

## The Role of Exchange Rate on the Road towards the Euro Area: The Case of Baltic and Central Emerging European Economies

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### Abstract

*The paper deals with the attractiveness of the euro area for emerging EU members (Central Emerging European Economies vs Baltic States) from the angle of previously applied exchange rate regimes (floaters vs fixers). Monetary convergence is accompanied with real exchange rate appreciation, but the adjustment channels differ in dependence from adopted exchange rate framework. Impulse response functions from bivariate VAR models in the period 2000 – 2018/euro adoption are used to identify the impact of monetary and real shocks to real exchange rate variations, as well as real exchange rate transmission to economic activities. The results indicate: the prevalence of real shocks in initiating real exchange rate appreciation; higher real exchange rate sensitivity for the floaters with higher loss in terms of stabilization mechanism; less contractionary real exchange rate appreciation for the floaters with less output constraints due to the role of exchange rate as a shock absorber.*

**Keywords:** convergence, euro area, real exchange rate, monetary shocks, real shocks

**JEL Classification:** E52, F15, F45

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### Introduction

From thirteen Emerging European Economies which joined the European Union in 2004, 2007 and 2013, seven adopted the euro so far (Slovenia, Cyprus, Malta, Slovakia, Estonia, Lithuania, and Latvia). If we observe European Union members since 2004, three Central Emerging European countries (Poland, Czech Republic and Hungary) remain outside the euro area. The question is whether

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exist the connection between adopted exchange rate regime with their reluctance to deepen monetary integration, enter the ERM II and, finally, accept the euro in contrast to the Baltic States. Baltic States from one side and Central Emerging European Economies from the other side adopted two different monetary approaches at the convergence path towards the euro area.

The hesitation of Central Emerging European Economies (Poland, Czech Republic, Hungary) regarding further monetary integration could be observed from internal and external viewpoints. From the internal or national viewpoint, there is a realization that they performed better during the crisis impact compared to the Baltic States and euro area periphery (under rigid exchange rate regimes). The difference in adjustment mechanisms is based on implemented exchange rate regime. Entering the ERM II, and especially entering the monetary union, constrain monetary authorities with diminishing, then abolishing, role of exchange rate as a shock absorber. These economies progressed in real and monetary convergence on the road towards the euro area, which strengthened their awareness of self-sufficiency and staying at the current level (common market) of European integration. From the external perspective, euro area as a final point of monetary convergence is not so attractive as before the global crisis. Namely, the crisis revealed all weaknesses of the euro area as unfinished and vulnerable project, currently less appealing for Central Emerging European Economies. These economies perform well within the current level of European integration and their sacrifice in terms of loss of monetary autonomy is high.

This paper focuses internal viewpoint and „wait and see“ strategy adopted by Poland, Czech Republic and Hungary through a parallel analysis of Baltic States at the opposite monetary convergence path. The motivation for the research was found in exploring the connection between the exchange rate regime and vulnerability to convergence shocks, as well as prevailing adjustment mechanisms of internal devaluation (the fixers) or nominal exchange rate adjustments (the floaters). Consequently, the aim of the paper is to shed more light into the differences between Baltic States as representatives of the fixers (euro area members) and Central Emerging European Economies as the floaters (euro area candidates) concerning the sacrifice of exchange rate and monetary sovereignty and their willingness to join the currency union.

Convergence process is accompanied with massive capital inflows and growing productivity which initiate upward price pressures and, consequently, real exchange rate appreciation. Real exchange rate appreciation, as a convergence phenomenon, could initiate contractionary effects, potentially harm real convergence, complicate compliance to the Maastricht criteria, with different transmission mechanisms for the fixers and the floaters. In order to analyse real exchange rate pressures, sources and real effects, yearly and quarterly proxies for real

exchange rate, different capital inflows and productivity, have been employed in descriptive and econometric analysis. The research period starts from 2000 till 2018 or euro adoption (pre-euro stage). In order to detect the transmission impact of real and monetary shocks to the real exchange rate, impulse response functions were derived on the basis of unrestricted bivariate VAR models.

Main hypothesis could be summarized as follows: Monetary and real shocks immanent to convergence process initiate real exchange rate appreciation of selected emerging European Economies; Less output variations as a response to real exchange rate movements is expected for the floaters (Central Emerging European Economies) thanks to the role of exchange rate as shock absorber; Real exchange rate variations as a competitiveness indicator are more prone to monetary and real shocks in the case of the floaters with stronger need to keep the monetary autonomy through managed floating exchange rate and to postpone ERM II target zone and monetary union. The paper is structured as follows. After introduction part, section 1 deals with literature survey followed with descriptive analysis of key distinctions between selected fixers vs floaters in section 2. Methodological framework is presented in section 3, while key empirical findings are discussed in section 4. Concluding remarks are pointed out in the last section.

## **1. Monetary Convergence and Challenges towards the Euro Area: Literature Review**

Since the beginning of the transition process, the convergence progressed steadily with the global crisis as a lesson for previous accumulation of macro-economic imbalances and posterior sharp adjustments as an answer to external shocks. The overheating of Emerging Europe was mostly financed with foreign capital resulting in unsustainable current account position in contrast to self-financing of economic growth in other emerging countries (Rahman, 2008; Shelburne, 2008; Allegret and Sallenave, 2015).

Short-term “hot” capital is strongly related to domestic credit booms, while credit booms are more commonly associated with fixed exchange rate regimes (Mendoza and Terrones, 2012; Lane and McQuade, 2013). During boom the floaters let nominal exchange rate appreciate, which tightened monetary conditions. As a result, they build up less imbalances, had less pronounced booms, and lower current account deficits (Edwards and Levy-Yeyati, 2003; Ghosh, Terrones and Zettelmeyer, 2008; Bakker, 2017). The signs of overheating and post-crisis adjustments were much more profound in the case of the Baltic States, representatives of the fixers. Painful internal devaluation was in their cases unavoidable, as a sign of demand-reducing adjustment mechanism under crisis driven external

shocks (Berglöf et al., 2009; Kang and Shambaugh, 2014). Spillover effects of global financial shocks are magnified for the fixers compared to the floaters mainly due to constrained monetary policy autonomy and higher sensitivity of capital flows to changes in global conditions (Ghosh, Ostry and Quareshi, 2014; Obstfeld, Ostry and Quareshi, 2017). Maintenance of exchange rate peg in the crisis period is connected to sharper deflation and fall of economic activities in order to induce real exchange rate depreciation and competitiveness improvement compared to the floaters (Hoffmann, 2008; Herrmann and Jochem, 2013; Devereux and Yu, 2016). Accordingly, the floaters took advantage of exchange rate as a shock absorber, engaging nominal exchange rate depreciation and redistributive adjustment mechanism under crisis impact (De Gregorio, 2013; Ghosh, Quareshi and Tsangarides, 2014; Josifidis, Allegret and Beker Pucar, 2014).

Monetary and real convergence are in essence difficult task for Emerging European Economies, often contradictory and burdened with different monetary pressures and challenges. One of the challenges is how to reconcile often conflicted monetary and real convergence (Fahrholz, 2003; Schadler et al., 2005; Tchorek, 2017). Even if through a constant effort the Maastricht criteria would be fulfilled in a relatively short period of time, nominal convergence sustainability depends eventually on the achievement of the real convergence (Palankai, 2015). Moreover, the adoption of monetary restrictions in order to force the achievement of the nominal convergence in a relatively short period of time, could have a negative impact on maintaining an accelerated rhythm of economic growth, which in fact would delay the fulfilment of the real convergence objectives. Even when Maastricht criteria of nominal convergence are fulfilled, euro adoption should be delayed until the real convergence is reached in order to avoid the asymmetric shocks (Ciobanu and Smarandache, 2010).

The convergence process involves dismantling of old production structures and structural reforms. Accompanying productivity growth and real wages changes exert an upward appreciating pressure on the real exchange rate. Precisely Balassa-Samuelson hypothesis predicts that real exchange rate appreciation occurs in fast growing, catching up and innovative economies (De Broeck and Slok, 2001; Issing, 2003; Mihaljek and Klau, 2008, DGTPE – Direction Genominale Exchange Rateale Du Tresor Et De La Politique Economique, 2008; Diaz del Hoyo et al., 2017). While the appreciation impact of relative productivity gains in the traded goods sector on the real exchange rate is the same under both regimes, the exchange rate regimes matters for the adjustment channel. In order to deal simultaneously with real convergence and Maastricht criteria, fiscal contraction and nominal appreciation are two main options to achieve the euro area membership (Szapary, 2001; De Grauwe and Schnabel, 2003). Fiscal contraction as a solution is confronted with the real convergence. Nominal appreciation,

even within ERM II, is a better option since the dampening effect on output is less and it could reconcile real and nominal convergence.

