Monetary and Exchange Rate Regimes Changes: The Cases of Poland, Czech Republic, Slovakia and Republic of Serbia

Kosta Josifidis, Jean-Pierre Allegret, Emilija Beker Pucar

PANOECONOMICUS, 2009, 2, pp. 199-226 UDC 339.743(438+437.3+437.6+497.11)

DOI: 10.2298/PAN0902199J

ORIGINAL SCIENTIFIC PAPER

Monetary and Exchange Rate Regimes Changes: The Cases of Poland, Czech Republic, Slovakia and Republic of Serbia *

Kosta Josifidis♣, Jean-Pierre Allegret♦ and Emilija Beker Pucar♠

Summary: The paper explores (former) transition economies, Poland, Czech Republic, Slovakia and the Republic of Serbia, concerning abandonment of the exchange rate targeting and fixed exchange rate regimes and movement toward explicit/implicit inflation targeting and flexible exchange rate regimes. The paper identifies different subperiods concerning crucial monetary and exchange rate regimes, and tracks the changes of specific monetary transmission channels i.e exchange rate channel, interest rate channel, indirect and direct influences to the exchange rate, with variance decomposition of VAR/VEC model. The empirical results indicate that Polish monetary strategy toward higher monetary and exchange rate flexibility has been performed smoothly, gradually and planned, compared to the Slovak and, especially, Czech case. The comparison of three former transition economies with the Serbian case indicate strong and persistent exchange rate pass-through, low interest rate pass-through, significant indirect and direct influence to the exchange rate as potential obstacles for successful inflation targeting in the Republic of Serbia.

Key words: Exchange rate targeting, Inflation targeting, Intermediate exchange rate regimes, Monetary transmission channels.

JEL: E42, E52, F41.

---

* Preliminary empirical results were presented at 13th Annual International Conference on Macroeconomic Analysis and International Finance, May 28-30, 2009, Rethymno, Crete, Greece.

♣ University of Novi Sad, Serbia; Faculty of Economics in Subotica, Department of European Economics and Business, Novi Sad: josifidis@gmail.com.

♦ University of Lyon, Lyon, F-69003, France; CNRS, UMR 5824, GATE, Ecully, F-69130, France; ENS LSH, Lyon, F-69007, France; Centre Leon Berard, Lyon, F-69003, France: allegret@gate.cnrs.fr.

♠ University of Novi Sad, Serbia; Faculty of Economics in Subotica, Department of European Economics and Business, Novi Sad: emilib@eunet.rs.

Received: 14 March 2009; Accepted: 16 April 2009.

Introduction

Former transition economies, now members of the European Union (EU hereafter), used different exchange rate regimes and monetary policy frameworks in the transition process, on the road to the EU membership (for an overview on exchange rate regimes choice in emerging countries, see Jean-Pierre Allegret, 2007; and Kosta Josifidis, Jean-Pierre Allegret, and Emilija Beker, 2009). However, most countries at the beginning of the transition process used an exchange rate as a nominal anchor policy. The reason for almost uniform acceptance of exchange rate as a nominal anchor is well known. An exchange rate is a natural anchor in transition economies having in mind (hyper)-inflationary past.

After this initial stabilization phase, at least three groups of countries can be distinguished. The first group – comprising Estonia, Lithuania and Latvia – refers to countries that kept rigid exchange rate form and thus exchange rate targeting. Estonia and Lithuania chose currency board and exchange rate targeting monetary regime in June 1992 and March 1994, respectively. Latvia adopted a conventional fixed peg in February 1994. All these countries are currently participating in the Exchange Rate Mechanism II (ERM II) without changing their initial exchange rate regime, except Latvia that moved from conventional fixed peg to a basket to conventional fixed peg to a single currency in January 2005. The second group of countries – including Slovenia, Bulgaria and Romania – followed no specific way, staying on the rigid exchange rate form or performing more flexible regimes with different nominal anchors. Slovenia used different *de jure*[1] regimes alternating more or less rigid ones until its entry into the EU. After entry, Slovenia used intermediate exchange rate regime, namely the target zone of ERM II and in the end, joined the monetary union in January 2007. In the aftermath of the failure of pegging in January 1991, Bulgaria chose an independently floating regime. Under the pressure of a currency crisis in July 1997, due to a dramatic increase in inflation, Bulgaria changed direction toward hard peg by adopting a currency board. Exchange rate regime in Romania followed different forms of intermediate regimes but has converged toward managed floating regime since November 2004. A common feature for Slovenia, Bulgaria and Romania is the absence of explicit monetary strategy with the single anchor, like exchange rate targeting or inflation targeting.

[1] Officially declared, i.e., *de jure*, exchange rate regimes could be different from *de facto* applied exchange rate regimes. IMF's classifications are related with *de jure* or officially reported exchange rate regimes. However, observing the volatility of time series of nominal exchange rates, foreign exchange reserves and interest rates, distinction between *de jure* and *de facto* regimes could be identified. Thus, 'fear of floating' is evident in the situation when nominal exchange rate variability is low while foreign exchange reserves variability (direct influence to the exchange rate) and interest rate variability (indirect influence to the exchange rate) are high. For more details concerning the distinction between *de jure* and *de facto* exchange rate policies see Eduardo Levy-Yeyati and Federico Sturzenegger (2002) and Guillermo A. Calvo and Carmen M. Reinhart (2002).

The last group of former transition economies that changed monetary and exchange rate regimes during the transition process consists of Poland, the Czech Republic, Slovakia and Hungary. All these countries first used exchange rate as a nominal anchor and then switched to a more flexible (some kind of intermediate form) exchange rate regime. Finally, they accepted free/managed floating exchange rate regimes and explicit/implicit inflation targeting framework. Slovakia is now member of the European Monetary Union (EMU) after participation in ERM II, while Poland, the Czech Republic and Hungary still do not participate in ERM II.

This paper focuses on this last group. It investigates the road toward managed/free floating exchange rate regimes and explicit/implicit inflation targeting framework by identifying changes in monetary transmission channels between different monetary and exchange rate regimes[2]. To this end, we use variance decompositions analysis in the cases of Poland, the Czech Republic, Slovakia, and the Republic of Serbia. Indeed, this latter country also abandoned exchange rate targeting, then accepted intermediate exchange rate regime and, finally, managed floating in the combination with (the preparation for an explicit) inflation targeting. Hence, it seems interesting to compare the experiences of Poland, the Czech Republic and Slovakia with the Serbian case concerning the changes of nominal anchors and exchange rate regimes.

Section 1 reviews the main changes in monetary and exchange rate regimes for the studied countries. Section 2 introduces our empirical methodology and analyses the main results. Section 3 concludes.

1. An Overview of Countries Experiences

In this section, we review the experience of Poland, the Czech Republic, Slovakia and the Republic of Serbia, respectively. We focus on main changes concerning the choices of monetary and exchange rate regimes. The main purpose of this section is to identify different time periods corresponding to different combinations of monetary and exchange rate regimes.

Poland

Transition reforms in Poland started in January 1990 with the adoption of fixed exchange rate and then a monetary strategy based on exchange rate targeting. This monetary regime was one of the main foundations of the economic strategy

[2] In this paper, exit strategies – e.g., transition from fixed or intermediate exchange rate regimes toward floating ones – are not analysed. On this point, see Barry Eichengreen, Paul Masson, Miguel Savastano, and Shunil Sharma (1999); Pierre-Richard Agénor (2004); Atil Ahmet Asici, Nadezhda Ivanova, and Charles Wyplosz (2005); Josifidis, Allegret, and Beker (2009).

in the phase of macroeconomic stabilization. The Polish currency, the *zloty*, was initially tied to the American dollar. In the aftermath of the May 1991 devaluation, the exchange rate regime moved from dollar pegging to a basket. In October 1991, Poland used more flexible exchange rate form (compared to the previous conventional fixed parity), concretely forward looking crawling basket peg. Such a regime was used since October 1991 until May 1995 while the rate of crawl was decreased from 1.8% to 1.2%. From May 1995 to April 2000, Poland adopted a crawling corridor or target zone with fluctuation margins of +/-7%. This exchange rate arrangement constitutes a new step toward higher exchange rate flexibility. After this date, Poland finally accepted a flexible exchange rate regime. However, in the period of the crawling corridor, very frequent changes of the corridor's characteristics existed, above all, gradual widening of fluctuation margins (in February 1998 – +/-10%, in October 1998 – +/-12.5%, and in March 1999 – +/-15%) and decreasing of monthly crawl rate (from 1.2% in February 1995 to 0.3% in March 1999). Poland has not yet participated in the ERM II. Thus, actual regimes are still free exchange rate floating and inflation targeting.

