Monetary Policy Rules in Central and Eastern Europe*

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Abstract:
We estimate monetary policy rules for six central and eastern European countries (CEEC) by taking changes in the policy settings explicitly into account. Distinguishing rather fixed and more flexible exchange rate arrangements we find that for most countries exchange rates played an important role in monetary policy during the fixed exchange rate regime, whereas their influence disappears after the introduction of floating exchange rate regimes. This indicates that most countries followed their officially announced policy settings. For Slovenia and to some extent for Romania, however, we find evidence for exchange rate targeting, although they officially announced a managed float.

* Any findings, interpretations, and conclusions are those of the authors and do not necessarily represent the views of the Deutsche Bundesbank.

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Introduction:

The interest setting behaviour of a central bank can give important information on the objectives which are most important in its conduct of monetary policy. The analysis often focuses on the comparison of the actual setting of policy rates by central banks with what would have been predicted by the Taylor rule first proposed in 1993. The rule suggests that interest rates would be changed according to the deviation of inflation from a target and an output gap (Taylor, 1993, Svensson 1999, 2002). The empirical literature on industrial countries has grown significantly during the past decade and often concludes that the most successful central banks in large industrial countries have followed such a rule (Clarida et al. 1998). Regime shifts, however, seem to matter. Kahn and Parrish (1998), for example, find that significant structural breaks in the monetary policy reaction function occurred, after New Zealand and the UK introduced inflation targeting. In both countries the significance of the exchange rate lost importance.

Research in the context of emerging market economies is of more recent origin. An important finding is that central banks in emerging market economies tend to look beyond inflation and focus on other objectives as well, most prominently on exchange rate changes. Filosa (2001) examines the interest setting behaviour of selected central banks in more advanced Asian and Latin American emerging market economies. Many of them react strongly to exchange rate changes, although shifts in the monetary regime make it difficult to assess the relative importance placed by countries on inflation control and external equilibrium. Mohanty and Klau (2004) find that many central banks in their sample of emerging market economies change interest rates systematically in response to exchange rate changes, in some, the response is even found to be stronger than that to the inflation rate or the output gap. Corbo (2002) analyses monetary policy rules for selected countries in Latin America. His results indicate that these central banks look beyond just inflation to take into account other variables, which often are spelled out in their charter. In case of Chile, for example, the ratio of the current account deficit to GDP seems to be important in deciding the stance of monetary policy, in case of Costa Rica and Peru, it is both the output gap and the real exchange rate.

The treatment of exchange rate changes in monetary policy rules is also discussed in the theoretical literature. Ball (1999, 2002) argues that pure inflation targeting without explicit attention to the exchange rate is dangerous in an open economy, because it creates large fluctuations in exchange rates and output. In an open economy, the effects of exchange rates on inflation through import prices is the fastest channel from monetary policy to inflation, and so inflation targeting implies that it is used aggressively. Large shifts in the exchange rate, however, produce large fluctuations in output. In his opinion policymakers in open economies should modify a Taylor-like reaction function to give a role to the exchange rate: Their policy instrument should be a Monetary Condition Index (MCI) based on both the interest rate and the exchange rate. As a target variable, policymakers should choose "long-run inflation" – an inflation variable purged of the transitory effects of exchange rate fluctuations.

Svensson (2000) compares strict inflation targeting (when stabilizing inflation around the inflation target is the only objective for monetary policy) with flexible inflation targeting (when there are additional objectives for monetary policy). His results also indicate that strict inflation targeting implies a vigorous use of the direct exchange rate channel for stabilizing (CPI-) inflation at a short horizon. In contrast, flexible inflation targeting ends up stabilizing inflation at a longer horizon, and thereby also stabilizes real exchange rates and other variables to a significant extent. In comparison with the Taylor rule, the reaction function under inflation targeting in an open economy responds to more information, in particular to foreign disturbances.

Taylor (2001) argues that a monetary policy rule that reacts directly to the exchange rate, as well as to inflation and output, sometimes works worse than policy rules that do not react directly to the exchange rate and thereby avoid more erratic fluctuations in the interest rate. In Taylor (2002), however, he points out that monetary policy in open economies is different from that in closed economies. Open-economy policymakers seem averse to considerable variability in exchange rate. In his view they should target a measure of inflation that filters out the transitory effects of exchange rate fluctuations and they should also include the exchange rate in their policy reaction functions. He leaves open to further research, whether the exchange rate should appear on the left- or the right-hand side of the rule – that is, whether the policy instrument should be an interest rate or an MCI.

In our study the emphasis is on positive or descriptive rather than normative aspects of policy analysis. We want to obtain some evidence about interest rate setting behaviour in a

group of emerging market economies in Central and Eastern Europe. It includes the Visegrád Group (the Czech Republic, Hungary, Poland and Slovakia) and Slovenia and Romania. It thus focuses on new EU member countries and EU accession and candidate countries in Central and Eastern Europe that have either moved from fixed to more flexible exchange rate regimes (the Visegrád Group) or that have already pursued a fairly flexible exchange rate regime since the early stages of transition (Romania and Slovenia)[1]. We analyse the role of the exchange rate by looking at the interest rate setting behaviour of the central bank and to what extent the interest rate setting behaviour has taken exchange rate developments into account. The paper thereby sheds some light on the discussion to which extent the interest setting behavior of these central banks complies with the "fear of floating" hypothesis, as analyzed by Reinhart (2000) and Calvo and Reinhart (2002).[2] A central bank that changes interest rates systematically in response to inflation and also to exchange rate shocks is more likely to support evidence on this hypothesis. Furthermore, the analysis takes into account shifts in monetary policy regimes that have occurred in most countries of the sample.

