Monetary Policy Transparency in the Inflation Targeting Countries: the Czech Republic, Hungary and Poland [1]

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Abstract

This paper evaluates transparency of monetary policy in the three New Member States of the EU that are pursuing direct inflation targeting strategy. Two dimensions of transparency are quantified: (1) the institutional transparency that indicates the extent to which the central bank discloses information related to its policymaking process and (2) the behavioural transparency that reflects the clarity of indication given to the financial market participants by central bank with respect to its policy stance. The paper shows an ambiguous association between these two measures of transparency, which may be attributed to the active exchange rate management policy that undermines the actual transparency as proxied by the behavioural measure.

Keywords: monetary policy, institutional transparency, behavioural transparency, direct inflation targeting, New Member States, monetary convergence, euro

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1. Introduction

The main objective of this study is to evaluate monetary policy transparency in the three New Member States (NMS) of the European Union (EU) that are pursuing monetary policy based on direct inflation targeting (DIT) framework i.e. the Czech Republic, Hungary and Poland. The common challenge for these NMS is to meet the Maastricht criteria and to harmonise their monetary policies with that of the European Central Bank (ECB) in preparation for adopting the euro. The main presumption of this paper is that the candidates to the euro need to take steps towards greater monetary policy transparency, comparable to that of the ECB. To this end enhanced transparency can be viewed as an important aspect underlying a successful monetary convergence to the euro. The ECB's transparency, therefore, serves as a benchmark for evaluating our results. Although the ECB does not follow the DIT strategy, its policy is considered seemingly transparent as it identifies a well-prescribed inflation target.

For the purpose of our analysis, we define transparency as the central bank's far-reaching communication of monetary policy goals, strategies and operational tactics that is reflected in the clarity of financial market participants. We thus evaluate transparency from the institutional and the behavioural standpoint. The institutional transparency is understood as the extent to which central bank discloses information that is related to the policymaking process (Eijfinger and Geraats, 2002) and the behavioural transparency reflects the clarity of indication given to the financial market participants by the central bank with respect to its policy stance. We further analyse the link between the institutional and the behavioural transparency and put forth some hypothesis explaining a seemingly weak association between the two.

We measure the institutional transparency in NMS by employing the methodology of Eijffinger and Geraats (2002). By adopting their survey questions we obtain the transparency index for the three central banks in NMS. This index comprises political, economic, procedural, policy and operational aspects of transparency. We subsequently extend our evaluation of institutional transparency by devising a supplementary questionnaire that captures the specific features of the inflation targeting framework. Our behavioural measure is based on the econometric model originally proposed by Haldane and Reed (2000), but modified in our study to account for specific conditions of the three NMS. We believe that our dual approach to measuring monetary policy transparency could bring a new dimension to the literature addressing various aspects of monetary convergence to the euro.

The paper is organised as follows. Section 2 elaborates on the importance of monetary policy transparency from the institutional and the behavioural standpoint. Section 3 presents the empirical investigation of the institutional transparency by assessing information disclosure patterns in the Czech Republic, Hungary and Poland. Section 4 measures the behavioural transparency in the three NMS and Section 5 examines the link between both measures. Section 6 encapsulates our findings.

2. The Importance of Monetary Policy Transparency

In general terms, transparency of monetary policy can be ascertained as an effort to mitigate information asymmetry between the monetary authority and the public at large. Specifically, a transparent central bank is prone to disclose full information about its policy goals, strategies and tactics (Bernanke, et. al., 1999) as well as about its modelling assumptions, methods, and official forecasts. To this end, transparency leads to more accurate expectations of the public at large

and thus enhances the credibility of the central bank as financial market participants can more easily judge its intentions.

Chortareas et al. (2003) show that transparency tends to lead to a lower average inflation and a lower variability in inflation and output. Thus in essence, transparency is considered to be an important element in the design of a modern central banking. This importance is underscored by the IMF (1999) in its "Code of Good Practices on Transparency in Monetary and Financial Policies". The significance of transparency is also affirmed in practice. According to the survey results of 91 central banks conducted by Fry et al. (2000), 74% of them consider transparency to be an important feature of central banking as important or very important. In this survey transparency comes third in the rank of importance after institutional independence and the ability to contain inflation expectations.

Such perception is understandable given potential benefits from diminishing the information asymmetry between the monetary authority and the economic agents. First, the central bank gains an opportunity to match its actions to its public statements, which is an effective venue for strengthening credibility (IMF, 1999). Second, transparency helps align private sector expectations with the official forecasts of inflation and other monetary variables, which reduces their volatility and makes a country's monetary conditions less risky (Favero et al., 2000). Third, a higher degree of transparency reinforces the expectations channel of monetary policy transmission relative to alternative channels such as the aggregate demand, the exchange rate, etc. (Svensson, 1999). In the context of our research, this gain is particularly important, since the expectations channel plays a pivotal role in the DIT policy framework, thus transparency can be viewed as an important prerequisite for a viable introduction of the DIT (Mishkin, 2000), particularly by monetary authorities in transition economies (Orlowski, 2000, 2001).

We distinguish two basic approaches to measuring monetary policy transparency: (1) the institutional approach evaluates the extent of information disclosed by central banks through available documents (Eijffinger and Geraats, 2002) and (2) the behavioural approach takes into consideration the clarity of indication given to the financial market participants by central bank with respect to its policy stance and can be assessed by measuring the impact of policy announcements on market interest rates (Haldane and Read, 2000). We conduct our analysis along both approaches. This allows us to determine the extent to which central banks can improve behavioural transparency and thus the effectiveness of monetary policy by simply changing patterns of information disclosure.

2.1. Institutional Transparency: The Eijffinger-Geraats Approach

We find the Eijffinger and Geraats (2002) approach particularly useful in our assessment of monetary policy transparency in NMS as it allows for a meaningful comparison of common criteria across countries as well as for an independent evaluation[2]. They perceive transparency as a multidimensional concept that comprises political, economic, procedural, policy and operational aspects of central banking. These dimensions can be illustrated in relation to the simple model of the economy:

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[2] A similar approach is presented by De Haan et.al. (2001), although it is less comprehensive and based on arbitrary weighting of responses. Bernanke et al. (1999) evaluate transparency of selected countries and Blinder et al. (2001) offer informal discussion of transparency of major central banks. These studies do not provide common criteria for cross-country comparison. Fry et al. (2000) construct an index of 'policy explanations' for 91 central banks on the basis of their survey that may lead to biased results. Other studies measure transparency along one selected dimension, for example, Chortareas et al. (2001) focus exclusively on the degree of detail of published forecasts in their survey of 87 countries.

$$L = (\pi - \pi^*)^2 + A\left(y - k\overline{y}\right)^2 \tag{1}$$

$$y = \overline{y} - a\left(i - \pi^E - \overline{r}\right) + d \tag{2}$$

$$\pi = \pi^E + b(y - \overline{y}) + s \tag{3}$$

$$i = f(\pi, \pi^E, y) + e \tag{4}$$

Equation (1) is the central bank loss function, π^* is the inflation target, $k\overline{y}$ is the output target, $\overline{y}$ is the potential level of output, $k>1$ represents the political pressure at high levels of output[3], and A is the relative weight attached to output stabilisation that determines the willingness of a central bank to allow deviations from inflationary targets (Cukierman, 2001b). Accordingly, a transparent central bank will explain a *political* decision about its preference assigned to the output gap (a high parameter A) or price stability. Equation (2) characterises the aggregate demand where i is nominal interest rate, $\overline{r}$ is long-term interest rate and d is aggregate demand shock. In essence, it reflects economic growth conditions thus it pertains to *economic transparency*. Equation (3) is a new-Keynesian Phillips curve with the slope b and supply shock s. It is a basis for formulating a central bank's reaction function, which underlines its *policy* decisions and their *economic* repercussions. Equation (4) represents an instrument rule of a central bank that generally should be consistent with its loss function and the structure of the economy, while e denotes financial shocks leading to the imperfect control of a central bank over i. Through its public disclosure, a central bank provides information about *procedural* aspects of interest rate decisions.

