

Macroeconomic Policy Responses and Financial Crises in the European Emerging Economies

- Preliminary draft -

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Abstract: The paper explores external shock transmission and monetary policy response in two crisis periods in the case of selected Emerging European Economies (EEEs). External shock transmission to domestic real and financial stability, as well as monetary response via interest rate changes and foreign exchange reserves, are empirically examined in two crisis periods, 1995:Q1-2001:Q4 and 2002:Q1-2010:Q4. The sample includes Baltic States (Estonia, Lithuania, Latvia) and Bulgaria as currency board countries, and CE-3 (Poland, Czech Republic, and Hungary) with flexible ER arrangements. The proxies for real and financial external shocks, domestic economic activity and financial stability, as well as domestic economic policy, are included in Structural Bayesian Vector Autoregression Model (SVAR) in order to reveal the difference in the impact and monetary response in different crisis episodes for selected EEEs.

Key words: Crises episodes, External shocks, Emerging European Countries, SVAR model.

JEL: G1, E5, E6.

1. Introduction

The worst hit by global economic crisis within the group of emerging countries were EEEs with the highest output losses. Although EEEs were among those countries that suffered the most from the economic crisis, the crisis has evolved differently across them. EEEs are far from homogeneous groups, it comprises three different regions¹. In this paper we investigate more closely the cases of Poland, Czech Republic, Hungary (CE-3), Estonia, Lithuania, Latvia (Baltic states), and Bulgaria. In heterogeneous sample of EEEs, Baltic and South-Eastern European economies were hit harder than other countries, highlighting the fact that already vulnerable economies and more financially integrated suffer more from external shocks. Wide range of literature deals with the problem of crisis impact to emerging economies, particularly EEEs (Berglöf et al. 2009; Llaudes, Salman, and Chivakul 2010; Gallego et al. 2010; Myant and Drahokoupil 2010; Gardó and Martin 2010; Blanchard, Faruqee, and Das 2010; Anastasakis, Bastian, and Watson 2011; etc.). EEEs were experiencing economic boom before global crisis characterized with relatively strong GDP growth according to easy external financing conditions, as well as positive expectations related with ongoing convergence towards the EU. EEEs were not faced with significant consequences of global crisis until the last quarter of 2008 (that could be viewed in the light of non-exposure to subprime or subprime-related assets) with Lehman Brothers bankruptcy. However, resistance to global turmoil was stopped since September 2008 with the decrease in investor confidence, as well as sudden stop in capital inflows on which EEEs relied upon to finance credit and GDP growth. Significant decline happened in 2009, but growth returned in 2010.

Emerging countries, hit with external real and financial shocks, were exposed in various ways depending from their specific vulnerability points. Some emerging economies were very open to trade, others not; some had large short-term external debt and/or large current account deficits, others not; some had large foreign currency debt, others not. Accordingly, emerging economies reacted in different ways, mostly relying on fiscal expansion and monetary easing. Some monetary authorities used reserves to maintain the exchange rate, while others instead letting it adjust. Here we concentrate at monetary policy response trying to shed some light at the following points: (i) how external shocks disturbed real and financial stability in selected EEEs; (ii) the difference between the impact of various proxies for financial shocks, as EMBI shock, VIX shock, realized volatility of MSCI for G7 group and realized volatility of MSCI for Emerging Markets, at one side, and real external shock as a transmission of G7 GDP from the other side; (iv) how vulnerability of EEEs has changed in the first and second crisis period in selected country cases; (v) how monetary policy responded in the first and the second crisis period regarding changes in interest rate and foreign exchange reserves as a reaction to different external shocks in both periods; (vi) has the role of real exchange rate as an adjustment mechanism increased in respecting crisis periods for investigated EEEs.

We extend our analysis beyond the current financial crisis in order to better identify factors affecting Emerging Europe's responses to financial crises. Literature dealing with the identification of crisis episodes could be grouped in: (i) sudden stop literature (Calvo, Izquierdo, and Meja 2008; Hutchison, Noy, and Wang 2010; Cavallo and Frankel 2008; and Honig 2008); (ii) financial stress

¹ (i) Central Europe and Baltic states (CE3 usually referred to Poland, Czech Republic and Hungary and the three Baltic economies Estonia, Lithuania, Latvia) all of which joined the European Union in May 2004 and have yet to adopt the euro¹; (ii) South-East Europe (Turkey, Serbia, Croatia, Albania, Bosnia & Hercegovina, Macedonia, Montenegro -not yet members of the EU- and Romania and Bulgaria which entered the EU in 2007); and (iii) Russia and CIS (Russia, Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan, Ukraine, Uzbekistan and Mongolia).

index (International Monetary Fund and Balakrishnan et al. 2009); (iii) EMBI and VIX indicators (which are especially correlated during periods of intense financial pressures). Explored studies dealing with identification of crisis episodes lead to similar crisis episodes: (i) Mexican crisis 1994-1995; (ii) Asian and Russian crises 1997-1998 and Brazilian crisis 1999 (crises cluster around 1997-1999); (iii) ICT bubble and 09 11 bombing attack 2000-2001; (iv) Subprime crisis. However, in choosing the relevant windows for crises periods, we are constrained by the number of observations. Having in mind data availability motives, we used quarterly data, and our empirical investigation is conducted on two crisis episodes. First crisis period assumes “cluster” crisis approach covering the period 1995:Q1-2001:Q4. The second crisis period covers the period after “cluster” crisis episodes covering subprime crisis, namely 2002:Q1-2010:Q4. Macroeconomic responses are analyzed with structural Bayesian vector autoregressive (SVAR) models.

The paper is structured as follows. After introduction part, Section 2 deals with descriptive analysis of crisis impact to EEEs. Section 3 explains the model, while Section 4 includes analysis our main findings. Section 5 contains concluding remarks.

2. Descriptive Analysis of the Crisis Impact to EEEs

Loose monetary policy of the US FED and ECB, excessive capital inflows i.e. carry trade, excessive credit expansion, real estate bubble, rising inflation, current account deficit, currency mismatch problems, are some of main causes of crisis spillover to EEEs as a combination of external and internal (domestic) factors (Aslund 2010). The situation is largely similar in new EU member states and current transition economies with the exemption of Baltic economies that were hit early and experienced declines in 2008, even larger declines in 2009, and negative growth in 2010. The Baltic countries suffered some of the largest drops in industrial production and GDP during crisis compared to other emerging countries. Estonia, Latvia, and Lithuania were more severely affected by global financial crisis than any other regions with cumulative output declines of 20%-25% from their peak levels. Capistran, Cuadra, and Ramos-Francia (2011) argue that the crisis was triggered by external factors, but the severity of the impact of the shocks on each economy seems to be related to domestic elements. Thus, countries with sound macroeconomic framework (low inflation rate, low current account deficit, strong fiscal position, low public debt) based on fiscal and monetary discipline were the ones that were able to respond more aggressively to the external shocks, and the opposite holds for countries with weak fundamentals. The strength of external shocks, mainly decline in trade and capital inflows, depended mostly from country openness and quality of economic policy reflected in crucial macroeconomic imbalances from internal and external aspects prior the crisis. EEEs were hit differently starting from Poland who escaped recession at one side, to the Baltic countries, Romania and Hungary, which suffered deep downturn at the other side. In other words, the impact of crisis depends from structural features of the economy, the quality of macroeconomic policies, and the exchange rate regime.

Concerning *structural characteristics* of an economy, in a crisis circumstances it is good to be a relatively big, less dependent economy with relatively large internal market, i.e. to be less vulnerable to real external shock with limited trade channel. The other aspect besides the size of an economy is diversified production base, i.e. more diversified production and export structure is related to also limited impact of external real shocks i.e. lower trade transmission channel. The case of Poland is a confirmation since it has relatively big domestic market, but also a diversified export industry. Andersen (2009) states that Poland’s economy alone constitutes 40% of the region and if we add two other countries that have remained relatively stable—the Czech Republic and Slovakia—they constitute 65% of the region’s GDP. The case of Poland as an economy the least

affected during crisis give us a better picture of how emerging Europe has handled the crisis rather than looking at, say, Latvia as highly open and dependent economy, constrained with currency board arrangement with relatively high currency mismatch problem.

The other factor, besides structural features of the economies, is *macroeconomic policy* reflected in sustainability of fiscal policy as well as monetary policy. Countries with unsustainable fiscal policies fell into crisis first, that proves Hungarian and Romanian cases. From the other side there are EEEs who managed their policies well, remained relatively stable with pretty constrained and temporary crisis impact, i.e. at this side are Czech Republic and Poland. The other aspect of macroeconomic policy includes financial sector supervision and accordingly the problems of currency mismatch, interest rate policy and accordingly vulnerability to carry trade and hot money destabilizing flows. Czech Republic as an economy with strong supervisory regime in place, managed to avoid excessive currency mismatch or negative balance sheet problem. Policy of low interest rates is also important because there were no incentive to engage in carry trade. The same was true, but to a lesser extent, in the case of Poland.

Besides structural characteristics and macroeconomic policy, ERR also play a role in country's vulnerability to external shocks. Fixed *exchange rate regimes* have been a pillar of economic stability since the beginning of transition process in the case of Baltic states and for Bulgaria since 1997 when it switched towards currency board arrangement. But these regimes usually encourage excessive capital inflows that in combination with undisciplined macroeconomic policy initiates RER appreciation with large external imbalance and high sensitivity to capital outflows. However, it is important to note ERR is only one factor. The relativity of this factor is proven with the fact that some of the hardest hit countries, including Ukraine, Hungary, and Romania had floating ERs. The influence of floating ER regime should be viewed in the light of more space for an adjustment process, which could be partly or even totally performed through ER depreciation, rather than deflationary adjustment process with certain output and employment loss. Contrary, fixed regimes radically limit the policy options in crisis circumstances.

Figure 1 and Figure 2 in Appendix show growth rate and inflation rate as an aspect of internal balance, and current account deficit as an aspect of external balance in selected EEEs prior and after the crisis. Figures are based on yearly data from World Economic Outlook database of the World Bank. Figure 1 shows GDP percentage change for selected EEEs in the period 2007-2012. As Figure 1 shows, in 2007 most EEEs experienced economic boom. The highest GDP growth in 2007 was in Latvia, Lithuania, Estonia, and Bulgaria (currency board countries), Russia, Poland, Croatia, Turkey, while Hungary was the exception experiencing only modest GDP growth. However, in EEEs crisis start in 2008 and in this year Estonia and Latvia experienced negative growth, while Lithuania and Bulgaria still had positive GDP growth. Other EEEs, except two Baltic States, also were on positive GDP track in 2008. The crisis transmitted to the real sector of EEEs in 2009 with different impact. The most severe output drop experienced Baltic States that previously experienced the highest overheating. Shelburne (2009) compare Baltic States and their recessionary adjustment with the US GDP fall of 29% during Great depression, and Argentina of 22% during 1998-2002 crisis i.e. with the cases of worst financial crisis of the previous century. Moderate GDP fall in 2009 was registered in Russia, Hungary, Turkey, Croatia and Bulgaria, while only in Poland GDP growth was positive. In the next year, adjustment mechanisms work out and most economies returned to positive GDP growth, while Croatia and Latvia had modest negative growth.

Overheating prior the crisis based on excessive domestic demand fueled with huge capital inflows created internal imbalance in the form of relatively high inflation rate. Higher inflation certainly means competitiveness loss, especially in the case of countries which practice fixed ERR, thus experiencing RER appreciation. Competitiveness restoring in these cases assume internal devaluation i.e. deflationary adjustment mechanism, while countries with flexible ER could restore

competitiveness via NER depreciations. Observing ERR, Aslund (2010) argue that Slovenia and Slovakia which accepted the euro in 2007 and 2009 respectively didn't experience the crisis, currency board countries (Estonia, Lithuania, Latvia and Bulgaria) experienced the biggest output slump, while EEEs with floating ERs expressed mixed results concerning crisis impact (Poland, Czech Republic, Hungary and Romania). While most overheating happened in currency board countries with consequently biggest GDP slump, positive side was successful internal devaluation (only Latvia needed IMF support) and solid fiscal policy. Regarding floating ER combined with inflation targeting monetary framework, Poland and Czech Republic are examples of successful practicing of this combination, while Hungary and Romania needed IMF support and generally fiscal policy was poorer (especially in Hungary). Figure 2 in Appendix shows inflation rate in the case of selected EEEs for the period 2007-2012. The inflation rate in 2008 was the highest in the case of currency board countries, Russia and Turkey; while it was relatively modest in Croatia, Hungary, Poland. Most countries decreased inflation level in the next year, only Turkey and Russia have kept relatively higher inflation years in the following years.

