# *Implications of ERM2 for Poland's Monetary Policy*

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**Abstract:**

This study proposes an extension to the inflation targeting framework for Poland that takes into consideration the exchange rate stability constraints imposed by the obligatory participation in the ERM2 on the path to the euro. The modified policy framework is based on targeting the differential between the domestic and the implicit euro area inflation forecasts. The exchange rate stability objective enters the central bank reaction function and is treated as an indicator variable. Adjustments of interest rates respond to changes in the relative inflation forecast, while foreign exchange market intervention is applied for the purpose of stabilizing the exchange rate. The dynamic market equilibrium exchange rate is ascertained by employing the Johanssen cointegration tests and the threshold generalized autoregressive heteroscedasticity model with the in-mean extension and generalized error distribution (TGARCH-M-GED).



**JEL Classifications:** E58, E61, F33, P24.

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* Views presented in this paper are those of the authors and do not necessarily represent the official views of the National Bank of Poland

## 1. Introduction

This study is aimed at devising a monetary policy framework that is conducive to monetary convergence of Poland to the euro zone, particularly under the exchange rate stability constraints imposed by the obligatory participation in the ERM2. We take on the task of examining a proper transition from the current framework of direct inflation targeting (DIT) via ERM 2 to the actual euro adoption that is intended to take place at the end of the present decade.

An underlying assumption for our analysis is that a strict variant of DIT is not a suitable policy framework for facilitating convergence to the euro. Therefore, the euro-convergence process calls for adopting a more flexible DIT framework that would combine achieving price convergence with exchange rate stability. We identify two crucial convergence tasks for monetary authorities: reducing the (forward-looking) inflation differential and lowering exchange rate volatility. These objectives are treated in the following way. The central bank reaction function encompasses targeting a differential between the domestic and the implicit eurozone inflation forecast within a framework prescribed by Orlowski (2005b) as a relative inflation forecast targeting (RIFT). A central bank adjusts interest rates in response to changes in the relative inflation forecast. Exchange rate smoothing is viewed as a policy indicator variable and is secured primarily through foreign exchange market interventions.

We further analyze repercussions and policy responses to the official reference exchange rate set within the ERM2 mechanism, which may differ from the dynamic equilibrium exchange rate as perceived by financial markets. In general terms, an official rate that is perceived by the market as suboptimal is likely to exacerbate exchange rate volatility. A rate that is viewed as too weak may jeopardize the inflation target; while the one that is too strong may contribute to real currency appreciation and the deterioration of balance of payments. We estimate the dynamic market equilibrium exchange rate by employing Johanssen cointegration tests and the threshold generalized autoregressive heteroscedasticity model with the in-mean extension and generalized error distribution (TGARCH-M-GED).

The paper is organized as follows. Section 2 elaborates choices of parameters of a central bank loss function with respect to constraints imposed by the euro-convergence and ERM2. Different venues of expanding policy flexibility are overviewed in Section 3. A model outlining a central bank reaction function and instrument rules under the RIFT framework is developed in Section 4. The implications of deviations of various levels of the official reference exchange rate from the dynamic market equilibrium rate are covered in Section 5. Empirical estimation of the dynamic equilibrium rate on the basis of the cointegration and volatility dynamics tests is examined in Section 6. A synthesis along with some policy recommendations is presented in Section 7.

## 2. Flexible Inflation Targeting for Euro-Convergence

Following up on our assumption that monetary policy remains autonomous to the very end of the euro accession process while controlling a stable path of nominal exchange rate, we advocate supplementing the DIT framework with an ancillary objective of exchange rate stability. In quintessence, we see no conflict between the precepts of the ERM2 and a continuous pursuit of DIT, however, in a modified, more elaborate format. We certainly accept the constraints imposed by the ERM2, namely the requirements of: (1) applying this mechanism for at least two years prior to the examination period qualifying for the euro zone, (2) maintaining currency stability within a 'normal' band of fluctuations and (3) refraining from currency devaluation in any form. We agree with a widely accepted opinion that participation in ERM2 should not exceed the arbitrarily imposed minimum two-year period, sharing the views of Szapáry (2000), Kennen and Meade (2003), and Kočenda, Kutan and Yigit (2005), among others. In hindsight, while the ERM2 necessitates the pursuit of exchange rate stability objective, we view the possibility of incorporating it into DIT framework as a preferred policy option, which will preserve policy autonomy to the very end of the euro-convergence process.

The choices between price stability and exchange rate stability objectives can be explained by weighting parameters of an open economy central bank loss function. It is not our intention to estimate the parameters based on the current or projected monetary policy of a converging country's central bank, particularly the National Bank of Poland (NBP) but rather to discuss the choices facing monetary authorities for the purpose of providing guidance for making current DIT strategy more flexible. Therefore, we design a central bank reaction function based on a more elaborate model that will possibly offer more specific guidance for policy-makers than the standard theoretical loss function.

The quadratic loss function is stated as:

$$L = \omega_1(\pi_t - \bar{\pi}_t)^2 + \omega_2(y_t - \bar{y}_t)^2 + \omega_3(s_t - \bar{s}_t)^2 \qquad (1)$$

The loss function is devised for an open economy framework and nominal, not real, convergence to a common currency system. Therefore, nominal rather than real exchange rate is entered into it. In theory, the exchange rate could be treated here in a more conventional way as a real rate, but in more practical and feasible terms it is determined as a nominal rate. Following the logic of this open-economy loss function, a monetary authority needs to prioritize the inflation, output stability and the exchange rate objectives. If the weight on inflation target ( $\omega_1$ ) is equal to unity and the remaining weights are zero, the central bank assigns an exclusive priority to the inflation target and the policy framework that follows this logic is defined as *strict DIT*. But when the central bank lowers the weight on inflation target and raises either one of the two remaining $\omega$-weights, it switches to *flexible DIT* strategy (Svensson, 1999).