Given this set-up, *political transparency* implies openness about policy objectives, including an explicit prioritisation of potentially conflicting goals and quantitative targets or in other words openness about parameters of equation (1). This could be beneficial as formal objectives and quantitative targets might diminish the uncertainty about policymakers' preferences and therefore reduce inflationary bias, as shown by Nolan and Schaling (1996). Also IMF (1999) underlines the importance of matching policymakers' actions to public statements in order to enhance their reputation. Last but not least, institutional arrangements and the central bank independence in particular play a crucial role in the evaluation of political transparency as they might be critical for preventing deviations from stated objectives.[4]

Economic transparency relates to the release of macroeconomic fundamentals underlying monetary policy decisions including the available economic data, employed policy models and the internal forecasts that the central bank relies on. In other words it involves the symmetric information about both economic variables and structural parameters in equations (2) and (3). According to Tarkka and Mayes (1999) monetary policy is more predictable due to the release of the central bank forecast. Furthermore, Geraats (2000) shows that the publication of comprehensive central bank forecasts or its economic model facilitates reputation building and allows for greater flexibility to stabilise economic shocks. Geraats (2001) argues that "only perfect transparency about economic information completely eliminates the inflation bias". Chortareas et al. (2002) find that the greater degree of detail in the central banks' published forecasts is associated with lower average inflation. In a different vein, Gersbach (1998) and Cukierman (2001a) find that greater economic transparency has a negative impact on stabilisation effectiveness in the absence of preference uncertainty. Geraats (2002b) also argues that economic transparency might lead to greater political pressure on a central bank when its independence is not well established.

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[3] This can be attributed to the political cycles driven by elections (Blanchard and Fischer, 1989) that can create pressure on the government to support targeting output above the natural rate (Alesina, 1988).

[4] The evidence of the importance of independence for credibility of monetary policy and price stability is documented, among others, by Cukierman (1996).

Procedural transparency means openness about the decision making process and it might entail policy rule or strategy and also release of minutes and voting records that show the considerations underpinning the decisions. In other words, it involves openness about the functional form of equation (4). Buiter (1999) and Gersbach and Hahn (2001a, 2001b) seem to suggest the positive consequences of disclosure of non-attributed voting records and minutes, while there is still controversy about the release of attributed documents. The release of voting records has an important informational value for financial markets, as indicated by Clare and Courtenay (2000). In a similar vein, Buiter (1999) claims that financial market participants can extrapolate the assessment of market risk based on the disagreement among the voting members of the monetary policy council.[5]

Policy transparency involves prompt announcement and adequate explanation of the decision as well as policy inclination to signal possible future actions, i.e. availability of information about i in equation (2). Tabellini (1987), Dotsey (1987), Rudin (1988), Cosimano and Van Huyck (1993) show that higher secrecy about short-term monetary targets impedes achievement of monetary objectives particularly if the knowledge about the long-term target is low and the information exchange between a central bank and economic agents is imperfect. However, neither the importance of policy explanation nor indication has been unambiguously evaluated in the literature.

Operational transparency relates to control errors in implementation of monetary policy and disturbances that affect the transmission of monetary policy or the symmetry in knowledge about shocks s, d and e in equations (2), (3) and (4), respectively. Faust and Svensson (2002) argue that operational transparency tends to reduce the inflation bias and improve social welfare; however, they also show (Faust and Svensson, 2001) that operational transparency is likely to be quite limited in practice. Jensen (2001) argues that although high operational transparency might alleviate the low credibility problem, it may also impair the central bank's ability to stabilise output.

All five dimensions of the institutional transparency described above are assessed for the central banks of NMS in Section 3.

2.2. Behavioural Transparency: the Haldane-Read Model

The behavioural approach to transparency measures market perceptions that can be assessed directly in a survey of financial market participants or through analyzing impact of policy announcements on market interest rate movements.

Haldane and Read (2000) propose a simple theoretical framework underlining the behavioural measure of transparency. Their approach is based on the model of monetary policy surprises that captures interactions between the private sector and the monetary authorities. It contains three behavioural equations[6]:

$$x_{t+k} = \alpha x_{t+k-1} + \beta_t \, {}_t i^c_{t+m} + \varepsilon_{t+k} \tag{5}$$

$$_t i^c_{t+m} = \delta\left(x_t - x_t^*\right) \tag{6}$$

$$E_{t-1}\left({}_{t+j} i^c_{t+m+j}\right) = {}_{t+j} i_{t+m+j/t-1} \tag{7}$$

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[5] It is worthy noting that a number of influential central banks (including U.S. Federal Reserve, Bank of Japan and Bank of England) publish voting records with some time lag following their meetings.

[6] Equation (5) can be interpreted as a reduced form of equations (2) and (3); equation (6) restates (4).

Equation (5) describes the monetary policy transmission mechanism, in which x_t stands for a vector of the variables embedded in the central bank's reaction function[7], k is the average transmission policy lag, β is a coefficient explaining the monetary transmission mechanism[8] and $_t i^c_{t+m}$ is the central bank's official interest rate at time t with maturity m. Some information asymmetry is assumed, as ε_{t+1} $(i{\geq}0)$ is known only to the monetary authorities at the time preceding decision-making on interest rates. Equation (6) can be perceived as a policy feedback rule that specifies coefficient δ reflecting discrepancies between the vector of feedback variables and the vector of policy targets.[9] Future policy targets $x_{t+i}{}^*$ $(i{\geq}0)$ that are not known to the private sector agents create another source of information asymmetry. The private sector determines the yield curve reflecting a predicted path of future official interest rates based on the expectations theory of the term structure that is included in equation (7).

The economic rationale behind this model is that a central bank uses equation (5) embedding monetary transmission mechanism to infer x_t when a shock ε_t occurs at the beginning of each period (t-1). Subsequently, a central bank sets future policy targets $x_t{}^*$. Since this part of the process cannot be observed by the private sector, predictions regarding a path of official interest rates are based on its own judgements of the current and expected values of x_t and $x_t{}^*$ included in equations (5) and (6). These expectations can be extracted from the yield curve by analysing the forward rates. If a shift in the forward rates occurs following the decision announcement about official interest rates at time t relative to t-1 in which the expectations were formed, the sets of feedback variables x_t and policy targets $x_t{}^*$ for a central bank and the private sector were different. This can be interpreted as the lack of transparency that can impair credibility of monetary authorities because they were not able to provide sufficient information about their reaction function and to convince the market participants about their commitment to achieving the policy goals. Based on this argument, the econometric analysis of market interest rates responses to changes in official interest rates may provide a useful behavioural measure of transparency. We conduct this analysis in the empirical section of our paper.