Besides productivity gains, the liberalization of capital accounts resulting in growing capital inflows are also recognized as appreciation source of the real exchange rate (Kutan and Dibooglu, 1998; Issing, 2003; Schadler et al, 2005; DGTPE, 2008; Carlson et al., 2016). Saving-investment gap and relatively high returns on investments in the Emerging European Economies continue to attract large capital inflows, matched by large current account deficits. Large foreign capital surges are to a large extent a natural part of a catching-up process with the euro area (Begg et al., 2002). However, despite the contribution to the rapid real convergence, foreign capital inflows also led to the build-up of imbalances and vulnerabilities (Vamvakidis, 2008). Convergence process and macroeconomic overheating in the pre-crisis period brought to higher sensitivity to sudden stop episodes. If the inflows are mostly based on foreign direct investments, it coincide with real convergence representing stable and favourable way to finance current account deficit. Volatility of portfolio and other investments remains a key risk for sudden stop episodes, capital reversals and sharp current account adjustments (Schadler et al., 2005).

In essence, when countries get richer with the progressed real convergence, their price level increases. Furthermore, there is a close link between convergence in real incomes and convergence in prices (nominal convergence). Faster-growing (converging) economies usually experience real exchange rate appreciation which often materialises through higher inflation (Žuk et al., 2018). If exchange rate is fixed, this will happen through higher inflation. Real exchange rate appreciation was common across Emerging European Economies in the lead-up to the crisis, but this coincided with nominal appreciation of the floaters and higher inflation of the fixers (International Monetary Fund, 2015; Carlson et al., 2016).

Emerging European Economies, European Union members, have followed two different monetary paths on the road towards the euro area. The choice of path assumes adequate monetary and exchange rate framework which is crucial for adjustment processes (Backe et al., 2004; Bakker, 2017). One path assumes gradual approach and even before euro area entrance, this road mimics the adjustment mechanisms within the monetary union. Baltic States, Bulgaria, Slovenia and Croatia have followed this path (the fixers). Another option has been followed by Central Emerging European countries (Poland, Czech Republic, Slovakia, Hungary) and Romania (Pelinescu and Caraiani, 2006; Belhocine et al., 2016). Monetary convergence of the floaters assumed inflation targeting monetary framework in the combination with flexible exchange rate (Orlowski, 2001; 2005; Josifidis, Allegret and Beker Pucar, 2011; Bakker, 2017). However, the latter

monetary strategy assumed more radical change of exchange rate regimes starting from exchange rate targeting to inflation targeting (growing exchange rate flexibility), reversal to ERM II target zone and, at last, monetary union (decreasing exchange rate flexibility) (Frait, 2004). Some representatives of mentioned “double shift approach” in monetary convergence are no longer eager to early euro adoption. With the exception of Slovakia which entered the euro area after the crisis impact in 2009, remaining economies of Central Emerging European Economies (namely, Poland, Czech Republic, and Hungary) fifteen years after entering the European Union are still in pre-euro stage.

## **2. Descriptive Analysis of Key Distinctions between Baltic vs Central Emerging European Countries**

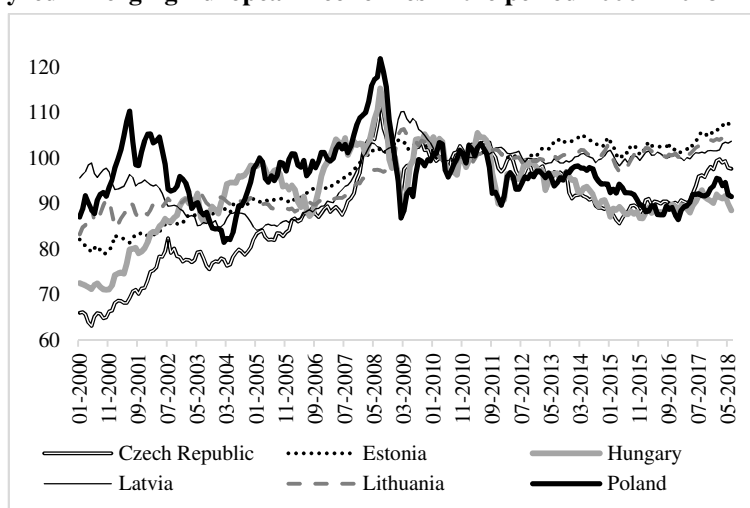
One of crucial distinctions between Baltic States as euro area members and Central Emerging European countries as non-euro area members (Poland, Czech Republic, Hungary) presents applied exchange rate regime. Baltic States practised exchange rate as a nominal anchor since the beginning of transition. These economies *de jure* changed exchange rate regime in ERM II target zone, but *de facto* monetary framework of exchange rate targeting remained the same during the monetary convergence. Rigid exchange rate and limited monetary autonomy are framework within which Estonia, Lithuania and Latvia have functioned until euro area participation.

From the other side, Poland, Czech Republic, Slovakia and Hungary adopted different monetary strategy towards higher flexibility, starting from exchange rate as a nominal anchor, later moving towards intermediate and finally flexible exchange rates. Until 2000 all Central Emerging European countries adopted inflation targeting monetary regime combined with managed/free floating exchange rate regime. For the purpose of this research, Poland, Czech Republic and Hungary will be observed as the floaters due to the renouncement of the parity and adoption of inflation targeting monetary strategy. But it should be born in mind that the intensity and frequency of foreign exchange intervention differ between these economies under managed floating arrangement. According IMF (2015; 2017) there is a range of floating (Hungary), free floating (Poland), but also “other managed arrangement” or “stabilized arrangement” as in the case of Czech Republic. The classification of Czech koruna reflects central bank’s interventions in the context of unconventional monetary policy in order to stimulate economic activities in the post-crisis episode at the zero interest bound. However, the Czech koruna was classified as “free floating” until 2013 (International Monetary Fund, 2015; Hledik, Holub and Kral, 2016).

Real exchange rate appreciation is a common feature of emerging economies which come naturally as a part of convergence process. It was evident in the pre-crisis period when convergence process continuously progressed. Appreciation trend was especially emphasized since 2004 when macroeconomic imbalances were worsened until the outbreak of the crisis. In the post-crisis period the floaters experienced smooth real exchange rate depreciation as a competitiveness improvement, while the fixers struggled to avoid real exchange rate appreciation (Figure 1). Catching-up assumes growing productivity between emerging economies and euro area. At the same time catching up attracts abundant capital inflows with specific accompanying challenges. Real shocks reflected in higher growth/productivity boost the prices, while capital inflows create excessive domestic liquidity (monetary shock). Both types of shocks initiate real exchange rate appreciation.

Figure 1

**Real Effective Exchange Rate as Competitiveness Indicator (2010 = 100) for Analyzed Emerging European Economies in the period 2000 – 2018**