The direction of monetary and exchange rate policy toward full flexibility and higher autonomy in the period 1990-2000 is obvious. Changes of monetary and exchange rate policy have been conducted gradually from exchange rate to inflation targeting and from conventional fixed parity to a free floating exchange rate regime. According to the International Monetary Fund (IMF, 2009a), the monetary regime of exchange rate targeting (i.e., exchange rate as a nominal anchor policy) includes several exchange rate regimes, namely rigid exchange rate regimes, conventional fixed parity, adjustable and crawling pegs. Hence, in the case of Poland the period of exchange rate targeting was January 1990 – May 1995. The period of crawling band or corridor (i.e., intermediate exchange rate regime) with widening fluctuation margins was May 1995 – April 2000. The latter period does not imply explicit monetary strategy, but some kind of transitional monetary strategy toward explicit, direct, full-fledged inflation targeting. And finally, the period after April 2000 assumes new monetary strategy: an inflation targeting monetary framework. Gradual transition toward higher exchange rate flexibility has been shown as a correct strategy concerning achieved and maintained macroeconomic stability. Macroeconomic stability was primarily achieved due to exchange rate as a nominal anchor policy, but it has been kept due to changed monetary strategy with more discretion and autonomy.

In order to investigate monetary transmission channels within specific monetary and exchange rate arrangements, and in order to avoid structural breaks especially emphasized in time series of transition countries, our overview of Polish experience leads us to distinguish the following subperiods:

- the first subperiod, 1990:01-1995:05, the period of exchange rate as a nominal anchor (monetary regime), conventional fixed parity and crawling peg with decreasing rate of crawl (exchange rate regimes);
- the second subperiod, 1995:05-2000:04, transitional monetary strategy toward inflation targeting (monetary regime), crawling corridor regime with widening fluctuation margins and decreasing rate of crawl (exchange rate regime);
- the third subperiod, 2000:04-2009:01, period of explicit inflation targeting (monetary regime) and free exchange rate floating (exchange rate regime).

Czech Republic

Czechoslovakia started with transition reforms in January 1990, choosing a conventional fixed exchange rate with narrow fluctuation margins +/-0.5% regarding the basket peg (including the currencies of key trading partners – Germany, the United States, Austria, Switzerland and the United Kingdom). In January 1993, Czechoslovakia was divided into the Czech Republic and Slovakia, and monetary union between them disappeared. Hence, empirical research of exchange rate and monetary regime changes in the Czech Republic and Slovakia starts with January 1993.

In May 1993, monetary authorities of the Czech Republic decided to restructure the currency basket and confined it to the German mark with 65% ratio and the American dollar with 35% ratio. There were no crucial changes until February 1996 when the Czech Republic switched it's exchange rate regime from conventional fixed to intermediate regime in the form of the corridor with +/-7% fluctuation margins. At the same time, exchange rate targeting was abandoned and accepted the combination between exchange rate and monetary targeting (M2 monetary aggregate). However, in May 1997, under speculative attacks, the Czech *koruna* significantly depreciated, along with other crisis indicators, and monetary authorities were forced to leave intermediate exchange rate regime and accept managed floating.

A new monetary strategy of inflation targeting, compatible with more flexible exchange rate regime, was officially accepted in December 1997. On the base of described changes of monetary and exchange rate regimes in the Czech Republic, key subperiods for empirical investigation are identified:

- the first subperiod, 1993:01-1996:02, exchange rate targeting (monetary regime) and conventional fixed parity (exchange rate regime);
- the second subperiod, 1996:02-1997:12, transitional monetary strategy toward inflation targeting (monetary regime) and intermediate exchange rate regime in the form of a corridor (exchange rate regime);
- the third subperiod, 1997:12-2009:01, inflation targeting monetary regime (since December 1997) and managed floating exchange rate regime (since May 1997).

The third subperiod is quite long (1997:12-2009:01) and within the subperiod, nominal exchange rate depreciation and appreciation tendencies are clearly observable. Hence, for the third subperiod, variance decomposition is derived for the first part of the third subperiod 1997:12-2001:01 (nominal exchange rate depreciation tendency) and the second one 2001:01-2009:01 (nominal exchange rate appreciation tendency). If these results are significantly different from the whole third subperiod, they are presented separately within empirical results.

Slovakia

Empirical research related to changes of nominal anchors and exchange rate regimes in Slovakia starts with January 1993, having in mind already mentioned division of the monetary union between the Czech Republic and Slovakia. The former Czechoslovakia used fixed exchange rate tied to basket currencies with narrow fluctuation margins +/-0.5% around the central parity. Slovakia, like the Czech Republic, continued with exchange rate targeting in order to achieve macroeconomic stability. The exchange rate was used as a nominal anchor for four years. Changes were related only to the basket restructuring in January 1994 (60% German mark and the remaining 40% American dollar), and the widening of fluctuation margins to 1.5%. After the period of exchange rate targeting, a new intermediate exchange rate regime in the form of the corridor with fluctuation margins +/-7% had been adopted in January 1997.

From a *de jure* perspective, there was no explicit anchor for monetary policy in Slovakia since 1997, but from a *de facto* viewpoint, monetary regime could be considered implicit inflation targeting (Mathias Nell, 2004). The exchange rate regime was changed into managed floating in October 1998. Managed floating was the third exchange rate regime since the beginning of the transition and at the same time, the third subperiod for our empirical research. In contrast to Poland and the Czech Republic, Slovakia is a member of the eurozone and previously participated in ERM II. Hence, after managed floating, the exchange rate regime was again moved toward intermediate option of the target zone with +/-15% fluctuation margins in November 2005. The last change assumed monetary non-autonomy and rigid exchange rate regime with joining the EMU in January 2009.

According to mentioned monetary and exchange rate regime changes in Slovakia since the beginning of the transition until today, the following subperiods have been identified:

- the first subperiod, 1993:01-1997:01, exchange rate as a nominal anchor policy (monetary regime) and conventional fixed parity (exchange rate regime);
- the second subperiod, 1997:01-1998:10, no explicit monetary strategy (implicit inflation targeting) and intermediate exchange rate regime in the form of the corridor (exchange rate regime);

- the third subperiod, 1998:10-2005:11, no explicit monetary strategy (implicit inflation targeting) and managed floating regime (exchange rate regime);
- the fourth subperiod, 2005:11-2009:01, no explicit monetary strategy (implicit inflation targeting) and intermediate regime of the corridor or target zone – ERM II;
- the fifth subperiod, 2009:01-_, membership in the EMU (monetary non-autonomy) and rigid exchange rate regime.

Republic of Serbia

At the beginning of the transition process, from October 2000, Serbia used the exchange rate as a nominal anchor in order to achieve macrostability. Namely, a conventional fixed peg was used from October 2000 until January 2003. Since January 2003, the nominal *dinar* exchange rate started to depreciate and was accompanied with rising inflation. The period January 2003 – September 2006 was marked with significant exchange rate depreciation within intermediate exchange rate regime, namely crawling peg. However, exchange rate as a nominal anchor created distortions concerning internal and external balance (Emilija Beker, 2007; Kosta Josifidis and Emilija Beker, 2007). Inflation inertia combined with an exchange rate peg resulted in real exchange rate appreciation with negative consequences on external balance in the form of rising current account deficit. Due to rising negative pressures from internal and external aspects, monetary authorities in Serbia decided to change monetary and exchange rate strategy and accept inflation targeting combined with a managed floating exchange rate regime. Having in mind that exchange rate targeting includes exchange rate regimes from the rigid form to the crawling peg, Serbia officially abandoned the exchange rate as a nominal anchor in September 2006 when National Bank of Serbia (NBS, 2008a) announced the preparation for full-fledged inflation targeting.

The period since September 2006 until now presents the third important subperiod in research of monetary strategy changes in the transition process. According to the mentioned changes, three subperiods are identified in the case of Serbia:

- the first subperiod, 2001:01-2003:01, exchange rate targeting (monetary regime) and conventional fixed parity (exchange rate regime);
- the second subperiod, 2003:01-2006:09, mixed monetary strategy[3] and intermediate exchange rate regime in the form of the crawling peg (exchange rate regime);

[3] According to the IMF's classification of exchange rate regimes and monetary policy frameworks, in 2003 and 2004, Serbia used an 'other' monetary program, while in December 2005, the Serbian monetary program is regarded as monetary targeting. Hence, in this empirical investigation, the subperiod between exchange rate targeting and inflation targeting is instead called 'mixed monetary strategy'.

