Insulating property of the exchange rate regime in Central and Eastern European countries

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Abstract

This paper examines the insulating property of flexible exchange rate in eight middle-income Central and Eastern European economies. All of them fit to the standard of a small open economy, but have quite different exchange rate regimes. We derive long-term zero and sign restrictions on the reactions of underlying macro variables to real and nominal shocks from the stochastic macroeconomic model. For each country a Bayesian structural vector autoregression model with common serial correlations is estimated on quarterly data from the 1998-2015 period for relative GDP, interest rate differential, real exchange rate and relative price level. We use forecast error variance decompositions to identify the importance of individual shocks. Then we compare impulse response functions of relative output in order to discern the differences between floaters and peggers and in this way assess the magnitude of insulating property of flexible exchange rate. Our main finding is that though the empirical evidence is mixed, it lends non-negligible support to the hypothesis that the flexible exchange rate insulates the economy against shocks to a greater extent than the fixed exchange rate regime.

Keywords: *open economy macroeconomics, exchange rate regimes, real and nominal shocks, Bayesian structural VAR, common serial correlation*

JEL Classification: F41, C11

1 Introduction

The insulating properties of the exchange rate regime together with its impact on policy effectiveness and importance for the adjustment to trade imbalances constitute one of ‘three main strands’ in the literature on the choice of exchange rate regime (Ghosh et al., 2010). One of the central findings of this strand is that the floating exchange rate better insulates output against real shocks as it facilitates adjustment in the face of nominal rigidities, whereas foreign exchange reserves movements under the fixed exchange rate automatically offset nominal shocks. In a nutshell, using words of Ghosh et al. (2002), ‘the relative incidence of nominal and real shocks becomes a key criterion in choosing the exchange rate regime.’

There are two main empirical approaches to study the insulating properties of the exchange rate regime. First, the relationship between volatility of output growth and the exchange rate flexibility is examined. The results are mixed: there is some evidence of greater output

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volatility under pegged exchange rates than under either intermediate or floating regimes, but the result holds for advanced and developing economies and not for emerging market economies where output volatility is lower under pegged and intermediate regimes (Ghosh et al., 2010). In an earlier study Levy-Yeyati and Sturzenegger (2003) found a negative link between output volatility and exchange rate flexibility for nonindustrial countries but not for industrial ones. Similar conclusion was drawn in more recent studies by Edwards (2011) and Erdem and Özmen (2015). They found that the impact of external shocks on economic activity is less pronounced in economies under flexible exchange rate regimes.

Second, a structural vector autoregression (SVAR) is used to identify shocks hitting an economy, to assess their importance for the output variance and – in some studies – to examine output reactions to real and nominal shocks. The results are again inconclusive, e.g. the exchange rate fluctuations in Central and Eastern European countries were found to be fed by nominal shocks by Kuijs and Borghijs (2004) and Shevchuk (2014) and by real shocks by Stążka-Gawrysiak (2009) and Dąbrowski and Wróblewska (2016a, b).

The research objective of this paper is to examine whether there are discernible differences across exchange rate regimes in Central and Eastern European (CEE) economies with respect to insulating output against economic shocks. We follow the second empirical approach and construct a set of Bayesian SVAR models for each of eight CEE countries in our sample and focus on comparison of output response functions to real and nominal shocks. Our main finding is that there is weak but not negligible evidence of insulating properties of floating exchange rate regime in CEE economies. The paper is structured as follows. The next section briefly lays out theoretical issues. Empirical methodology and data are briefly presented in Section 3. Empirical results are reported in Section 4 and the last section concludes.

2 Theoretical issues

The seminal papers of Fleming (1962) and Mundell (1963), published well after the establishment of the Bretton Woods system, have reignited economists' interest in choices and consequences of exchange rate regimes. In a study summarising the state of the art on the exchange rate regimes Ghosh et al. (2002) built a simple stylized model in the spirit of the Barro-Gordon approach and demonstrated that the floating exchange rate is preferable to pegged rate if shocks are real but worse if shocks are nominal. This conclusion, however, rests on the assumption of high capital mobility (used in their formal model). If capital mobility is low, e.g. due to capital controls, aggregate demand shocks are partly offset under fixed exchange rate, whereas floating rate amplifies such shocks (Ghosh et al., 2002).

While their model is neat and elegant, it allows for two sources of shocks only: (real) productivity shock and (nominal) monetary shock. Although it is just enough to convey the main theoretical point about insulating properties of the exchange rate regime it seems too parsimonious to be used as a theoretical framework in empirical research.

