Real Output and Prices Adjustments under Different Exchange Rate Regimes

Mirdala, Rajmund

Faculty of Economics, Technical University in Kosice, Slovak republic

January 2013

Real Output and Prices Adjustments under Different Exchange Rate Regimes

Rajmund Mirdala
Faculty of Economics, Technical University of Košice, Slovakia
rajmund.mirdala@tuke.sk

Abstract
Exchange rate regimes evolution in the European transition economies refers to one of the most crucial policy decision in the beginning of the 1990s employed during the initial stages of the transition process. During the period of last two decades we may identify some crucial milestones in the exchange rate regimes evolution in the European transition economies. due to existing diversity in exchange rate arrangements in the European transition economies in the pre-ERM2 period there seems to be two big groups of countries - "peggers" (Bulgaria, Estonia, Latvia, Lithuania) and "floaters" (Czech republic, Hungary, Poland, Romania, Slovak republic, Slovenia). Despite the fact, there seems to be no real prospective alternative to euro adoption for the European transition economies, we emphasize disputable effects of sacrificing monetary sovereignty in the view of positive effects of exchange rate volatility and exchange rate based adjustments in the country experiencing sudden shifts in the business cycle. In the chapter we analyze effects of the real exchange rate volatility on real output and inflation in ten European transition economies. From estimated VAR model (recursive Cholesky decomposition is employed to identify structural shocks) we compute impulse-response functions to analyze responses of real output and inflation to negative real exchange rate shocks. Results of estimated model are discussed from a prospective of the fixed versus flexible exchange rate dilemma. To provide more rigorous insight into the problem of the exchange rate regime suitability we estimate the model for each particular country employing data for two subsequent periods 2000-2007 and 2000-2011.

Keywords: exchange rate volatility, economic growth, economic crisis, vector autoregression, variance decomposition, impulse-response function

JEL Classification: C32, F32, F41

1. Introduction

Nowadays, in the time of economic and debt crisis, many European Union member countries are exposed to the large complex of negative implications of recession, peaking rates of unemployment, increased public debt burden as well as worsen conditions to maintain fiscal sustainability. Moreover, increased uncertainty on the financial markets resulted in higher volatility of market prices/rates reduces predictability of market trends, even in the short period. As a result, increased instability of exchange rates seems to be inevitable but painful implication. Due to many external causes we may also experience sudden changes in determination potential of exchanges rate especially toward key aspects of macroeconomic performance in countries under flexible exchange rate arrangements. One of the most controversial implications of different exchange rate arrangements is addressed to their appropriateness and sustainability in countries at different stage of business cycle in short period while reflecting the overall macroeconomic performance. Wide range of such implications became highly discussed especially in the group of countries (so called European transition economies[1] which joined European Union in 2004. It may seem that fixed versus flexible exchange rates dilemma in the period of increased global uncertainty and negative trends in the global economy became alive again while discussions on policy issues, challenges and controversies may find it difficult to provide clear suggestions.

[1] Bulgaria, Czech republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak republic, Slovenia.

European transition economies already challenged a decision to adopt euro and participate in the project of common currency in the Eurozone together with Western European countries few years before world economic crisis arises. Among many circumstances and policy issues associated with a proposition of convenient time table for the schedule of euro adoption became the sacrifice of monetary sovereignty a highly discussed implication. The loss of exchange rate flexibility in the Eurozone candidate countries raised as a direct contrary effect of gained exchange rate stability associated with sacrificed monetary sovereignty. Despite real benefits of fixing exchange rate to euro followed by the euro adoption it may seem that the risks of loss in mutual interconnections between the overall macroeconomic development and the exchange rate leading path are still not well observed in the current empirical literature.

Exchange rate regimes evolution in the European transition economies refers to one of the most crucial policy decision in the beginning of the 1990s employed during the initial stages of the transition process. Despite its differences there seem to be some similar features of the starting point affecting exchange rate regime choice in each particular economy, such as similar macroeconomic development after initial transition shock (recession followed by restoration of macroeconomic stability), number of transition packages employed to support market principles and incentives as well as intention to apply for European Union membership followed by the euro adoption in the near future.

During the period of last two decades we may identify some crucial milestones in the exchange rate regimes evolution in the European transition economies. Macroeconomic stability, as one of the primary objectives in the initial phase of the transition process, revealed an absence of nominal anchor and its crucial role in reducing the risks of excessive external imbalances while providing firm constrains for national authorities. A decision to adopt so pegged exchange rate regimes (feasibility to estimate the "right" equilibrium exchange rate may be still disputable) might seem to be the most convenient and appropriate solution to reduce current account imbalances, strengthen fiscal discipline and provide a suitable anchor for prudential monetary policy. On the other hand, sustainability of pegged exchange rate is obviously determined by central bank's ability to maintain safe level of exchange reserves. Inadequate stock of foreign exchange held by central banks in Bulgaria, Romania and Slovenia refers as a most common reason to their inability to establish soft-pegged exchange rate regime in the early 1990s. Despite general expectations, European transition economies did not follow a common trend in the exchange rate regime evolution during last two decades. Central European countries (Czech republic, Hungary, Poland, Slovak republic) have experienced a long trend of successive shift from soft-pegged exchange rate regimes to floating regimes. Baltic countries implemented pegged exchange rate regimes in the first half of the 1990s. Estonia and Lithuania anchored exchange rate based stabilization by employing hard peg regime (currency board), while Latvia implemented soft peg regime (conventional fixed pegs). Bulgaria challenged financial crisis in 1996-97 initiated by imbalanced growth and low credibility (excessive amount of failed commercial bank loans) followed by forced shift from floating regime (managed floating) to hard peg regime (currency board). Romania and Slovenia remained as the only two countries not enjoying benefits of exchange rate based stabilization and kept employing floating exchange rate regimes during the whole period.

Determination process of the exchange rates leading path in the European transition economies followed quite similar principles in the long run. At the same time, it has also reflected effects of many specific features of the transition process, i.e. structural changes in the production base, institutional changes, deregulation of markets, changing structure of relative prices, etc. All those country-specific processes substantially affected long-run trends (even in the area of the exchange rate determination), that is why a rigorous insight into their

principles seems to be crucial for understanding and implementation the appropriate exchange rate regime in particular country from the group of the European transition economies.

Considering a substantial similarity of exchange rate regimes employed by the most of the European transition economies in the early 1990s (provided their diversity at later stages of the transition process) similar initial conditions at the starting point of the transition process seem to be a crucial for its understanding. A decision to adopt pegged exchange rate regimes reveals an intention to benefit from firm external nominal anchor in fighting high inflation and reducing costs of disinflationary process. Such an approach reflected the fact that the most of the countries from the past Eastern bloc performed as small opened economies. After successful accession of the European transition economies to the European Union in 2004 and 2007 (Bulgaria and Romania) it seems that new European Union countries with flexible exchange rate arrangements enjoyed higher exchange rate stability. Participation of national currencies in ERM 2 followed by euro adoption seems to be the only feasible solution at the final stage of the successful lung-run integration process of the European transition economies.

Despite the fact, there seems to be no real prospective alternative to euro adoption for the European transition economies, we emphasize disputable effects of sacrificing monetary sovereignty in the view of positive effects of exchange rate volatility and exchange rate based adjustments in the country experiencing sudden shifts in the business cycle. On the other hand, due to existing diversity in exchange rate arrangements in the European transition economies in the pre-ERM2 period there seems to be two big groups of countries - "peggers" (Bulgaria, Estonia, Latvia, Lithuania) and "floaters" (Czech republic, Hungary[2], Poland, Romania, Slovak republic, Slovenia). Effects of sacrificing exchange rate flexibility and its spurious effects on real output and inflation can be conventionally interpreted as fixed versus flexible exchange rates dilemma. At the same time, macroeconomic effects of various exchange rate arrangements during the crisis period may provide a better insight into suitability of relative exchange rate volatility in each individual economy during sudden changes in the business cycle.

In the chapter we analyze effects of the real exchange rate volatility on real output and inflation in ten European transition economies. From estimated VAR model (recursive Cholesky decomposition is employed to identify structural shocks) we compute impulse-response functions to analyze responses of real output and inflation of positive real exchange rate shocks. Results of estimated model are discussed from prospective of fixed versus flexible exchange rate dilemma. To provide more rigorous insight into the problem of the exchange rate regime suitability we estimate the model for each particular country employing data for two subsequent periods 2000-2007 and 2000-2011. Comparison of results for both models is crucial for analysis of the current economic crisis implications on real output and inflation responses to the negative (devaluation or depreciation) real exchange rate unexpected shifts. We suggest our results provide a rigorous insight into real exchange rate determination potential in ten European transition economies. Relative diversity in real output and inflation adjustments under different exchange rate arrangements may reveal disputable implications and associated risks of the breakdown in mutual interconnections between the overall macroeconomic development and the exchange rate leading path.

