Institute of Economic Studies, Faculty of Social Sciences
Charles University in Prague

# Credibility of Exchange Rate Policies in Selected EU New Members: Evidence from High Frequency Data

Jarko Fidrmuc
Roman Horváth

IES Working Paper: 28/2006

Institute of Economic Studies,
Faculty of Social Sciences,
Charles University in Prague

[UK FSV – IES]

Opletalova 26
CZ-110 00, Prague
E-mail : ies@fsv.cuni.cz
http://ies.fsv.cuni.cz

Institut ekonomických studií
Fakulta sociálních věd
Univerzita Karlova v Praze

Opletalova 26
110 00 Praha 1

E-mail : ies@fsv.cuni.cz
http://ies.fsv.cuni.cz

**Disclaimer**: The IES Working Papers is an online paper series for works by the faculty and students of the Institute of Economic Studies, Faculty of Social Sciences, Charles University in Prague, Czech Republic. The papers are peer reviewed, but they are *not* edited or formatted by the editors. The views expressed in documents served by this site do not reflect the views of the IES or any other Charles University Department. They are the sole property of the respective authors. Additional info at: ies@fsv.cuni.cz

**Copyright Notice**: Although all documents published by the IES are provided without charge, they are licensed for personal, academic or educational use. All rights are reserved by the authors.

**Citations**: All references to documents served by this site must be appropriately cited.

**Bibliographic information**:
Fidrmuc, J., R., Horváth (2006). " Credibility of Exchange Rate Policies in Selected EU New Members: Evidence from High Frequency Data " IES Working Paper 28/2006, IES FSV. Charles University

This paper can be downloaded at: http://ies.fsv.cuni.cz

# Credibility of Exchange Rate Policies in Selected EU New Members: Evidence from High Frequency Data

Jarko Fidrmuc[#]
Roman Horváth[*]

[#]Department of Economics, University of Munich; CESifo
Faculty of Mathematics, Physics and Informatics, Comenius University Bratislava
E-mail: jarko.fidrmuc@fmph.uniba.sk

[*] Czech National Bank
IES, Charles University Prague
E-mail: roman.horvath@cnb.cz

October 2006

**Abstract:**
We examine the daily exchange rate dynamics in selected EU new member states (Czech Republic, Poland, Romania, and Slovakia) using GARCH and TARCH models between 1999 and 2004. We show that these countries tried to reduce volatility of the spot exchange rate despite their official policy of free floating and inflation targeting. However, we find that the low credibility of exchange rate policy implied higher volatility of exchange rates when it substantially deviated from the implicit target rates for all countries. Finally, we find significant asymmetric effects of the volatility of exchange rates in all new member states.

**Keywords**: Exchange rates, target zones, ERM II, inflation targeting, GARCH

**JEL:** F31, C22, C23.

**Acknowledgements:**

We thank an anonymous referee for helpful comments. The views expressed here do not necessarily represent those of the Czech National Bank.

Financial support from the IES (Institutional Research Framework 2005-2010, MSM0021620841) is gratefully acknowledged.

## 1. Introduction

All new member states (NMS) of the EU[1] face a trade off between exchange rate stability and flexibility. The recent literature on optimum currency area (OCA) criteria in the NMS surveyed by Fidrmuc and Korhonen (2006) shows that these countries increasingly constitute an optimum currency area with the EMU. Similarly, Horváth (2006) finds that the NMS fulfill OCA criteria at approximately the same level as the euro area countries before they adopted euro suggesting that the benefits of exchange rate stability may prevail.

By contrast, the developments especially in Central Europe[2] showed a process of increasing exchange rate flexibility during the previous decade (see Markievicz, 2006, and Frömmel and Schobert, 2006), which was reversed only recently by the first accessions to the Exchange Rate Mechanism II and the starting process of euro adoption in the NMS of the EU (Slovenia in January 2007).[3] In the specific conditions of these countries, relatively flexible exchange rate regimes have appeared to be appropriate to deal with the high capital flows,

[1] Reflecting that also Romania and Bulgaria will join the EU in January 2007, we refer to all countries in Central and Eastern Europe analyzed here as to NMS.

[2] On the other hand, several smaller transition economies in South East Europe and in the Baltics have adopted currency boards or comparably fixed exchange rate regimes. This development confirms Eichengreen's (1994) bipolar hypothesis that small and open economies have to decide between the extreme points of exchange rate flexibility.

[3] Estonia, Lithuania and Slovenia joined the ERM II in 2004, while Cyprus, Malta, Latvia and Slovakia followed in 2005. Furthermore, Slovenia already fulfilled the Maastricht criteria meaning that it will be able to introduce the euro by January 2007.

productivity improvements and the increasing appreciation of exchange rates also in the nominal terms (see Égert and Lommatzsch, 2004). At the same time, the exchange rate peg was replaced by monetary policies putting more emphasis on inflation stabilization. Actually, nearly all countries of our sample have adopted different types of inflation targeting.[4] Still, several NMS have used interventions at the foreign exchange market (see Égert and Komárek, 2006 or Geršl and Holub, 2006). On the one hand, these actions were largely motivated by inflation and competitiveness pressures, which depend in small and open economies heavily on exchange rates. On the other hand, this development corresponds also to the fear of floating phenomenon analyzed by Calvo and Reinhart (2002).

These arguments mean that some NMS are likely to pursue a *de facto* exchange rate policy of implicit target zones around time-varying target exchange rates, which is similar to the proposal of target zone around a fundamental equilibrium exchange rate proposed by Williamson (1985), Edison *et al*. (1987), and Chmelarova and Schnabl (2006). Similarly like in Krugman's (1991) exchange rate target zone model, the volatility of exchange rate at the borders of target zones should be smaller than in the area close to the central parity if the regime is fully credible. In the opposite case, we should observe that exchange rate volatility increases with the distance from the target exchange rates. The opposite case is especially appealing for us, as we model the countries that did not adopt official target zone, but rather intervened from time to time on the foreign exchange market.