- the third subperiod, 2006:09-2009:01, preparation for direct inflation targeting framework (monetary regime) and managed floating exchange rate regime.

2. Changes of Nominal Anchors and Monetary Transmission Channels: A VAR-VEC Approach

Our first step introduces our empirical methodology and literature review. Our second step analyses the main empirical results for each country while the third step analyses them by comparing our four studied countries.

Methodology and Literature Review

Changes concerning monetary transmission channels in different monetary and exchange rate regimes in the cases of Poland, the Czech Republic, Slovakia and Serbia are investigated with variance decomposition of structural Vector Auto-regression (VAR) and Vector Error Correction (VEC) models. Monthly time series are obtained from IMF database (International Financial Statistics)[4] and websites of central banks for the period 1990:01-2009:01.

Following time series are used in the model: consumer price index, CPI (base year 2000); nominal effective exchange rate, NEER (base year 2000); nominal exchange rate, NER (only in the case of Serbia, dinar per euro); refinancing rate, REFR (before the announcement of the reference repo rate in the case of Poland[5]); reference repo rate, IRR (with the adoption of inflation targeting regime in the case of Poland); discount rate, DR (only available interest rate set by the central bank[6] until inflation targeting adoption in the case of the Czech Republic); repo rate, RR (since the adoption of inflation targeting in the Czech case); discount rate, IR (in the case of Slovakia); and foreign exchange reserves, FE. Before unit root testing, time series are transformed to logarithms and seasonally adjusted.

After data transformations, an Augmented Dickey-Fuller (ADF) test is conducted in the level and the first differences. Constant and trend are included as deterministic variables in the level of time series, constant in the first differences, and lags are determined according to common information criteria. If time series are I(1), i.e., integrated of order one, Johansen's cointegration method is applied to decide whether they are cointegrated. If non-stationary time series

[4] **International Monetary Fund**. 2009b. *International Financial Statistics*. http://www.imfstatistics.org/imf (accessed January 3, 2009).

[5] Refinancing rate is used as a proxy for the interest bank set by the central bank of Poland. It is used until the announcement of the repo rate, key in the period of inflation targeting. Both time series are taken from IMF database, International Financial Statistics.

[6] Discount rate is used for the first and the second subperiod in the case of the Czech Republic until the inflation targeting adoption. Since then, repo rate time series have been announced and they are used in the model for the third subperiod.

form a long run relation, i.e., they are cointegrated, the VEC model is estimated and variance decomposition is derived from the model. If time series are not stationary, they are included in the VAR model, because variance decomposition and impulse responses assume stationarity of the whole system. A combination of stationary and non-stationary time series are also included in the VAR model, but non-stationary series have to be differenced in order to attain stationarity. Variance decomposition is derived from estimated VAR or VEC model with different variable ordering, impulse and responses, depending from the examined transmission channel. The dynamic influence of different shocks is observed within the period of 24 months.

As Poland, the Czech Republic, and Serbia have yet to participate in ERM II – and thus have not switched from free/managed floating to the target zone of ERM II – the fourth and the fifth subperiods in the case of Slovakia will not be investigated. The empirical research refers to the monetary path from exchange rate targeting to inflation targeting and the exchange rate path from conventional fixed parity to managed/free floating.

Levy-Yeyati and Sturzenegger (2002), and Calvo and Reinhart (2002) used time series of foreign exchange reserves, interest rates as well as nominal exchange rates to identify the difference between *de jure* and *de facto* exchange rate regimes. The situation of *de jure* floating exchange rate, but with significant variations of foreign exchange reserves and interest rate to mitigate exchange rate fluctuations, indicates a 'fear of floating' problem.

Soyoung Kim (2003) uses SVAR model in order to identify two types of influences (shocks) to exchange rate: the influence of conventional monetary policy (via interest rate) and foreign exchange interventions (via foreign exchange reserves) in the case of the United States in the post Bretton Woods era. The author comes to three key findings: first, the shocks of foreign exchange interventions (above all, net purchase of foreign currency) have stronger influence on exchange rate fluctuations (appreciations) compared to shocks of conventional monetary policy of the Federal Reserve; second, the Federal Reserve more often used foreign exchange interventions in order to stabilize the exchange rate compared to interest rate policy, namely sterilized intervention within one month; and third, conventional monetary policy through an interest rate instrument has also had significant influence on the exchange rate although to a lesser extent than foreign exchange intervention.

Reginaldo Pinto Nogueira (2006) investigates exchange rate pass-through with the SVAR model on the example of developed and emerging economies before and after the adoption of the inflation targeting framework. SVAR model – i.e., variance decomposition and impulse responses – is used in the research of the strength and dynamics of inflation, interest rate and foreign exchange reserves reactions to exchange rate changes. The author confirms stronger exchange rate pass-through to prices in the case of emerging compared to developed economies. Exchange rate pass-through and foreign exchange rate

interventions have weakened after inflation targeting adoption in all investigated economies.

Javier A. Reyes (2003) does not agree with the findings of empirical research concerning the decreasing exchange rate pass-through after the inflation targeting adoption. The reasons for exchange rate pass-through weakening have been explained with credibility growth of monetary authorities in emerging economies, low inflationary environment and/or negative output gaps. However, the main point, as Reyes argues, is the fact that monetary authorities strongly intervene in foreign exchange markets to directly limit exchange rate fluctuations, and in that way to hit the inflation target. The exchange rate pass-through is actually still significant – the reason for direct influence to exchange rate movements via foreign exchange interventions – but data point to transmission weakening because fluctuations are constrained in order to achieve the inflation target.

Dejan Krusec (2005) analyses an adequacy of inflation targeting regime for Poland, the Czech Republic, Slovakia and Hungary on the road to the EMU. The author explores the period since the inflation targeting adoption by examining following variables: three-month interest rates on money market (indicator for nominal interest rate of the central bank), inflation rate (first difference of consumer price index) and industrial production (logarithmic values of industrial production in the level). The mentioned variables are used in order to investigate the reaction of, above all, an inflation to the shock of restrictive monetary policy with impulse responses in VAR model. In all cases, restrictive monetary policy relatively quickly reduces inflation rate which returns to the zero value four to six months after the initial interest rate shock. A nominal interest rate increase of one percentage point (the impulse) induces an inflation rate fall from one half to one percentage point (the response) in all examined EU member countries. On the basis of empirical results, Krusec argues that inflation targeting is an acceptable regime for former transition economies on the road to the EMU because Polish, Czech, Slovak and Hungarian monetary authorities could successfully control and reduce inflation with restrictive policy due to a clear relationship of monetary instruments and the final goal.

However, according to the authors' acknowledgement, there has not been the empirical investigation of monetary transmission channels changes in transition economies concerning identified subperiods on the road from exchange rate as a nominal anchor toward inflation targeting (with compatible changes of exchange rate regimes, from fixed regime, through intermediate, and finally managed/free floating regime) which at the same time comprise several transmission channels with identification of (in)direct influence to the exchange rate. The paper empirically investigates the changes within monetary transmission channels on the road toward higher monetary and exchange rate flexibility in (former) transition economies which have chosen the mentioned path in the transition process. Hence, the cases of Poland, the Czech Republic and Slovakia and the Republic of Serbia are focused on. Empirical research is based on inves-

tigation of: exchange rate tranmission to consumer price level (exchange rate channel), comparison of strength and dynamic of exchange rate and interest rate pass-through to consumer price level (comparison of exchange rate and interest rate channel), indirect influence to the exchange rate via interest rate policy and direct influence to the exchange rate via foreign exchange inerventions.

Results

Tables 1 to 4 in the Appendix show exchange rate transmission, interest rate transmission, indirect and direct influence to the exchange rate within identified subperiods of exchange rate targeting, intermediate exchange regimes and inflation targeting in the cases of Poland, the Czech Republic, Slovakia and the Republic of Serbia, successively.

Poland

The empirical results concerning the exchange rate and interest rate pass-through, (in)direct influence to the exchange rate in the case of Poland, are presented with Table 1 in the Appendix.

See Table 1 in the Appendix

Exchange rate pass-through to the price level (the so-called exchange rate channel) is identified with the variance decomposition of consumer price index as a response to nominal exchange rate shock. Exchange rate pass-through is not significant in the case of Poland in all studied subperiods. In the period under exchange rate targeting, nominal exchange rate shock explains only 0.67% variation of the price level. The impact of nominal exchange rate shock is not significantly higher in the second and third subperiods when exchange rate regime has moved toward higher flexibility while monetary strategy changed toward an inflation targeting framework. When we compare the respective influence of nominal exchange rate and interest rate shocks, exchange rate pass-through remains insignificant in all exchange rate regimes and both monetary strategies. This relatively low impact of nominal exchange rate changes to consumer prices is a favorable precondition for successful inflation targeting because low pass-through reduces the necessity to limit exchange rate fluctuations. As a result, the central bank can use its interest rates to achieve its inflation target.