Table 1 summarizes the official monetary policy strategies of the six central and eastern European countries since 1994. The Czech Republic, Hungary, Poland and Slovakia switched from fixed to flexible exchange rate regimes during the sample period and then chose inflation targeting as a monetary strategy[3]. Romania and Slovenia officially declared managed floating exchange rate regimes during the entire sample period. Whereas Romania never officially declared any monetary policy strategy, Slovenia pursued different forms of monetary targeting and later on moved to a two-pillar strategy akin to the strategy of the European Central Bank.

Table 2 shows the evolution of exchange rate arrangements in the CEEC under consideration. Apart from Romania and Slovenia which officially claimed to have had managed floating regimes during the total sample period, the CEECs have successively moved from rather fixed to more flexible exchange rate regimes by widening the exchange rate bands over time. Thus, officially the role of the exchange rate has declined over time or never has played a significant role in the monetary policy strategies of the respective countries. Nevertheless, it still may have been of an implicit significance in monetary policy strategies.

[1] For the choice of exchange rate regimes in transition economies see Hagen and Zhou (2005).
[2] For Central and Eastern European countries, for example, Schnabl (2004).
[3] For some general considerations on inflation targeting in the case of Poland see Christofferson et al. (2001).

– INSERT TABLE 1 ABOUT HERE –

– INSERT TABLE 2 ABOUT HERE –

As a first approach we look at correlation coefficients in order to investigate whether there is a closer relationship between short-term interest rates and inflation or short-term interest rates and exchange rates. In table 3 the results are given for inflation (π), real effective exchange rates (REER), and exchange rates to the respective anchor currency or basket of anchor currencies (anchor). Inflation is measured as yearly changes of consumer price indices, for exchange rates we look at monthly changes.

During fixed exchange rate regimes the correlation coefficient between interest rates and exchange rates to the anchor would be negative if the authorities changed interest rates in order to hold the exchange rate inside the band, i.e. a depreciation of the domestic currency (a decrease of the exchange rate to the anchor) would imply an increase of the interest rate. During flexible exchange rate regimes the countries may have implicitly followed an exchange rate target, for these central and eastern European countries it presumably has been an exchange rate target to the D-mark or the euro or to the REER.

Indeed, apart from Slovakia the correlation between the interest rate and the exchange rate is negative during fixed exchange rate regimes, however, not always closer than the correlation between the interest rate and inflation. The correlation declines during the flexible exchange rate period. Thus, the evidence broadly supports the impression, that the role of the exchange rate decreased after official shifts to more flexible regimes. In order to analyse this question more deeply and in order to detect implicit exchange rate targeting we move on to the estimation of interest rate reaction functions in the next section.

– INSERT TABLE 3 ABOUT HERE –

2. Estimation of Taylor-Rules for Open Economies

Following the seminal paper by Taylor (1993), it has become common practice to model monetary policy decisions as simple linear feedback rules linking the central bank's interest rate decision to the output gap and inflation

$$i_t = \pi_t + \bar{r} + 0.5(\pi_t - \pi_t^*) + 0.5 \cdot y_t$$

where i is the short-term nominal interest rate set by the central bank, π is the inflation rate, π^* is the inflation target of the central bank and y is the percent deviation of real GDP from its target, the output gap.

Clarida et al. (1998) have generalised the interest-rate rule to a class of policy rules that explicitly include forward-looking elements and Taylor (2001) discusses open-economy monetary policy rules, which take into account the role of the exchange rate.

Our approach includes these elements into two estimation functions.

$$i_t = c + \alpha_1 \cdot \pi_{t+12} + \alpha_2 \cdot y_t + \alpha_3 \cdot s_{t,REER} + \alpha_4 \cdot s_{t-1,REER} + \alpha_5 \cdot i_{t-1} \quad (1)$$

$$i_t = c + \alpha_1 \cdot \pi_{t+12} + \alpha_2 \cdot y_t + \alpha_3 \cdot s_{t,ANC} + \alpha_4 \cdot s_{t-1,ANC} + \alpha_5 \cdot i_{t-1} \quad (2)$$

A positive intercept captures the unknown long-run real interest rate. π_{t+12} is the actual inflation rate 12 months ahead and serves as a proxy for expected inflation. The coefficients α_1 and α_2 reflect the extent to which the central bank responds to deviations of expected inflation and output from their respective targets (in case of inflation, the target is either assumed to be zero or it corresponds to the announced inflation target). α_5 captures the degree of interest rate smoothing. Traditional explanations for smoothing interest rate changes include, for example, fear of disrupting capital markets, loss of credibility from sudden large policy reversals or the need for consensus building to support a policy change (Clarida et al., 1998). The so-called "Taylor principle" then requires $\alpha_1/(1-\alpha_5)$ to be larger than 1. In this case the central bank's response to a deviation of inflation from target does not only entail an increase in the nominal but also in the real interest rate.

The exchange rate s is measured either as a real effective exchange rate, s_{REER}, in equation (1) or as a nominal exchange rate to the respective anchor currency or basket of currencies, s_{ANC}, in equation (2). An increase of both exchange rates is an appreciation. The question about the role of the exchange rate in a policy rule is a question about whether α_3 and α_4 should be non-zero and if so what should be their signs and numerical values. We distinguish four cases in table 4, of which only the fourth case reflect exchange rate targeting in its narrow sense. In the other three cases the central bank only reacts to transitory changes of the exchange rate.

