic countries were in need of economic stabilization and as a measure to achieve this all three countries introduced their own currencies in 1992 in an ambition to signal the independence from the former Soviet Union as well as enable them to pursue independent monetary and fiscal policies (Knöbl & Haas 2003). The reaction to stabilizing policies in combination with structural reforms within e.g. taxation resulted in lower inflation and more stabilized economies but at the same time output was decreasing. As more liberalizing reforms were made throughout the 1990's the countries experienced lower inflation and higher growth combined with current-account deficits. These current-account deficits were to large extent financed by foreign direct investments (FDI) and there were signs of overheating in Estonia in 1997 because of excessive domestic credit expansions. At the outbreak of the Russian crisis in 1998 the Baltic countries were hit hard. Although independent from the former Soviet Union and striving to increase trade with the western economies, large parts of their exports were still bound for Russia and the Commonwealth of Independent States, CIS. Trade to these countries made up 15-20 percent of total trade in Estonia, 20-30 percent of total trade in Latvia and 25-45 percent in Lithuania (Knöbl & Haas 2003). Estonia was already in an economic slow-down phase and showed signs of overheating, and as the Russian crisis evolved, fiscal deficits in all three countries rose. The crisis hit the Baltic countries with different magnitude but the economies of all three countries went into recession (Ibid).

Despite the economic stress endured during the transition period, especially prominent during the Russian crisis, all three countries maintained their fixed exchange rate regimes throughout the period.¹⁸ The fact that the pegs were maintained likely provided the countries' exchange rate regimes with great credibility which according to Darvas (2009) contributed to both foreign investors' and domestic residents' confidence in the years to come. The economic

¹⁸ The details for these fixed exchange rate regimes are explained in section 5.1

turbulence created by the Russian crisis ended rather fast and the Baltic countries entered a period of fast and stable growth with average growth rates in real GDP of 5-6 percent during the 1996-2003 period. This development was however associated with growing external imbalances as current account deficits as share of GDP reached levels of 12-13 percent in Estonia and Latvia and about 8 percent in Lithuania (IMF CR 06-353). During the growth period after the Russian crisis all three countries also managed to improve fiscal balances with Estonia running a surplus of 1,8 percent of GDP by 2003 and significantly reduced deficits at just over 1 percent for the other two countries (EIB 2008). Following this period of positive development the Baltic countries were granted membership in both the EU and NATO in 2004.

3.2. The EU membership boom and the slowdown

By 2004 the global financial environment was characterized by abundant liquidity and low risk aversion. Low interest rates in advanced countries led to large capital flows to emerging markets, among them the new member states (NMS) of the EU.¹⁹ As mentioned earlier the Baltic countries had by this time made substantial market oriented reforms and in combination with high income growth, prospects of future Euro adoption and a stable fiscal balance they composed a very attractive market for financial investments.

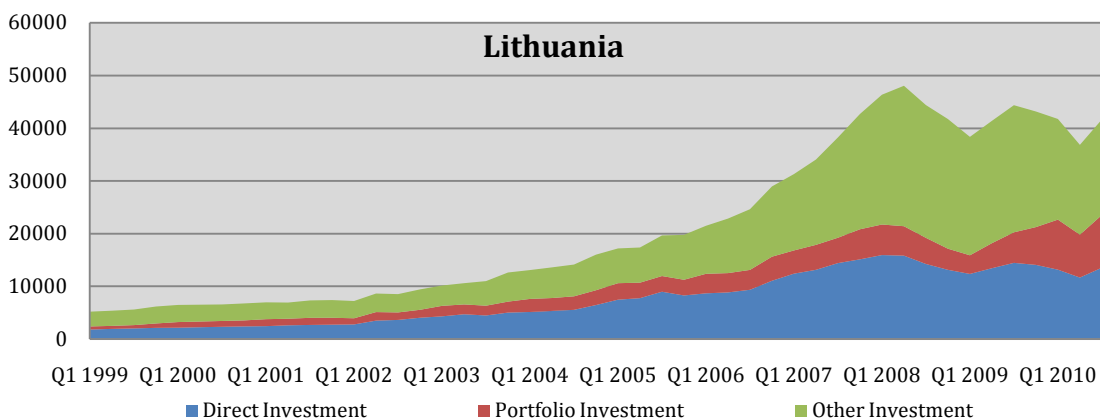
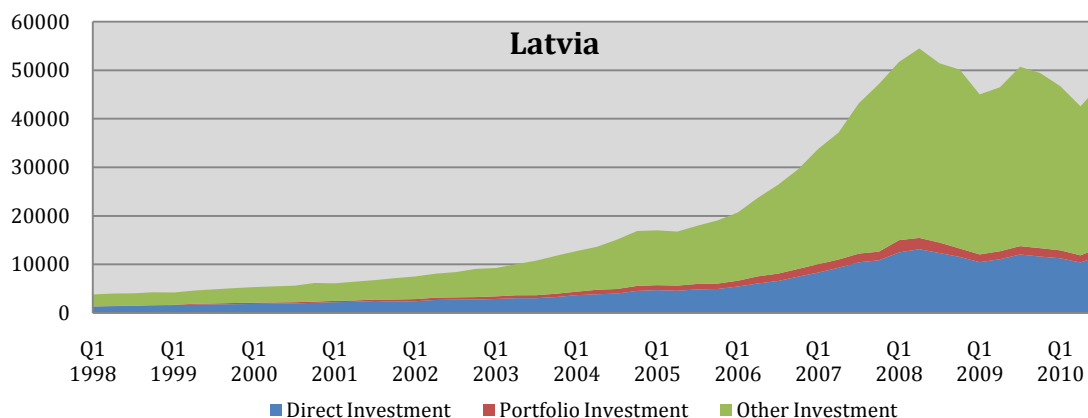
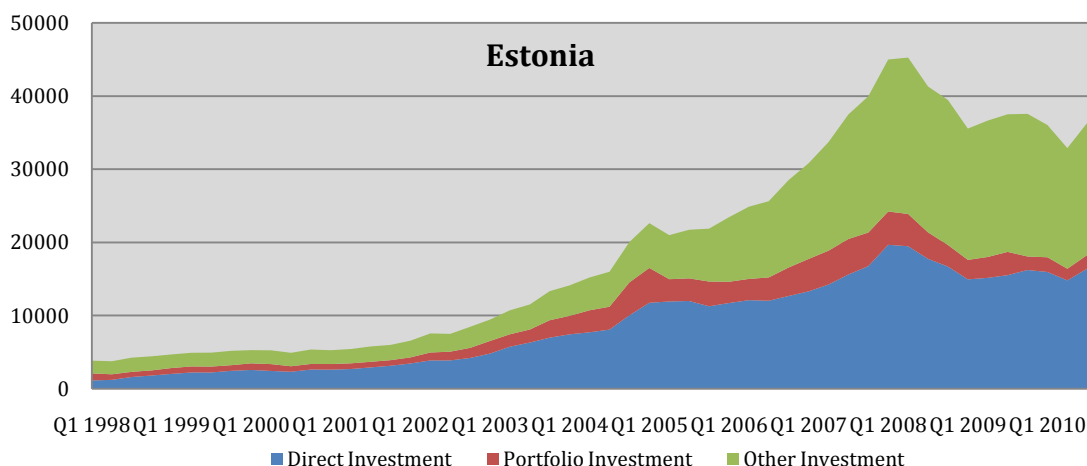
The countries had already started to receive large capital inflows before EU accession but these increased further during the 2003-2007 period. Cumulative net capital inflows as a share of 2003 years GDP over the period amounted to 166 percent in Latvia, 111 percent in Estonia and 85 percent in Lithuania. Such rapid capital inflows were experienced in several other eastern European NMS, with unweighted average capital inflows of 107 percent of 2003 years GDP.²⁰ However the Baltic countries were extreme in many aspects, to some extent together with Romania and Bulgaria. In all five countries capital inflows increased substantially more than in the other NMS, especially credit to the private sector was expanded at a faster pace, and the composition of capital inflows differed substantially between the NMS. Other investments (mainly bank lending) composed 75-80 percent of total capital inflows to the Baltic countries compared to 20-53 percent in other NMS. The equivalent shares of FDIs were around 25 percent for Latvia and Lithuania and 49 percent in Estonia, while portfolio investments were negative for all three countries (Bakker & Gulde 2010).²¹

¹⁹ In addition to the Baltic countries the Czech republic, Hungary, Poland, Slovakia and Slovenia joined in 2004 and Bulgaria and Romania joined in 2007

²⁰ Almost three times the size of those experienced in Indonesia, Philippines and Thailand in the run-up to the Asian crisis

²¹ It should be noted that capital flows from parent banks to local subsidiaries are partly included in both FDI (permanent debt and equity) and other investments (loans and deposits).

Figure 2 - Cumulative Capital Inflows Baltic countries (USD millions), Source: National Central Banks

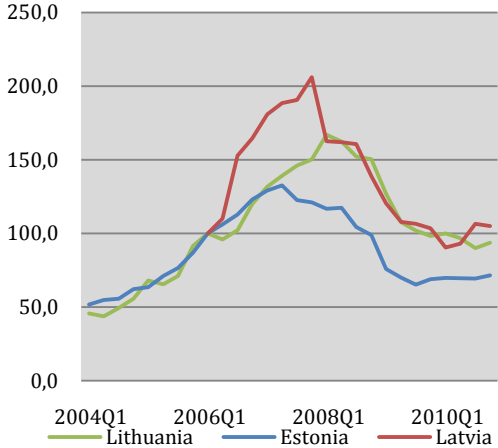


A great share of the inflowing capital went into the banking sector, as Nordic banks channelled investments to local subsidiaries in order to service the increasing demand for credit.²² By 2005 all three Baltic countries had joined the ERMII, as a first step to become full

²² Even though the Nordic banks were very dominant in the Baltic region, domestically owned banks in Latvia and Lithuania also expanded credit rapidly funded by non-resident deposits and borrowing on global markets. However by 2007 the share of foreign banks in the Baltics measured by the value of assets was 98,7 percent in Estonia, 91,7 percent in Lithuania and 63,8 percent in Latvia (Alvarez-Plata 2009).

members of the EMU.²³ As a result they all maintained strict pegs towards the Euro which induced FX denominated borrowing and kept interest rates low. The positive outlook for the Baltic countries raised income expectations and since credit was given at low real interest rates, especially on euro denominated loans, the domestic credit demand increased (Purfield & Rosenberg 2010). Darvas (2009) in fact argues that nominal interest rates on euro denominated loans were actually below the inflation rate making the effective real interest rates on such loans negative. Between 2005 and 2007 credit expanded extremely fast at a rate of about 40-60 percent annually (Riksrevisionen 2011). By the end of 2008 the share of credit denominated in foreign currency was 85,1 percent in Estonia, 88,4 percent in Latvia and 60 percent in Lithuania (Alvarez-Plata & Engerer 2009). Such a situation is potentially dangerous as it creates currency mismatches in borrowers' revenues and liabilities. A potential depreciation (or devaluation) under such circumstances could come as a dreadful burden to borrowers, who would become much more indebted in relation to their disposable income. A large share of foreign denominated debt thus limits authorities' options of exchange rate realignment in order to increase competitiveness (Purfield & Rosenberg 2010).

Figure 3 - Residential Property Price Index (Q1 2006=100), Source: BIS



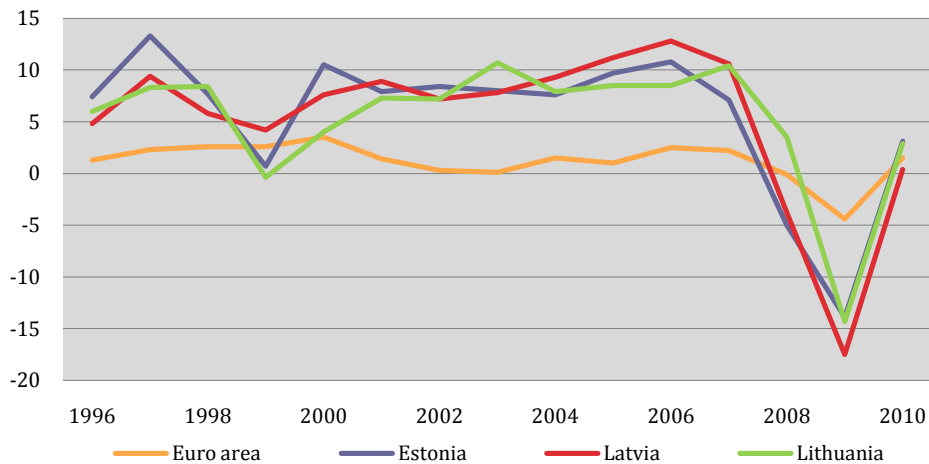
With easy access to cheap credit and high future income expectations domestic demand increased sharply. About half of the domestic credit issued in the Baltics went to households, mainly in the form of mortgages, which induced a rapid increase in real estate prices, most prominent in Latvia where nominal real estate prices grew by 60 percent per year during 2003-2007.²⁴ Such price increases created substantial wealth effects as house owners asset value increased. This further boosted consumption which was the largest contributor to GDP growth in Latvia and Lithuania (Mitra 2011).

The increase in domestic demand induced higher GDP growth, and throughout the years 2003-2007 the Baltics experienced an annual GDP growth rate of 8-10 percent, higher than that for any other NMS (Bakker & Gulde 2010).

²³ A more thorough description of the Baltic exchange rate regimes and the ERMII can be found in section 5.1

²⁴ This figure should be taken with some cautiousness as we suspect that it only reflects real estate prices in the Latvian capital Riga.

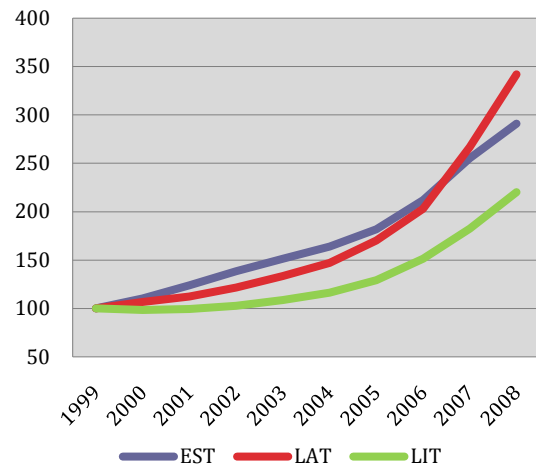
Figure 4 - Real GDP growth (yearly percentage change), Source: Eurostat



However, the increasing demand also led to rising inflation pressure which was further fuelled by price level convergence towards price levels in the rest of the euro area, as the Baltics pegged their currencies against the euro.²⁵ Similar rising inflationary pressures had previously been seen in e.g. Spain and Ireland after they entered the Euro²⁶. In addition, the EU accession meant increases in some indirect taxes and custom duties which, in combination with surging world energy and food prices, also contributed to raising domestic prices, especially in Latvia (IMF CR 05-282).