2. Overview of Exchange Rate Regime Evolution in the European Transition Economies

Macroeconomic stability, fast recovery from deep and sudden transition shock and real output growth stimulation represents one of the most challenging objectives for the European transition economies in the early 1990s. Consistent choice as well as flexible

[2] Hungarian forint operated during pre-crisis period in de facto fixed peg regime, but due to substantial range for fluctuations provided by wide horizontal bands it was included in the group of countries, so called "floaters"

adjustments of monetary policy framework and exchange rate regime accompanied key crucial economic policy decisions in this process. Associated changes in monetary-policy strategy reflected wide range of macroeconomic aspects underlying sustainability of appropriate exchange rate regime choice.

Among key determinants of the exchange rate regime choice in the European transition economies at the beginning of the 1990s we may consider an effort to regain macroeconomic stability, foreign exchange reserves requirements and availability, overall external economic (trade and financial) openness, etc. At the later stages of transition process we emphasize the role of massive foreign capital inflows, sustainability of real economic growth, institutional adjustments according to perspectives of ERM2 entry.

Initial transition shock followed by the sharp real output decline associated with intensive inflation pressures (caused by rapid exchange rate devaluations, price liberalization and deregulation, tax reforms, fiscal imbalances, etc.) emphasized a crucial importance of strong nominal anchor for monetary authorities in restoring a macroeconomic stability and confidence as well as positive expectations of economic agents. However immediate exchange rate based stabilization became an appropriate strategy only for countries with adequate foreign exchange reserves while being able to significantly reduce inflation pressures in adequate (short) time period to prevent undesired rapid overvaluation. As a result it seems to be convenient to divide the European transition economies in two groups (so called “peggers” and “floaters”) considering initial exchange rate regime framework.

Relative diversity in exchange rate regimes in the European transition economies revealed uncertain and spurious conclusions about the exchange rate regime choice during last two decades. Moreover, Eurozone membership perspective (de jure pegging to euro) realizes uncertain consequences of exchange rate regime switching especially in the group of large floaters.

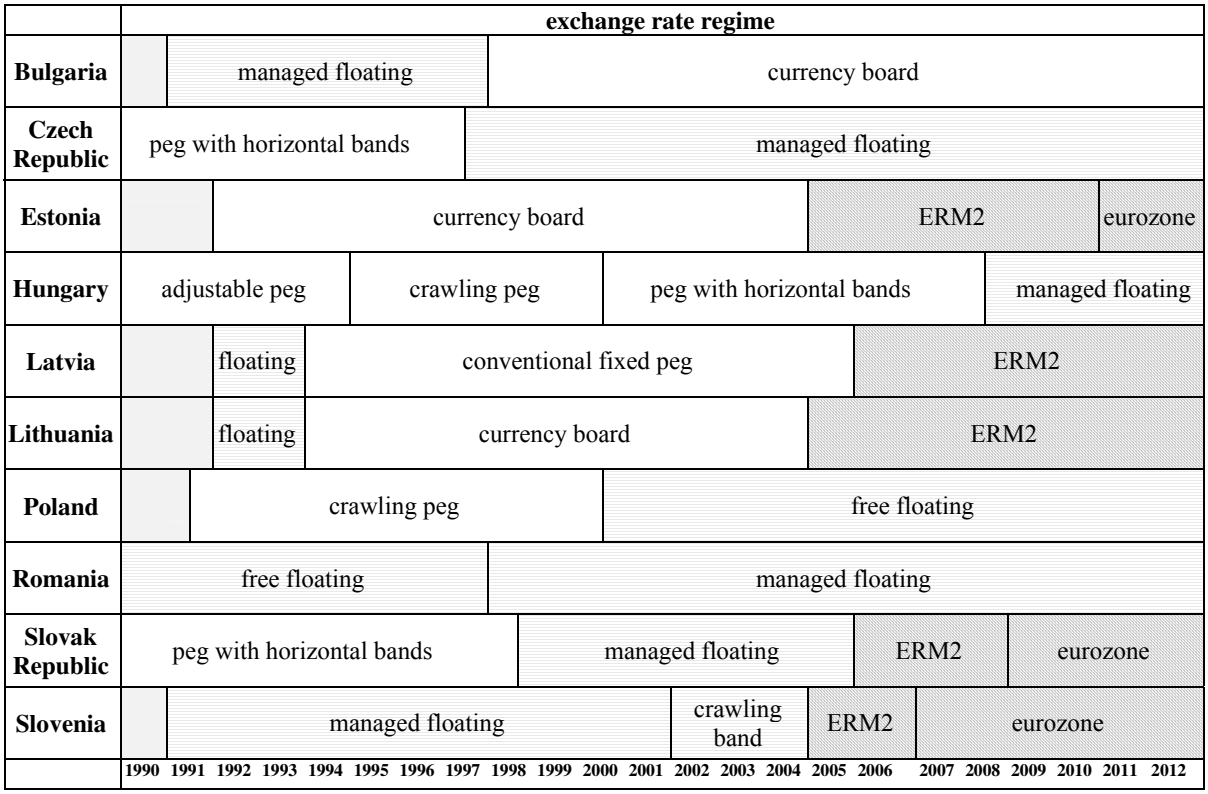
Successful anti-inflationary policy associated with stabilization of inflation expectations in the European transition economies at the end of 1990s significantly increased the role of short-term interest rates in the monetary policy strategies. At the same time, so called qualitative approach to the monetary policy decision-making performed in the low inflation environment, gradually enhanced the role of real interest rates expectations in the process of nominal interest rates determination. However, economic crisis increased uncertainty on the markets and thus worsen expectations (inflation expectations including) of agents.

Eurozone member countries as well as global economy are currently exposed to the negative effects of the economic and debt crisis. To alleviate recession and support economic recovery, monetary authorities dramatically reduced key interest rates. Low interest rates together with quantitative easing, however, should not necessarily increase supply of loans due to prudential credit policy of commercial banks reflecting increased uncertainty on the markets. As a result, policy of low interest rates seems to be inefficient.

Exchange rate policy evolution represents one of the key parts of crucial economic policy decisions at the beginning of the transition process in countries from the region of Central and Eastern Europe in the early 1990s. Despite its complexity and particularity there seems to be some similar features at the starting point of transition process in all European transition economies such as recession followed by initial transition shock and common vision of European union and Economic and Monetary union membership.

Macroeconomic stability as one of the primary objectives in the initial phase of the transition process affected exchange rate regime choice in the European transition economies. However, low credibility of monetary institutions, lack of foreign exchange reserves and high inflation differentials represented real constraints and difficulties related to the sustainability of pegged exchange rate regimes. Brief overview of the exchange rate regimes evolution in the European transition economies provides table 1.

Table 1 Exchange Rate Regimes in the European Transition Economies



Note: Exchange rate regime evolution in the European transition economies: *Bulgaria* - since 1991 floating (pegged exchange rate regime undesirable due to possible low credibility), currency board since 1997 (after 1996-1997financial crisis (public debt, bad commercial banks loans)). *Czech Republic* - exchange rate pegged to currency basket with narrow but continuously widen horizontal bands, since May 1997 after currency attacks switch to managed floating with no predetermined path for the exchange rate with DEM (EUR) as reference currency. *Estonia* - currency board since 1992 till 2011 (euro adoption), plan to adopt in 2008 but delayed due high inflation, since 2011 eurozone membership. *Hungary* - managed floating till February 1995, since March 1995 till the end of 1999 crawling peg with continuously decreased rate of periodical devaluation and widen horizontal bands, since January 2000 exchange rate pegged to euro combined with wide horizontal bands (since May 2001), since May 2008 managed floating with EUR as reference currency. *Latvia* - since February 1994 exchange rate pegged to SDR (fixing the exchange rate to a basket of currencies (SDR) instead of a single currency serves to promote long-term stability) (since January 2005 pegged to EUR). *Lithuania* - since April 1994 currency board (exchange rate pegged to USD, in February 2002 pegging switched to EUR). *Poland* - since the end of 1991 crawling peg with continuously decreased rate of periodical devaluation and widen horizontal bands, since April 2000 free floating. *Romania* - free floating, since 1998 exchange rate arrangement reclassified as managed floating. *Slovak Republic* - exchange rate pegged to currency basket with narrow but continuously widen horizontal bands, since October 1998 after currency attacks switch to managed floating with no predetermined path for the exchange rate with DEM (EUR) as reference currency, since 2009 eurozone membership. *Slovenia* - managed floating with no predetermined path for the exchange rate (since February 2002 crawling band - the monetary authority manages the float of the domestic currency within certain fluctuating margins around a depreciating path - a heavily-managed crawling band with pragmatic monetary, real, external and financial indicators).

ERM2 - June 2004 - Estonia (left in January 2011 after euro adoption), Lithuania, Slovenia (left in January 2007 after euro adoption)

- May 2005 - Latvia
- November 2005 - Slovak Republic (left in January 2009 after euro adoption)

.***Source:*** IMF AREAER 1990-2011, author's processing.