Furthermore, expectations may be in principle formed differently in the appreciation and depreciation parts of the target zones (either *de jure* or *de facto*), which may cause systematic asymmetric effects. Finally, countries following pure inflation targeting policy are likely to show no significant differences in exchange rate volatility with respect to the target exchange rates. The estimation of this pattern of exchange rate behavior necessitates the approximation of the target exchange rates and models of exchange rate volatility by generalized autoregressive conditional heteroskedasticity (GARCH) models. Potential asymmetry in exchange rate volatility is addressed by threshold autoregressive conditional heteroskedasticity (TARCH) models.

The paper is structured as follows. The next section reviews the literature on the exchange rate target zones. Section 3 presents data and Section 4 estimates GARCH models. Finally, Section 5 concludes.

[4] Czech Republic and Poland adopted inflation targeting in 1998, Romania and Slovakia followed after a period of informal inflation targeting in 2005.

## 2. Related Literature

A fixed exchange rate regime with a non-zero fluctuation band is generally referred to as a target zone (see for example Ghosh *et al.*, 2003). The motivation for maintaining a target zone exchange rate regime is typically that some flexibility in exchange rate fluctuations is allowed, while the bands in principle assure an elimination of the eventually excessive fluctuations common under free float exchange rate regime. For a comprehensive survey of this literature, we refer a reader to Kempa and Nelles (1999), Obstfeld and Rogoff (1998), and Sarno and Taylor (2002).

Krugman (1991) provides a seminal contribution to an analysis of exchange rate dynamics under target zones. The early naive approach to exchange rate modeling in the target zone assumed that exchange rate behaves as the free float inside the band and as the fixed exchange rate regime at the edge of the band. In consequence, fluctuation band has no influence on exchange rate behavior inside the band. However, Krugman (1991) stresses the role of exchange rate expectations and argues that existence of credible fluctuation band influences the exchange rate behavior not only at the edge of the band, but also inside the band. Consequently, when exchange rate is close to the edge of the band, the foreign exchange market participants expect that central bank will intervene in order to keep the exchange rate inside the band. As a result, the expected change of exchange rate is non-zero, but either positive or negative depending whether the exchange rate reaches weaker or stronger side of the fluctuation band. Consequently, exchange rate is mean-reverting (this is typically labeled as honeymoon effect in target zone literature). Besides, the exchange rate becomes completely insensitive to fundamentals at the edges of the band (which is referred to as smooth pasting).

There have been several papers examining the Krugman model empirically. Engle and Gau (1997) examine whether the position of spot exchange rate within the band is associated to its volatility using the data from several EU countries participating in the European Monetary System in 1986-1993. They find rather mixed support for the Krugman model, namely only in few countries the negative relationship between the deviation of the exchange rate from its central parity and the exchange rate volatility is detected. Crespo-Cuaresma *et al.* (2005a) study exchange rate dynamics in a majority of EU members over different sample periods. Primarily, they test for the so-called effective band within the officially announced band. The motivation is that central banks typically do not wait until the exchange rate hits the official band, but rather start intervening already within the band. Chmelarova and Schnabl

discuss intervention pattern based on Krugram's model in Croatia as compared to developed countries.

Exchange rate volatility in selected NMS is also analyzed by Kočenda and Valachy (2006). They find that exchange rate volatility generally increased with the introduction of more flexible exchange rate arrangements and the level of interest rates differential tends to decrease exchange rate volatility, while the volatility of interest rates differential increase it.

**Table 1: Descriptive Statistics**

| | Czech Republic | Poland | Slovakia | Romania |
|---|---|---|---|---|
| Mean | 33.63 | 4.11 | 42.49 | 281.0 |
| Median | 33.31 | 4.09 | 42.47 | 278.9 |
| Maximum | 38.68 | 4.90 | 46.98 | 414.3 |
| Minimum | 28.95 | 3.35 | 39.71 | 128.7 |
| Standard deviation | 2.28 | 0.35 | 1.41 | 87.95 |
| Skewness | 0.22 | 0.08 | 0.12 | 0.04 |
| Kurtosis | 1.86 | 2.34 | 2.62 | 1.63 |
| Jarque-Bera test | 91.26 | 28.30 | 12.36 | 115.3 |
| | [0.00] | [0.00] | [0.00] | [0.00] |
| Observations | 1466 | 1466 | 1466 | 1466 |

Notes: *p*-values are reported in the brackets.

## 3. Data

In this section, we present the data and some descriptive statistics. At our disposal, we have the daily data on exchange rate of local currency vis-à-vis euro for the Czech Republic, Poland, Slovakia, and Romania between January 1999, and March 2005. In total, this makes about 1500 observations. The implicit target exchange rate is approximated by 240$^{th}$ moving average mode (that is, the average of ±120 trading days or approximately one year), MA(240).[5] The computation of moving average restricts our estimation period to January 1999 until August 2004. Alternatively, we use the equilibrium values of exchange rates estimated within the monetary model by Crespo-Cuaresma, Fidrmuc and MacDonald (2005)[6] and extrapolate them to daily values.

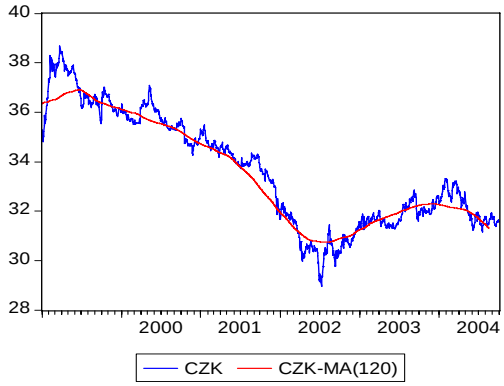
[5] Moving average, as the approximation of equilibrium exchange rate, is also adopted by e.g. Ito and Yabu (2006) and Chmelarova and Schnabl (2006).

[6] For the sake of space, we do not present the results based on these data, but they are available on a request.