As unemployment decreased throughout the boom period, to a large extent as a result of increased construction, total wage costs increased as well. Annual growth rates of nominal wages, in both public and private sectors, amounted to about 16 percent in Estonia and Lithuania and as much as 20 percent in Latvia during the 2004-2008 period (Purfield & Rosenberg 2010). This was partly due to expansionary fiscal policies but wage increases were also affected by migration to Western Europe and shortages of qualified labour (Darvas 2009). Even though fiscal balance actually improved in the Baltic countries over the period, public expenditures were likely to loose. During the boom strongly growing revenues, arising both from the expanding economy and from access to EU grants, were used to finance expanding public expenditures which added further fuel to the consumption boom, thus further fuelling

Figure 5 - Nominal Wage index (Q1 1999 = 100), Source: Eurostat



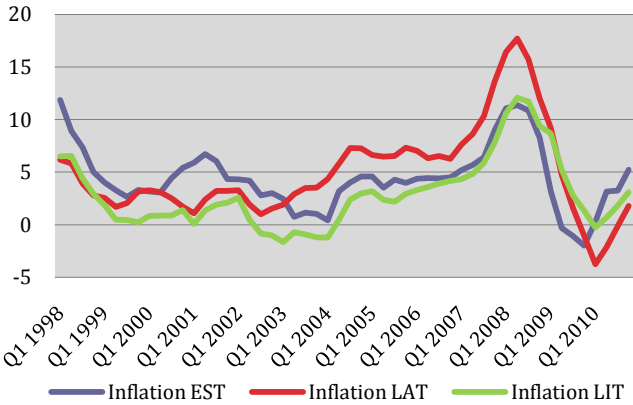
²⁵ The different pegs that were pursued are explained in section 5.1

²⁶ The development seen in Spain and Ireland was not as substantial. However they experienced housing and construction booms following economic growth with inflation rates above the average in the euro-area. This was triggered by low interest rates in the euro-area which increased demand leading up to the booms (Darvas 2009).

overheating (Bakker & Gulde 2010). In Latvia e.g. social benefits rose by 44 percent between 2006-2008 in real terms and Lithuania and Estonia showed similar developments (Purfield & Rosenberg 2010).

The increased consumption following the improved access to credit and higher incomes, resulted in very large current account deficits that by 2007, made up 23 percent of the gross domestic product in Latvia, 18 percent in Estonia and 15 percent in Lithuania (IMF CR 09-86). Only Bulgaria, among the EU-9, had higher current account deficits than the Baltics. It can be noted that among the NMS, countries which experienced higher growth in credit to GDP also experienced higher inflation, larger current account deficits and higher external debt (Bakker & Gulde 2010). The large current account deficits were not only due to consumption well above production capacity. The rapidly increased wage levels caused unit labour costs (ULCs) to increase and inflation caused the real effective exchange rate to appreciate which both deteriorated external competitiveness (Ibid).

Figure 6 - Change in CPI (% yearly), Source: IFS



Eventually in 2008, prior to the global financial crisis, growth started to slow down in the Baltic region and foreign creditors who recognized the slowdown and the vulnerability of the wide credit expansion, made efforts to decelerate credit expansion to an annual 20-25 percent (Riksrevisionen 2011). The credit rating outlook for the region was lowered and the economic activity started to decelerate in 2008, especially in Estonia and Latvia (Purfield & Rosenberg 2010). However

inflation remained at its higher levels to a large extent because of continued high domestic demand and wage growth. This created a gap between GDP growth and inflation which implicitly meant that people could afford less consumption. Comparing the three countries we see that the gap was much larger for Latvia and lower but still substantial and quite similar for Lithuania and Estonia. We also see that Latvia had the lowest level of GDP per capita and at the same time had the highest price levels. Worth mentioning here is also that the end to the boom and the recognition of the slowdown was made at an earlier stage in Estonia than in Latvia and Lithuania. As an example of this, pension and wage increases were granted in Latvia and Lithuania as late as in the middle of 2008 which partly explain the remained high price levels (Purfield & Rosenberg 2010).

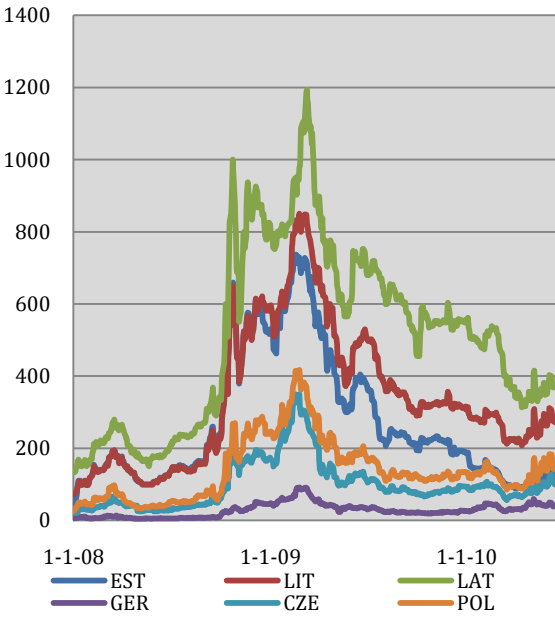
It was during this very vulnerable slowdown phase that the global financial crisis struck, and the impact of it to the Baltic countries were to be more severe than in any other region in the world as cumulative output declined by 20-25 percent from its peak levels (Ibid).

3.3. The global financial crisis

When the global financial crisis emerged the slowdown turned into a sharp downturn for the Baltics. As the crisis evolved financial institutions worldwide started deleveraging their balance sheets to reduce risk exposure. Global scepticism of bank soundness led to decreased confidence for both foreign owned and domestic banks in the Baltic region. Parex Banka, the second largest bank in Latvia and domestically owned, experienced a deposit run and was eventually saved by the Latvian government taking over 51 percent initially and 85 percent eventually in 2009 (IMF CR 10-356). The Baltics experienced sharp declines in capital inflows, predominantly consisting of declines in bank inflows. Annual capital inflows were decreasing by 20 percent of GDP for Latvia, 14 percent for Estonia and 12 percent for Lithuania as compared to the boom period which was more than most other NMS (Mitra 2011).²⁷ The sudden stop had the most impact in Latvia, and as liquidity dried up and speculative pressure arose on the LAT, a EUR 500 million swap line between the central banks of Sweden and Denmark on one side and the Bank of Latvia on the other side was put in place. The intent behind the swap line was to facilitate protection of the Latvian currency reserve until the first payments from IMF and the EU were carried out (Ingves 2010). A swap line to Estonia was also granted by the central bank of Sweden, Riksbanken, although it was never utilized. In Estonia reserve requirements were high as was taxation on dividends, which had encouraged banks to maintain large reserves (Ingves 2010, Purfield & Rosenberg 2010). In Lithuania, reserve requirements were decreased from 6 to 4 percent and the coverage of the deposit insurance was increased. These measures in combination with increased liquidity support from parent banks to their subsidiaries to meet withdrawals were substantial enough and no swap line was necessary in Lithuania (Purfield & Rosenberg 2010).

Confidence in the Baltic economies plummeted rapidly as the crisis evolved which can be seen from Figure 7 which shows the basis spread of a five-year Credit Default Swaps (CDS). The large spread on these indicates that in order to buy “insurance” against a debt default of either government, investors had to pay high premiums. The reduced confidence is also illustrated by the fact that Latvia received the lowest investment grade credit rating possible by Fitch and S&P in 2009 which reduced confidence for the country’s ability to maintain their currency peg (IMF CR 09-3). The overall quality in the credit market deteriorated sharply and by the end of 2009, 20 percent of the banking system consisted of non-performing loans in Latvia and Lithuania while the equivalent share in Estonia was only

Figure 7 - CDS 5 year (Basis Points), Source: Datastream



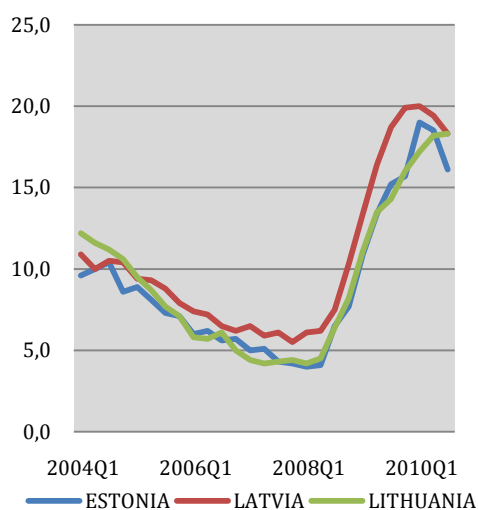
²⁷ Bulgaria similarly experienced a large decrease of 17 percent of GDP.

6 percent, possibly as a result of stricter risk management (Purfield & Rosenberg 2010). As a result of the deteriorated credit quality, supervisors in the three Baltic countries requested banks to keep their earnings and foreign banks to tighten provisioning.²⁸

With decreased consumer and investor confidence, governments had a hard time raising financing for their expenditure. Government expenditure was therefore reduced, as can be seen in section 5.1, and this further contributed to a contraction of the aggregate demand in the region. The credit expansion had been one of the main drivers of domestic demand and asset prices and once it came to a halt, both plummeted.

Looking at Figure 25 in the appendix we clearly see that domestic demand started to decrease in all three countries around 2007 and continued to decrease until the end of 2009 when it started to stabilize.²⁹ The decrease was mainly driven by reduced consumption and investments, the latter decreased by 65 percent when compared to the peak of investments (Bakker & Gulde 2010). The sharp and sudden, yet short-lived, peak in demand in Lithuania in 2008 might be due to the fact that GDP was decreasing faster than domestic demand at that point.

Figure 8 - Unemployment (%),
Source: Eurostat



arrangements were removed and lay-off costs were decreased (Ibid).

In addition, increasing unemployment, from levels around 4-6 percent in 2008 to levels around 20 percent in 2010, and decreasing nominal wages further reduced domestic demand. The Baltic countries performed different labour market reforms in order to increase the flexibility and ease the impact of being unemployed. Estonia reformed their labour law in 2009 by initially reducing lay-off costs for employers. A simultaneous increase in unemployment benefits was intended but could not be accomplished due to fiscal constraints (IMF CR 10-4). In Latvia measures were taken by increasing the duration of unemployment benefits, relaxing the criteria for eligibility and introducing a minimum floor to benefits (Purfield & Rosenberg 2010). In Lithuania, restrictions on flexible employee

Furthermore, downward adjustments of wages were performed in response to the global crisis. In Latvia the downward adjustment was mainly driven by public sector wage decreases of 11,5 percent for 2009, while private sector wages only decreased by 1,31 percent. The public sector had however also experienced larger wage increases during the boom period and public wages was in general higher than in the private sector. In Estonia and Lithuania the corresponding adjustments in the public and private sector wages were 4,3 and 4,0 percent in Estonia and 2,19 and 6,37 percent in Lithuania (Purfield & Rosenberg 2010).

²⁸ Credit inflows to the NMS countries, except Poland, decreased by 75-110 percent when comparing the period after 2007 with the period up to 2008 (Mitra 2011).

²⁹ In 2009 the decrease in domestic demand was 27,8 percent in Latvia, 24,8 percent in Lithuania and 23,9 percent in Estonia showing a pace much faster than that for the rest of the EU new member states (Bakker & Gulde 2010).

The increasing unemployment was accompanied by a sharp decline in production. Between 2008 and 2009 the cumulative output decreased by 14 percent in Lithuania, 18 percent in Estonia and 25 percent in Latvia placing Latvia and Estonia as the two countries in the world with the largest decrease in cumulative output followed by Ukraine, Lithuania and Zimbabwe (IMF CR 10-201). As the primary trade partners of the Baltics, were also hit hard by the crisis, trade was severely reduced as foreign demand decreased and the currencies of the Nordic countries and Russia depreciated against the Euro. Since the Baltics were operating currency pegs against the euro this further reduced trade with these countries. Hence, the sharp decline in output was caused by both internal and external factors.

Beginning in 2006 the current account deficits had started to decrease to a large extent due to improving trade balances. As mentioned earlier exports were decreasing throughout the crisis but imports were decreasing to an even further extent. In Latvia for example goods exports fell by 21 percent in 2009 while imports fell by 40 percent leading to an improvement in the current account (IMF CR 10-356).

Figure 9 - Current Account (% of GDP), Source: IFS

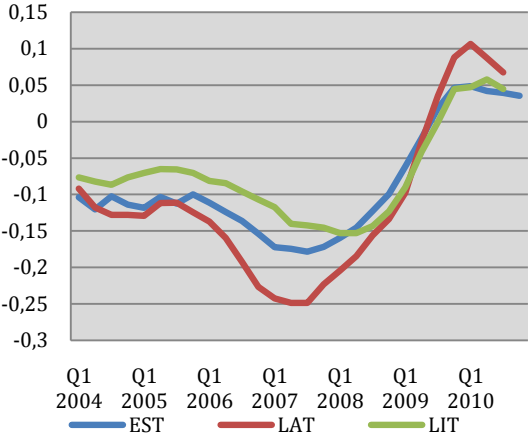
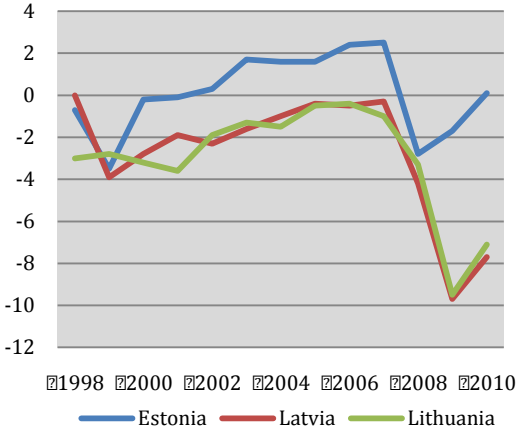


Figure 10 - Fiscal Balance (% of GDP), Source: IFS



In order to avoid a dramatic deterioration of the fiscal balance following the crisis, sizeable adjustments were necessary (Purfield & Rosenberg 2010). The Latvian government's hands were tied in this respect since payments under the IMF Stand-By Agreement (SBA) were conditioned on several terms, among them a cap on fiscal deficit of 5 percent of GDP and a reduction of local government wages of 15 percent (IMF CR 09-3). Expenditure savings became the principal measure for fiscal adjustment accounting for half of the adjustment in Latvia and Estonia and three quarters in Lithuania.