**Table 1:** Loss Function Parameters under Strict and Flexible DIT

| ***Variant*** | ***Parameters*** | ***Advantages*** | ***Dangers*** |
|---|---|---|---|
| **Strict DIT** | $\omega_1 = 1, \omega_2 = 0, \omega_3 = 0$ | Effective strong disinflation, improved c. b. credibility | Potentially high welfare costs |
| **Flexible DIT in developed closed economy** | $\omega_3 = 0$ | Disinflation and growth, lower welfare costs, condition: ex ante credibility | Exch. Rate instability (depending on the level of openness) |
| **Flexible DIT in open economy under monetary convergence** | $\omega_2 = 0$ | Disinflation, stable exchange rate | Some, hard to specify welfare costs |

Source: the authors.

Strict DIT was the only viable and credible option for central banks in transition economies when their knowledge about the aggregate demand and the exchange rate channels of monetary policy transmission was limited. But once the price stability was achieved, central banks began infusing flexibility into their DIT frameworks by increasing weights on either the output or exchange rate stability.

Since the Maastricht criteria for monetary convergence call for achieving low inflation as well as the exchange rate stability, without considering the output growth ($\omega_2 = 0$), a proper balance between $\omega_1$ and $\omega_3$ is required for increasing the DIT flexibility.[1] By a general rule, the weights assigned to $\omega_1$ and $\omega_3$ depend directly on the degree of openness. For a more open economy, which is more susceptible to external shocks, $\omega_3$ shall be greater than $\omega_1$. This also stems from a more pronounced exchange rate channel of monetary policy transmission in open economies (Golinelli and Rovelli, 2005).

It shall be further noted that the shape of the loss function adopted by a central bank switching from strict via flexible DIT to ERM2 requires a careful consideration. First, a quadratic loss component related to nominal deviation from an officially-adopted reference exchange rate $\bar{s}_t$ is an imprecise approximation of the actual loss faced by the central bank within the ERM2 mechanism. While the official definition of the exchange rate stability criterion is imprecise[2], it appears that the deviations on the weak side of the ERM2 corridor will entail greater welfare loss than deviations on the strong side would. This stems from the fact that central parity can be revalued within the EMR2 framework, while central parity devaluation

[1] Viability and applicability of the Maastricht convergence criteria to new Member States are subject to intense scrutiny and debates, as they reflect the European Commission's apparent precept that the euro candidates should be treated as an isomorphic block, disregarding their prevalent structural and institutional differences (Szapáry, 2000; Kenen and Meade, 2003).

[2] The assessment of meeting the exchange rate stability criterion is subject to interpretations and judgments based on the analysis of deviations from the prescribed band (Jonas, 2004). Initially, the ERM1 band was set at +/- 2.25 percent around a central parity rate. However, following the 1992 currency crisis, the ERM2 was introduced by widening the band to +/-15 percent. Based on the opinions of both the European Commission and the ECB one may conclude that, despite the "equal treatment" wording used in official documents, the criterion of 2.25 percent deviation from the parity will not be adopted strictly. It seems that if a given country fulfills the Maastricht fiscal, inflation and interest rate criteria, and during the ERM2 period it experiences a few short-lived significant depreciations from the parity, it would not be qualified as failing to pass the exchange rate stability test. Nevertheless, the European authorities will review every deviation from the parity on the case by case basis.

would automatically reset the minimum two year testing period back to the beginning. Consequently, the welfare loss resulting from nominal exchange rate deviating by, for example, 4 percent from the central parity on the weak side should be a lot bigger than a loss associated with the 4 percent deviation on the strong side. In essence, the welfare loss associated with the currency appreciation is much less significant than the one stemming from the same percentage level of currency depreciation. However, once the currency depreciates more than could possibly be accepted by the European Commission and the ECB (for example by 5 percent or more), the ERM2 clock will restart from zero again, and further depreciation may not be associated with rapid increases of the welfare loss.

To our knowledge, there is little evidence suggesting that adding the exchange rate stability objective to the central bank loss function is welfare enhancing. Ball (1999) and Haldane (1997), among others, argue that exchange rate movements have an impact on both inflation and output, so exchange rate volatility is already captured by the other two terms in the loss function. But even if we assumed that central banks had knowledge of these results, they would act as if exchange rate term were explicitly put into the loss function.

A debatable issue is whether the output gap variable needs to be included in a loss function in the countries converging to the euro. After all, an output gap and real convergence benchmarks are not included among the Maastricht convergence criteria. In principle, we subscribe to the opinion of incorporating the output gap variable since the policy efforts to achieve the low inflation target prescribed by the Maastricht criteria will likely entail certain output losses[3]. Alternatively, central bank may want to stabilize inflation expectations at low enough level few years before the ERM2 test, which may require that output will be kept below its potential level for a prolonged period of time. This approach, however, may be associated with additional risks. Monetary policy ignoring the output gap in the loss function may result in asymmetric approach to inflation risks and could tolerate higher than necessary output losses. This in turn could undermine the popular support for the euro adoption.

[3] The lowest can be 1.5 percent if there are three countries with zero inflation when the inflation criterion is computed, which is consistent with the rule of thumb adopted by the Commission to exclude countries with HICP deflation from the computation of the inflation criteria. It is worth noting that the new Member States face by definition tougher inflation criterion that the incumbent Members, because now three countries are chosen from among 25, as opposite to 15 members, thus the probability of finding a country with zero inflation is now higher.