The connection between large GDP growth, relatively high inflation, then abrupt GDP and inflation fall in 2009 as a part of adjustment mechanism, is directly related with external balance. The period of boom in EEEs prior the crisis, financed mostly with capital inflows, assumed boosting of domestic demand, higher inflation, competitiveness loss, and finally external imbalance in the form of current account deficit. Capistran, Cuadra, and Ramos-Francia (2011) argue that economies with higher inflation rates and larger current account deficits prior the crisis tended to experience a greater widening in sovereign risk indicators, following the sharp increase in uncertainty in mid-September 2008. Crisis brought risk aversion among international investors that is directly connected to the size of current account deficit and the level of domestic inflation. Higher external imbalance meant that external accounts would be perceived as unsustainable with more severe negative effect, while higher domestic inflation meant more possibility of losing confidence in currency value that intensified the negative impact.

Shelburne (2009) identifies dependence on capital inflows and unsustainable current account deficits prior the crisis, as a primary vulnerability of EEEs. Figure 3 in Appendix shows current account deficit as a percent of GDP in selected EEEs in the period 2007-2012. Although current account experienced most EEEs as a general pattern (except Russia, which had current account surplus in the observed period), the specific pattern differed in relation to individual country cases. Again, currency board countries experienced the largest external imbalance, followed with modest current account deficit in the case of Croatia, Hungary, Turkey, and Poland. Baltic States in accordance to their sharp adjustment had current account surplus in the next year (as well as Hungary), while Bulgaria, Croatia, Poland and Turkey still had modest current account deficit.

3. The Model

The representation of the reduced form of the vector auto-regression model VAR(q) is:

$$Y_t = \sum_{i=1}^q A_i Y_{t-i} + e_t \quad (1)$$

Where q is the number of lags, e_t is a white noise.

In order to simplify the representation, the variables are divided into two blocks: y_{1t} represents the exogenous variable and y_{2t} the domestic variables. The error vector whose variance-covariance matrix has no restrictions, that is to say $E(e_t, e_t^T) = \Omega$ and $E(e_t) = 0$.

L is the lag operator. Consequently, the VAR(q) model can be written as:

$$A(L)Y_t = e_t \quad (2)$$

In order to obtain the shock response functions and the forecast error variance decomposition, it is necessary to write the process in the Moving Average infinite structural form. An intermediate step consists in “reversing” the canonical VAR model according to the Wold Theorem in order to obtain its moving average form:

$$Y_t = \sum_{j=0}^{\infty} C_j e_{t-j} = C(L)e_t \quad (3)$$

where e_t represents the vector of canonical innovations.

Thus, the structural Moving Average representation is:

$$Y_t = \sum_{j=0}^{\infty} \Theta_j \varepsilon_{t-j} = \Theta(L)\varepsilon_t \quad (4)$$

with

$$e_t = P\varepsilon_t \quad (5)$$

where P is an invertible matrix $n \times n$ which has to be estimated in order to identify the structural shocks². The short-run constraints are imposed directly on P and correspond to some elements of the matrix set to zero. The Θ_j matrix represents the response functions to shocks ε_t of the elements of Y_t . The different structural shocks are supposed to be non-correlated and to have a unitary variance:

$$E(\varepsilon_t, \varepsilon_t^T) = I_n \quad (6)$$

Ω is the variance-covariance matrix of the canonical innovations e_t , thus :

$$E(e_t, e_t^T) = PE(\varepsilon_t, \varepsilon_t^T)P^T = PP^T = \Omega \quad (7)$$

In the representation of the reduced form of the vector auto-regression model VAR(q), e_{it} is the vector of errors with $e_{it} = b_i + b_t + b_{it}$ with b_i the individual fixed effect, b_t the time fixed effect

and b_{it} the disturbance term whose variance-covariance matrix has no restrictions, that is to say $E(b_{i,t}, b_{i,t}^T) = \Omega$ and $E(b_{i,t}) = 0$. The vector of canonical innovations $b_{i,t}$ is supposed to be a linear combination of the structural impulses $d_{i,t}$ at the same time³. Thus $b_{i,t} = Pd_{i,t}$.

The contemporaneous restrictions

$$\text{Let } Y = \begin{pmatrix} EXT \\ GDP \\ R \\ FOREX \\ REER \\ FA \end{pmatrix} \text{ the vector of endogenous variables, and } \varepsilon_t = \begin{pmatrix} \varepsilon_{ext} \\ \varepsilon_{rs} \\ \varepsilon_{ms} \\ \varepsilon_{mp} \\ \varepsilon_{rd} \\ \varepsilon_{fi} \end{pmatrix} \text{ the vector of structural}$$

shocks, where ε_{ext} represents the international shock and ε_{rs} , ε_{ms} , ε_{mp} , ε_{rd} and ε_{fi} are respectively the real supply, money supply, monetary policy, real demand and financial shocks.

We use five variables as proxies of external shocks. As a proxy for external real shock we employed GDP of G7 group (G7_GDP). As a proxy for external financial shocks we used Emerging Market Bond Index (EMBI), VIX (implied volatility of S&P 500 USA stocks), realized volatility of MSCI of G7 group (RV_G7) and MSCI of Emerging Markets (RV_EM), and USA interest rate (US_R). As domestic variables are analyzed domestic GDP (GDP), financial account excluding FDI as a ratio to GDP (FA), interest rate (R), foreign exchange reserves (FOREX), and real effective exchange rate (REER). The influences of mentioned external shocks are tracked during four quarters since the shock impact to respective domestic variables in the first and the second crisis period.

The purpose is to study the monetary, real, and financial impact of real and financial international shocks. More precisely, the model can underline if the international crisis revealed by extreme fluctuations on the financial markets and a decrease in global production spreads from the financial to the real sphere of these economies.

The variables are used in logarithm form, except for the interest rate. They are seasonally adjusted. It is not necessary to test the stationarity and the cointegration of the model's variables by following the postulate of Sims (1988) and Sims and Uhlig (1991) because a Bayesian inference is used and the model is not then affected by the presence of a unit root.

We impose only contemporaneous restrictions in our model. Our objective is to identify the n^2 elements of the P matrix. The Ω matrix is symmetric; consequently $\frac{n(n+1)}{2}$ orthogonalization constraints have already been imposed. It is necessary to determine the 15 remaining constraints, in reference to the economic literature. Firstly, we consider the variables of volatility to be exogenous in the short term (Mackowiak 2007). Secondly, we follow the postulate of Sims and Zha (1999) and Kim and Roubini (2000) who believed that the monetary authority's function of reaction, that is to say the interest rate, does not react immediately to a shock in production because of information delay. Moreover, the hypothesis of a lag in the response of the interest rate to a shock of foreign

³ For more details, see Gimet and Lagoarde (2010).

reserves and a lag in the response of economic activity to financial disturbances (national and international), to a monetary shock and to a real exchange rate shock are retained (Sims and Zha, 2006; Kim 2005; Kim and Roubini 2000). The foreign exchange reserves are supposed to be impacted by real supply and demand shocks only with a lag (Kim 2005; Calvo Leiderman and Reinhart, 1993). Finally, the real supply shock does not impact the real exchange rate in the short term (Mackowiak 2007).

Following the Schwartz, Akaike and Hannan-Quinn tests, two delays were selected for all models⁴. In addition, further tests have to judge the lack of residuals autocorrelation.

4. The Results of External Shock Transmission

In analysis of specific country cases in EEEs sample, we try to answer to the following questions: (i) which external shock dominantly influenced variations in domestic GDP and financial (in)stability, and has vulnerability to different types of external shocks been increased or decreased in the second compared to the first crisis period; (ii) how instruments of monetary policy, namely interest rate and foreign exchange reserves, were influenced with different types of shock in the first and second crisis period; (iii) how real exchange rate as an adjustment mechanism reacted to specific external shocks, which shock was the most relevant; how the shock composition changed in the second compared to the first crisis sub-period; (iv) where is the position of the country compared to other countries regarding influence of external real and financial shocks to the real and financial stability, as well as macroeconomic policy response to the shocks.

Tables 1-5 in Appendix show the results of variance decomposition of Estonian, Lithuanian, Latvian, Bulgarian, Polish, Czech and Hungarian real economic activity (GDP), financial account excluding FDI (FA), interest rate (R), foreign exchange reserves (FOREX), and real effective exchange rate (REER, as response to all observed external shocks during 4 quarters after the external shock impact. Real external shock is observed through changes of G7_GDP, while financial external shocks are observed as changes in EMBI, VIX, RV_EM, RV_G7, and US_R.

4.1 Baltic Countries: Estonia, Lithuania, Latvia and Bulgaria

Under crisis circumstances, Baltic economies which externally-financed domestic demand boom experienced abrupt output collapse that bring back an income level to the 2005/06 levels. Real economy was primarily affected through domestic demand channel and export channel (Purfield and Rosenberg 2010). Domestic demand channel worked via “sudden stop“ in banks’ credit expansion, investor and consumer shaken confidence, sharp decline in government spending, and further weakening of private demand through nominal wage cuts and unemployment rise. Export channel worked via main trading partners which were also hit (although not equally) with crisis shocks and through the fact that currencies of trading partners significantly depreciated inducing real exchange rate appreciation for Baltic economies. Purfield and Rosenberg (2010), however, conclude that export channel (although the fall in export wasn’t negligible, 27% between 2008Q3 and 2009Q3) wasn’t crucial reason for GDP fall, but primarily domestic demand.

The costs of internal adjustments in Baltic economies are related with their rigid exchange rate to euro and impossibility of depreciation and automatic competitiveness improvement (Frankel and Saravelos 2010; Popov 2010; Purfield and Rosenberg 2010). Popov (2010) argues that Estonia, Latvia and Lithuania experienced the largest output fall in the period 2007-2009 in range 12%-22%

⁴ Except for the models by country with the variables RV_G7 and RV_EM which required only a lag.

not because of trade and capital account shocks, but above all due to exchange rate policy and obligation to preserve the rigid parity. Adjustment strategy of Baltic economies was notably relied upon contractionary fiscal and nominal wage policies, contrary to nominal ER adjustment. Adjustment process under rigid ERR assumed internal devaluation⁵ via fiscal and nominal wage cuts that made a progress but with clear real economy sacrifices. Adjustment progress is reflected in reduced fiscal deficits to pre-crisis level, disappearance of external imbalances and inflation, maintained confidence in ER parity, and improved competitiveness. However, unavoidable costs of adjustment process⁶ were reflected in unemployment surge and wage fall.

Currency board countries differed according to the crisis impact and macroeconomic policy responses. Thus, Bulgaria as an economy also operating under currency board, experienced rather milder crisis impact and macroeconomic response compared to Baltic countries. Although main difference is observable in relation Baltic countries – Bulgaria, Baltic economies also differed in crisis impact and policy responses. Country cases follow our general discussion.

Estonian Case

The crisis impact to Estonian economy was among the strongest between observed EEEs, together with the cases of Latvia and Lithuania. Baltic States which used currency board since the beginning of the transition process, experienced most severe crisis consequences to their domestic economic activity. Internal imbalance was reflected in relatively highest level of inflation before the crisis compared to other EEEs, which in the combination with rigid exchange rate initiated competitiveness loss with large current account deficit. Internal deflationary adjustment was unavoidable during crisis. Observing another aspect of internal balance, Estonian economy experienced a severe recession following credit boom prior the crisis. Domestic demand started to slow already in 2007 and GDP dropped around 5% 2007 (Latvia and Estonia were only countries which experienced negative growth in 2007 before the crisis hit other EEEs). Demand decrease is was firstly connected with a bursting of the property bubble, then with common cause for all EEEs i.e. the collapse of global financing and trade in the aftermath of the Lehman bankruptcy in September 2008. GDP dropped by about 14% in 2009, while unemployment rose from 5.5% in 2008 to 13.8% in 2009. Positive aspect in this story is certainly high flexibility of “Baltic tigers” and accordingly their capability to cope with external shocks and parity maintenance via internal adjustment. Previous imbalances were corrected quickly with demand slump and internal adjustment. Namely, inflation significantly dropped from 10% to deflationary -0.09%, competitiveness improved and current account balance restored from -9.7% in 2007 to 4.5% in 2008; GDP growth recovered with 3.1% in 2010, 6.5% in 2011 and estimated 4% in 2012.