One interpretation of thes rule of thumb discussed by Taylor (2001) and Obstfeld and Rogoff (1995) is the first case, in which α_3 is less than zero and α_4 is equal to zero (assuming a lag α_4 is less than zero and α_3 is equal to zero). Then a higher than 'normal' exchange rate would call on the central bank to lower the short-term interest rate, which presumably would represent a "relaxing of monetary policy". Furthermore, if α_4 is positive and α_3 is negative but greater in absolute value than α_4, the second case in table 4, the initial interest rate reaction is partially offset in the next period. Another interpretation of the rule of thumb discussed by Taylor (2001) and Obstfeld and Rogoff (1995) is the third case, in which $\alpha_3 < 0$ and $\alpha_4 = -\alpha_3$; then the interest rate reacts to the *change* in the exchange rate. Assuming that the exchange rate is mean reverting implies that it does not have any significant impact on the central bank's inflation forecast. However, if shocks to the exchange rate are large and persistent and the central bank places a higher weight on exchange rate stability we would expect significant negative coefficients on both the current and lagged values of the exchange rate. The fourth case is therefore the only case which reflects exchange rate targeting in its narrow sense.

– INSERT TABLE 4 ABOUT HERE –

In line with Clarida et al. (1998) we estimate the parameter vector using generalized method of moments (GMM). The instrument set includes lagged values of output, inflation, interest rates and the growth rates of the other countries in our data set. Each of these variables is potentially useful for forecasting inflation and output and is exogenous with respect to the interest rate.

3. Data and Estimation Results

We analyze monthly data for the Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia. All data apart from the REER for Slovenia is from the IMF's "International Financial Statistics" CD-rom[4] and covers the period between January 1994 and February 2005. REERs for Slovenia are own calculations based on the five most important trading

[4] We use the series (ccc denotes the country code): ccc..AE.ZF (exchange rate), ccc..RECZF (REER), ccc60B..ZF (money market rate), ccc60C..ZF (treasury bill rate), ccc64..ZF (consumer price index), ccc66..ZF (industrial production). As for Slovakia money market rates are only available from 2000, and treasury bill rates are not included in the IFS database, we use daily interbank rates, provided by Thomson Financial Datastream.

partners in 1996 and 2002, deflators are CPI for Slovenia and PPI for the trading partners. The central parities for pegged exchange rates to a basket of currencies have been provided by the national central banks.

Orphanides (2001) and others have shown that the use of real-time information can considerably change the outcome of an analysis of past monetary policy decisions. However, compiling real-time data sets which includes the central bank's own estimates of potential output is not possible for this group of countries, as internal estimates are either not available at all or not publicly available. In order to partly overcome this problem we use GDP growth and not the output gap. Gerberding et al. (2004) have shown that there is a sizable bias in the real–time estimates of the output gap and that this can be an argument for policy-makers in favour of using differences rather than levels. These findings are in line with Walsh (2004) who presents evidence that "difference rules" may perform well in the presence of imperfect information about the level of potential output.

As a first step we estimate equations (1) and (2) for the whole sample period[5]. The results are given in table 5. The estimated coefficient for inflation is correctly signed for all estimations but equation (2) for Slovenia. Like Slovenia Romania has opted for a managed float without any formal anchor and α_1 is significant for equation (1). Hungary is the only country which does not show any significantly positive coefficient for inflation. The long-term reaction of the interest rate to inflation (α_1^{LR}) exceeds one only for the Czech Republic (4.261 resp. 4.200) and Slovakia (1.338 resp. 1.060). For the other countries it takes values between (0.135 for Romania, equation 2, and 0.864 for Hungary, equation 1). The estimated coefficients α_2 for the output are less convincing: In five out of twelve cases they are negative, i.e. wrongly signed, however never significant though. Only for the Czech Republic and Poland the coefficients of both the inflation rate and GDP growth are correctly signed and significant. The finding of highly significant and large coefficients for the lagged interest rate is in line with the empirical literature. Only for Slovakia the value for α_5 is comparatively low (0.227 resp. 0.237).

The coefficients for the exchange rate are of special interest in the case of small open economies. As pointed out in the previous section (the four cases in table 4), we would expect

[5] We do this as single equation estimations using GMM. We also estimate the equations as system, but there is no substantial effect on the results. Therefore we do not show these results, they are available from the authors on request.

that α_3 and α_4 are not both significantly negative, if the central bank does not explicitly consider the exchange rate (cases 1 to 3 in table 4). In contrast, we expect that both coefficients take significant negative values, if the central bank puts more weight on exchange rate movements (case 4). The central bank will then increase the interest rate to reverse a depreciation of the domestic currency and vice versa.

– INSERT TABLE 5 ABOUT HERE –

Regarding the influence of the exchange rate on the interest rate setting behaviour of the central bank, the results in table 5 do not draw a clear picture and we find all patterns for α_3 and α_4 described in the previous section in the data except for case 2. Most results for the exchange rate, however, are not significant. Only for Romania (for equation (1)) and for Slovenia we find significantly negative values of a considerable magnitude for both α_3 and α_4, thus indicating exchange rate targeting.

Summing up so far, the estimation of a standard Taylor rule for open economies leads to mostly correctly signed results for the inflation rate (although the long term response to inflation is usually too low), and for the output variable in case of the Czech Republic, Poland, Romania (only for equation (1)) and Slovakia. The results for the coefficients on the exchange rate provide only for Romania and Slovenia evidence for exchange rate targeting.

The results for the whole sample period overlook different exchange rate and monetary policy regimes. Therefore we repeat the calculations for the different subperiods. As CEECs changed their exchange rate regimes frequently and some of the arrangements only lasted for few months (see table 2), one has to aggregate some of the subperiods. We do this by classifying all (official) exchange rate regimes with bandwidths up to 10 per cent as fixed exchange rates, whereas we refer to all other exchange rate regimes (free and managed floats as well as Hungary's peg to the Euro with ± 15 per cent) as floating exchange rates. In table 2 all periods which we classify as fixed are shadowed. Although this classification is quite rough, we will show that we gain substantial additional insights into the CEEC's monetary policy settings.