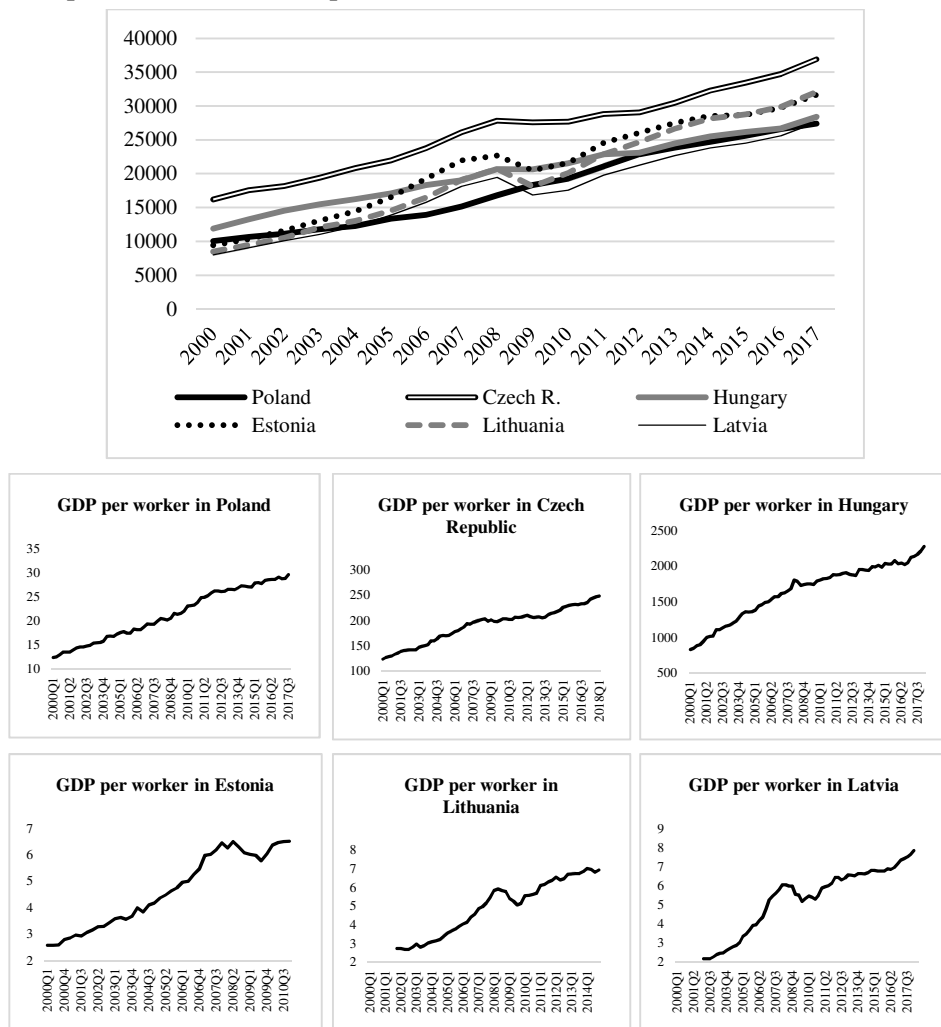


Source: Authors according to BIS (CPI based, broad indices, monthly averages, 2010=100) effective exchange rate database.

Rising productivity in convergence process is often represented with rising GDP *per capita* and rising GDP *per worker* (Figure 2). Real convergence trend is obvious with a slowdown in the crisis period, more pronounced in the case of Baltic States. Concerning the monetary source of real exchange rate appreciation, all types of capital inflows were growing in the pre-euro stage. Taking a closer look to the Figure 3, foreign direct investment prevails in Poland (post-crisis period), Estonia (post-crisis period) and Hungary (prior and post-crisis) as a favourable way to finance current account deficit and inflow that is in line with

real convergence. Firstly, direct investments aren't volatile, and secondly, they are often allocated into productive and export sectors, supporting the real convergence process. Less favourable composition of capital inflows has been recorded in Czech Republic, Lithuania and especially Latvia, in which other investments are dominant. These types of investments are more volatile and connected with macroeconomic overheating.

**Figure 2**  
**Growing Productivity as Real Convergence Indicator in Selected Emerging European Economies in the period 2000 – 2018**

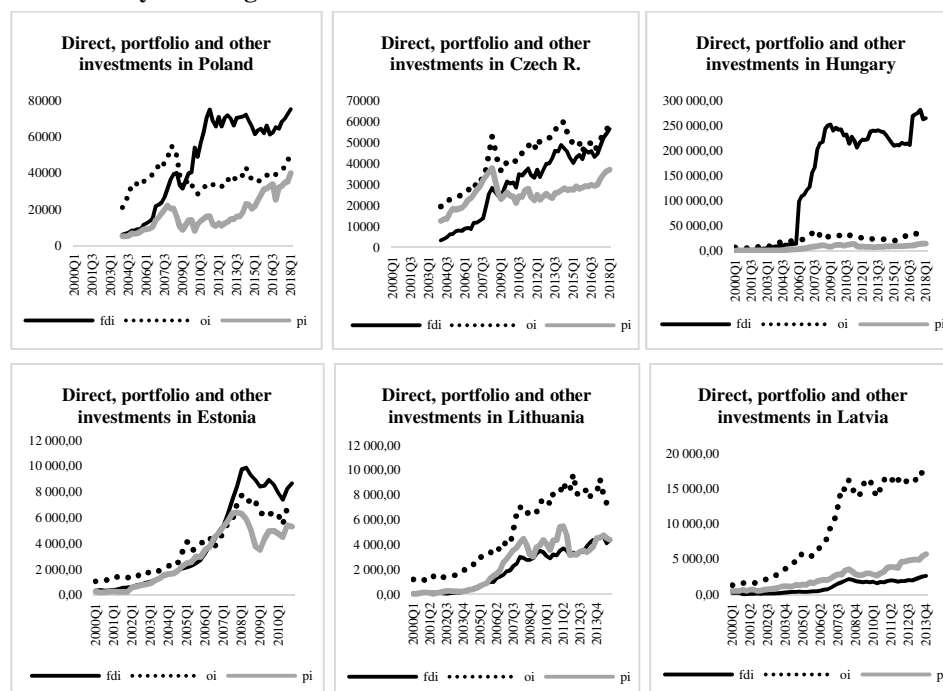


*Notes:* GDP per worker (quarterly frequency) - calculated as GDP (nominal, seasonally adjusted, domestic currency) / Employment (number of persons), from IMF International Financial Statistics. GDP per capita (yearly frequency) – PPP, current international dollars from WB World development Indicators.

*Source:* Authors according to IMF International Financial Statistics yearly and quarterly data.



**Figure 3**  
**Capital Inflows and their Composition for Selected Emerging European Economies in Monetary Convergence Period since 2000**



*Notes:* fdi – direct investments, US dollars; oi – other investments, US dollars; pi – portfolio investments, US dollars.

*Source:* Authors according to IMF International Financial Statistics quarterly data.

Monetary challenges on the road towards the euro area are especially stressed for the countries with rigid exchange rate regimes, as Baltic States with their currency board arrangement in the pre-euro phase. More relaxed position is reserved for the floaters (Central Emerging European countries) since nominal exchange rate initiate real exchange rate variations serving as a buffer against external shocks. The fixers are generally more prone to overheating and substantial internal and external imbalance within rigid exchange rate framework. Internal and external imbalances worsened more in Baltic States prior the crisis. Inflation differential, as well as GDP growth and productivity differential compared to the euro area, was much more profound for the fixers compared to the floaters (Figure 4). The sign of overheating was growing current account deficit as an external imbalance. Post-crisis internal and external adjustments were sharp and fast for the fixers, conducted mainly through price adjustment or internal devaluation. Naturally nominal exchange rate changes, reflecting exchange rate as a shock absorber, were stronger in the case of floaters (right panel) compared

to the fixers (left panel of the Figure 5). Nominal (and real) appreciation few years prior the crisis was evident for the floaters, with reversing nominal (and real) depreciation trend after the crisis.

Figure 4

**Macroeconomic Imbalances in Analyzed Emerging European Economies in the Period 2000 – 2018**



*Notes:* 1-Poland, 2-Czech Republic, 3-Hungary, 4-Estonia, 5-Lithuania, 6-Latvia. Inflation (consumer prices, annual percent) differential – the difference between domestic inflation rate and euro area inflation rate. GDP growth (annual percent) difference – the difference between domestic GDP growth and euro area GDP growth. Productivity – calculated as GDP seasonally adjusted/employment (persons). Productivity differential – the difference between domestic and euro area productivity. Current account – % of GDP. Yearly time series of GDP growth, inflation rate, employment and current account are obtained from IMF International Financial Statistics and WB World Development Indicators.