Our results (see Tables in Appendix) indicate that Lithuanian real activity was more vulnerable to all types of investigated external shocks in the second compared to the first crisis period. This is the case for real external shock transmission, where in the first crisis period the percent of GDP variations explained with G7_GDP shock was 15% in the first quarter with decreasing effect to 6% after a year, while in the second crisis period the shock influence was 46% with increasing effect to 63% of GDP variations after 4 quarters. Besides real external shock,

⁵ Purfield and Rosenberg (2010) under the term “internal devaluation” assume: fiscal adjustment, nominal wage adjustment, financial stability preservative, private corporate and households balance sheet reparation.

⁶ Adjustment was extremely socially costly in the Baltic states, which attempted to defend their fixed exchange rate arrangements through public spending and wage cuts. “In June 2009 Latvia, the worst hit country, implemented spending cuts and tax increases of €712m, designed to reduce the budget deficit by 10 percent of GDP in the next three to four years. It cut wages in the public sector by almost 40 percent and reduced pensions by 10 percent. It also reduced benefits and increased payments in health care.” (Shelburne 2009).

external financial shocks almost identically caused GDP variations in the second crisis period: EMBI shock 33-66% within four quarters (compared to 1.6-37% in the first crisis period), RV_EM shock 38-73% (compared to 12-34% in the first crisis period), RV_G7 shock 38-74% (compared to 5-31%), VIX shock 23-43% (27-6% in the first crisis period) and US_R shock 13-42% (29-14% in the first crisis period).

Financial stability observed via financial account (excluded FDI) changes was threatened in lesser extent compared to Estonian GDP. While external shocks initiated between 48-69% of GDP variations, FA variations were explained between 4-34% with different external shocks (VIX and EMBI shock, dominant in the first crisis period, were significantly lowered in the second crisis period). Compared to other investigated EEs, Estonia belong to the group with the highest vulnerability of GDP to all types of external shocks in both crisis periods, but with the lowest influence of external shocks to financial account variations in the second period (in the first period, higher vulnerability was related with EMBI and VIX shock, but it was reduced in the second one).

Estonian interest rate changes were mainly explained with external financial shocks in both crisis periods, with less influence of real external shock to interest rate variations. Interest rate mostly reacted to EMBI shock in the second crisis period, VIX in the both periods, RV_G7 and RV_EM in the first crisis period. Foreign exchange reserves were less explained with G7_GDP shock, VIX shock, RV_EM shock, and more with US_R shock in the second compared to the first crisis period. Foreign exchange reserves were more used to withstand the shocks in the first crisis period when Estonia belong to the group with the highest variations of foreign exchange reserves as a response to different external shocks, while in the second crisis period in general decreased use of foreign exchange reserves. Real exchange rate variations were higher in the first compared to the second crisis period with strong decrease in VIX, RV_G7 and RV_EM influence who caused up to 48% of REER variability in the first crisis period. REER variability was mostly related to VIX, RV_G7, RV_EM external financial shocks in the first period, but similar as reaction of interest rate and foreign exchange reserves, REER reaction to these shocks dropped in the second period. Less response of REER to external shocks point to less flexibility and more painful adjustment mechanism in the second crisis period.

Results indicate that Estonian domestic activity was severely hit with different types of external shocks in the second crisis period. Vulnerability of Estonian GDP strongly increased in the second compared to the first crisis period to all types of external shocks. However, according to increasing vulnerability of GDP to different external shocks, interest rate and foreign exchange reserves were not used more to withstand different shocks in the second period. Although, interest rate reacted to some types of external financial shocks, foreign exchange reserves were less used than in the first period. These results indicate that internal adjustment mainly performed through fiscal measures through price and wage cut. Relatively weak response of REER as an important buffering adjustment mechanism in the second crisis period points to rigidly fixed NER, slower price adjustment compared to NER, and recessionary effect and price adjustment in main trading factors due to global slump.

Lithuanian Case

After years of strong growth along with widening macroeconomic imbalances during boom period, reversal in capital flows has initiated sharp contraction and adjustment in the Lithuanian economy. Sharp adjustment was reflected in rapid drop of Lithuanian GDP from 2.9% in 2008 to -14.7% in 2009. Gross domestic product recovered in 2010 with 1.3% GDP growth. Widening imbalances included relatively high and unsustainable inflation which rose from 5.8% in 2007 to 11.2% in 2008, however with decreasing tendency to 4.2% in the following year due to recessionary adjustment

mechanism. Concerning external imbalance the situation was similar to other currency board countries. Namely, current account deficit existed in the year prior the crisis (-14.6%) and in crisis 2008 year (-13.4%) with correction in 2009 to 4.5% of GDP due to deflationary adjustment. Besides export drop due to external trade shock, domestic demand dropped due to internal adjustment performed via rise in unemployment, wage decrease, tightened credit conditions, declining asset values, which all together decrease private sector investment and consumption.

The results presented in Tables 1-5 in Appendix reveal that the influence of G7_GDP, EMBI, RV_EM and EV_G7 external shocks significantly increase in explanation of Lithuanian GDP variations, while influence of VIX and US_R shocks decreased. Lithuanian GDP was more vulnerable in the second crisis period which particularly holds for real external shock explaining 20-70% of GDP variations within three quarters (compared to 22-23.5% in the first crisis period), EMBI shock explaining 18-75% within three quarters (compared to 14% in the first crisis period), RV_G7 3.5-74% (compared to 16-12% in the first crisis period), RV_EM 4-72% (compared to 6.5-31% in the first crisis period). Financial account changes were more influenced with EMBI 42% in the impact with decreasing effect to 10% after three quarters (compared to 1.6-4.3% in the first period), VIX 27-19% (compared to 2.8% in the first period), RV_G7 38%-49% (compared to 0-10% in the first period), RV_EM shocks in the second period 26-30% (1-25% in the first period), while the influence of US_R shock dropped (from 11-38% in the first to 1-4% in the second period). Overall, Lithuanian interest rate more reacted to external shocks in the second crisis period which is compatible with the fact that Lithuanian real and financial sector were more exposed and hit with real and external shocks in the second crisis wave. Interest rate mostly reacted to real external shock in the second crisis period 2-54% during four quarters (compared to 14-9% in the first period), as well as RV_G7 2-58% (compared to 1-4% in the first period) and RV_EM shock 0-34% (compared to 2-4% in the first period). As the interest rate, foreign exchange reserves were also more used in the second crisis period, again dominantly as a response to real external G7_GDP shock 43-60% during four quarters (compared to 10-27% in the first period) and to external financial EMBI shock around 45% one year since shock impact (compared to 27-22% in the first period). FOREX were less explained with VIX, RV_G7 and US_R shock. REER variations were less explained with most external shocks (the exception is RV_G7 shock) in the second crisis period that especially holds for the strongest external shocks RV_G7 and EMBI. This result indicate weakened capability of one of currency board countries to cope with external shocks with NER depreciations, but rather with internal deflationary adjustment accompanied with sharp output and employment fall.

In comparison with other EEEs, Lithuania followed the path of other currency board countries Estonia and Latvia. Namely, while it belonged to the group with lower GDP variations as a response to G7_GDP, EMBI, VIX, RV_EM and RV_G7 shocks (the exception is US_R shock where the vulnerability is significantly decreased in the second crisis period) in the first crisis period, in the second crisis period the situation is reversed. The same holds for financial account vulnerability meaning that FA changes were more under influence of external shocks in the second crisis period (exception is again US_R shock), especially G7_GDP, EMBI, RV_G7 and RV_EM in the second crisis period where Lithuania belonged to the group of most influenced economies. Concerning the use of interest rate as an answer to different shocks, Lithuania more used interest rate in the second crisis period compared to the first one when its vulnerability was lower. According the usage of interest rate in the second crisis period as a response to G7_GDP and RV_G7 shock Lithuania was on the first place, belonging also to the group with relatively high usage of interest rate as a response to EMBI shock, and relatively low usage of interest rate as response to US_R and VIX shocks (in accordance with weakened influence of these shocks in the second crisis period). Observing the usage of foreign exchange interventions as a response to different shocks

compared to other EEEs, Lithuania belong to the group with higher response in the case of G7_GDP (in both periods) and EMBI shock (in the second crisis period), while as expected the response to VIX and US_R shock was lowered as in the case of interest rate and in accordance with shocks' lower impact to GDP and financial stability. Respecting REER variations, Estonia generally reflected weak adjustment via REER compared to other EEEs in both crisis periods with the exception of real external shock in the first crisis period with decreased impact in the second crisis period.

Latvian Case

In the years that followed Latvia's acceptance into the EU, the economy experienced a huge boom period with 10% of GDP growth rate. However, during the overheating period large macroeconomic imbalances were creating. Like in many EEEs, continued strong credit growth (bank credit to the private sector reached 95% of GDP in 2007; data from Andersen 2008) with boosting effect to aggregate demand, also boosts private external debt (amounting to about 130% of GDP; data from Andersen 2008), with negative effect to external equilibrium (current account deficit amounted -22.3% of GDP in 2007). Mentioned circumstances prior the crisis, made Latvia extremely vulnerable to the credit crunch since capital inflows financed the boom. The overheating proof is reflected in 10% of inflation rate in 2007 and 15% in 2008 (Figure 2). High inflation in combination with currency board regime meant real exchange rate appreciation and competitiveness loss, together with the fact that capital inflows were directed to non-tradable sector such as financial services, retail and real estate. While financial and housing market could support growth in short run, it certainly doesn't create income necessary to service accumulated external debt. Given described key points of Latvian vulnerability to external shocks, Latvia was most negatively hit with the crisis experiencing the largest GDP adjustment with the drop from 10% in 2007 to -4.2% in 2008, and -18% in 2009. Inflation also sharply dropped from 15% in 2008 to 3% in 2009. Current account improved from -22% in 2007 to -13% in 2008 and 8.6% of GDP in 2009 as a reflection of improved competitiveness due to price and wage fall, as well as generally decreased demand due to sudden stop problem.

The results of our research (see Tables in Appendix) indicate that Latvian real economic activity was increasingly vulnerable to all types of investigated external shocks (except VIX shock which significance is similar in both period) in the second compared to the first crisis period. In the first crisis period external shocks caused at most 25% of GDP variations, while in the second crisis period they initiated up to 68% of GDP variations. Namely, in the second crisis period variations of Latvian GDP was explained 27-54% (during four quarters since the shock arise) with real external shock (compared to 7.5% in the first crisis period), 10-54% with EMBI financial external shock (compared to 0-11% in the first period), 13-68% with RV_G7 external financial shock (compared to 2-8% in the first period), 1-27% with RV_EM external financial shock (compared to 1-3% in the first crisis period), 27-54% with US_R external financial shock (compared to 20-14% in the first crisis period). Therefore, GDP activity was increasingly exposed to external shocks in the second compared to the first crisis period, the most to RV_G7, G7_GDP and US_R shocks initiating more than 60% of Latvian GDP variations.

Beside the rising vulnerability of real economic activity to real and financial external shocks, the same conclusion holds for financial stability or changes of financial account (excluding FDI) to GDP. Financial stability was increasingly exposed to different external shocks explaining up to 52% of FA variations, while in the first crisis period at most 15% of FA variations were explained with different external shocks. More concretely, FA variations in the second crisis period in Latvia were explained with 17-30% with real external shock (compared to 0-0.4% in the first period), 38-14%

with EMBI shock (compared to 9-13% in the first crisis period), 14-25% with VIX shock (compared to 4-5% in the first period), 17-53% with RV_G7 external shock (compared to 5-15% in the first period), 4-9% with RV_EM shock (compared to 0-14% in the first period), 17-30% in the first period (compared to 7% in the first period). Hence, the strongest shock to financial instability were financial external shock RV_G7 initiating more than 50% of FA variations, followed with EMBI and real external shocks initiating between 31-38% of FA instability.

The response of economic policy in the second crisis period, having in mind increased vulnerability of real and financial stability in Latvia, mostly relied upon foreign exchange interventions whose role rapidly increased in the second crisis period as a response to all types of external shocks. Nevertheless, foreign exchange interventions were combined with interest rates which role moderately increased as an answer to three types of external shocks in the second compared to the first crisis period (G7 GDP from 2% to 21-12%, VIX from 0-7% to 16-19% and US_R from 7-4% to 21-12% of interest rate variability during four quarters). More reliance upon foreign exchange interventions in the second crisis period is observable in the fact that external shocks explained at most 40% of interest rate variability and 70% of FOREX variability. Concerning FOREX variability in the second crisis period, it is mostly influenced with G7_GDP and US_R external shocks with around 62% after four quarters (compared to 3% for G7_GDP and 39% for US_R in the first crisis period); follows VIX with 54% after four quarters (compared to 3% in the first period), EMBI 50% after two quarters (compared to 12% in the first period after four quarters), RV_G7 with 44% after four quarters (compared to 19% in the first period). Contrary to other currency board cases, REER variations increased as an answer to specific types of external financial shocks (VIX, RV_G7 and RV_EM), and decreased as an answer to real external shock, EMBI and US_R financial shocks. Increased REER variability for certain types of external shocks point to higher internal flexibility of Latvian economy in the case of necessity of internal adjustment process under rigid ER arrangement.