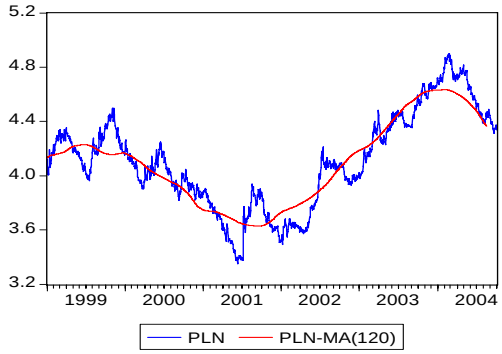
Figure 1 presents the exchange rate developments for our sample countries. Generally, nominal exchange rate appreciation is visible for the Czech Republic and Slovakia. On the other hand, Polish exchange rate does not seem to exhibit any pattern during the analyzed period. Finally, the Romanian lei depreciates substantially over the sample period, which corresponds to the de facto crawling peg applied by the Bank of Romania. Table 1 provides some basic descriptive statistics. Using the coefficient of variation, Slovak currency is the least volatile, followed by Czech crown and Polish zloty. On the other hand, Romanian currency exhibits a much larger volatility, which reflects also the exchange rate depreciation during the analyzed period.

**Figure 1: Exchange Rates vis-à-vis Euro, 1999-2004**

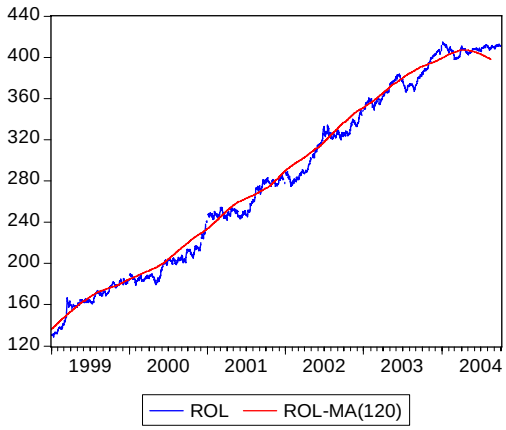
**Czech Republic**



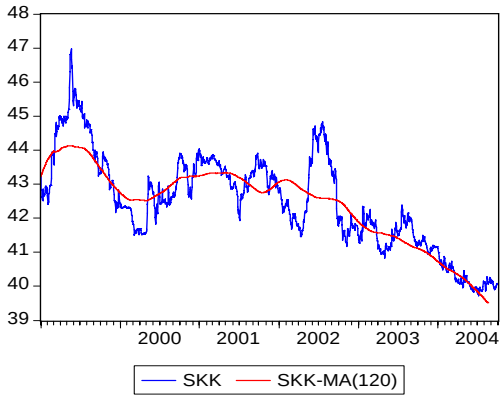

**Poland**




**Romania**




**Slovakia**



# 4. Results

## 4.1. GARCH Models

The GARCH models are generally applied for the estimations of the conditional volatility of high-frequency (daily) exchange rate changes (see Baillie and Bollerslev, 1989). Following Engle and Gau (1997), we test one of the implications of Krugman (1991) model of target zones. Krugman shows that the conditional volatility of exchange rate decreases as exchange rate approaches the edge of the target band. As a result, we estimate whether the deviation of the exchange rate from its target rate decreases the conditional volatility. Our baseline specification is a GARCH(1,1) model,

$$\Delta s_{jt}^{D} = \mu_j + \xi_{jt}, \tag{1}$$

$$\sigma_{jt}^2 = \gamma_{j1} + \gamma_{j2}\xi_{jt-1}^2 + \gamma_{j3}\sigma_{jt-1}^2 + \delta_j \left| s_{jt-1}^{D} - s_{jt-1}^{F} \right| + \omega_{jt}, \tag{2}$$

where $s^D$ and $s^F$ denote the spot daily exchange rate of currency to euro and the time varying target rate (moving average of ±120 trading days) as defined in the previous section, respectively. We do not include any explanatory variables except for constant to equation (1), because daily exchange rates are expected to be influenced largely by news and other random events (see Bask and Fidrmuc, 2006, for the discussion of high-frequency exchange rate movements in the NMS). The constant term in equation (1), $\mu$, shows the average rate of appreciation or depreciation. The error term, $\xi$, of the mean equation (1) is assumed to have a time varying conditional variance, $\sigma^2$, specified by equation (2).

The conditional variance equation includes in addition to the ARCH term, $\xi_{t-1}$, and the GARCH term, $\sigma_{t-1}^2$, also the distance between the spot and the target exchange rates, which is the major variable of our interest. Krugman's (1991) model implies that $\delta$ is negative, i.e. the conditional volatility decreases as exchange rate moves towards the edge of the band, as long as the announced or implicit target zones are fully credible. The opposite is true for the target zones subject to speculative attacks and low credibility. Finally, we expect no relationship between the conditional variance and the target exchange rates if no implicit target zones are specified.

Our dataset contains daily exchange rates of Czech, Polish, Romanian, and Slovak currencies to euro between January 1999 and March 2005 (note that the computation of moving average restricts our estimation period to August 2004, as mentioned above). On the one hand, the starting point of our analysis is determined by the creation of the euro. Thus, we avoid observations characterized by possibly non-standard volatility due to the change-over in the euro area countries. On the other hand, all NMS introduced free floating policies

supported by a kind of inflation targeting regime in this period. These countries also did not experience any severe currency crisis during the analyzed time. As Hungary and Slovenia experienced policy changes related to the introduction of the floating exchange rates in the former case and the participation in the ERM II in the latter one, we exclude these countries from our analysis. Similarly, we had to exclude all countries with currency boards (Bulgaria and the Baltic States).

Table 3 reports the estimations of (1) and (2) for the Czech Republic, Poland, Slovakia, and Romania between January 1, 1999, and October 1, 2004.[7] The results provide several interesting insights. First, we can see that the NMS do not show any significant trend of nominal appreciation or depreciation. In turn, the Romanian currency depreciated significantly during the period, which corresponds to the de facto crawling peg applied by the Bank of Romania (see Crespo-Cuaresma *et al.*, 2005c). Second, we can see that the conditional volatility significantly depends on actual lagged squared error term and lagged conditional variance of the error term. Furthermore, the sum of the ARCH and GARCH term is relatively high, which indicates that the volatility of the shocks in all countries is quite persistent. Nevertheless, the sum of both coefficients is significantly lower than unity in all countries except for Romania.