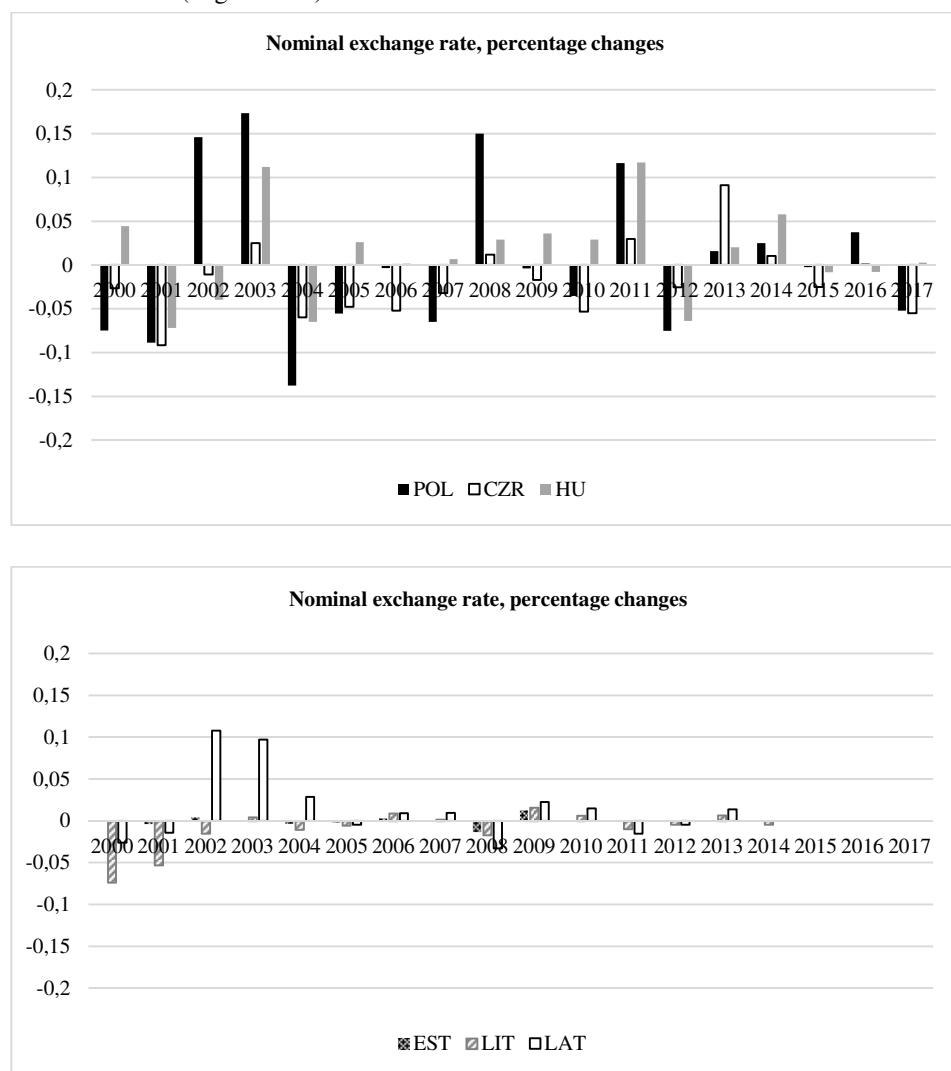
*Source:* Authors according to yearly data from IMF International Financial Statistics and WB World Development Indicators.

Currency mismatching problem is phenomenon closely related to emerging economies previously confronted with episodes of macroeconomic instability, above all high (hyper) inflationary pressures. However, this indicator differs between observed countries. Baltic States have recorded extremely high currency mismatch related to foreign currency loans and liabilities. Entering the euro area

brought to sharp decrease of currency mismatching problem (Figure 6). This clearly point to *de facto* absence of monetary sovereignty in the pre-euro phase. Since monetary autonomy has been already highly constrained with exchange rate target, combined with pronounced currency mismatching, joining the euro area practically do not mean sacrifice of monetary autonomy. The opposite holds for the floaters or Central Emerging European economies.

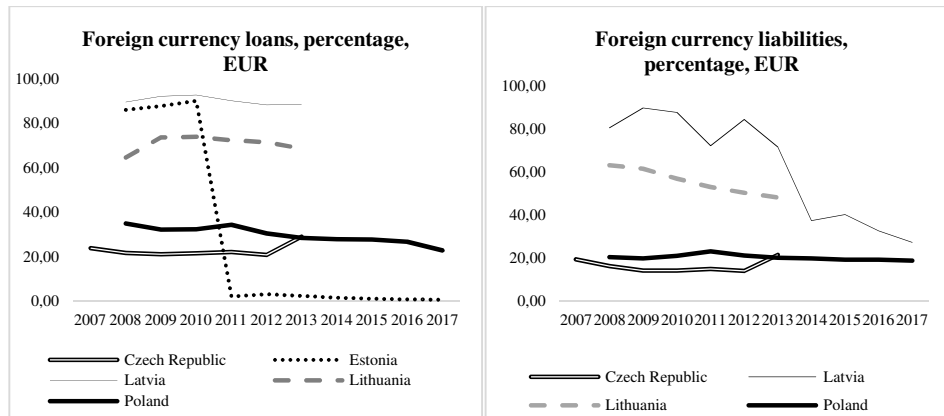
Figure 5

**Nominal Exchange Rate Changes in the Group of Floaters (Left Panel)  
and the Fixers (Right Panel)**



Source: Authors' calculation according to yearly series of NER (domestic currency per euro, end of period, rate), IMF's International Financial Statistics.

Figure 6  
 “Currency Mismatch“ Indicators



Notes: available yearly data since 2007; foreign currency loans and liabilities data are not available for Hungary; foreign currency liabilities data are not available for Estonia.

Source: Authors according to IMF Financial Soundness Indicators yearly data.

Since real exchange rate appreciation is accompanying phenomenon of catching-up process, the question is which source of appreciation dominate, real or monetary, productivity or capital inflows (and which type of inflows)? Another dilemma is how real exchange rate changes are transmitted to the real economic activities i.e. are real exchange rate appreciations contractionary and in which extent? Is there any difference between observed emerging fixers (euro area members) and emerging floaters (euro area candidates) concerning vulnerability to shocks and adjustment/transmission channels? Following empirical results shed some light into these issues.

### 3. Methodology Framework

On the idea that theoretical constraints are uncertain and often arbitrary, and in order to base the model more on data than on theoretical assumptions, a VAR approach has been developed as a natural extension of the univariate autoregressive model. VAR model is useful for describing the dynamic behaviour of time series implied to be jointly endogenous. Therefore, this model implies that all components of the vector of dependent variables, which are stationary, depend linearly on their own lags, as well as the lags of all other variables (Sims, 1980). VAR models are usually applied in macroeconomic research in order to capture the dynamics of relationships between relevant variables. It is also used for structural inference and policy analysis. In structural analysis, certain assumptions about the causal structure of variables are imposed, and the resulting

causal impacts of unexpected shocks or innovations to specified variables in the model are analyzed. These causal impacts are usually summarized with impulse response functions and forecast error variance decompositions. The technical surveys and application of VAR techniques are given in Watson (1994), Hamilton (1994), Mills (1999), Tsay (2001), Lutkepohl (2004; 2011).

Vector autoregression model as dynamic macroeconomic model has been extensively used in the empirical literature in the analysis of the monetary transmission mechanism. It is appropriate tool for measuring the strength and effectiveness of transmission channels of financial, monetary and real shocks, e.g. Garbuza (2003), Borghijs and Kuijs (2004), Horska (2004), Hristov (2005), Korhonen and Wachtel (2005), Ito and Sato (2006), Tang (2006), Maćkowiak (2007), Jarocinski (2008), Galesi and Lombardi (2009), Josifidis, Allegret and Beker Pucar (2011), Bayraci, Ari and Yildirim (2011), Polito and Wickens (2012), Sun, Heinz and Ho (2013), Josifidis, Allegret, Gimet and Beker Pucar (2014), Arratibel and Michaelis (2014), Kapuscinski et al. (2016), Serwa and Wdowinski (2016), Ulrich (2018), Dabrowski and Wroblewska (2019).

In order to detect the sources of real exchange rate appreciation, as well as output variations as a response to real exchange rate movements, in selected Emerging European Economies at pre-euro stage, unrestricted VAR model has been estimated, defined as (Lutkepohl, 2004; 2011):

$$\mathbf{y}_t = \mathbf{A}_0 + \mathbf{A}_1 \mathbf{y}_{t-1} + \dots + \mathbf{A}_p \mathbf{y}_{t-p} + \boldsymbol{\varepsilon}_t,$$

where

$\mathbf{y}_t$  – vector of endogenous variables,

$\mathbf{A}_p$  – matrix of autoregression parameters,  $p = 1, \dots, P$ ,

$\mathbf{A}_0$  – vector of constant term,

$\boldsymbol{\varepsilon}_t \sim \text{NID}(0, \boldsymbol{\Sigma})$  – vector of error terms.

The vector of endogenous variables includes the following stationary transformations of time series (see Table 2 in Appendix for stationarity tests): real effective exchange rate (REER), unit labour costs (*ulc*), direct investments (*di*), portfolio investments (*pi*), other investments (*oi*), GDP change (*gdp*), GDP per worker (*prod*). Variables description and sources are depicted in Table 1. The aim of the research is to reveal the dominance and persistence of monetary and real shocks in initiating real exchange rate (*REER or ulc*) appreciation for selected Emerging European Economies. Following the aim, monetary shocks are presented with three different capital inflows: direct investments (*di*), portfolio investments (*pi*) and other investments (*oi*). As the real shock, GDP change is used as a proxy for real convergence towards the euro area (*gdp*), as well as productivity changes calculated as GDP per worker (*prod*).