The small open economy model we use in this paper is in principle taken from the study by Clarida and Galí (1994) who in turn extended the model developed by Obstfeld et al. (1985). It describes equilibria in the goods market, money market and the foreign exchange market with the conventional IS, LM and UIP relations. Due to price stickiness (PS relation) shocks hitting an economy bring about an adjustment process, so the flexible-price equilibrium is attained only in the long term. Taking into account extension put forward by Dąbrowski (2012) the model includes supply, u^s, demand, u^d, financial, u^f, and monetary, u^m, shocks. A more detailed description of the model is presented by Dąbrowski and Wróblewska (2016a).

We use the solution for the flexible-price equilibrium to derive zero and sign restrictions that will be imposed on the empirical reactions of relative output, y_t, real interest rate differential, r_t, real exchange rate, q_t, and the relative price level, p_t, to structural shocks. Vector moving representation of a SVAR model

$$\Delta z_t = C(L)u_t, \tag{1}$$

where $\Delta z_t = [\Delta y_t, \Delta r_t, \Delta q_t, \Delta p_t]'$ is a vector of the first differences of macroeconomic variables, $C(L)$ is a matrix of lag polynomials and $u_t = [u_t^s, u_t^d, u_t^f, u_t^m]'$ is a vector of structural shocks, can be used to succinctly write the restrictions imposed: $C_{12}(1)$, $C_{13}(1)$, $C_{14}(1)$, $C_{24}(1)$, $C_{34}(1)$ are set to zero, $C_{11}(1)$, $C_{22}(1)$, $C_{23}(1)$, $C_{32}(1)$, $C_{42}(1)$, $C_{44}(1)$ are positive, $C_{21}(1)$, $C_{31}(1)$, $C_{41}(1)$, $C_{33}(1)$ are negative and the $C_{43}(1)$ is left free, where $C_{ij}(1)$ is the ijth element of the total impact matrix $C(1)$ (see e.g. Lütkepohl, 2006).

3 Methodology and data

The basic model employed in the empirical analysis is a stable Bayesian n-dimensional VAR(k) model with a constant and non-stochastic starting points ($\Delta z_{-k+1}, \Delta z_{-k+2}, \ldots, \Delta z_0$):

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + \Gamma_2 \Delta z_{t-2} + \ldots + \Gamma_k \Delta z_{t-k} + \Phi D_t + \varepsilon_t, \quad \varepsilon_t \sim iiN(0, \Sigma), \quad t = 1,2,\ldots,T, \tag{2}$$

where Σ is a PDS covariance matrix of the Gaussian white noise process $\{\varepsilon_t\}_{t=1}^{T}$, D_t collects deterministic components and $\Gamma_1, \Gamma_2, \ldots, \Gamma_k$, Φ are the matrix/vector parameters. The Normal-Wishart prior structure is imposed on the model parameters with normal distribution for Γs centered around zero and the prior expectation of Σ is $0.01I_4$, i.e. $\Sigma \sim iW(0.01I_4, n+2)$, $(\Gamma_1, \Gamma_2, \ldots, \Gamma_k)|\Sigma, \nu_\Gamma \sim mN(0, \nu_\Gamma I_{nk}, \Sigma)$, $\Phi|\Sigma, \nu_\Phi \sim N(0, \nu_\Phi \Sigma)$.

Additionally, in the set of the analysed models there are also structures with the reduced rank restrictions imposed on the Γs parameters:

$$\Delta z_t = \gamma\delta_1 \Delta z_{t-1} + \gamma\delta_2 \Delta z_{t-2} + \ldots + \gamma\delta_k \Delta z_{t-k} + \Phi D_t + \varepsilon_t, \quad \varepsilon_t \sim iiN(0, \Sigma), \quad t = 1,2,\ldots,T, \qquad (3)$$

where $\gamma_{n\times(n-s)}$ is a matrix of full column rank. As pointed out by Engle and Kozicki (1993) in the VAR framework such restriction is equivalent to common serial correlations among the analysed processes, *s* denotes the number of these common features. Such a Bayesian VAR-CC model (Bayesian vector autoregression with common serial correlations model) has been already analysed e.g. by Dąbrowski and Wróblewska (2016a).

For each considered country we compare 20 non-nested specifications, which may differ in the number of lags ($k \in \{5,6,\ldots,9\}$) and the number of common features ($s \in \{0,1,2,3\}$). We assume equal prior probability for each of them.