3. Institutional Transparency in New Member States

3.1. Eijffinger and Geraats Index for NMS

In this section we employ questionnaire developed by Eijffinger and Geraats (2002) in order to compile the transparency index for the central banks in the three NMS countries that have adopted the DIT strategy. The questionnaire contains five questions related to the five transparency types. Since each question is based on three criteria and the score for each answer ranges from zero to one (all answers are equally weighted), the minimum score of the evaluated central bank can be zero and the maximum can be fifteen. The questionnaire is synthesized in Table 1, which also shows the results of our evaluation. We derive answers to each question from the information that was in the public domain in English in May 2003. Subsequently, we obtain the set of indices characterising each transparency dimension: political, economic, procedural, policy and operational. They are compared to the ECB benchmark score replicated from the Eiffinger and Geraats (2002).

……. Insert Table 1 around here …….

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[7] These variables can be inflation, output, or employment (Svensson, 1997).
[8] Haldane and Read (2000) assume that β is known for both the central bank and private sector.
[9] It is assumed that both the central bank and the private sector know the δ parameter.

The assessment of *political transparency* involves inquiry about the existence of formal objectives, a quantitative target and independence. All three central banks in our sample have *formal objectives* of monetary policy, all explicitly specify a *quantitative target* for the price stability and all have guaranteed *institutional independence from the government*, mostly in the form of explicit instrument independence[10]. In the case of Poland this independence is guaranteed by the Constitution. A similar legislation is to be introduced in the Czech Republic in an effort to comply with the EU law. In sum, in terms of political transparency the three central banks are in line with the ECB benchmark score.

In evaluating *economic transparency*, we focus on three criteria: the disclosure of economic data, the policy models and the official forecasts. To assess the timely *release of economic data*, Eijffinger and Geraats look at the disclosure practice of money supply, inflation, GDP, unemployment rate and capacity utilisation data[11]. These data, with the exception of capacity utilisation, are published in all three countries on at least quarterly basis, either by the central bank or the national statistical office. Estimation of capacity utilisation still poses a methodological challenge for countries undergoing major structural changes and is available only for Hungary, which receives a full score for this question, while the two other NMS receive a reduced score. The second query is based on the assumption that in order to interpret the central bank's policy actions it is important to know its underlying *policy models*. Among the three NMS, only the National Bank of Poland (NBP) is yet to publicly disclose its model. Furthermore, NBP does not release numerical *internal forecasts* for inflation and/or output. Since the Czech National Bank (CNB) and the National Bank of Hungary (NBH) publish quarterly forecasts, they receive a full score. In sum, only Poland seems to lag behind the ECB in economic transparency at the time of our analysis.

To measure *procedural transparency*, we look for the central banks' description of monetary policy strategy, the publication of minutes and voting records. All central banks in our sample pursue an *explicit monetary policy strategy,* namely the DIT framework. With respect to the *minutes*, only the CNB releases a comprehensive account of policy deliberations within a reasonable amount of time, however, not detailed and non-attributed. Neither the NBH nor the NBP publishes the minutes, although both banks release policy announcements following monthly meetings of their governing councils. The third criterion is based on the assumption that monetary authority should also release *voting records* that would disclose how each decision on its main operating instrument or target was reached. The NBP is the only central bank that publishes attributed voting records. The CNB discloses non-attributed voting records and therefore scores a half point, while the NBH does not disclose any voting records and scores a zero. In summary, in the category of procedural transparency the NBH score is at par with the benchmark score of the ECB that does not provide minutes, or voting records, while both the CNB and the NBP outperform it.

Policy transparency entails timely disclosure of policy decisions, its explanation and the future bias. In terms of a *prompt announcement* of monetary policy decisions, all central banks receive a full score. Two of them publish a *policy explanation*, although in different forms. The CNB includes the statement of policy decision in its minutes, while the NBP provides

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[10] Formal guarantees of central bank independence in NMS are in fact a reflection of the historically strong political pressures.

[11] Following the discussion of major factors affecting monetary policy action outlined in the central bank documents one might argue that some indicators of the fiscal policy stance along with the external imbalance and exchange rate misalignment could be also considered under this category. In fact, the general government balance and the current account data are available in each of the examined NMS, at least on a quarterly basis. In addition, the inclusion of other factors such as labour productivity, real wages and unit labour cost could further enhance transparency.

explanation in the press release following each meeting of the Monetary Policy Council. Only the NBH does not provide policy explanation and therefore receives a zero score. It is not a common practise among the examined central banks to publish the *policy inclination*, with the exception of the NBP that announces a policy bias, and thus scores a full point. To sum up, in terms of policy transparency the NBP emerges as a leader with a maximum score, followed by the CNB. Both outperform the ECB, which does not provide any policy inclinations and publishes solely a vague policy explanation. Hungary lags behind the two other NMS and the ECB.

Operational transparency encompasses control errors, transmission disturbances and evaluation of policy outcome. *Control errors* pertain to the degree of achieving the policy operating targets. All three central banks provide such evaluation on at least annual basis and all get a full score. The second criterion inquires whether a central bank regularly provides information on unanticipated macroeconomic disturbances that affect the policy transmission process. In other words, it tells us whether or not the central bank includes a *discussion of past forecast errors*. Only the NBH includes such discussion, while the CNB and the NBP provide merely a general assessment of developments in monetary policy transmission mechanism, thus both score half point. The next issue is whether a central bank provides regularly an evaluation *of the policy outcome* relative to its macroeconomic objectives. In this respect all three central banks obtain a full score, although their analyses do not appear equally thorough. In summary, all examined central banks seem to be more transparent in evaluating their policy performance than the ECB. This underpins their credibility-building efforts, even though their analyses and policy explanations are at times vague - the factor that is not captured by the Eijffinger and Geraats index.

As shown in Table 1, the overall score does not fully reflect the pronounced differences in the specific transparency criteria for the individual NMS. Moreover, the results imply that the institutional transparency achieved by the three NMS is impressively high and not inferior to that of the ECB. In the following sections we discuss why such a favourable assessment might be somewhat misleading, as the high institutional transparency does not translate into high behavioural transparency.

3.2. The Inflation Targeting Dimension

In this section we dwell further on the qualitative aspects of institutional transparency in the three DIT countries. We want to address the highly diversified DIT conditions in the individual NMS that are examined in the literature (Orlowski, 2003). We, therefore, evaluate the monetary regimes in NMS against the DIT blueprint that contains a unique, forward-looking inflation target, specified as a linear trajectory with a continuous target monitoring and adjustment on a rolling basis, and well-prescribed reaction rules on missing the target (Svensson, 1999; Orlowski, 2001; Jonas and Mishkin, 2003). Consistently, we supplement the analysis based on the original Eijffinger and Geraats questionnaire by devising a set of DIT-specific questions about a number of policy goals, exchange rate policy, forward-looking character, target specification, trajectory, monitoring, adjustment rules and overshooting procedures. Our additional questionnaire (Appendix 1) is applied to the three NMS as well as to the ECB since we need to derive a benchmark score. The results are reported in Table 2.