Low exchange rate pass-through is connected with the openness of the Polish economy. According to the data of the World Bank Group (2008)[7], Poland is a relatively large and closed economy with relatively low ratio of export/import activities to Gross Domestic Product (GDP). Compared to the Czech

[7] **World Bank Group**. 2008. *Quick Query selected from World Development Indicators.* http://ddp-ext.worldbank.org/ext/DDPQQ/member.do?method=getMembers (accessed December, 2008).

Republic, Slovakia and the Republic of Serbia, Poland has the smallest ratio of foreign trade to GDP. Hence it is a relatively closed economy with limited impact of exchange rate pass-through. In addition, in line with IIan Goldfajn and Sergio R. da C. Werlang (2002), who consider the potential determinants of the pass-through, it is interesting to stress that over the 1994-2008 period, Poland recorded the best inflation performance – such a credibility effect decreases the degree of pass-through – and at the same time, the lower growth one, reducing the ability of firms to transmit exchange rate swings to their prices.

As exchange rate pass-through is not strong in the case of Poland, a weighted implication is that the interest rate should not react significantly to exchange rate shocks. Our results confirm this implication: exchange rate shock explains less than 1% of interest rate variations in the first and second subperiods. However, under inflation targeting monetary regime and free exchange rate floating, exchange rate shock explains somewhat higher (but still not significant) variations of the repo interest rate, 8.33% after two years.

Variations of foreign exchange reserves are the main instrument used by the authorities when the exchange rate is the nominal anchor of the monetary policy. In this sense, foreign exchange reserves exert a direct influence on the exchange rate. As results show, in the period of exchange rate targeting, the impact of nominal exchange rate shock rises, thus explaining 7.4% of foreign exchange reserves variations after 24 months. This result is consistent with the previous argument. The results of direct influence on exchange rate fluctuations in the periods of intermediate and free floating exchange rate regimes point to the distinction between *de jure* and *de facto* chosen exchange rate regimes. However, in the case of Poland, such distinction does not matter since the variations of foreign exchange reserves are not predominantly explained by nominal exchange rate shocks: 0.78% in the second and 1.45% in the third subperiods after 24 months.

Overall, results of variance decomposition in VAR/VEC model exhibit pretty low exchange rate pass-through in the case of Poland. Hence exchange rate movements explain only a small part of interest rate changes. As expected, we show that foreign exchange reserves are used more to defend parity in the period of exchange rate targeting, while in the period of higher exchange rate flexibility, foreign exchange interventions are not significant. Finally, in the period of free exchange rate movements and inflation targeting, there are no important interventions pointing to the fact that *de jure* are at the same time *de facto* regimes.

Czech Republic

The exchange rate and interest rate pass-through to consumer prices, like indirect and direct influences to exchange rate fluctuations via interest rate and foreign exchange reserves, in the case of the Czech Republic are presented with Table 2.

See Table 2 in the Appendix

Exchange rate pass-through to consumer prices is strong in the case of the Czech Republic. As results suggest when exchange rate is a nominal anchor, nominal exchange rate shock causes 11.52% of variation in the consumer price level. Pass-through is the weakest in the period of managed floating regime and inflation targeting framework: exchange rate shock explains only 5.28% of price level changes after 24 months. Interestingly, if we separate this last subperiod by considering the depreciation period (until 2001) and the appreciation one (since 2001), then results of exchange rate pass-through are different. Namely, the exchange rate shock explains even 66% of variation in the consumer price level after 24 months in the period of significant nominal exchange rate depreciation. The results indicate that exchange rate pass-through is much stronger when depreciation pressures are intense. Likewise, very strong and increasing influence of the exchange rate shock to consumer price level is obvious in the second subperiod (exchange rate shock explains 60% of price variations after 12 months) when the Czech Republic left exchange rate as a nominal anchor and switched to intermediate (corridor) regime. This period involves the currency crisis in May 1997 that was accompanied with strong exchange rate depreciation.

By comparing exchange rate and interest rate pass-through to consumer prices, the influence of the exchange rate shock is fairly moderate in the first and third subperiod, explaining 3.68% and 0.54% of price variations after 24 months, respectively. But in the second subperiod the influence of the exchange rate shock has grown rapidly and significantly, thus explaining 0.88% of price variation in the first month and even 76% in the second month. However, the depreciation period shows that exchange rate pass-through is higher relative to the whole third subperiod (the exchange rate shock explains 20% of price variation after one year in the depreciation period and for the whole third subperiod, only 0.15% of price variation). The impact of the interest rate shock is moderate, but we observe a rising trend. More precisely, the highest impact corresponds to the inflation targeting subperiod: the shock explains 23.61% of consumer price changes. The strengthening of interest rate influence is a good sign for inflation targeting framework because the central bank should primarily use the repo interest rate (i.e., interest rate channel) to achieve its final target.

Nominal exchange rate shock causes 15.16% of interest rate variation in the period of exchange rate targeting, 60.77% in the period of intermediate exchange rate regime and 12.74% in the period of managed floating/inflation targeting, 24 months after the initial shock. Interest rate changes are dominantly explained by the nominal exchange rate shock in the second subperiod when exchange rate pass-through was the highest. Of course, in more flexible regimes indirect influence on the exchange rate via interest rate is more appropriate than direct interventions via foreign exchange reserves. Observing the results of di-

rect influence on the exchange rate, the foreign exchange interventions appear quite moderate in the first and second subperiods and somewhat higher in the period of inflation targeting (the exchange rate shock explains 7.17% of foreign exchange variations in the first month, while the influence of the shock increases to 36.35% after 24 months). Increasing and relatively higher direct influence on exchange rate fluctuations in the period of managed floating/inflation targeting leads to the conclusion that Czech monetary authorities use more foreign exchange interventions to manage exchange rate movements than repo interest rate.

Slovakia

The results of variance decomposition in VAR/VEC model in the case of Slovakia are presented with Table 3.

See Table 3 in the Appendix

The exchange rate pass-through in Slovakia has not passed 13% (percentage explaining consumer price variations) in all investigated subperiods. When we compare the influence of exchange rate and interest rate shocks to consumer price level, we see that the exchange rate pass-through is stronger than interest rate pass-through. In the first subperiod – where the exchange rate is a nominal anchor – the interest rate shock explains 6.84% of price variation, while the exchange rate shock explains 35.06% of price variation after 24 months. The dominance of exchange rate shocks over interest rate shocks in the transmission to the price level is the strongest in the period of intermediate exchange rate regime. During this period, the nominal exchange rate depreciates as in the case of the Czech Republic. In that period, the exchange rate shock explains 96.98% of price variation compared to the influence of the interest rate shock – 0.01% of price variation.

High exchange rate pass-through is found in the circumstances of significant nominal depreciation. Hence, the highest indirect and direct influence on the exchange rate is observed in the period of intermediate exchange rate regime characterized with nominal exchange rate depreciation. The interest rate is significantly used (97% of interest rate variation is explained by nominal exchange rate shock two years after the initial shock) to influence exchange fluctuations in the subperiod of intermediate exchange rate regime and to a lesser extent, foreign exchange reserves (31.8% of foreign exchange variation are explained by nominal exchange rate shock two years after the initial shock). In the third subperiod of implicit inflation targeting/managed floating exchange rate regime, the exchange rate pass-through weakens, decreasing the necessity to limit exchange rate fluctuations. The exchange rate shock explains 3.61% of interest rate variation, while the same shock explains only 0.8% of foreign exchange rate variation. These results indicate weak managing of the exchange rate fluctuations

with more indirect interest rate influence (that is in line with the inflation targeting framework) and the consistency between *de jure* and *de facto* applied exchange rate policy.

Republic of Serbia

The results of the variance decomposition in VAR/VEC model for the Republic of Serbia are presented with Table 4.

See Table 4 in the Appendix

Exchange rate pass-through in Serbia is significant and persistent in all subperiods. When exchange rate was the nominal anchor in the conduct of monetary policy, the exchange rate shock explained 35% of price variation after 24 months, in the subperiod of intermediate regime 33.94% and 40.47% in the subperiod of managed floating in combination with the preparation for explicit inflation targeting, respectively. These results indicate that exchange rate is the common nominal anchor in the Serbian economy because exchange rate pass-through is quite resistent regardless of different *de jure* monetary and exchange rate regimes.