The below presented results are obtained by taking the advantage of the Bayesian Model Averaging technique within the set of models with the highest posterior probability (i.e. higher than the assumed 0.05 prior probability). To impose over mentioned sign and zero restrictions, resulting from the economic model, the algorithm proposed by Arias et al. (2014) is employed.

Quarterly, seasonally adjusted data for real GDP, three-month money market interest rate, nominal exchange rate (defined as a price of domestic currency in terms of the euro), harmonised index of consumer prices for the period 1998q1-2015q4 are retrieved from the Eurostat database. They are used to construct relative real output, real interest rate differential, real exchange rate and relative price level. It was natural to choose the euro area as a reference country, so the *relative* output, for example, is the difference between the log of real GDP in a given country and the log of real GDP in the euro area.

4 Empirical results

Out of eight CEE countries included in our sample only two can be classified as being at opposite poles of an exchange rate regime spectrum: Bulgaria with its currency board (adopted in 1997) and Poland with free floating (adopted in 2000). The reading of the IMF's *Annual Reports on Exchange Arrangements and Exchange Restrictions* makes it reasonable, however, to extend the group of 'pegs' to Croatia, Slovenia and Slovakia and treat the Czech Republic, Hungary and Romania as belonging to the group of 'floats.' This classification is of course imperfect since for example Hungary can be considered a soft pegger, just like Croatia, although Hungary adopted such a regime between 2002 and 2004 only. Instead of relying on one of many exchange rate regime classifications, we illustrate the degree of variability of the exchange rate in Figure 1. In the left-hand-side panel we use the average absolute monthly change of the exchange rate to compare our pegs and floats: the lines correspond to minimum and maximum averages in each group. Floats have indeed experienced a greater exchange rate variability than pegs and the explicit overlap between them can only be observed at the turn of the centuries (1998-2002) and in 2006 (this was due to a gradual appreciation of the Slovak koruna within the ERM II).

Comparison with respect to openness to capital flows, measured with the Chinn-Ito index, is depicted in the right-hand-side panel of Figure 1. All floaters recorded an above-median level of the index starting in 2002, whereas peggers were slightly lagging behind till 2005. The difference nevertheless was exclusively due to Bulgaria, so one can argue that our sample includes, by and large, countries with relatively high capital mobility. Therefore, drawing on the theory we expect the floating exchange rate to insulate output against real shocks to a greater extent than the fixed rate.

The conventional analysis of insulating properties of floating exchange rate is based on the forecast error variance decomposition as it allows to identify the proportions of variability accounted for by structural shocks. Thus, in Table 1 the sources of output and exchange rate fluctuations are depicted. It is quite clear that irrespective of the exchange rate regime real, especially supply, shocks are behind output variability. A small difference between Bulgaria and other CEE countries in this respect dissipates at longer forecast horizons and at four-year horizon the contribution of real shocks is more than 99% in all countries (results for other forecasting horizons and variables are available from the authors upon request). There is also little difference between pegs and floats with respect to the relative importance of real and nominal shocks to the real exchange rate variability. Both the floating and fixed rates are mainly driven by demand and financial shocks and the contribution of real shocks increases with the forecasting horizon, whereas that of nominal shocks goes down.

Overall, the similarity between pegs and floats can be interpreted as evidence against the view that the floating exchange rate is heavily influenced by financial shocks that are subsequently transmitted into a real economy. Instead, we observe that nominal shocks are equally important sources of real exchange rate variability in both group of countries.