……. Insert Table 2 around here …….

We first ask a fundamental question whether the inflation target constitutes the *unique goal* of monetary policy. The CNB and the NBP receive a full score, as they do not specify other explicit goals beyond the one stated in the DIT strategy, although the CNB is also pursuing a

managed float but without a target reference rate. On the contrary, the NBH is targeting the exchange rate band around a predetermined reference rate in addition to the inflation target thus it scores zero. The ECB receives a full score since it follows a clearly predetermined inflation target of maximum two percent based on the harmonised CPI.

We then look at i*nterventions in the foreign exchange market* since they may reduce transparency in the implementation of DIT strategy. The NBP is the only examined bank that does not intervene in the foreign exchange market and thus receives a full score. The CNB that has engaged only in small-scale interventions receives a half-point, while the NBH scores no point for its prevalent heavy interventions. Since the ECB intervenes infrequently and on a relatively small scale, it scores a half point.

Next, we evaluate the *conformity of policy rule with DIT strategy*. According to Rudebusch and Svensson (1999), inflation forecast targeting requires the policy instrument to be adjusted in such a way that a conditional inflation forecast (the intermediate target variable) hits the inflation target at an appropriate level. The ECB emphasises the forward-looking character of conducted policies, but only the NBH and the CNB formulate their monetary policy based on such a forward-looking rule, which also implies publishing the inflation forecasts. Both central banks publish a discussion about the outlook for the main determinants of inflation, taking into consideration the upside and downside risks of missing the target. Consequently, they receive a full score. The NBP does not release forecasts, and thus it does not conform to the forward-looking policy rule.

The next question deals with the choice of the inflation target. In principle, core inflation has the advantage of greater stability and smaller vulnerability to shocks. Using core inflation reduces the danger of missing the target due to price volatility that is outside the scope of monetary policy. However, there are also substantial drawbacks of adopting core inflation as a target, as it does not encompass adjustments in administratively regulated prices. Also, core inflation indexes have not proved to be more stable than the headline index in transition countries (Jonas and Mishkin, 2003). The main argument in favouring CPI over core inflation as a policy target is that the private sector customarily uses it as a basis for forming inflation expectations. The ECB and the three analysed central banks specify their *policy target* on the basis of the headline CPI[12]. In addition, all three employ various measures of core inflation to the price changes that they can influence. The CNB used to employ net inflation as its main analytical and communicative indicator of inflation; however, it has switched to targeting headline inflation since April 2001. Thus all central banks in our analysis receive a full score for the choice of the inflation target.

The subsequent question is based on the assumption that the inflation targeting central bank should announce *target trajectory*. Only CNB and NBP release information about pursuing inflation target trajectory for the medium-term. They apply the target trajectory for headline inflation by means of a continuous band. We assign a half point to NBH that provides operating year-end targets for the next two years, as well as the ultimate target of 3 percent to be met by 2005 instead of a continuous band.

The next question asks whether a central bank employs a *rolling basis for quarterly assessment of target fulfilment*. The two central banks that meet this standard are the CNB and the NBP, as indicated in their Inflation Reports. The NBH receives no point, since it follows the year-end targets only, in spite of publishing a target trajectory for the medium- term. We note that the practice of the ECB is to provide such assessment monthly.

We assign a half point to the CNB and NBH for an *ex post target change* of the inflation target. Neither one of them explicitly excludes a possibility of a target change; however, such action has not taken place since the introduction of DIT. The same assessment applies to the

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[12] More precisely, the ECB inflation target is based on the Harmonised Index of Consumer Prices for the euro area.

ECB. The NBP has an inclination to change the inflation target when meeting it becomes problematic (as in 1999 and in 2002) and therefore receives no point.

Achieving the inflation target is the main factor determining the decision-making process with respect to changes in monetary policy instrument at any stage. Nonetheless, a number of possible exogenous shocks or unforeseen events, the causes of which remain fully or predominantly outside of monetary policy control should be taken into account. Attempts to correct such shocks in the short run would likely be costly for monetary policy. Thus, it is extremely important for monetary authorities pursuing DIT to work out *target overshooting procedures*. Only the CNB obtains a half point for releasing precisely defined escape clauses. Such clause is also missing in the case of the ECB.

In contrast to our previous evaluation based on the Eijffinger and Geraats index, this extended analysis shows that there are marked differences in institutional transparency among the three central banks. The CNB policy appears to be the most transparent as it is the only central bank in our analysis that outscores the ECB. The overall scores of NBH and NBP lag behind. It shall be noted, however, that the NBP scores relatively better on questions related to the exclusivity of inflationary goal, while the NBH on the forward-looking character of the policy.

4. Behavioural Measures of Transparency: Empirical Results

In this section we test whether the monetary policy in the three NMS that are pursuing DIT is transparent based on the observed dynamics of financial markets. Under a transparent policy, a central bank provides financial market participants with a clearly defined indication of its policy stance. Consequently, market interest rates closely follow the official rates. We ask whether the introduction of DIT strategy actually increased such defined behavioural transparency. In order to address this issue we estimate the reaction of short-term money market interest rates to changes in official rates. This methodology follows Haldane and Read (2000) who argue that in a transparent monetary policy regime, short-term interest rates anticipate to some extent changes in official rates. Their argument relies on information asymmetry and the existence of a stationary stochastic equilibrium with full knowledge of the authorities' reaction function[13]. The original econometric model proposed by Haldane and Reed (2000) is as follows:

$$\Delta_{t+j} i_{t+m+j} = \alpha_j + \beta_j(L)\Delta_{t+j}i_{t+m+j} + \gamma_j \Delta_t i^c_{t+m} + \delta_j D_j \Delta_t i^c_{t+m} + e_{t+m+j} \tag{8}$$

for *j*=1,3,6,24,60,120,240, where *j* stands for maturity of the forward rate expressed in months and *t* is a time index. It assumes that *m*=1, as the main instrument usually affects monthly money market rate; β(L) is a vector of polynomial lag operator (L). The lagged dependent variables are used to remove autocorrelation, whereas *D* is a regime-shift dummy variable aimed at capturing the introduction of DIT. Both variables are specified in first differences in order to examine contemporaneous movements in interest rates. We modify the original specification because of the underdeveloped forward interest rates markets in the examined NMS. Thus the specification

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[13] The original idea of Haldane and Read (2000) is "to extract measures of interest rate surprises along the yield curve". Therefore, the authors also examine whether the monetary policy is credible by looking at the long-end of the yield curve. This approach is however not feasible in the case of analysed NMS, as they had to bring inflation down (which has shifted their yield curves significantly over the last decade) and as they lack developed forward rates market. These factors could lead to misleading results in evaluation of credibility, but are not essential in the evaluation of transparency that is the focus of this research.

that is employed in the model excludes forward interest rates and embeds short-term money market interest rates. The modified equation can be expressed as follows:

$$\Delta i_{t,j} = \alpha + \beta_j(L)\Delta i_{t,j} + \gamma_j \Delta i_t^c + \delta_j D_j \Delta i_t^c + \varepsilon_t \tag{9}$$