For the *Czech Republic* (table 6) we identify a fixed exchange rate regime between 1994 and May 1997, and a managed float after 1997. Considering subperiods has substantial effects on the role of inflation and the exchange rate. The model now matches the exchange rate and monetary policy much better. During the fixed exchange rate regime we find that both α_3 and

α_4 are negative, indicating that a depreciation of the exchange rate goes along with an increase in the Czech interest rate. This is in line with the Czech Republic's official policy settings. The specification of the policy rule slightly affects the results: For equation (1) (the real exchange rate specification) only α_3 is significant, whereas for equation (2) (the anchor currency exchange rate) both, α_3 and α_4, are significantly negative and therefore match the officially announced exchange rate regime. The similarity may be due to the Czech's choice of the exchange rate basket, consisting of the Deutsche mark and the US dollar, which at the same time reflect a major part of the (though nominal) effective exchange rate. In contrast, the output and the inflation coefficients are not significant and the inflation coefficient is even wrongly signed. The results for the fixed exchange rate period reflect the dominance of the exchange rate objective over domestic objectives. For the flexible exchange rate regime, in contrast, we only find marginal influence of the exchange rate (in terms of the coefficient α_3) in equation (2). Interestingly the coefficients for inflation suffer from low significance, which may be due to the comparatively short sample period of only approximately seven years (n=83). Furthermore we modify the Taylor rules by using the deviation of the inflation rate from the forecast in the Czech National Bank's (CNB's) inflation report. The results are given in columns 7 and 8 of table 4. Interestingly for equation (2) we still find some influence of the exchange rate as described by case (3) in table 4, indicating that the CNB still tries to smooth the exchange rate movements, though the coefficient for inflation remains insignificant.

– INSERT TABLE 6 ABOUT HERE –

For *Hungary* the estimation for the whole sample period was least successful. Table 7 shows that re-classifying the sample period again improves the results: For the fixed exchange rate period from 1994 to 2000 we find significant coefficients for the inflation and the exchange rate (α_3, $\alpha_4 < 0$) in equation (2). Therefore the monetary policy prior to 2000 can be characterized as exchange rate targeting with explicit consideration of inflation, thus confirming the view by Golinelli and Rovelli (2002). In contrast, in the flexible exchange rate regime we find that the interest rate is mainly determined by output, whereas the role of the exchange rate is ambiguous: We find some reaction to the movements of the HUF/EUR exchange rate (col. 6) with $\alpha_3 < 0$, $\alpha_4 < 0$. This result is quite meaningful, as the Hungarian National Bank (MNB) still manages the forint, shadowing ERM2. Following the approach for the Czech Republic, we re-estimate the monetary policy rules for the inflation targeting period with deviations of the realized from the forecasted inflation rate. Here we hardly find any

influence of the exchange rate, hinting at a less important role of the exchange rate in Hungary's nowadays monetary policy.

– INSERT TABLE 7 ABOUT HERE –

For *Poland* the results from the whole sample estimation were already satisfactory and in line with the expectations from a Taylor rule estimation. Splitting the sample provides an interesting insight in the National Bank of Poland's (NBP) monetary policy (table 8): During the fixed exchange rate period the results do not differ much from those for the whole sample apart from equation (2), in which the (lagged) exchange rate becomes significant. The impression is still that the NBP put much weight on inflation and output as domestic objectives. After the NBP abandoned the fixed exchange rate regime and introduced inflation targeting, we find significant and increased weights for inflation only. Output as well as the exchange rate becomes insignificant. Thus, regarding the interest setting behaviour the NBP seems to be a true inflation targeter during the recent years. The significance of the inflation coefficient, however, gets lost when we again apply deviations of realized from forecasted inflation rates.

– INSERT TABLE 8 ABOUT HERE –

For *Romania* some specific methodological issues need to be discussed. First, Romania has never pursued a formal peg to any currency or basket. Therefore it is necessary to consider the Euro as well as the US dollar as a possible anchor currency for the Romanian leu[6]. Therefore, we consider the exchange rate of the ROL against the Euro as well as against the US dollar in our estimations. Second, Romania never changed its official exchange rate regime pursuing a managed float since 1994. There is, however, recent empirical evidence that there was a substantial change in the Romanian exchange rate system between 1998 and 1999 (Frömmel and Schobert, 2006). Therefore we split the sample at this time and estimate the equations for both subperiods. The results are given in table 9. We find that the influence of the exchange rate is very strong during the first subperiod. The interest rate reacts strongly to both, changes in the Euro and the US dollar. During the second subperiod, however, this relation becomes weaker, being significant for the lagged exchange rate only. Therefore our

[6] The particular importance of the US dollar for Romania may be best described by the fact that mineral products account (in 2005) for 15.3 per cent of all imports and 10.9 per cent of all exports (Romania National Institute of Statistics, 2005).

results are in favour of a Deutsche mark and US dollar basket until 1998 with only little influence of the exchange rate on the interest rate afterwards.

– INSERT TABLE 9 ABOUT HERE –

The results for *Slovakia* (table 10) are least encouraging. While we find some counterintuitive significant coefficients during the fixed exchange rate period, there is not any significant coefficient other than the lagged interest rate after Slovakia abandoned the koruna's peg in 1998. The result, however, is in line with the observation, that Slovakia's monetary policy can be best described as "implicit inflation targeting with a significant amount of discretion" (Beblavý, 2002), which makes it difficult to find systematic and stable relations between interest rates and other variables.

– INSERT TABLE 10 ABOUT HERE –

To *Slovenia* the same applies as to Romania: Slovenia has officially opted for a managed float during the whole sample period. However, there was little doubt among observers that the Bank of Slovenia (BoS) – if they did any implicit exchange rate targeting – were shadowing the Deutsche mark respectively the Euro. Therefore we do not consider the rate of the Slovenian tolar against the US dollar. As Slovenia used monetary targets until it changed to a two-pillar strategy in 2001, we additionally include the change of reserve money[7] to our equation. This seems to be reasonable as Slovenia was the only CEEC putting significant weight on monetary developments during a notable period of time. As the BoS has changed its monetary policy in early 2001, we split the sample into two subperiods (1994-2000 and 2001-2005).