Table 1  
The Description of Variables, Quarterly Frequency

Variable	Description	Database
reer	Exchange Rates, <i>Real Effective Exchange Rate</i> based on Consumer Price Index, 2010=100	IMF International Financial Statistics
ulc	<i>Unit Labor Costs</i> , Index, 2010=100	OECD database
gdp	National accounts, <i>Gross Domestic Product</i> , Nominal, Seasonally adjusted, Domestic currency	IMF International Financial Statistics
prod	National accounts, <i>Gross Domestic Product</i> , Nominal, Seasonally adjusted, Domestic currency / Employment, number of persons	IMF International Financial Statistics
fdi	International Investment Position, Assets, <i>Direct investment</i> , US dollars	IMF International Financial Statistics
pi	International Investment Position, Assets, <i>Portfolio investment</i> , US dollars	IMF International Financial Statistics
oi	International Investment Position, Assets, <i>Other investment</i> , US dollars	IMF International Financial Statistics

Note: Real effective exchange rate in quarterly frequency is not available for Estonia and Lithuania, and instead as a competitiveness indicator are used unit labour costs (*ulc*).

Source: Authors' research.

Since the aim is to identify main appreciation pressures on monetary convergence path towards the euro area, the research period starts with 2000. Until 2000 all investigated Central Emerging European countries (Poland, Czech Republic, Slovakia and Hungary) have adopted current monetary framework of inflation targeting in the combination with managed floating exchange rate regime. Baltic States (the fixers) as current euro area members practised the combination of exchange rate targeting and exchange rate as a nominal anchor monetary strategy since the beginning of their transition process. Central Emerging European countries (the floaters) used exchange rate as a nominal anchor at the beginning of their transition process, moving towards intermediate exchange rate forms until the adoption of current inflation targeting monetary framework in the combination with managed floating exchange rate. Slovakia is excluded from the analyses since it entered the euro area in 2009 as the only floater which adopted the euro so far.

Therefore, our sample consists from Baltic States as euro area members (Estonia, Lithuania, Latvia) and Central Emerging European countries (Poland, Czech Republic, Hungary) as euro area candidates. Research period covers monetary convergence path towards the euro area: in the case of Poland, Czech Republic and Hungary 2000Q1 – 2018Q1 and in the case of Estonia 2000Q1 – 2010Q4, Latvia 2000Q1 – 2013Q4, and Lithuania 2000Q1 – 2014Q4.

For each country case, usual empirical procedure for unrestricted VAR estimation has been applied. Stationarity of variables has been analyzed via Dickey-Fuller and Phillips-Perron tests. Except the variable real exchange rate (REER) in the case of Poland, trend is included in the regression with the lags

selected according to Likelihood ratio test (LR), Akaike's information criterion (AIC), Hannan-Quinn information criterion (HQIC) and Schwarz-Bayesian information criterion (SBIC). Except in the case of real exchange rate variable for Poland, the results of the unit root tests suggest the acceptance of the null hypothesis (non-stationarity). The results of stationarity testing are presented in Table 2 in Appendix. Time series, except real exchange rate in Poland, enter the standard VAR model in first differences. Since most variables are integrated at order one, Johansen cointegration test is performed for all countries, except Poland with stationary real exchange rate. Cointegration is found in several relations, mainly between real exchange rate and proxies for real shocks in the case of Czech Republic, Estonia and Hungary. However, estimated VEC models aren't stable, suggesting that their cointegration relations aren't stationary. Final estimations are based on VAR model in log differences, except Polish real exchange rate which entered the VAR model in the log-level form. According to selection-order criteria (final prediction error – FPE, LR, AIC, HQIC, SBIC), adequate VAR order has been chosen. Since estimated VAR models satisfy stability condition, Lagrange multiplier test for autocorrelation and Jarque-Bera normality tests were applied. After diagnostic checks and acceptance of the null (no autocorrelation and normal residual distribution), impulse response functions have been derived.

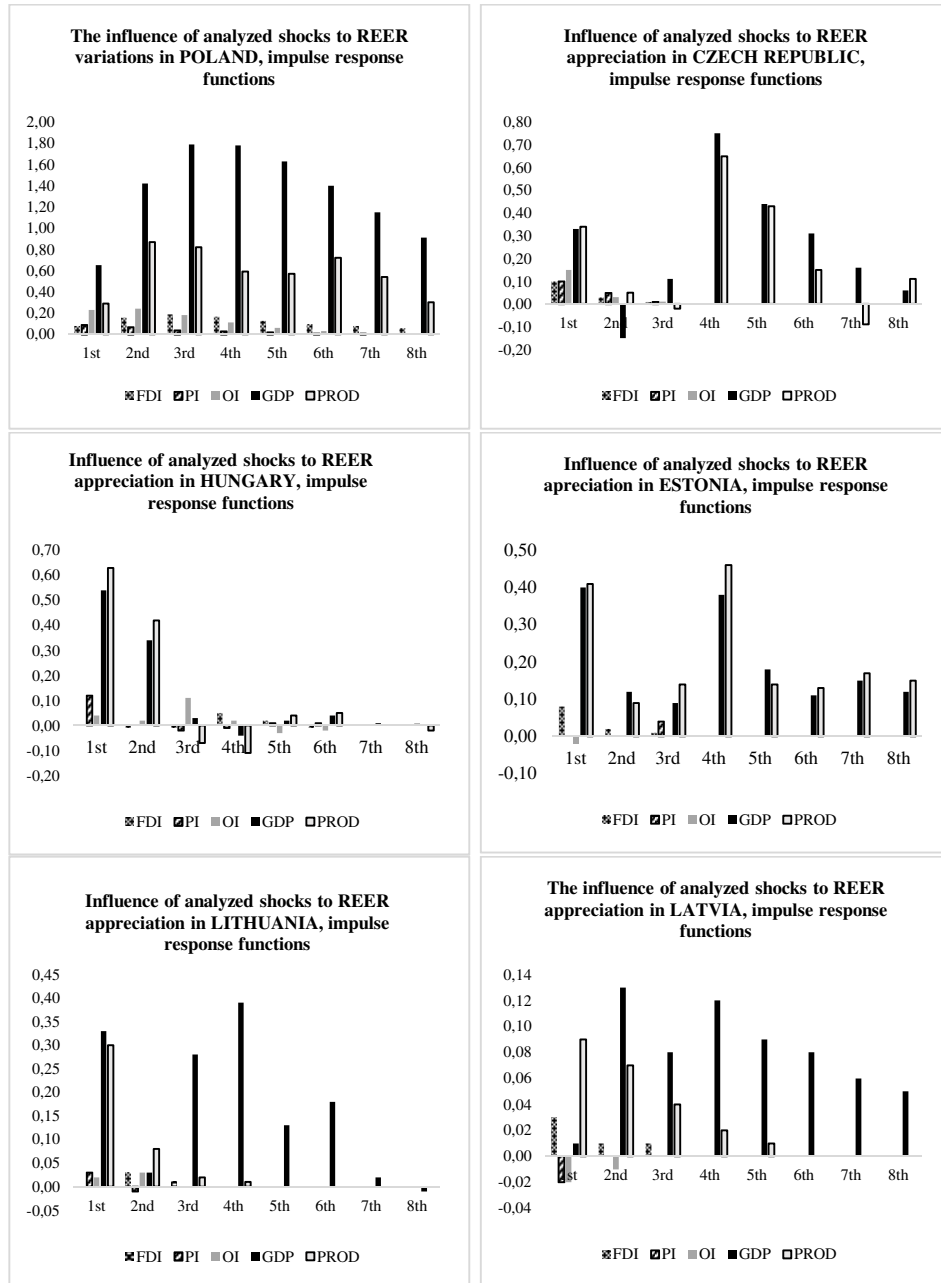
An impulse response gives the response of one variable, to an impulse in another variable in a system. In this research, impulse responses reveal the nature of transmission of monetary and real shocks to real exchange rate variations during eight quarters. As the impulse are set types of capital inflows (direct, portfolio and other investments) and real shocks (gross domestic product changes and productivity rise), while the response represents real exchange rate variations. In the same way, real exchange rate is set as an impulse while GDP changes are responses in order to analyse real exchange rate transmission to economic activities.