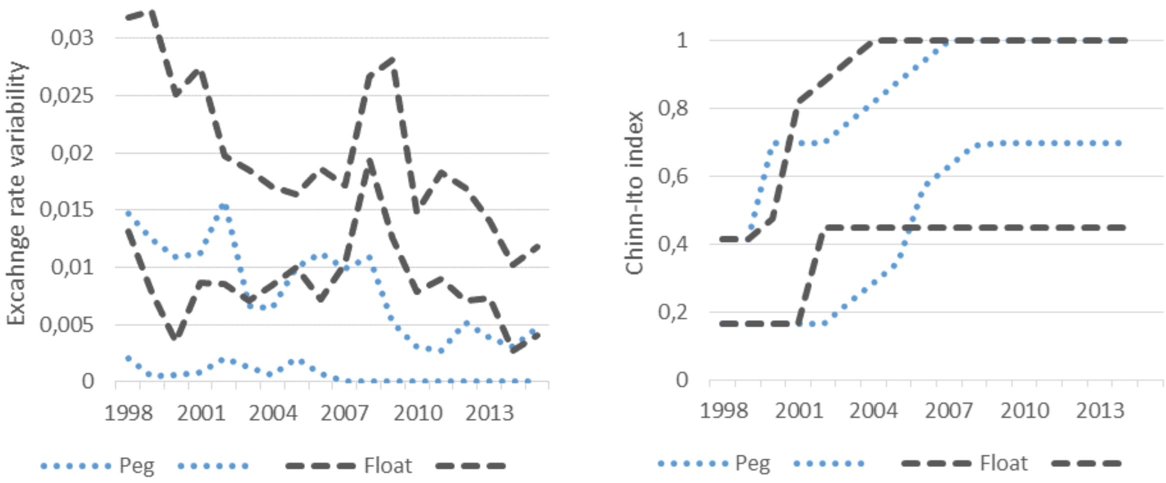

Fig. 1. Exchange rate variability and capital account openness in CEE countries.

Variable	Shock	Bulgaria	Croatia	Slovenia	Slovakia	Czech Rep.	Hungary	Poland	Romania
Relative output	supply	88.2	97.0	93.3	95.3	96.1	98.5	97.3	97.0
	demand	8.3	1.4	3.2	2.5	1.7	0.7	1.1	0.5
	financial	2.5	0.9	1.6	1.1	1.0	0.5	0.9	0.6
	monetary	1.0	0.7	1.8	1.0	1.2	0.4	0.8	1.9
Real exchange rate	supply	6.6	1.6	3.5	3.2	2.6	2.5	10.5	2.5
	demand	45.5	49.4	50.4	51.2	50.9	50.2	47.4	54.4
	financial	38.6	47.7	44.3	43.1	45.1	45.3	41.7	40.4
	monetary	9.3	1.3	1.8	2.5	1.3	1.9	0.5	2.7

Table 1. Posterior expected value of forecast error variance decomposition of the relative output and real exchange rate in CEE countries in percent (forecast horizon is one quarter).

In an attempt to examine the insulating properties of the flexible exchange rate one cannot rely on the forecast error variance decomposition only. Even though the contribution of financial shocks is similar in CEE floats and pegs, it is uncontroversial that the nominal exchange rate variability is greater under floating rate regime (see Figure 1). The important question is whether the increased exchange rate variability moderates output reactions to shocks hitting an economy. Thus, following Dąbrowski and Wrólewska (2016a) we examine the impulse response functions of the relative output to structural shocks.