The reason for focusing primarily on reducing expenditure was that the level of spending that was reached during the boom was no longer considered adequate. Furthermore it was also in line with previous international experience suggesting that fiscal adjustment is most successful when driven by spending cuts. The alternative solution would be to raise taxes, which was not in line with the general preference of the Baltics to maintain low taxation. The main measures taken were: reductions in capital budgets of e.g. education and health ministry budgets forcing them to reduce inefficiencies and increase savings, reduced government wage bills e.g. by reducing the public sector wage levels, structural reforms in e.g. sickness benefits and pensions, and protection of the most vulnerable groups e.g. the unemployed (Purfield & Rosenberg 2010). There were also some measures directed at

increasing revenues, mainly increases in indirect taxation such as the VAT. In addition increased EU grants also generated some revenues (Ibid).

Astonishingly all three Baltic countries managed to endure the global financial crisis without devaluation or a full blown banking crisis. Nevertheless the recovery is far from complete and the boom years and following recessions have left deep wounds to public finances, competitiveness and labour markets which will likely take many years of care to heal. Due to the somewhat earlier onset of the recession with following swift policy actions, eligible due to accumulation of fiscal reserves during the boom, Estonia managed to escape the crisis with a fiscal deficit below the Maastricht ceiling and joined the Euro in January 2011. This indicates that prudential policies and strong institutions during a boom can at least to some extent reduce the magnitude of a subsequent crisis. It also seems as if Lithuania entered the boom phase somewhat later than the other two countries leading to a slightly smaller impact of the crisis. This could also be explained by Lithuania's relatively larger economy which might have been more able to absorb the large capital inflows. Latvia was the most affected country and monetary authorities had to put up a fierce defence of its currency peg as shown in IMF Country Report 09-3 (2009). Interestingly the market share of foreign banks was largest in Estonia and smallest in Latvia. As suggested by Purfield & Rosenberg (2010) the relative soundness of foreign parent banks might have helped reduce the impact of the crisis as they were able to provide strong capital and liquidity support.

4. Exchange market pressure

In order to shed some light on the development of the Baltic countries' exchange rates, and get a better understanding of this development we now turn to the measurement of exchange rate pressure. We know that all three countries were operating strict pegs over the period and that in particular Latvia was subject to substantial exchange rate pressure during crisis period. Still all three countries managed to maintain their fixed exchange rate regimes. We thus need a way of capturing exchange rate pressure not only focusing on nominal exchange rate movements as this was kept constant. Fortunately, this is not a new problem, and there is already a vast literature on an appropriate measurement called exchange market pressure (EMP). Once we have created such a measurement we turn to investigate what factors that seem to affect it in an attempt to get a better understanding of the development in the Baltics.

4.1. Methodology

The EMP index

The initial measure of exchange market pressure, which captures currency movements and ways of avoiding such, was first introduced by Girton & Roper (1977) and later extended by Weymark (1997). The EMP of the domestic currency is defined as:

"...the (relative) depreciation required to remove excess supply of domestic currency on the foreign exchange market in the absence of policy actions to offset that excess supply." (Klaassen & Jager 2006 p. 2)

A stylized derivation of the commonly used EMP index is given by Klaassen & Jager (2011). Let $M_t = D_t + R_t$, denote domestic (base-)money supply, where D_t is domestic credit created by the central bank and R_t is its holdings of international reserves. Assuming a conventional monetary money demand function, money market equilibrium is given by:³⁰

$$m_t = \log(D_t + R_t) = p_t + \beta y_t - \alpha i_t \quad (1)$$

where $m_t = \log(M_t)$, p_t is the log price level, y_t is log real income, i_t is the interest rate, α is the interest semi-elasticity and β is the income elasticity, α and β are both assumed to be positive and equal across countries. The same equation is assumed to hold in the foreign country. Denoting the log of the nominal spot exchange rate as s_t (domestic currency price of one foreign currency unit) and using asterisks (*) to denote foreign variables, PPP is given by:

$$s_t = p_t - p_t^* \quad (2)$$

By solving for p_t and p_t^* in the money market equilibrium equations and using (2) and rearranging, exchange rate equilibrium can be expressed as:

$$s_t = \log(D_t + R_t) - m_t^* - \beta(y_t - y_t^*) + \alpha(i_t - i_t^*) \quad (3)$$

³⁰ Note that we have omitted the money multiplier from the money supply. This is due to the implicit assumption that it is constant and equal across countries.

The derivation of EMP continues by taking the first-difference of (3), using linear approximation for $\Delta \log(D_t + R_t)$ and rearranging which yields:

$$\Delta s_t - \frac{\Delta R_t}{M_{t-1}} = \frac{\Delta D_t}{M_{t-1}} - \Delta m_t^* - \beta(\Delta y_t - \Delta y_t^*) + \alpha(\Delta i_t - \Delta i_t^*) \quad (4)$$

EMP is then defined as the left hand side of (4)

$$EMP_t = \Delta s_t - \frac{\Delta R_t}{M_{t-1}} \quad (5)$$

The intuition behind the measure is that a disturbance in the domestic money market, which is assumed to be in initial equilibrium, can be restored through a combination of a currency appreciation (depreciation) and/or outflows (inflows) of international reserves i.e. through intervention by the central bank. Focusing on the domestic market, if there is excessive domestic money demand, so that the money market equilibrium is disturbed, this will require an appreciation of the exchange rate or an increase of international reserves held by domestic authorities (or both) in order to restore the money market equilibrium. On the contrary an excess supply of domestic money will require depreciation and/or outflows from the reserves. As the model allows equilibrium to be restored through changes in either the exchange rate or the reserves, or both, the model is applicable irrespective of the exchange rate regime (Van Poeck et al. 2007). Looking at a flexible exchange rate regime there will be no change in international reserves, as the exchange rate will adjust to restore equilibrium. In a fixed exchange rate regime the exchange rate cannot change so the international reserves will adjust instead. Finally, looking at an intermediate regime, i.e. managed floating exchange rate, the equilibrium will be restored through a change in the international reserves, the exchange rate or both. Furthermore the EMP index has the advantage of detecting periods of stress that do not lead to a devaluation or change of exchange rate regime. If e.g. the authorities manage to withstand a speculative attack on their currency by intervention, this episode will still be reflected in the EMP index through the change in reserves (Hegerty 2010).

Since the original Girton-Roper formula was presented in 1977 there has been much debate regarding the proper specification of the EMP equation. There are two main issues that need to be addressed. The first is what components to include and in what form, and the second is what weights to assign to the different components. The basic Girton-Roper formula, later modified by Weymark (1997), is based on structural theoretical models of exchange rate determination from where the specification is derived.³¹ As a result these specifications are mentioned in the literature as model-dependent EMP indexes. However the weak performance of the theoretical exchange rate models in estimating short-run currency fluctuations has led the model-dependent approach to be questioned.

Eichengreen et al. (1994) instead puts forward an alternative model-independent approach which has been adapted by several authors.³² The model-independent EMP index looks very similar to the original index but has two differences. In order to capture central banks indirect ability to affect the exchange rate through the interest rate, the model-independent index also

³¹ See Weymark (1997) for a comprehensive derivation.

³² See e.g. Hegerty (2009) and Van Poeck et al (2007)

includes interest rate changes as a component.³³ This is done by simply adding $\Delta(i_t - i_t^*)$ on both sides of Eq. (4).³⁴ The other step away from the model-dependent index is that instead of using parameters derived from a monetary model they choose the parameters so that the conditional volatility of each component is equal. This is done in order to avoid that the EMP index is to heavily driven by changes in reserves which has proven to be far more volatile than the changes in exchange rates, which in turn is far more volatile than changes in interest rates (Eichengreen et al. 1995 p.36).

Their EMP measure thus is:

$$EMP_t = \Delta s_t + w_1 \Delta(i_t - i_t^*) - w_2 \frac{\Delta R_t}{M_{t-1}}, \quad (5)$$

Where i_t and i_t^* denote the money market rate in home and foreign respectively and w_1 and w_2 are the weights assigned.

In a recent paper Klaassen & Jager (2011) revisit the way of measuring EMP. The key argument is that EMP by definition is the depreciation required to remove excess supply of the domestic currency in the counterfactual situation of a passive policy maker i.e. a policy maker acting without any concerns regarding the exchange rate. They argue that the previously adopted EMP index constructions are not consistent with this definition since they compare current policy variables with their lagged values instead of their counterfactual values as prescribed by the definition. The counterfactual situation cannot be observed directly but one can observe the policy variables that are set to remove pressure. If the counterfactual policy variables can be estimated properly, it is hence possible to calculate EMP as the deviation of the observed policy variables from the counterfactual ones. By disregarding other objectives of FX intervention³⁵ than affecting the exchange rate, the authors set the counterfactual change in foreign reserves to zero, making the counterfactual level of reserves equal to R_{t-1} .³⁶ The counterfactual interest rate denoted i_t^d , is to be interpreted as the policy interest rate chosen by the domestic monetary authorities in the absence of exchange rate considerations. Since the counterfactual interest rate is not observable it needs to be estimated and the authors use a generalized Taylor rule to accomplish a theoretical specification of how such estimations can be made. For the sake of brevity and since our main interest in the EMP index lies within its practical implementation we do not go into any further detail regarding the theoretical aspects of the counterfactual interest rate but instead turn our focus on finding a practically useful EMP specification.³⁷

³³ The direct way for central banks to affect the exchange rate is through market interventions i.e. increasing or decreasing it's holdings of foreign reserves. The model-dependent EMP index only accounts for this direct channel.

³⁴ An alternative way would be to move the term $\alpha(\Delta i_t - \Delta i_t^*)$ to the left hand side. However this would complicate the estimation of EMP as the semi-elasticity (α) would have to be estimated first, and would interfere with the weight attached to the component.

³⁵ e.g. accumulation of foreign reserves out of concern of financial stability.

³⁶ This actually makes the reserve component of the EMP identical to earlier constructions but the motivation behind it differs.

³⁷ Interested readers are referred to Klaassen & Jager 2011 for a thorough theoretical treatment.

EMP equation specification

Before constructing our EMP index we must consider the proper specification for the Baltic countries. Two issues need to be addressed. The first is what components to include; the second is what weights to assign to the different components. We will start with the issue of component selection and specification.

Components

The three Baltic countries have maintained a fixed exchange rate regime throughout our period of interest. Hence, there should not be much fluctuation in the nominal exchange rate, which we confirm by investigating the countries exchange rate against the Euro (ECU before Euro adoption). In accordance with Hegerty (2009) we thus choose to omit the exchange rate component in our EMP index. This leaves us with two components to specify; changes in reserves and interest rates. Bertoli et al. (2010) point out that only part of a central banks operation is captured by the change in international reserves. In addition to direct intervention on the spot market by selling or accumulating foreign reserves, central banks also have the ability to defend its currency by e.g. drawing on stand-by credits from the IMF (which can be used for FX intervention or to increase reserves) or performing off-balance sheet operations such as interventions on the forward market. These types of interventions will not be captured by a gross measure of international reserves.³⁸ Since off-balance sheet operations are generally not reported by central banks there is clearly a constraint in data availability regarding such operations. However, IMF credits are reported on a monthly basis which allows for the creation of a net reserves component which could better capture the actions taken to defend a currency (Bertoli et al. 2010). Since such IMF credits have been used in the Baltic countries we will use changes in net reserves as a component in our EMP measure. This method is in line with the work of Stavarek (2010) who estimates the determinants of EMP in eight eastern European countries over the period 1995-2009. Our international reserve component (IR_t) will thus be given by: $IR_t = \frac{\Delta R_t}{M_{t-1}}$, where $\Delta R_t = R_t - R_{t-1}$, is the change in the level of net international reserves, and M_{t-1} is the monetary base at time t-1.³⁹

The last component of our EMP measure is the interest rate component. Typically the interest rate has entered the EMP equation as the difference of money market interest rates between the domestic country and a chosen reference country (usually the USA or Germany). As with the other components most authors has used this interest rate differential in first difference form i.e. as the change in the interest rate differential. Klaassen & Jager (2011) however show by an empirical application that this specification fails to fully capture the role of interest rates in relieving exchange rate pressure since a onetime increase in the domestic interest rate, followed by several periods of significant interest rate gap, will not fully be taken into account (i.e. $\Delta i_t = 0$ for all but the first and last period of interest divergence). With their interest rate component ($i_t - i_t^d$) this problem is circumvented. As discussed earlier the authors suggest a theoretical derivation of the counterfactual interest rate (i_t^d). They do however acknowledge that this approach has some practical limitations. They hence test some different specifications which are easier to use and find that a simple version of the counterfactual rate defined as the foreign nominal money market rate (i^*) plus the inflation differential ($\pi - \pi^*$) is

³⁸ This is since the use of IMF resources to defend a currency on the spot market will not affect the central bank's recorded holdings of foreign assets.

³⁹ Data sources and definitions are provided in appendix 3

sufficient to provide good information on EMP. We chose to follow this approach and our interest rate component will thus be: $r_t - r_t^*$, where r_t is the domestic money market rate and $r_t^* = i_t^* + (\pi_t - \pi_t^*)$ is used as a proxy for the counterfactual reference rate. As the foreign reference country we choose Germany in accordance with other similar studies of Central and Eastern European Countries such as Hegerty (2009), Van Poeck et al. (2007), Stavarek & Marek (2009) and Stavarek (2010 & 2010b).

Our full EMP index can thus be outlined as follows:

$$EMP1_t = w_1(r_t - r_t^*) - w_2IR_t \quad (6)$$

where $(r_t - r_t^*)$ is the real interest level differential as defined by Klaassen & Jager (2011), IR_t is the change in net foreign reserves in relation to the monetary base. w_1 and w_2 are the (positive) weights assigned to our components which will be explained in the next section. A positive EMP value indicates that the domestic currency is experiencing depreciation pressure and a negative EMP value that there is appreciation pressure present. The intuition behind the signs of the components is that depreciation (appreciation) pressure can be fended off by central banks through two channels; by increasing (decreasing) interest rates or by intervening on the FOREX market by buying (selling) the domestic currency, thereby decreasing (increasing) the amount of foreign reserves.

Weights

The last choice to be made is what weights to assign to the different components. Some authors like Stavarek (2010) choose to use an unweighted index with the motivation that this makes the EMP index easier to interpret. However, in order to avoid that the EMP index is dominated by the most volatile component of the equation many authors have proposed a variance smoothing approach where each component is weighted by their relative volatility.⁴⁰ Some different alternatives to accomplish this are outlined within the existing literature with no particular preference for any of them.⁴¹ We chose to follow Sachs et al. (1996) and define:

$$w_1 = \frac{1/\sigma_r}{1/\sigma_r + 1/\sigma_{IR}} \quad w_2 = \frac{1/\sigma_{IR}}{1/\sigma_r + 1/\sigma_{IR}}$$

where σ_r is the standard deviation of the interest differential series and σ_{IR} is the standard deviation of the series of changes in foreign reserves.