The relative ratio of exchange rate and interest rate shocks explaining price level variations shows that the percentage of the exchange rate shock is much higher in all subperiods. Within an exchange rate targeting monetary framework, the exchange rate shock explains 31.66% of price variation after 24 months, while the interest rate shock explains only 2.73%. Within intermediate exchange rate regime, the exchange rate shock explains 35% (compared to 3.44% due to the interest rate shock) of consumer price changes after two years. Finally, with the acceptance of managed floating regime, exchange rate pass-through is still strong, explaining 55% of price variation after 24 months, compared to 2.73% of price variation explained by the interest rate shock.

As the exchange rate pass-through appears significant and persistent in the case of Serbia, limiting exchange rate fluctuations in the second and the third subperiods stays important for the authorities. The indirect influence on the exchange rate has been increased in the period of managed floating. Although the influence of the repo interest rate has been strengthened in the third subperiod, direct influence with foreign exchange reserves is still the strongest channel to limit exchange rate fluctuations. According to the results of the third subperiod, nominal exchange rate shock induces 15.86% of variation of foreign exchange reserves in the first month, with rising influence to 81.92% after two years.

In the case of Serbia, the dominant transmission channel is the exchange rate channel. However, an encouraging sign is the growing role of the interest rate for indirect managing of exchange rate fluctuations, although the dominant influence remains foreign exchange intervention. Strong exchange rate pass-through, weak interest rate pass-through and dominant direct managing of the

exchange rate fluctuations, however, are not good prerequisites for successful managed floating and inflation targeting regimes. These findings are in line with our previous thought (Josidifis and Beker, 2008) that an inflation targeting framework will be confronted with serious obstacles concerning strong exchange rate pass-through, financial euroization and inconsistency between monetary and fiscal policy. These obstacles favor a fixed rather than flexible regime, as well as exchange rate targeting rather than inflation targeting. However, we also argue that with the entry to the EU, the transition toward the target zone ERM II will be more smooth, with less shocks concerning internal and external balance. Also, current monetary and exchange rate regimes offer monetary authorities in Serbia more discretionary space having in mind the decision whether to influence the exchange rate fluctuations and in what way – indirectly via interest rate or directly through foreign exchange interventions.

Comparison of Poland, Czech Republic, Slovakia and Republic of Serbia

On the basis of the previous results of variance decomposition in VAR/VEC model, Figures 1, 2, 3 and 4 show a comparison of Polish, Czech, Slovak and Serbian cases regarding the changes of nominal anchors and exchange rate regimes. Figure 1 presents the exchange rate pass-through to consumer prices in all subperiods in Poland, the Czech Republic, Slovakia and the Republic of Serbia.

See Figure 1 in the Appendix

As we can see in the Figure, Serbia has the highest exchange rate pass-through in the period when exchange rate is the nominal anchor (the first subperiod) and in the period of managed floating (the third subperiod). The Czech Republic, in the period of disorderly exit from exchange rate as a nominal anchor policy (the second subperiod of intermediate exchange rate regime), has the highest exchange rate pass-through, then follows Serbia, Slovakia and, with the lower exchange rate pass-through, Poland. Poland has experienced the lowest level of exchange rate pass-through and among other factors, that was the indicator of successful, gradual and planned exit from one monetary strategy to another.

Figure 2 shows the results of interest rate pass-through to consumer prices in all subperiods.

See Figure 2 in the Appendix

Results are mixed. Poland exhibits the strongest interest rate transmission in the first subperiod, the Czech Republic in the second and third subperiods. One positive sign of monetary anchor changes in the Czech Republic is

the growing impact of interest rate shocks and rising role of this key monetary instrument, especially in the period of inflation targeting. At the opposite, in the case of Serbia, the role of the interest rate concerning direct interest rate pass-through to prices has not been increased during the transition toward flexible exchange rate and inflation targeting. In fact, the interest rate has been used more to influence the exchange rate as a crucial monetary channel.

Figures 3 and 4 point to the indirect and direct influences on exchange rate fluctuations. While foreign exchange interventions are quite normal in order to defend the parity within the exchange rate targeting monetary framework, in the circumstances of floating exchange rate regimes, a favorable option is indirect influence via the repo interest rate, although exchange rate managing is allowed only in rare and *ad hoc* situations. Indirect influence on exchange rate movements, presented with Figure 3, is interesting since the adoption of more flexible exchange rate regimes because within fixed exchange rate arrangements there is no significant fluctuation (except maybe very narrow bands).

See Figure 3 in the Appendix

Hence, in the period of intermediate exchange rate regime, Slovakia and the Czech Republic mostly used the interest rate to influence exchange rate fluctuations, followed by Serbia and Poland. These results are in line with the finding that within intermediate regime, exchange rate pass-through was very high in the Czech and Slovak cases; Poland had very low exchange rate pass-through with no significant need to influence the exchange rate; Serbia had very high exchange rate-pass through but not a strong interest rate channel in that period. Concerning the Serbian case, in the third subperiod, the impact of the repo rate to exchange rate fluctuation is stronger and compared to other cases, Serbia has shown the highest impact of repo interest rate to exchange rate changes – an encouraging sign for the new monetary framework.

The direct impact on exchange rate fluctuation with foreign exchange reserves is presented with Figure 4.

See Figure 4 in the Appendix

In the period of exchange rate targeting, direct influence on exchange rate fluctuation was rising but moderate, as nominal exchange rate shock did not explain more than 10% of variation in foreign exchange reserves. Higher direct influence was in the second subperiod of intermediate exchange rate regimes, when Slovakia (after six months) and Serbia (after 24 months) had the highest levels. Obviously, as Serbia did not use indirect influence, it instead limited exchange rate fluctuations with foreign exchange reserves. The least direct influence shows in Poland, again in line with the fact that exchange rate pass-through was pretty low in the second subperiod as well. Within an inflation targeting

framework without preferable use of foreign exchange interventions, the Republic of Serbia has expressed the strongest and increasing role of foreign reserves, followed by the Czech Republic with much lower direct exchange rate influence. Slovakia has not significantly used foreign reserves, while Poland traditionally has not used direct, nor indirect, influences to limit exchange rate fluctuations.

Concluding Remarks

The paper investigates the changes of nominal anchors and exchange rate regimes in the cases of Poland, the Czech Republic, Slovakia and the Republic of Serbia. All these countries have moved toward more flexible exchange rate regimes with finally the adoption of managed/free floating regimes and implicit/explicit inflation targeting framework. According to the results presented in the paper, in the case of *Poland* changes of nominal anchors have been gradual, planned and smooth. This country is characterized by a relatively low exchange rate pass-through, reducing the need to influence exchange rate fluctuations either directly with foreign exchange reserves or indirectly via the interest rate. From this standpoint, the Polish strategy is regarded as the most successful, as the current free exchange rate floating/inflation targeting frameworks are the most convenient compared to other economies that followed the same exchange rate and monetary path. From the opposite side, changes of exchange rate regimes toward higher flexibility in the *Czech Republic* have been accompanied with strong depreciation pressures while the exit strategy was marked as disorderly or crisis driven. On the basis of presented results, the Czech Republic expressed very strong exchange rate pass-through, especially in the period of nominal exchange rate depreciation. Accordingly, monetary authorities aim to limit exchange rate fluctuations directly and indirectly in all analysed exchange rate regimes and monetary frameworks. However, positive signs concerning inflation targeting are the growing interest rate pass-through and higher possibility to influence the final goal of monetary policy directly through the interest rate channel. Besides strengthening the interest rate channel, it seems that exchange rate pass-through has been weakened in the period of managed floating with relative fall of direct/indirect interventions. In the case of *Slovakia*, the success regarding the transition to more flexible monetary and exchange rate regimes is somewhere between the successful Polish case and the unsuccessful Czech case. Although *Serbian* authorities have abandoned exchange rate targeting in favorable circumstances (strong capital inflows with appreciation pressures), flexible exchange rate regime and inflation targeting will be confronted with some difficulties. On the basis of our findings, exchange rate pass-through is significant (the highest compared to former transition economies); then, indirect and direct influences on exchange rate fluctuations stay important. The interest rate pass-through to the final monetary goal is not strong enough, thus monetary policy via the repo interest rate indirectly influence the exchange rate and consequently,

the inflation target. Indirect and direct influences to exchange rate fluctuations are the highest compared to investigated former transition economies in the period of inflation targeting. While indirect influence is permitted, as the exchange rate channel represents one of key monetary transmission channels, undesirable direct influence is still significant enough to indicate the difference between *de jure* and *de facto* applied exchange rate regimes.