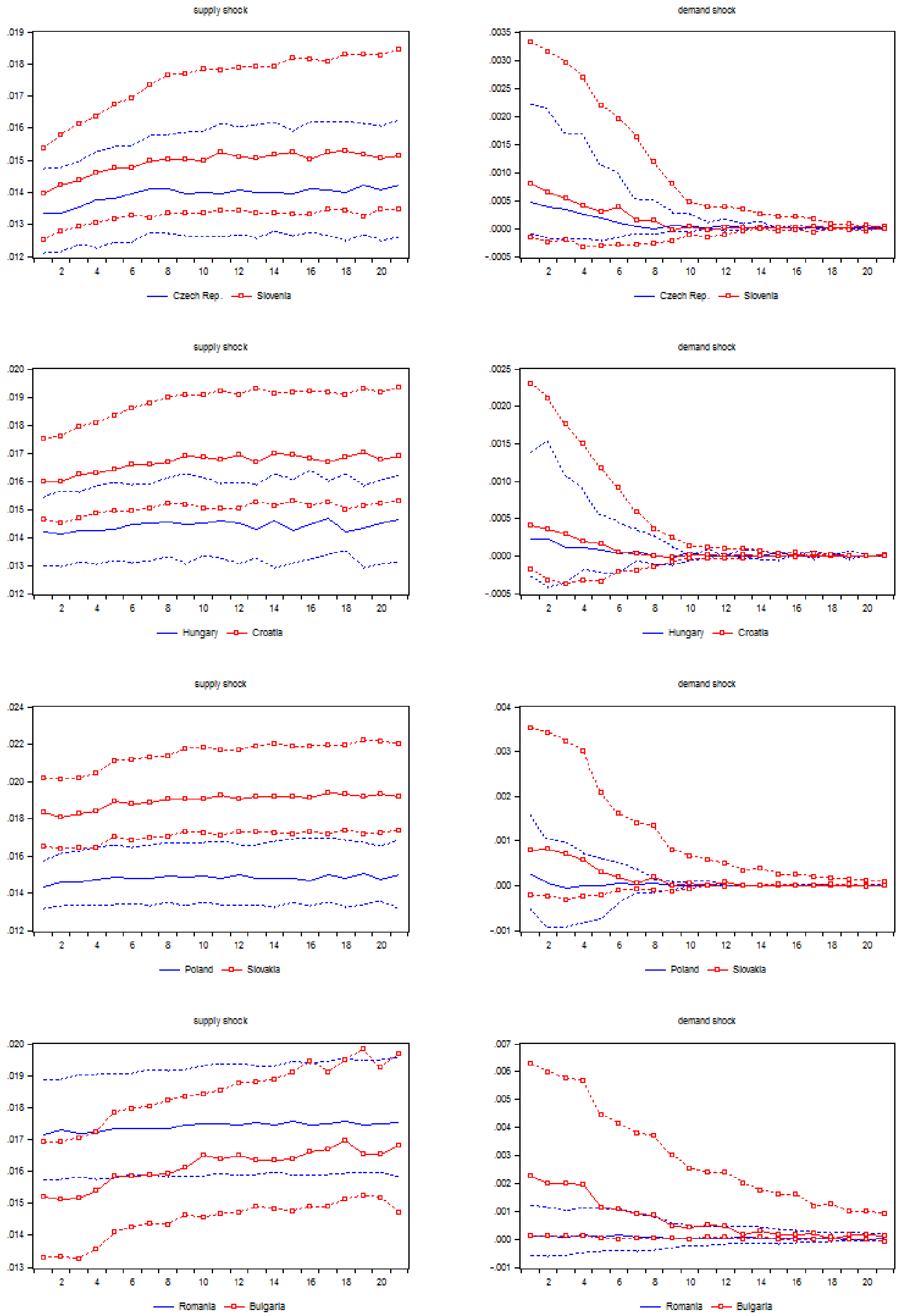

Fig. 2. Impulse response functions of the relative output in CEE countries.

In Figure 2 the median reactions of output to two real shocks are illustrated with solid lines and (the analogue of) the confidence interval, i.e. the 16th and 84th quantiles of the posterior distribution, are depicted with broken lines (results for other shocks and variables are available upon request). To keep the figure uncluttered countries are compared in pairs: one pegger (lines with squares) and one floater are presented in each row.

A closer inspection of impulse response functions presented in Figure 2 results in three observations. First, in general, there are more differences in the output reactions to supply shocks than to demand shocks. The former's contribution to output variability is much greater than that the latter's (see Table 1). This observation implies that any potential differences between pegs and floats identified below are even more important.

Second, the response of output under fixed exchange rate regime to at least one real shock is stronger than that under floating rate regime in each of our four pairs: Croatia, Slovakia and Slovenia react more intensely to a supply shock than their floating-rate counterparts, i.e. Hungary, Poland and the Czech Republic, whereas Bulgaria reacts stronger to a demand shock than Romania. This observation is in line with the view that exchange rate flexibility can be useful in insulating output against real shocks.

Third, in three pairs the median reaction of output under peg is outside the confidence interval for the corresponding reaction under floating exchange rate. This is especially the case for impulse response functions of Slovak and Polish output to supply shocks where there is no overlap between confidence intervals. The dissimilarity between reactions to a supply shock in Croatia and Hungary is smaller, although still quite pronounced. The least noticeable difference is between Bulgaria and Romania in their reactions to a demand shock: it prevails for one year only and in the long run it disappears completely (the difference in the response to a supply shock is reversed but even less distinct). In the remaining pair one can observe that the Slovenian reaction to a supply shock is a bit stronger than the Czech reaction, but both medians are within of the counterpart's confidence interval.

One can question our strategy of comparison pegs and floats in pairs arguing that the changes in pairs would result in different conclusions. To conserve space, we do not provide detailed arguments in favour of our pairs. Instead, we briefly discuss the results of comparison of output reactions to shocks in each country with analogous reactions in Poland. The latter has been chosen because its exchange rate was formally floated in April 2000 (and de facto in 1998 when the National Bank of Poland decided to refrain from foreign exchange market interventions), and out of CEE currencies it is the Polish zloty that has been floating for the longest time. Output reactions to supply shocks of all peggers turned out to be stronger except that of Slovenia which was comparable. The reactions of floaters were more diversified: stronger for Romania, comparable for Hungary and slightly weaker for the Czech Republic. The similar pattern was observed for output responses to demand shocks: stronger for peggers (except for Croatia that had a similar reaction) and comparable for floaters (except for the Czech Rep. that reacted more strongly).