4.2 The Case of Bulgaria

The impact of the global economic and financial crisis on the Bulgarian economy has been severe, however not so severe as in the case of other currency board countries. Concerning internal balance, inflation has declined from 7.4% in 2008 to -0.4% in 2009 from one side, while real economy has been threatened with the sharp drop of domestic demand. Firstly, domestic demand has been decreased having in mind sharp drop in capital inflows which has led to near-halt of credit growth from one side, while trade shock assumed reduced exports (from 11.5% in 2008 to -10%) due to recession in Bulgaria's trading partners. Consequently, Bulgarian GDP dropped to -5.5% in 2009 from 6.2% in previous year. External balance improved having in mind that current account deficit has dropped from -23% in 2008 to -9% in 2009 respecting, above all, decreased import from 4% in 2008 to -23% in 2009. For more details, see IMF, World Economic Outlook, yearly data.

Bulgaria started the downturn with public sector buffers and private sector vulnerabilities. The public sector buffers included high foreign exchange reserves, large fiscal surplus, and sizeable reserves in the fiscal reserve account. From the other side private sector vulnerabilities assumed considerable private sector external debt at around 100% of GDP at the end of 2008, above all, due to rapid credit growth and large capital inflows. Bulgarian financial system was estimated as relatively healthy with high capital adequacy ratio of the banking system (17.6% as of end-June 2009). According to IMF Country Report details, banking sector remained profitable on average during the first half of 2009, despite the rise in provisioning for non-performing loans. For other details, see IMF Country Report for Bulgaria for the period 2008-2011.

Peshev (2010) argue that Bulgarian economy was hardly hit, but not as much as the Baltic States, because it was later recognized as a hot investment spot and because low wages in the countries kept its attractiveness for FDIs. Quite the opposite, wages in Estonia, Latvia and Lithuania were converging to the EU average levels very fast during the boom period and global economic recession caught the economies of Estonia, Latvia and Lithuania with lowered competitiveness. Peshev states that salaries in Bulgaria are close to 50% of Latvian and Lithuanian level and about 40% of Estonian wages. Returning economy on a competitive path can be accomplished either through devaluing national currency or through a process of internal devaluation, which is a synonym of wage cuts in the public and private sector, decrease in government spending, and overall costs optimization. Devaluing the currency in each of the four countries for recovering competitiveness is not an option at all, because of their high currency mismatching problem. While Baltic States experienced severe internal adjustments through wage reduction in the public and private sectors in order to restore economic competitiveness, this wasn't the case with Bulgaria because of the much lower wages in the country compared with salaries in the Baltic region, and because of the less severe recession. Denominated in foreign currency loans of firms and households, compared to GDP are with highest value for Latvia and lowest for Bulgaria. Lending penetration in the Baltic region was much deeper than in Bulgaria, because SEE region was recognized much later as a hot investments destination.

Our results indicate (see Tables 1-5 in Appendix) that Bulgarian GDP was dominantly disturbed with real external shock explaining more than 50% of GDP variations. The vulnerability of Bulgarian GDP to external shock generally increased, especially in the case of G7_GDP shock. Opposite to real channel of crisis transmission, Bulgaria decreased its vulnerability observing financial account variations or financial instability. Although the exposure of FA to external shocks was at most 30% of FA variations in first crisis period (less than GDP disturbance), the vulnerability of FA changes decreased to G7_GDP, EMBI and RV_EM which were the most influential in the first crisis period. Although, there wasn't significant changes concerning the use of interest rate to withstand the external shocks in observed periods, external shocks in both crisis periods determinate at most 25% of interest rate changes. However, if we observe FOREX variations, it was mainly used to buffer real external shock (more than 50% of FOREX variations) that is compatible with the finding that Bulgarian GDP was increasingly threatened with this type of shock. The most important external financial shock respecting FOREX variations was VIX shock in the second crisis period (40% four quarters after shock arise). REER variations are smaller in the second crisis period, which is expected having in mind that first two years of our first crisis period, Bulgaria didn't practice currency board regime, consequently experienced higher NER variations. However, comparing the influence of external shock to REER in the second crisis period, the most influential is real external shock explaining slightly above 10% of REER variations.

Compared with other countries, Bulgarian GDP did not vary rapidly and sharply observing both periods. Concerning financial (in)stability, although in the first crisis period belonged to more vulnerable country group, it significantly decreased its vulnerability in the second crisis period rather belonging to less vulnerable country group. Bulgaria did not intensively used interest rate to buffer the external shock compared to other countries, however, in using FOREX to withstand to real external shock in the second crisis period it belonged to the country group with relatively high usage of this monetary instrument. In REER variations, Bulgaria belongs to the country group with the least REER variations in both periods with less variations in the second crisis period.

4.3 General Remarks on Currency Board Cases

Estonian domestic activity was severely hit with different types of external shocks in the second crisis period. Vulnerability of Estonian GDP strongly increased in the second compared to the first crisis period to all types of external shocks. Estonia belong to the group with the highest vulnerability of GDP to all types of external shocks in both crisis periods, but with the lowest influence of external shocks to financial account variations in the second period. However, according to increasing vulnerability of GDP to different external shocks, interest rate and foreign exchange reserves were not used more to withstand different shocks in the second period. Although, interest rate reacted to some types of external financial shocks, foreign exchange reserves were less used than in the first period. These findings indicate that internal adjustment mainly performed through fiscal measures through price and wage cut. The results of REER variability, as an important buffering adjustment mechanism, point to rigidly fixed NER with relatively slower price adjustment compared to NER, which in combination gives less REER response to external shocks.

Lithuanian domestic activity and financial stability was more vulnerable in the second crisis period, which particularly holds for real external shock. Lithuanian monetary policy reacted more, with both explored instruments, in the second compared to the first crisis period for all types of external shocks (but especially real external shock) which is compatible with the fact that Lithuanian real and financial sector were more exposed and hit with real and external shocks in the second crisis wave. Compared to Estonia, monetary policy response to external shocks was stronger. REER variations were less explained with most external shocks in the second crisis period that indicate weakened capability of one of currency board countries to cope with external shocks with NER depreciations, but rather with internal deflationary adjustment accompanied with sharp output and employment fall.

Latvian real economic activity and financial stability was increasingly vulnerable to all types of investigated external shock in the second compared to the first crisis period. The response of economic policy in the second crisis period, having in mind increased vulnerability of real and financial stability in Latvia, mostly relied upon foreign exchange interventions whose role rapidly increased in the second crisis period as a response to all types of external shocks. Nevertheless, foreign exchange interventions were combined with interest rates which role moderately increased as an answer to certain types of external shocks in the second compared to the first crisis period. Contrary to other currency board cases where REER variability decreased in the second crisis period as a response to different external shocks, increased REER variability in Latvia as response to certain types of external shocks, point to relatively higher internal flexibility via fast and sharp price adjustments under internal adjustment process.

Bulgarian domestic activity did not vary rapidly and sharply observing both periods. Concerning financial (in)stability, although in the first crisis period belonged to more vulnerable country group, it significantly decreased its vulnerability in the second crisis period rather belonging to less vulnerable country group. Bulgaria did not intensively used interest rate to buffer the external shock compared to other countries, however, in using FOREX to withstand to real external shock in the second crisis period it belonged to the country group with relatively high usage of this monetary instrument. Observing REER variations, Bulgaria belongs to the country group with the least REER variations in both periods, with even fewer variations in the second crisis period.

4.3 The Case of CE-3: Poland, Czech Republic and Hungary

Poland

Poland had the most favorable macroeconomic indicators prior the crisis, and accordingly the least suffered from the crisis impact. Figures 1-3 in Appendix clearly point to relatively favorable macroeconomic indicators related to internal balance in the form of GDP growth and inflation rate, and external (im)balance in the form of current account deficit. Poland was the only EEE to have escaped the recession in 2009. GDP growth was positive, 1.6% in 2009, while in the previous years also experienced relatively strong GDP growth, 6.8% in 2007 and 5.1% in 2008 (see Figure 1). Having in mind relatively resistant Polish growth during crisis, we could suppose that inflation rate and current account deficit were under control compared to other countries. And they were. Figure 2 suggests that Poland, compared to other EEEs, experienced the lowest inflation rate 2.5% in 2007, 4.2% in 2008 and 3.5% in 2009. Also, Figure 3 suggests that external imbalance was pretty moderate compared to other countries, -6.2% in 2007, -6.6% in 2008, -4% in 2009. True, only Russia have had positive balance due to oil exporting position during the period 2007-2012. And Latvia, Lithuania and Estonia abruptly reversed its external position to surplus in 2009 due to sharp adjustment process. Poland obviously didn't experience severe internal adjustment as Baltic states that is certainly related to two facts: firstly, to the fact that it has had relatively favorable macroeconomic fundamentals; and secondly, to the fact that Poland has practised floating ERR under which internal adjustment is not the only option. Since all currencies of EEEs that fluctuate on foreign exchange market experience depreciations, Poland also benefited from a weak currency with zloty depreciation of some 50% against the euro in 2008. Zloty weakening increased export demand by 10.5% in the crisis period with investment also growing at a strong 8.7%. For more details, see IMF Country Reports for Poland in the period 2008-2011. IMF in Country Reports for Poland states that Poland has weathered the global crisis well compared to other European countries. Main reasons for such positive outcome are reflected in large domestic market and limited reliance on exports, well-capitalized and profitable banking system, along with limited pre-crisis imbalances and the flexible ER policy which provided adequate space for significant monetary and fiscal stimulus as the key factors preventing Poland from falling into recession.

Table 1 in Appendix shows that Polish economy was less vulnerable to external real shock, EMBI and VIX shocks in the second compared to the first crisis period, and slightly more vulnerable to certain types of external financial shocks (RV_EM, RV_G7 and US_R). Comparison of GDP response to G7_GDP real external shock between EEEs clearly shows that Poland belong to less vulnerable economies in the first crisis period and it was the least influenced with real external shock in the second crisis period. The same conclusion holds for EMBI financial shock. Concerning VIX external shock, Poland was the most affected with this type of financial shock in the first crisis period, while in the second crisis period the transmission of this shock to Polish GDP sharply reduced, therefore Poland was the least affected EEE with VIX shock in the second crisis period. Although the influence of RV_EM, RV_G7 and US_R financial shocks slightly increased in the second crisis period, in both periods Poland belong to the EEE country group the least hit with these shocks. As main macroeconomic indicators shows at Section 2, Polish real sector was the least vulnerable and hit with all types of external shocks, especially in the second crisis period.

Similar conclusion could be derived if we observe financial instability or the influence of external shocks to financial account changes (Table 2 in Appendix). Poland reduced vulnerability of FA to real external shock (although it was already at low level in the first sub-period), EMBI, VIX, RV_M and US_R. Only for RV_G7 financial stability was threatened more in the second crisis

period. Comparison with other EEEs indicate that Poland belong to the country group where financial stability was relatively less influenced to all types of external shocks in the second crisis period. Indeed, Poland belong to the group more exposed to VIX and US_R, however this exposure is abruptly lowered in the second crisis period.

Interest rate (Table 3) and foreign exchange reserves (Table 4) were less used in the second crisis period to withhold the external shocks. The variations of Polish interest rate and foreign exchange reserves were less as a response to G7_GDP, EMBI, VIX, RV_EM and US_R shock. Expectedly, since RV_G7 influence to the real and financial Polish stability increased, the changes of monetary instruments were more explained with this type of external financial shock in the second crisis period. Less transmission of most external shocks to interest rate and FOREX changes are understandable having in mind less vulnerability of Polish economy and relatively mild crisis impact. Also, this finding is in line with previous finding in Josifidis, Allegret, and Beker Pucar (2011a) that Poland is the most successful inflation targeter regarding the role of ER in monetary framework. Poland was proved as the country that the least manage the NER fluctuations compared to others inflation targeters in Emerging Europe, directly via foreign exchange interventions and indirectly via interest rate changes. Polish less need to manage NER fluctuations is related with the fact that ER pass-through is relatively low (the least open economy with large domestic market, thus with lower import and risk or ER transmission to inflation) and that currency mismatch problem (like in the case of Czech Republic) is rather constrained and limited.