#### **4. The Discussion of Results**

The aim of the research is the identification of crucial sources (monetary and real shocks) of real exchange appreciation for the Baltic States (the fixers) and selected Central European emerging economies (Poland, Czech Republic and Hungary as the floaters) in the pre-euro stage. The results show the importance of monetary and real shocks in explaining short-run real exchange variations from one side, as well as output variations as a response to real exchange rate movements from another side.

Figure 7

### Capital Inflows and Real Convergence as Sources of Real Exchange Rate Appreciation in Selected Emerging European Economies



Notes: FDI – foreign direct investments; PI – portfolio investments; OI – other investments; GDP – gross domestic product; PROD – productivity (GDP per worker).

Source: Authors' estimations.



According to the hypothesis, the results indicate that direct, portfolio and other investments (monetary shocks), as well as real shocks (converging GDP and productivity rise) pose appreciation pressures to the real exchange rate of selected emerging European economies.

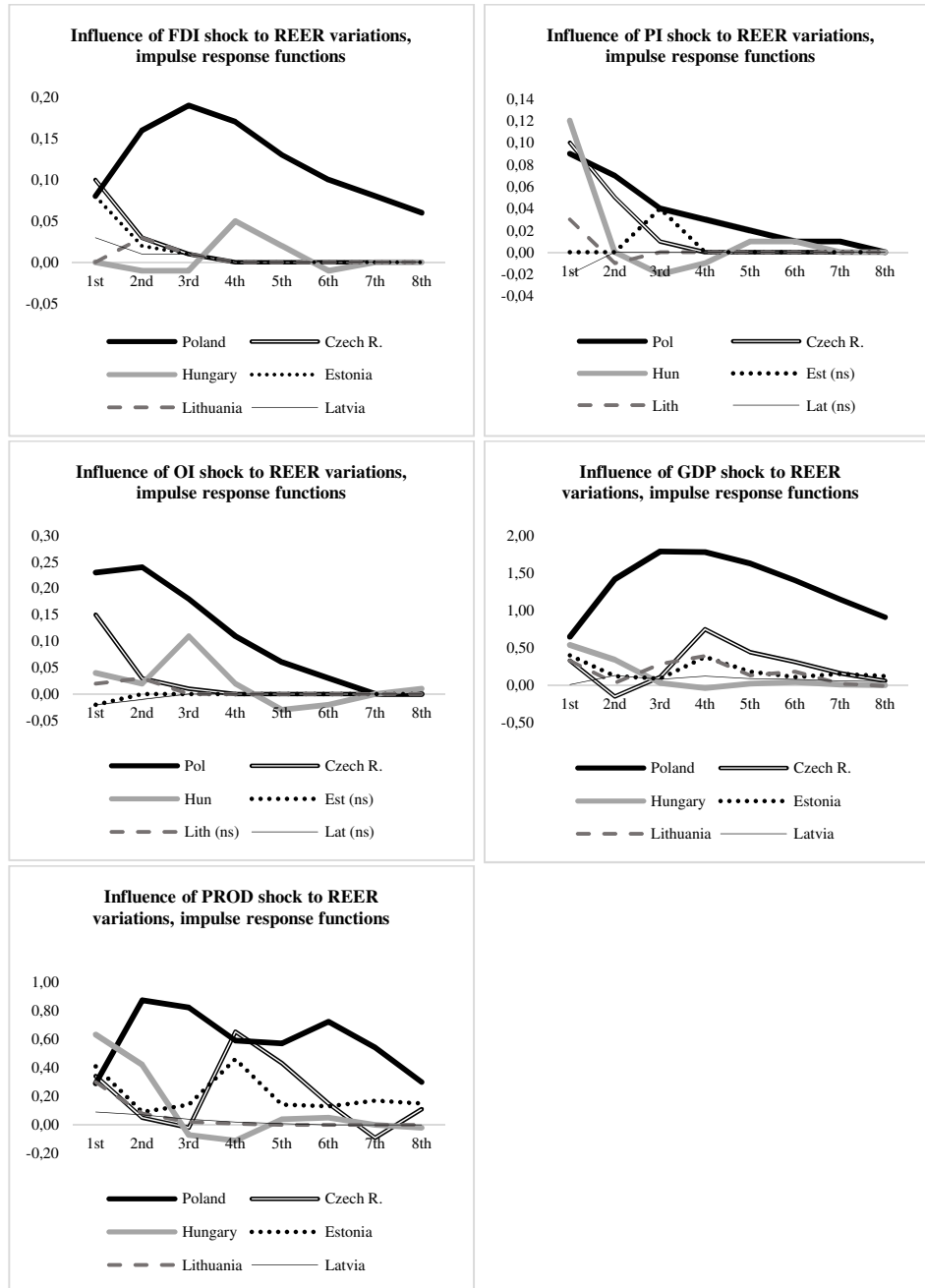
However, as the results of impulse responses suggest, the shock persistence and their strength differ between economies at the opposite monetary paths towards the euro area. Observing the impact of analysed shocks to real exchange rate variations, impulse response functions for individual countries show the dominance of real shocks over capital inflows in initiating real exchange rate appreciation (Figure 7).

Compared to the real shock the shock originating from capital inflows is relatively weaker and short lived. Besides the general dominance of real shocks (represented with GDP changes and productivity rise), Figure 7 reveals that in the case of Hungary their impact is temporary (diminishes after the second quarter), while in the case of other countries the peak is reached after one year, slowly diminishing after two years. Despite the general insight concerning the prevalence of the real shocks, it could also be noticed that GDP change (as a proxy for the real convergence and real shock) exerts a stronger influence on real exchange rate appreciation compared to the productivity change.

In order to take a closer look at the influence of specific shocks to real exchange rate appreciation, Figure 8 shows their relative power and persistence between Baltic states (euro area members) and Central Emerging European countries (euro area candidates). The impact of *direct investment* inflows on real appreciation is the strongest in Poland with a persistent (although decreasing) impact even after two years. Real exchange rate appreciation induced with direct investments is short lived and weaker in the case of other countries. In the case of the Czech Republic and Baltic States, the appreciation impact disappears after three quarters, while in the case of Hungary appreciation rises from the third until the sixth quarter. *Portfolio inflows* initiate real appreciation in all euro area candidates, again most persistent in the case of Poland, followed by the Czech Republic and Hungary with decreasing influence after one year. The strongest and most persistent impact of the *real shock* on real exchange rate appreciation is evident in Poland, while appreciation pressures are weaker for other economies, especially euro area members. Similar conclusions hold for the productivity real shock.

The pressures on real exchange rate appreciation, as a reaction to real shocks primarily (then direct investment and other inflows), are prevalent for euro area candidates or the floaters. Appreciation pressures for the group of fixers are relatively weaker.

**Figure 8**  
**Comparison of the Impact of Capital Inflows/Real Shocks to Real Exchange Rate Appreciation between the Fixers and the Floaters**



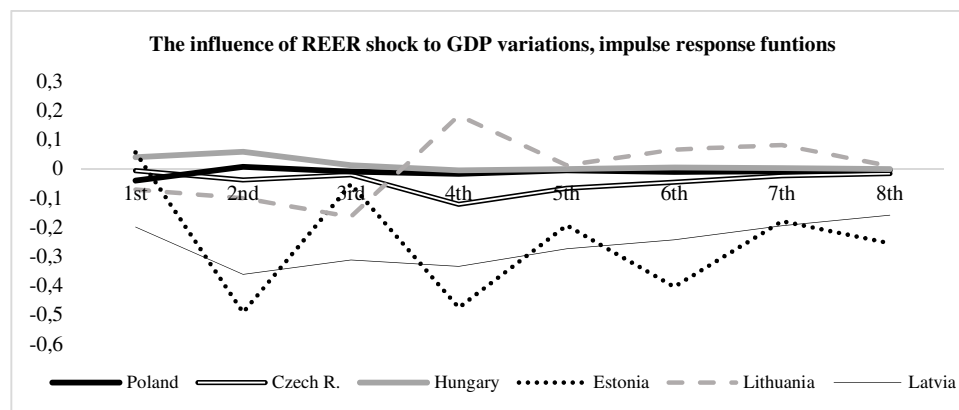
*Notes:* FDI – foreign direct investments; PI – portfolio investments; OI – other investments; GDP – gross domestic product; PROD – productivity (GDP per worker); (ns) – non significant impulse response functions.

*Source:* Authors' estimations.

