



11-2008

Relative Inflation-Forecast as Monetary Policy Target for Convergence to the Euro

Lucjan T. Orłowski

Sacred Heart University, orlowskil@sacredheart.edu

Follow this and additional works at: http://digitalcommons.sacredheart.edu/wcob_fac



Part of the [International Economics Commons](#), and the [Political Economy Commons](#)

Recommended Citation

Orłowski, L.T. (2008). Relative inflation-forecast as monetary policy target for convergence to the euro. *Journal Of Policy Modeling*, 30(6), 1061-1081. doi: 10.1016/j.jpolmod.2008.01.001

This Article is brought to you for free and open access by the Jack Welch College of Business at DigitalCommons@SHU. It has been accepted for inclusion in WCOB Faculty Publications by an authorized administrator of DigitalCommons@SHU. For more information, please contact ferribyp@sacredheart.edu.

Relative Inflation-Forecast as Monetary Policy Target for Convergence to the Euro

Lucjan T. Orlowski ^a

*Professor of Economics and International Finance, Sacred Heart University, 5151 Park Avenue,
Fairfield, CT 06825. USA*

Abstract:

A monetary policy framework based on targeting a relative inflation-forecast is proposed for the economies converging to the euro. Such strategy aims at containing the differentials between the domestic and the implicit monetary union inflation forecasts. Hence these differentials become a basis for setting an operational policy target. The proposed framework can be viewed as an extension of flexible inflation targeting that prioritizes low and stable inflation over the exchange rate stability. It is believed to be consistent with the Maastricht convergence criteria and can be implemented in concurrence with the exchange rate stability benchmark for the ERM2. Several empirical tests are conducted to determine feasibility of adopting an instrument rule for the proposed policy framework in the three largest inflation-targeting candidates to the euro: the Czech Republic, Hungary and Poland. The stability tests as well as the volatility dynamics tests suggest that adoption of the relative inflation-forecast targeting framework is possible in these countries.

JEL classification: E42; E52; F36; P24.

Keywords: inflation targeting, exchange rate, monetary convergence, ERM2, new EU Member States, GARCH.

This version January 2008

^a Corresponding author: Lucjan T. Orlowski, Department of Economics and Finance, Sacred Heart University, 5151 Park Avenue, Fairfield, CT 06825. Tel. (203) 371 7858. Fax (203) 365 7538. E-mail: OrlowskiL@sacredheart.edu

1. Introduction

Monetary policy-makers in the new Member States (NMS) that joined the European Union (EU) in 2004 and 2007 are facing a challenging task of devising an appropriate policy framework for navigating the path of convergence to the eurozone. The larger NMS countries are now pursuing autonomous monetary policies based on direct inflation-targeting (DIT)¹ that will, however, have to be modified at the more advanced stage of convergence. These modifications are likely to be based on easing the exclusive targeting of domestic inflation and incorporating the objectives of lowering the spreads between domestic and the eurozone monetary variables for effective implementation of convergence to the euro.

The literature pertaining to modern inflation-targeting regimes does not offer much guidance in this respect as it focuses primarily on domestic monetary variables in the context of fully autonomous policy regimes and generally does not take into consideration the issue of monetary convergence to a currency union (Bernanke et al., 1999; Svensson, 1999; Levin et al., 2004; Faust and Henderson, 2004). A number of empirical studies addressing the eurozone enlargement tackle various aspects of monetary strategies; however, they generally do not aim at prescribing optimal monetary policy sequencing for transition from the current autonomous policies to the euro via the obligatory interim ERM2 stage (Begg, et al., 2003; Kočenda, et al., 2006; DeGrauwe and Schnabl, 2005). In an attempt to tackle this issue, this paper proposes a modified DIT framework for convergence to the euro.

The proposed monetary policy framework is an extension of current DIT regimes that takes into account the dominant (flexible) inflation target and the exchange rate stability objective. It is based on *relative inflation-forecast targeting* (RIFT). Its key precept is that a dynamic reduction of differentials between the domestic and the implicit monetary union inflation forecast for a predetermined time-period becomes the main operational goal of monetary policy. In the long run, the inflation target of the converging country becomes fully aligned with the common currency area inflation forecast. For the euro-candidates, the eurozone inflation forecast can be formulated on the basis of the Maastricht convergence inflation benchmark that requires the inflation rate of the euro-candidate not to exceed the average inflation of the three lowest EU inflation rates by more than 1.5 percent. Therefore, the proposed

¹ By direct inflation targeting we understand a policy regime that is geared toward achieving a prescribed numerical inflation goal, as oppose to indirect inflation targeting that aims at achieving long-term price stability via alternative targets, such as a stable exchange rate or money growth.

RIFT framework is believed to be consistent with the Maastricht convergence criteria assuming that the officially chosen ERM2 central parity rate does not violate the inflation benchmark.

Implementation of RIFT is based on the policy “instrument dichotomy”, i.e. on changes in the central bank reference interest rate as well as foreign exchange market interventions. Shocks to inflation forecasts, particularly those perceived as permanent, are countered with increases in interest rates, while shocks to exchange rate stability may be offset with foreign exchange market intervention. A possible currency depreciation shock can be also counteracted with higher interest rates but only if it poses a serious threat to the realization of the inflation target. The instrument dichotomy is unavoidable for alleviating potential conflicts between disinflation and exchange rate stability objectives.

The empirical section of this study is designed to investigate the link between the NMS vis-à-vis eurozone inflation differentials (viewed as the policy target variable), the exchange rate (as a supporting convergence objective) and the candidates’ short-term interest rates (as the policy instrument). If these variables are interdependent, implementation of RIFT will not jeopardize financial stability in these countries. Moreover, policies aimed at prioritizing disinflation are not likely to exacerbate exchange rate volatility beyond the fluctuations band prescribed by the ERM2, providing that the reference exchange rate is set around the long-term market equilibrium rate and the fluctuations band remains to be wide (at 15 percent around the central parity). Feasible adoption of RIFT depends on a prior record of price stability and on a functional relationship between the time-varying dynamics of the relative inflation-forecast, the nominal exchange rate and market interest rates. Such stability enables policy-makers to devise a credible instrument rule for RIFT.

Section 2 of this paper explains the rationale for targeting the differential (spread) between the domestic and the eurozone inflation forecasts. The model outlining the RIFT framework is presented in Section 3. Section 4 examines the degree of stability of interactions between inflation differentials vis-à-vis the eurozone, exchange rates and short-term interest rates in the three largest inflation-targeting NMS, namely, the Czech Republic, Poland and Hungary.² The stability testing of the derived instrument rule for RIFT is conducted in Section 5 by

² In addition to the three examined NMS, The National Bank of Slovakia has also adopted DIT. The new policy was announced in May 2004 following the country’s EU accession, as part of strategy to adopt the euro in 2009. Since it went into effect as of January 2005, the Slovak experience with DIT is too recent and does not provide a sufficient number of observations for inclusion in the empirical section of this paper.

employing the generalized autoregressive conditional heteroscedasticity with variance-in-mean and generalized error distribution (GARCH-M-GED) process. The concluding Section 6 summarizes key findings and presents several policy recommendations.

2. Functional Identity between Long-Term Inflation Targets

Monetary policies in the NMS converging to the euro have undergone a remarkable transition since the inception of economic reforms in the early 1990s. At the early stage of reforms, central banks were confronted with the task of containing extremely high inflation stemming mainly from the far-reaching price liberalization. Lacking prior record of policy credibility and facing underdeveloped, highly volatile financial markets, central banks in these countries could not achieve financial stability by employing flexible, autonomous monetary policies. Thus they resorted to currency pegs.

As the transition evolved, currency pegs became increasingly burdensome. Fixed exchange rates combined with the remnants of high inflation eventually led to real currency appreciation and, subsequently, to current account deficits and deteriorating risk structure of capital inflows. These unfavorable developments prompted the monetary authorities to devising various exit strategies from currency pegs toward autonomous monetary policies and increasingly flexible exchange rates (Corker et al., 2000). After rather unsuccessful experiments with interest rate targeting, followed by monetary base targeting (only in Poland) and targeting the exchange rate within the crawling devaluation band several central banks have ultimately embraced DIT strategies (Masson, 1999; Orłowski, 2004; Jonas and Mishkin, 2005; Roger and Stone, 2005). The Czech National Bank (CNB) began implementing DIT in January 1998, the National Bank of Poland (NBP) in January 1999 and the National Bank of Hungary (NBH) in May 2001.³ The actual implementation of DIT stirred a heated debate over its timing, the exact format and the overall rationale. In the case of Poland, the new policy was initially characterized as a bit premature since the country's average monthly annualized CPI headline inflation in 1998 was still running at 11.9 percent and the functional relationships between inflation and other monetary policy variables were highly unstable (Christofferssen and Wescott, 1999). Without doubt, the three examined NMS did not satisfy the prerequisites for DIT formulated by Mishkin

³ A more detailed examination of the systemic evolution of DIT regimes in these countries can be found for instance in Roger and Stone (2005) or Orłowski (2005).