Having in mind higher NER flexibility in in observed period⁷, we could expect higher REER variations and higher possibility of adjustment via nominal ER fluctuations. The results (see Table 5 in Appendix) indicates that generally REER variations expectedly increased in the second crisis period. The exemption is the response of REER to real external shock and US_R as external financial shock which could be observed in the light of relatively weak transmission of these shocks to real and financial activities in Poland.

Hungary

Hungarian GDP growth was the lowest in 2007 and 2008 compared to other EEEs, 0.8% in both years. Real activity drop in 2009 was -6.7% with further pretty modest recovery of real activity in the following years (1.2% in 2010, 1.8% in 2011 and 1.7% in 2012, see Figure 1). Inflation and current account deficit (Figures 2 and 3 respectively) as a general pattern of EEEs also existed in Hungary, however, although these imbalances were higher compared to the successful Polish story, they were far from dramatic imbalances in the case of currency board countries.

However, among Central European countries, Hungary appeared to be the most susceptible to the global financial crisis. Compared to Hungary, Polish economy is less dependent on global markets with much sounder macroeconomic fundamentals. Crucial indicators of Hungarian vulnerability to crisis impact were certainly huge foreign debt of all sector of the economy. In total 30% of public debt and 60% of corporate and individual loans were denominated in foreign currency. The private economy is highly euroized (both on the asset and liability side) with 20% of deposits in foreign currency, above 60% of foreign currency liabilities of households, while for corporations it amounted to around 25% (Carare and Popescu 2011). This fact made Hungarian

⁷ Since 1995 Polish monetary authorities used intermediate ERR in the form of a crawling corridor with band widening. Managed floating ERR in the combination of inflation targeting monetary framework was accepted since 2000. For more details about changes in ER policy and monetary frameworks since the beginning of transition until the end of 2010 in the cases Poland, Czech Republic, Hungary, Slovakia, and Serbia, see Josifidis, Allegret, and Beker Pucar (2011a).

economy vulnerable to investors' sentiments, to speculative attacks to forint value (opposite to other CE-3 countries who experienced nominal appreciation in the years prior the crisis), as well as stock market indices changes. Although capital inflows and credit boom as a way to finance economic growth in Emerging Europe is actually a general pattern, the distinction between Hungary and other Visegrad countries (Poland, Czech Republic, and Slovakia) is that Hungary used loans for consumption (as Baltic states), while previous group of countries used loans to boost export and competitiveness. Except high currency mismatch problem and problematic loan direction, Hungary has already problems with fiscal imbalance i.e. higher government debt (90% of GDP) and budget deficit with systematically higher government bond yields and country risk premium than other Visegrad countries. For more specific details concerning Hungarian economy see Carare and Popescu (2011) and IMF Country Reports for Hungary.

Contrary to Polish case, Hungarian real economy vulnerability to all types of external shocks strongly increased in the second crisis period (see Table 1 in Appendix). According to results, it seems that Hungarian financial account was less vulnerable to external shocks in the second compared to the first crisis period, except in the case of RV_EM external shock. Hungarian interest rate was more adjusted as an answer to EMBI, RV_G7, RV_EM and US_R external financial shock, and less adjusted as a response to real external shock. Concerning the usage of foreign exchange reserves, there is no significant distinction between the sub-periods. Foreign exchange reserves were moderately used to withstand the external shocks, while Hungary more used interest rate to respond to different external shocks (G7_GDP in the first crisis period, EMBI in the second crisis period, VIX in the first crisis period, RV_EM in the second crisis period, US_R in both crisis period) compared to other countries. REER variability wasn't crucially changed in the second crisis period when NER was more flexible in Hungary. It should be noted that NER flexibility was more constrained in Hungary compared to other CE-3 countries, since Hungarian monetary authorities practiced crawling peg in the period 1994-2001 covering our first crisis episodes, 2001-2008 crawling corridor covering most of our second crisis period, and only in 2008 officially switched to floating ERR. The results in Table 5 suggest that REER flexibility isn't dramatically changed as a response to real external shock and EMBI, while the response to US_R shock decreased. Nevertheless, REER flexibility increased as an answer to VIX, RV_EM and RV_G7 shock. Comparison with other countries suggests that Hungary belonged to the group of countries with relatively higher REER variability as a response to RV_G7 in both crisis periods, EMBI in the second crisis periods, VIX in the second crisis periods, RV_EM in the second crisis period, and US_R in the first crisis period. This result indicates that Hungary retained adjustment potential in the second crisis period due to higher ER flexibility.

Czech Republic

The Czech Republic is export-oriented, small open economy. Presumably, it was likely that the economic crisis would spillover into the Czech economy through export drop. As Tvrdon (2010) states, the Czech economy is one of those most closely integrated with "old" EU Member States and one of the main channels through which the global economic crisis has affected the Czech economy is trade channel and this dependence on foreign markets seems to be the main cause of macroeconomic vulnerability. Therefore, the main weaknesses of the Czech economy were limited internal market (contrary to Poland) and high taxation burdens. From the other side, there were more strengths of the Czech economy reflected in high productivity and industrial competitiveness, high investment attractiveness and financial reliability, improved fiscal performance and low government debt, low private debt, credible inflation targeting resulting in low inflation and interest rates, liquid and conservative banking sector which limited build-up of balance sheet vulnerabilities.

Large FDI inflows fostered trade integration, underpinning an export-led expansion that created environment for real convergence. Despite the fact that macroeconomic position of Czech Republic was strong due to good macroeconomic performance and the stable banking sector, the Czech economy has been impacted by spillover effects from the global crisis, mainly through decline in foreign demand. Although the Czech Republic is not among the countries most affected by the crisis and despite its limited vulnerability, it still has been significantly affected by the global crisis. According to IMF Country Report a downturn in the euro-area (especially in Germany, the main Czech trading partner) decreased export and accordingly output drop by 4.25% in 2009. At the same time, along with decreased export, investment decline due to a drop in FDI and tightening of domestic banks' lending standards that hit the corporate sector. Observing external vulnerabilities, in this area also existed limited and temporary crisis impact. Namely, similar to other EEEs, Czech Republic have had current account deficit, financed with FDI. However, although FDI more than halved in crisis year, EU funds replaced FDI covering instead current account deficit, avoiding in that way spending of foreign exchange reserves. Robust external position is reflected in relatively fast recovery of koruna exchange rate that initially nominally depreciated, but soon real exchange rate returned to fundamentals path.

Our results also indicate that real external shock or trade channel was the dominant one in crisis transmission to the Czech economy. Namely, in the first crisis period Czech Republic was in the country group the least affected with the G7_GDP shock, but in the second crisis period the exposure of Czech GDP to economic activity of most developed (G7) economies sharply increased and Czech belonged to the country group which GDP is highly affected with real external shock. Concretely, Czech economy increased vulnerability to almost all types of external shocks (except US_R), but the highest ratio of GDP variations in the second crisis period is related to real external shock: G7_GDP with 32-65% during three quarters (compared to 1-7% in the first crisis period); RV_G7 with 24-67% during three quarters (compared to 19-21% in the first crisis period); RV_EM with 19-39% (compared to below 1% in the first period); EMBI shock with 24-39% during three quarters (compared to 24-25% in the first crisis period); VIX shock with 20-24% during three quarters (compared to 10-29% in the first period). To sum up, economic activity of Czech Republic is mostly influenced with trade channel or real external shock initiating more than 60% of GDP variations in the second period (around 10% in the first period), while from external financial shocks the most important was RV_G7 shock initiating more than 60% of GDP variations (around 40% in the first period).

Observing financial account changes (excluding FDI), results indicate that Czech Republic was less vulnerable to EMBI and VIX shock, approximately the same with G7_GDP shock, but financial account changes were more affected with RV_EM, RV_G7 and US_R external financial shocks. The strongest shock in the second crisis period was US_R 0-45% during three quarters (2-4% in the first period), RV_EM 28-40% (2-8% in the first period) and RV_G7 31-37% during four quarters (2-13% in the first period). Comparing Czech financial account vulnerability with other EEEs, Czech Republic belong to the country group highly influenced with US_R, RV_EM and RV_G7 external financial shocks. Interest rate variations were more explained with RV_G7, G7_GDP, and RV_EM external shock (their influence do not exceed 30% of interest rate variations), that is expected having in mind rising influence of these shocks to the real and financial stability. Interest rate changes as a reaction to EMBI and VIX shocks decreased in the second crisis period, while interest rate approximately equally reacted to US_R shock in both periods. Comparison with other EEEs points to the fact that Czech Republic belong to the country group without significant use of interest rate to withstand the shocks. The use of foreign exchange reserves was significantly reduced in the second crisis period as an answer to all types of external shocks, but it mostly reacted to US_R shock 18-34% and EMBI shock 6-26% during four quarters, while the

influence of other types of external shocks don't exceed 10% of FOREX variations. Czech Republic belongs to the country group with relatively low use of foreign direct interventions to withstand the shocks in the second crisis period. Having in mind relatively limited role of interest rate and foreign exchange interventions it could be concluded that NER of Czech koruna floats relatively freely which is compatible with previous statements of successful inflation targeter. At the same time, it should be noted that such scenario is possible due to already mentioned limited currency mismatch problem in Czech Republic. Real exchange rate variations were lower in the second period as an answer to EMBI, VIX and US_R external financial shock, while the influence of real external shock to REER variations was low in both period. REER variations are more explained with realized volatility of MSCI of G7 economies (21-66% in the second compared to 8-12% in first crisis period during four quarters) and realized volatility of MSCI of emerging economies (11-35% in the second compared to 7-19% in the first crisis period during four quarters).

General Remarks on CE-3 Cases

Poland had the most favorable macroeconomic indicators prior the crisis, and accordingly the least suffered from the crisis impact compared to other EEEs. The combination of structural features (large internal market with less dependence from export and trade channel transmission, as well as low exchange rate pass-through), macroeconomic policy (favorable pre-crisis indicators, and among other factors limited currency mismatch problem), and ER policy (flexible ER arrangement with higher RER variations as automatic stabilizer) give us the example of most successful i.e. the least vulnerable economy to external shocks. Comparison of GDP response to real external shock between EEEs clearly shows that Poland belong to less vulnerable economies to trade channel transmission in the first crisis period and certainly the least influenced with real external shock in the second crisis period. Tracking the transmission of external shocks to financial account changes in Poland compared to other EEEs, financial stability was relatively less influenced to all types of external shocks in the second crisis period. Having in mind limited crisis impact to real and financial side of Polish economy, monetary policy response via interest rate and foreign exchange reserves was less in the second crisis period. Expectedly, since lower external shock transmission to real and financial stability assumes less need to respond with interest rate and/or foreign exchange reserves. According to rising ER flexibility in the observed period, REER variations generally increased in the second crisis period as a response to most external shocks.

Although the **Czech Republic** is not among countries most affected by the crisis, despite its limited vulnerability, external shock transmission to Czech economy can not be neglected. Czech economy is small open economy, export oriented, and it is expected that the economic crisis would spill over into the Czech economy mainly through the trade channel. Results prove that real external shock or trade channel was the dominant one in crisis transmission to the Czech economy. Czech Republic was among least affected with the real external shock in the first crisis period, but in the second crisis period the situation reversed since Czech GDP became highly affected with changes of economic activity in most developed G7 economies. Although trade channel was the dominant one, the vulnerability of Czech GDP increased to almost all types of external (financial) shocks. Likewise, Czech Republic belonged to the country group with high vulnerability of financial account changes to external financial shocks. However, tracking monetary policy response and comparing it with other EEEs, significant use of interest rate to withstand the shocks was not evident, while the role of foreign exchange reserves significantly reduced in the second crisis period as an answer to all types of external shocks. With regard to relatively limited role of interest rate and foreign exchange interventions, it could be concluded that NER of Czech koruna floats relatively freely. At the same time, it should be noted that such scenario is possible due to already mentioned limited currency

mismatch problem in Czech Republic. Monetary policy response to increasingly threatened domestic and financial stability wasn't dramatic and significant, that points to the fact that NER was used to absorb external shocks through depreciation and possibly fiscal policy had bigger role in adjustment process. More specific conclusion concerning transmission of external shocks to REER variations could not be derived since REER variations were more influenced with some kind of shocks and less with other types of shocks.