Under different policy scenarios the weights assigned by the central bank to the loss function terms are quite different. Strict inflation targeting is characterized by following weights:

$$\omega_1 > 0, \omega_2 = 0, \omega_3 = 0$$

Flexible inflation targeting in a small open economy may have weights:

$$\omega_1 > 0, \omega_2 > 0, \omega_3 > 0, \omega_1, \omega_2 > \omega_3,$$

Upon joining the ERM2, a central bank may wish to emphasize the exchange rate stability objective weighted as:

$$\omega_1 > 0, \omega_2 > 0, \omega_3 > 0, \omega_1 >> \omega_2, \omega_3 >> \omega_2, \omega_3 > \omega_1,$$

The weight distribution upon entering the ERM2 implies that the prior strict inflation targeting regime is replaced with *a hybrid of inflation and exchange rate targeting.* [4]

## 3. Strategies for Combining Price Convergence and Exchange Rate Stability

There is a well-established consensus in the literature that the DIT declaration alone does not guarantee its success (Taylor, 2000; Jonas and Mishkin, 2003; Eichengreen, 2005). The announcement of inflation goals needs to be supported with an analytical model outlining a set of monitoring formulas, such as money demand functions, core inflation forecasts, exchange rate behavioural models, etc., as well as instrument rules, generally based on various forms of open-economy Taylor or first-difference rules. More advanced versions of full-fledged DIT ought to encompass such well-prescribed behavioural and policy-reaction functions. For the countries

[4] On practical grounds, this policy option is suitable for the larger euro-candidate countries. The smaller candidates, such as the Baltic States, whose financial markets are less developed thus not fully capable of providing necessary signals for implementation of inflation targeting should continue embracing their present currency board arrangements.

required to enter the ERM2 in order to adopt the euro, DIT ought to be augmented with an exchange rate stability objective.

There have been several noteworthy proposals in the literature pertaining to reformulation of the present monetary policies in Poland and other new Member States on the final passage to the euro - some calling for a radical regime switching while others devising a smooth transition. Nonetheless, the majority of studies voice concerns over incompatibility of current DIT strategies with the exchange rate convergence criterion embodied in the ERM2. They anticipate high costs of switching regime back to exchange-rate-based monetary policy upon the ERM2 entry (Natalucci and Ravenna, 2002; DeGrauwe and Schnabl, 2004; Kočenda, Kutan and Yigit 2005) assuming the prevalence of Harrod-Balassa-Samuelson effects[5].

The proposals for a gradualist approach to adjusting monetary policies are based on various degrees of reformulation of current DIT regimes. They all call for a greater flexibility of DIT by placing more or less balanced weights on inflation and exchange rate stability targets. In all cases, the inclusion of the exchange rate stability objective is believed to be critical for a successful convergence. In spite of the differences in specific policy prescriptions among the discussed proposals, the gradualist approach recognizes the importance of allowing sufficient time for a successful coordination of monetary, real and institutional convergence thus remains in a fundamental disagreement with calls for a leap to early euroization.

An extreme departure from the strict DIT policy is proposed by Bofinger and Wollmershäuser (2001, 2002) who advocate adopting a monetary regime based on flexible exchange rate targeting for the final passage to the euro. In their policy scenario, exchange rate stability becomes the key policy objective, while price stability plays a secondary role, as it is presumed to be derived from less volatile exchange rates. In terms of the central bank's loss function (Eq. 1), they prioritize $\omega_3$ over $\omega_1$. Their stance also implies a significant regime switch

[5] The assumption of continuous Harrod-Balassa-Samuelson effects ought to be viewed with an extreme caution. This phenomenon claims that high inflationary pressures stem from productivity improvements in the tradable goods sector that drive up wages and prices of non-tradables thus aiding inflation. There is a convincing empirical evidence that these effects have evaporated by now in the new Member States (Égert, et.al., 2003; Błaszkiewicz, et.al., 2004). We fully share this opinion.

that might prove to be costly, due to the requirement of frequent foreign exchange market interventions, particularly if financial markets are institutionally unprepared for absorption of nominal shocks. In addition, it might be reasonable to expect that the monetary regime focusing strictly on exchange rate stability (even in a stricter form than the one allowed by the ERM2) will exacerbate price instability. It is because the exchange rate channel of monetary policy transmission in the larger new Member States is highly unstable (Orlowski, 2003)[6]. Therefore, a smooth transmission of more stable exchange rate into low inflation is not automatically guaranteed upon adopting a flexible exchange rate targeting regime.

A more balanced weighting of inflation and exchange rate stability targets is discussed by Jonas (2004). His 'dual target-one instrument' policy scenario extends the present DIT regimes by assigning equal importance to inflation and the exchange rate stability targets, $\omega_1 = \omega_3$. Yet, the actual implementation of such policy may pose serious difficulties as there are several identifiable conflict areas between the two targets. Among them is a possible combination of currency appreciation and high inflation in the presence of large capital inflows. A proper response to a stronger national currency would require lowering interest rates that subsequently could jeopardize the inflation target. On the contrary, raising interest rates in response to higher inflation may lead to real currency appreciation and exacerbate exchange rate volatility. Possible conflicts between those targets are likely to emerge particularly in the presence of the Harrod-Balassa-Samuelson effects. Given that these effects are presently less important than they were at the early stages of economic transition, the arguments for an early unilateral euroization, which are derived on their basis, seem to have little merit. Moreover, the dual target-one instrument strategy is based on adjustments of interest rate as a single policy tool aimed at hitting both targets simultaneously. Needless to say, such solution seems impractical.

The weakest weight on the exchange rate is found in the RIFT framework advanced by Orlowski (2005b) who treats the exchange rate stability objective as a policy indicator variable, not as a target variable, and assigns the highest weight on the inflation target. In essence, the RIFT emphasis is on achieving price stability while exchange rate stability is treated as an

[6] A more optimistic view is presented by Golinelli and Rovelli (2005) whose empirical tests indicate a seemingly robust channel of monetary policy transmission in the NMS.

outcome derived from inflation targeting. A strong priority placed on disinflation allows for reducing possible conflicts between the two objectives.