Finally, we find that the deviation of the spot exchange rate from its target level is positively significant for all the countries. This implies that as the target bands were implicit, they suffered generally under their low credibility. Similarly to e.g. Borghijs and Kuijs (2004) our results suggest that exchange rates do not act as shock absorbers. In turn, exchange rates may be a source of macroeconomic destabilization if they approach ranges of the implicit target zones. Nevertheless, we have to keep in mind that all coefficients are very small, although Poland and the Czech Republic shows the highest impact (in absolute value) of exchange rate deviations from the exchange rate target. In case of Slovakia, we have to include MA(1) in the mean equation to assure white noise in the residuals.

Figure 2 presents the conditional variance for all countries in our sample. Poland and Romania show higher conditional variance in selected periods (2001 for Poland and 1999 for Romania) than the Czech Republic and Slovakia. Nevertheless, we can see frequent changes of the conditional variance in all NMS.

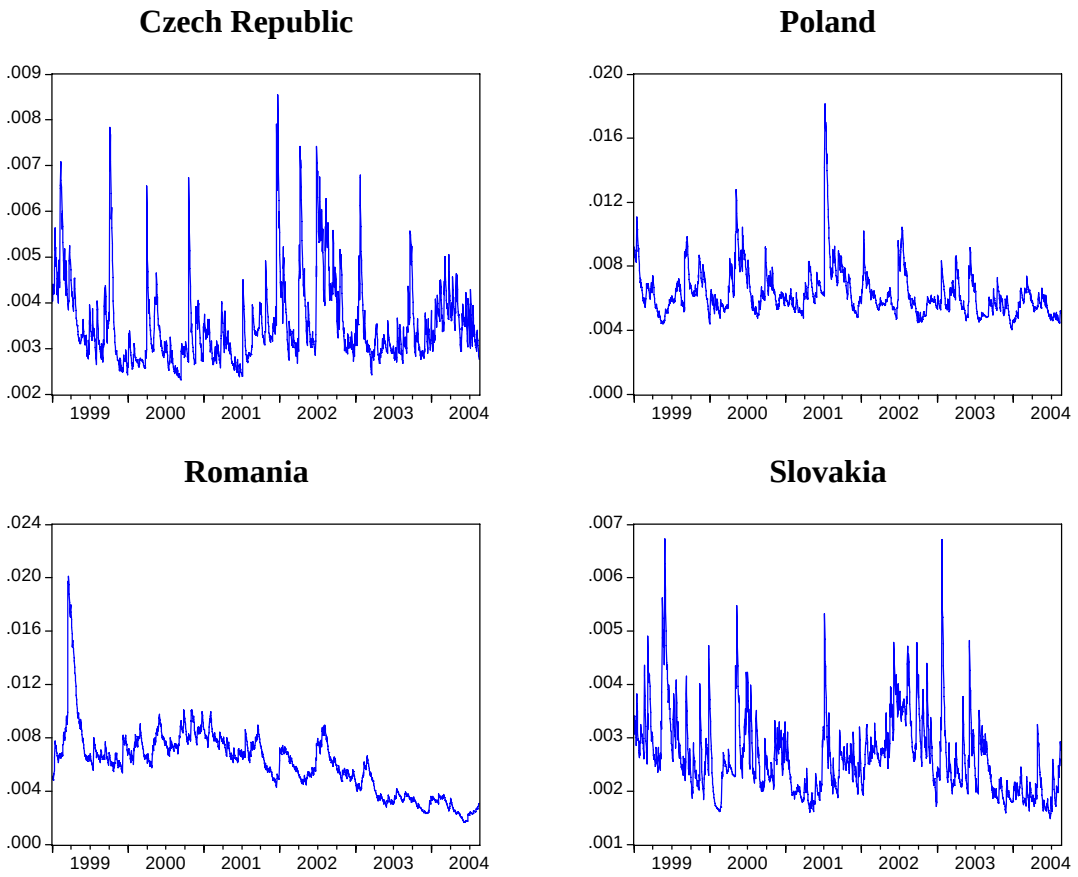
[7] The computation of the moving average for daily exchange rate as a proxy for the target rate restricts slightly the available estimation period)

Table 2: Estimates of the Effect of the Spot Position to the Target Value on Conditional Volatility (GARCH Models)

| **Country** | **Czech Republic** | **Poland** | **Slovakia** | **Romania** |
|---|---|---|---|---|
| $\mu$ | 0.000 | 0.000 | 0.000 | 0.001*** |
| | (-1.048) | (-0.193) | (-0.953) | (4.710) |
| $\gamma_1$ | 0.000*** | 0.000*** | 0.000*** | 0.000 |
| | (6.149) | (3.371) | (4.752) | (-0.903) |
| $\gamma_2$ | 0.105*** | 0.078*** | 0.111*** | 0.064*** |
| | (7.138) | (6.979) | (9.247) | (10.790) |
| $\gamma_3$ | 0.785*** | 0.857*** | 0.800*** | 0.934*** |
| | (27.667) | (42.000) | (37.967) | (143.177) |
| $\delta$ | 0.361*** | 0.381*** | 0.289*** | 0.097** |
| | (3.759) | (6.066) | (5.903) | (2.153) |
| $\gamma_2 + \gamma_3 = 1$ | 0.890*** | 0.935*** | 0.911*** | 0.999 |
| | [0.000] | [0.000] | [0.000] | [0.480] |
| Period | 1999:I-2004:VIII | 1999:I-2004:VIII | 1999:I-2004:VIII | 1999:I-2004:VIII |
| L-B(10), RES | 6.56 | 10.00 | 11.52 | 8.58 |
| | [0.77] | [0.44] | [0.24] | [0.57] |
| L-B(10), SQRES | 4.31 | 7.18 | 2.99 | 7.21 |
| L-B(10), SQRES | [0.93] | [0.71] | [0.97] | [0.71] |
| *N* | 1469 | 1469 | 1469 | 1469 |

Notes: We report *z*-statistics in parenthesis and *p*-values of the Wald test that $\gamma_2 + \gamma_3 = 1$ and the Ljung-Box *Q*-statistics of the 10th lag for standard and squared residuals in brackets. ***, **, and * - denotes significance at 1 percent, 5 percent, and 10 percent, respectively. For clarity of the discussion in the text, the coefficient $\delta$ is multiplied by $10^5$.