Among CE-3 country group, **Hungary** appeared to be the most susceptible to the global financial crisis. Crucial indicators of Hungarian pre-crisis vulnerability are high foreign debt, high currency mismatch, overheating in consumption, fiscal imbalance. Relatively weak pre-crisis macro-indicators underlined expectations of higher external shock transmission to Hungarian domestic activity, especially in second crisis period. The results confirm that vulnerability of Hungarian real economy strongly increased to all types of external shocks in the second crisis period. Hungarian financial account appears generally less vulnerable to external shocks in the second compared to the first crisis period. Monetary policy response indicate generally higher use of interest rate (whose role is increased compared to the first period) in the combination with moderate usage of foreign exchange reserves (without significant change between the periods). Monetary response was generally higher than in the cases of Poland and Czech Republic pointing to two facts: (i) the response was stronger due to stronger external shocks' transmission, and (ii) the role of ER as a shock absorber was limited. REER variations were increasingly explained with certain types of external shocks, but at the same time less explained with other types, which also points to limited adjustment via currency weakening. Hungary expressed limited adjustment potential via ER in the second crisis period; exchange rate adjustment is possible due to higher flexibility of ERR in the observed periods; but limited due to weak pre-crisis fundamentals including relatively high currency mismatching problem.

5. Concluding Remarks

Although the composition of shocks and strength of transmission differs from country to country, EEEs were generally more exposed to all types of external shocks. This is expected having in mind rising trade and financial integration as a necessary part of their catching-up and convergence process. The reason for different transmission and response of EEEs to external real and financial shocks lies in the combination of structural characteristics, previous macroeconomic policy with favorable or worsened pre-crisis macroeconomic indicators, as well as practiced ERR.

General pattern of pre-crisis period in EEEs includes economic boom, strong capital inflows (in FDI form and carry trade), credit boom, real estate bubbles, higher inflation, competitiveness loss, external imbalance in the form of current account deficit, etc. However, this general pattern is more or less emphasized depending from specific structural characteristics, sustainability of macroeconomic policies, and ERR of respecting economies. Having these factors in mind, more closed economy, with large internal market, more diversified production and export structure, were generally less dependent from external environment and more resistant to external real shock. Countries with low or moderate external imbalance in the form of current account deficit are less vulnerable to different types of external financial shocks that destabilize financial stability of respecting economy. Countries with unsustainable fiscal and monetary policies, regardless of ERR but more important in the case of fixed ERRs, are also more susceptible to stronger external shock transmission to the real and financial stability. Economies with fixed ERR are stronger hit with external shocks having in mind internal devaluation as a necessary adjustment mechanism accompanied with higher output and employment losses. Economies with flexible ERR have more

space for adjustment having in mind possibility of NER depreciation or a combination of NER and internal devaluation.

However, no one factor worked alone, but rather all should be used to explain properly the crisis impact in the case of EEEs. Thus, Poland as less dependent economy and less vulnerable to trade shock transmission, with more diversified export structure, relatively favorable pre-crisis macro-indicators (without strong overheating, relatively lowest inflation rate, relatively low current account deficit, without large currency mismatch problem), with flexible ER as a shock absorber, has managed to escape the recession in 2009 when other EEEs experienced significant/severe GDP fall. Other countries had more or less serious consequences to their real and financial stability, but they either had less favorable structural characteristics (more dependent from external trade and more exposed to trade channel transmission), or they had less favorable pre-crisis macroeconomic indicators (large overheating concentrated mainly in consumption, relatively high inflation, large external imbalance, high currency mismatching problem or negative balance sheet effects), or rigidly fixed ER (like currency board) without option to use it as a shock absorber. Hence, from the other side, we have countries relatively open and vulnerable to trade shock as Baltic states, with negative pre-crisis indicators (relatively high inflation, competitiveness loss, the largest current account deficit among EEEs, high currency mismatching problem) combined with rigid currency board ER arrangement. These countries experienced the largest downturn and the strongest transmission of external shocks to their domestic activities. Somewhere between these extremes (the case of Poland and Baltic states) is a combination of these factors. Bulgaria, practicing currency board under high currency mismatching problem, but without severely deteriorated pre-crisis indicators (smaller overheating, lower level of wages and limited competitiveness loss, fiscal surplus, high foreign exchange reserves) compared to currency board peers (Baltic States). Czech Republic with less favorable structural characteristics (tight internal market and high external trade dependence), but relatively favorable pre-crisis indicators (limited inflation, external imbalance, and currency mismatching problem) and with possibility to use ER as a shock absorber. Hungary, with *de jure* possibility to use ER as a shock absorber that is *de facto* limited due to high currency mismatching problem, and with vulnerability problems reflected in fiscal imbalance, huge foreign debt and demand overheating located mainly in consumption.

Results indicate that Estonia, Lithuania and Latvia have had the highest transmission of external real and financial shocks to domestic economic activity, while Bulgarian domestic activity didn't vary rapidly and sharply observing both periods. All countries expressed higher vulnerability of their GDP to all types of external shocks, especially sensitiveness to real external shock in the second compared to the first crisis period. Concerning the transmission of external shocks to financial account changes as a source of financial instability, results are mixed depending from the country. While Bulgarian and Estonian financial account changes were less in the second crisis period as a response to different types of external shocks, Lithuania and Latvia have increased vulnerability and shock transmission to financial account changes. However, monetary policy response differed between Baltic economies. Latvia used more foreign exchange reserves to withstand the shocks with moderate increase in usage of interest rate; Bulgaria also used more foreign exchange reserves with less use of interest rate compared to the first crisis period; Lithuania used more both instruments; while Estonia used less both monetary instruments, implying that fiscal policy was more dominant and active as a reaction to the crisis impact. Higher response of REER to external shocks marks faster recovery and more flexible economy. Having in mind NER inflexibility, higher REER in the case of currency board countries points to quick price adjustment and improved competitiveness. Only Latvian REER reacted more to some types of external shocks, while in the case of Estonia, Lithuania, and Bulgaria the adjustment process via REER is much more difficult.

Although crisis influence to CE-3 economies was not so severe, as in the case of Baltic States, this country group is also heterogeneous. Therefore, Poland was the least affected with shock transmission, follows Czech Republic, then Hungary with the strongest crisis impact. Accordingly, Poland and Czech Republic didn't significantly vary their monetary policy instruments, interest rate and foreign exchange reserves in the second compared to the first crisis period, that could be in largely attributed to (i) their relatively favorable pre-crisis indicators including relatively low currency mismatching problem, (ii) weaker external shock transmission to domestic and financial stability; (iii) the possibility to use ER as a shock absorber. Opposite holds for vulnerable Hungarian economy with relatively stronger use of monetary instruments as a response to different external shocks. REER points to higher adjustment potential in the case of Poland and Czech Republic, and somewhat lower in the case of Hungary. These results are also interconnected with the fact that, in the Hungarian case, ER capacity to serve as a shock absorber and automatic stabilizer is partly limited due to emphasized currency mismatching problem.

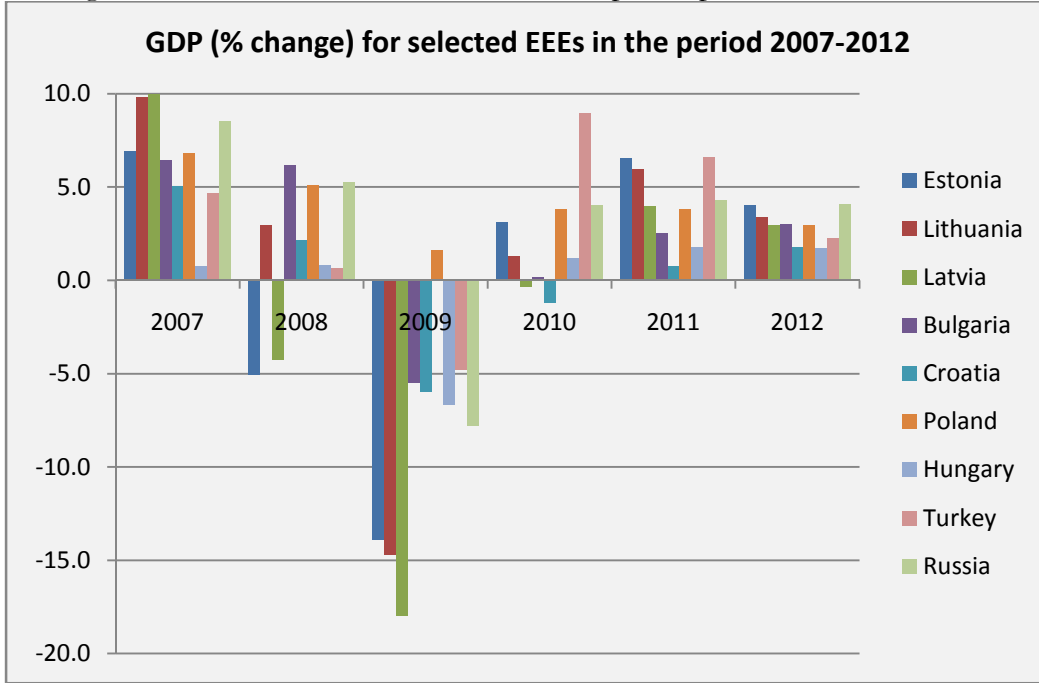
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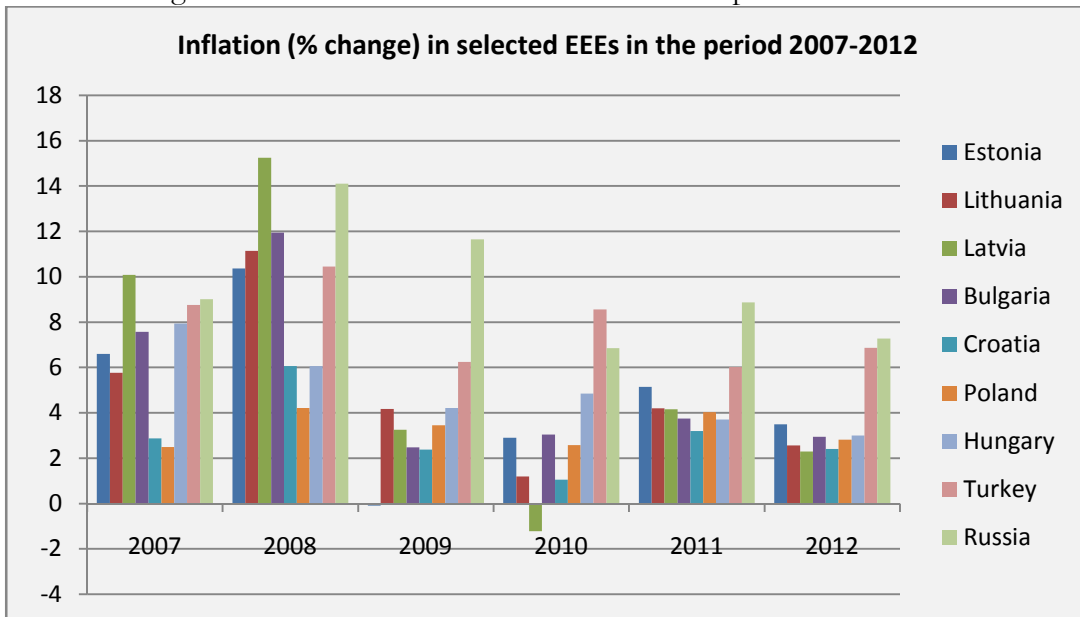
Appendix

Figure 1: Real sector of selected EEC in the period prior and after the crisis



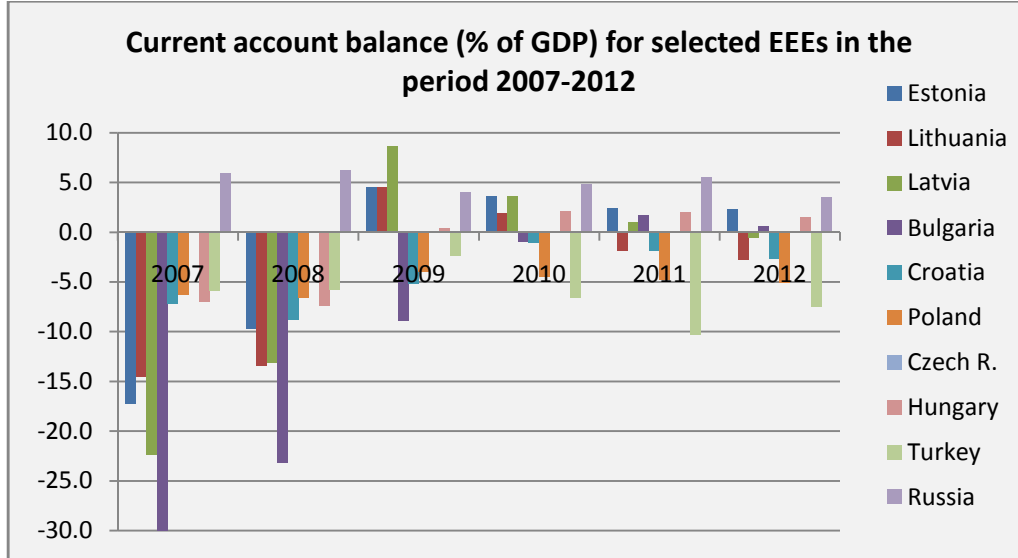
Source: Authors' review based on yearly World Economic Outlook data.