For the purpose of facilitating convergence to the euro, the RIFT framework assumes a perfect identity between the long-term inflation targets of the candidate country and the eurozone.[7] The RIFT operational procedure is based on adjusting policy instrument in response to the deviations of the CPI-inflation forecast of the candidate relative to the eurozone for a specified period ahead. If the candidate's expected relative inflation rises, its central bank may either raise domestic interest rates or allow domestic currency to depreciate in euro terms, but only if the anticipated inflation shock is perceived as temporary. In addition, since the ancillary exchange rate stability objective is treated only as an indicator, not as a target variable, the central bank of the converging economy will respond to an observed excess exchange rate volatility (or a surge in the exchange rate risk premium) with foreign exchange market intervention, while the interest rate instrument will react mainly to changes in the relative inflation forecast. Thus in quintessence, RIFT can be described as a combination of a forward-looking DIT and a managed float. However, if the observed exchange rate volatility is destabilizing and is likely to endanger realization of the inflation target, it may be also curtailed with higher interest rates.

The basic precepts of RIFT guide our analytical model. The RIFT operating targets and instruments under the constraints imposed by ERM2 are implied by the analytical model presented below that is derived from some basic structural open-economy identities.

[7] In practical terms, the inflation guidance can be derived from the ECB definition of price stability, which is quantified as a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) of below 2 percent over the medium term (ECB, 2004a, p. 50). This is not significantly different from the Maastricht convergence benchmark that requires the euro-candidates' inflation not to exceed 1.5 percent above the average of the three lowest inflation rates among the EU members. It has been recently reported at 2.4 percent (ECB, 2004b).

## 4. Reaction Function and Instrument Rule

As a basis for constructing our policy model, we assume that the output gap is $x_t = y_t - \bar{y}_t$ , thus it is defined as a difference between the actually observed and the potential output determined at time t. The model is derived from three structural equations:

Open-economy IS curve

$$x_t = \alpha_1 x_{t-1} - \alpha_2 r_{t-1} - \alpha_3 e_{t-1} + \xi_t \tag{2}$$

Open-economy accelerationist Phillips curve

$$\pi_t = \pi_{t-1} + \beta_1 x_{t-1} - \beta_2 \left(e_{t-1} - e_{t-2}\right) + \eta_t \tag{3}$$

Real exchange rate (higher value means domestic currency appreciation)

$$e_t = \theta r_t + \upsilon_t \tag{4}$$

$r_t$ is real interest rate, $e_t$ real exchange rate, and $\xi_t, \eta_t, \upsilon_t$ are stochastic shocks that capture the effects of omitted variables.

Construction of our model is based on a general assumption of symmetric partial information between the central bank and the aggregate private sector in order to satisfy the certainty-equivalence and to uphold separation between optimization and estimation, similarly to Svensson and Woodford (2000). We further assume the following operational procedure of a central bank. First, the bank chooses $r_t$ or in essence, a nominal $i_t$ adjusted for the inflation forecast for $\tau$ - periods ahead

$$r_t = i_t - \hat{\pi}_{t+\tau} \tag{5}$$

Second, the bank monitors changes in $i_t$ that affect $\pi_{t+\kappa}$ through the exchange rate-, expectations- and other monetary policy transmission channels, while it affects $x_t$ mainly through the aggregate demand (credit) channel. One can reasonably expect that the relative importance of transmission channels is highly sensitive to the prevalent type of monetary regime. The early exchange rate pegging relied on the exchange rate channel. Various departures have increased reliance on alternative channels. Specifically, since its adoption, a DIT policy framework 'activates' the expectations channel, while the role of the remaining ones remains ambiguous. By analogy, the proposed venues of policy flexibility on the passage towards the euro may have an impact on the relative importance of these channels. In order to be effective and plausible, the proposed framework of flexible inflation targeting requires some relevance of the expectations channel.

The real exchange rate can be further decomposed by inserting Eq, (5) into (4), which gives

$$e_t = \theta i_t - \theta \hat{\pi}_{t+\tau} + \upsilon_t \tag{6}$$

Thus the level of real exchange rate is a function of contemporaneous domestic interest rate, expected rate of inflation for $\tau$-periods ahead and a stochastic shock. Assuming that both the purchasing-power parity (PPP) and uncovered interest parity (UIP) conditions hold, the risk premium is equal to the difference between domestic and the currency union interest rates $i_t - i_t^*$, augmented with the expected domestic currency appreciation (or depreciation with a negative sign) for the targeted time horizon $\tau$.

$$\upsilon_t = i_t - i_t^* + \Delta \hat{s}_{t+\tau} \tag{7}$$

In essence, the stochastic term $\upsilon_t$ can be interpreted as the country-specific, time-varying risk premium. It is critical to view it in such a way for an economy converging to a currency union since it can be interpreted as an indicator of substitutability between the domestic and the reference currency as the expected exchange rate can be replaced with the *ex post* observed rate.

If a large, systematically positive or negative risk premium is present, substitution between the two currencies remains out of sight. But the variance of the risk premium close to zero means a progress in monetary integration as both currencies become accepted as close substitutes. If monetary integration is in place, forecast errors will be small and the path of exchange rate variations will become predictable. This will enable monetary authorities to determine a 'safe' reference rate for a smooth convergence to a currency union.

As proposed by Orlowski (2003), the risk premium variations are attributable to fluctuations in interest rates or in nominal exchange rate. Therefore,

$$\upsilon_t = \upsilon_{rt} + \upsilon_{st} \tag{8}$$

We further assume that both interest rate and exchange rate volatility components can be treated in an intertemporal setting as multivariate moving average representations or a vector autoregressive process for a finite period k – VAR(k). The VAR(k) of real interest rate is

$$\upsilon_{rt} + \rho\upsilon_{rt-1} + ... + \rho^k \upsilon_{rt-k} = \sum_{h+0}^{k} \rho^h \upsilon_{rt-h} = \Phi_t \tag{9}$$

The VAR(k) of r is defined as a country-specific time-varying *inflation risk premium* $\Phi_t$, which is an average variation in the real interest rate over an observed, specified period h. It is imperative to assume that volatility of inflation, not of the nominal interest rate, is the main source of variation in the real interest rate. If correlation between nominal interest rates and the exchange rate were strong, ordinary least square estimation of their sensitivity parameter would be biased and inconsistent. It would certainly be the case if the exchange-rate-based monetary policies were in place, carried through responses of the nominal interest rate differential to the current exchange rate. On the contrary, the DIT based policies would weaken correlation between nominal interest rates and the exchange rate making an inflation risk premium more identifiable.