It seems to be clear that the European transition economies did not follow common practice in the process of the exchange rate regime choice at the beginning of the 1990s.

Small Baltic countries adopted currency board regime (Estonia and Lithuania) eventually conventional fixed peg regime (Latvia). Hungary adopted crawling peg regime (after few years of adjustable peg in place) together with Poland. Czech Republic and Slovak Republic adopted pegged regime with horizontal bands. Despite high inflation rates Bulgaria, Romania and Slovenia adopted floating exchange rate regime due to low level of reserves and lack of credibility though Bulgaria switched to currency board after 1996-97 financial crisis. It seems to be clear that most of the European transition economies enjoyed disinflationary and credibility benefits of so called hard or soft exchange rate regimes. Fixed exchange rates as the nominal anchor significantly contributed to the successful disinflationary process at the end of the 1990s.

Till the end of the decade many countries from the group switched to more flexible exchange rate regimes (Czech Republic in 1997, Slovak Republic in 1998 and Poland in 2000). Similarly Hungary switched to intermediate regime by widening horizontal bands. Although Hungary stacked to exchange rate pegged to euro, by employing wide horizontal bands de facto followed the same trend as previous group of countries.

Exchange rate regime choice also affected corresponding monetary policy strategy framework. Countries with exchange rate as nominal anchor (hard pegs or soft pegs with narrow horizontal bands) successfully implemented exchange rage targeting. Countries with soft pegs (pegs with wide horizontal bands or crawling pegs) and floating regimes employed monetary targets as intermediate criteria of monetary policy (monetary targeting).

Overall success of disinflationary process represents one of the key milestones on the road to stable macroeconomic environment with crucial role of low and stable inflation expectations. Low inflation combined with stable inflation expectations is considered to be a substantial condition for switching from quantitative (money supply) to qualitative (interest rates) approach in monetary policy decision-making. This adjustment in monetary policy strategies seems to be obvious in the European transition economies since the end of 1990s as a part of prevailing trend in weakening of relationship between money and inflation. Increased role of inflation expectations together with raising credibility of monetary authorities resulted in adoption of direct (explicit) inflation targeting strategy in many European transition economies - Czech Republic (1998), Poland (1999), Hungary (2001), Slovenia (2002), Romania (2005) and Slovak Republic (2005).

European transition economies challenged a decision of a euro adoption and Eurozone membership several years before the economic crisis arises. Disputable policy implications of sacrificing monetary sovereignty rose as a crucial assumption affecting main features as well as durability of preparation phase timetable in countries with flexible exchange rate regimes (Czech Republic, Poland, Romania, Slovak Republic and Slovenia). Among a variety of determinants and aspects we emphasize the role of decisions inevitably associated with "right" scheduling of the Eurozone entry. Some countries from the group of the European transition economies already joined the Eurozone (Estonia (2011), Slovak Republic (2009), Slovenia (2007)) followed by participation of their currencies in ERM2 (Estonia (June 2004), Slovak Republic (November 2005), Slovenia (June 2004)). On the other hand currencies of Lithuania and Latvia are still participating on ERM2.

The loss from sacrificing exchange rates flexibility in the Eurozone candidate countries became directly confronted with benefits related to exchange rate stability associated with sacrificing monetary autonomy. Despite plausible advantages of pegging exchange rates of candidate countries to euro followed by the euro adoption it seems to be clear that risks associated with potential effects of breakdown in mutual interconnections between macroeconomic development and flexible exchange rates leading path seem to be of a minor interest in current empirical literature.

Economic theory provides clear suggestions in fixed versus flexible exchange rates dilemma in fighting high inflation pressures. At the same time exchange rate based enhancement of external competitiveness may provide a convenient framework to foster economic growth even when domestic economy is cooling down. On the other hand, incentives to increase external demand during the crisis period may start unfavorable spiral of competitive devaluations. Central banks and governments may tend to devaluate currencies (internal devaluation) especially in times when low interest rates policy associated with quantitative easing doesn't provide correct and sufficient incentives to foster domestic demand. Internal devaluation causing real exchange rate to depreciate became highly discussed nowadays, in the time of economic and debt crisis in Eurozone, when inability of low performing economies to increase foreign competitiveness of their production forces authorities to experiment with internal devaluation considering all adjustments are made by prices, wages (and associated costs of production) and assets values falling.

3. Overview of the Literature

Effects of the real exchange rate volatility on the macroeconomic performance of countries at the different stages of business cycle are well document in the empirical literature. Aguirre a Calderón (Aguirre a Calderón, 2005) analyzed the role of the real exchange rate in determining the real output volatility on the sample consisting of 60 countries implementing cointegration analysis using panel data. Burdekin a Siklos (Burdekin a Siklos, 1999) investigated implications of the exchange rate regime shifts to price level development in the United Kingdom, United States, Canada and Sweden. Domac, Peters a Yuzefowich (Domac, Peters a Yuzefowich, 2001) observed mutual relationships between the exchange rate regime and macroeconomic performance of the selected European transition economies (Czech republic, Hungary, Estonia, Poland and Slovenia). Ghosh, Gulde, Ostry a Wolf (Ghosh, Gulde, Ostry a Wolf, 1996) analyzed effects of the alternative exchange rate regimes on inflation and economic growth on the sample of 145 countries during the 30 years period. Levy-Yeyati a Sturzenegger (Levy-Yeyati a Sturzenegger, 2001) observed implications of exchange rate volatility on domestic price level, money supply, real interest rates and real output in 154 countries since 1974 till 1979. Arratibel, Furceri, Martin and Zdzienicka (Arratibel, Furceri, Martin and Zdzienicka, 2011) investigated relationships between exchange rates development and foreign direct investments, domestic loans and current account on the sample of 9 countries from the Central and Eastern Europe. Lee a Chinn (Lee a Chinn, 1998) analyzed implications of real exchange rate fluctuations on the current account development in 7 most developed industrial countries. Sek a Chuah (Sek a Chuah, 2011) explored causality between the exchange rate changes and the current account dynamics in 6 Asian countries. Arghyrou a Chortareas (Arghyrou a Chortareas, 2008) investigated effects of the exchange rate volatility on the current account adjustments in 11 Eurozone member countries. Obstfeld a Rogoff (Obstfeld a Rogoff, 2005) focused their investigation on estimation of effects of global current account imbalances reduction on exchange rates (USD, EUR and Asian currency) equilibrium path in the model with alternative scenarios.

4. Fixed versus Flexible Exchange Rate Dilemma

To estimate effects of the real exchange rate variability on industrial production and inflation in the European transition economies under different exchange rate arrangements we divided countries from our group to two groups - "peggers" (Bulgaria, Estonia, Latvia, Lithuania) and "floaters" (Czech republic, Hungary[3], Poland, Romania, Slovak republic,

[3] Hungarian forint operated during pre-crisis period in de facto fixed peg regime, but due to substantial range for fluctuations provided by wide horizontal bands it was included in the group of countries, so called "floaters"

Slovenia). Responses of industrial production and inflation to the exchange rate depreciation under different exchange rate regimes seems to be crucial for estimation and understanding of possible effects related to the exogeneity of exchange rate shocks.

Exchange rate flexibility (i.e. exchange rate depreciation as a result of economic growth cool down) serves as a convenient vehicle for exchange rate based recovery (i.e. automatic adjustment process) through increased competitiveness of domestic production on markets home and abroad provided there are flexible adjustments to price incentives on the markets. On the other hand, exchange rates shifts (under fixed exchange rate regime) associated with volatility of main reference currency serving as the nominal anchor are usually not originated by changes in domestic economy (i.e. real output fluctuations during the business cycle turnovers in country with fixed exchange rate) and thus may act as unexpected and destabilizing shock reducing its price effects on demand. As a result we suggest that the exchange rate downward flexibility may provide wide range of incentives stimulating overall demand and thus accelerate economic growth in the recession. Exchange rate rigidity under fixed exchange rate arrangement may stabilize exchange rate expectations with positive contributions to the overall macroeconomic stability. Sudden shifts in exchange rate of the reference currency may cause a fixed exchange rate of domestic currency to become volatile. Moreover, exchange rate based adjustments of real output will not work provided that price incentives may be associated with false signals and spurious effects on expected short-term exchange rate leading path.

Effects of the exchange rate volatility on inflation, as a part of the fixed versus flexible exchange rates dilemma, refer to relative changes in prices of exports and imports and associated price effects on the aggregate price level. Under fixed exchange rate arrangement, credible nominal anchor (i.e. sound foreign currency of a country with a low and stable inflation) provides very efficient tool in fighting high inflation while helping to stabilize inflation expectations. As a result, country with fixed exchange rate should experience successful periods of disinflation (provided that a decision to adopt fixed exchange rate originated from high inflation pressures). Ability of the country to achieve price stability (and maintain low inflation differentials) within a reasonable period of time seems to be crucial for fixed exchange rate sustainability. It seems that stable inflation expectations anchored by fixed exchange rate to credible foreign currency represent a crucial role for understanding price effects of the sudden exchange rate shifts. Exchange rate volatility under fixed exchange rate arrangement originated in anchoring foreign currency instability may cause domestic price level to adjust accordingly in the short period, though persisting inflation or disinflation pressures are not expected. It is especially due to positive effects of stable inflation expectations that (we suggest) do not seem to be affected for longer period of time.