Figure 2: Inflation rate in selected EEEs in the period 2007-2012



Source: Authors' review based on yearly World Economic Outlook data.

Figure 3: External imbalance as a percent of GDP in the years prior and after the crisis in selected EEEs



Source: Authors' review based on yearly World Economic Outlook data.

Table 1: The response of GDP to external real and financial shocks in the first and the second crisis period for selected EEE

GDP response to G7_GDP shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	15.26	6.41	4.66	5.93
Lithuania	21.501	14.834	23.434	20.679
Latvia	7.361	6.193	5.279	5.189
Bulgaria	23.155	20.954	9.127	8.732
Hungary	16.672	16.822	34.811	50.449
Poland	14.84	12.417	9.739	11.835
Czech R.	0.882	11.876	7.393	5.496
GDP response to G7_GDP shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	46.307	66.254	74.615	62.603
Lithuania	19.513	64.719	69.606	59.906
Latvia	26.947	60.206	60.853	54.407
Bulgaria	9.807	25.985	48.29	52.332
Hungary	37.375	50.986	54.441	57.127
Poland	10.392	3.912	2.367	1.96
Czech R.	32.397	61.923	64.504	62.695
GDP response to EMBI shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter

Estonia	1.579	8.58	24.634	37.523
Lithuania	14.258	10.101	9.933	14.893
Latvia	0.029	10.179	10.091	10.571
Bulgaria	0.76	2.055	3.929	3.794
Hungary	3.459	3.967	3.292	5.354
Poland	15.978	11.135	11.219	9.375
Czech R.	24.367	31.722	24.842	18.532
GDP response to EMBI shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	33.16	55.964	69.375	66.317
Lithuania	18.06	62.505	74.584	65.445
Latvia	10.468	23.292	48.338	54.114
Bulgaria	2.812	10.469	17.633	25.254
Hungary	9.475	28.467	43.185	49.594
Poland	0.682	0.345	2.036	1.801
Czech R.	24.413	43.053	39.316	31.458
GDP response to VIX shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	26.622	12.971	7.85	5.686
Lithuania	19.457	19.648	18.124	16.22
Latvia	5.579	17.222	22.463	25.304
Bulgaria	7.774	10.346	10.433	10.663
Hungary	0.073	4.755	9.697	31.501
Poland	17.35	19.72	27.407	31.811
Czech R.	10.436	20.552	28.719	27.599
GDP response to VIX shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	23.44	24.04	33.079	43.391
Lithuania	0.134	25.104	22.834	12.709
Latvia	2.059	12.108	16.437	21.28
Bulgaria	9.577	6.901	9.83	8.174
Hungary	14.153	21.526	23.21	22.577
Poland	0.461	0.861	1.205	7.312
Czech R.	19.97	23.187	23.731	19.985
GDP response to RV_G7 shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	5.283	21.095	34.383	31.216
Lithuania	15.999	15.78	12.327	11.117
Latvia	2.214	5.668	7.595	8.046
Bulgaria	0.499	12.149	11.307	10.6
Hungary	1.288	1.503	2.177	2.023

Poland	2.13	1.457	1.765	2.613
Czech R.	18.989	41.467	20.799	18.19
GDP response to RV_G7 shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	37.555	66.235	72.185	74.161
Lithuania	3.422	60.97	71.915	74.323
Latvia	13.013	57.589	66.431	68.113
Bulgaria	0.804	9.726	11.91	9.979
Hungary	34.034	67.849	68.205	62.701
Poland	7.421	9.517	8.686	6.989
Czech R.	24.093	63.141	66.884	59.766
GDP response to RV_EM shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	11.9	5.609	25.289	34.48
Lithuania	6.473	27.936	31.472	30.716
Latvia	1.303	4.101	3.682	3.245
Bulgaria	3.476	10.225	23.789	24.217
Hungary	2.288	4.111	4.226	4.047
Poland	12.04	7.105	7.079	8.644
Czech R.	0.973	0.679	0.676	1.319
GDP response to RV_EM shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	38.236	66.701	70.759	73.135
Lithuania	3.979	65.732	72.437	72.136
Latvia	1.104	20.392	20.903	27.409
Bulgaria	0.748	18.9	11.806	11.43
Hungary	29.623	60.531	64.335	62.931
Poland	6.617	11.516	15.093	17.053
Czech R.	19.376	39.8	39.293	31.939
GDP response to US_R shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	28.84	20.826	16.638	14.348
Lithuania	11.08	26.762	29.047	20.298
Latvia	19.635	16.298	15.101	14.11
Bulgaria	3.585	5.803	9.187	9.319
Hungary	20.83	11.768	5.717	18.107
Poland	3.518	3.514	6.261	7.34
Czech R.	42.061	40.275	43.865	41.726
GDP response to US_R shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	13.029	11.731	27.519	42.176

Lithuania	1.251	2.161	2.714	2.264
Latvia	26.947	60.206	60.853	54.407
Bulgaria	5.861	4.333	6.124	16.644
Hungary	1.948	4.622	12.498	26.808
Poland	2.433	3.517	4.247	14.661
Czech R.	3.244	12.475	10.688	7.101

Table 2: The response of FA (financial account without FDI as a percent to GDP) to external real and financial shocks in the first and the second crisis period for selected EEE

FA response to G7_GDP shock in the first crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	0.742	2.481	2.517	2.642
Lithuania	20.81	16.511	20.326	21.669
Latvia	0.008	0.064	0.386	0.383
Bulgaria	0.003	33.201	34.418	29.531
Hungary	15.763	19.794	22.992	22.413
Poland	8.053	4.594	6.092	10.997
Czech R.	0.006	3.56	10.553	18.737
FA response to G7_GDP shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	4.741	7.082	7.175	7.749
Lithuania	25.313	31.343	26.065	23.81
Latvia	17.429	31.825	31.239	30.296
Bulgaria	2.999	12.531	8.38	11.881
Hungary	0.43	8.628	7.002	9.692
Poland	4.919	5.231	5.206	5.073
Czech R.	15.448	17.272	17.243	17.266
FA response to EMBI shock in the 1 st crisis period				
	1 st quarter	2 nd quarter	3 rd quarter	4 th quarter
Estonia	10.365	33.547	41.524	45.81
Lithuania	1.595	1.112	6.62	4.276
Latvia	9.165	8.4	7.506	13.379
Bulgaria	31.29	31.898	30.966	26.881
Hungary	4.506	13.227	11.621	9.853
Poland	20.728	16.073	21.33	21.264
Czech R.	1.1	27.119	21.196	39.235
FA response to EMBI shock in the 2 nd crisis period				
	1 st quarter	2 nd quarter	3 rd quarter	4 th quarter
Estonia	6.191	5.02	2.841	3.669
Lithuania	41.856	32.313	9.941	7.979

Latvia	37.869	34.614	27.577	13.605
Bulgaria	1.285	15.102	12.893	12.261
Hungary	6.64	10.334	9.246	14.567
Poland	0.017	2.197	6.026	4.053
Czech R.	0.008	1.407	3.149	3.694
FA response to VIX shock in the 1 st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	2.105	27.135	28.038	27.872
Lithuania	2.761	1.87	1.584	2.831
Latvia	3.781	3.32	3.837	5.058
Bulgaria	9.807	7.462	7.001	7.515
Hungary	25.491	43.67	34.729	28.751
Poland	44.259	37.419	44.319	44.719
Czech R.	35.491	32.332	30.941	29.167
FA response to VIX shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	0.182	11.378	10.93	8.919
Lithuania	26.905	21.497	19.373	18.847
Latvia	13.568	19.626	23.269	25.302
Bulgaria	5.534	3.893	13.292	21.751
Hungary	15.761	14.136	12.718	12.904
Poland	0.05	2.975	7.128	5.391
Czech R.	6.096	5.573	6.169	4.928
FA responses to RV_G7 shock in the 1 st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	0.76	1.148	7.528	10.396
Lithuania	0.207	8.102	9.464	9.731
Latvia	6.352	10.02	13.44	14.855
Bulgaria	19.771	16.825	15.694	15.448
Hungary	14.593	8.965	10.498	10.114
Poland	12.483	10.652	10.576	10.795
Czech R.	2.083	6.195	14.395	13.103
FA response to RV_G7 shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	1.658	7.041	11.884	14.057
Lithuania	37.839	32.564	45.803	48.654
Latvia	17.263	52.591	55.94	52.838
Bulgaria	6.696	4.697	14.745	13.001
Hungary	6.436	5.333	14.494	17.466
Poland	13.603	25.282	21.668	25.222
Czech R.	31.38	27.896	31.448	36.811

FA response to RV_EM shock in the 1 st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	2.427	26.795	25.067	36.537
Lithuania	0.946	10.314	20.695	24.62
Latvia	0.057	17.398	14.615	13.973
Bulgaria	33.807	16.419	13.725	11.487
Hungary	13.186	8.822	8.597	8.461
Poland	11.668	17.204	18.98	19.265
Czech R.	2.363	7.389	8.439	8.484
FA response to RV_EM shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	0.99	27.4	29.116	31.825
Lithuania	26.423	27.196	29.676	30.374
Latvia	4.035	2.881	10.332	9.466
Bulgaria	7.318	4.193	6.628	5.817
Hungary	7.882	18.2	28.555	28.993
Poland	14.207	11.628	10.003	10.724
Czech R.	28.184	44.691	40.258	37.706
FA response to US_R shock in the 1 st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	0.492	1.442	1.086	2.967
Lithuania	11.222	21.542	28.687	38.87
Latvia	7.347	6.74	6.784	7.129
Bulgaria	8.892	6.945	12.772	12.16
Hungary	0.033	18.755	31.582	24.98
Poland	24.086	23.57	32.106	40.315
Czech R.	2.516	4.383	3.203	4.363
FA response to US_R shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	0.016	0.981	6.814	7.507
Lithuania	0.997	3.336	3.057	3.999
Latvia	17.429	31.825	31.239	30.296
Bulgaria	4.929	9.685	8.217	10.323
Hungary	2.449	1.953	1.546	4.02
Poland	2.265	1.703	1.547	2.104
Czech R.	0.097	37.896	45.117	34.08

Table 3: Interest rate response to external real and financial shocks in the 1st and 2nd crisis period in the case of selected EEE

Interest rate response to G7_GDP shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	14.655	21.1	17.666	16.527
Lithuania	13.997	6.468	7.475	8.673
Latvia	2.377	1.989	1.516	1.868
Bulgaria	11.662	5.844	13.962	9.606
Hungary	11.867	46.577	53.746	63.306
Poland	0.407	5.415	6.333	11.923
Czech R.	0.635	0.539	3.401	3.106
Interest rate response to G7_GDP shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	15.283	15.116	18.189	16.838
Lithuania	1.904	10.262	34.467	54.021
Latvia	20.691	31.782	15.06	12.113
Bulgaria	0.051	0.046	5.149	17.86
Hungary	2.472	4.257	3.258	3.797
Poland	1.644	2.558	4.591	3.478
Czech R.	0.15	7.964	14.288	18.024
Interest rate response to EMBI shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	5.887	8.516	9.274	10.385
Lithuania	2.144	5.914	15.293	16.213
Latvia	11.701	19.75	23.736	34.703
Bulgaria	0.003	7.403	7.199	17.123
Hungary	11.75	3.361	1.749	0.799
Poland	3.98	2.684	33.865	52.656
Czech R.	2.925	33.68	35.599	46.834
Interest rate response to EMBI shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	34.594	37.231	31.513	23.194
Lithuania	0.237	11.834	22.341	27.619
Latvia	4.738	2.503	1.738	6.141
Bulgaria	14.741	10.271	9.977	7.561
Hungary	28.53	24.75	21.004	18.037
Poland	3.612	2.322	2.023	3.303
Czech R.	1.237	2.473	3.518	6.059
Interest rate response to VIX shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	21.284	43.428	40.142	38.74