By analogy, we define the average variation of the nominal exchange rate as a country-specific time-varying *exchange rate risk premium* $\Psi_t$ stemming from the VAR(k) process of nominal exchange rate variations

$$\upsilon_{st} + \rho\upsilon_{st-1} + ... + \rho^k \upsilon_{st-k} = \sum_{h+0}^{k} \rho^h \upsilon_{st-h} = \Psi_t \tag{10}$$

Accounting for risk premia, Eq. (6) can be modified as

$$e_t = \theta i_t - \theta\hat{\pi}_{t+\tau} + \Phi_t + \Psi_t \tag{11}$$

It can be further assumed that multivariate shocks to $\Phi_t$ and $\Psi_t$ may have an impact on the path of inflation and real exchange rate for $\tau$ -periods ahead.[8] This reformulation of the exchange rate allows for deriving an interest rate rule, as practical instrument rule guiding central bank decisions. Such rule should be associated with the task of sustaining the balance of payments, thus requiring the central bank to prevent real currency appreciation. Therefore, if $e_t = 0$, Eq. (10) can be restated as

$$i_t = \hat{\pi}_{t+\tau} + \frac{1}{\theta}(\Phi_t + \Psi_t) \tag{12}$$

Consistently, the target nominal short-term interest rate is viewed as a sum of the inflation forecast for $\tau$ -periods ahead, augmented with the sum of the known, prevalent exchange rate and inflation risk premia. In principle, it can be understood in the Brownian motion sense as a trajectory or drift component (the inflation forecast) and the cumulative sum of volatility stemming from inflation risk and exchange rate risk observed average variations. In order to alleviate a unit root problem, the interest rate process can be restated in dynamic, first-differenced terms

[8] Disaggregation of a time-varying country-specific risk for the countries converging to the euro into exchange rate and inflation risk has been originally proposed by Orlowski (2003). Holtemöller (2003) provides a compelling estimate of the size and volatility of country-specific risk premia for EMU accession countries by employing rolling regression tests.

$$\Delta i_t = \Delta \hat{\pi}_{t+\tau} + \Delta \frac{1}{\theta}(\Phi_t + \Psi_t) \tag{13}$$

A more exact specification of the interest rate rule for an open economy requires incorporating foreign nominal interest rate and inflation variable (denoted with an asterisk)

$$\Delta(i_t - i_t^*) = \Delta(\hat{\pi}_{t+\tau} - \hat{\pi}_{t+\tau}^*) + \Delta \frac{1}{\theta}(\Phi_t + \Psi_t) \tag{14}$$

The instrument rule prescribed by Eq. (14) is appropriate for implementation of the RIFT framework. Accordingly, long-term domestic inflation target $\bar{\pi}_{t+\tau+k}$ becomes identical with that of the currency union $\bar{\pi}_{t+\tau+k}^*$. This relative interest rate rule is a first difference rule (DR) rather than a standard open-economy Taylor rule (TR) as defined by Walsh (2003). TR is normally stated in level terms and does not follow a stationary process, while DR resolves the unit root problem[9]. Also, the risk premium component $\Delta \frac{1}{\theta}(\Phi_t + \Psi_t)$ can be prescribed as a Wicksellian *neutral interest rate,* because it is devised as a dynamic autoregressive process; rather than the Taylor's natural rate of interest, which is normally stated in level terms. For monetary convergence to be successful, the constant path $\frac{1}{\theta}$ of risk premia must converge to zero. It can be also observed that the prescribed DR rule is different from monetary condition index (MCI) targeting rules that are based on combination of interest rate and real exchange rate as policy instruments. In our opinion, MCI targeting is logistically difficult if not implausible for the countries aspiring to join the euro, in spite of its recognized general usefulness for emerging market economies (Eichengreen, 2005) as well as its specific applicability for Turkey (Us, 2004) or New Zealand (Hunt,1999).

[9] As argued by Svensson (2003), standard Taylor rules might yield suboptimal results because they are not modeled as first-order optimizing rules thus are not useful for economic agents that normally seek achieving dynamic optimization conditions. This holds true particularly in the economy entering an intrinsically dynamic process of monetary convergence to a currency union.

Under full commitment to RIFT, a central bank will adjust interest rates to ensure an appropriate alignment between the domestic and the implicit foreign inflation forecast. Then, the nominal exchange rate variability will become the main source of real exchange rate variability. Therefore, a central bank will attempt to reduce nominal rate fluctuations with unannounced foreign exchange market interventions, based, however, on some predetermined formulas.

A similar instrument rule suitable for RIFT can be derived from the structural identity between the open-economy IS curve and the accelerationist Phillips curve. In order to devise a sensible inflationary process from the set of Eqs. (1), (2) and (6), we first extract the lagged output gap from Eq. (1)

$$x_{t-1} = \alpha_x^{'} x_t + \alpha_r^{'} r_{t-1} + \alpha_e^{'} e_{t-1} + \xi_t^{'} \tag{15}$$

where $\alpha_x^{'} = \dfrac{1}{\alpha_x}$, $\alpha_r^{'} = \dfrac{\alpha_r}{\alpha_x}$ and $\alpha_e^{'} = \dfrac{\alpha_e}{\alpha_x}$.