References

Agénor, Pierre-Richard. 2004. "Orderly Exits from Adjustable Pegs and Exchange Rate Bands." *Policy Reform,* 7(2): 83-108.

Allegret, Jean-Pierre. 2007. "Which Currency Exchange Regime for Emerging Markets? Corner Solutions Under Question." *Panoeconomicus,* 54(4): 397-427.

Asici, Atil Ahmet, Nadezhda Ivanova, and Charles Wyplosz. 2005. "How to Exit From Fixed Exchange Rate Regime." HEI Working Paper 03/2005.

Beker, Emilija. 2007. "Strategija Promene Režima Deviznog Kursa sa Osvrtom na Zemlje u Tranziciji." Master's thesis. Faculty of Economics, University of Belgrade.

Calvo, A. Guillermo, and Carmen M. Reinhart. 2002. "Fear of Floating." *The Quarterly Journal of Economics,* 117(2): 379-408.

Eichengreen, Barry, Paul Masson, Miguel Savastano, and Shunil Sharma. 1999. "Transition Strategies and Nominal Anchors on the Road to Greater Exchange-Rate Flexibility." Essays in International Finance 213.

Goldfajn, Ilan, and Sergio R. da C. Werlang. 2000. "The Pass-Through from Depreciation to Inflation: A Panel Study." Banco Central de Brasil Working Paper 5.

International Monetary Fund. 2009a. De Facto Classification of Exchange Rate Regimes and Monetary Policy Frameworks. http://www.imf.org/external/np/mfd/er/2008/eng/0408.htm (accessed February 30, 2009).

Josifidis, Kosta, Jean-Pierre Allegret, and Emilija Beker. 2009. *Exchange Rate Regimes in Emerging and Transition Economies*. Subotica, Serbia: Faculty of Economics in Subotica, University of Novi Sad.

Josifidis, Kosta, Emilija Beker, and Novica Supić. 2008. "Real Exchange Rate Appreciation in the Transition Economies." Paper presented at the 12th International Conference on Macroeconomic Analysis and International Finance, Rethymno, Crete.

Josifidis, Kosta, and Emilija Beker. 2008. "Monetarni Deadlock u Srbiji: Rigidni Režim Deviznog Kursa vs Upravljano Fluktuiranje – ili Obrnuto?"

Paper presented at the Miločerski Ekonomski Forum 2007, Korporativno i javno upravljanje u funkciji razvoja konkurentnosti, Miločer.

Josifidis, Kosta, and Emilija Beker. 2007. "Deja Vu Also in Serbia: Problems of Targeting." Paper presented at the 11th International Conference on Macroeconomic Analysis and International Finance, Rethymno, Crete.

Kim, Soyoung. 2003. "Monetary Policy, Foreign Exchange Intervention, and the Exchange Rate in a Unifying Framework." *Journal of International Economics,* 60(2): 355-386.

Krusec, Dejan. 2005. **"**Monetary Policy Efficiency in Inflation Targeting New EU Countries on Their Way to EMU." Paper presented at the 4th Annual Conference of the European Economics and Finance Society on Economic and Financial Issues in an Enlarged Europe, Faculty of Economics, University of Coimbra, Portugal, May 19-22.

Levy-Yeyati, Eduardo, and Federico Sturzenegger. 2002. "Classifying Exchange Rate Regimes: Deeds vs. Words." http://profesores.utdt.edu/~fsturzen/DW2002.pdf.

National Bank of Serbia. 2008a. Memorandum of the National Bank of Serbia on Inflation Targeting as Monetary Strategy. http://www.nbs.rs/export/internet/english/30/Memorandum_monetarna_strategija_122008_eng.pdf (accessed January 15, 2009).

National Bank of Serbia. 2008b. Statistical Bulletin – September 2008. http://www.nbs.rs/export/internet/english/90/index.html (accessed December 30, 2008).

Nell, Mathias. 2004. "Monetary Policy in the Slovak Republic, Implicit Inflation Targeting and the Choice of an Optimal Exchange Rate Regime." *BIATEC*, 12(11): 22-24.

Nogueira, Reginaldo Pinto. 2006. "Inflation Targeting, Exchange Rate Pass-through and 'Fear of Floating'." ftp://ftp.ukc.ac.uk/pub/ejr/RePEc/ukc/ukcedp/0605.pdf.

Reyes, A. Javier. 2003. "Exchange Rate Pass-through Effect and Inflation Targeting in Emerging Economies: What is the Relationship?" http://comp.uark.edu/~reyes/Files/Research/PassthroughIT.pdf.

APPENDIX

Table 1. Monetary transmission channels in the first, second and third subperiod in Poland according the results of variance decomposition of CPI, REFR/IR, FE to NEER and REFR/IR shocks within VAR/VEC model

Transmission of shocks during months (percentage ratio)	**Exchange rate channel**	**Interest rate channel**		**Indirect influence to NEER**	**Direct influence to NEER**
	NEER shock to CPI	*NEER shock to CPI*	*REFR shock to CPI*	*NEER shock to REFR*	*NEER shock to FE*
1st month					
1st subperiod	0.139001	0.133970	19.65289	0.002969	1.037512
2ndsubperiod	1.623695	0.810554	0.511203	0.833423	8.041218
3rd subperiod	1.520634	1.104617	0.004968	0.069752	0.335224
6th month					
1st subperiod	0.576418	0.519463	22.23313	0.383286	2.569608
2ndsubperiod	0.804810	0.841919	1.606029	0.529248	2.929139
3rd subperiod	0.904606	0.256149	3.889830	0.585732	0.161026
12th month					
1st subperiod	0.646043	0.584810	23.17031	0.389023	3.705389
2ndsubperiod	0.814934	0.730913	5.190357	0.605059	1.474019
3rd subperiod	0.818558	0.226787	6.783222	0.587263	0.463380
18th month					
1st subperiod	0.667559	0.604420	23.39594	0.391783	5.608150
2ndsubperiod	0.818631	0.592743	11.52467	0.619296	1.010997
3rd subperiod	0.793302	0.223126	7.835916	7.835916	0.925674
24th month					
1st subperiod	0.677801	0.613653	23.50136	0.392550	7.404585
2ndsubperiod	0.820391	0.497905	17.01943	0.622658	0.783262
3rd subperiod	0.781546	0.221702	8.330368	8.330368	1.446956

Notes: exchange rate channel→ordering NEER-CPI, responses of CPI; interest rate channel→ordering NEER-REFR/IRR-CPI, responses of CPI; indirect influence to NEER→NEER-CPI-REFR/IRR, responses of REFR/IRR; direct influence to NEER→NEER-FE, responses of FE.

Source: authors' estimations.

Table 2. Monetary transmission channels in the first, second and third subperiod in the Czech Republic according to results of variance decomposition of CPI, DR/RR, FE to NEER and DR/RR shocks within VAR/VEC model

Transmission of shocks during months (percentage ratio)	**Exchange rate channel**	**Interest rate channel**		**Indirect influence to NEER**	**Direct influence to NEER**
	NEER shock to CPI	*NEER shock to CPI*	*DR/RR shock to CPI*	*NEER shock to DR/RR*	*NEER shock to FE*
1st month					
1st subperiod	2.089344	0.553514	1.893431	13.55431	0.552045
2ndsubperiod	0.228753	0.877146	4.554775	7.153304	24.49000
3rd subperiod	2.090504	1.719247	9.757214	1.267797	7.173883
(1997:12-2001:01)	(1.317709)	(0.319348)	(19.21934)	(5.143566)	
6th month					
1st subperiod	10.92910	3.571675	11.33322	7.667857	1.243673
2ndsubperiod	66.72146	75.79215	6.803735	72.77316	18.48274
3rd subperiod	0.766756	0.214081	15.33864	1.632316	16.04633
(1997:12-2001:01)	(47.04658)	(18.34143)	(18.90202)	(81.93783)	
12th month					
1st subperiod	11.51544	3.586234	11.76606	10.65152	3.698823
2ndsubperiod	60.11565	77.63113	14.51875	63.69028	17.43292
3rd subperiod	2.066622	0.149743	18.95154	5.209146	24.10995
(1997:12-2001:01)	(65.97062)	(19.59105)	(18.47791)	(90.25681)	
18th month					
1st subperiod	11.55872	3.643616	11.87317	13.32705	4.750981
2ndsubperiod	53.95582	78.37893	16.26559	61.23576	16.75884
3rd subperiod	3.827606	0.306942	21.55722	8.877681	30.80058
24th month					
1st subperiod	11.51846	3.682184	11.90097	15.15966	5.271905
2ndsubperiod	49.45121	78.27326	17.37055	60.77241	16.32038
3rd subperiod	5.278379	0.538646	23.61042	12.74496	36.35207

Notes: exchange rate channel→ordering NEER-CPI, responses of CPI; interest rate channel→ordering NEER-DR/RR-CPI, responses of CPI; indirect influence to NEER→NEER-CPI-DR/RR, responses of DR/RR; direct influence to NEER→NEER-FE, responses of FE**.**

Source: authors' estimations.