**Figure 2: Conditional Standard Deviation (GARCH Models)**




## 4.2. TARCH Models

We can often see that the volatility of financial variables is different along positive and negative trends (see Engle and Ng, 1993). The downwards movements of share prices are usually associated with higher volatility of financial data. In this regard, Zakoian (1990) and Glosten *et al.* (1993) proposed the threshold ARCH models to analyze asymmetric volatility.

Central banks may be also likely to fight against the currency depreciation more intensively than against currency appreciation. One reason for this asymmetry can be the fact that countries in this region typically experience real exchange rate appreciation due to the Balassa-Samuelson effect (Égert and Lommatzsch, 2004). Additionally, the ERM II has even some inherited certain asymmetric components as countries are allowed to appreciate the central parity, but its depreciation causes a violation of the exchange rate criterion (see de Grauwe and Schnabel, 2005). This pattern of behavior may play an important role already during the preparation for the later membership in the ERM II. Thus, the exchange rate target zones may be more credible if exchange rate is approaching the depreciation limit (that is, the upper bound according to our definition of exchange rates) of the target band. In turn, a

central bank may define its objective in relation to the national competitiveness. Several transition countries have been often concerned by the excessive exchange rate appreciation and some even aimed to stabilize its real exchange rate (see Coricelli *et al.*, 2006). This may be especially important for the NMS with the strong appreciation trends due to the Balassa-Samuelson effect, deregulation of prices and tradable prices appreciation. Finally, market participants may behave differently if exchange rate is overvalued or undervalued. Actually, Crespo-Cuaresma *et al.* (2005a) find important asymmetric volatility effects both in EU15 countries as well as in the NMS.

Correspondingly, we extend the standard TARCH model as we take into account also the position of the spot exchange rate in relation to its target value. Our estimation specification is as follows,

$$\Delta s_{jt}^{D} = \mu_j + \xi_{jt}, \tag{3}$$

$$\sigma_{jt}^2 = \gamma_{j1} + \gamma_{j2}\xi_{jt-1}^2 + \gamma_{j3}\sigma_{jt-1}^2 + \gamma_{j4}D_{jt-1}^{arch}\xi_{jt-1}^2 + \delta_{j1}\left|s_{jt-1}^{D} - s_{jt-1}^{F}\right| + \delta_{j2}D_{jt-1}^{s}\left|s_{jt-1}^{D} - s_{jt-1}^{F}\right| + \omega_{jt}, \tag{4}$$

where $D^{arch}$ is a dummy variable which equals 1 if the residual from the mean equation, $\xi$, is negative and zero otherwise. Similarly, $D^s$ is a dummy variable equal to 1 if the spot exchange rate is lower than the target value, that is, if the exchange rate is in the appreciation part of the target zone.

Although the asymmetric ARCH terms, $\gamma_4$, is significant only in Poland, we can see that that the asymmetric effects of exchange rate misalignments are significant also in the Czech Republic and Slovakia (see Table 3).[8] Negative exchange rate deviations (that is, exchange rate appreciation) are positive and significant both in the Czech Republic and Slovakia. We find a positive sign also for Poland. This indicates that the target zones are less credible in the appreciation part in these countries.[9] By contrast, we can see that the persistence of exchange rate shocks is lower during the appreciation periods in Poland and in Slovakia, while it is generally low in the Czech Republic than otherwise. Only in Romania we can find as before that the exchange rate volatility is persistent in both parts of the implicit target zones. In Poland, the persistence of exchange rate shocks is not significantly different from unity in the depreciation periods, but the opposite is true for the appreciation times.

[8] Correspondingly, the development pattern of exchange rate volatility is similar to that presented in Figure 2. Detailed results are available upon request from authors.

[9] Note that, by definition, the opposite is true for the depreciation side of the target zone.

Table 3: Asymmetric Estimates of the Effect of Spot Position to Target Value on Conditional Volatility (TARCH Models)

| **Country** | **Czech Republic** | **Poland** | **Slovakia** | **Romania** |
|---|---|---|---|---|
| $\mu$ | 0.000* | 0.000 | 0.000 | 0.001*** |
| | (-1.748) | (0.250) | (-1.094) | (4.708) |
| $\gamma_1$ | 0.000*** | 0.000*** | 0.000*** | 0.000 |
| | (5.750) | (3.799) | (4.446) | (-1.546) |
| $\gamma_2$ | 0.081*** | 0.099*** | 0.107*** | 0.061*** |
| | (4.010) | (6.597) | (7.483) | (11.205) |
| $\gamma_3$ | 0.773*** | 0.887*** | 0.823*** | 0.939*** |
| | (23.507) | (52.000) | (42.007) | (124.638) |
| $\gamma_4$ | 0.027 | -0.099*** | -0.021 | -0.001 |
| | (1.347) | (-4.719) | (-1.030) | (-0.089) |
| $\delta_1$ | 4.090*** | 2.610*** | 1.910*** | 1.560*** |
| | (3.567) | (2.238) | (3.600) | (2.266) |
| $\delta_2$ | 7.370*** | 1.040 | 1.790*** | -0.746 |
| | (4.517) | (1.144) | (3.588) | (-1.219) |
| $\gamma_2 + \gamma_3 = 1$ | 0.854*** | 0.986 | 0.930*** | 0.999 |
| | [0.000] | [0.295] | [0.000] | [0.927] |
| $\gamma_2 + \gamma_3 + \gamma_4 = 1$ | 0.881*** | 0.887*** | 0.909*** | 0.998 |
| | [0.000] | [0.000] | [0.000] | [0.850] |
| Period | 1999:I-2004:VIII | 1999:I-2004:VIII | 1999:I-2004:VIII | 1999:I-2004:VIII |
| L-B(10), RES | 6.163 | 10.852 | 11.778 | 8.883 |
| | [0.801] | [0.369] | [0.226] | [0.543] |
| L-B(10), SQRES | 5.168 | 5.686 | 3.008 | 7.151 |
| | [0.880] | [0.841] | [0.964] | [0.711] |
| *N* | 1468 | 1468 | 1468 | 1468 |