(2000); particularly the requirement of single-digit inflation, a stable relationship between inflation and policy instruments, and the well-defined channels of monetary policy transmission. Nevertheless, strong commitment to disinflation and confidence about gaining monetary stability in the near future prompted policy-makers in these countries to embrace DIT (Jonas and Mishkin, 2005).

At the early stage of DIT, the three central banks had to streamline policy efforts toward achieving the predetermined inflation target without consideration alternative policy objectives, such as income growth or currency stability. By the time of the EU accession in May 2004, the DIT policies significantly contributed to price stability in the three NMS (Roger and Stone, 2005). Inflation became stabilized at low levels and interest rate risk premia for investors fell significantly. Thus in essence, the early DIT strategies laid out favorable ground for advancing to the next stage of monetary reforms in these countries, namely the convergence to the euro. As stipulated by the Maastricht convergence criteria, in addition to reducing inflation, the converging NMS have to stabilize the exchange rate and reduce long-term interest rates in order to become eligible for adopting the euro. In practical terms, the multiple tasks of monetary convergence imply a necessity of relaxing the rigid DIT regimes by combining low inflation and exchange rate stability objectives.⁴

The RIFT framework proposed in this study incorporates the convergence parameters into a more flexible variant of DIT that combines the inflation with the exchange rate stability objectives.⁵ It prioritizes targeting the relative inflation-forecast, i.e. the differential between the domestic and the monetary union inflation forecasts. Such approach allows for a better synchronization of the policy target and instrument variables in the converging countries with the corresponding variables in the currency union. The analytical assumptions for RIFT can be stated as follows:

⁴ Serious concerns about inflexibility of the Maastricht criteria are expressed by Kenen and Meade (2003), who question the rationale of using the average inflation and long-term interest rates in the three lowest inflation EU countries as monetary convergence benchmarks and instead suggest applying the inflation rates and the average long-term interest rates prevailing in the euro area.

⁵ The proposed framework is suitable for the countries that are currently pursuing DIT strategies and whose financial markets are relatively well-developed, thus capable of providing appropriate policy signals. Such framework may not be a 'best-practice' policy option for smaller NMS, such as the Baltic States that pursue a currency board arrangement on their passage toward the euro. Their departure from the present monetary regime could entail large shocks to their undercapitalized and volatile financial markets.

1. The monetary policy reaction function of a converging country is based on the differential between the domestic and the implicit monetary union inflation forecast.⁶ This differential becomes the policy operational target (as distinguished from the long-term target) and is subject to continuous monitoring and revisions as its time-varying path is conditional on the nominal exchange rate volatility.
2. In the long-run, the inflation targets of the converging countries and the monetary union become identical. The candidates relinquish a certain degree of policy autonomy and act as the long-term inflation ‘target-takers’. Such target identity is likely to mitigate the risk of experiencing major nominal shocks to convergence.
3. The inflation-forecast differential takes priority over the exchange rate stability. Such hierarchy of goals means adherence to the ‘instrument dichotomy’ rule whereas interest rates are adjusted in response to changes in the relative inflation-forecast, while exchange rate stability is secured with foreign exchange rate market interventions. Thus in essence, the RIFT framework combines inflation targeting with a managed float.
4. Policy-makers adjust the inflation-forecast differential in response to changes in a matrix of selected indicator variables that may include changes in money growth rates, market interest rates and term spreads on sovereign bonds - all in relation to their corresponding monetary union levels.

The underlying conjecture of RIFT is that a continuation of DIT strategies in the present form would likely yield suboptimal results relative to the main tasks of a smooth convergence to the euro. Stating briefly, it would exacerbate volatility of monetary variables, particularly nominal and real exchange rates, thus elevate risk premia and deteriorate the risk structure of capital inflows.

Consistently with the above assumptions, central banks in small converging economies cannot set policy targets and adjust instruments exclusively on the basis of domestic macroeconomic fundamentals; they need to monitor and forecast the corresponding foreign variables as well. Narrower differentials between domestic and foreign variables signalize the progress of convergence. A set of indicator variables relevant for monitoring convergence may include compression of long-term bond yields, declining market risk premia, relative money

⁶ In practical terms, the implicit currency union inflation forecast can be proxied by the Maastricht inflation benchmark. Its reference value in May 2007 was set at 3.0 percent (ECB, 2007).

growth rates (as one of the determinants of the inflation risk) and the exchange rate volatility (the exchange rate risk). Effective reduction of these risks contributes to better synchronization between domestic and eurozone inflation expectations.

The long-run equivalence of inflation targets between the converging country and the currency union can be stated as

$$\bar{\pi}_{t+\kappa,t} - \bar{\pi}_{t+\kappa,t}^* = 0 \quad (1)$$

where $\bar{\pi}_{t+\kappa,t}$ denotes the domestic long-term inflation target and $\bar{\pi}_{t+\kappa,t}^*$ denotes the implicit foreign target, both specified at time t for κ -periods ahead⁷.

In an alternative form, the target identity can be prescribed as

$$\bar{\pi}_{t+\kappa,t} = \gamma \bar{\pi}_{t+\kappa,t}^* \quad (2)$$

The γ translator between foreign and domestic inflation targets is equal one if there is a perfect identity between these targets. It may slightly exceed unity for a converging economy, thus assimilate a small “inflation target premium” intended to provide a safety cushion against possible external shocks for κ -periods ahead. Yet, such a cushion does not necessarily constitute the best-practice policy, because it entails an inflation risk premium that might be associated with a persistent fiscal dominance, political instability or other potential threats to financial stability. On one hand, a perfect target identity without a safety cushion underscores policy-makers’ full commitment to monetary convergence, while on the other, a cushion built into the domestic inflation target is likely to raise public doubts about effectiveness of the official convergence program.

In a backward-looking open-economy setting, a central bank reaction function within a strict DIT operational framework can be stated as

$$\Delta\pi_t + \theta_t = \bar{\pi}_{t+\tau,t} + \beta_i \Delta i_{t+1} + \beta_s \Delta s_{t+1} \quad (3)$$

⁷ With respect to NMS, the κ -period should correspond with the timing of their assessment of eligibility for adopting the euro. The implicit target for κ -periods ahead may be modified upon the entry to ERM2 that requires a two-year test period for the exchange rate stability.

The first-order autoregressive movements of inflation, short-term interest rate and exchange rate are respectively: $\Delta\pi_t = \pi_t - \pi_{t-1}$, $\Delta i_{t+1} = i_{t+1} - i_t$ and $\Delta s_{t+1} = s_{t+1} - s_t$.

Eq. (3) reflects the first-order autoregressive inflation process as a function of two endogenous variables, namely the long-term inflation target and the inflation risk premium θ_t , as well as the next period's interest rate and nominal exchange rate as exogenous variables. The historical inflation risk premium can be assessed as a difference between a smoothed inflation rate extrapolated from the past and the neutral nominal interest rate. Computed in this way, the inflation risk premium is in essence identical with the observed dynamic neutral real interest rate. In a forward-looking setting, the inflation risk premium can be also endogenized as it is likely to decline along with the expected gains in monetary policy credibility.

It can be further noted that the forward-looking domestic inflation target shall account for a long-term inflation risk free target $\bar{\pi}_{t+\tau,t}^{rf}$ and the prevalent inflation risk premium, such as

$$\bar{\pi}_{t+\tau,t}^{rf} = \bar{\pi}_{t+\tau,t} - \theta_t \quad (4)$$

The functional relationship prescribed by Eq. (3) implies that an observed surge in inflation might be counteracted by raising the next period's interest rate (as the adjustment in the policy instrument), or translated into the next period's domestic currency depreciation (increased s_t) if there is no change in the policy instrument. Thus by assumption $\beta_i + \beta_s = 1$. If β_i equals zero, the policy stance is neutral, allowing the national currency to depreciate.

A more dynamic version of policy reaction function prescribed by Eq. (3) takes into consideration exchange rate pass-through effects on inflation. A complete pass-through takes place when

$$\beta_s \Delta s_{t-1} = \Delta \pi_{t+l} \quad (5a)$$

with the optimal pass-through period denoted by $l+1$. A partial pass-through is reflected by

$$\beta_s \Delta s_{t-1} = \beta_\lambda \Delta \pi_{t+l} \quad (5b)$$

The pass-through effects can become neutralized by actual or expected interest rate increases; then, β_s is equal zero.

As the DIT strategy evolves to a more advanced stage, it becomes increasingly important for a central bank to contain inflation by influencing the public's expectations. This can be accomplished by improved information disclosure and, in general terms, by a higher degree of central bank transparency, which constitutes a critical component of a DIT strategy (Bernanke et al, 1999). In a more transparent policy environment, actual inflation follows a path of prior inflation expectations, which in essence entails 'activation' of the expectations channel of monetary policy transmission. In order to increase sensitivity of actual inflation to inflation expectations, a central bank may choose to adopt a forward-looking policy approach with interest rate decisions based on the difference between the inflation forecast and the official target. Under such policy scenario, a reaction function of the central bank in an open economy setting can be specified as

$$\Delta\pi_{t+\tau,t} = \bar{\pi}_{t+\tau,t} - \theta_t + \beta_i \Delta i_{t+1} + \beta_s \Delta s_{t+1} \quad (6)$$

The inflation forecast for the τ -period ahead, which corresponds with the inflation target period, is reflected by $\Delta\pi_{t+\tau,t}$.