We find significant coefficients for the Euro exchange rate until 2000, whereas for the period 2001-2005 the real exchange rate turns out to be significant (table 11). For the second subperiod we also find an additional significant contribution of the inflation rate next to the exchange rate for equation (1). Furthermore, the coefficient for the changes in money is significantly positive for all estimations but one.

[7] Slovenia actually used reserve money as a monetary target only in earlier years and then moved to a broad money target. In the Taylor rule estimations, however, only reserve money was significant. The other coefficients do not differ substantially when we estimate the equation without money, the results are available from the authors on request.

We interpret the results from the subperiods for Slovenia as evidence for implicit pegging of the tolar to the Euro during the first subperiod and to real exchange rate during the second subperiods, which is in line with recent empirical research[8].

– INSERT TABLE 12 ABOUT HERE –

4. Conclusions

Many central banks in emerging market economies pay special attention to exchange rate movements, even though they do not officially claim to target the exchange rate. This "fear of floating" can also be traced in the interest setting behaviour of central banks. We estimate open-economy Taylor rules in order to analyse to which extent central banks in Central and Eastern Europe have given the exchange rate a special role in their interest rate decisions.

When estimating monetary policy rules one has to consider shifts in exchange rate regimes explicitly. The influence of the exchange rate on the interest rate setting behaviour of central and eastern European central banks can differ strongly between periods with different exchange rate arrangements. Most countries follow their officially announced policy settings, i.e. the importance of the exchange rate for the interest rates declined substantially after the introduction of floating exchange rates. Hungary and the Czech Republic have shifted the role of the exchange rate in their interest rate setting behaviour in line with their official policy shifts from fixed to flexible exchange rate regimes. Poland gives the strongest results for pure inflation targeting, also in line with the official announcements, while the results for Slovakia may reflect the discretionary stance of the central bank as observed by central bank members themselves. Our results, however, support exchange rate targeting for Slovenia and to some extent for Romania. Interestingly, both countries have had no explicit exchange rate target during the whole sample period, however, they may have implicitly targeted the exchange rate.

[8] Frömmel and Schobert (2006) find evidence that Slovenia possibly tried to peg the tolar horizontally in the early 1990s, but switched to a crawling peg against the deutsche mark and later the Euro after 1999 thus implying a stabilization of the real exchange rate. Although it seems the BoS did not stabilize the real *effective* exchange rate, Deutsche mark resp. Euro is the most important single currency in Slovenia's effective exchange rate.

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TABLE 1. Official monetary policy strategies since 1994

Czech Republic		Hungary		Poland	
1994-1997	Exchange rate and monetary targeting (credit volume and M2)	1994-2002	Exchange rate targeting	1994-1998	Exchange rate targeting
1998-2001	Net inflation[1] targeting	2002-	Inflation targeting (CPI annual average)[3]	1998-	Inflation targeting (end of year CPI inflation)
2002-	Headline inflation targeting with linear and declining target band				

Romania		Slovakia		Slovenia	
1994-	No official commitment to a monetary policy strategy	1994-1998	Exchange rate targeting	1994-1995	Base money targeting
		1998-	Informal inflation targeting	1996	Base money and M1-targeting
				1997- 2000	M3-targeting[2]
				2001 -	Two-pillar strategy[4]

[1] Headline inflation minus regulated prices and changes in indirect taxes
[2] In Slovenia also including foreign exchange deposits of private households
[3] Exchange rate targeting continues in a wide band (±15%)
[4] Similar to the strategy of the European Central Bank the Bank of Slovenia bases its monetary policy indicators on two pillars, i.e. indicators of liquidity, and other economic indicators.

TABLE 2. Official Exchange Rate Policies 1994-2005

Czech Republic		Hungary		Poland	
01/01/1994-29/02/1996	Basket peg, 65% DEM, 35%USD, Band: ±0.5%	01/01/1994-31/12/1996	Crawling peg[1], 70% Ecu, 30% USD, Band: ±2.25%	01/01/1994-15/05/1995	Crawling peg, 45% USD, 35% DEM, 10% GBP, 5% FRF, 5% CHF Band: ±1 %
01/03/1996-26/05/1997	Band: ±7.5%	01/01/1997-31/12/1999	70% DEM, 30% USD	16/05/1995-24/02/1998	Band: ±7%
27/05/1997-present	Managed float	01/01/2000-30/04/2001	100% EUR	25/02/1998-31/12/1998	Band: ±10%
		01/05/2001-30/09/2001	Band: ±15%	01/01/1999-11/04/2000	45% USD, 55% EUR
		01/10/2001-present	Peg to EUR[2], Band: ±15%	12/04/2000-present	Free float
Romania		**Slovak Republic**		**Slovenia**	
since 01/01/1994	Managed float	01/01/1994-31/12/1996	Basket peg, 60% DEM, 40%USD, Band: ±1.5%	01/01/1994-26/06/2004	Managed float
				since 27/06/2004	ERM2
		01/01/1997-30/09/1998	Band: ±7%		
		01/10/1998-24/11/2005	Managed float		
		Since 25/11/2005	ERM2		

Source: IMF, Annual Report of Exchange Rate Arrangements and Restrictions, various issues
[1] Until 16.3.1995, the NBH devalued in discrete steps
[2] 276.1 HUF/EUR