Notes: We report *z*-stats in parenthesis and p-values of the Wald test that $\gamma_2 + \gamma_3 = 1$ and $\gamma_2 + \gamma_3 + \gamma_4 = 1$, as well as the Ljung-Box *Q*-statistics of the 10th lag for standard and squared residuals in brackets. ***, **, and * denotes significance at 1 percent, 5 percent, and 10 percent, respectively. For clarity of the discussion in the text, coefficients $\delta$ are multiplied by $10^5$.

**Figure 3: Conditional Variance and the Deviation of Spot Exchange Rate from the Target Rate**

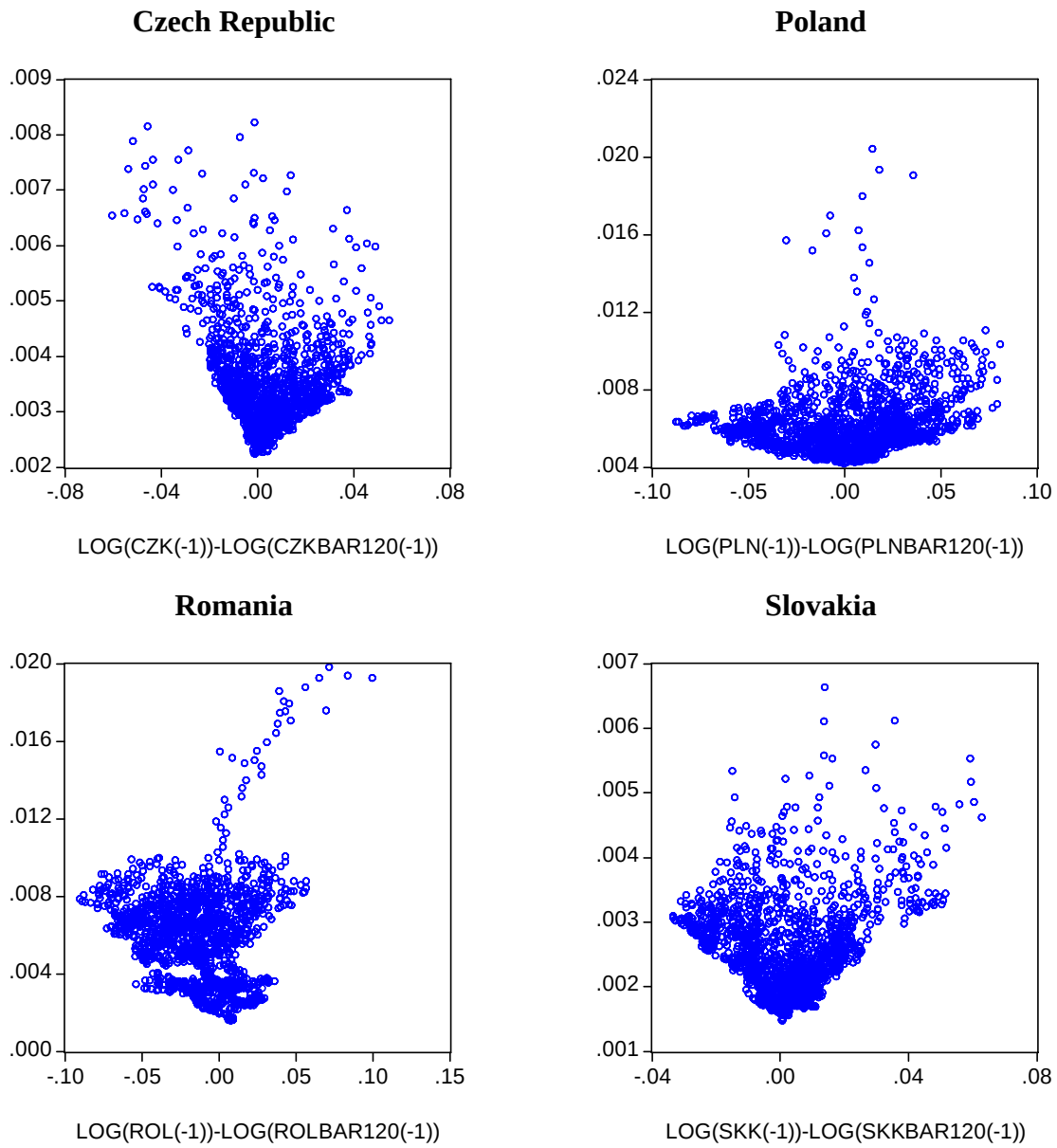



Figure 3 documents the asymmetrical relationship between exchange rate volatility and the relative level of exchange rates as compared to the targets based on the results reported in Table 3. We can see that the conditional variance increases as the actual exchange rate deviates from its implicit target rate. Furthermore, there are influential observations with exchange rate appreciation and extreme values of exchange rate volatility also in the Czech Republic. By contrast, observations with extreme exchange rate volatility are concentrated in the depreciation part of the target zones in Romania (especially observations from 1999, as

can be seen also in Figure 2) and in Slovakia. Poland shows the highest volatility of exchange rates around the implicit target values in 2001 (see also Figure 2).

## 5. Conclusions

We analyze high frequency exchange rate dynamics in selected NMS. Our sample consists of four inflation targeting countries (Czech Republic, Poland, Slovakia and Romania) that maintain flexible exchange rate policies between 1999 and 2004.