The reaction function prescribed by Eq. (6) reflects an open-economy environment since it includes the exchange rate variable. Such functional relationship provides a basis for a flexible inflation targeting rule because it entails combination of low inflation and exchange rate stability objectives.⁸ The reaction function prescribed by Eq. (6) focuses on the deviation between the path of domestic inflation and the inflation target and does not account for the corresponding foreign inflation variables.

3. RIFT Model

⁸ Flexible inflation targeting models that incorporate the exchange rate stability objective have been introduced to the literature by Ball (1999), expanded, among others, by Svensson (2000), and adopted to the environment of transition economies by Orłowski (2001; 2005) and Golinelli and Rovelli (2005). They do not, however, incorporate the fundamental objectives faced by the economies converging to a common currency area.

By introducing the foreign inflation target and forecast variables, the central bank reaction function in the converging country becomes

$$\Delta\pi_{t+\tau,t} - \Delta\pi_{t+\tau,t}^* = \bar{\pi}_{t+\tau,t} - \theta_t - \bar{\pi}_{t+\tau,t}^* + \beta_i \Delta i_{t+1} + \beta_s \Delta s_{t+1} \quad (7)$$

with the asterisk denoting foreign variables.

Since inflation risk is embedded in a broader market risk, we incorporate into the above functional relationship the market risk premium ψ_t , which is assumed to account for the difference between domestic inflation-risk-free target and the foreign inflation target point (or forecast if the explicit foreign target is not specified). The market risk premium is specified as

$$\psi_t = \bar{\pi}_{t+\tau,t} - \theta_t - \bar{\pi}_{t+\tau,t}^* \quad (8)$$

Augmented with the market risk parameter, *the RIFT operational framework* becomes

$$\Delta\pi_{t+\tau,t} - \Delta\pi_{t+\tau,t}^* = \psi_t + \beta_i \Delta i_{t+1} + \beta_s \Delta s_{t+1} \quad (9)$$

It shall be noted that the identity between the long-term inflation targets can be only ensured when the market risk premium ψ_t cedes to exist. Since the domestic market risk premium is ultimately encapsulated by an average excess variability of domestic inflation over the variability of implicit foreign inflation in the observed recent period $t-k$, it can be proxied by the difference between the conditional variances of domestic and implicit foreign inflation rates denoted respectively by σ_t^2 and σ_t^{*2} .

$$\int_{t-k}^t \sigma_t^2 d\kappa - \int_{t-k}^t \sigma_t^{*2} d\kappa = \psi_t \quad (10)$$

As stated above, a successful monetary convergence requires the market risk premium to be gradually reduced to zero, thus

$$\lim \psi_t \rightarrow 0 \tag{11}$$

Reduction of the market risk premium can be viewed as an important condition for effective convergence because large risk premia tend to precipitate shocks to nominal exchange rates (Orlowski, 2003; Csermely, 2004; Dibooglu and Kutan, 2005) as well as real exchange rates (Golinelli and Rovelli, 2005; Kočenda, et al., 2006).

In sum, the RIFT reaction function prescribed by Eq. (9) implies that the central bank of a converging country can either raise short-term interest rates or let the national currency depreciate in response to a surge in the relative inflation-forecast. It further assumes that in the long-run market risk premium will gradually converge to zero. Because of the continued priority of the inflation target over the alternative policy objectives, the RIFT framework shall be viewed as an extension of and not a replacement for DIT.⁹

From the standpoint of effective convergence, it may be pragmatic to formulate the operating target reflecting the inflation differential as a gradually narrowing range. A range rather than a point specification of the target may allow the candidate's inflation forecast to overshoot the implicit monetary union forecast by a certain narrow margin, which will not jeopardize achieving price stability in the long run. This means that the monetary policy operating target on the path toward the euro could be formulated as a one-sided asymmetric range, with the lower boundary fixed at a perfect parity between the domestic and the implicit currency union inflation forecast, and the upper boundary set at a predetermined margin above it. A reasonably narrow range is likely to provide a safety cushion against possible temporary inflation shocks stemming from large capital inflows that will be likely accelerated by the convergence expectations.

⁹ It can be also noted that the reaction function prescribed by Eq. (9) differs from standard central bank loss functions that emphasize a trade-off between disinflation and narrowing the output gap. Income creation can still be accounted for within the RIFT framework in a more dynamic, intertemporal setting. It is because the proposed policy is ultimately designed to mitigate the market risk premium, which in turn is likely to promote credit growth thus generate more favorable consumer spending and business investment conditions.

Because the RIFT reaction function prescribed by Eq. (9) implies adoption of an extended, more flexible variant of DIT, its practical implementation should be based on observed changes in selected indicator variables. Since a detailed, comprehensive examination of all necessary indicator and instrument variables for the RIFT exceeds the scope of this study, our empirical analysis focuses only on evaluation of the instrument rule. The analyzed rule reflects the time-varying path of short-term interest rates as a function of changes in the selected target and indicator variables, which include the differential between domestic vis-à-vis eurozone inflation, the nominal exchange rate and the foreign short-term interest rate. Inclusion of the foreign interest rate highlights the fact that the converging country's central bank acts as a 'policy-taker' since its instrument decisions follow closely the underlying market conditions and central bank decisions in the common currency system. In addition, the policy rule may include some priority weighting on narrowing the output gap. As a consequence, the basic RIFT instrument rule is derived from Eq. (9) and augmented with changes in the foreign interest rate i_t^* as well as the output gap \hat{y}_t

$$i_t = \beta_0 + \beta_\psi \psi_t + \beta_y \hat{y}_t + \beta_\pi (\pi_{t+\tau,t} - \pi_{t+\tau,y}^*) + \beta_s s_{t+\tau,t} + \beta_{if} i_{t+\tau,t}^* + \varepsilon_t \quad (11)$$

All variables in Eq. (11) are in first differences and τ is a forward-looking lag operator that may vary for each of the independent variables. In essence, Eq. (11) represents a complex Taylor rule that reflects various policy preferences under conditions of a converging open economy. On practical grounds, such policy rule may be difficult to implement since it contains a number of seemingly conflicting target and instrument variables. Moreover, it may prove to be impractical if policy-makers will not have a full knowledge about monetary policy transmission channels, as argued by Svensson (2003). This word of caution certainly pertains to NMS for which it remains debatable whether a sufficient degree of stability of the exchange rate, the aggregate demand, the credit, and the expectations channels has been reached (Golinelli and Rovelli, 2005; Dibooglu and Kutan, 2005; Kočenda, et al., 2006). Moreover, such a complex instrument rule may not be transparent and credible. For this reason, a number of simplifications can be made on a passage toward a common currency considering the priority of the inflation target and monetary convergence tasks over the output gap stability. Consistently, the weight on the output gap can be reduced to zero. Exclusion of the output gap will also help alleviate the

potential problem of serial correlation between the exchange rate and market risk dynamics, and the output gap. With the β_y parameter equal zero, the RIFT forward-looking policy rule becomes

$$i_t = \beta_0 + \beta_\psi \psi_t + \beta_\pi (\pi_{t+\tau,t} - \pi_{t+\tau,y}^*) + \beta_s s_{t+\tau,t} + \beta_{if} i_{t+\tau,t}^* + \varepsilon_t' \quad (12)$$

In sum, the policy rule prescribed by Eq. (12) is based on changes in short-term market interest rates as a function of the relative inflation-forecast for the τ -period ahead, the exchange rate and the foreign interest rate forecasts, the neutral (Wicksellian) interest rate (denoted by β_0) and the market risk premium dynamics¹⁰. Phrasing differently, the implementation of the RIFT policy rule is guided by the objective of narrowing the forward-looking inflation differential with some consideration given to stabilizing the exchange rate. It can, however, be hindered by potentially volatile foreign interest rates that could obstruct the process of monetary convergence. It can be further thwarted by an excessive market risk premium, a serious component of which is the inflation risk. In the case of NMS the inflation risk is believed to be associated with the Balassa-Samuelson effects.¹¹ In essence, the implementation of RIFT depends on the prior knowledge of the policy transmission channels or, in other words, on stable relationships between the regressors included in the instrument rule prescribed by Eq. (12).

4. Feasibility of Adopting RIFT in the Euro-Candidate Countries

Evidence of a sufficient stability of the components of the RIFT instrument rule is a crucial prerequisite for its successful implementation. Most critical among them is the stability of the inflation series. Descriptive statistics shown in Table 1 shed some light on the established time-path and the degree of stability of CPI-based inflation in the three examined NMS in comparison with the HICP-based inflation in the eurozone. The monthly data series begin respectively with the dates of DIT adoption by NMS and the eurozone inception, and end in June 2007.