By definition, $r_{t-1} = i_t - \hat{\pi}_{t+\tau-1}$. Subsequently, by folding Eq. (15) into the Phillips curve equation (2) and dividing it by $\beta_x \alpha_r^{'}$ we obtain

$$\gamma_\pi \Delta\pi_t + \hat{\pi}_{t+\tau-1} = \gamma_x x_t + i_{t-1} + \gamma_e e_{t-1} + \eta_t^{'} \tag{16}$$

where $\gamma_\pi = \dfrac{1}{\beta_x \alpha_r^{'}}$ , $\gamma_x = \dfrac{\alpha_x^{'}}{\alpha_r^{'}}$ and $\gamma_e = \dfrac{\alpha_e^{'}}{\alpha_r^{'}}$.

Under DIT framework, an inflation target $\overline{\pi}_{t+\tau}$ for $\tau$-periods ahead as well as the target-consistent nominal interest rate $\overline{i}_t$ are introduced, which allows for modifying Eq. (16) into

$$\gamma_\pi \Delta\pi_t + \hat{\pi}_{t+\tau-1} - \overline{\pi}_{t+\tau} = \gamma_x x_t + \gamma_i (i_{t-1} - \overline{i}_t) + \gamma_e e_{t-1} + \eta_t^{''} \tag{17}$$

Strict DIT calls for the elimination of the output gap and the real exchange rate, thus $\gamma_x$ and $\gamma_e$ both equal zero, while $\gamma_\pi$ equals unity.

The central bank reaction function prescribed by Eq. (17) is further modified by incorporating the determinants of the real exchange rate as specified by Eq.(11). Inserting (11) into (17) results in the inflation targeting reaction function that focuses on domestic variables

$$\gamma_{\pi d}\Delta\pi_t + \gamma_{f\pi d}\hat{\pi}_{t+\tau-1} - \overline{\pi}_{t+\tau} = \gamma_{id} i_{t-1} - \gamma_{iT}\bar{i}_t + \gamma_e\Phi_{t-1} + \gamma_e\Psi_{t-1} + \eta_t^{''} \tag{18}$$

where the parameter of the domestic inflation forecast is specified as $\gamma_{f\pi d} = (1+\gamma_e\theta)$, the parameter of the one-period lagged interest rate is $\gamma_{id} = (\gamma_i + \gamma_e\theta)$ and the parameter of the target interest rate corresponding with the inflation target is $\gamma_{iT} = \gamma_i$. The function describes a forward-looking flexible inflation targeting framework, which assigns a strong priority to the inflation target, excludes the output stability objective by assuming $\gamma_x = 0$ and incorporates the objective of exchange rate stability by including the one-period lagged exchange rate risk premium. It can be certainly rewritten for the differential between the one-period lagged and the target interest rate as a dependent variable.

In order to account for the convergence process, it is necessary to formulate a currency union's inflation targeting process

$$\gamma_{\pi f}\Delta\pi_t^* + \gamma_{f\pi f}\hat{\pi}_{t+\tau-1}^* - \overline{\pi}_{t+\tau}^* = \gamma_{if} i_{t-1}^* - \gamma_{iT}\bar{i}_t^* \tag{19}$$

The convergence process requires combining the domestic and implied foreign reaction functions specified by Eqs. (18) and (19). However, in order to facilitate a successful convergence, it is necessary to make at least two rigorous assumptions. First, long-term inflation targets of both parties are to be identical. In practical terms, it means that the candidate country should be able to meet the implicit long-term foreign inflation target by the time of the official euro entry. Therefore, $\overline{\pi}_{t+\tau} = \pi_{t+\tau}^*$ with a possibility of allowing some additional period of time beyond $\tau$ if the formal euro adoption is to be delayed. Second, it is indispensable to coordinate the interest rate targets in the long-run, in order to ensure consistency between the inflation target and the target interest rate level $\bar{i}_t = \bar{i}_t^*$ . On practical grounds, this assumption would necessitate a full long-term interest rate compression as a prerequisite for joining the eurozone, or perhaps even for entering the ERM2. Subtracting Eq. (19) from Eq. (18) allows to formulate a central bank reaction function that combines price stability and convergence objectives under a flexible DIT framework, or specifically, under RIFT. The reaction function is prescribed as

$$\gamma_{\pi d}\Delta\pi_t - \gamma_{\pi f}\Delta\pi_t^* + \gamma_{f\pi d}\hat{\pi}_{t+\tau-1} - \gamma_{f\pi f}\hat{\pi}_{t+\tau-1}^* = \gamma_{id}i_{t-1} - \gamma_{if}i_{t-1}^* + \gamma_e\Phi_{t-1} + \gamma_e\Psi_{t-1} + \eta_t^{'''} \qquad (20)$$

The corresponding instrument rule (an open economy Taylor rule) forwarded one period relative to that directly stemming from Eq. (20) is

$$\gamma_{id}i_t - \gamma_{if}i_t^* = \gamma_{\pi d}\Delta\pi_{t+1} - \gamma_{\pi f}\Delta\pi_{t+1}^* + \gamma_{f\pi d}\hat{\pi}_{t+\tau} - \gamma_{f\pi f}\hat{\pi}_{t+\tau}^* - \gamma_e\Phi_t - \gamma_e\Psi_t + \eta_t^{''''} \qquad (21)$$

It is evidently a forward-looking rule that weights strongly on the inflation objective. The function stated in level-variables is very likely to suffer from unit root problems, thus for estimation purposes and practical policy guidance all variables in Eq. (21) should be entered in first-differenced terms. The function will then assume the form identical to that prescribed by Eq. (14).