TABLE 3. Correlation of short-term interest rate, 1994-2005

	π (p.a.)	REER (p.m.)	Anchor (p.m.)		π (p.a.)	REER (p.m.)	Anchor (p.m.)
Czech Rep. fix	-0.55	-0.62	-0.60	Romania	0.59	0.45	0.07
Czech Rep. flex	0.86	0.07	-0.09	Slovak Rep. fix	-0.42	0.36	0.15
Hungary fix	0.94	-0.09	-0.52	Slovak Rep. flex	0.03	-0.20	-0.47
Hungary flex	0.76	0.32	0.36	Slovenia	0.70	0.17	-0.09
Poland fix	0.79	-0.19	-0.48				
Poland flex	0.78	0.08	0.05				

TABLE 4. Reactions of Monetary Policy Rules to the Exchange Rate

case			
1	weak reaction to exchange rate	$\alpha_3<0$	$\alpha_4=0$
		$\alpha_3=0$	$\alpha_4<0$
2	weak reaction to exchange rate, partly offset in next period	$\alpha_3<<0$	$\alpha_4>0$
3	temporary reaction to change in exchange rate	$\alpha_3<0$	$\alpha_4= -\alpha_3$
4	exchange rate targeting	$\alpha_3<0$	$\alpha_4<0$

TABLE 5. Taylor rule estimations for the whole sample period

	c	π_{t+12}	y_t	s_t	s_{t-1}	i_{t-1}	α^{LR}	adj. R^2	DW
Czech Rep.									
REER	**-0.518*****	**0.098****	**0.042*****	-0.044	0.014	**0.977*****	4.261	0.928	1.820
equation (1)	**(0.000)**	**(0.013)**	**(0.002)**	(0.164)	(0.392)	**(0.000)**			
Anchor currency	**-0.530*****	**0.105****	**0.043*****	**-0.067*****	0.005	**0.975*****	4.200	0.816	1.126
equation (2)	**(0.000)**	**(0.011)**	**(0.002)**	**(0.010)**	(0.767)	**(0.000)**			
Hungary									
REER	**0.531****	0.076	-0.445	-0.058	**-0.182*****	**0.912*****	0.864	0.992	1.593
equation (1)	**(0.018)**	(0.282)	(0.665)	(0.236)	**(0.000)**	**(0.000)**			
Anchor currency	**0.525****	0.052	-0.385	-0.058	**-0.196*****	**0.915*****	0.612	0.992	1.693
equation (2)	**(0.014)**	(0.454)	(0.651)	(0.301)	**(0.001)**	**(0.000)**			
Poland									
REER	0.313	**0.059****	**0.087*****	-0.012	0.066	**0.908*****	0.641	0.943	2.807
equation (1)	(0.486)	**(0.048)**	**(0.003)**	(0.733)	(0.298)	**(0.000)**			
Anchor currency	0.347	**0.064****	**0.087*****	0.008	0.073	**0.907*****	0.688	0.943	2.795
equation (2)	(0.440)	**(0.038)**	**(0.003)**	(0.795)	(0.196)	**(0.000)**			
Romania									
REER	0.211	**0.052****	0.008	-0.592	**-1.180****	**0.927*****	0.641	0.742	1.572
equation (1)	(0.959)	**(0.037)**	(0.960)	(0.120)	**(0.038)**	**(0.000)**			
Anchor currency	0.458	0.020	-0.017	**-0.440*****	**-1.597*****	**0.852*****	0.135	0.821	1.885
equation (2)	(0.878)	(0.473)	(0.869)	**(0.010)**	**(0.000)**	**(0.000)**			
Slovakia									
REER	-0.935	**1.034****	0.117	-0.606	0.049	**0.227***	1.338	0.029	1.697
equation (1)	(0.840)	**(0.023)**	(0.705)	(0.387)	(0.851)	**(0.097)**			
Anchor currency	0.773	**0.809****	0.056	-1.218	0.232	**0.237***	1.060	0.117	1.745
equation (2)	(0.867)	**(0.037)**	(0.846)	(0.321)	(0.564)	**(0.059)**			
Slovenia									
REER	**0.807****	**0.089****	-0.043	**-0.265****	**-0.239*****	**0.800*****	0.445	0.674	2.268
equation (1)	**(0.012)**	**(0.013)**	(0.152)	**(0.023)**	**(0.001)**	**(0.000)**			
Anchor currency	0.531	-0.020	-0.025	**-0.532*****	**-0.362*****	**0.900*****	--	0.884	1.804
equation (2)	(0.335)	(0.757)	(0.514)	**(0.001)**	**(0.004)**	**(0.000)**			

Significance in parentheses.
Number of asterisks refers to level of significance, ***: one per cent, **: five per cent, *: ten per cent.

TABLE 6. Taylor rule estimation for the Czech Republic

	1994/1 to 2005		1994/1 to 1997/5 (fixed)		1997/6 to 2005 (flexible)		1997/6 to 2005 (flexible[1])	
	eq (1) (REER)	eq (2) (Anc)	eq (1) (REER)	eq (2) (Anc)	eq (1) (REER)	eq (2) (EUR)	eq (1) (REER)	eq (2) (EUR)
c	**-0.518*** **	**-0.530*** **	-4.716	**-5.674** **	**-0.396*** **	-0.230	**-0.245** **	-4.951
	(0.000)	**(0.000)**	(0.129)	**(0.025)**	**(0.002)**	(0.159)	**(0.047)**	(0.197)
π_{t+12}	**0.098** **	**0.105** **	**-0.612** **	-0.296	0.039	0.032	0.027	-0.046
	(0.013)	**(0.011)**	**(0.034)**	(0.181)	(0.136)	(0.230)	(0.181)	(0.444)
y_t	**0.042*** **	**0.043*** **	0.045	0.062	**0.040** **	0.009	**0.035** **	**0.061** **
	(0.002)	**(0.002)**	(0.665)	(0.390)	**(0.016)**	(0.677)	**(0.035)**	**(0.013)**
s_t	-0.044	**-0.067*** **	**-1.472*** **	**-0.626***	-0.056	**-0.091***	-0.045	**-0.003***
	(0.164)	**(0.010)**	**(0.003)**	**(0.056)**	(0.215)	**(0.071)**	(0.339)	**(0.071)**
s_{t-1}	0.014	0.005	-0.263	**-1.727*** **	-0.013	-0.022	-0.012	**0.002***
	(0.392)	(0.767)	(0.277)	**(0.000)**	(0.567)	(0.569)	(0.624)	**(0.100)**
i_{t-1}	**0.977*** **	**0.975*** **	**1.958*** **	**1.727*** **	**0.994*** **	**1.005*** **	**0.995*** **	**0.947*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
α^{LR}	4.261	4.2						
adj. R^2	0.928	0.816	0.333	0.371	0.940	0.935	0.940	0.946
DW	1.820	1.126	1.722	1.609	2.130	2.020	2.151	2.248
n	109	109	28	28	81	81	81	81