To our knowledge the level real interest rate component suggested by Klaassen & Jager (2011) has not yet been employed by any other authors despite its intuitive validity. In order to investigate the implication of the choice of interest rate component we hence construct three alternative EMP measures, which we call EMP2, EMP3 and EMP4. EMP2 simply removes the inflation adjustment and instead uses the level of nominal money market interest rate differential between the domestic country and the reference country (Germany). EMP3 instead includes the frequently used specification of the change in money market interest rate

⁴⁰ See e.g. Eichengreen et al. (1995), Sachs et al. (1996) and Hegerty (2009 & 2010)

⁴¹ Pontines & Siregar (2008) apply several techniques to evaluate different specifications but does not find any clear cut superiority of any single one of them.

differential while EMP4 uses the change in the real interest differential. We thus end up with three alternative EMP measures with different interest rate components specified as:

$$EMP2_t = w_1(i_t - i_t^*) - w_2IR_t \quad (7)$$

$$EMP3_t = w_1\Delta(i_t - i_t^*) - w_2IR_t \quad (8)$$

$$EMP4_t = w_1\Delta(r_t - r_t^*) - w_2IR_t \quad (9)$$

Where $(i_t - i_t^*)$ is the nominal money market interest rate differential and the other components are defined as before.

4.2. Estimation

Data

The data used in the construction of our EMP series is obtained from the IMF International Financial Statistics (IFS) over the period 1998-2010. In accordance with the conclusions of Klaassen & Jager (2011) we use the highest frequency possible which in our case is monthly data. However since monthly data of the monetary base is not available for the entire period for all countries we use M1 to deflate the IR component instead of the monetary base.⁴²

Results

From our monthly exchange market pressure series (EMP1, EMP2, EMP3 and EMP4) provided in Figure 11 to Figure 13 a couple of things are worth commenting on. From the graphs we clearly see the turbulence experienced during the two periods of crisis. Interestingly we note that the magnitude of exchange rate pressure in Estonia and Lithuania was most pronounced during the Russian crisis years of 1998-2000, while Latvia experienced more turbulence during the 2008-2009 crisis. Regarding the specifications we see that the different EMP measures seem to be rather consistent over the greater part of the period. However we can note that our preferred specification (EMP1) starts to drift downwards in all countries around the time of EU accession in 2004, thus indicating appreciation pressure. This is due to the fact that the increasing inflation rate in the Baltics during this period was not off-set by proportional increases in monetary policy rates. Such a development makes the interest rate component in the EMP1 specification decrease, thus indicating appreciation pressure. This appreciation pressure makes intuitive sense despite growing current account deficits since we know that the Baltic countries experienced a surge in capital inflows. Since the EMP1 specification uses level interest rate differentials instead of first-differences the indicated appreciation pressure is persistent over time, which is not the case for EMP4 which uses change in the real interest rate differential instead. Some persistency can also be noted in the other level specification (EMP2) but without any particular trends.

⁴² This approach does not change the properties of our EMP series when we compare them to the series deflated by the monetary base over the periods with availability of data of both money aggregates. Using M1 instead of the monetary base is furthermore a frequently used approach see e.g. Klaassen & Jager (2011) or Hegerty (2009)

Figure 11 - EMP series Estonia

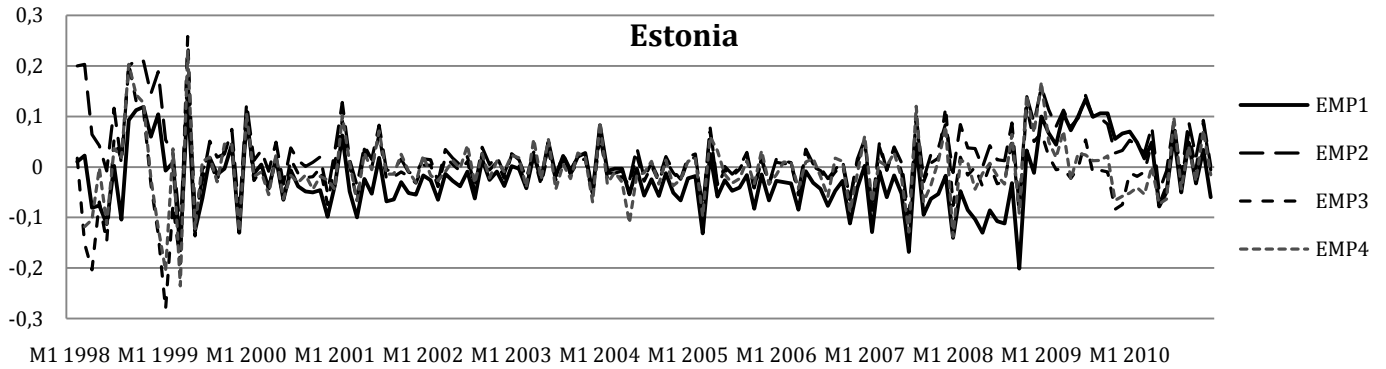


Figure 12 - EMP series Latvia

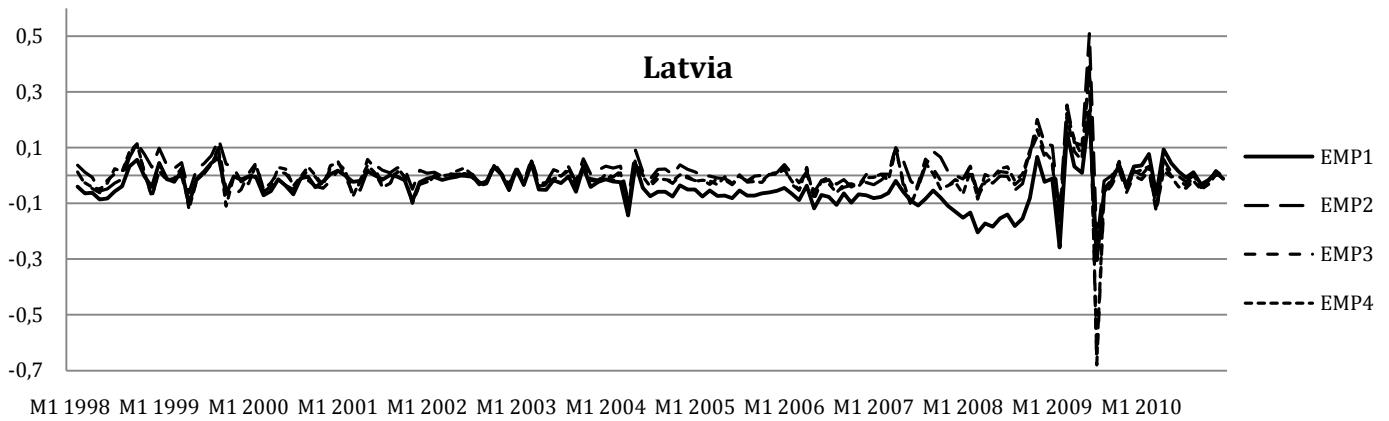


Figure 13 - EMP series Lithuania

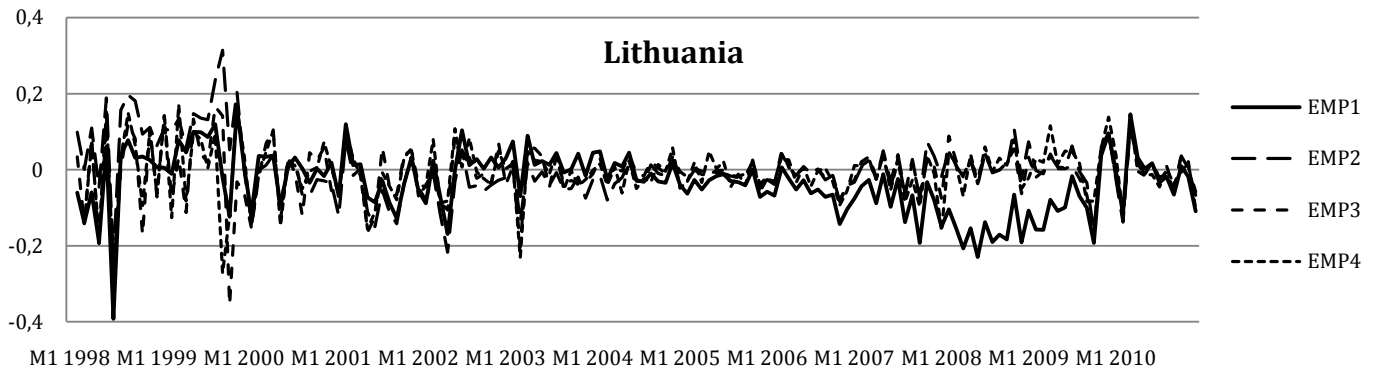


Table 1 to Table 3 provides some descriptive statistics of our EMP series and their components. Interestingly EMP1, EMP3 and EMP4 all indicate average appreciation pressure (negative means) while EMP2 instead indicate depreciation pressure. This finding suggests that using the level nominal interest rate might omit some important information. We also see that EMP1 in general seems to have somewhat less pronounced spikes as the difference between min and max values for it is smaller than the other series, especially compared with EMP3 and EMP4. Standard deviation of all EMP series seems to be very consistent between the series and the weights assigned to the different components are roughly in line, with much greater weight assigned to the reserve component. From the correlation matrices found in appendix 2 we see that EMP3 and EMP4 are the most associated series while EMP1 generally is least associated with the other series, although differences are small.

Table 1 - Descriptive statistics EMP series Estonia

	EMP1	EMP2	EMP3	EMP4
Mean	-0,0197	0,0283	-0,0071	-0,0051
Median	-0,0257	0,0192	-0,0057	-0,0096
Max	0,1395	0,2117	0,2581	0,2299
Min	-0,2009	-0,1269	-0,2814	-0,2349
Std Dev	0,0645	0,0628	0,0642	0,0648
w1	0,0150	0,0171	0,0449	0,0369
w2	0,9850	0,9829	0,9551	0,9631

Table 2 - Descriptive statistics EMP series Latvia

	EMP1	EMP2	EMP3	EMP4
Mean	-0,0385	0,0094	-0,0083	-0,0079
Median	-0,0363	0,0007	-0,0081	-0,0110
Max	0,2310	0,5096	0,3849	0,3908
Min	-0,3045	-0,2415	-0,6798	-0,6508
Std Dev	0,0656	0,0675	0,0786	0,0790
w1	0,0110	0,0226	0,0207	0,0195
w2	0,9890	0,9774	0,9793	0,9805

Table 3 - Descriptive statistics EMP series Lithuania

	EMP1	EMP2	EMP3	EMP4
Mean	-0,0350	0,0004	-0,0082	-0,0075
Median	-0,0266	-0,0097	-0,0035	-0,0019
Max	0,1632	0,3144	0,1660	0,1701
Min	-0,3922	-0,2398	-0,3554	-0,2777
Std Dev	0,0817	0,0789	0,0748	0,0758
w1	0,0205	0,0371	0,0544	0,0470
w2	0,9795	0,9629	0,9456	0,9530

If we turn to graphically investigating the evolution of the international reserve and interest rate components individually, which can be found in appendix 2, we can confirm our observations that Estonia and Lithuania were under more stress during the Russian crisis than they were during the global financial crisis while the opposite is true for Latvia. The persistency of the level difference interest rate components can also be observed, especially for the real interest rate component used in EMP1. The volatility in the interest rate components during the periods in between the crises is relatively small. The changes in international reserves in contrast seem to fluctuate more symmetrically over time. This could reflect that direct intervention in the FX market has been the preferred tool of the Baltic central banks during normal times while periods of severe tension required further measures to be taken thus inducing them to use the more indirect policy tool of interest rate adjustment.

By looking at the descriptive statistics of the individual components a few things are worth mentioning. We see that the average nominal interest rate differential differs across countries being largest for Estonia followed by Latvia and then Lithuania. This could indicate a relatively larger independency of Estonian monetary policy or be caused by differing risk premiums

between countries. However these indications are naturally very weak and should not be used for any definite conclusions. From the max values of the nominal interest rate differentials we also see the relatively large response to the crisis in Latvia.

5. What scope for different policies?

Before assessing the policy performance of the Baltic countries a couple of aspects should be taken into consideration. First, we must recognize that even though it is easy to identify much vulnerability with the advantage of hindsight, there was no anticipation of an external economic shock of the magnitude of the 2008-09 global financial crisis. Furthermore, as argued by Bakker & Gulde (2010), the risks were not entirely recognized or at least underestimated⁴³, not only for the Baltics and the NMS but also globally. Economists disagreed on the risks associated with the imbalances that arose in the region during the boom years. It was noted that capital was flowing from rich to poor countries within Europe, but this was explained as income convergence and catching-up of credit-to-GDP levels, which was in accordance with economic theory.⁴⁴ Others pointed out that current account deficits, external debt and credit growth were at unprecedented levels, not only compared to the countries historical levels but also compared to other emerging countries and that this was unsustainable. The differing opinions among economists made decision making more difficult and even though the risk of a crisis triggered by a shock was recognized, the event of such a severe shock was considered as a very unlikely event (Bakker & Gulde 2010).

Secondly, with the background of underestimated risks and relatively prosperous future growth prospects, there was little incentive for domestic policy makers to build fiscal buffers. Darvas (2009b) actually argues that several economic advisors called for increased public investments in order to improve infrastructure. With these aspects in mind we now turn to the topic of policy evaluation in order to investigate if the devastating outcome of the crisis could have been reduced through more suitable policies. We will follow the principle framework laid out by Ostry et al. (2010) and assess the Baltic countries' experience and possible policy options when attempting to deal with the surging capital inflows. We start by examining the macroeconomic concerns.

5.1. Macroeconomic concerns

Exchange rate policy

The first consideration according to Ostry et al. (2010) is exchange rate policy or more specifically, to consider if the exchange rate should be allowed to appreciate in response to capital inflows? All three Baltic countries were operating fixed exchange rate regimes following their independence. Estonia initially pegged against the Deutsche Mark and later against the Euro while Lithuania and Latvia pegged against the US Dollar until 2002, then against the IMF SDR until 2004, and thereafter against the Euro. In June 2004 Estonia and Lithuania joined the ERMII and by April 2005 they were joined by Latvia (IMF CR 05-282). The standard fluctuation band within the ERMII is 15 percent but it is possible for individual countries to set a narrower band if desired. It should however be noted that in order to fulfil the Maastricht criteria a country must keep the much narrower fluctuation margin of 2.25 percent without any severe tension for at least two years prior to joining the EMU (Van Poeck et al. 2007). Estonia and Lithuania officially chose the wider band of 15 % when joining ERMII but according to Eurostat data the central parity has been maintained without virtually any fluctuation since it was set in 2004. Latvia also officially joined the ERMII at a 15 % fluctuation band but in addition declared

⁴³ See e.g. Riksrevisionen (2011) for a discussion.