This general insight is in line with the hypothesis that real exchange rate variations as a competitiveness indicator are more prone to monetary and real shocks in the case of floaters. These economies express stronger preference to keep the monetary autonomy and postpone further deepening of monetary integration. Higher real exchange rate vulnerability to convergence shocks imply more need to keep nominal exchange rate variations or shock absorbing role in contrast to internal devaluation necessary in the case of rigid exchange rate arrangement. Therefore, another question related with the role of exchange rate on monetary convergence path is how these economies cope with these pressures i.e. which adjustment mechanism of real exchange rate prevailed, internal adjustment (price adjustments) or nominal appreciation? The fixers' internal devaluation or price adjustment channel brings more economic costs in terms of output and employment losses. The opposite holds for the floaters in which nominal and real exchange rates buffer the influence of the shock and limits its' transmission to the economic activity. In order to get an impression concerning the influence of REER shock to GDP variations, Figure 9 shows the direction and persistence of this transmission during eight quarters.

Figure 9

**Real Exchange Rate Transmission to Economic Activities in the Case of the Fixers and the Floaters**



Source: Authors' estimations.

Real exchange rate appreciation exerts more contractionary effects to economic activities of Lithuania until third quarter, and prolonged contractionary pressures even after two years in the case of Estonia and Lithuania. Contractionary real appreciations are especially emphasized for Estonia (with more volatility) and Latvia (less GDP volatility). Recall that Baltic States despite stronger macroeconomic imbalances prior the crisis adjusted sharply in post-crisis period.

Baltic States, current euro area members, are flexible in terms of labour and product markets which facilitated the adjustment (Purfield and Rosenberg, 2010; European Central Bank, 2011). This is necessary precondition for functioning under rigid currency board arrangement in the pre-euro stage. Figure 9 also uncovers different position of euro area candidates or the floaters in which real exchange rate appreciations aren't strongly contractionary. Hereof the benefit of keeping the exchange rate as a shock absorber by the floaters since nominal and real exchange rate variations do not cause too sharp internal real adjustments and disturbance of convergence process. These insights confirm the hypothesis that less output variations as a response to real exchange rate movements is expected for the floaters (Central Emerging European Economies) thanks to the role of exchange rate as a shock absorber.

Similar research idea and methodology was applied in Kutan and Dibooglu (1998). The authors identified real and nominal shocks to real exchange rate in Poland and Hungary in the period 1990-1998. After identifying the shocks, the dynamic effect of nominal and real shocks were analyzed by variance decompositions and impulse response functions typical of VAR methods. The dominance of the nominal shocks in the case of Poland and in less extent in the case of Hungary could be attributed to the observed period of macroeconomic stabilization. In the first decade of a transition process, macroeconomic stabilization involved higher vulnerability to nominal shocks, while in the latter phases of fostered convergence towards the European Union involved higher vulnerability to real shocks. According the findings of Borghijs and Kuijs (2004) the impulse response functions indicate that exchange rate response generally dampens demand shocks and amplifies monetary/financial shocks, in terms of the impact on output in the case of five Central European economies. The authors thus suggest that the costs of losing exchange rate flexibility in the Central European economies are rather limited. Lesuisse (2019) explored ECB monetary policy transmission in Central and Eastern European economies differing the fixers and the floaters with panel VAR techniques in the period 1995 – 2016. The author concludes that exchange rate regime plays a small significant role looking at prices, but no role when the focus is put on real variables such as GDP. Further progress towards the euro area, Lesuisse (2019) relates dominantly to institutional issues. Dabrowski and Wroblewska (2019) have examined the insulating properties of the floating exchange rate regime by comparing pegs and floats adopted in eight Central and Eastern European economies in the period 1998 – 2015. Based on impulse response functions and variance decompositions of estimated Bayesian VAR model, the authors found that flexible exchange rate regime insulates the economy against real shocks and does not act as a propagator of nominal shocks

in explored economies. Obstfeld, Ostry and Qureshi (2017) found that the transmission of global financial shocks is magnified under fixed exchange rate regimes relative to more flexible regimes for investigated 40 emerging economies in the period 1986 – 2013. This conclusion the authors attribute to reduced monetary policy autonomy and a greater sensitivity of capital flows to changes in global conditions under fixed rate regimes. Zeev (2019) based the research on panel of 40 emerging market economies exploring the relation between the type of exchange rate regime and the effects of global credit supply shocks. Key findings highlight that output responds more adversely to contractionary global credit supply shocks in the case of the fixers compared to the floaters. Lack of exchange rate depreciation for the fixers is accompanied by a stronger fall in exports. Allegret and Sallenave (2015) and Carlson et al. (2016) are also supportive to our hypothesis and findings in the sense that the floaters in Emerging Europe benefited from exchange rate as a shock absorber and therefore the reluctance to renounce this stability mechanism during convergence process.

### **Concluding Remarks**

An eagerness for deepening monetary integration towards Exchange Rate Mechanism II and euro area is complex issue from the angle of Emerging EU members associated with internal and external viewpoints. Internal in the sense of sacrificing monetary policy and exchange rate as a shock absorber, while external viewpoint emphasizes the attractiveness or weaknesses of the euro area as a safe zone and stable external anchor. This paper focuses internal aspect by stressing potential sacrifice in pursuing further monetary integration related with real exchange rate pressures and real transmission effects at pre-euro stage. The position of Central Emerging European economies or the floaters is confronted with the position of Baltic States or the fixers in descriptive and econometric analysis.

Vast literature is devoted to the examination of role of exchange rate regime in Emerging European economies during convergence towards the euro area (e.g. Backe et al., 2004; Schadler et al., 2005; Belhocine et al., 2016; Bakker, 2017; Tchorek, 2017; Adomnicai, 2018; Žuk et al., 2018). Spillover effects of different shocks are mainly explored with impulse response functions and forecast error variance decompositions on the basis of estimated (panel)VAR models (e.g. Maćkowiak, 2007; Feldkircher, 2015; Kucharcukova, Claeys and Vasicek, 2016; Moder, 2017; Dabrowski and Wroblewska, 2019; Lesuisse, 2019). Nevertheless, little has been done concerning the spillover effects of real and monetary shocks to the real exchange rate variations, as well as the connection between identified vulnerability to shocks and applied exchange rate regime. This paper

contributes to the existing literature by highlighting the role of exchange rate and corresponding adjustment mechanisms on the road towards the euro area at the sample of Baltic States (the fixers) as well as the Central Emerging European economies (the floaters) in the period from 2000 until 2018 or euro adoption.

The hypothesis of appreciation pressures due to monetary and real shocks on monetary convergence path towards the euro area has been confirmed. Namely, progressed convergence towards the euro area brings capital inflows, growing productivity, and consequently, rising real exchange rate appreciation. Pressures and adjustments differ between Baltic States and Central Emerging European countries as these groups accepted different monetary approaches towards the euro area.

The results confirm the hypothesis that euro candidates or the floaters are more exposed to real appreciation pressures, primarily originated from the real shocks, while appreciation pressures for the fixers are relatively weaker. In that sense, the floaters (especially Poland) express more need for nominal exchange rate as an adjustment tool against analysed shocks. Flexible exchange rate more easily adjusts real exchange rate, with less economic costs in terms of slowing real convergence. The sacrifice of this tool, necessary in the case of joining the euro area, is higher for the floaters compared to the Baltic States.

The hypothesis of less output variations as a response to real exchange rate movements in the case of floaters has been also confirmed. Namely, real appreciations are not strongly associated with economic contraction under floating exchange rate regimes, and *vice versa*. This fact is also the benefit of keeping the exchange rate as a shock absorber by the floaters, since nominal and real exchange rate variations do not cause too sharp real adjustments. From the other side, Baltic States have already less to lose in terms of autonomous monetary policy. Having in mind their relatively high currency mismatching problem, contractionary appreciations through internal devaluation channel, as well as long experience with exchange rate targeting, monetary autonomy has already been *de facto* sacrificed in the pre-euro stage.

The motive for postponing deeper monetary integration in the case of the floaters, as well as the willingness of the fixers to accept the monetary union, could be observed in the light of applied exchange rate regime and prevailing adjustment mechanisms. Nevertheless, further empirical steps would be desirable in order to differentiate in more details between Polish, Czech and Hungarian cases, as well as between explored Baltic States. More general insights are pointed out in the paper, while more specific and national related insights are left for further research. Authors are aware of the complexity of this issue, stressing that external aspect is also highly relevant, as well as fiscal and political context of monetary integration.