Significance in parentheses.
Number of asterisks refers to level of significance, ***: one per cent, **: five per cent, *: ten per cent.
[1] With deviation of inflation from target.

TABLE 7. Taylor rule estimation for Hungary

	1994/1-2005		1994-1999 (fixed)		2000-2005 (flexible)		2001/6-2005 (flexible[1])	
	eq (1) (REER)	eq (2) (Anc)	eq (1) (REER)	eq (2) (Anc)	eq (1) (REER)	eq (2) (EUR)	eq (1) (REER)	eq (2) (EUR)
c	**0.531****	**0.525****	0.307	0.406	**2.258*****	**1.715****	0.085	0.112
	(0.018)	**(0.014)**	(0.497)	(0.337)	**(0.002)**	**(0.013)**	(0.941)	(0.908)
π_{t+12}	0.076	0.052	**0.082****	**0.074***	-0.177	-0.069	-0.018	-0.038
	(0.282)	(0.454)	**(0.045)**	**(0.089)**	(0.199)	(0.458)	(0.885)	(0.721)
y_t	-0.004	-0.004	0.001	0.005	0.004*	0.026	**0.062***	**0.055***
	(0.665)	(0.651)	(0.967)	(0.820)	(0.087)	(0.281)	**(0.088)**	**(0.088)**
s_t	-0.057	-0.058	-0.095	**-0.102***	-0.060	**-0.052***	0.034	0.011
	(0.236)	(0.301)	(0.109)	**(0.079)**	(0.114)	**(0.067)**	(0.507)	(0.727)
s_{t-1}	**-0.182*****	**-0.196*****	**-0.224****	**-0.243****	**-0.136****	**-0.182*****	-0.033	-0.032
	(0.000)	**(0.001)**	**(0.012)**	**(0.017)**	**(0.017)**	**(0.004)**	(0.556)	(0.446)
i_{t-1}	**0.912*****	**0.915*****	**0.918*****	**0.898*****	**0.823*****	**0.852*****	**0.970*****	**0.969*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
adj. R^2	0.992	0.992	0.987	0.987	0.857	0.857	0.792	0.795
DW	1.593	1.693	2.153	2.199	1.238	1.228	1.655	1.633
n	109	109	59	59	50	50	33	33

Significance in parentheses.
Number of asterisks refers to level of significance, ***: one per cent, **: five per cent, *: ten per cent.
[1] With deviation of inflation from target.

TABLE 8. Taylor rule estimation for Poland

	1994/1-2005		1994-2000/3 (fixed)		2000/4-2005 (flexible)		2000/4-2005 (flexible[1])	
	eq (1) (REER)	eq (2) (Anc)	eq (1) (REER)	eq (2) (Anc)	eq (1) (REER)	eq (2) (EUR)	eq (1) (REER)	eq (2) (EUR)
c	0.313	0.347	**1.867****	**1.884****	-0.396	**-0.435***	**-0.508****	**-0.470****
	(0.486)	(0.440)	**(0.019)**	**(0.017)**	(0.192)	**(0.094)**	**(0.031)**	**(0.040)**
π_{t+12}	**0.059****	**0.064****	**0.087***	**0.094***	**0.253****	**0.240****	0.116	0.061
	(0.048)	**(0.038)**	**(0.069)**	**(0.058)**	**(0.043)**	**(0.030)**	(0.423)	(0.609)
y_t	**0.087*****	**0.087*****	**0.198*****	**0.190*****	-0.024	-0.022	0.017	0.040
	(0.003)	**(0.003)**	**(0.000)**	**(0.000)**	(0.662)	(0.668)	(0.647)	(0.189)
s_t	-0.012	0.008	-0.130	-0.028	0.007	0.031	0.027	0.016
	(0.733)	(0.795)	(0.203)	(0.712)	(0.809)	(0.311)	(0.415)	(0.653)
s_{t-1}	0.066	0.073	0.156	**0.124***	0.027	0.015	0.022	-0.049
	(0.298)	(0.196)	(0.199)	**(0.055)**	(0.585)	(0.814)	(0.624)	(0.458)
i_{t-1}	**0.908*****	**0.907*****	**0.773*****	**0.774*****	**0.969*****	**0.978*****	**1.032*****	**0.998*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
adj. R^2	0.943	0.943	0.844	0.845	0.961	0.960	0.957	0.957
DW	2.807	2.795	2.841	2.873	2.562	2.581	2.537	2.610
n	107	107	62	62	45	45	45	45

Significance in parentheses.
Number of asterisks refers to level of significance, ***: one per cent, **: five per cent, *: ten per cent.
[1] With deviation of inflation from target.