⁴⁴ See e.g. Kiss-Martón & Vonnak (2006) or Egert et al. (2006)

that they unilaterally would maintain a narrower band of only 1 %. This central parity has been kept despite some rare adjustments within the narrow 1 % band which can only be assumed to have had negligible effects. Estonia and Lithuania operated formal currency boards meaning that the exchange rate regime and applicable exchange rate is set out in law, making it very credible and hard to abandon. Latvia on the other hand operated what is called a “quasi currency board” where long practice and public visibility makes it similarly credible (Bakker & Gulde 2010). According to the rules guarding their exchange rate mechanisms all three Baltic central banks ensure full backing for the currency in circulation by foreign reserves which further adds to their credibility.

From our EMP estimations we have seen that the countries’ currencies were under some appreciation pressure due to the large capital inflows following EU accession. These flows were perceived to be part of a convergence process towards Western European levels and thus not that likely to come to be suddenly withdrawn. It might hence in retrospect appear as if some exchange rate realignment would have been a suitable strategy in response to the surging capital inflows. However it is important to keep in mind that the political path to Euro adoption set out early in the boom phase in combination with fear of widespread uncertainty if exchange rate realignment discussions were initiated, likely worked as heavy arguments in favour for keeping the central parities. Furthermore all three countries were running current account deficits of around 10 percent of GDP already by the time of EU accession, and these kept on deteriorating during the boom phase as did external competitiveness. Such developments would normally be considered reasons for devaluation. So to summarize we conclude that political ambitions, fear of losing confidence in the currency pegs and the conflict between the experienced appreciation pressure and the worsening external imbalances, likely made exchange rate adjustment an undesirable response to the surging capital inflows.

Reserve accumulation and sterilization

The next consideration to make is whether reserve accumulation is feasible, and if such accumulation should be sterilized. To assess whether the Baltic countries held an appropriate amount of international reserves it is important to put the level of reserves in relation to other variables of interest. We hence take a look at three different reserve ratios that have been suggested in the literature; the Greenspan-Guidotti rule of a reserves-to-STED ratio equal to one, the general result of Jeanne & Ranci re suggesting a reserves-to-GDP ratio of 10 percent and the reserves-to-M2 ratio discussed in Obstfeld et al. (2008) for which do not have a suggested ratio.

Starting with reserves-to-STED ration we see that Latvia and Lithuania have only held a ratio of around 0,4 over the period while Estonia started off at a ratio around one but this was severely reduced during the boom years. This indicates that the countries did not have enough foreign reserves to be able to cover a full year of external debt repayments without external financing. In accordance with the results of Rodrik & Velasco (1999) this indicates that all three countries should have accumulated more reserves in order to reduce the risk of experiencing a currency crisis. However, when looking at the reserves-to-GDP ratio we see that this has increased over the period in all three countries, starting around the proposed 10 percent at the end of the Russian crisis and rising to 15-20 percent in the run-up to the 2008-09 crisis. These ratios are clearly above those suggested and thus indicate that the Baltic reserve levels were very cautious. Finally when looking at the reserves-to-M2 ratio we see that there is some difference between the countries. In the run-up to the crisis Latvia held foreign reserves of approximately 40 percent of M2 while Estonia and Lithuania had 35 percent coverage. Remembering the Argentinean experience in 1995 where one-eighth of M2 was exchanged for central bank reserves over a rather short period of time, it still seems as if the Baltic reserve levels were adequate measured in relation to M2. With regard for the high credibility for the exchange rate regimes one cannot expect the Baltic central banks to have anticipated a currency run exceeding one-third of M2.

Figure 14 - Reserves to Short-Term External Debt ratio, Sources: IFS, QEDS

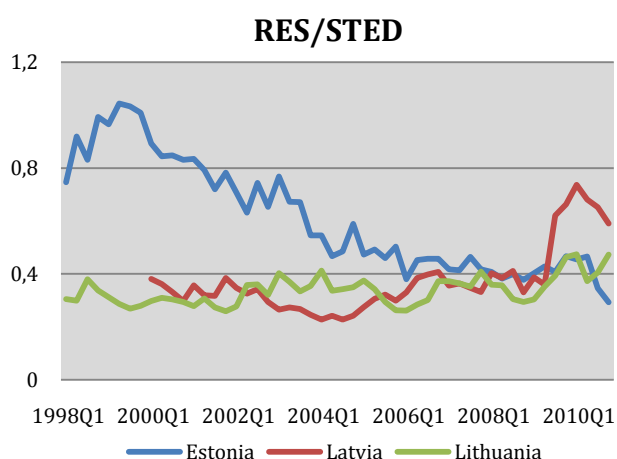


Figure 16 - Reserves to GDP ratio, Source: IFS

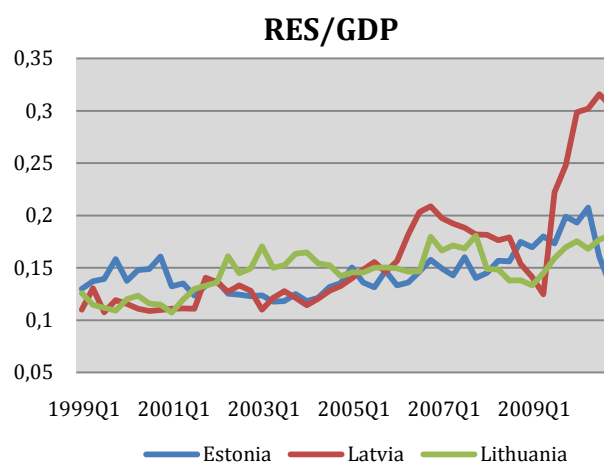
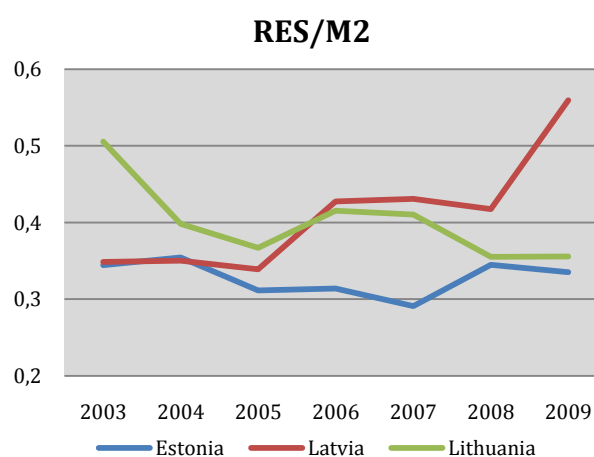


Figure 15 - Reserves to M2 ratio, Source: IFS



After reviewing the different suggested measures of reserve adequacy there is one more thing to keep in mind before drawing any conclusions regarding the Baltic countries reserve adequacy, namely that they were all operating very rigid exchange rate regimes with full reserve backing of the currency in circulation. In such a setting maintaining the central parity is

naturally the first priority. However during appreciation pressure there is no conflict between exchange rate targeting and reserve accumulation, in fact in order to maintain the peg there is likely a need for some reserve accumulation which was also the case in the Baltics as nominal reserves doubled in Lithuania, and increased three to four times in Estonia and Latvia during the 2004-2008 period. That raises the question of sterilization. With the surging inflation rates in mind it seems as if sterilization was motivated. However, due to the complexity of sterilization operations⁴⁵ we have not been able to perform any in-depth investigation of the extent of sterilization operations in the Baltic region. As mentioned in section 2.2 there are some limitations to sterilization which might have had impact on the extent of such operations performed in the Baltics. Both the direct cost of interest rate differential between foreign and domestic assets, and the fear of larger capital inflows following increasing domestic interest rates, could have posed obstacles to sterilization. Furthermore a large part of the increasing money supply came through private bank credit which left domestic authorities with little room for sterilization.

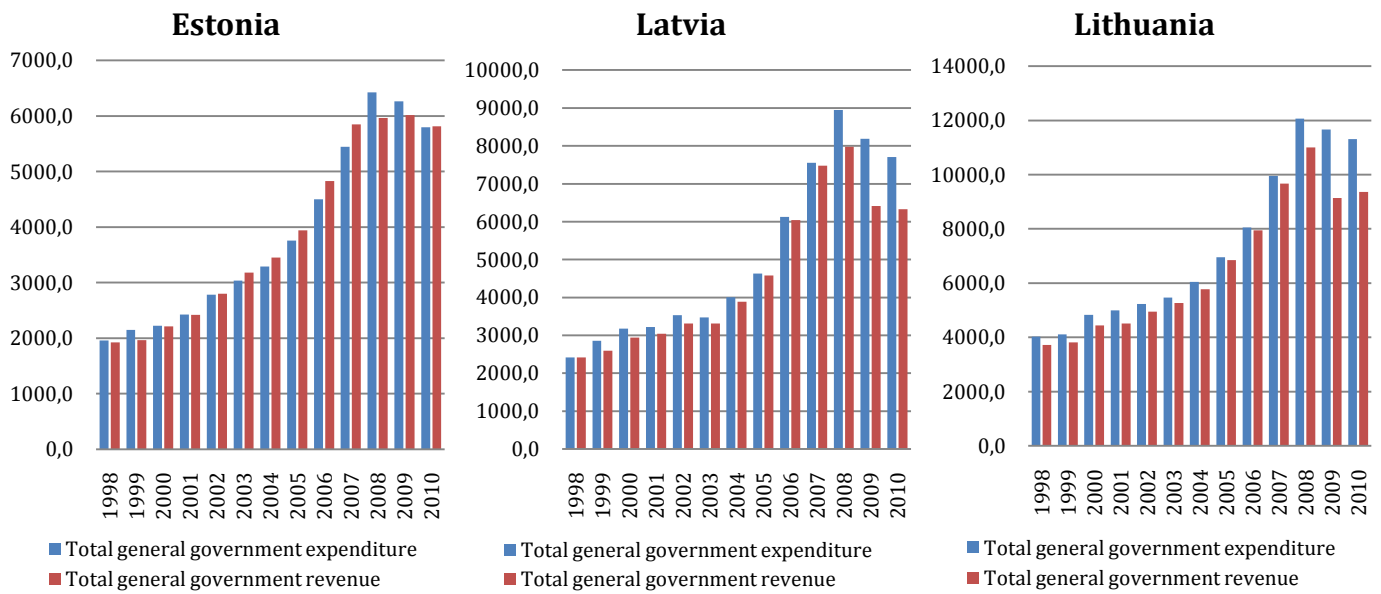
Monetary and fiscal policy

Due to their exchange rate regimes the Baltic countries lacked an independent monetary policy as control of interest rates was sacrificed in order to maintain their currency pegs. There was thus no scope for drastic interest rate increases in response to rising inflation and credit growth, thereby making real interest rates become very low or even negative as argued by Darvas (2009). The close alignment between the Baltic interest rates and the German (Euro) interest rate can also be seen in appendix 2 where the series of both nominal and real interest rate differentials can be found.

Regarding fiscal policy Darvas (2009b) finds that the three countries differed in their policy approach. For Latvia he finds a clear pro-cyclical approach, while Lithuania acted only somewhat pro-cyclical and Estonia counter-cyclical over the period 2001-2007. Looking at the government balance of the three Baltic countries, which can be found in Figure 10, we see that Estonia ran positive balances throughout the years 2003-2007 and started to run deficits only as the crisis emerged. Latvia and Lithuania on the other hand were running deficits, although the deficits were relatively small and improved throughout the boom. However fiscal balances fail to capture the entire picture. As GDP expanded very fast, so did government revenue. This allowed the countries to increase public expenditure which added fuel to the boom in domestic demand. Furthermore rapid public sector wage increases particularly in Latvia, contributed to wage driven inflation. The rapid increase in nominal revenues and expenditures can be seen in Figure 17. Bakker & Gulde (2010) point out that among the CEECs the countries with the sharpest increase in public expenditure were also showing more prominent signs of overheating. It hence seem as if more fiscal discipline would have been motivated out of concerns of overheating alone, but there would have been additional gains to be made from more prudent spending. The increasing revenues could have been used to build up fiscal buffers which could have been utilized to stimulate the economies during the downturn and to ward off illiquidity. This is particularly true for Latvia where a larger fraction of the banking sector was domestically owned and would hence relied on national sources of financing in times of stress.

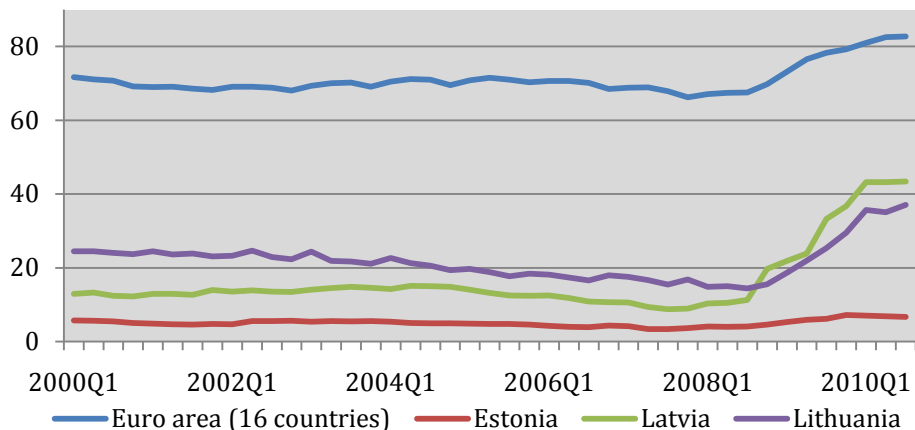
⁴⁵ See BIS (2009) for a comprehensive treatment of both market based and non-market sterilization operations.

Figure 17 - Total general government revenue and expenditure, Source: Eurostat



So it seems as if there were many reasons why the Baltic countries should have tightened fiscal policy during the boom phase. It is however important to keep in mind that the countries were for a long time looked upon as growth miracles and GDP growth was expected to continue, although somewhat slower, in IMF forecasts made in 2007 for the 2008-2012 period. The large capital inflows were perceived to be in line with economic theory as capital flowed from richer to poorer countries. Even the extreme credit expansion was by some estimates only reflecting a catch-up to Western European levels (Darvas 2009b, Bakker-Gulde 2010). Furthermore all three countries had very small levels of government debt in comparison with Western European countries (see Figure 18), which likely reduced worries over fiscal spending. Despite these facts we note that some of the risks were acknowledged, and with the very large imbalances and rapidly expanding domestic demand there should have been a realization of the need for fiscal tightening, especially in Latvia.