The graphical presentation of the data series for the three NMS and the ECB is shown in Figures 1-4.[14]

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The econometric estimation of the Equation (9) at the short-end of the yield curve[15] provides the evidence of a substantial improvement in transparency of the CNB and the NBP (Table 3). The coefficients for the variables measuring reaction to changes in the official repo rate are statistically significant and their estimated values are lower during the DIT period relative to the pre-DIT. This improvement confirms expectations about positive results of enhanced communication strategy as well as the quality of analytical publications since the introduction of the DIT that seemingly allowed for more clarity about central banks reaction functions among financial market participants. Based on lower values of estimated coefficients γ and δ for Poland, one can draw a conclusion that the NBP is more transparent than the CNB. This is somewhat puzzling given the higher CNB scores on institutional transparency. Nevertheless, they both lag behind the ECB, whose γ coefficient is slightly lower than that of the NBP. The most intriguing are the results for Hungary. The empirical evidence suggests that the NBH's transparency has declined following the introduction of DIT, leaving it behind both the NBP and the CNB, while under the exchange rate peg NBH seemed to be ahead of both of them. The noted deterioration in NBH behavioural transparency has taken place in spite of the improvement in information disclosure over the last three years. One may therefore argue that the active exchange rate management of NBH and also the CNB tends to deteriorate the behavioural transparency in contrast to the NBP's pure float.

.... Insert Table 3 around here ....

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[14] Our econometric analysis is based on the official interest rates data available on the CNB, the NBH, and the NBP web sites as well as the data on money market interest rates obtained from the Reuters Database and the EcoWin Database. The time series that are used in the estimations are sampled daily and cover the period of January 1, 1996 to July 21, 2003 for the Czech Republic, December 25, 1996 to May 23, 2003 for Hungary, and March 2, 1998 to May 23, 2003 for Poland. We gratefully acknowledge helpful comments on the data and financial markets developments in NMS received from Rafal Benecki of the Bank Millennium and Radomir Jac of the Commerzbank Securities.

[15] Detailed results are provided in the annex.

5. The Link between Institutional and Behavioural Transparency

The behavioural measure of transparency suggests that Poland has the most and Hungary the least transparent monetary policy. These results are not fully consistent with the institutional measure based on the Eijffinger and Geraats index, by which the CNB appears to be the most transparent. The CNB's leadership seems to be confirmed by the assessment based on our extended index of transparency that incorporates the specific features of the DIT strategy. Based on this DIT-specific analysis, the CNB again emerges as the most transparent central bank, although this result is at odds with the behavioural measure.

Looking at individual categories of institutional transparency, the scores are more differentiated. For instance, the score for the economic transparency is inconsistent with the behavioural measure; it therefore seems ambiguous whether the publication of the model, capacity utilisation and even internal forecasts has a significant impact on the behavioural transparency. Moreover, while we strongly believe that the political aspect of transparency, in particular the central bank independence, is essential, there is not enough variation in scores among the examined NMS to draw a definite conclusion about its link to the behavioural transparency. On the other hand, the policy transparency corresponds very well to the ranking of the behavioural measure. This suggests that the policy explanation along with the statement of policy inclination may have been strongly correlated with the behavioural transparency.

Taking into consideration our DIT-specific index, the institutional transparency seems to be correlated with the behavioural transparency in terms of a single policy goal and the absence of active exchange rate policy. Poland is leading on both counts. The two other NMS may be suffering from the "fear of floating" that poses a constraint on their policy conduct within the DIT framework. This might be explained by their high degree of openness relative to Poland. As a result, their frequent resorting to foreign exchange market interventions misleads the financial markets and thus inhibits the behavioural transparency. Although the NBP lags behind on some important aspects of DIT – in particular by relying on the backward- rather than forward-looking policy rule and by not publishing the inflation forecasts - these shortcomings are more than offset by its firm commitment to the inflation goal and by refraining from foreign exchange market interventions[16].

In our opinion, it is therefore exactly the uniqueness of goal and absence of active exchange rate policy that becomes crucial in determining the behavioural transparency. However, the analysis of Hungary also suggests that, when the exchange rate based policy is not de facto abandoned, targeting the exchange rate translates into a more transparent monetary policy than targeting inflation. This finding is potentially important for preparations for the euro accession and the preceding participation in the ERM II, as the exchange rate target needs to be given more consideration. This, in turn, may potentially hinder the monetary policy transparency in NMS to some degree.

6. Concluding Remarks

Our general finding is that the monetary authorities of Poland, Hungary and the Czech Republic have advanced their monetary policy transparency to the level roughly comparable to that of the ECB. Since improved transparency can be viewed as an effective venue of enhancing monetary policy credibility, we feel entitled to argue that the three examined central banks are ripe to join the European System of Central Banks as its fully credible members. The demonstrated degree

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[16] This is consistent with the assessment of the success in DIT implementation by Jonas and Mishkin (2003).

of alignment of monetary policy transparency between the three central banks and the ECB can be also interpreted as a progress on the road to the euro.

Nevertheless, our examination of the three monetary authorities by the individual criteria of institutional transparency identifies a number of deficiencies that they still need to overcome, in spite of their overall success. Specifically, the NBP may improve transparency by increasing reliance of its policy decisions on inflation forecasts and other forward-looking variables, as well as by publicly disclosing its underlying policy model and the official inflation forecast. Both the CNB and the NBP could expand the range of economic data made available for public dissemination. At minimum, the NBH needs to improve its procedural transparency with respect to a public disclosure of minutes and voting records of the governing council meetings. Perhaps more importantly, the NBH could become more transparent if it provided a clear prioritisation of the inflation target over the exchange rate stability goal. In sum, by the institutional transparency definition, the CNB appears to be the most transparent among the examined central banks, even outperforming the ECB.

On the behavioural transparency grounds, the NBP emerges as a clear leader. This is a noteworthy accomplishment since it implies an important venue for strengthening credibility and promoting the role of expectation channel in the conduct of monetary policy. While the behavioural transparency has improved in the Czech Republic and Poland following the adoption of DIT, it has declined in Hungary, as implied by our empirical exercise. However, more definite conclusions can only be drawn on the basis of further testing that would capture the dynamic evolution of central banking environment in the three NMS.

In the near future the three NMS will be obliged to join the ERM II on their way to adopting the euro. In doing so, they will have to supplement their predominant inflation target by the exchange rate stability objective. It remains to be seen whether such a strategy will dilute their commitment to price stability and, therefore, hinder their monetary policy transparency. In response to such fears, new means of fostering transparency will have to be explored and devised for such a complex policy framework stemming from the necessity to fulfil the Maastricht convergence criteria.

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Appendix 1: DIT specific Questionnaire

Our transparency index specific for DIT central banks is a sum of the scores for the answers to eight questions below; thus min =0 and max=8.