¹⁰ The time-varying market risk premium can be technically assessed through the GARCH-M process, which includes the conditional variance as the risk proxy in the conditional mean equation. Its detailed description and analysis can be found for instance in Poon and Granger (2003).

¹¹ However, several recent empirical studies provide compelling evidence that the Balassa-Samuelson effects have dissipated and no longer contribute to the inflation process in NMS (Égert, et al. 2003; Błaszkiwicz et al. 2004), while others uphold their prevalence (Natalucci and Ravenna, 2002; DeGrauwe and Schnabl 2005).

..... insert Table 1 around here

As shown in Table 1, the average inflation in the three NMS has been higher and somewhat more unstable than the eurozone inflation, although in all three countries DIT policies have contributed to its declining time trend. Disinflation trends in the Czech Republic and Poland are more pronounced than the disinflation path in Hungary where fiscal dominance still persists and elevates inflation expectations (Kočenda, et al., 2006). Perhaps more important from the standpoint of feasibility of RIFT are the measures of skewness and kurtosis. The obtained skewness indicators show that positive shocks to inflation in NMS prevail over the negative ones implying that at turbulent times the inflation risk remains to be quite substantial. In addition, inflation series in Poland and Hungary follow a platykurtic (wider-waist) distribution since the kurtosis coefficients for both countries are less than three. Thus evidently, inflation rates in these two countries tend to be more dispersed and unstable than those in the Czech Republic or in the eurozone at 'normal' or tranquil inflation volatility periods. Furthermore, the inflation series in all three NMS are non-stationary (as implied by the ADF statistics), while the eurozone inflation follows a stationary path.

In sum, the data shown in Table 1 suggest that DIT policies in NMS have contributed to the declining path of inflation. However, headline inflation in these countries remains to be more unstable than the underlying inflation in the eurozone as indicates by the standard deviation coefficients. The excessive volatility of inflation denotes elevated inflation. Thus a progress in mitigating inflation risk should be required of NMS for a more effective nominal convergence to the euro.

In addition to the advancement of price stability, well-defined relationships between the key policy variables are needed for a feasible introduction of a forward-looking policy based on RIFT. In particular, policy-makers need to be informed about optimal adjustment lags between interest rates and inflation, with a reasonable margin of error, if they are to devise appropriate interest rate adjustments for the purpose of hitting the future inflation target. A full knowledge about the transmission of exchange rates into inflation is also indispensable. If the actual response lags were subject to large, unpredictable errors and the relationship between inflation, interest rates and exchange rates were highly unstable, forward-looking policy decisions guided by RIFT could lead to unintended outcomes. Moreover, reliable methodologies to prepare such

forecasts as well as their disclosure to the public at large are also necessary. Given these prerequisites are met, inflation expectations of the central bank and the private sector will become fully synchronized making the implementation of RIFT feasible.

To establish whether such stability has been in place in NMS, we investigate impulse responses between changes in the inflation differentials, exchange rates and short-term interest rates. The results are shown in Figures: 1a for the Czech Republic, 1b for Poland and 1c for Hungary. It shall be noted that all tested variables are in first differences, with four lags in VAR and a maximum of ten lag intervals applied for generating impulse responses. The inflation differentials are computed as a difference between actual domestic inflation and the eurozone inflation, which is smoothed with the Hodrick-Prescott filter in order to exclude the effects of transitory shocks. The exchange rates are specified as domestic currency values of the euro. The first row in each set of graphs shows the response of the inflation differential to: its own shock, the shock to the exchange rate, and the shock to the short-term interest rate (3-month Treasury bill). The left columns show feedback responses to the shock to the inflation differential on: the inflation differential itself, the exchange rate and the interest rate.

..... insert Figures 1a, 1b and 1c around here

As demonstrated by the set of graphs for the Czech Republic, there is a pronounced positive response of the inflation differential to the shock in the exchange rate with a 2 to 5 month lag. Thus evidently, inflation in the Czech Republic rises above the eurozone inflation trend in response to the Czech Koruna (CZK) depreciation. The inflation differential also widens in response to the shock to the short-term interest rate with a 2 month lag, which seems to indicate the impact of the interest rate risk premium on inflation. While the reaction of the exchange rate to the shock to the inflation differential seems ignorable, there is a pronounced 4 month lagged response of the interest rate to the inflation differential, suggesting an active and effective instrumentalization of a forward-looking DIT.

The structure of impulse responses in the case of Poland follows a very similar pattern to the Czech case. The inflation differential responds positively to shocks to the exchange rate and to the short-term interest rate, although the response lag to the Polish Zloty (PLN) depreciation seems to be a bit shorter comparing to the Czech case, while the response to the elevated interest rate risk premium is somewhat more extended over time. More importantly from the standpoint

of this analysis, there is a pronounced response of interest rates to the shock in the relative inflation, which also underscores prevalence of a forward-looking DIT. It can be further noticed that interest rates in Poland respond positively to the PLN depreciation, while the response in the Czech case is rather inconclusive.

There is also a pronounced response of the inflation differential to the shock to interest rates in Hungary, suggesting transmission of inflation expectations into interest rates i.e. prevalence of an elevated risk premium. But unlike in the previous two countries, the inflation differential in Hungary responds inversely to shocks to the exchange rate implying an inflationary impact of the Hungarian Forint (HUF) appreciation and subsequent large capital inflows. This impulse reaction may also stem from the combination of the crawling devaluation regime and high interest rate targets during the first 6 years of the sample period. Moreover, the short-term interest rates in Hungary do not seem to respond to shocks to the inflation differential, which seems to question an effective pursuit of DIT. Clearly, the main drivers of inflation in Hungary, including the continuous fiscal dominance and the elevated interest rate risk, would have to be contained prior to adoption of a more flexible DIT.

In conclusion, the evident gains in the degree of stability of the examined policy variables as well as the knowledge about their mutual interactions and policy transmission channels suggest that adoption of the proposed RIFT framework is plausible, particularly in the Czech Republic and Poland. Its effective management will depend on a more precise knowledge and predictability of the transmission channels. Further inquiry in this area is needed due to the prevalent instability and unpredictability of the monetary policy transmission channels in these economies as evidenced by Égert, et al. (2007).

5. RIFT Instrument Function – Volatility Dynamics Analysis

Deeper insights on the interactions and the degree of stability among the examined variables can be derived from the volatility dynamics analysis. As argued above, feasibility of adopting a realistic instrument rule for RIFT depends on stable co-movements between market interest rates, (forward-looking) inflation differentials and exchange rates. Recognizing the importance of such prerequisites, the empirical section of this study is aimed to examine whether there is a predictable time-varying path of changes in interest rates as a function of changes in inflation differentials vis-à-vis the monetary union and the exchange rate. For this purpose the two-step

GARCH(p,q)-M-GED tests are employed for the three NMS. In essence, this exercise is aimed at testing stability of the RIFT instrument rule derived from the underlying RIFT model. The GARCH process entails the conditional mean and the conditional variance equations.¹² The conditional mean equation is the instrument function prescribed by Eq. (12) with the time-varying market risk premium ψ_t proxied by the GARCH conditional variance, i.e. the variance-in-mean M component. The inflation differential variable is entered as a change in the difference between domestic and the Hodrick-Prescott filtered annualized HICP inflation rates for the eurozone. The exchange rate is a change in the log of the average monthly domestic value of the euro. In consistency with Eq. (12), the tested conditional mean equation also includes as an additional regressor the eurozone interest rate, proxied by the German 3-month T-bill rate.

The conditional variance equation that examines the impact of volatility subcomponents is specified as

$$h_t^2 = \omega + \sum_{l=1}^p \beta_l \varepsilon_{t-l}^2 + \sum_{j=1}^q \beta_j h_{t-j}^2 \quad (13)$$

Such specification of volatility dynamics consists of the ARCH term in the order of ‘p’ represented by $\sum_{l=1}^p \beta_l \varepsilon_{t-l}^2$ and the q-order GARCH conditional variance term $\sum_{j=1}^q \beta_j h_{t-j}^2$. The ARCH term shows the impact of the error variance in the previous period (or periods) on the current period error variance. It allows for evaluating the impact of ‘innovations’ from the previous periods (up to the q-order) on the conditional variance. The GARCH term reflects the degree of persistency in volatility as it measures the impact of the forecast variance from the previous period on the current conditional variance. In addition, the conducted empirical tests assume non-Gaussian distribution of error terms, which seems to be a realistic conjecture for the three NMS since they all follow DIT policies.¹³ Specifically, all the conducted tests for the

¹² The GARCH-M-GED is a combination of the GARCH process and the ‘in-mean’ extension (GARCH-M), estimated with generalized error distribution (GED) residuals. A comprehensive overview of the ARCH-class models can be found in Poon and Granger (2003). A noteworthy synthesis is given by Engle (2004) in his Nobel Prize acceptance lecture. The applications of GARCH models for evaluating time-varying inflation volatility dynamics as well as various categories of financial risk in the NMS can be found in Matoušek and Taci (2003); Orłowski (2003 and 2005); and Kočenda and Valachy (2006).