In essence, the policy instrumentalization prescribed by Eq. (21) is carried through the impact on risk premia[10]. If the domestic inflation forecast rises above the foreign inflation forecast, a central bank has two choices: it may either increase nominal interest rates, thus boosting the inflation risk premium, or it may allow the domestic currency to depreciate, increasing the exchange rate risk premium. Only the first choice has a desirable feedback effect

[10] The rule prescribed by Eq. (21) offers an important advantage for policy-makers in converging countries as it draws attention to the observable financial risk premia. In reality, these premia ought to be augmented with additional risk components in order to reflect realistic conditions of Poland and other euro-candidates. At least two categories of risk are particularly relevant: the risk factor related to uncertainty about fiscal discipline and the political risk, stemming from unpredictable political jitters (such as those of the first half of 2005) that may cast doubts about sustainability of macroeconomic stabilization.

on inflation. The second choice is destabilizing (suboptimal) because it is likely to exacerbate exchange rate risk premium, which can be mitigated through FX market intervention. Thus in essence, policy-makers influence the target of the relative inflation forecast with instruments affecting risk premia. At this juncture, we assume that $\beta_x$ is close to zero, as the differential rule (DR) for RIFT prescribed by Eq. (21) encompasses a very short time period in which a change in policy instruments has no effect on output gap. Such assumption may be useful for the inflation process in Poland. It is consistent with the empirical finding of Dibooglu and Kutan (2005) who show that inflation fluctuations in Poland are predominantly influenced by nominal supply-side and monetary shocks, in contrast to Hungary where real exchange rate and balance of payments shocks strongly affect price level movements.

To reiterate, a successful convergence calls for a gradual dissipation of the risk premia. The task of lowering the inflation risk premium $\Phi_t$ depends on the ability of the candidate's central bank to close the inflation gap, thus to demonstrate gains in credibility. By comparison, the task of lowering the exchange rate risk premium $\Psi_t$ depends on a number of factors that are exogenous to central bank decisions. Gains in this area are directly related to all factors affecting an improved overall investment climate. Nevertheless, a central bank can and should counteract larger shocks to $\Psi_t$ by conducting foreign exchange market interventions. In addition, the magnitude of permitted shocks will depend strongly on the appropriate choice of the official reference rate that should not be changed for a two-year period under the assumption that the initial ERM2 reference rate is set at the proper equilibrium level and that economic fundamentals will not change during the two-year period to justify a significant change of the euro conversion rate. It should also depend on the width of the band of permitted currency fluctuations, although, as we stated before, the precise width of the band and its asymmetry will not be known ex ante as it will likely depend on the ability to fulfill other Maastricht criteria. Moreover, the monetary authorities of all ERM2 participating countries are advised to avoid declaring or even mentioning any particular deviations from the reference rate, as such statements could invite speculative capital flows seeking to test stated levels.

## 5. Nominal Exchange Rate under ERM2

Critical for our analysis is the definition of $S_t^R$ as an official *de jure* reference rate of one euro in domestic currency (PLN) terms. Its more specific definition and suggestions for computation are discussed below. We further distinguish between: $S_t$ or actual spot exchange rate (PLN value in EUR), $S_t^R + A$ that prescribes upper (maximum appreciation) boundary of the exchange rate tolerance band, $S_t^R + B$ denoting the lower (maximum depreciation) boundary of the exchange rate tolerance band, and $S_t^M$ defined as market-perceived sustainable long-run equilibrium rate, which could be also stated as a *de facto* euro-entry rate.

For the determination of the appropriate reference rate that would satisfy the RIFT framework and the euro-convergence objectives, we assume two conditions pertaining to the deviation between the long-run equilibrium rate and the official rate. First, the official rate is chosen at a somewhat stronger level than the market-perceived equilibrium rate $S_t^R - S_t^M \rangle 0$ in order to underpin the commitment to the inflation target. An official rate above the market equilibrium would provide a necessary cushion to account for possible destabilizing effects of exchange rate volatility. The stronger rate is likely to aid the disinflation as it is quickly transmitted into lower inflation through the exchange rate channel. Second, a spread between both exchange rates depends directly on the magnitude of underlying risk premia, at minimum, on the observed size of $\Phi_t$ and $\Psi_t$. Thus the spread can be specified as

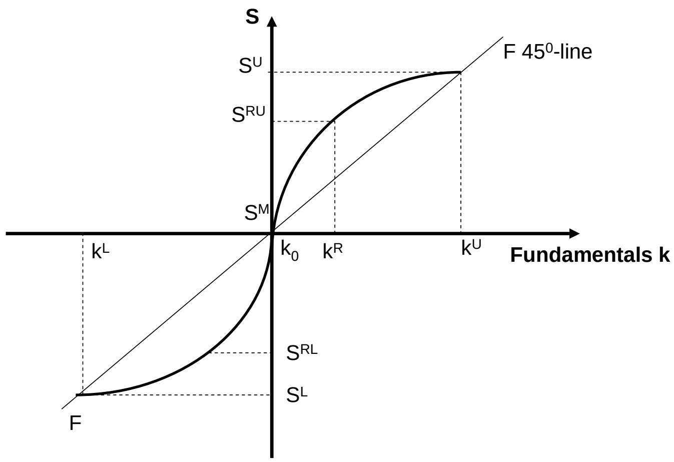
$$S_t^R - S_t^M = f\left(\Phi_{t-1} + \Psi_{t-1}\right) = \beta_\Phi \Phi_{t-1} + \beta_\Psi \Psi_{t-1} \qquad (22)$$

The market equilibrium and the official exchange rates within the band of permitted fluctuations can be ascertained on the basis of the target zone model developed by Krugman (1991). The original model presents the market equilibrium exchange rate $S^M$ surrounded by the target zone with the lower and upper limits prescribed by $S^L$ and $S^U$ respectively (Figure 1). The exchange rate time path $S_t$ is a function of a set of macroeconomic fundamentals $k$. The boundaries of the currency target zone correspond with the lower and the upper limits on the fundamentals labeled as $k^L$ and $k^U$. The exchange rate function is tangent to the top and the bottom endpoints of the band thus its time path becomes smoothed as it gets closer to the edges, which is known in the target zone literature as the 'smooth pasting effect'. Consistently, the exchange rate time path follows a U-shaped distribution[11]. When the exchange rate hits the band edges, it will have to be corrected with the foreign exchange market intervention, which is referred to in the literature as the 'honeymoon effect'.