On the other hand, price stability in countries with flexible exchange rate arrangement obviously suffers even more in the short period due to absence of credible nominal anchor provided that the monetary policy strategy of the central bank is based on either inflation targeting or interest rate transmission channel. Low levels of inflation targeted by the monetary authority are obviously more sensitive to exogenous price shocks originated in the sudden and unexpected exchange rate shifts. Price effects of exchange rate volatility in countries with flexible exchange rate arrangements may be even strengthened by corresponding effects of real output or its components to unexpected movements of exchange rate on domestic price level as a part of the exchange rate adjustment process. As a result, exchange rate fluctuations in countries with flexible exchange rate arrangements are usually associated with more intensive a durable adjustment in price level.

Quite specific seems to be a situation in countries with fixed exchange rate arrangement and anchoring currency that serves as a local or global currency widely used in foreign transactions. Real output and price effects of volatility in reference currency leading

path may be reduced provided that a large number of trading partners are also fixing their exchange rate against same reference currency (membership of countries in currency union with our reference currency as common currency seems to have the same effect). Even when the large portion of foreign transactions in country with fixed exchange rate against such anchoring currency were immune to the reference currency volatility, remaining transactions are still exposed to the reference currency exchange rate unexpected shifts. On the other hand, real exchange rate sudden shifts are not exclusively caused by the nominal exchange rate volatility. Increased intensity of price adjustments associated with crisis related effects on real output are usually followed by accelerated deviations of real exchange rates from their equilibrium leading path especially in the short period.

Effects of exchange rate volatility on the price level in countries with different exchange rate regime may be even strengthened during the crisis period. Excessive price adjustments due to uncertainty and lower predictability of the exchange rate leading path under flexible exchange rate arrangement, regardless of the sources and intensity of exchange rate instability, reflects the absence of a nominal anchor to stabilize inflation expectations. At the same time, inflation expectations anchored by the credible foreign currency, provides more fundamentally appropriate framework to preserve and sustain price stability.

5. Econometric Model

VAR models represent dynamic systems of equations in which the current level of each variable depends on past movements of that variable and all other variables involved in the system. Residuals of vector ε_t represent unexplained movements in variables (effects of exogenous shocks hitting the model); however as complex functions of structural shocks effects they have no economic interpretation. Structural shocks can be still recovered using transformation of true form representation into reduced-form by imposing a number of identifying restrictions. Applied restrictions should reflect some general assumptions about the underlying structure of the economy and they are obviously derived from economic theory. There are two general (most used) approaches to identify VAR models. Cholesky decomposition of innovations implies the contemporaneous interactions between the exogenous shocks and the endogenous variables are characterized by a Wald causal chain. Ordering of the endogenous variables than reflects expected particular economy structure following general economic theory assumptions. However the lack of reasonable guidance for appropriate ordering led to the development of more sophisticated and flexible identification methods - structural VAR (SVAR) models. Identifying restrictions implemented in SVAR models reflects theoretical assumptions about the economy structure more precisely.

We implement a VAR methodology to analyze macroeconomic aspects of the real exchange rate volatility in the Central European countries. Cholesky decomposition of variance-covariance matrix of the reduced-form VAR residuals is implemented to estimate effects of the real exchange rate fluctuations on the selected main macroeconomic indicators variability.

True model is represented by the following infinite moving average representation:

$$X_t = A_0\varepsilon_t + A_1\varepsilon_{t-1} + A_2\varepsilon_{t-2} + \ldots = \sum_{i=0}^{\infty} A_i\varepsilon_{t-i} = \sum_{i=0}^{\infty} A_i L^i\varepsilon_t = A(L)\varepsilon_t \qquad (1)$$

where X_t represents n x 1 a vector including endogenous variables of the model, $A(L)$ is a n x n polynomial consisting of the matrices of coefficients to be estimated in the lag operator L representing the relationship among variables on the lagged values, ε_t is n x 1 vector of identically normally distributed, serially uncorrelated and mutually orthogonal errors (white

noise disturbances that represent the unexplained movements in the variables, reflecting the influence of exogenous shocks):

$$E(\varepsilon_t)=0, \quad E(\varepsilon_t\varepsilon_t')=\Sigma_\varepsilon=\mathrm{I}, \quad E(\varepsilon_t\varepsilon_s') = [0] \quad \forall t \neq s \tag{2}$$

Vector X_t consists of six endogenous variables - industrial production $(y_{r,t})$, money supply (m_t), core inflation (p_t), short-term nominal interest rates $(ir_{n,t})$ and real exchange rate $(er_{r,t})$. In the five-variable VAR model $(X_t = [ip_{r,t}, m_t, p_t, ir_{n,t}, er_{r,t}])$ we assume five exogenous shocks that contemporaneously affects endogenous variables - demand shock $(\varepsilon_{ip_r,t})$, nominal shock $(\varepsilon_{m,t})$, inflation shock $(\varepsilon_{p,t})$, monetary policy shock $(\varepsilon_{ir_n,t})$ and exchange rate shock $(\varepsilon_{er_r,t})$.

The structural exogenous shocks from equation (1) are not directly observable due to the complexity of information included in true form VAR residuals. As a result structural shocks cannot by correctly identified. It is than necessary to transform true model into following reduced form

$$X_t = C(L)Y_{t-1} + e_t \tag{3}$$

where $C(L)$ is the polynomial of matrices with coefficients representing the relationship among variables on the lagged values and e_t is a n x 1 vector of normally distributed errors (shocks in reduced form) that are serially uncorrelated but not necessarily orthogonal:

$$E(e_t)=0, \quad \Sigma_u = E(e_te_t') = A_0E(\varepsilon_t\varepsilon_t')A_0' = A_0A_0', \quad E(e_te_s') = [0] \quad \forall t \neq s \tag{4}$$

Relationship between reduced-form VAR residuals (e_t) and structural shocks (ε_t) can be expressed as follows:

$$e_t = A_0\varepsilon_t \tag{5}$$

As we have already noted at the beginning of the chapter we implement a Cholesky identification scheme to correctly identify structural shocks. In order to identify our model there must be exactly $n^2-[(n^2-n)/2]$ relationships among the endogenous variables of the model, where n represents a number of variables. We have to impose $(n^2-n)/2$ restrictions on the matrix A_0 based on the Cholesky decomposition of the reduced-form VAR residual matrix that define matrix A_0 as a lower triangular matrix. The lower triangularity of A_0 (all elements above the diagonal are zero) implies a recursive scheme (structural shocks are identified through reduced-form VAR residuals) among variables (the Wald chain scheme) that has clear economic implications and has to be empirically tested as any other relationship. Identification scheme of the matrix A_0 implies that particular contemporaneous interactions between some exogenous shocks and some endogenous variables are restricted reflecting causal (distribution) chain of interaction transmission. It is clear that the Wald causal chain is incorporated via convenient ordering of the variables.

Considering lower triangularity of a matrix A_0 the equation (5) can be rewritten as follows:

$$\begin{bmatrix} e_{y_r,t} \\ e_{m,t} \\ e_{p,t} \\ e_{ir_n,t} \\ e_{er_n,t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{y_r,t} \\ \varepsilon_{m,t} \\ \varepsilon_{p,t} \\ \varepsilon_{ir_n,t} \\ \varepsilon_{er_n,t} \end{bmatrix} \quad (6)$$

Correct identification of the exogenous structural shocks reflecting Cholesky ordering of variables denotes following assumptions:

- Industrial production doesn't contemporaneously respond to the shock from any other endogenous variable of the model.
- Money supply doesn't contemporaneously respond to inflation, interest rate, and exchange rate shocks, while it is contemporaneously affected only by the industrial production shock.
- Inflation doesn't contemporaneously respond to the interest rate and exchange rate shocks, while it is contemporaneously affected by the industrial production and money supply shocks.
- Interest rate doesn't contemporaneously respond to current account shock, while it is contemporaneously affected by the industrial production, money supply, inflation and interest rate shocks.
- Exchange rate is contemporaneously affected by the shocks from all of the endogenous variables of the model.

After initial period endogenous variables may interact freely without any restrictions.