¹³ The inclusion of non-Gaussian distribution parameters is an important aspect of inflation-forecast targeting practices, as argued by Svensson (1999; 2003). It is because policy transmission mechanisms are intrinsically non-

purpose of this exercise have shown consistently that the GARCH process is unconditionally symmetric and leptokurtic, that is, peaked at the center, with tails fatter than those of the normal distribution, as implied by the generalized error distribution GED parameters lower than 2.0. The leptokurtic volatility clustering is typical for smaller countries whose financial markets are susceptible to large nominal shocks.

The empirical tests are conducted for the Czech Republic, Hungary and Poland for the sample period January 1995 – June 2007 and their results are shown in Table 2. It shall be noted that different data generating process (DGP) assumptions have been applied on the basis of minimizing the Akaike and Schwartz information criteria.¹⁴ The results of these tests are sensitive to DGP assumptions in terms of different lag operators of the tested variables, and the orders of ARCH and GARCH terms. The evidence of sensitivity to DGP assumptions implies prevalence of systemic differences between the three countries that drive the time-varying volatility dynamics process prescribed by Eqs. (12) and (13). By design, observations preceding January 1995 have been excluded from this exercise due to the prevalent rigidities of exchange rates (currency pegs) and interest rates in all three countries. In addition, all the tested variables have been entered in their first-differenced terms as they are all non-stationary at their levels. The one-period forwarded inflation differentials vis-à-vis the eurozone are treated as a proxy for relative inflation-forecasts for the three NMS.

..... insert Table 2 around here

The empirical results reveal both common and country-specific factors underlying the tested volatility dynamics in the three NMS. As indicated by the obtained estimates of the conditional mean equation, the time-varying path of interest rates is significantly driven by the forwarded inflation differentials both in Hungary and in Poland, but not in the Czech Republic where the inflation risk premium might have dissipated by now. In both Hungary and the Czech

linear and non-additive thus a certainty-equivalence that is associated with a linear transmission is no longer applicable. For this reason, a forecast-targeting procedure should not be restricted to the mean forecast only, but should also contain a conditional probability distribution of the target and instrument variables.

¹⁴ Alternative forms of ARCH-class models have also been tested but are excluded from this analysis due to their statistical insignificance for all three NMS (in particular the asymmetric effects captured by threshold and exponential GARCH). The orders of ARCH and GARCH components, as well as different lag operators of the regressors have been chosen by maximizing the likelihood ratio, minimizing the Akaike and Schwartz information criteria, and investigating probabilities associated with Q-statistics in correlograms of standardized residuals.

Republic, interest rate increases (or decreases) correspond with a concurrent domestic currency depreciation (or appreciation). This finding suggests active exchange rate management. This empirical result is not surprising considering that the CNB officially follows a managed float and the NBH has adopted an ERM2-shadowing regime (Roger and Stone, 2005; Jonas and Mishkin, 2005). A different reaction is detected for Poland, which has been following a pure float since April 2000. Its short-term interest rates react inversely to the one-period forwarded exchange rate, or in other words, the expected PLN appreciation seems to drive up current interest rates. In all three cases changes in domestic interest rates react positively to expected changes in the German (eurozone) interest rates, which indicates ongoing compression of yields on sovereign bonds. The conditional mean equation estimation also shows the negative, statistically significant GARCH conditional variance coefficient for the Czech Republic and (insignificant) Poland. In contrast, the GARCH coefficient for Hungary is positive. The negative signs imply the ongoing convergence of the market risk premium to the steady-state in the first two NMS. A similar progress in financial stability and monetary convergence in Hungary is unfortunately not apparent.

The estimated coefficients in the conditional variance equations point to the systemic and institutional differences in volatility dynamics in the NMS. The ARCH innovations or ‘surprises’ to the interest rate volatility are not uniform. Shocks to the conditional volatility are transmitted quickly into higher interest rates in the Czech Republic and Poland, while a similar reaction is delayed by one period in Hungary. In addition, the conditional interest rate volatility is highly persistent in the first two countries, as indicated by the GARCH coefficients closer to the unity. The volatility series show lower persistency but higher susceptibility to shocks in Hungary. Significant higher-order ARCH effects in Hungary and the Czech Republic suggests that the interest rate volatility dynamics are subject to diverse shocks of rather unspecified duration – the sources of which very likely lie outside the boundaries of the monetary policy influence. Not surprisingly, GED parameters in all three cases are considerably lower than two, implying a leptokurtic data distribution. Evidently, interest rate volatility tends to be exacerbated during turbulent market times, which suggests that financial markets in these countries still remain vulnerable to large, potentially destabilizing shocks. One could however reasonably expect that the forward-looking policy based on the proposed RIFT framework would likely provide a suitable venue for pre-emptive actions to counter anticipated shocks to interest rates.

The accuracy indicators for the forecasts generated by GARCH-M-GED are somewhat encouraging for adopting the estimated functional relationships as a monetary policy instrument rule. The forecast is highly accurate for Poland, as implied by the low value of the Theil coefficient and the very high covariance proportion relative to the sum of the bias and the variance proportions. In the cases of Hungary and the Czech Republic, the GARCH forecasts seem fairly accurate given the low values of the Theil coefficients. The forecasts, however, seem somewhat unstable as implied by the insufficiently low covariance proportions.

Further insights on the degree of stability of these forecast functions are provided by the GARCH variance distributions shown in Figures 2a-c.

..... insert Figures 2 a-c around here

The GARCH conditional variance series for the Czech Republic shows a significant shock to interest rates in the aftermath of the DIT adoption in 1998 (Fig. 2a). This can be explained by the CNB sharply increasing its interest rate target in response to the increase in administratively-regulated prices enacted by the Czech Government concurrently with the inception of DIT. By this action, the CNB defended the realization of the inflation target (Roger and Stone, 2005). Since 1999, the GARCH volatility of the Czech interest rates has been remarkably low and stable. These favorable conditions have been additionally reinforced by the adoption of a permanent low inflation target as of 2006. The low volatility of the GARCH series is encouraging for adopting a policy based on RIFT.

The GARCH conditional variance dynamics for Poland (Fig. 2b) show somewhat different results. Since the inception of DIT in January 1999, the interest rate pattern has been a subject to several shocks, all of which occurring during the early stage of the new policy regime between 1999 and 2003. During the first four years, the Polish DIT was based on the determination of year-end targets that were actively defended by the NBP (Orlowski, 2005). Specifically, the central bank reference rate reached 19 percent in February 2001. It was subsequently cut in several steps to 6.75 percent at the end of 2002 (Roger and Stone, 2005). In spite of such monetary tightening, the 1999 and 2000 inflation targets were significantly overshooted. The 2001 target was achieved as a result of the tight monetary policy, but the 2002 and 2003 targets were considerably undershooted. Since the beginning of 2003, the NBP switched from the year-end to the continuous inflation targeting within a 2.5-4.5 percent linear

trajectory band. In hindsight, the Polish experience with DIT implementation provides strong evidence in support of the permanent inflation target over the year-end target determination¹⁵. Among other advantages, the permanent linear-trajectory inflation targets allow policy-makers to reduce volatility of interest rates (lower interest rate risk) and, therefore, to engender higher degree of financial stability than the year-end targets, which frequently necessitate abrupt interest rate increases.

The volatility pattern of Hungarian interest rates (Fig. 2c) shows their considerable instability in 2002 and 2003, which resulted from the elevated inflation risk premium in response to a sharp deterioration of fiscal discipline and significant wage increases, particularly in the public sector (Kiss, 2005). In the 2002 election year, the government budget deficit jumped to 9.2 percent of GDP and was reduced only to 7 percent in the following year. To defend the inflation targets, the NBH raised interest rates. Its base reference rate reached 12 percent in January 2004 and has been decreasing since then along with the decline in private sector inflation expectations. The Hungarian case seems to highlight the notion that inflation targeting cannot be successful without a disciplined fiscal policy as well as a stable political situation (low political risk premium).

In sum, the presented empirical analysis shows that devising a reliable instrument rule for RIFT is possible, as the examined time-varying volatility dynamics relationships in NMS have become quite stable, particularly since the adoption of permanent inflation targets. The results underscore the importance of incorporating in the instrument function all three tested independent variables in the conditional variance equation: (1) the forwarded inflation differential, (2) the exchange rate and (3) the forwarded eurozone interest rate. They also call attention to the need to mitigate inflation and interest rate risks. In hindsight, the RIFT framework along with its policy rule encompasses a complex set of economic indicators that may provide mixed signals about policy preferences to financial markets. For this reason, the proposed policy needs to be understood by the public at large in terms of its viability for ensuring a successful convergence to the euro.

¹⁵ The advantages of permanent inflation targets are explained by King (1996).