TABLE 9. Taylor rule estimation for Romania

	1994/1-2003/5			1994/1-1998/12			1999/1-2003/5		
	(REER)	(EUR)	(USD)	(REER)	(EUR)	(USD)	(REER)	(EUR)	(USD)
c	0.211	0.458	**7.622****	**12.251***	3.554	6.893	-0.656	-0.808	0.922
	(0.959)	(0.878)	**(0.012)**	**(0.059)**	(0.524)	(0.154)	(0.621)	(0.476)	(0.647)
π_{t+12}	**0.052****	0.020	-0.007	0.051	0.006	-0.008	0.001	-0.010	-0.131
	(0.037)	(0.473)	(0.815)	(0.144)	(0.886)	(0.821)	(0.996)	(0.938)	(0.282)
y_t	0.008	-0.017	-0.160	-0.279	-0.074	-0.105	-0.080	-0.092	-0.185
	(0.960)	(0.869)	(0.134)	(0.180)	(0.723)	(0.550)	(0.503)	(0.358)	(0.209)
s_t	-0.592	**-0.440*****	**-0.338***	**-1.294*****	**-0.502*****	**-0.411****	0.271	0.238	0.495
	(0.120)	**(0.010)**	**(0.085)**	**(0.005)**	**(0.009)**	**(0.017)**	(0.561)	(0.402)	(0.342)
s_{t-1}	**-1.180****	**-1.597*****	**-2.057*****	-0.430	**-1.868*****	**-1.889*****	-0.391	**-0.459***	**-1.768*****
	(0.038)	**(0.000)**	**(0.000)**	(0.663)	**(0.000)**	**(0.000)**	(0.328)	**(0.100)**	**(0.000)**
i_{t-1}	**0.927*****	**0.852*****	**0.718*****	**0.671*****	**0.780*****	**0.747*****	**1.010*****	**1.011*****	**1.007*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
adj. R^2	0.742	0.821	0.853	0.418	0.741	0.770	0.873	0.876	0.892
DW	1.572	1.885	1.979	0.973	1.840	1.869	2.215	2.194	2.123
n	96	96	96	43	43	43	53	53	53

Significance in parentheses.
Number of asterisks refers to level of significance, ***: one per cent, **: five per cent, *: ten per cent.

TABLE 10. Taylor rule estimation for Slovakia

	1994/1-2005		1994-1998 (fixed)		1998-2005 (flexible)	
	Equ. (1) (REER)	Equ. (2) (ANC)	Equ. (1) (REER)	Equ. (2) (ANC)	Equ. (1) (REER)	Equ. (2) (EUR)
c	-0.935	0.773	4.831	2.809	0.477	-0.321
	(0.840)	(0.867)	(0.109)	(0.209)	(0.811)	(0.888)
π_{t+12}	**1.034****	**0.809****	-0.320	0.221	0.114	0.192
	(0.023)	**(0.037)**	(0.539)	(0.644)	(0.466)	(0.340)
y_t	0.117	0.056	-0.200	**-0.230***	-0.003	0.028
	(0.705)	(0.846)	(0.265)	**(0.066)**	(0.970)	(0.777)
s_t	-0.606	-1.218	0.539	**3.400***	0.012	0.371
	(0.387)	(0.321)	(0.690)	**(0.097)**	(0.944)	(0.486)
s_{t-1}	0.049	0.232	-0.458	1.807	-0.093	-0.123
	(0.851)	(0.564)	(0.543)	(0.226)	(0.493)	(0.355)
i_{t-1}	**0.227***	**0.237***	**0.880*****	**0.827*****	**0.820*****	**0.813*****
	(0.097)	**(0.059)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
adj. R^2	0.029	0.117	0.057	0.115	-0.573	-0.681
DW	1.697	1.745	3.162	3.178	2.207	2.196
n	108	108	41	41	67	67

Significance in parentheses.
Number of asterisks refers to level of significance, ***: one per cent, **: five per cent, *: ten per cent.

TABLE 11. Taylor rule estimation for Slovenia (including growth of reserve money)

	1994-2005		1994-2000		2001-2005	
	Equ. (1) (REER)	Equ. (2) (EUR)	Equ. (1) (REER)	Equ. (2) (EUR)	Equ. (1) (REER)	Equ. (2) (EUR)
c	0.877	0.452	0.149	-1.001	**0.553****	**0.755****
	(0.172)	(0.422)	(0.931)	(0.426)	**(0.028)**	**(0.021)**
π_{t+12}	0.025	-0.004	0.088	0.150	**0.108*****	0.017
	(0.739)	(0.947)	(0.592)	(0.271)	**(0.009)**	(0.705)
y_t	-0.045	-0.014	-0.014	0.005	-0.078	-0.016
	(0.369)	(0.737)	(0.767)	(0.916)	(0.110)	(0.790)
s_t	-0.235	**-0.557*****	-0.042	**-0.808*****	**-0.374*****	-0.165
	(0.109)	**(0.001)**	(0.823)	**(0.001)**	**(0.000)**	(0.277)
s_{t-1}	-0.248	**-0.269****	-0.184	**-0.220**	**-0.301*****	**-0.236***
	(0.189)	**(0.019)**	(0.428)	**(0.344)**	**(0.000)**	**(0.076)**
ΔM	**6.811****	**4.925****	**19.213*****	8.972	**0.262*****	**2.547****
	(0.040)	**(0.037)**	**(0.005)**	(0.146)	**(0.003)**	**(0.016)**
i_{t-1}	**0.862*****	**0.900*****	**0.861*****	**0.899*****	**0.833*****	**0.831*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
adj. R^2	0.857	0.879	0.756	0.817	0.724	0.725
DW	1.681	1.683	1.640	1.480	1.848	1.754
n	109	109	71	71	40	40

Significance in parentheses.
Number of asterisks refers to level of significance, ***: one per cent, **: five per cent, *: ten per cent.