Estimated VAR model is used to compute impulse response functions to analyse responses of endogenous variables to the one standard deviation negative exchange rate shock in the European transition economies countries. To check the robustness of the empirical results we estimate the model considering different ordering of the endogenous variables in both models (model A (2000M1-2007M12) and model B (2000M1-2011M12)):

- model A1, B1 $\left(X_t = \left[y_{ip_r,t}, m_t, p_t, ir_{n,t}, er_{r,t}\right]\right)$
- model A2, B2 $\left(X_t = \left[y_{ip_r,t}, er_{r,t}, m_t, ir_{n,t}, p_t\right]\right)$
- model A3, B3 $\left(X_t = \left[y_{ip_r,t}, p_t, m_t, ir_{n,t}, er_{r,t}\right]\right)$

6. Data and Results

We employed monthly data for period 2000M1-2007M12 (model A) consisting of 96 observations and with period 2000M1-2011M12 (model B) consisting of 144 observations for the following endogenous variables - industrial production[4] (nominal volume of the industrial product deflated by averaged PPI), money supply (monetary aggregate M2), inflation (core inflation), short-term interest rates (interbank offered rates with 3 months maturity[5]), exchange rate (real effective exchange rate) and balance of payment's current account (Figure 11.1). Estimation of two models is in line with the primary objective of the chapter to estimate effects of the real exchange rate variability to industrial production and inflation considering possible implications of economic crisis on presented results. Time series for all endogenous

[4] Time series for monthly industrial production were employed due to absence of data on the same basis for real output (GDP).

[5] Short-term interest rates in Estonia, Slovak republic and Slovenia we replaced by EURIBOR after euro adoption in each particular country (2007, 2009 and 2011).

variables were drawn from IMF database (International Financial Statistics, February 2013). Time series for industrial production, money supply and inflation were seasonally adjusted.

Figure 1 Industrial Production, Money Supply, Inflation, Interest Rates and Real Effective Exchange Rate in the European Transition Economies (2000Q1-2011Q4)

Note: Endogenous variables - industrial production (IP), money supply (M2) and real effective exchange rate (REER) are expressed as indexes (left axis in figures) (2005 = 100). Inflation (INF) and interest rates (IR) are expressed in percentage (right axis in figures).
Source: Compiled by author based on data taken from IMF - International Financial Statistics (February 2013).

To correctly identify exogenous shocks hitting the model as well as to compute impulse-response functions it is necessary VAR model to be stationary. To check the model it is necessary to test the time series for unit roots and cointegration.

A. Testing Procedures

The augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests were computed to test the endogenous variables for the unit roots presence. Both ADF and PP tests indicate that most of the variables are non-stationary on the values so that the null hypothesis of a unit root cannot be rejected for any of the series. Testing variables on the first differences indicates the time series are stationary so that we conclude that the variables are I(1).

Because there are endogenous variables with a unit root on the values it is necessary to the test the time series for cointegration using the Johansen and Juselius cointegration test (we found reasonable to include variables I(0) for testing purposes following economic logic of expected results). The test for the cointegration was computed using three lags as recommended by the AIC (Akaike Information Criterion) and SIC (Schwarz Information Criterion).

The results of the Johansen cointegration tests confirmed the results of the unit root tests. Both trace statistics and maximum eigenvalue statistics (both at 0.05 level) indicate that there is no cointegration among the endogenous variables of the model.

To test the stability of the VAR model we also applied a number of diagnostic tests. We found no evidence of serial correlation, heteroskedasticity and autoregressive conditional heteroskedasticity effect in the disturbances. The model also passes the Jarque-Bera normality test, so that errors seem to be normally distributed. The VAR models seem to be stable also because the inverted roots of the model for each country lie inside the unit circle. Detailed results of time series testing procedures are not reported here to save space. Like any other results, they are available upon request from the author.

Following the results of the unit root and cointegration tests we estimated the model using the variables in the first differences so that we can calculate impulse-response functions for all ten European transition economies. In line with the main objective of the chapter we focus on interpretation of the responses of industrial production and inflation on the negative one standard deviation exchange rate shock. We also observe effects of economic crisis on the exchange rate determination potential in the European transition economies by comparing the results for models estimated using time series for two different periods - model A (2000M1-2007M12) and model B (2000M1-2011M12).

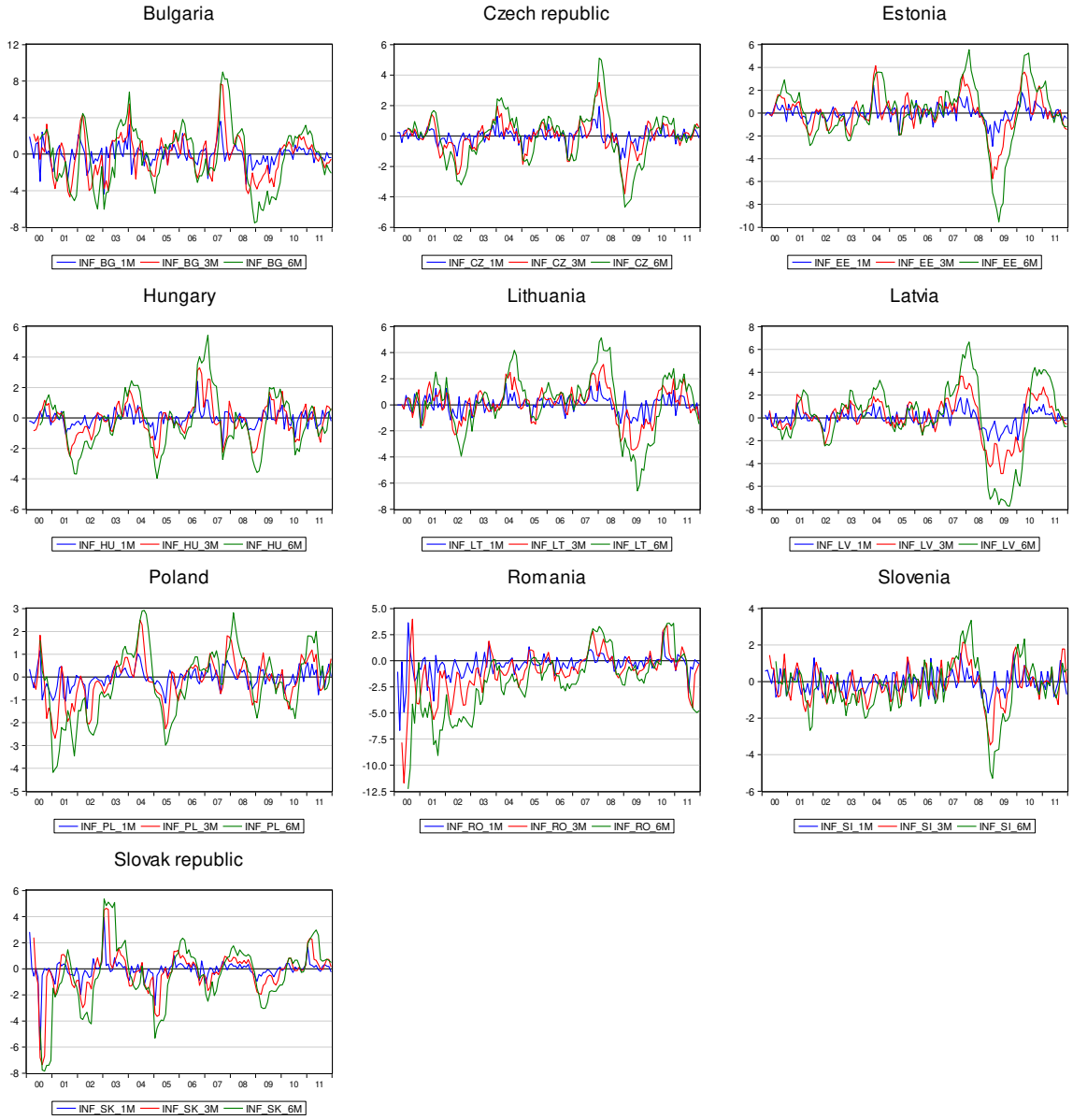
Changed ordering of the variables didn't seem to affect the results of the analysis. Considering impulse-response functions are not very sensitive to the endogenous variables ordering we present the results of the models (model A1 and B1) with default ordering of the endogenous variables (detailed results for models A2, A3, B2, B3 are available upon request from the author).

B. Crisis Effects on Volatility of Inflation and Exchange Rates

One of the most significant effects of the economic crisis refer to sudden changes in the price level accompanied by diverse effects on relative prices and thus changing relative prices. So called redistributive price effects (even on international level) seem to be much more significant among large number of countries provided that they are operating a common market for free goods, services, labor and capital movements.

The figure 2 provides an overview of the inflation differentials calculated on 1, 3 and 6 months basis in the European transition economies during the period 2000-2011. We suggest that smaller volatility in inflation differentials reveals slower speed of adjustment in price level to the price effects of market forces and thus reflects higher stability of inflation expectations. Sudden and sharp shifts in the inflation differentials seem to be associated with higher speed of adjustment in the price level with negative impact to the stability of inflation expectations.