6. A Synthesis

This study proposes an extension to the inflation targeting strategies currently pursued by NMS for the purpose of ensuring their successful monetary convergence to the euro. The proposed RIFT policy is based on targeting the inflation-forecast differentials between the converging country and the monetary union. In such modified framework, the low inflation target takes priority over the exchange rate stability objective. Accordingly, the inflation target is treated as a focal policy goal while the exchange rate stability is regarded as a policy indicator variable. The policy-makers considering relative inflation-forecast targeting may wish to develop a system of continuous monitoring and active responding to the differentials between the domestic and the foreign inflation-forecasts for a predetermined time-period. They may use a range of indicator variables that have a predictive power for inflation, including various measures of exchange rate stability.

The main prerequisite for adopting RIFT is a prior record of monetary stability, which will enable policy-makers to devise a reliable instrument rule guiding the inflationary process. At minimum, a stable functional relationship between the inflation forecast, exchange rate and market interest rates ought to be in place so that the transmission of changes in interest rates and the exchange rate into anticipated inflation should be known to policy-makers.

The empirical analysis shows that the determination of a stable instrument rule for RIFT is entirely possible and may serve well the euro-convergence policies of the Czech Republic, Poland and Hungary. The conducted GARCH-M-GED tests show pronounced, yet diverse interactions between short-term market interest rates, the inflation differentials and the exchange rates. They also prove some sensitivity of domestic interest rates to the German rates. However, the significance coefficients of these variables are not uniform. The diverse interactions between the key monetary variables highlight systemic and institutional differences underlying the euro-convergence process. Therefore, specific rules and means of pursuing the proposed RIFT based policy require careful tailoring to the existing institutional and behavioral conditions of a given country.

It shall be further noted that an effective implementation of RIFT is unlikely to be hindered by the policy constraints engendered by the ERM2, providing the reference exchange rate for the ERM2 entry is determined correctly. A properly determined entry rate should be fully aligned with the forecast of the long-run market equilibrium exchange rate that is credible for

financial markets. A suboptimal entry rate implies a narrower *de facto* than the *de jure* band of permitted currency fluctuations. It may exacerbate exchange rate volatility in response to market expectations of the reference rate resetting. It may further incite more frequent, costly and asymmetric foreign exchange market interventions. In essence, the precepts of RIFT are consistent with the Maastricht convergence criteria providing that the exchange rate band will be maintained at a wide +/- 15 percent range around the central parity rate. The wide band is likely to yield a sufficient degree of exchange rate flexibility that will enable the converging countries to implement inflation targeting strategies based on RIFT.

It seems that the intended euro adoption by the examined NMS is still distant enough to allow for modifications of their existing inflation-targeting regimes that take into account the euro-convergence parameters. Specific guidelines and prescriptions for RIFT need further discussion and articulation in order to make policies to this end entirely possible.

References

- Ball, L., 1999. Policy rules for open economies. In: Taylor, J. (Ed.), *Monetary policy rules*, University of Chicago Press. Chicago, Illinois, pp. 127-156.
- Begg, D., Eichengreen, B., Halpern L., von Hagen, J., Wyplosz C., 2003. Sustainable regimes of capital movements in accession countries. CEPR Policy Paper No. 10, London.
- Bernanke, B.S., Laubach, T., Mishkin, F.S., Posen, A.S., 1999. *Inflation targeting: lessons from the international experience*. Princeton University Press, Princeton, NJ.
- Błaszkiwicz, M., Kowalski, P., Rawdanowicz, Ł., Woźniak, P., 2004. Harrod-Balassa-Samuelson Effect in selected countries of Central and Eastern Europe. Centrum Analiz Społeczno-Ekonomicznych (CASE), Raport No. 57, Warsaw.
- Christofferssen, P.R., Wescott, R.S., 1999. Is Poland ready for inflation targeting? International Monetary Fund Working Paper No. WP/99/41. Washington, D.C.
- Corker, R.J., Beaumont, C., vanElkan, R., Iakova, D., 2000. Exchange rate regimes in selected advanced transition economies: coping with transition, capital flows, and EU accession. International Monetary Fund: Policy Discussion Paper No. 2000/3. Washington, D.C.
- Csermely, A., 2004. Convergence expectations and convergence strategies: lessons from the Hungarian experience in the pre-EU period. *Comparative Economic Studies* 46 (1), 104-126.
- De Grauwe, P., Schnabl, G., 2005. Nominal versus real convergence: EMU entry scenarios for the new EU member states. *Kyklos* 58(4), 537-555.
- Dibooglu, S., Kutan A.M., 2005. Sources of inflation and output movements in Poland and Hungary: policy implications for accession to the economic and monetary union. *Journal of Macroeconomics* 27 (2) 107-131.
- Égert, B., I. Drine, K. Lommatzsch and C. Rault, 2003. The Balassa-Samuelson effect in Central and Eastern Europe: myth or reality?. *Journal of Comparative Economics* 31(3), 552-572.
- Égert, B., Crespo-Cuaresma, J., Reiningger, T., 2007. Interest rate pass-through in new EU Member States: reborn from ashes merely to pass away? *Journal of Policy Modeling* 29(2), 209-225.
- Engle, R., 2004. Risk and volatility: Econometric models and financial practice. *American Economic Review* 94 (3), 405-420.
- European Central Bank, 2007. 2007 Convergence Report. ECB: Frankfurt, Germany.

- Faust, J., Henderson, D.W., 2004. Is inflation targeting best-practice monetary policy? In: Inflation targeting, prospects and problems. The Federal Reserve Bank of St. Louis Review, 86 (4), 117-144.
- Golinelli, R., Rovelli, R., 2005. Monetary policy transmission, interest rate rules and inflation targeting in three transition countries. Journal of Banking and Finance 29 (1), 183-201.
- Jonas, J., Mishkin F.S., 2005. Inflation targeting in transition economies: Experience and prospects. In: Bernanke, B.S., Woodford, M. (eds.) *The Inflation-Targeting Debate*, University of Chicago Press, pp. 353-413.
- Kenen, P., Meade, E.E., 2003. EU accession and euro: Closer together or far apart? Princeton University – Institute for International Economics, International Policy Briefs No. PB03-9.
- King, M.A., 1996. How should central banks reduce inflation? - Conceptual issues, in: *New Challenges for Monetary Policy - A Symposium sponsored by the Federal Reserve Bank of Kansas City, Kansas City, Missouri*, pp. 53-92.
- Kiss, G., 2005. Monetary policy in Hungary on the eve of EU membership. Bank for International Settlements Papers No. 23, pp. 156-160.
- Kočenda, E., Valachy, J., 2006. Exchange rate volatility and regime change: Visegrad comparison. Journal of Comparative Economics 34 (4), 727-753.
- Kočenda, E., Kutan, A.M., Yigit, T.M., 2006. Pilgrims to the eurozone: How far, how fast? Economic Systems 30 (4), 311-327.
- Levin, A.T., Natalucci, F.M., Piger, J.R., 2004. The macroeconomic effects of inflation targeting. In: Inflation targeting, prospects and problems. The Federal Reserve Bank of St. Louis Review, 86 (4), 51-80.
- Masson, P.R., 1999. Monetary and exchange rate policy of transition economies of Central and Eastern Europe after the launch of EMU. IMF Policy Discussion Paper No. PDP/99/5, International Monetary Fund, Washington, D.C.
- Matousek, R., Taci, A., 2003. Direct inflation targeting and nominal convergence: The Czech case. Open Economies Review, 14 (3), 269-283.
- Mishkin, F.S., 2000. Inflation targeting in emerging-market countries. The American Economic Review: AEA Papers and Proceedings 90 (2), 105-109.
- Natalucci, F. M., Ravenna F., 2002. The road to adopting the euro: monetary policies and exchange rate regimes in EU accession countries. Board of Governors of the U.S. Federal Reserve System, International Finance Discussion Papers: 741.

- Orlowski, L.T., 2001. From inflation targeting to the euro-peg: a model of monetary convergence for transition economies. *Economic Systems* 25 (3), 233-251.
- Orlowski, L.T., 2003. Monetary convergence and risk premiums in the EU accession countries. *Open Economies Review* 14 (3), 251-267.
- Orlowski, L.T., 2004. Money rules for the eurozone candidate countries. *Journal of Policy Modeling* 26 (7), 817-837.
- Orlowski, L.T., 2005. Monetary convergence of the EU accession countries to the eurozone: A theoretical framework and policy implications. *Journal of Banking and Finance* 29 (1), 203-225.
- Poon, S.H., Granger, C.W.J., 2003. Forecasting volatility in financial markets: a review. *Journal of Economic Literature* 41(2), 478-539.
- Roger, S., Stone, M., 2005. On target? The international experience with achieving inflation targets. International Monetary Fund: Working Paper No. WP/05/163, Washington, D.C.
- Svensson, L.E.O., 1999. Inflation targeting as a monetary policy rule. *Journal of Monetary Economics* 43 (3), 607-654.
- Svensson, L.E.O., 2000. Open-economy inflation targeting. *Journal of International Economics* 50 (2), 155-183.
- Svensson, L.E.O., 2003. What is wrong with Taylor rules?: Using judgment in monetary policy through targeting rules. *Journal of Economic Literature* 41(2), 426-477.