1. Is inflation rate target the only goal of monetary policy?
   No = 0
   Yes=1

2. Is central bank conducting an active exchange rate policy?
   There is exchange rate target or there were major foreign exchange interventions since the introduction of the DIT = 0
   There is an exchange rate target or there were limited size interventions since the introduction of the DIT = 0.5
   No = 1

3. Is policy rule consistent with forward-looking character of the DIT strategy?
   Yes, policy is forward-looking and based on inflation forecasts =1
   No, policy is backward looking=0

4. What is policy target?
   Core inflation = 0
   CPI=1

5. Is trajectory of the target provided?
   Only one, short or medium, term targets is specified = 0
   There are combined short and medium term targets=0.5
   Yes, full target trajectory for the medium term (up to 3 years)=1

6. Is meeting the target assessed on the rolling basis at least quarterly?
   No= 0
   Yes=1

7. What is the probability of ex-post target change?
   Not explicitly excluded and the target has been modified ex-post since the introduction of the DIT=0
   Not explicitly excluded, but ex-post target change has never taken place since the introduction of the DIT=0.5
   Explicitly excluded=1

8. Are there procedures for the contingency of target overshooting?
   No explicit rule = 0
   Explicit rule triggered by more than two quarters of target overshooting or precisely specified escape clauses =0.5
   Explicit rule (including explanation given to national authorities, redundancy of central bankers, interest action required in order to meet the target) triggered by no more than two quarters of target overshooting =1

Appendix 2. Econometric Results

Testing for stationarity of the data is omitted mainly for two reasons: (1) variables are already in first differences to capture interest rate movements rather than general trends in interest rates and (2) the sample period is relatively short. For these two reasons cointegration analysis is also neglected.[17]

The estimation of equation (2) is commenced with checking for structural breaks, heteroskedasticity and serial correlation. We test (2) considering various sample periods that correspond with major policy changes in the examined NMS. At no case the differential intercepts prove to be significant, therefore a differential slope coefficient is included.

The White's test for heteroskedasticity in the residuals reveals that for all NMS the null hypothesis of no heteroskedasticity in residuals is rejected for both 1- and 3-month interest rates. The detection of heteroskedasticity in the residuals means that although the OLS estimators are still linear and unbiased, they are no longer efficient, i.e. they are not BLUE. As the consequence of this violation, standard errors, *t*-statistics and *F*-statistics are biased, therefore we cannot interpret them. To resolve for the presence of heteroskedasticity we apply the method proposed by White (1980) who derived consistent covariance matrix estimator that allows to interpret standard errors and the above mentioned statistics unless a problem of a small sample is faced. By using this method we obtain corrected standard errors and the *t*-statistics.

The second test checks for the presence of serial correlation in the residuals. The Breusch-Godfrey Serial Correlation LM test allows checking for autocorrelation of higher orders and it is still valid if there is a lagged endogenous variable among explanatory variables.[18] The detection of autocorrelation in the residuals for almost all NMS invalidates standard errors and both t-ratios and F-statistics. Since we face problems with both heteroskedasticity and autocorrelation of residuals, we apply the methodology proposed by Newey and West (1987). This extension of White's procedure provides us with heteroskedasticity-and-autocorrelation-consistent (HAC) robust standard errors as well as well as t- and F-statistics.

Czech Republic

Three sample periods are chosen following Matousek and Taci (2003), although the null hypothesis of no structural change in the equations explaining 1- and 3-month interest rates cannot be rejected by the Chow test. However, the null hypothesis is rejected in the case of 6-month interest rate at 1% significance level indicating a structural change in assumed periods. The sample is divided into the following sub-samples: January 1, 1996–March 31, 1997; April 1, 1997–December 31, 1997; and January 1, 1998–May 23, 2003.

The first period predates the major international financial crisis (the Asian crisis), which by itself is captured by the second period. The 1997 crisis is extracted from the overall sample because it caused significant instability of the Czech financial markets while leaving Polish and Hungarian markets relatively unscathed. The third period follows the crisis and it coincides roughly with the pursuit of the DIT strategy that was enacted by the CNB in January 1998 (Matousek and Taci, 2003). However, one of the drawbacks of the Chow test is that it does not inform whether the structural change is due to a slope coefficient, different intercepts or both. In order to address this issue and assess structural characteristics of the three sample periods, the

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[17] Haldane and Read (2000) also neglect checking for the stationarity of the data and the cointegration analysis, although they analyse the period of more than a decade.
[18] Durbin-Watson statistics should not be used under these circumstances.

tested form of the model for the Czech Republic (estimated at different maturities) is prescribed as a slightly modified Equation (9):

$$\Delta i_{t,j} = \alpha + \beta_j(L)\Delta i_{t,j} + \gamma_j \Delta i_t^c + \delta_1 D_1 \Delta i_t^c + \delta_2 D_2 \Delta i_t^c + \varepsilon_t \qquad (10)$$

where D_1 and D_2 represent dummy variables capturing the first and second sample periods respectively, thus the remaining observations correspond with the third period. The estimation results of Equation (10) for the two maturities are presented in Table A.3.1.

Table A.3.1. Estimation representations of Equation (10) for the Czech Republic

	Coefficients						
	α	β_1	γ	δ_1	δ_2	adj. R^2	F-test
PRIBOR 1m	-0.0013	0.1194	0.4740**	0.5311**	-0.5493**	0.0211	11.6661
	[0.0193]	[0.1480]	[0.0789]	[0.1123]	[0.1722]		0.0000
PRIBOR 3m	-0.0024	0.1572**	0.3136**	0.8336**	-0.2116*	0.0509	27.5505
	[0.0092]	[0.0780]	[0.0753]	[0.0969]	[0.1095]		0.0000

HAC standard errors are reported in parentheses; * indicates significance at 5%; ** indicates significance at 1%, second rows for *F*-statistics represent *p*-values
Source: Own estimations

The results show that both parameters γ and δ are statistically significant, which means that the null hypothesis of zero coefficient is rejected. The interactive dummy variables are also statistically significant. Since estimated δ_2 coefficients are negative, it can be argued that transparency of the monetary policy has increased after the introduction of DIT.

Hungary

The empirical test of responses of market interest rates to the official rates in Hungary is based on two sample periods: December 19, 1996–May 3, 2001; and May 4, 2001–May 23, 2003. The point of division reflects the day of the inception of DIT by the NBH. Therefore, the structural analysis reflecting differences in interest rate reactions during these two periods enables to assess contribution of the new policy regime to financial stability relative to the stability under the previous system that was based on exchange rate targeting. Due to the identification of two periods only, the tested function for Hungary is based on Equation (9) to allow for D to capture the pre-DIT period. The results of the Equation (9) for two maturities are presented in Table A.3.2

The empirical evidence suggests that the NBH is not transparent. Furthermore, there is a marked decline in its transparency following the introduction of the DIT, as a parameter γ is significantly different from zero and δ is negative.