Table 3. Monetary transmission channels in the first, second and third subperiod in Slovakia according to results of variance decomposition of CPI, IR, FE to NEER and IR shocks within VAR/VEC model

Transmission of shocks during months (percentage ratio)	**Exchange rate channel**	**Interest rate channel**		**Indirect influence to NEER**	**Direct influence to NEER**
	NEER shock to CPI	*NEER shock to CPI*	*IR shock to CPI*	*NEER shock to IR*	*NEER shock to FE*
1st month					
1st subperiod	1.632762	6.101209	0.551523	0.076878	0.019710
2nd subperiod	3.001886	8.645780	11.63434	6.944580	0.011166
3rd subperiod	0.721297	0.491837	0.438554	1.660716	4.238217
6th month					
1st subperiod	5.890589	33.66318	6.334360	2.243575	1.373679
2nd subperiod	5.113302	16.02893	5.266170	81.66988	65.53615
3rd subperiod	3.794384	6.083423	1.125121	8.174605	2.832146
12th month					
1st subperiod	3.982014	34.92794	6.711776	3.795178	4.589797
2nd subperiod	2.905511	75.86481	0.681559	93.92115	51.28456
3rd subperiod	7.240321	10.95083	0.901404	5.964050	1.575951
18th month					
1st subperiod	5.663634	35.04081	6.799506	5.747864	7.640764
2nd subperiod	2.344940	94.97195	0.029597	96.84484	41.75847
3rd subperiod	10.12596	14.23887	0.718577	4.514342	1.061975
24th month					
1st subperiod	7.544606	35.05978	6.837670	8.157355	9.528785
2nd subperiod	10.39871	96.98244	0.019201	97.23514	31.79053
3rd subperiod	12.31707	16.45401	0.599710	3.608723	0.798249

Notes: exchange rate channel→ordering NEER-CPI, responses of CPI; interest rate channel→ordering NEER-IR-CPI, responses of CPI; indirect influence to NEER→NEER-CPI-IR, responses of IR; direct influence to NEER→NEER-FE, responses of FE.

Source: authors' estimations.

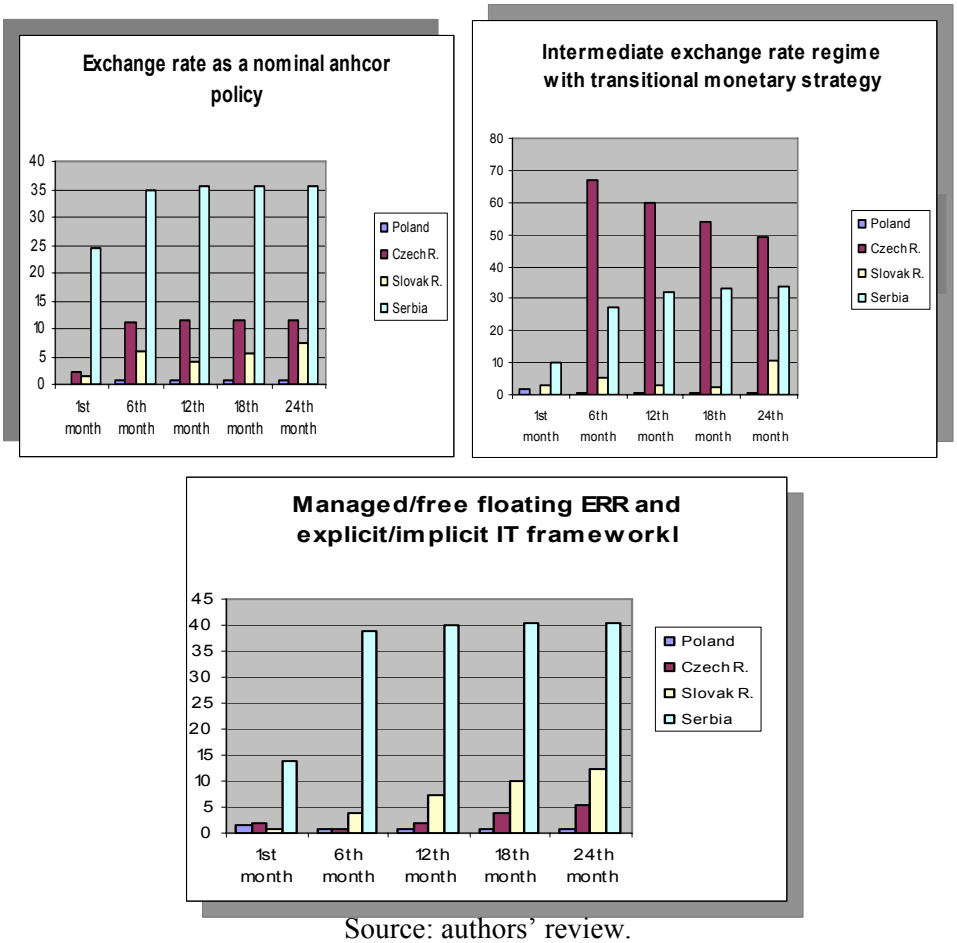
Table 4. Monetary transmission channels in the first, second and third subperiod in the Republic of Serbia according to results of variance decomposition of CPI, IROMO, FE to NER and IROMO shocks within VAR/VEC model

Transmission of shocks during months (percentage ratio)	**Exchange rate channel**	**Interest rate channel**		**Indirect influence to NER**	**Direct influence to NER**
	NER shock to CPI	*NER shock to CPI*	*IROMO shock to CPI*	*NER shock to IROMO*	*NER shock to FE*[8]
1st month					
1st subperiod	24.59285	23.10192	0.162310	5.626024	-
2nd subperiod	10.32368	10.32947	5.373216	2.785595	2.763060
3rd subperiod	13.68096	27.20191	0.485395	0.096457	15.85959
6th month					
1st subperiod	34.92790	31.14777	2.285137	13.33351	-
2nd subperiod	27.29152	28.37844	4.153149	4.989227	14.63982
3rd subperiod	38.90179	53.67366	3.188154	30.27787	63.38531
12th month					
1st subperiod	35.40627	31.60240	2.128240	13.35143	-
2nd subperiod	31.92454	33.04881	3.651718	4.997893	12.38021
3rd subperiod	39.96571	54.58139	2.874762	32.75575	74.61353
18th month					
1st subperiod	35.46205	31.65716	2.112336	13.35415	-
2nd subperiod	33.30348	34.43824	3.510158	5.017231	20.85426
3rd subperiod	40.30910	54.85765	2.779292	35.37767	7948954
24th month					
1st subperiod	35.46843	31.66440	2.110287	13.35478	-
2nd subperiod	33.93622	35.07856	3.445157	5.036714	41.05736
3rd subperiod	40.47336	54.99030	2.733485	37.97048	81.91291

Notes: exchange rate channel→ordering NER-CPI, responses of CPI; interest rate channel→ordering NER-IROMO-CPI, responses of CPI; indirect influence to NER→NER-CPI-IROMO, responses of IROMO; direct influence to NER→NER-FE, responses of FE.
Source: authors' estimations.