Figure 2 Volatility of Inflation Adjustments (2000M1-2011M12)

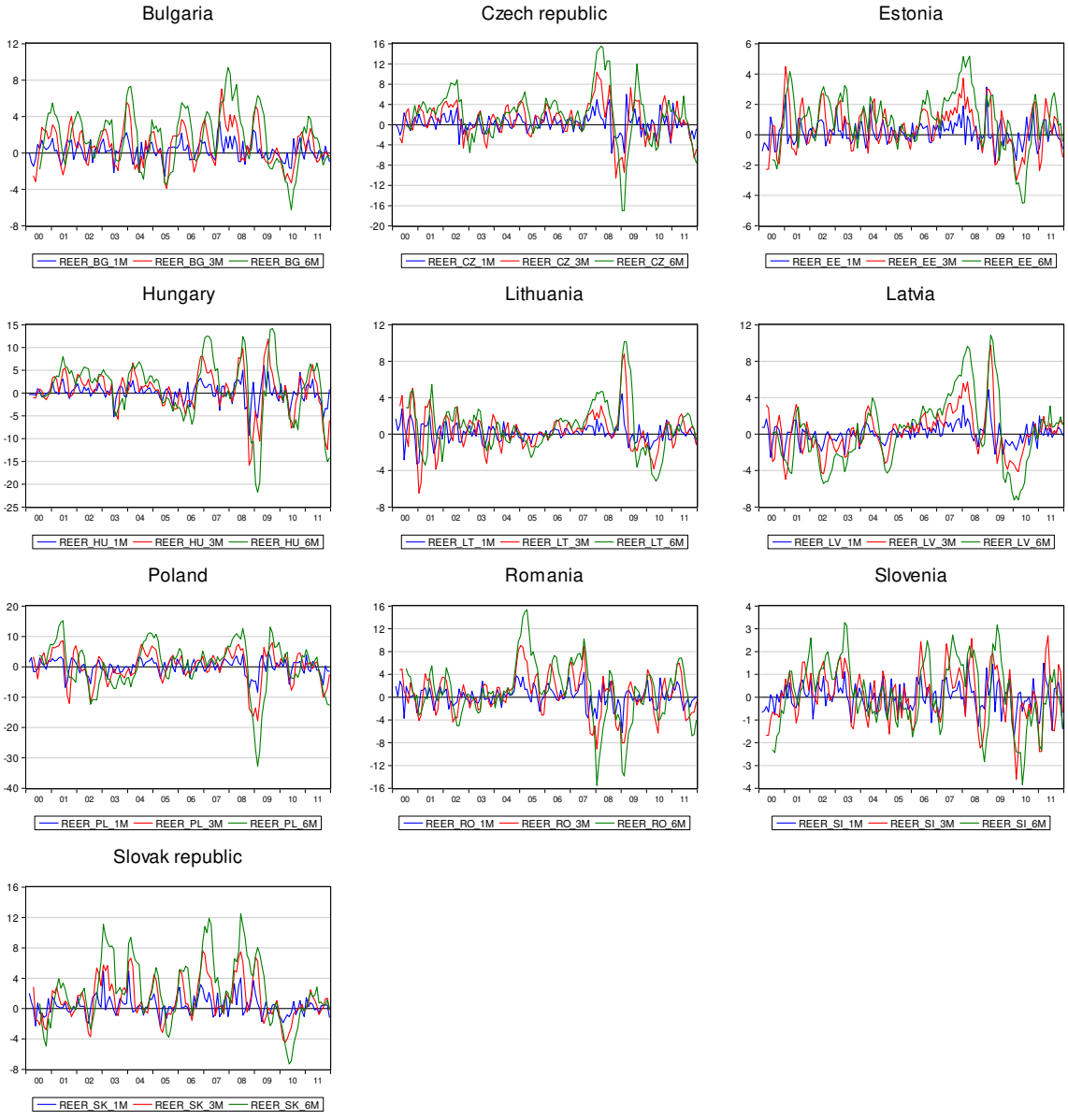


Note: Curves represent inflation differentials calculated on 1, 3 a 6 month basis.
Source: Author's calculation.

Volatility of inflation rates reveals relatively high diversity among individual countries. Despite some minor exception, Baltic countries ("peggers") experienced relatively stable speed of adjustment in the rates of inflation during the whole pre-crisis period. However, with increasing lag for differencing the inflation rates it seems that a volatility of inflation differentials increased. The last country from the group of "peggers", Bulgaria, experienced little more volatile adjustments in the rates of inflation. It seems that the strong nominal anchor may provide a convenient vehicle for the reduction of inflation pressures however doesn't seem to be sufficient to successfully stabilize inflation expectations, especially in the low performing transition economy. Our results also reflect slightly higher average volatility of inflation differentials in the group of "floaters" during the pre-crisis

period. The Czech republic and Slovenia seem to be provide the best results followed by the Slovak republic and Hungary. Despite the absence of nominal anchor (i.e. fixed exchange rate) in this group of four countries it seems that adoption of direct inflation targeting was associated with reduction in the speed of inflation rates adjustment and thus providing very efficient framework for stabilizing inflation expectations. The highest speed of adjustment in price level we experienced in case of Romania reflects the absence of credible nominal anchor especially during the first half of the pre-crisis period. Inflation targeting implemented at the later stage in the low inflation environment significantly helped to reduce the volatility of inflation adjustment.

Figure 3 Volatility of Exchange Rates Adjustments (2000M1-2011M12)



Note: Curves represent real exchange rate differentials calculated on 1, 3 a 6 month basis.
Source: Author's calculation.

Economic crisis affected the volatility of inflation adjustments in the European transition economies with ambiguous results. Overall volatility of inflation in the European transition economies during the crisis period significantly increased especially due to sharp decrease in the rate of inflation followed by peaking inflation pressures at the end of the pre-crisis period. Strong nominal anchor in the group of "peggers" (the size of the group increased due to new Eurozone member countries - Slovenia (2007) and Slovak republic (2009)) even accelerated disinflation processes in countries with fixed exchange rate arrangement. On the other hand, countries from the group of "floaters" experienced similar scenario of increased inflation adjustments volatility during the crisis period. Finally, due to complexity of the crisis effects on the volatility of inflation adjustments we provide some insight into fixed versus flexible exchange rate dilemma in the part C.

The figure 3 provides an overview of the real exchange rates differentials calculated on 1, 3 and 6 months basis in the European transition economies during the period 2000-2011. The overall volatility of the exchange rates adjustments seems to be significantly higher in comparison to the volatility of inflation adjustments. Despite effects of price adjustments, real exchange rates are determined by either nominal exchange rate adjustments (under flexible exchange rates arrangements) or adjustments in the exchange rate of the anchoring reference currency. As a result, real exchange rates may become more volatile (even under fixed exchange rate arrangement) provided that the leading paths of the nominal exchange rate and the rate of inflation follow different trend. On the other hand, the real exchange rate volatility may be reduced (under flexible exchange rate arrangement) provided that the nominal exchange rate leading paths (determining external purchasing power of the currency) is associated with inflation differentials and corresponding adjustments of the domestic price level (determining internal purchasing power of the currency).

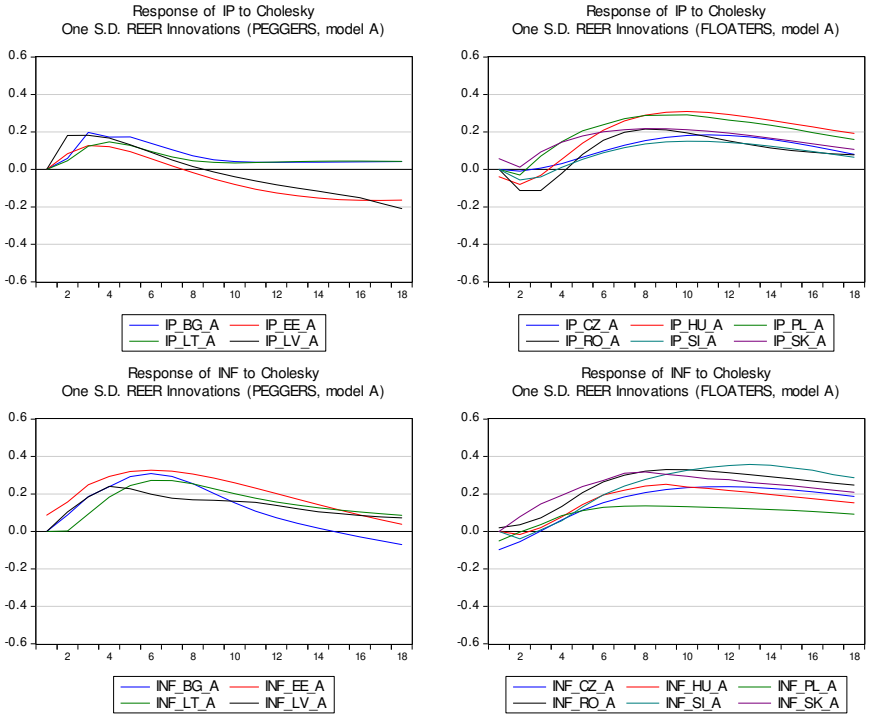
It seems that real exchange rates leading path of countries from the group of "peggers" reflected slightly higher stability in comparison of those from the group of "floaters" during the pre-crisis period. It seems that the volatility of nominal exchange rates in countries with flexible exchange rate arrangements was not inevitably associated with inflation differentials causing higher real exchange rates variability. Economic crisis increased exchange market pressures (Stavarek, 2012). As a result, nominal and real exchange rates of countries from the group of "floaters" became much more volatile. The lack of credible nominal anchor made freely floated exchange rates much more sensitive to the market imperfections. Here again we observed the stabilizing effects of the euro adoption to the real exchange rate deviations during the crisis period in Slovenia and Slovak republic.