Table A.3.2. Estimation representations of Equation (9) for Hungary

	Coefficients					
	α	β_1	γ	δ_1	adj. R^2	F-test
BUDBOR 1m	-0.0071*	0.1091	0.5667**	-0.5478**	0.0434	26.2798
	[0.0031]	[0.0836]	[0.1866]	[0.1993]		0.0000
BUDBOR 3m	-0.0053*	0.2805**	0.5500**	-0.5346**	0.1400	91.6862
	[0.0024]	[0.0676]	[0.1807]	[0.1816]		0.0000

HAC standard errors are reported in parentheses; * indicates significance at 5%; ** indicates significance at 1%; second rows for *F*-statistics represent *p*-values

Poland

The empirical analysis of the model for Poland is based on the extraction of two sample periods: January 1, 1996–June 3, 1998; and June 4, 1998–May 23, 2003. The first sample period predates the announcement of the DIT strategy, while the second period follows it. Thus the tested function for Poland includes one dummy capturing the pre-DIT period. There is also a dummy for the period of the end of 1999 to adjust for a dynamic increase in the market interest rates related to the year 2000.[19]

$$\Delta i_{t,j} = \alpha + \beta_j(L)\Delta i_{t,j} + \gamma_j \Delta i_t^c + \delta_1 D_1 \Delta i_t^c + \delta_2 D_2 \Delta i_t^c + \varepsilon_t \tag{11}$$

where D_1 and D_2 represent dummy variables capturing the regime shift in monetary policy and Y2K problem, respectively. The results of the Equation (11) for two maturities are presented in Table A.3.3.

Table A.3.3. Estimation representations of Equation (11) for Poland

	Coefficients						
	α	β_1	γ	δ_1	δ_2	adj. R^2	F-test
WIBOR 1m	-0.0038	0.2504***	0.3199***	0.2471*	-0.3831**	0.2029	87.8142
	[0.0042]	[0.0648]	[0.1282]	[0.1323]	[0.1274]		0.0000
WIBOR 3m	-0.0072**	0.2041***	0.1848**	0.2054*	-0.1528**	0.1746	73.1434
	[0.0033]	[0.0480]	[0.0779]	[0.1105]	[0.0775]		0.0000

HAC standard errors are reported in parentheses, * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1%, second rows for *F*-statistics represent *p*-values

The empirical evidence suggests that the NBP is not transparent because a parameter γ is significantly greater than zero. However, there is a statistically significant increase in its monetary policy transparency following the introduction of DIT, as δ_1 is significant at 10% level and has a positive sign.

ECB

The empirical analysis covers the period of January 1, 1999 – May 23, 2003. The empirical test for the Eurozone does not include a regime shift dummy variable, as there has been no change in the monetary policy strategy of the ECB in the analysed period.

$$\Delta i_{t,j} = \alpha + \beta_j(L)\Delta i_{t,j} + \gamma_j \Delta i_t^c + \varepsilon_t \tag{12}$$

Table A.3.4 Estimation representations of Equation (12) for the ECB

	Coefficients				
	α	β_1	γ	adj. R^2	F-test
EURIBOR 1m	-0.0005	0.1094**	0.2718**	0.1331	88.6911

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[19] Market participants and general public were afraid of problems with liquidity that could occur as a consequence of obsolete software possessed by some banks.

		[0.0009]	[0.0315]	[0.0975]		0.0000
EURIBOR 3m		-0.0006	0.1526**	0.2064*	0.1300	86.3236
		[0.0008]	[0.0407]	[0.0914]		0.0000

HAC standard errors are reported in parentheses; * indicates significance at 5%, ** indicates significance at 1%; second rows for *F*-statistics represent *p*-values

Source: Own estimations

The empirical evidence suggests that the ECB is not transparent because a parameter γ is significantly greater than zero, although its magnitude is slightly lower than for Poland.

Table 1. Transparency Index for NMS based on Eijffinger and Geraats versus ECB

Transparency Type	CNB	NBH	NBP	ECB
Political	**3**	**3**	**3**	**3**
a. Formal Objectives	1	1	1	1
b. Quantitative Targets	1	1	1	1
c. Institutional Arrangements	1	1	1	1
Economic	**2,5**	**3**	**0,5**	**2,5**
a. Economic Data	0,5	1	0,5	1
b. Policy Models	1	1	0	1
c. Central Bank Forecasts	1	1	0	0,5
Procedural	**2.5**	**1**	**2**	**1**
a. Explicit Strategy	1	1	1	1
b. Minutes	1	0	0	0
c. Voting Records	0.5	0	1	0
Policy	**2**	**1**	**3**	**1,5**
a. Prompt Announcement	1	1	1	1
b. Policy Explanation	1	0	1	0,5
c. Policy Inclination	0	0	1	0
Operational	**2,5**	**3**	**2,5**	**2**
a. Control Errors	1	1	1	1
b.Transmission Disturbances	0,5	1	0,5	0,5
c. Evaluation Policy Outcome	1	1	1	0,5
Total	**12.5**	**11**	**11**	**10**

Table 2. DIT-Specific Transparency Index for NMS and ECB

	CNB	NBH	NBP	ECB
Unique goal	1	0	1	1
Exchange rate policy	0.5	0	1	0.5
Forward/backward	1	1	0	1
CPI or core inflation	1	1	1	1
Trajectory	1	0.5	1	1
Quarterly rolling basis	1	0	0	1
Target change	0.5	0.5	0	0.5
Missing the target	0.5	0	0	0
Total	**6.5**	**3**	**4**	**6**

Source: Own evaluation based on documents available at official web sites of NMS central banks and the ECB as of May 2003.
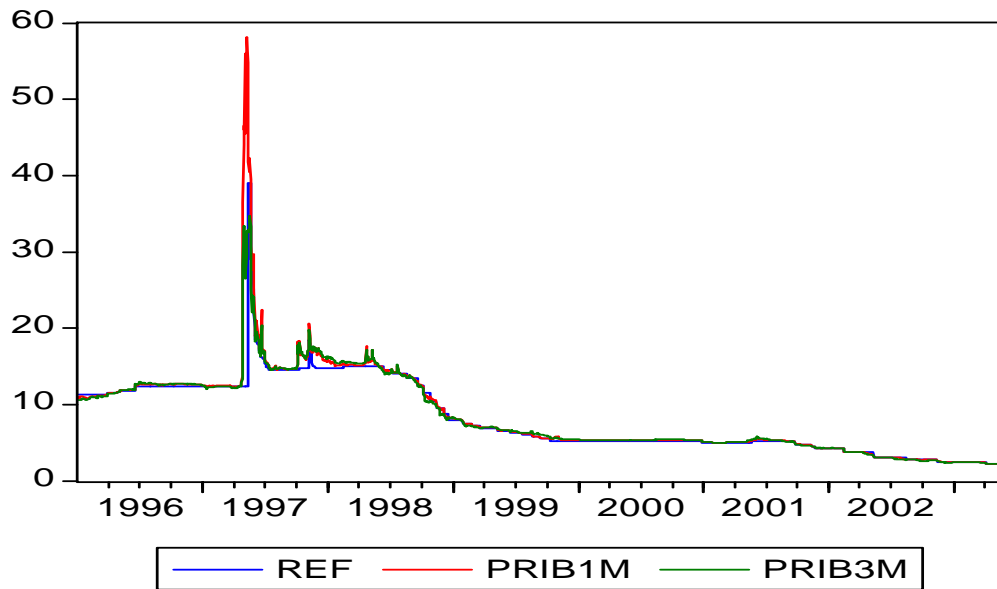
Table 3. Estimation Representations of Equation (9)