Following the target zone model by Krugman (1991), we examine the exchange rate volatility in connection to the estimated target exchange rate. We estimate GARCH models of daily exchange rate volatility. We find that the volatility is quite persistent in all NMS. In addition, the exchange rate is more volatile the further it is from its implicit target rate in all analyzed countries. This implies that there are implicit exchange rate target zones in these countries, however, which suffer under insufficient credibility.

Finally, our TARCH results point to systematic asymmetries in the exchange rate volatility in the EU NMS. Especially during the periods of exchange rate appreciation, the volatility of exchange rate is pronounced in all NMS except for Romania. In summary, our results indicate that exchange rates are ineffective tools for stabilization policies in NMS. Policy measures aiming at maintaining competitiveness result mainly in increased volatility of exchange rates, which may introduce further uncertainties to exporters in these countries.

## References


Baillie, R.T. and T. Bollerslev. 1989. The Message in Daily Exchange Rates: A Conditional-Variance Tale. *Journal of Business and Economic Statistics*, 7: 297-305.

Bask, M. and J. Fidrmuc. 2006. Fundamentals and Technical Trading: Behavior of Exchange Rates in the CEECs. *Bank of Finland discussion paper*, No.10/2006 .

Borghijs, A., and L. Kuijs. 2004. Exchange rates in Central Europe: A Blessing of a Curse? Working paper WP/04/2. International Monetary Fund. Washington.

Calvo, G. and C. Reinhart. 2002. Fear of Floating. *Quarterly Journal of Economics*, 117, 379-408.

Chmelarova, V. and Gunter Schnabl 2006. Exchange Rate Stabilization in Developed and Underdeveloped Capital Markets. Working Paper 636, European Central Bank, Frankfurt.

Coricelli, F. Jazbec, B. and I. Masten. 2006. Exchange Rate Pass-through in EMU Acceding Countries: Empirical Analysis and Policy Implications, *Journal of Banking and Finance*, 30, 1375-1391.

Crespo-Cuaresma, J. Egert, B. and R. MacDonald. 2005a. Non-Linear Exchange Rate Dynamics in Target Zones: A Bumpy Road towards a Honeymoon. *The Williams Davidson Institute Working Paper*, No. 771.

Crespo-Cuaresma, J., Fidrmuc, J. and R. MacDonald. 2005b. The Monetary Approach to Exchange Rates in the CEECs. *Economics of Transition*, 13, 395-416.

Crespo-Cuaresma, J., Fidrmuc, J. and M. A. Silgoner. 2005c. On the Road: The Path of Bulgaria, Croatia and Romania to the EU and the Euro. *Europe-Asia Studies*, 57, 843-858.

De Grauwe, P. and G. Schnabl. 2005. Nominal Versus Real Convergence – EMU Entry Scenarios for the NewMember States. *Kyklos*, 58 (4), 537–555.

Edison, H. J., Miller, M. H. and J. Williamson. 1987. On Evaluating and Extending the Target Zone Proposal. *Journal of Policy Modeling*, 9, 199-227.

Égert, B. and K. Lommatzsch. 2004. Equilibrium Exchange Rates in Transition: The Tradable Price-based Real Appreciation and Estimation Uncertainty. *The Williams Davidson Institute Working Paper*, No. 676.

Égert, B. and L. Komárek. 2006. Foreign Exchange Interventions and Interest Rate Policy in the Czech Republic: Hand in Glove?, *Economic Systems*, 30, 121-140.

Eichengreen, B. 1994. International Monetary Arrangements for the 21st Century. Washington, DC, The Brookings Institution, 1994.

Engle, R.F. and Y. Gau. 1997. Conditional Volatility of Exchange Rates under a Target Zone. *University of California at San Diego Working Paper*, No. 06/97.

Engle, R. F. and V. K. Ng. 1993. Measuring and Testing the Impact of News on Volatility. *Journal of Finance*, 48, 1022–1082.

Fidrmuc, J. and I. Korhonen. 2006. Meta-analysis of the business cycle correlation between the euro area and the CEECs, *Journal of Comparative Economics*, 34, 518-537.

Frömmel, M. and F. Schobert. 2006. 'Exchange Rate Regimes in Central and East European Countries: Deeds vs. Words', *Journal of Comparative Economics*, 34, 467-483.

Geršl, A. and T. Holub. 2006. Foreign Exchange Interventions under Inflation Targeting: The Czech Experience, *Contemporary Economic Policy,* 24, 475-491.

Ghosh, A. R., Gulde, A.M., and H. C. Wolf. 2003. Exchange Rate Regimes: Choices and Consequences. Cambridge, The MIT Press.

Glosten, L. R., R. Jaganathan, and D. Runkle. 1993. On the Relation between the Expected Value and the Volatility of the Normal Excess Return on Stocks. *Journal of Finance*, 48, 1779–1801.

Horváth, R. 2006. Ready for Euro? Evidence on EU New Member States, *Applied Economics Letters*, forthcoming.

Ito, T., Yabu, T., 2006. What Promotes Japan to Intervene in the Forex Market? A New Approach to a Reaction Function, Journal of International Money and Finance, forthcoming.

Kempa, B. and M. Nelles. 1999. The Theory of Exchange Rate Target Zones. *Journal of Economic Surveys*. 13, 173-210.

Krugman, P. 1991. Target Zone and Exchange Rate Dynamics. *Quarterly Journal of Economics*, 56, 669-682.

Kočenda, E. and J. Valachy. 2006. Exchange Rate Volatility Before and After Regime Shift: A New Measure and New Evidence from Transition. *Journal of Comparative Economics*, forthcoming.

Markiewicz, A. 2006. Choice of Exchange Rate Regime in Transition Economies: An Empirical Analysis. *Journal of Comparative Economics*, 34, 484-498.

Obstfeld, M. and K. Rogoff. 1998. Foundations of International Macroeconomics, Cambridge, MIT Press.

Williamson, J. 1985. *The Exchange Rate System*. Institute for International Economics, Washington D.C.

Zakoïan, J. M. 1994. Threshold Heteroskedastic Models. *Journal of Economic Dynamics and Control*, 18, 931-944.