C. Impulse-Response Function

In order to analyze effects of the real exchange rate volatility under different exchange rate arrangements in the European transition economies we estimate responses of industrial production and inflation to the negative (devaluation or depreciation) one standard deviation exchange rate shock employing monthly data for two subsequent periods 2000-2007 (model A) and 2000-2011 (model B).

In the figure 4 we summarize impulse-response functions of the endogenous variables for the model with time series for the pre-crisis period (model A1) in the European transition economies.

Figure 4 Responses of Industrial Production and Inflation to REER Shock (2000M1-2007M12) (Model A)



Note: Curves represent responses of industrial production (IP) and inflation (INF) to the one standard deviation negative exchange rate shock in each country from the group of European transition economies.
Source: Author's calculation.

The figure 4 shows estimated responses of industrial production and inflation to the Cholesky positive one standard deviation negative REER shock (depreciation or devaluation of real exchange rate) in the European transition economies during the pre-crisis period. It seems to be clear that the negative exchange rate shock was followed by the *industrial production (IP)* increase in all ten European transition economies. This investigation is in line with a general empirical experience considering the exchange rate depreciation causes an increase in the real output through the net exports (current account surplus). At the same time we observed an interesting difference among countries in the length of the initial lag associated with the industrial production increase after the exchange rate shock in each particular country. Effects of the shock seem to vary across countries especially in the view of their exchange rate arrangement. In the group of "peggers" industrial production increased after the negative exchange rate shock with just around one month lag. While the intensity of the shock seems to be quite similar in these group of countries, its durability slightly differs. Initial positive effect of the exchange rate shock died out within one year. Considering subsequent adjustment we may conclude that overall effect of the shock in the long run seems to be neutral. Situation is different when we focus on the results of industrial production responses to the negative exchange rate shock in countries from the group of "floaters". In comparison with countries with fixed exchange rate arrangement it seems that industrial production increased with slightly longer lag (around 2-4 months). Moreover, in some countries (i.e. Hungary, Romania and Slovenia) we experienced initial negative response of industrial production reflecting low price elasticity of external demand immediately after the shock (problem known as J-curve). Despite delayed effect of the exchange rate depreciation it

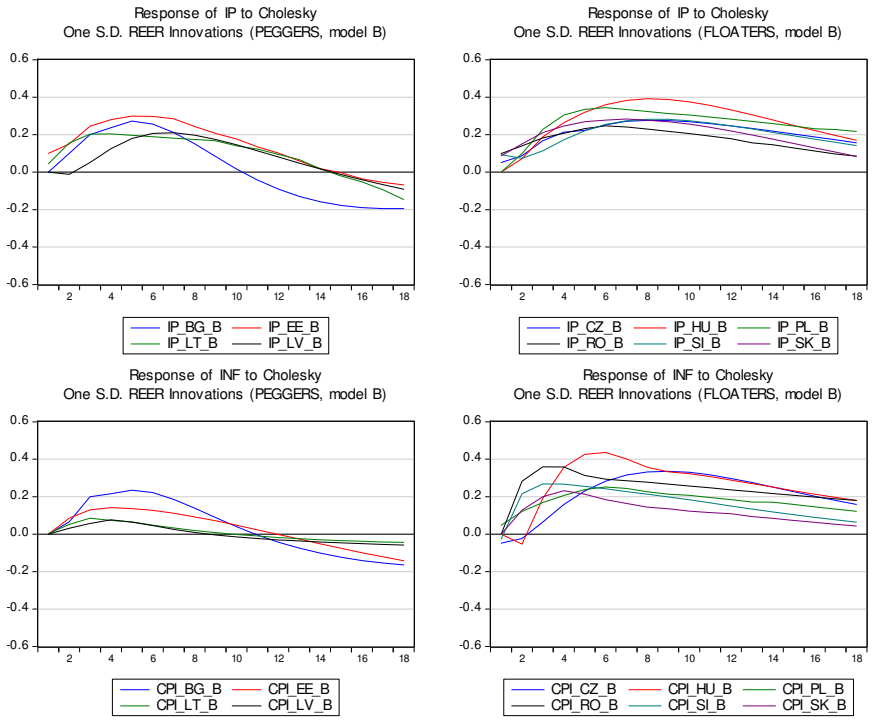
is clear that the positive effect of the shock on industrial production seems to be more significant and durable in the group of "floaters" thought it has died out in the long run too.

In general, the negative exchange rate shock should be followed by an increase in the *inflation* provided distribution price chain across countries. Results seem to vary again for countries with different exchange rate arrangement. Countries with pegged exchange rates experienced a moderate trend of the inflation increase since the first month after the shock. Although a negative effect largely culminated within first six months after the shock, its pro-inflationary effect slightly decreased over the time and completely died out during the second year after the shock. On the hand, initial pro-inflationary effect of the negative exchange rate shock in the group of countries with flexible exchange rate arrangement seems to be reduced. However, negative effect of the shock increased during the second half of the year since the shock. At the same time, its impact on inflation subsequently fades out and became similarly neutral in the long run.

The one standard deviation negative exchange rate shock seemed to be neutral in determining the leading path of both industrial production and inflation in the long-run in all ten European transition economies. On the hand, it causes distorting effects across different exchange rate arrangements and thus reveals curious implications of the exchange rate regime choice.

In the figure 5 we summarize impulse-response functions of the endogenous variables for the model with time series for the extended period (model B1) in the European transition economies.

Figure 5 Responses of Industrial Production and Inflation to REER Shock (2000M1-2011M12) (Model B)



Note: Curves represent responses of industrial production (IP) and inflation (INF) to the one standard deviation negative exchange rate shock in each country from the group of European transition economies.
Source: Author's calculation.

The figure 5 shows estimated responses of industrial production and inflation to the Cholesky positive one standard deviation negative REER shock (depreciation or devaluation of real exchange rate) in the European transition economies during the extended period. Crisis period affected responses of *industrial production* to the exchange rate shock. In the group of "peggers" we observed generally more dynamic response (increase) of industrial production to the shock. This result may be addressed to more dynamic adjustments to changes in foreign competitiveness provided that economic crisis accelerated redistribution effects on the international level. Moreover, this shock in the group of "peggers", caused by sudden shifts in the exchange rate of the foreign anchoring currency, serves as a vehicle for transmission of impulses not originated in domestic economy and thus seems to have just a temporary effect. Despite its increased and more durable impact (in comparison with pre-crisis period) on industrial production in the short run, the overall cumulative effect of the shock in the long run seems to be neutral. On the other hand, crisis period slightly reduced the length of the lagged response (some countries even experienced immediate increase) in industrial production to the negative exchange rate shock in the group of "floaters" reflecting higher sensitivity to the exchange rate related price effects (size of the effect mostly increased as well). At the same time, durability of the positive effects of the shock on industrial production increased only at negligible rate, confirming its long run neutrality.

Course of impulse-response functions of *inflation* during the extended period reflecting crisis contributions to the effects of unexpected exchange rate shifts reveals another crucial implication of the exchange rate regime choice. Besides generally reduced inflation pressures initiated by the negative exchange rate shock (in comparison with the pre-crisis period), countries from the group of "peggers" experienced considerably faster recovery of the price stability (negative effect of the shock to the price level died out much earlier) than in countries from the group of "floaters". It seems that the crisis period reduced a durability of the shock from the exchange rate sudden shift even more. We suggest that stabilizing effects of the exchange rate nominal anchor during the crisis period contributed to the overall reduction of price related effects associated with external price shocks. At the same time, crisis period increased vulnerability of the domestic price level to the unexpected shifts in the short-term leading path of exchange rate. While the total short-term contribution of the negative exchange rate shock to the price level is comparable in both periods, the overall effect of the shock culminated in most countries from the group of "floaters" with significantly reduced lag (during first three months). In both groups of countries price effects of the one standard deviation negative exchange rate shock seems to be neutral in the long run.