Figure 18 - General government debt to GDP (percent), Eurostat



5.2. Financial stability concerns

The work of assessing Baltic financial regulation is a very complex task given our limited knowledge of their respective domestic regulation. This work is further complicated by the fact that all countries have made substantial changes following the crisis and that archives of older regulation documents only are available in national languages. Furthermore, it is a very hard task to establish the sphere of responsibilities regarding the supervision of local subsidiaries and branches of foreign parent banks.⁴⁶ In short subsidiaries are regulated by domestic authorities while branches answer to home country regulation. For these reasons we will not be able to give any detailed assessments of the policies performed. Instead we focus on the observable development and discuss what policies that could have been used in order to meet such a development. We find some indication of the policies performed in a paper by Hilbers (2005), who examine prudential policy responses to the credit expansion for the CEECs up until 2004-05. Unfortunately we have not been able to find any similar reviews covering later time periods. Since discriminatory prudential policies and capital controls are prohibited by EU legislation we will not take such measures into consideration.

Credit growth and housing bubbles

There were several concerns of financial instability present during the Baltic boom. One of them was the rapidly inflating house price bubble mainly caused by expanding mortgage lending and high future income expectations. Such worries according to Ostry et al. (2011), call for prudential policies or broad based capital controls. Imposing credit ceilings or raising capital requirements could potentially have had some effect in the Baltics, but could also induce foreign banks to serve their prime customers directly through branches, thus circumventing the regulations, leaving domestic credit institutions and subsidiaries with a worse set of clients. This scenario had previously been observed in Bulgaria where credit growth continued even after the introduction of credit ceilings (Bakker & Gulde 2010). The Estonian and Latvian authorities of financial supervision reached out to their counterparts in parent banks' home countries in 2005, in an attempt to convince them to help reduce credit growth in the Baltics. However these attempts were met with little sympathy as the parent banks' risk management was perceived to be satisfactory on a banking group level. Furthermore there was doubt of whether measures directly targeting parent banks' Baltic operations might be in conflict with EU regulation (Riksrevisionen 2011).

Hence it seems as the scope for supply-side prudential policies was rather limited, which brings us to demand side prudential policies. Given the Baltic macroeconomic development it seems as if stricter regulation in order to decrease demand for credit would have been feasible. This could have been done for example by imposing strict Loan-To-Value (LTV) ratios, especially on mortgages, or by policies aimed at reducing incentives to take on loans, such as reducing tax-deductibility of interest rate payments. Another policy option could have been to adopt stricter bank specific regulation based on bank soundness. However, estimations of bank risks were performed by both parent bank supervisors and international institutions such as the IMF⁴⁷ with the general conclusion that both domestic banks and foreign subsidiaries supported by parent banks were not suffering from any obvious unsoundness (IMF CR 06/414, Riksrevisionen 2011).

⁴⁶ See IMF (2007) for a comprehensive overview of the complexity and uncertainty regarding the responsibility sharing in the supervision of financial institutions.

⁴⁷ See e.g. Tamirisa & Igan (2008) who did not find that bank soundness had deteriorated substantially but did encourage close future monitoring.

With this fact in mind it is hard to see that the Baltic supervisory authorities could have done any different judgements.

FX exposure

Rapid expansions of FX denominated debt and increasing exposure to currency risk had been seen before in connection to the Latin-American and Asian crises. However the risks associated was principally considered less worrying in the Baltic region, since much of the exposure was assumed to be protected by solvent parent banks (Riksrevisionen 2011). Since most lending to ultimate borrowers was denominated in foreign currency there was no big concern of open FX positions of credit institutions. This currency risk was instead concentrated to ultimate borrowers who typically do not appreciate the risks that arise from having mismatches in income and liabilities. The currency composition of lending to residents can be seen in Figure 24. We clearly see how the share of Euro denominated loans increased in Latvia and Lithuania following EU accession and ERMII entry. In Estonia about 75 percent of loans were already being issued in Euros by 2004. As an increasing share of the private sectors debt is in foreign currency policymakers' options in response to growing external imbalances and decreasing competitiveness becomes very limited. We have seen that there were large imbalances with plummeting current accounts and real appreciations in all Baltic countries but devaluation was not a feasible option because it would likely have triggered a severe recession and also likely caused massive losses to the banking sector as borrowers would not be able to service their debts. Plausible policy measures in response to such a situation involve limits or outright prohibition of FX lending or increased capital requirements on FX loans. Such regulation would likely have shifted the currency risk from ultimate borrowers to credit institutions who likely would have been more capable of realizing the risks and more able to acquire proper hedging. But timing of such measures would have been of crucial importance since it would likely have reduced confidence in the exchange rate pegs.

By the time of EU accession in 2004, competitiveness had not yet deteriorated much (see Figure 27) and despite large current account deficits, external imbalances were not a main concern. As a result, there was probably little incentive at that point to implement restrictions on FX borrowing, especially with regards to negative signals regarding Euro adoption this might have sent. The signalling effect likely became even more important as external imbalance grew and FX debt became even larger, thereby increasing uncertainty. The large speculative pressure on the Lats during the crisis do, at least to some extent, give some indication of what might have happened if confidence in the pegs had been lost. It therefore seems as if restrictions on FX lending would have required very early implementation, probably simultaneously with the financial market liberalizations following independence.

Liability structure and maturity mismatches

From Figure 19 we see the maturity composition of the Baltic countries external debt and in Figure 20 we see short-term external debt as a share of GDP reaching as much as 35-55 percent in the Baltic countries by 2007. We further know that a large part of foreign capital inflows was used to finance mortgage credits which are long-term assets. Such a development is clearly dangerous in the event of a liquidity squeeze, as experienced during the global financial crisis, since debt repayments might be hard to roll over.

Figure 19 - Maturity structure of external debt, Source: QEDS

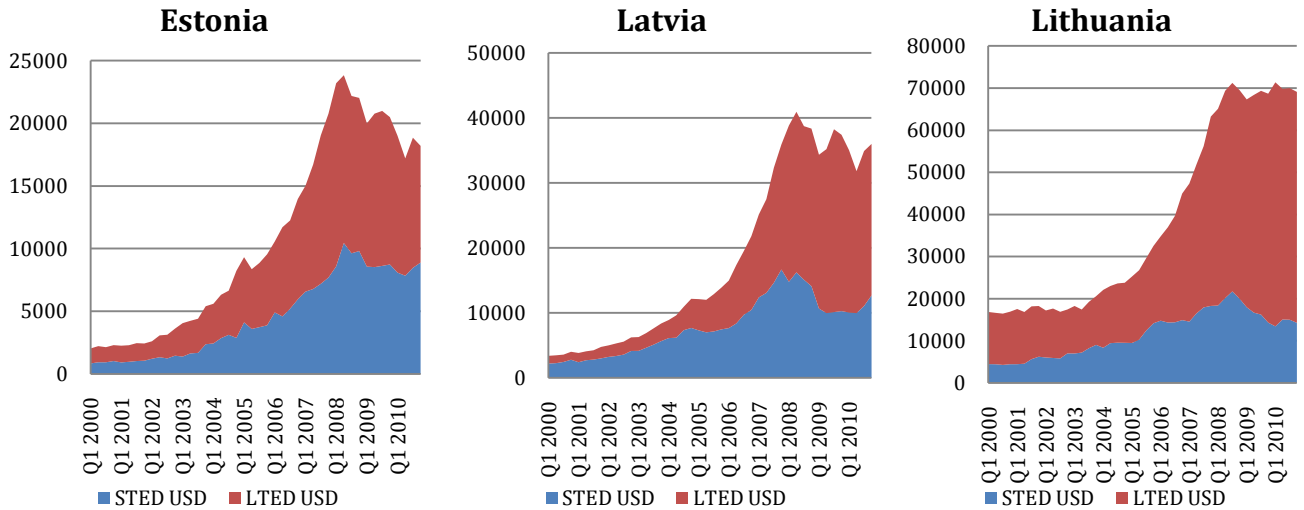
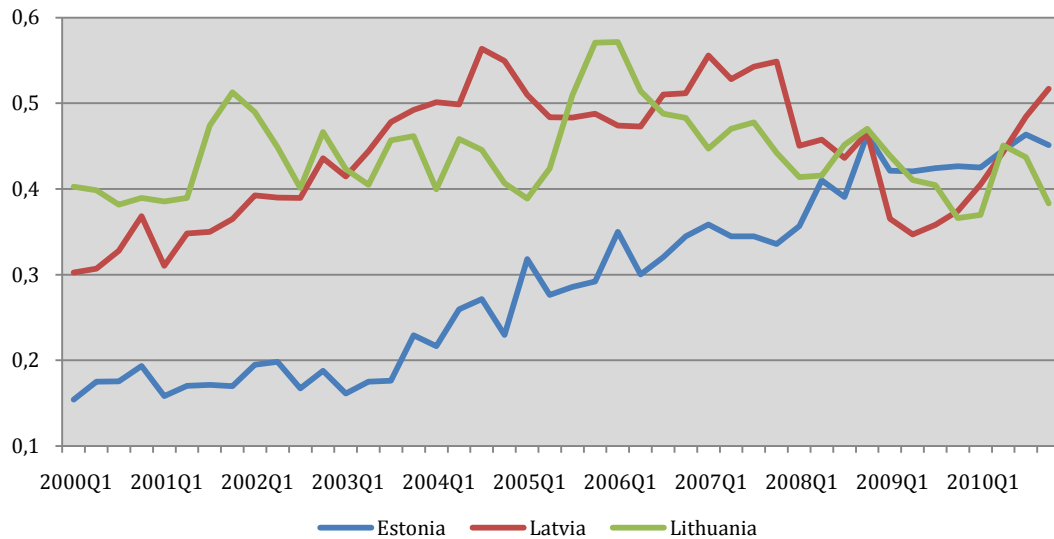


Figure 20 - STED to GDP ratio, Source: IFS, QEDS



There are several potential policy measures to address concerns of maturity mismatches outlined by Ostry et al. (2011) but many of them involve discriminatory measures which were not available to the Baltic countries. That leaves us with general prudential policies such as higher liquidity requirements, but as with all financial regulation these do not apply to branches of foreign banks and thus risks being circumvented.

6. Conclusions

It has become apparent from the many currency and financial crises observed during the last couple of decades that large capital inflows truly are a mixed blessing. After initially being on a very prosperously looking path of rapid convergence towards Western Europe, the Baltic countries eventually found themselves in a situation with little maneuverability to cool down their overheating economies. As the unanticipated global financial crisis struck with a largely unforeseen scale, the fragile Baltic economies took severe damage, although due to rapid responses of neighboring authorities and international organizations a full blown currency and banking crisis was avoided.

In retrospect it seems as if all three Baltic countries might have been too hasty in their ambition to become fully integrated in the EU. They all started off as very underdeveloped economies and in relatively short time imposed strict limitations to their monetary policy independence. It might have been better to allow for more flexibility initially in order to allow for their economies to adjust. Furthermore, they had little time to develop well functioning institutions which likely affected their supervisory authorities' ability to assess risks in the financial sector as well as their governments' fiscal discipline. Since the EU do not allow for restrictions to capital movements the only scope for different policies lies within these two policy areas. Regarding fiscal policy we have found that despite the relatively well looking fiscal balances were hiding very rapidly increasing expenditures which likely contributed to the eventually uncontrollable boom. Even though it is desirable to make sure that the benefits from increasing national income is distributed widely, it is equally important to plan for gloomier days to come. As we have seen capital flows, especially of short-term nature, can be very volatile and reliance on the persistency of such is associated with many dangers. There is hence a need to carefully monitor their impact on both financial risks and macroeconomic stability, and take appropriate action in order to meet such concerns.

In the Baltics areas of particular concern were the massive balance-sheet exposure of the private sector to currency risk and property prices, which effectively prevented the countries from exchange rate realignment. Furthermore the relatively large domestic financial sector in Latvia made the country particularly vulnerable to a liquidity squeeze as there were no foreign parent banks to rely on for financing during the crisis. This left the country very vulnerable to speculative pressure as concerns regarding government solvency arose, despite relatively low levels of public debt.

Measuring exchange rate pressure is an important area in order to gain knowledge of different exchange rate regimes. As have been shown in this study there is no wide consensus on the appropriate way of doing this. We have found that the approach suggested by Klaassen & Jager (2011) seems to provide some additional information and we argue that it is more intuitive than other approaches. Although our study also shows that the differences between alternative approaches is rather small. In addition, we have only been able to briefly examine the area, and there is plenty of scope for future research regarding the performance of different constructions and applications of the EMP index.

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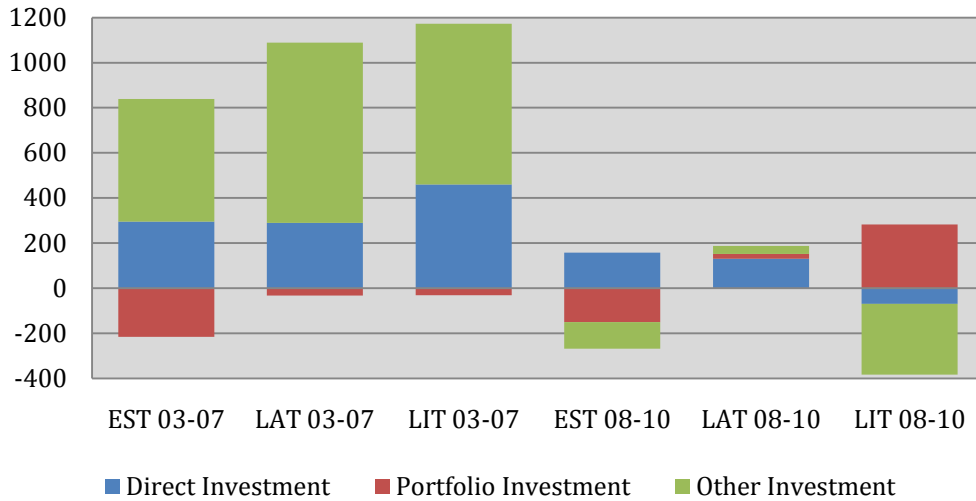
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Appendix 1 – The boom-bust cycle illustrated

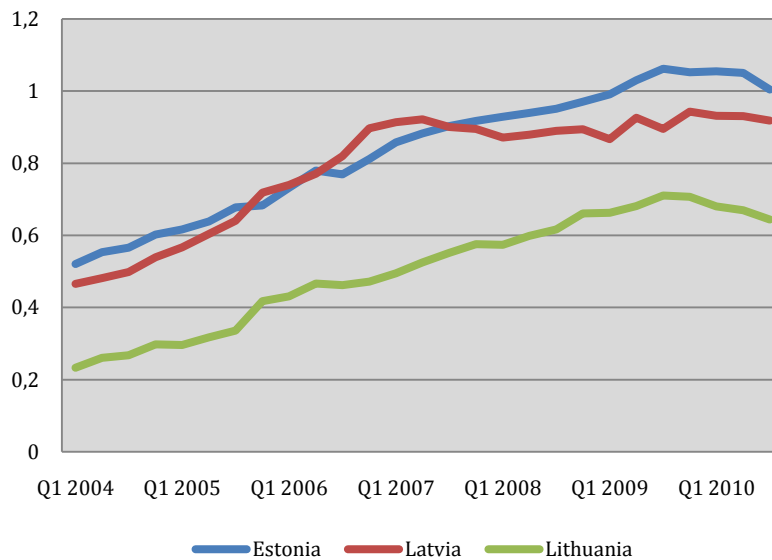
Following EU accession large levels of capital flowed into the Baltic economies

Figure 21 - Average Capital inflows (USD millions), Source: National Central Banks



A large part of the flows were directed to the financial sector which rapidly expanded credit to the private sector...