Sarno, L. and M. P. Taylor. 2002. The Economics of Exchange Rates. Cambridge University Press.

# IES Working Paper Series

## 2005

15. Oldřich Dědek: *Rizika a výzvy měnové strategie k převzetí eura*
16. Karel Janda, Martin Čajka: *Srovnání vývoje českých a slovenských institucí v oblasti zemědělských finance*
17. Alexis Derviz: *Cross-border Risk Transmission by a Multinational Bank*
18. Karel Janda: *The Quantitative and Qualitative Analysis of the Budget Cost of the Czech Supporting and Guarantee Agricultural and Forestry Fund*
19. Tomáš Cahlík, Hana Pessrová: *Hodnocení pracovišť výzkumu a vývoje*
20. Martin Gregor: *Committed to Deficit: The Reverse Side of Fiscal Governance*
21. Tomáš Richter: *Slovenská rekodifikace insolvenčního práva: několik lekcí pro Českou republiku*
22. Jiří Hlaváček: *Nabídková funkce ve vysokoškolském vzdělávání*
23. Lukáš Vácha, Miloslav Vošvrda: *Heterogeneous Agents Model with the Worst Out Algorithm*
24. Kateřina Tsolov: *Potential of GDR/ADR in Central Europe*
25. Jan Kodera, Miroslav Vošvrda: *Production, Capital Stock and Price Dynamics in a Simple Model of Closed Economy*
26. Lubomír Mlčoch: *Ekonomie a štěstí – proč méně může být vice*
27. Tomáš Cahlík, Jana Marková: *Systém vysokých škol s procedurální racionalitou agentů*
28. Roman Horváth: *Financial Accelerator Effects in the Balance Sheets of Czech Firms*
29. Natálie Reichlová: *Can the Theory of Motivation Explain Migration Decisions?*
30. Adam Geršl: *Political Economy of Public Deficit: Perspectives for Constitutional Reform*
31. Tomáš Cahlík, Tomáš Honzák, Jana Honzáková, Marcel Jiřina, Natálie Reichlová: *Convergence of Consumption Structure*
32. Luděk Urban: *Koordinace hospodářské politiky zemí EU a její meze*

## 2006

1. Martin Gregor: *Globální, americké, panevropské a národní rankingy ekonomických pracovišť*
2. Ondřej Schneider: *Pension Reform in the Czech Republic: Not a Lost Case?*
3. Ondřej Knot and Ondřej Vychodil: *Czech Bankruptcy Procedures: Ex-Post Efficiency View*
4. Adam Geršl: *Development of formal and informal institutions in the Czech Republic and other new EU Member States before the EU entry: did the EU pressure have impact?*
5. Jan Zápal: *Relation between Cyclically Adjusted Budget Balance and Growth Accounting Method of Deriving 'Net fiscal Effort'*
6. Roman Horváth: *Mezinárodní migrace obyvatelstva v České republice: Role likviditních omezení*
7. Michal Skořepa: *Zpochybnění deskriptivnosti teorie očekávaného užitku*
8. Adam Geršl: *Political Pressure on Central Banks: The Case of the Czech National Bank*
9. Luděk Rychetník: *Čtyři mechanismy příjmové diferenciace*
10. Jan Kodera, Karel Sladký, Miloslav Vošvrda: *Neo-Keynesian and Neo-Classical Macroeconomic Models: Stability and Lyapunov Exponents*

11. Petr Jakubík: *Does Credit Risk Vary with Economic Cycles? The Case of Finland*
12. Julie Chytilová, Natálie Reichlová: *Systémy s mnoha rozhodujícími se jedinci v teoriích F. A. Hayeka a H. A. Simona*
13. Jan Zápal, Ondřej Schneider: *What Are Their Words Worth? Political Plans And Economic Pains Of Fiscal Consolidations In New Eu Member States*
14. Jiří Hlaváček, Michal Hlaváček*: Poptávková funkce na trhu s pojištěním: porovnání maximalizace paretovské pravděpodobnosti přežití s teorií EUT von-Neumanna a Morgensterna a s prospektovou teorií Kahnemana a Tverského*
15. Karel Janda, Martin Čajka: *Státní podpora českého zemědělského úvěru v období před vstupem do Evropské unie*
16. Nauro F. Campos, Roman Horváth: *Reform Redux: Measurement, Determinants and Reversals*
17. Michal Skořepa: *Three heuristics of search for a low price when initial information about the market is obsolete*
18. Michal Bauer, Julie Chytilová: *Opomíjená heterogenita lidí aneb Proč afrika dlouhodobě neroste*
19. Vít Bubák, Filip Žikeš: *The Price of Stock Trades: Evidence from the Prague Stock Exchange*
20. Vladimír Benáček, Jiří Podpiera a Ladislav Prokop: *Command Economy after the Shocks of Opening up: The Factors of Adjustment and Specialisation in the Czech Trade*
21. Lukáš Vácha, Miloslav Vošvrda: *Wavelet Applications to Heterogeneous Agents Model*
22. Lukáš Vácha, Miloslav Vošvrda: *"Morální hazard" a „nepříznivý výběr" při maximalizaci pravděpodobnosti ekonomického přežití*
23. Michal Bauer, Julie Chytilová, Pavel Streblov: *Effects of Education on Determinants of High Desired Fertility Evidence from Ugandan Villages*
24. Karel Janda: *Lender and Borrower as Principal and Agent*
25. Karel Janda: *Optimal Deterministic Debt Contracts*
26. Jiří Hlaváček: *Pojištění vkladů: současný stav, srovnání a perspektiva v kontextu EU*
27. Pavel Körner: *The determinants of corporate debt maturity structure: evidence from Czech firms*

All papers can be downloaded at: http://ies.fsv.cuni.cz

Univerzita Karlova v Praze, Fakulta sociálních věd
Institut ekonomických studií [UK FSV – IES] Praha 1, Opletalova 26
E-mail : ies@fsv.cuni.cz http://ies.fsv.cuni.cz