Table 1: Descriptive statistics of NMS and eurozone inflation series

	DIT adoption	Mean	Median	Standard deviation	Skewness	Kurtosis	Time trend	ADF stat.
Czech R.	Jan.1998	3.33	2.80	3.00	+1.90	6.67	-0.052	-2.72 (-2.88)
Poland	Jan. 1999	4.02	3.30	3.14	+0.81	2.47	-0.081	-1.60 (-2.89)
Hungary	June2001	5.48	4.90	1.96	+0.38	2.34	-0.018	-2.64 (-2.90)
Eurozone	Jan.1999 (euro inception)	2.04	2.10	0.43	-0.88	4.05	+0.005	-3.33 (-2.89)

Notes: monthly series of CPI-based year-on-year inflation for NMS since DIT adoption and HICP-based inflation for eurozone since euro inception, all through June 2007. Time trend = average monthly linear time trend coefficient. ADF = Augmented Dickey-Fuller test statistics (with McKinnon critical values at 5 percent in parentheses).

Data Source: Czech Statistical Office, Polish Statistical Office, NBH and Bundesbank.

Table 2: Volatility dynamics of RIFT instrument function.
GARCH(p,q)-M-GED tests, Eqs. (12) and (13), for the Czech Republic, Hungary and Poland. January 1995 – June 2007 sample period.

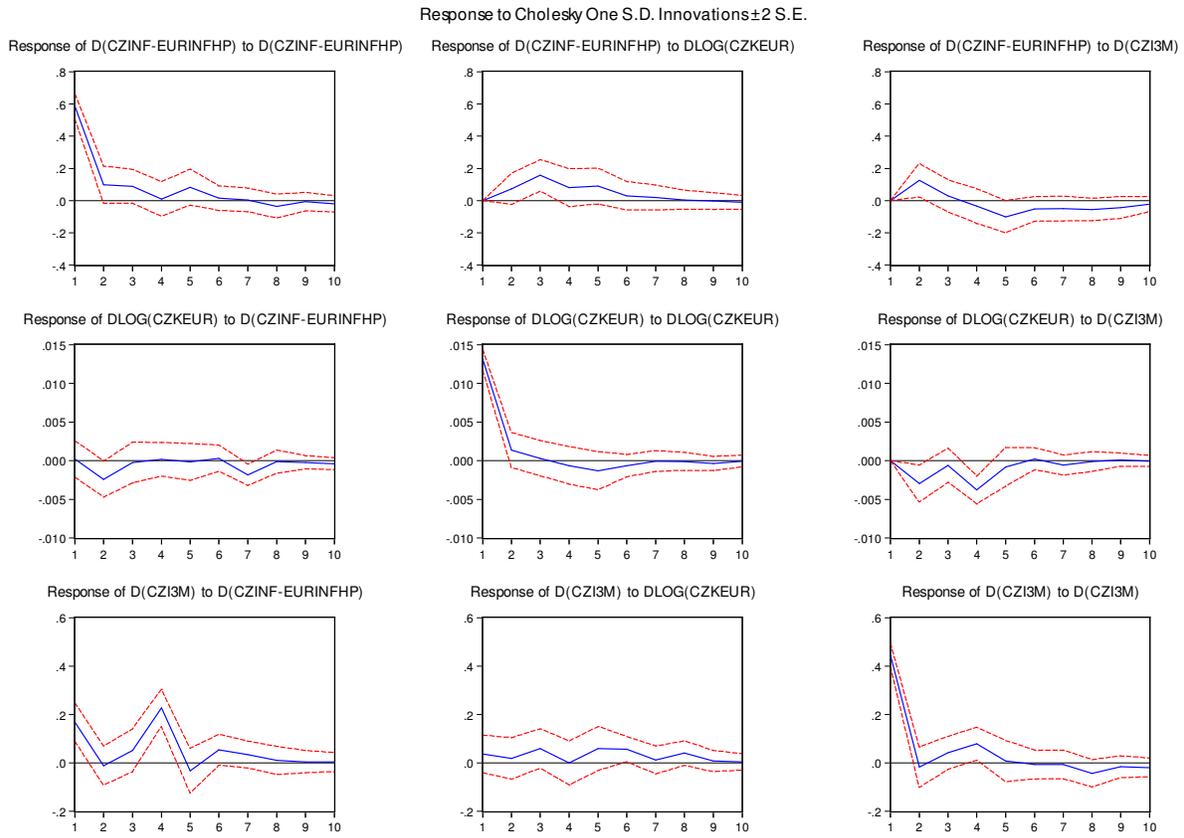
Dependent variable: change in the domestic short-term interest rate.

	Czech Republic	Hungary	Poland
<i>Applied lag operators for:</i>			
Δ inflation differential (τ)	+1	+1	+1
Δ log spot exchange rate (n)	0	0	+1
Δ German short-term interest r.(k)	+1	+1	+1
<i>Conditional mean equation</i>			
constant (β_0)	0.012 (1.46)	0.730 (5.10)***	-0.072 (-3.67)***
Δ infl. differential (β_π)	-0.002 (-0.029)	0.203 (13.25)***	0.172 (5.51)***
Δ log spot exchange rate (β_s)	1.900 (2.58)***	3.121 (4.17)***	-4.143 (-4.55)***
Δ German s.t. interest rate (β_f)	0.233 (3.71)***	0.128 (1.72)*	0.543 (2.77)***
GARCH cond. variance (β_ψ)	-0.395 (-3.15)***	1.087 (3.92)***	-0.027 (-0.50)
<i>Conditional variance eq.</i>			
Constant	0.002 (1.45)	0.185 (3.56)***	-0.001 (-0.71)
ARCH 1st order	0.541 (3.22)***	-0.011 (-1.50)	0.561 (1.83)**
ARCH 2 nd order	-0.500 (-3.22)***	0.059 (4.61)***	-0.489 (-1.64)*
ARCH 3 rd order	0.116 (3.04)***	-0.029 (-3.55)***	na
GARCH 1 st order	0.820 (12.83)***	0.606 (58.63)***	0.935 (18.35)***
GED parameter	0.810 (7.11)***	0.588 (7.03)***	0.808 (6.78)***
<i>Diagnostic statistics</i>			
log likelihood	1.573	-107.48	-108.79
AIC	0.127	1.601	1.605
SIC	0.350	1.824	1.807
<i>GARCH forecast accuracy</i>			
Theil U-coefficient	0.223	0.286	0.072
Bias proportion	0.042	0.853	0.026
Variance proportion	0.808	0.131	0.185
Covariance proportion	0.150	0.015	0.788

Notes: z-statistics are in parentheses; AIC and SIC are Akaike and Schwartz information criteria; nominal exchange rates are average monthly national currency values of the euro, and prior to 1999, of the German mark adjusted by its irrevocable conversion rate to the euro of 1.95583; differentials are monthly year-on-year national vis-à-vis eurozone headline CPI inflation rates; log of GARCH conditional variance applied for Hungary and GARCH cond. variance for Czech R. and Poland; *** indicates significance at 1%, ** at 5% and * at 10%.

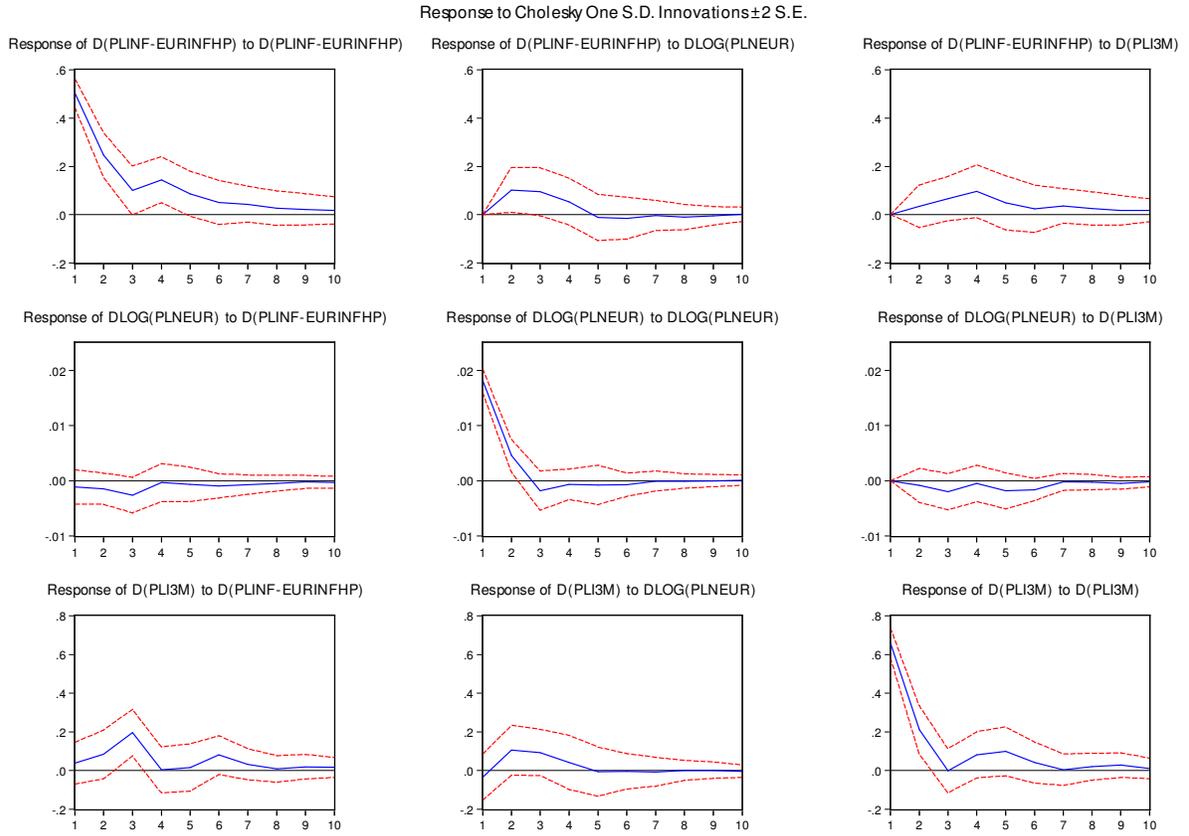
Source: Own computation based on the IMF, Bundesbank, CNB, NBH and NBP data.