7. Conclusion

Exchange rates determined main macroeconomic indicators in all ten European transition economies in the line with the general empirical investigations though we observed some specific implications of the distorting effects caused by the unpredicted exchange rate shifts during the crisis period that may be a subject of further academic discussion focusing on the wide causalities of the economic crisis. At the same time our results suggest some plausible causality between exchange rate regime and the way that the exchange rate shock affects industrial production and inflation. Thus, our investigations may be a relevant contribution to the fixed versus flexible exchange rate dilemma that seems to a crucial part of the discussion related to the possible implications of sacrificing monetary sovereignty in the Eurozone candidate countries.

Negative exchange rate shock had positive effect on industrial production in all ten European transition economies, though we experienced some differences across countries according to their exchange rate arrangement. Lagged response of industrial production as

well as durability of the effect seems to be reduced in the group of "peggers". In comparison with countries with fixed exchange rate arrangement it seems that industrial production in the group of "floaters" increased with slightly longer lag, while its overall effect seems to be more significant and durable in this group of countries thought it has died out in the long run too. It seems that sudden exchange rate shifts under flexible exchange rate arrangement provides more convenient vehicle for price incentives associated with international redistribution effects. On the other hand exchange rate shifts under fixed exchange rate regime associated with volatility of the main foreign anchoring currency seem to have nearly immediate but significantly reduced effect on industrial production. Crisis period affected responses of industrial production to the exchange rate shock. In the group of "peggers" we observed generally more dynamic response (increase) of industrial production to the negative exchange rate shock. It seems that higher volatility on foreign exchange markets during the crisis period leads to more dynamic adjustments to changes in foreign competitiveness due to acceleration in redistribution effects on the international level. Crisis period slightly reduced the length of the lagged response in industrial production to the negative exchange rate shock in the group of "floaters" reflecting similarly higher sensitivity to the exchange rate related price effects.

Countries from the group of "peggers" experienced a moderate trend of the inflation increase since the first month after the shock. Although a negative effect largely culminated within first six months after the shock, its pro-inflationary effect slightly decreased over the time and completely died out during the second year after the shock. On the hand, initial inflation pressure of the negative exchange rate shock in countries from the group of "floaters" seems to be reduced. However, negative effect of the shock increased during the second half of the year since the shock. Crisis period was associated with generally reduced inflation pressures initiated by the negative exchange rate shock as countries from the group of "peggers" experienced considerably faster recovery of the price stability (negative effect of the shock to the price level died out much earlier) than in countries from the group of "floaters". It seems that the crisis period reduced a durability of the shock from the exchange rate sudden shift even more. We suggest that stabilizing effects of the exchange rate nominal anchor during the crisis period contributed to the overall reduction of price related effects associated with external price shocks. At the same time, crisis period increased vulnerability of the domestic price level to the unexpected shifts in the short-term leading path of exchange rate. While the total short-term contribution of the negative exchange rate shock to the price level is comparable in both periods, the overall effect of the shock culminated in most countries from the group of "floaters" with significantly reduced lag (during first three months).

Acknowledgement

This chapter was written in connection with scientific project VEGA no. 1/0892/13. Financial support from this Ministry of Education's scheme is also gratefully acknowledged.

References

ADRANGI, B. - ALLENDER, M.E. - RAFFIEE (2011) *Exchange Rates and Inflation Rates: Exploring Nonlinear Relationships*, Review of Economics & Finance, 1(2): 1-16

AGUIRRE, Á. - CALDERÓN, C. (2005) *Real Exchange Rate Misalignments and Economic Performance*, [Central Bank of Chile, Working Paper No. 315/2005] Chile, Central Bank of Chile, 56 p.

ARGHYROU, M.G. - CHORTAREAS, G. (2008) *Current account imbalances and real exchange rates in the Euro area*, Review of International Economics, 9(5): 747-764

ARRATIBEL, O. - FURCERI, D. - MARTIN, R. - ZDZIENICKA, A. (2011) The effect of nominal exchange rate volatility on real macroeconomic performance in the CEE countries, Economic Systems, 35(2): 261-277

ARTIS, M. J. - EHRMAN, M. (2000) *The Exchange Rate - A Shock-absorber or Source of Shocks? A Study of Four Open Economies*, [Robert Schuman Centre for Advanced Studies, Working Paper No. 38/2000] San Domenico di Fiesole, European University Institute, 39 p.

BARTOKOVA, L. (2012) *Effects of single monetary policy on the selected economic and monetary union countries. Case of so-called "PIIGS" countries*, Journal of Applied Economic Sciences, 7(4): 351-360.

BORGHIJS, A. - KUIJS, A. (2004) *Exchange Rates in Central Europe*, [International Monetary Fund, Working Paper, No. 2/2004] Washington D.C., International Monetary Fund, 29 p.

CALVO, G. - REINHART, C. (2002) *Fear of Floating*, Quarterly Journal of Economics 117(2): 379-408

DAMIAN, M. (2011) *The Comparative Analysis of the Monetary Policy Strategies before the Adoption of the Euro Currency and the Impact upon the Maastricht Criteria*, Journal of Applied Economic Sciences, 6(3): 222-229

DOMAC, I. - PETERS, K. - YUZEFOWICH, Y. (2001) *Does the Exchange Rate Regime Affect Macroeconomics Performance? Evidence from Transition Economies*, [The World Bank, Policy Research Working Paper No. 2642/2001] Washington, The World Bank, 72 p.

ÉGERT, B. - HALPERN, L. - MACDONALD, R. (2005) *Equilibrium Real Exchange Rates in Transition Economies*, [William Davidson Institute, Working Paper, No. 793] Michigan, William Davidson Institute, 50 p.

FIDRMUC, J. - HORVÁTH, R. (2007) *Volatility of Exchange Rates in Selected New EU Members: Evidence from Daily Data*, [CESifo, Working Paper No. 2107] Munich, CESifo, 31 p.

FRAIT, J. - KOMÁREK, L. (2001) *Real Exchange Rate Trends in Transitional Countries*, [University of Warwick, Economic Research Paper No. 596] Warwick, University of Warwick, 35 p.

GHOSH, A.R. - GULDE, A.M. - OSTRY, J.D. - WOLF, H.C. (1996) *Does the Exchange Rate Regime Matter for Inflation and Growth*, [International Monetary Fund, Economic Issues No. 2/1996] Washington D.C., International Monetary Fund, 19 p.

JOSIFIDIS, K. - ALLEGRET, J.P. - PUCAR, E.B. (2009) *Monetary and Exchange Rate Regime Changes: The Case of Poland, Czech republic, Slovakia and Republic of Serbia*, Panoeconomicus, 56(2): 199-226.

KARA, A. - NELSON, E. (2002) *The Exchange Rate and Inflation in the UK*, [Bank of England, Monetary Policy Committee Discussion Paper No. 11/2002] London, Bank of England, 41 p.

KOLLMANN, R. (2001) *The Exchange Rate in a Dynamic-Optimizing Business Cycle Model with Nominal Rigidities: A Quantitative Investigation*, Journal of International Economics, 55(2): 243-262.

KULHÁNEK, L. (2010) *Money, Stock Prices and Economic Activity in Selected European Countries*, Journal of Advanced Studies in Finance, 2(2): 101-115.

LEE, J. - CHINN, M.D. (1998) *The Current Account and the Real Exchange Rate: A Structural VAR Analysis of Major Currencies*, [National Bureau of Economic Research Working Paper No. 6495] New York, National Bureau of Economic Research, 28 p.

LEVY-YEYATI, E. - STURZENEGGER, F. (2001) *Exchange Rate Regimes and Economic Performance*, [International Monetary Fund, Staff Paper No. 47/2001, Special Issue] Washington D.C., International Monetary Fund, 37 p.

MIRDALA, R. (2008) *Exchange Rate and Output Vulnerability in Selected CEECs (SVAR Approach)*, Journal of Economics (Ekonomický časopis), 56(8): 745-763.

MIRDALA, R. (2012) *Macroeconomic Aspects of Real Exchange Rate Volatility in the Central European Countries*, Journal of Applied Economic Sciences, 7(2): 163-178.

OBSTFELD, M. (1985) *Floating Exchange Rates: Experience and Prospects*, Brookings Papers on Economic Activity, 1985(2): 369-450.

OBSTFELD, M. - ROGOFF, K.S. (2005) *Global Current Account Imbalances and Exchange Rate Adjustments*, Brookings Papers on Economic Activity, 36(1): 67-123.

STAVAREK, R. (2012) *Exchange Market Pressure in Central European Countries from the Eurozone Membership Perspective*, South East European Journal of Economics and Business, 3(2): 7-18.

UROŠEVIC, B. (2012) *Jackknife Model Averaging of the Current Account Determinants*, Panoeconomicus, 59(3): 267-281.

WU, J.L. (1996) *The Empirical Investigation of Long-run Purchasing Power Parity: The Case of Thaiwan Exchange Rates*, International Economics Journal, 10(4): 59-69.