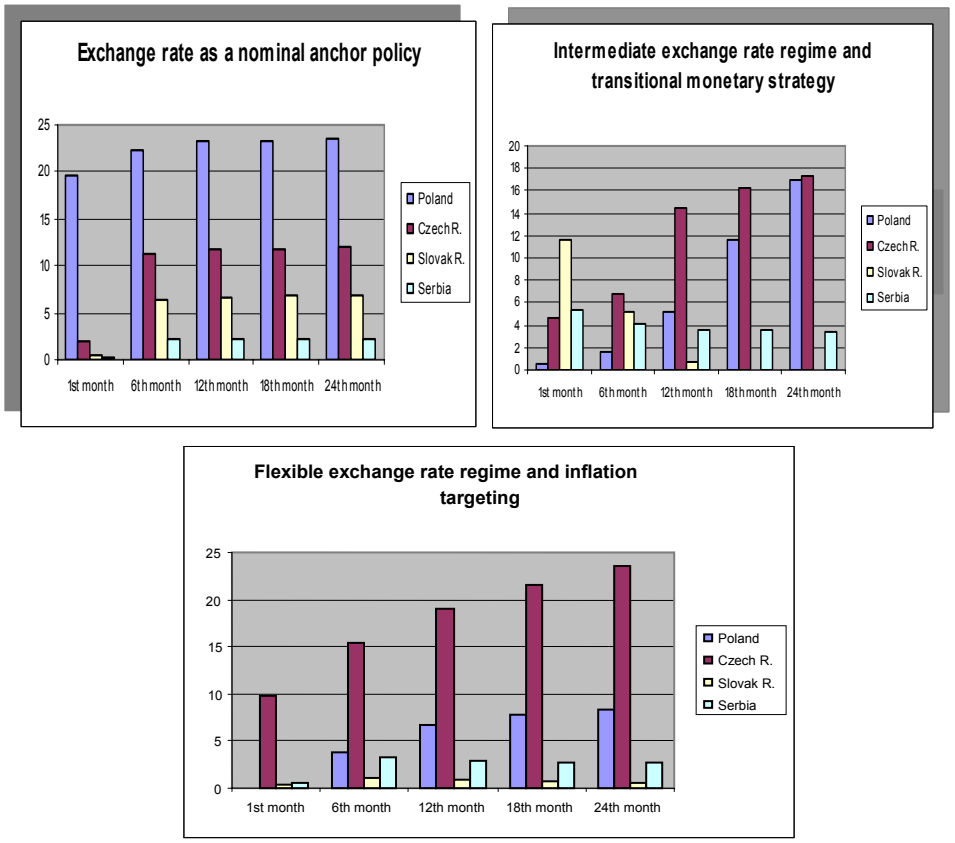
[8] In the case of Serbia, there is not enough observations for the first subperiod to estimate the direct influence to an exchange rate. Hence, the first and the second subperiods are estimated together.

Figure 1. Exchange rate pass-through to consumer prices in Poland, the Czech Republic, Slovakia and Serbia in identified subperiods according to results of variance decomposition in VAR/VEC model



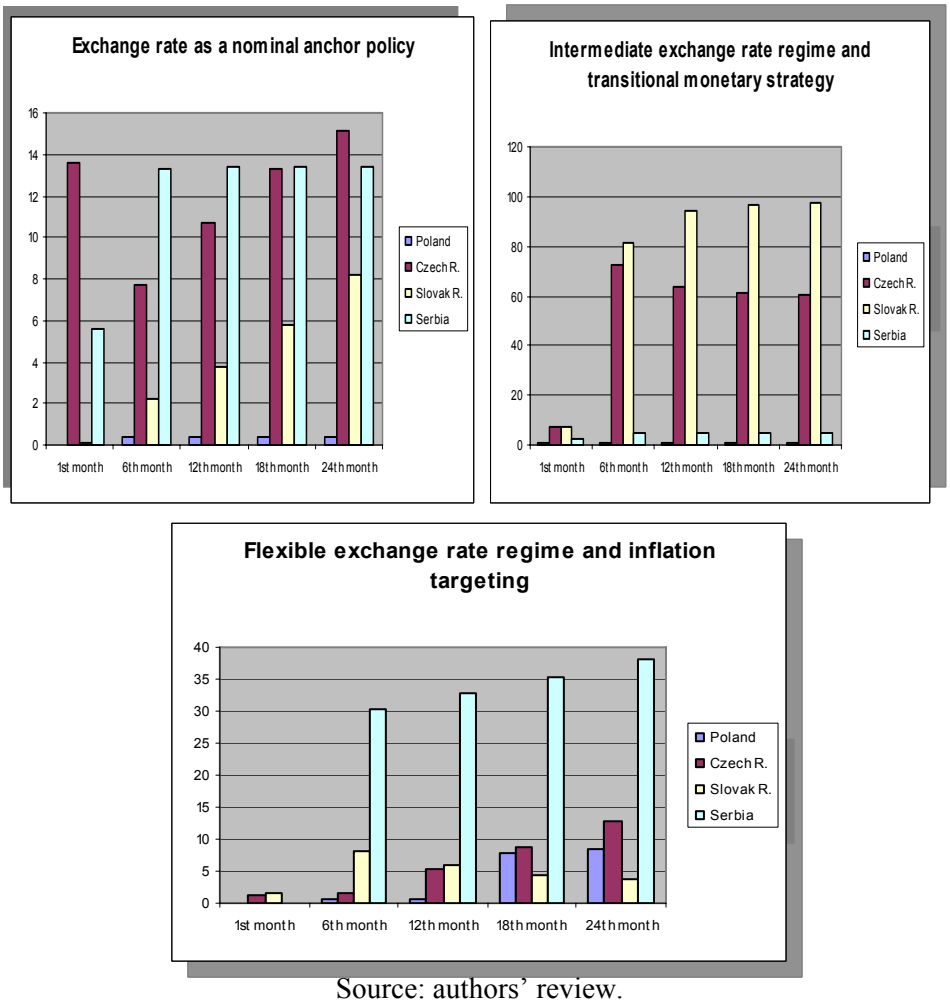
Source: authors' review.

Figure 2. Interest rate pass-through to consumer prices in Poland, the Czech Republic, Slovakia and Serbia in identified subperiods according to results of variance decomposition in VAR/VEC model



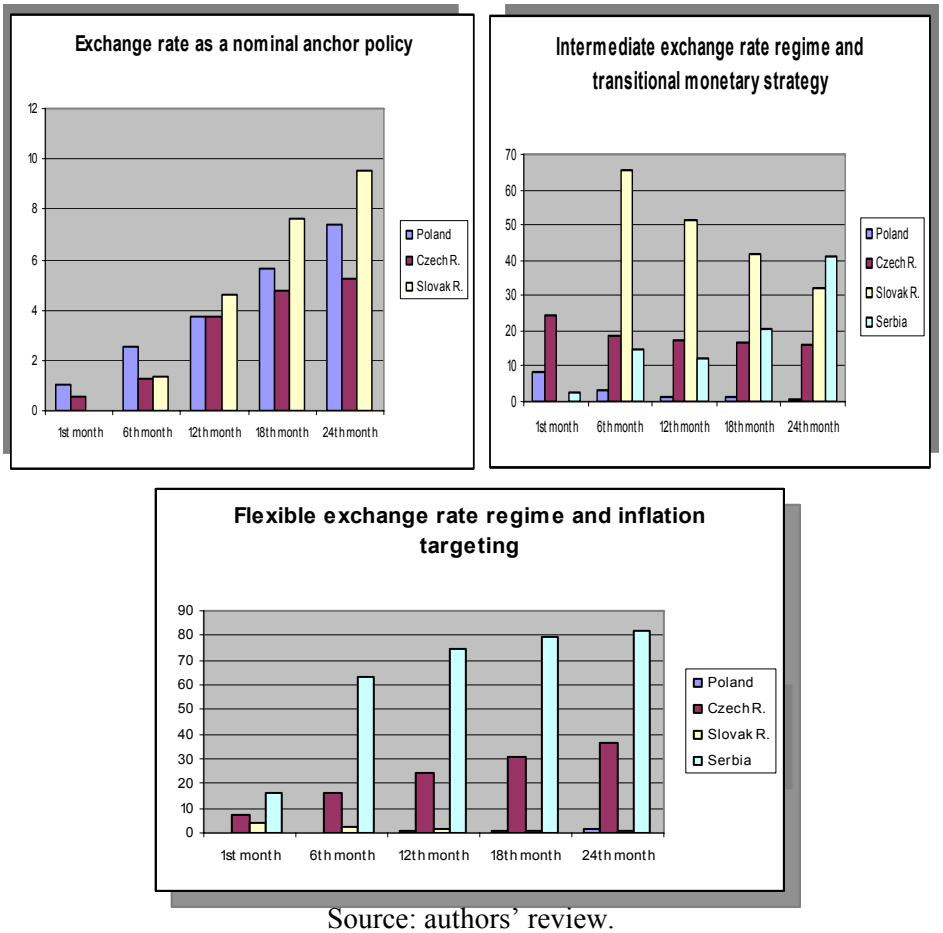
Source: authors' review.

Figure 3. Indirect influence to exchange rate fluctuations via interest rate in Poland, the Czech Republic, Slovakia and Serbia in identified subperiods according to results of variance decomposition in VAR/VEC model



Source: authors' review.

Figure 4. Direct influence to exchange rate fluctuations with foreign exchange reserves in Poland, the Czech Republic, Slovakia and the Republic of Serbia in identified subperiods according to results of variance decomposition in VAR/VEC model



Source: authors' review.