Lithuania	6.194	19.8	27.047	23.932
Latvia	0.244	1.579	4.113	7.219
Bulgaria	5.486	15.106	13.019	7.283
Hungary	1.051	7.555	20.252	27.665
Poland	1.418	18.308	20.816	16.456
Czech R.	18.082	14.094	17.649	29.364
Interest rate response to VIX shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	25.621	33.926	45.084	46.299
Lithuania	11.843	5.63	5.382	7.394
Latvia	15.817	12.362	18.761	18.777
Bulgaria	7.326	4.321	3.082	1.881
Hungary	12.578	14.643	14.985	14.747
Poland	4.956	2.264	2.471	2.019
Czech R.	5.716	2.286	1.562	1.695
Interest rate response to RV_G7 shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	32.004	55.54	43.303	50.363
Lithuania	1.193	1.987	3.224	3.848
Latvia	10.646	38.746	43.851	44.941
Bulgaria	0.211	7.698	9.901	16.773
Hungary	1.318	3.385	2.651	2.384
Poland	5.155	5.486	9.383	11.304
Czech R.	6.24	5.576	13.057	11.129
Interest rate response to RV_G7 shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	31.807	31.675	28.216	24.027
Lithuania	1.618	25.748	48.986	57.96
Latvia	1.262	1.837	2.221	5.173
Bulgaria	6.363	22.093	25.802	22.48
Hungary	17.164	13.918	12.663	11.943
Poland	0.085	12.389	25.568	29.507
Czech R.	0.295	29.157	34.905	28.91
Interest rate response to RV_EM shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	30.102	65.902	57.854	52.255
Lithuania	1.96	1.246	2.225	4.353
Latvia	1.074	14.761	22.371	24.456
Bulgaria	6.099	12.006	8.248	5.656
Hungary	0.805	0.733	0.682	1.053
Poland	4.667	2.209	1.475	1.389

Czech R.	0	0.209	0.962	1.944
Interest rate response to RV_EM shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	32.38	34.331	28.905	23.75
Lithuania	0.443	17.333	27.927	34.295
Latvia	5.543	5.15	17.686	16.725
Bulgaria	8.705	9.143	8.195	6.982
Hungary	16.886	29.724	41.736	48.269
Poland	1.434	2.736	5.675	5.822
Czech R.	0.173	5.483	9.338	7.436
Interest rate response to US_R shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	0.625	0.886	0.993	1.739
Lithuania	15.158	16.985	14.829	15.335
Latvia	6.641	4.905	3.313	3.834
Bulgaria	11.659	8.14	8.141	18.052
Hungary	0.446	0.564	9.119	26.569
Poland	6.927	6.337	6.265	5.975
Czech R.	20.228	19.834	19.292	20.964
Interest rate response to US_R shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	18.488	8.316	8.636	9.622
Lithuania	0.004	1.584	5.673	9.373
Latvia	20.691	31.782	15.06	12.113
Bulgaria	5.016	5.125	7.196	9.101
Hungary	13.681	19.773	23.629	22.346
Poland	11.241	17.149	24.414	22.589
Czech R.	13.828	13.251	18.735	19.004

Table 4: FOREX response to external real and financial shocks in the first and the second crisis periods in selected EEE

FOREX response to G7_GDP shock in the 1 st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	33.383	29.835	29.161	28.936
Lithuania	9.629	5.729	20.656	26.688
Latvia	0.528	2.342	1.847	2.9
Bulgaria	5.132	3.406	1.703	1.022
Hungary	1.909	1.705	7.861	16.865
Poland	5.359	20.757	9.675	7.321

Czech R.	0.15	21.761	30.088	24.455
FOREX response to G7_GDP shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	20.78	15.833	12.927	12.932
Lithuania	43.076	53.648	62.533	59.625
Latvia	39.715	68.591	64.536	61.809
Bulgaria	36.214	53.205	45.403	49.942
Hungary	6.87	17.011	18.027	19.187
Poland	4.433	2.266	1.654	1.562
Czech R.	0.145	1.522	1.451	2.285
FOREX response to EMBI shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	16.15	12.503	11.965	11.663
Lithuania	26.754	32.509	30.02	22.111
Latvia	7.432	9.354	12.609	11.651
Bulgaria	5.59	4.526	27.258	34.977
Hungary	2.506	16.255	10.448	9.341
Poland	8.849	28.213	28.707	23.96
Czech R.	55.663	76.428	55.411	39.271
FOREX response to EMBI shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	5.035	12.312	11.623	10.629
Lithuania	44.914	46.49	41.062	44.073
Latvia	38.253	50.127	33.631	24.002
Bulgaria	2.879	10.833	15.955	17.503
Hungary	2.932	4.275	11.24	16.022
Poland	2.066	5.154	8.656	7.148
Czech R.	6.488	27.564	24.506	26.319
FOREX response to VIX shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	27.626	40.571	38.394	37.985
Lithuania	30.98	25.519	27.165	22.616
Latvia	0.083	0.332	2.279	3.068
Bulgaria	1.574	3.671	8.673	9.308
Hungary	15.135	18.041	14.48	22.301
Poland	6.428	9.084	32.185	40.282
Czech R.	15.706	9.036	13.661	15.534
FOREX response to VIX shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter

Estonia	1.346	13.337	26.767	31.067
Lithuania	10.027	6.835	12.965	9.947
Latvia	33.037	39.411	55.225	54.348
Bulgaria	1.95	4.52	19.797	39.732
Hungary	0.099	3.088	6.536	4.974
Poland	4.302	5.374	9.809	8.517
Czech R.	0.363	11.838	9.663	10.022
FOREX response to RV_G7 shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	14.798	22.343	23.909	22.557
Lithuania	16.321	11.404	11.53	10.19
Latvia	16.614	19.894	18.453	19.07
Bulgaria	4.659	7.998	22.727	18.992
Hungary	12.299	16.635	15.877	14.958
Poland	1.508	8.722	8.09	7.139
Czech R.	5.219	3.178	12.06	11.263
FOREX response to RV_G7 shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	0.428	11.811	23.272	32.574
Lithuania	10.896	7.394	6.152	5.163
Latvia	17.809	34.505	41.703	43.827
Bulgaria	21.064	18.941	19.297	17.883
Hungary	10.564	15.335	14.56	12.857
Poland	28.377	41.249	41.973	36.168
Czech R.	2.594	3.379	3.923	10.661
FOREX response to RV_EM shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	37.931	44.112	42.891	42.723
Lithuania	15.76	17.43	19.757	20.481
Latvia	1.329	7.16	6.363	8.629
Bulgaria	0.633	0.599	0.755	3.484
Hungary	5.063	7.715	8.012	7.906
Poland	1.493	18.59	25.043	26.42
Czech R.	0.01	2.925	4.036	4.23
FOREX response to RV_EM shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	0.199	10.396	17.982	25.532
Lithuania	9.558	14.292	18.048	20.414
Latvia	4.9	15.056	29.745	24.718

Bulgaria	6.664	17.537	14.754	13.182
Hungary	12.373	12.458	8.786	7.308
Poland	27.651	16.807	21.513	22.577
Czech R.	3.001	3.561	9.918	11.385
FOREX response to US_R shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	0.008	5.664	7.627	6.731
Lithuania	28.019	21.448	21.73	18.745
Latvia	4.498	17.078	27.546	38.836
Bulgaria	2.677	7.349	7.41	13.188
Hungary	9.77	15.362	11.79	11.834
Poland	1.18	13.013	10.147	17.22
Czech R.	3.816	14.393	39.465	48.008
FOREX response to US_R shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	1.253	9.023	30.761	32.649
Lithuania	1.926	2.789	2.4	3.921
Latvia	39.715	68.591	64.536	61.809
Bulgaria	0.033	0.155	1.661	6.642
Hungary	17.91	10.567	8.053	7.274
Poland	0.017	5.154	5.817	5.308
Czech R.	17.822	16.776	40.201	34.317

Table 5: The response of REER to external real and financial shocks in the first and the second crisis periods in the case of selected EEE

REER response to G7_GDP shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	1.044	4.346	3.22	2.952
Lithuania	7.104	26.756	16.449	11.79
Latvia	25.514	23.112	20.698	17.804
Bulgaria	0.113	0.374	0.901	1.132
Hungary	27.329	18.826	22.769	21.866
Poland	21.468	14.542	14.7	13.581
Czech R.	4.112	4.067	4.786	10.864
REER response to G7_GDP shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	7.211	6.631	10.56	11.899
Lithuania	8.358	6.131	8.198	5.448
Latvia	7.926	13.491	13.814	18.476

Bulgaria	1.131	10.383	13.575	10.518
Hungary	18.514	20.211	20.838	19.533
Poland	7.17	4.99	6.236	5.831
Czech R.	5.763	6.031	3.759	2.709
REER response to EMBI shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	1.323	22.404	25.373	26.761
Lithuania	13.046	28.579	19.918	13.783
Latvia	16.321	11.228	16.012	13.932
Bulgaria	35.064	22.461	28.176	31.56
Hungary	3.669	19.085	21.118	20.043
Poland	15.506	9.695	14.704	24.869
Czech R.	45.382	72.584	70.112	61.105
REER response to EMBI shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	0.142	2.047	15.804	15.847
Lithuania	0.003	0.867	4.369	3.123
Latvia	4.875	6.184	6.25	3.536
Bulgaria	0.706	0.225	0.299	0.371
Hungary	25.975	30.339	30.18	26.809
Poland	28.711	29.548	27.039	25.308
Czech R.	1.213	15.212	12.881	13.969
REER response to VIX shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	12.59	49.683	47.325	46.279
Lithuania	1.33	8.736	5.372	4.269
Latvia	2.053	7.376	6.223	6.22
Bulgaria	14.195	18.76	16.494	14.459
Hungary	1.104	16.407	14.635	12.426
Poland	33.507	26.17	21.637	23.23
Czech R.	27.83	36.365	38.53	39.695
REER response to VIX shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	1.23	1.659	1.606	2.146
Lithuania	8.553	4.559	13.481	8.471
Latvia	1.794	10.13	20.732	29.595
Bulgaria	0.003	3.777	3.822	5.727
Hungary	28.82	34.332	29.155	27.352
Poland	28.43	38.792	39.179	38.86
Czech R.	0.486	4.173	4.046	5.022
REER response to RV_G7 shock in the 1st crisis period				

	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	15.826	41.677	40.148	36.38
Lithuania	5.249	4.994	3.449	2.62
Latvia	0.269	1.219	1.384	1.328
Bulgaria	0.511	1.053	7.024	11.744
Hungary	4.375	3.914	3.952	4.97
Poland	12.994	7.612	7.028	7.205
Czech R.	8.361	7.422	8.359	11.591
REER response to RV_G7 shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	0.012	4.734	6.338	7.824
Lithuania	0.734	19.744	28.286	23.542
Latvia	1.859	0.766	4.899	9.773
Bulgaria	1.556	2.784	3.096	7.478
Hungary	14.168	16.963	17.331	16.068
Poland	25.079	36.243	38.863	37.082
Czech R.	21.316	47.09	60.426	66.415
REER response to RV_EM shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	0.745	32.382	48.333	40.221
Lithuania	7.86	6.017	4.96	5.161
Latvia	4.126	6.163	5.468	5.267
Bulgaria	0.207	1.494	0.998	0.547
Hungary	6.11	4.022	2.79	2.199
Poland	23.148	16.885	12.078	9.783
Czech R.	6.59	16.313	19.079	19.402
REER response to RV_EM shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	1.012	0.823	1.046	1.77
Lithuania	2.527	8.435	7.929	6.277
Latvia	0.467	21.385	24.43	29.124
Bulgaria	1.136	5.987	8.12	7.251
Hungary	19.747	48.115	50.921	46.585
Poland	14.699	31.221	35.764	34.356
Czech R.	11.137	32.158	31.54	34.53
REER response to US_R shock in the 1st crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	3.045	1.871	1.31	1.894
Lithuania	6.87	18.973	18.407	18.051
Latvia	15.103	18.352	20.274	22.698
Bulgaria	0.425	7.523	4.242	13.687

Hungary	3.086	34.779	44.53	42.027
Poland	36.571	33.391	29.823	26.903
Czech R.	13.847	27.104	19.992	22.169
FOREX response to US_R shock in the 2nd crisis period				
	1st quarter	2nd quarter	3rd quarter	4th quarter
Estonia	0.845	11.407	16.255	14.776
Lithuania	6.744	9.388	10.415	11.631
Latvia	7.926	13.491	13.814	18.476
Bulgaria	0.01	0.33	4.423	14.026
Hungary	7.222	4.826	7.701	7.83
Poland	7.568	18.566	12.511	8.447
Czech R.	6.905	2.876	2.655	3.657