Figure 1a: Impulse responses between inflation differentials vis-à-vis eurozone, exchange rate and short-term interest rate in the Czech Republic



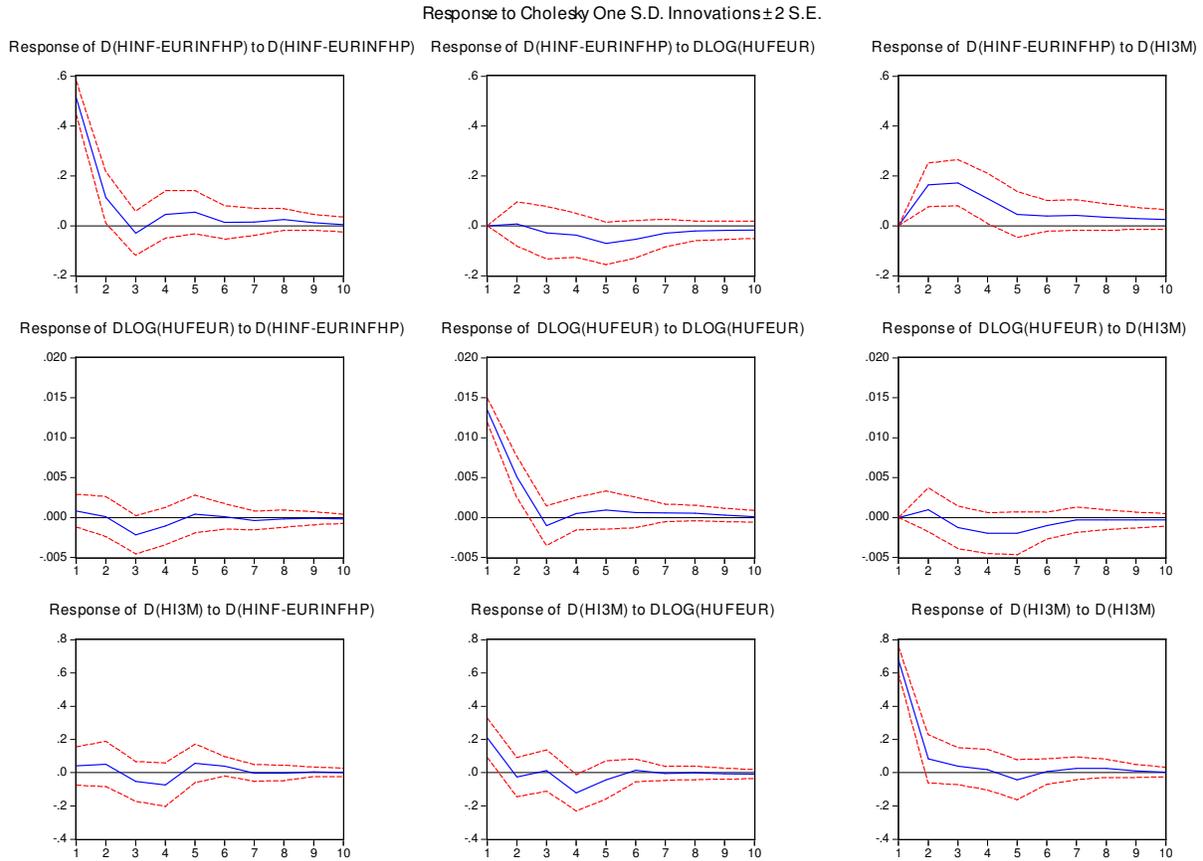
Data source: as in Table 2.

Figure 1b: Impulse responses between inflation differentials vis-à-vis eurozone, exchange rate and short-term interest rate in Poland



Data source: as in Table 2.

Figure 1c: Impulse responses between inflation differentials vis-à-vis eurozone, exchange rate and short-term interest rate in Hungary.



Data source: as in Table 2.

Figure 2a: GARCH conditional variance dynamics for the Czech Republic (generated from the functional relationship specified in Table 2).

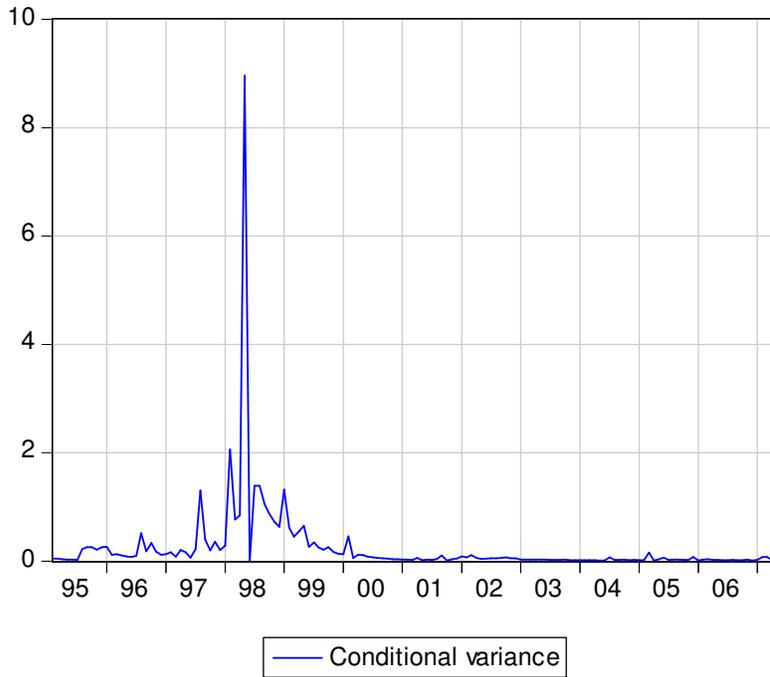


Figure 2b: GARCH conditional variance dynamics for Poland
(generated from the functional relationship specified in Table 2).

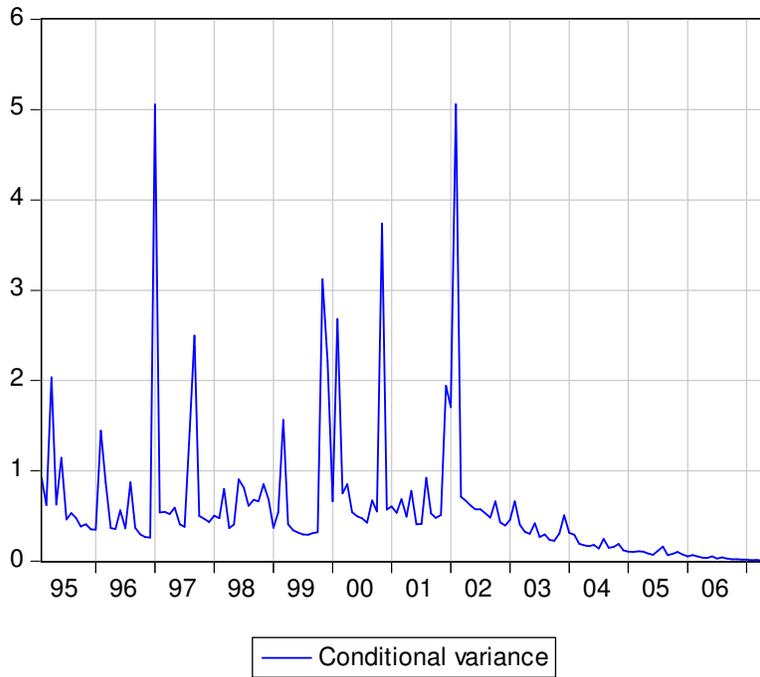


Figure 2c: GARCH conditional variance dynamics for Hungary
(generated from the functional relationship specified in Table 2).