		Czech Republic	Hungary	Poland	ECB
1m	γ	0.4740	0.5667	0.3199	0.2718
	δ_1	0.5311	-0.5478	0.2471	
	δ_2	-0.5493		-0.3831	
3m	γ	0.3136	0.5500	0.1848	0.2064
	δ_1	0.8336	-0.5346	0.2054	
	δ_2	-0.2116		-0.1528	

Figure 1. The Czech money market rates and the official interest rates

Note: The main instrument of the CNB monetary policy is a two-week repo rate through which it affects the money market rates, i.e. 1-month, 3-month, and 6-month PRIBOR (Prague Interbank Offering Rate).
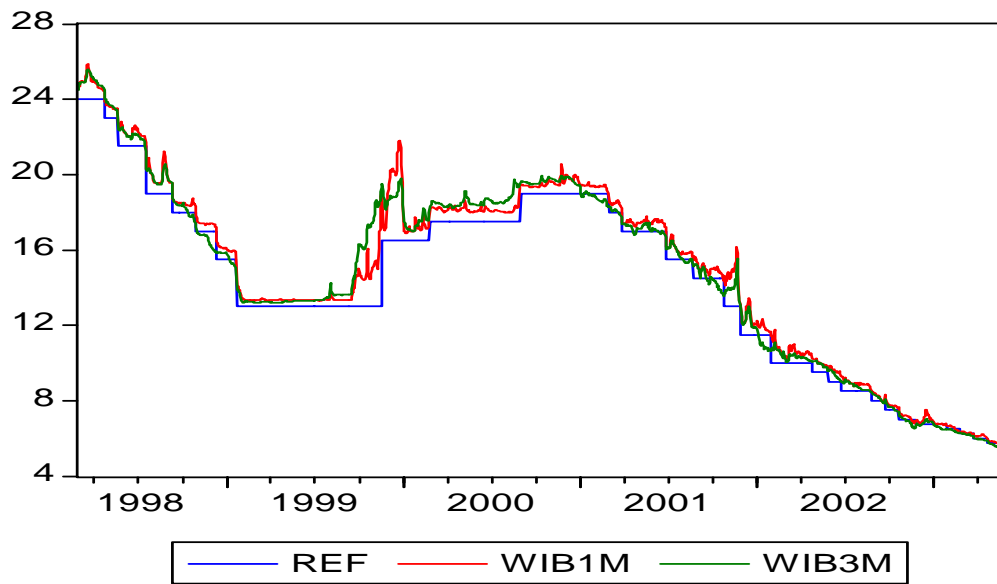
Source: EcoWin, Reuters, and CNB

Figure 2. The Hungarian money market rates and the official interest rates
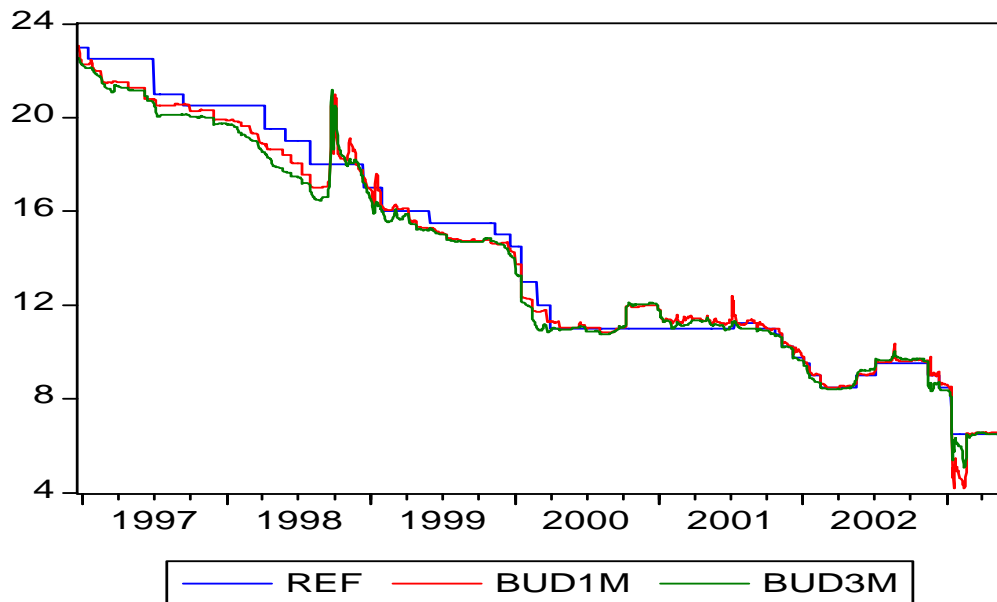
Note: The main instrument of the NBH monetary policy is a two-week refinancing rate through which it affects its money market rates, i.e. 1-month and 3-month BUBOR (Budapest Interbank Offering Rate).
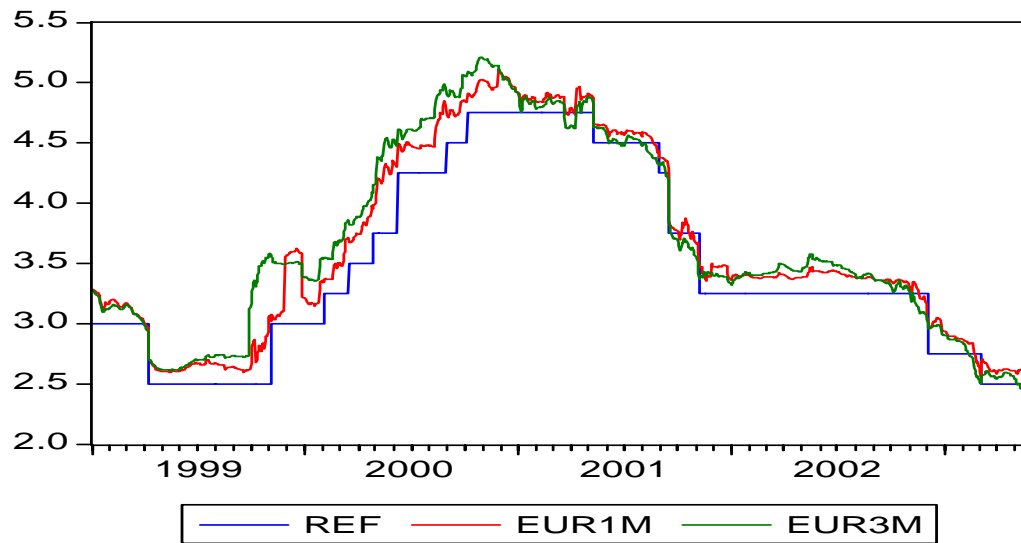
Source: EcoWin, Reuters, and MNB

Figure 3. The Polish money market rates and the official interest rates

Note: The main instrument of the NBP monetary policy is two-week reference rate (money market intervention rate) through which it affects its money market rates, i.e. 1-month and 3-month WIBOR (Warsaw Interbank Offering Rate).

Source: EcoWin, Reuters, and NBP

Figure 4. Money market rates and the ECB official interest rate

Note: The main instrument of the ECB monetary policy is a one-week refinancing rate through which it affects its money market rates, i.e. 1-month and 3-month EURIBOR (Euro Interbank Offering Rate).

Source: EcoWin, Reuters, and ECB