Figure 22 - Domestic credit to GDP, Source: IFS



...mainly through FX denominated loans...

Figure 24 – Loans to residents by currency (millions Local Currency), Source: National Central banks

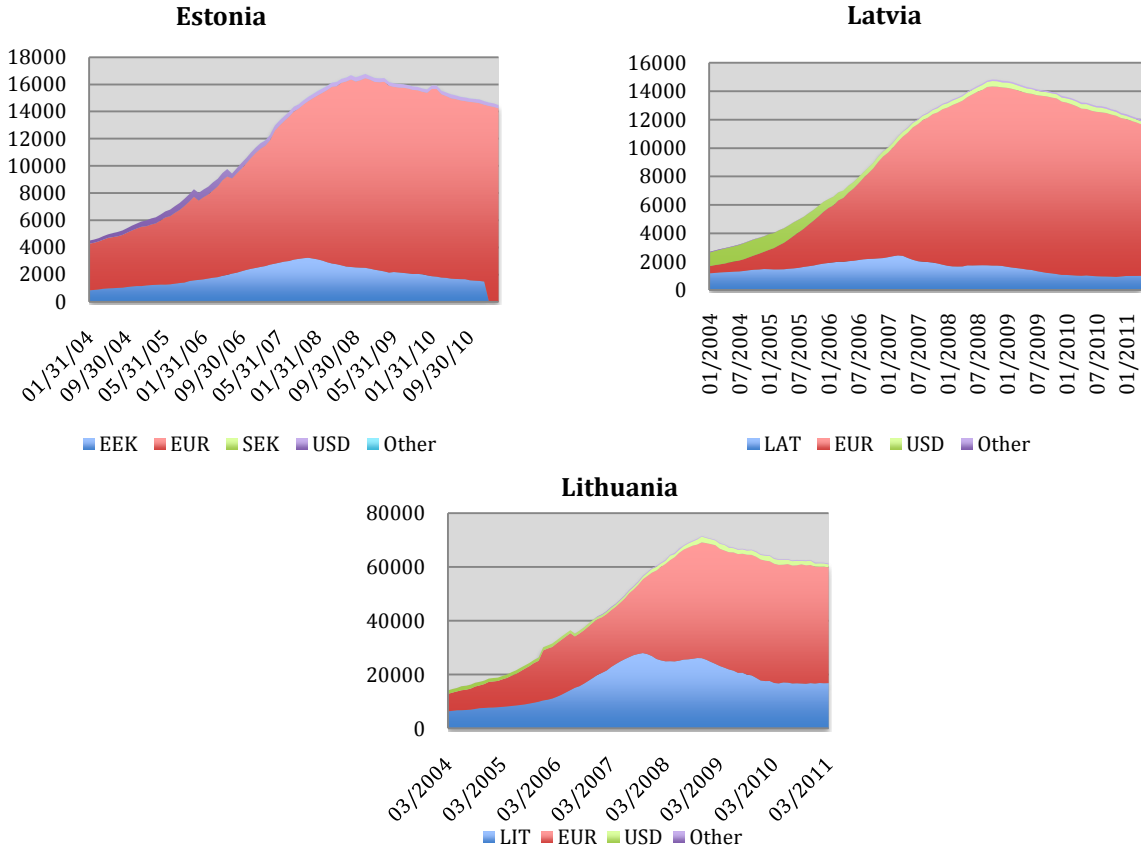
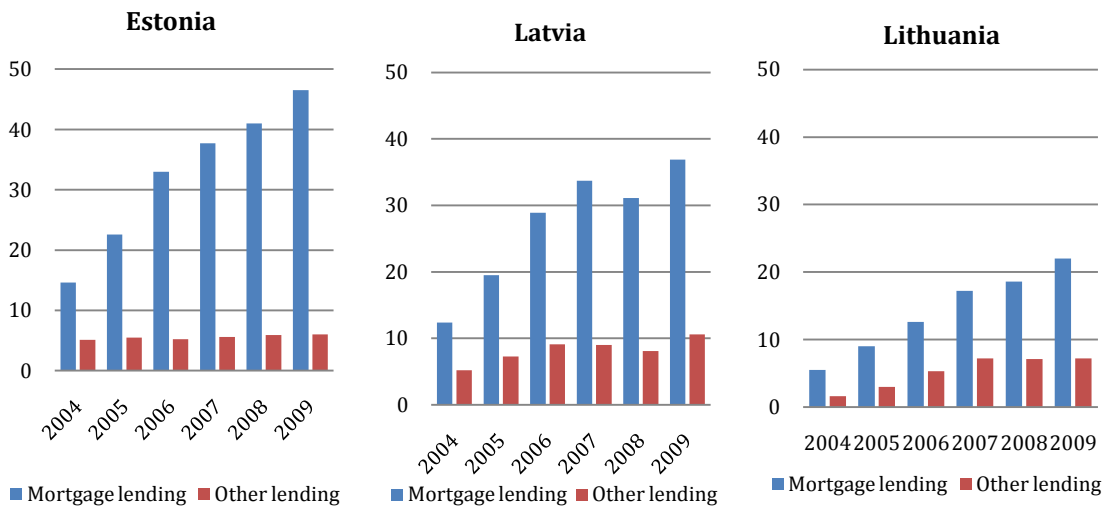


Figure 23 - Loans to households by type (% of GDP), Source: ERBD

...of which a large part went to mortgages.



Easy access to credit and rising income boosted domestic demand...

Figure 25 - Final Household Consumption Expenditure (Euro per person), Source: Eurostat

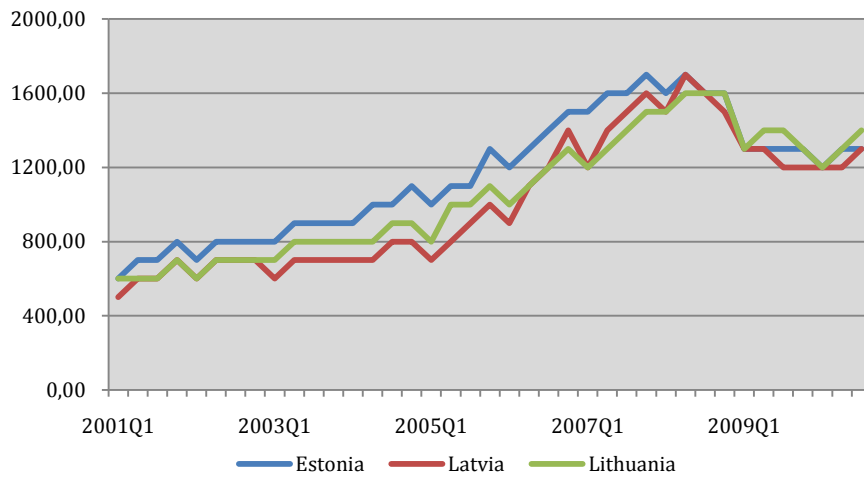
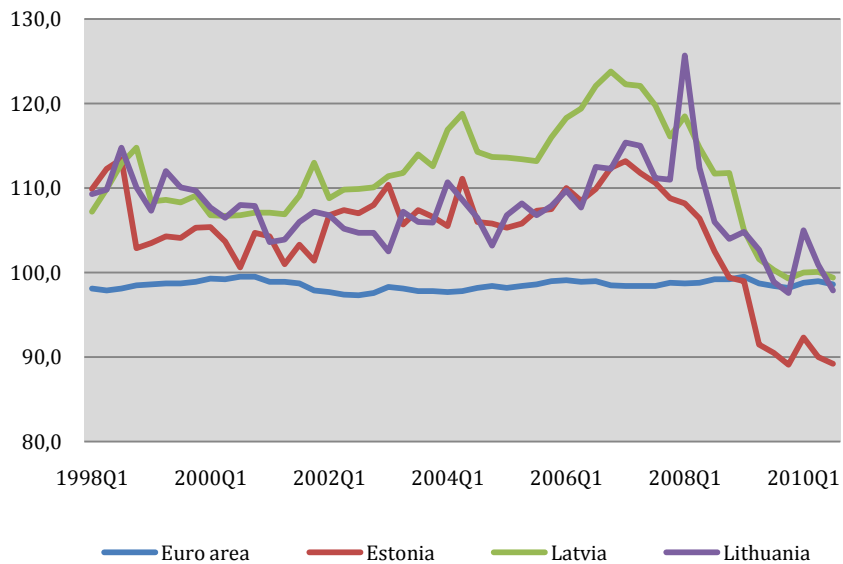


Figure 26 - Domestic demand to GDP, Source: Eurostat



...fuelling inflation and creating large external imbalances.

Figure 27 - REER 1999 = 100, Source: IFS

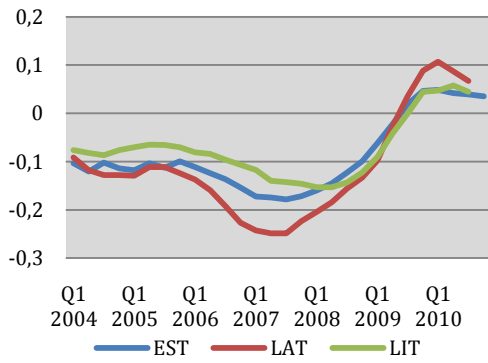
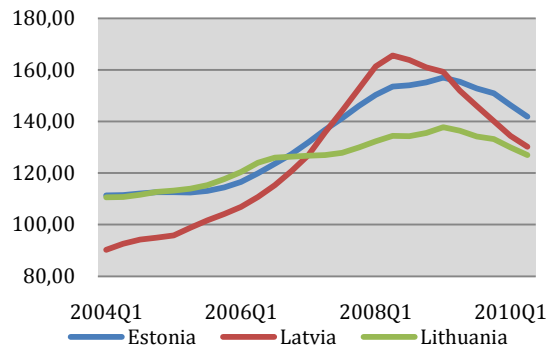
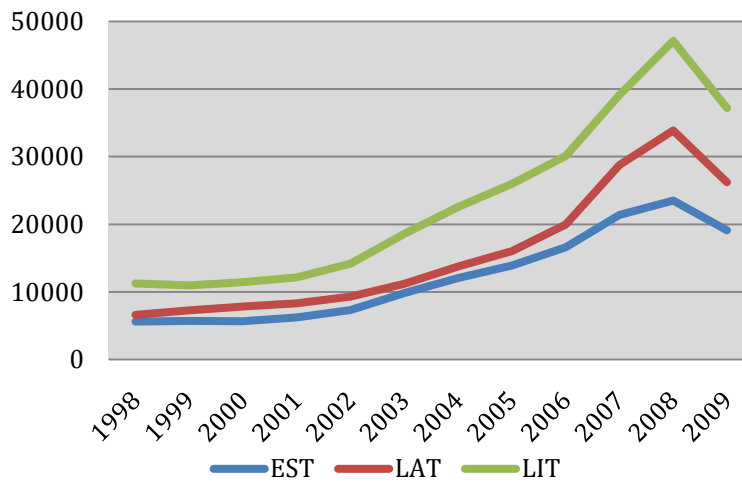


Figure 28 - Current Account (% of GDP), Source: IFS



The eventual bust caused substantial damage to the Baltic economies.

Figure 29 - Real GDP (USD millions), Source: IFS



Appendix 2 – Evolution of EMP components and descriptive statistics of EMP series

Figure 30 - IR component Estonia

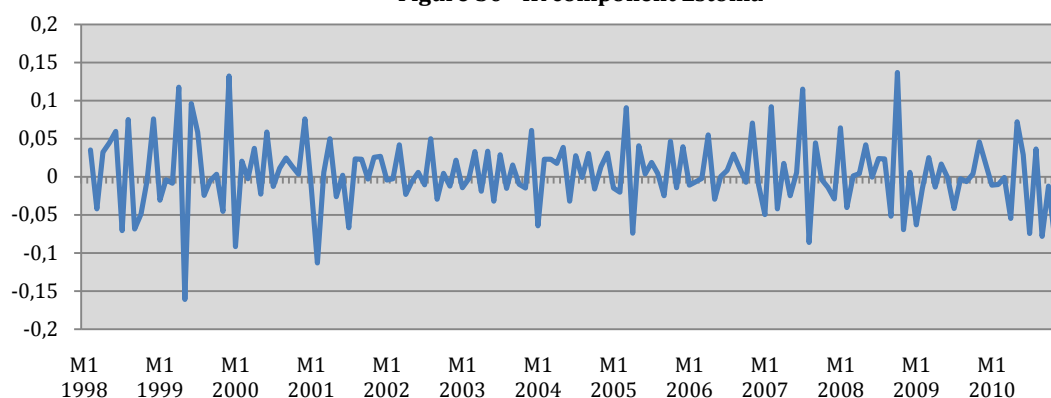


Figure 31 - Interest series Estonia (diff series right scale)