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## Appendix

Table 2  
Formal Stationarity Testing (Selection Criteria, Deterministic Variables, Results)

### Poland

	REER	GDP	PROD	FDI	PI	OI
Lag selection (LR, AIC, HQIC, SBIC)	2	4	3	1	1	2
Deterministic components	constant	Constant and trend	Constant and trend	Constant and trend	Constant and trend	Constant and trend
ADF test statistic: Level	-3.037	-1.138	0.348	-1.498	-2.487	-2.805
ADF test: Critical value 5%	-2.913	-3.482	-3.483	-3.483	0.3343	-3.496
p-value: level	0.0316	0.9225	0.9664	0.8299	0.3988	0.1953
PP test statistic: level	-16.593	-2.266	-2.966	-2.448	-10.372	-12.669
PP test: critical value 5%	-13.484	-20.196	-20.160	-19.908	-19.908	-19.908
PP test: p-value	0.0308	0.9549	0.9270	0.8349	0.3988	0.1033

Note: LR – Likelihood ratio test; AIC – Akaike’s information criterion; HQIC – Hannan-Quinn information criterion (HQIC); SBIC – Schwarz-Bayesian information criterion; REER – real effective exchange rate; GDP – gross domestic product; PROD – productivity; FDI – foreign direct investments; PI – portfolio investments, OI – other investments; PP – Phillips-Perron test; ADF – Augmented Dickey-Fuller test.

Source: Authors’ estimations.

### Latvia

	REER	GDP	PROD	FDI	PI	OI
Lag selection (LR, AIC, HQIC, SBIC)	2	4	2		2	1
Deterministic components	Constant and trend	Constant and trend	Constant and trend		Constant and trend	Constant and trend
ADF test statistic: Level	-2.094	-1.761	-1.407		-1.712	-0.200
ADF test: Critical value 5%	-3.497	-3.499	-3.520		-3.497	-3.496
p-value: level	0.7318	0.7234	0.8587		0.7457	0.9915
PP test statistic: level	-4.595	-2.963	-1.472		-10.211	-0.287
PP test: critical value 5%	-19.870	-19.890	-19.572		-19.890	-19.890
PP test: p-value	0.7655	0.9246	0.9703		0.4205	0.9925

Note: LR – Likelihood ratio test; AIC – Akaike’s information criterion; HQIC – Hannan-Quinn information criterion (HQIC); SBIC – Schwarz-Bayesian information criterion; REER – real effective exchange rate; GDP – gross domestic product; PROD – productivity; FDI – foreign direct investments; PI – portfolio investments, OI – other investments; PP – Phillips-Perron test; ADF – Augmented Dickey-Fuller test. The null hypothesis of ADF and PP tests: unit root is present in a time series sample.

Source: Authors’ estimations.

**Czech Republic**

	REER	GDP	PROD	FDI	PI	OI
Lag selection (LR, AIC, HQIC, SBIC)	2	4	1	1	1	4
Deterministic components	Constant and trend	Constant and trend	Constant and trend	Constant and trend	Constant and trend	Constant and trend
ADF test statistic: Level	-1.861	-1.993	-1.856	-2.385	-2.776	-1.998
ADF test: Critical value 5%	-3.480	3.482	-3.479	-3.495	-3.495	-3.498
p-value: level	0.6747	0.6052	0.6770	0.3875	0.2060	0.6024
PP test statistic: level	-4.572	-4.376	-3.862	-5.380	-8.757	-6.625
PP test: critical value 5%	-20.196	-20.196	-20.196	-19.908	-19.908	-19.908
PP test: p-value	0.7719	0.6787	0.6216	0.2845	0.2723	0.5503

*Note:* LR – Likelihood ratio test; AIC – Akaike’s information criterion; HQIC – Hannan-Quinn information criterion (HQIC); SBIC – Schwarz-Bayesian information criterion; REER – real effective exchange rate; GDP – gross domestic product; PROD – productivity; FDI – foreign direct investments; PI – portfolio investments, OI – other investments; PP – Phillips-Perron test; ADF – Augmented Dickey-Fuller test. The null hypothesis of ADF and PP tests: unit root is present in a time series sample.

*Source:* Authors’ estimations.

**Estonia**

	ULC	GDP	PROD	FDI	PI	OI
Lag selection (LR, AIC, HQIC, SBIC)	4	3	1	2	1	1
Deterministic components	Constant and trend	Constant and trend	Constant and trend	Constant and trend	Constant and trend	Constant and trend
ADF test statistic: Level	-3.358	-2.896	-0.637	-0.778	-1.028	-1.627
ADF test: Critical value 5%	-3.544	-3.540	-3.532	-3.536	-3.532	-3.532
p-value: level	0.0573	0.1634	0.9770	0.9675	0.9402	0.7816
PP test statistic: level	-6.668	-1.953	-2.162	-0.086	-2.058	-7.670
PP test: critical value 5%	-19.268	-19.268	-19.268	-19.268	-19.268	-19.268
PP test: p-value	0.7272	0.9688	0.9711	0.9937	0.9689	0.6900

*Note:* LR – Likelihood ratio test; AIC – Akaike’s information criterion; HQIC – Hannan-Quinn information criterion (HQIC); SBIC – Schwarz-Bayesian information criterion; ULC – unit labour cost (competitiveness indicator); GDP – gross domestic product; PROD – productivity; FDI – foreign direct investments; PI – portfolio investments, OI – other investments; PP – Phillips-Perron test; ADF – Augmented Dickey-Fuller test. The null hypothesis of ADF and PP tests: unit root is present in a time series sample.

*Source:* Authors’ estimations.

**Lithuania**

	<b>ULC</b>	<b>GDP</b>	<b>PROD</b>	<b>FDI</b>	<b>PI</b>	<b>OI</b>
Lag selection (LR, AIC, HQIC, SBIC)	1	3	1	1	4	4
Deterministic components	Constant and trend	Constant and trend	Constant and trend	Constant and trend	Constant and trend	Constant and trend
ADF test statistic: Level	-1.524	-2.145	-1.169	-0.762	-0.312	-0.312
ADF test: Critical value 5%	-3.492	-3.494	-3.499	-3.492	-3.495	-3.495
p-value: level	0.8206	0.5209	0.9168	0.9687	0.9892	0.9892
PP test statistic: level	-4.826	-4.612	-2.360	-1.420	-3.370	-3.370
PP test: critical value 5%	-19.962	-19.962	-19.836	-19.962	-19.962	-19.962
PP test: p-value	0.7820	0.8587	0.9614	0.9793	0.8948	0.8948

*Note:* LR – Likelihood ratio test; AIC – Akaike’s information criterion; HQIC – Hannan-Quinn information criterion (HQIC); SBIC – Schwarz-Bayesian information criterion; ULC – unit labour cost (competitiveness indicator); GDP – gross domestic product; PROD – productivity; FDI – foreign direct investments; PI – portfolio investments, OI – other investments; PP – Phillips-Perron test; ADF – Augmented Dickey-Fuller test. The null hypothesis of ADF and PP tests: unit root is present in a time series sample.

*Source:* Authors’ estimations.

**Hungary**

	<b>REER</b>	<b>GDP</b>	<b>PROD</b>	<b>FDI</b>	<b>PI</b>	<b>OI</b>
Lag selection (LR, AIC, HQIC, SBIC)	3	4	3	1	2	1
Deterministic components	Constant and trend	Constant and trend	Constant and trend	Constant and trend	Constant and trend	Constant and trend
ADF test statistic: Level	-2.557	-2.917	-3.714	-0.980	-1.225	-1.614
ADF test: Critical value 5%	-3.481	-3.482	-3.481	-3.479	-3.480	-3.479
p-value: level	0.3000	0.1568	0.0215	0.9468	0.9052	0.7869
PP test statistic: level	-6.009	-6.438	-4.310	-1.894	-2.200	-3.170
PP test: critical value 5%	-20.196	-20.196	-20.196	-20.196	-20.196	-20.196
PP test: p-value	0.5529	0.0359	0.0796	0.9578	0.9369	0.8654

*Note:* LR – Likelihood ratio test; AIC – Akaike’s information criterion; HQIC – Hannan-Quinn information criterion (HQIC); SBIC – Schwarz-Bayesian information criterion; REER – real effective exchange rate; GDP – gross domestic product; PROD – productivity; FDI – foreign direct investments; PI – portfolio investments, OI – other investments; PP – Phillips-Perron test; ADF – Augmented Dickey-Fuller test. The null hypothesis of ADF and PP tests: unit root is present in a time series sample.

*Source:* Authors’ estimations.