Conclusion

This paper investigates the insulating properties of the floating exchange rate regime by comparing pegs and floats adopted in eight Central and Eastern European economies. We find important evidence that bolsters up the hypothesis that the flexible exchange rate regime insulates the economy against shocks to a greater extent than the fixed exchange rate regime. The caveat is that the degree of uncertainty about the results obtained is far from being small.

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References

Arias, J. E., Rubio-Ramirez, J. F., & Waggoner. D. F. (2014). Inference based on SVARs identified with sign and zero restrictions: theory and applications. *Board of Governors of the Federal Reserve System International Finance Discussion Papers.* pp. 1100.

Clarida, R., & Gali, J. (1994. December). Sources of real exchange-rate fluctuations: How important are nominal shocks?. In *Carnegie-Rochester conference series on public policy* (Vol. 41. pp. 1-56). North-Holland.

Dąbrowski. M. A. (2012). Exchange rate regimes and output variability in Central European countries. *Actual Problems of Economics, 2*(10), 80-91.

Dąbrowski. M. A., & Wróblewska, J. (2016a). Exchange rate as a shock absorber in Poland and Slovakia: Evidence from Bayesian SVAR models with common serial correlation. *Economic Modelling, 58*, 249-262.

Dąbrowski. M.A.. & Wróblewska. J. (2016b). Exchange rate regime and sensitivity to economic and financial shocks in Central European countries. In: *Proceedings of the 10th Professor Aleksander Zelias International Conference on Modelling and Forecasting of Socio-Economic Phenomena (Papież. M.. and Śmiech. S.. eds.) Foundation of the Cracow University of Economics. Cracow* (pp. 26-35).

Edwards, S. (2011). Exchange-rate policies in emerging countries: Eleven empirical regularities from Latin America and East Asia. *Open Economies Review, 22*(4), 533-563.

Erdem, F. P., & Özmen, E. (2015). Exchange rate regimes and business cycles: An empirical investigation. *Open Economies Review, 26*(5), 1041-1058.

Engle, R. F., & Kozicki, S. (1993). Testing for common features. *Journal of Business and Economic Statistics, 11*(4), 369-380.

Fleming, M. (1962). Domestic financial policies under fixed and floating exchange rates. *Staff Papers-International Monetary Fund, 9*, 369-380.

Ghosh, A. R., Gulde-Wolf, A. M., & Wolf, H. C. (2002). *Exchange rate regimes: choices and consequences*. MIT Press.

Ghosh, A. R., Ostry, J. D., & Tsangarides, C. G. (2010). *Exchange rate regimes and the stability of the international monetary system* (No. 270). International Monetary Fund.

Kuijs, L., & Borghijs, A. (2004). *Exchange Rates in Central Europe: A Blessing Or a Curse?*. International Monetary Fund.

Levy-Yeyati, E., & Sturzenegger, F. (2003). To float or to fix: Evidence on the impact of exchange rate regimes on growth. *The American Economic Review, 93*(4), 1173-1193.

Lütkepohl, H. (2006). *New Introduction to Multiple Time Series Analysis*. Berlin and Heidelberg. Springer.

Mundell, R. (1963). Capital mobility and stabilization policy under fixed and flexible exchange rates. *Canadian Journal of Economics and Political Science*, *29*(04), 475-485.

Obstfeld, M., Cooper, R. N., & Krugman, P. R. (1985) Floating exchange rates: experience and prospects. *Brookings Papers on Economic Activity*, 1985(2), 369-464.

Shevchuk, V. (2014). Shock-absorbing properties of the exchange rates in transformation economies: SVAR estimates. In: *Proceedings of the 8th Professor Aleksander Zelias International Conference on Modelling and Forecasting of Socio-Economic Phenomena (Papież. M.. and Śmiech. S.. eds.) Foundation of the Cracow University of Economics. Cracow* (pp. 155-164).

Stążka-Gawrysiak, A. (2009). The Shock-Absorbing Capacity of the Flexible Exchange Rate in Poland. *Focus on European Economic Integration*, (4), 54-70.