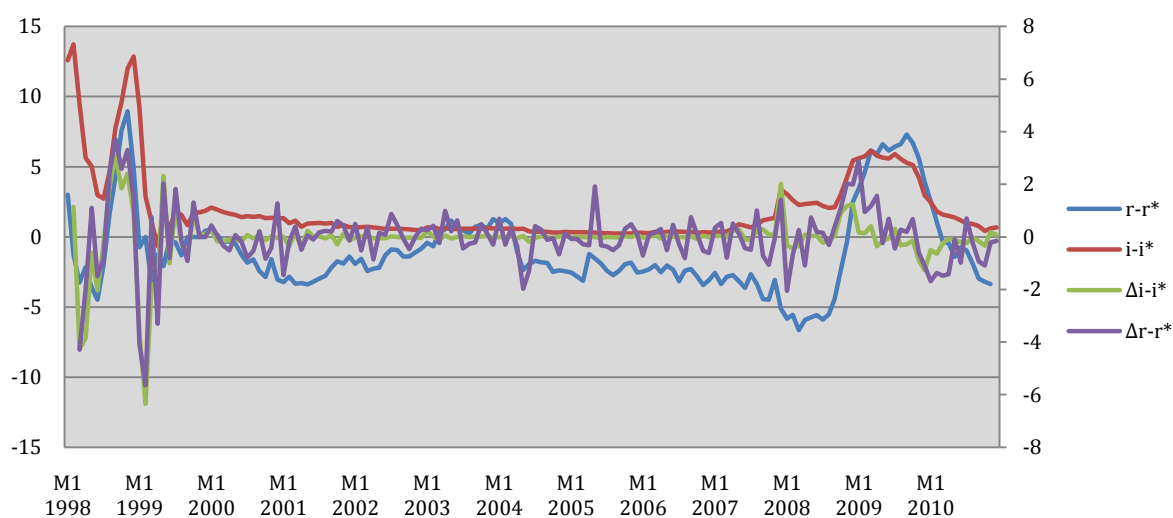


Table 4 - Descriptive statistics EMP components Estonia

	$r-r^*$	$i-i^*$	$\Delta i-i^*$	$\Delta r-r^*$	ΔIR
Mean	-1,0552	1,9531	-0,0768	-0,0413	0,0039
Median	-1,8422	0,8915	-0,0100	-0,0204	0,0012
Max	8,9718	13,7300	3,0700	3,7018	0,1366
Min	-6,6501	-0,6800	-6,3500	-5,6511	-0,1611
Std Dev	2,9758	2,6161	0,9655	1,1838	0,0454

Table 5 - Correlation Matrix EMP series Estonia

	EMP1	EMP2	EMP3	EMP4
EMP1	1,0000			
EMP2	0,8078	1,0000		
EMP3	0,5526	0,5647	1,0000	
EMP4	0,6227	0,6492	0,9050	1,0000

Figure 32 - IR component Latvia

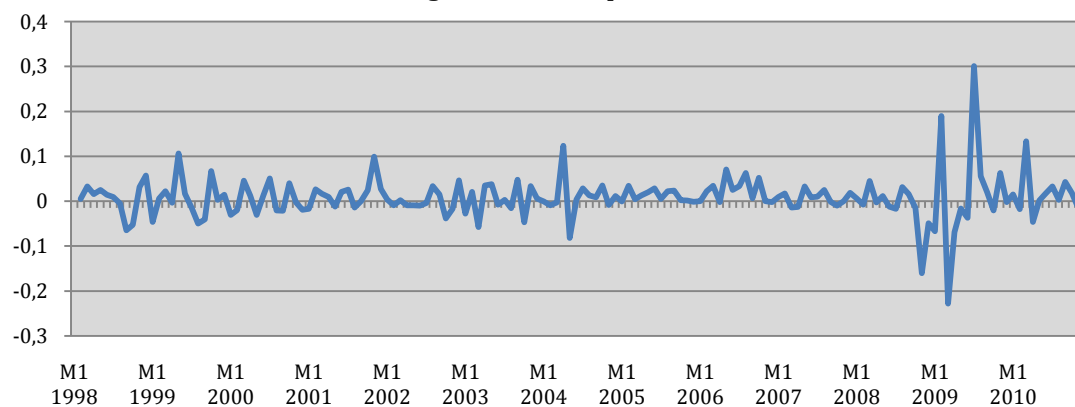


Figure 33 - Interest series Latvia (diff series right scale)

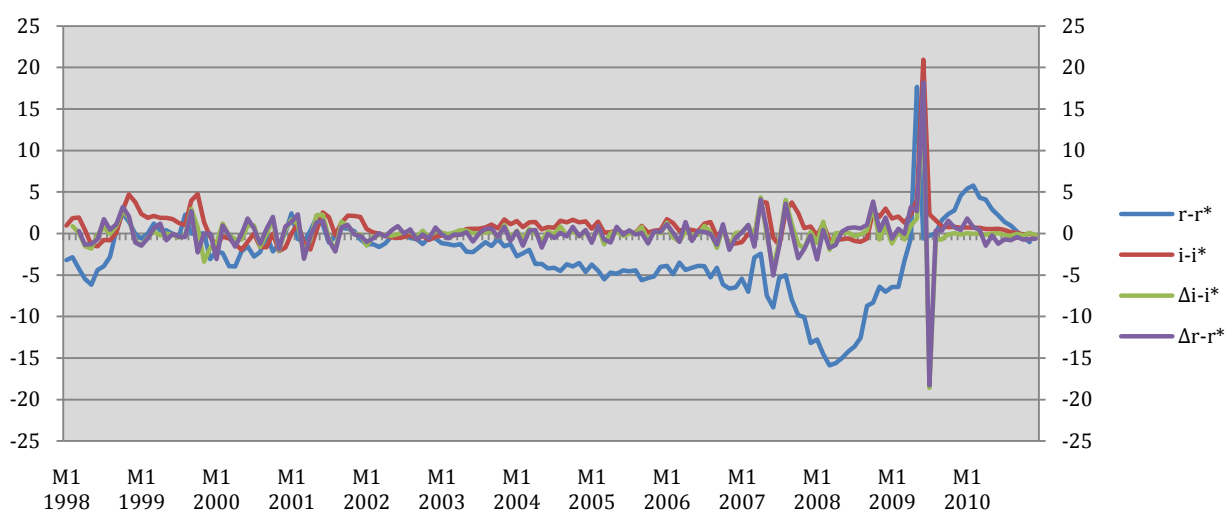


Table 6 - Descriptive statistics EMP components Latvia

	$r-r^*$	$i-i^*$	$\Delta i-i^*$	$\Delta r-r^*$	ΔIR
Mean	-2,7505	0,7774	-0,0077	0,0139	0,0084
Median	-2,2098	0,5500	-0,0100	0,0000	0,0059
Max	17,6510	20,9300	16,8500	18,2205	0,3010
Min	-15,8700	-2,1000	-18,6000	-18,2711	-0,2281
Std Dev	4,4070	2,1215	2,3238	2,4744	0,0491

Table 7 - Correlation Matrix EMP series Latvia

	EMP1	EMP2	EMP3	EMP4
EMP1	1,0000			
EMP2	0,7020	1,0000		
EMP3	0,6777	0,8134	1,0000	
EMP4	0,6935	0,8150	0,9804	1,0000

Figure 34 - IR component Lithuania

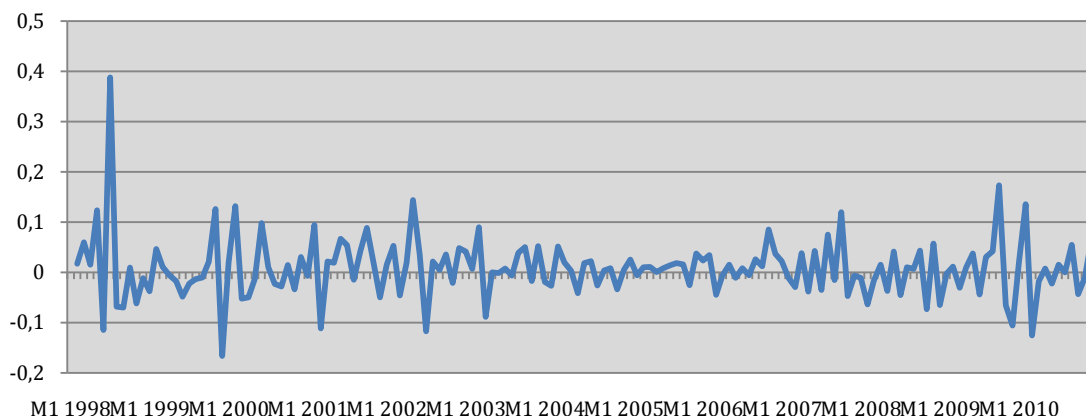


Figure 35 - Interest series Lithuania (diff series right scale)

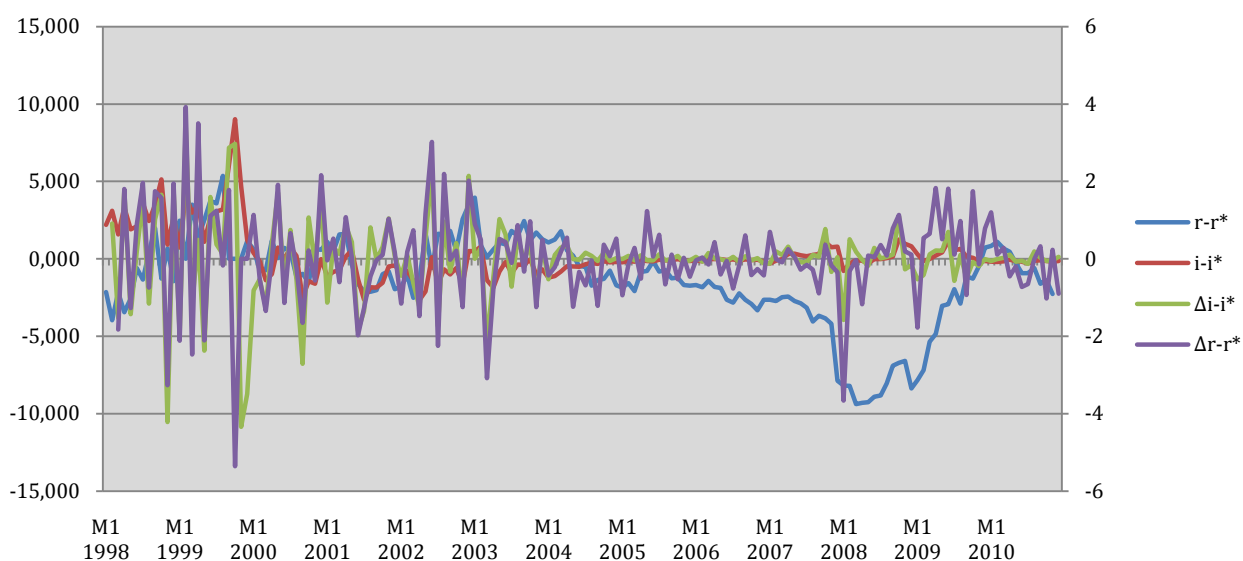


Table 8 - Descriptive statistics EMP components Lithuania

	$r-r^*$	$i-i^*$	$\Delta i-i^*$	$\Delta r-r^*$	ΔIR
Mean	-1,3351	0,2279	-0,0150	-0,0009	0,0079
Median	-1,1319	-0,1000	0,0200	0,0000	0,0082
Max	5,3556	9,0300	3,4200	3,9213	0,3879
Min	-9,3844	-2,6600	-4,3400	-5,3556	-0,1667
Std Dev	2,9006	1,5753	1,0537	1,2301	0,0606

Table 9 - Correlation Matrix EMP series Lithuania

	EMP1	EMP2	EMP3	EMP4
EMP1	1,0000			
EMP2	0,5462	1,0000		
EMP3	0,5262	0,6206	1,0000	
EMP4	0,5644	0,5326	0,7550	1,0000

Appendix 3. EMP Data

Variable	Definition	Source
EMP1	$EMP1_t = w_1(r_t - r_t^*) - w_2IR_t$	Authors' calculations
EMP2	$EMP2_t = w_1(i_t - i_t^*) - w_2IR_t$	Authors' calculations
EMP3	$EMP3_t = w_1\Delta(i_t - i_t^*) - w_2IR_t$	Authors' calculations
EMP4	$EMP4_t = w_1\Delta(r_t - r_t^*) - w_2IR_t$	Authors' calculations
w_1, w_2	$w_1 = \frac{1/\sigma_{(r_t - r_t^*)}}{1/\sigma_{r_t - r_t^*} + 1/\sigma_{IR}}$ $w_2 = \frac{1/\sigma_{IR}}{1/\sigma_{(r_t - r_t^*)} + 1/\sigma_{IR}}$ <p>where σ is the standard deviations of each series respectively.</p>	Authors' calculations
IR	Change (from last period) in net international reserves, denominated by M1	Net reserves: IMF International Financial Statistics (IFS) line 1L (total reserves minus gold) minus line 2EGS (Use of fund credit) M1: IMF International Financial Statistics (IFS) line 14/59MA
$(r_t - r_t^*)$	Short-term real interest rate differential where r_t is the domestic money market rate and r_t^* is the German money market rate plus the CPI based yearly inflation differential. Money market rates are period averages.	Money market rates: International Financial Statistics (IFS) line 60B Inflation: International Financial Statistics (IFS) line 64

Appendix 4 – Selected vulnerability indicators 2004 and 2009

Figure 36 - Selected vulnerability indicators 2004, Sources: Eurostat, IFS

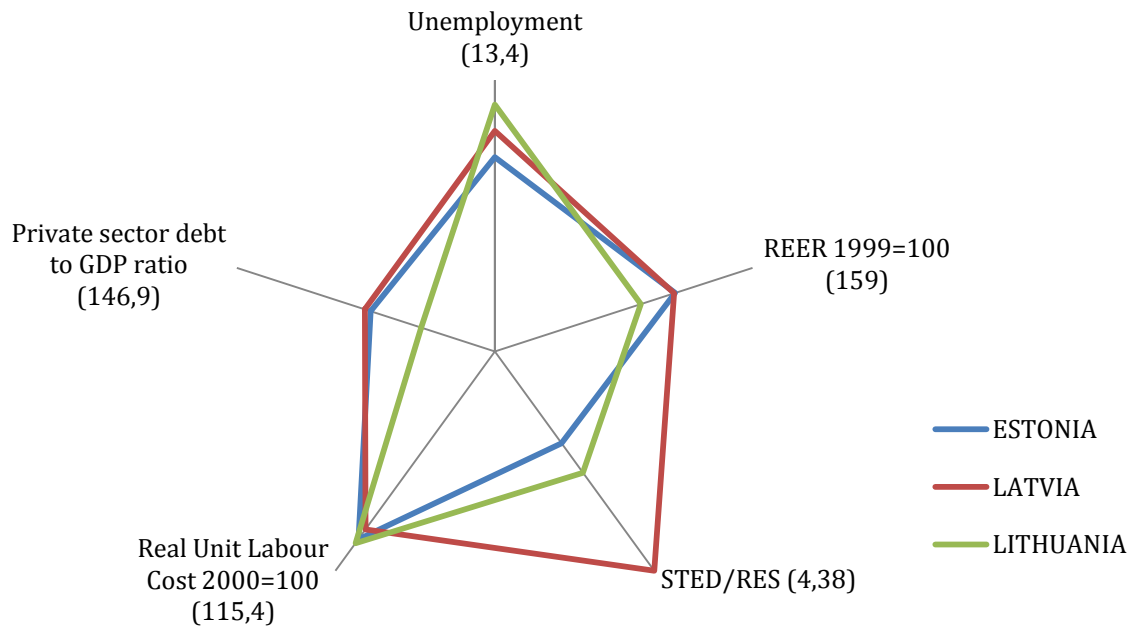


Figure 37 - Selected vulnerability indicators 2009, Sources: Eurostat, IFS