We adjust the original Krugman model to the conditions of inflation targeting and the prevalence of risk premia along with the active risk alignment process, as shown in Figure 1. We retain the Krugman assumption of the U-shaped data distribution as the fundamentals (the inflation time path) that are closer to the $k^L$ or $k^U$ limits will accelerate the exchange rate adjustments to the $S^L$ and $S^U$ boundaries. In consistency with our argument about the prevalence of the risk premia, the official reference rate $S^{RU}$ is chosen at the level corresponding with the fundamentals $k^R$ reflecting the inflation target. Since it encompasses the risk premia, the reference rate is at a stronger level in relation to the market equilibrium exchange rate $S^M$.

[11] Several extensions to the Krugman target zone solution, including Delgado and Dumas (1992) and Beetsma and van der Ploeg (1994), assume a hump-shaped distribution of the exchange rate pattern underscoring a notion that the exchange rate spends more time inside the target zone than on its band edges, which necessitates intra-marginal foreign exchange market interventions. Bertola and Cabalero (1992) as well as Tristani (1994) assume the U-shaped functions, as we do. Such functions are consistent with the endogenous risk realignment process and marginal interventions.

**Figure 1:** The exchange rate in a target zone with risk premia.




Source: the authors.

Taking into consideration the prevalent risk premia, Eq. 22 can be alternatively stated as

$$S_t^R - S_t^M = f\left(\Phi_{t-1} + \Psi_{t-1}\right) = f'\left(k_t^R - k_0\right) \qquad (23)$$

As a result, a soft or inner band of the exchange rate is set symmetrically within the $S^{RU}$ and $S^{RL}$ boundaries. In principle, the soft band rules out foreign exchange market interventions, which can only be considered in the $S^{RU}S^U$ and $S^{RL}S^L$ zones, and certainly necessitated outside the outer $S^LS^U$ target zone.

Our version of the target zone model suggests that the exchange rate stability can be restored by foreign exchange market interventions, leaving the adjustments in interest rate to controlling the relative inflation forecast, which is fully consistent with the RIFT framework. Thus in essence, the proposed policy framework for the euro-convergence is a combination of RIFT and a *managed float.* To reiterate, a benign neglect approach to the exchange rate is inconsistent with the task of monetary convergence to a currency union.

Excessive exchange rate volatility can be counteracted with foreign exchange market interventions. This approach is necessitated under RIFT as the convergence process in the presence of exogenous risks, mainly the uncertainty about the fiscal discipline and the unpredictable political risk, is likely to exacerbate the exchange rate risk premium.

A number of practical policy issues stemming from our model and pertaining to the determination of the reference exchange rate for the ERM2 can be identified:

1. A proper choice of the official reference rate is critical. The *de jure* reference rate needs to correspond with the *de facto* dynamic market equilibrium exchange rate in order to guide the euro-convergence process effectively. But the *de jure* rate may differ from the market rate by a certain margin that depends directly on the prevalent risk premia.

2. It is possible to determine the market equilibrium rate by using the steady-state equilibrium solutions, as demonstrated for instance by Golinelli and Rovelli (2005) and Orlowski (2004a).

3. A suboptimal reference rate set at a level different from the implied market perceptions would bring a number of policy consequences. In general terms, it would effectively narrow the tolerance band prompting the central bank to conduct frequent and possibly asymmetric foreign exchange market interventions. If the central bank decided to stick firmly to the suboptimal rate and refrained from its resetting, the *de jure* rate would function as a "magnet" pulling the actual exchange rates in a wrong direction (Schadler, 2004). This in turn would infuse some inflationary pressures in the case of an excessively weak domestic currency, or contribute to real currency appreciation if the *de jure* rate was too strong.

4. Moreover, a strong rate would have to be defended with suboptimally high interest rates or alternatively supported with foreign exchange market interventions, while a weak rate would trigger market expectations about interest rate cuts by the central bank. It is therefore imperative that the official reference rate is properly determined and introduced

at an appropriate time in order to avoid potentially damaging consequences of a wide gap between the *de jure* and the *de facto* rates.

5. An additional difficulty with arriving at the appropriate reference rate stems from prevalence of risk premia that are built into the market equilibrium exchange rate as implied by Eq. (22). The uncertainty about fiscal discipline and political stability may bring down the perceived *de facto* rate and necessitate a tighter monetary policy stance, i.e., higher interest rates encapsulating exogenous risk premia. Furthermore, a suboptimal rate is likely to exacerbate exchange rate volatility, thus increase the exchange rate risk premium due to uncertainty about the frequency of foreign exchange market interventions. In contrast, the volatility of exchange rates around the reference rate that is correctly chosen is likely to be lower.

6. The development of procedures and formulas for a proper determination of a reference exchange rate for ERM2 poses a major challenge for policy-makers in NMS as evidence on comparable exercises in the world economy is seemingly scant.

In practical terms, the ERM2 participation requires Poland's monetary authorities to determine the "right" reference rate, which implies that the exchange rate for PLN in relation to the euro is in close proximity to the fundamental equilibrium for the reasons specified above. Moreover, to ensure the compliance with the ERM2 rules, it is imperative to assume that the official reference rate remains constant during the ERM2 membership with a possibility of fine-tuning during the euro-conversion exchange rate-setting. A devaluation of the central parity would reset the ERM2 clock to zero, while central parity revaluation would undermine the credibility of the euro conversion rate and could invite large speculative inflows, resulting in an overly-appreciated conversion exchange rate with negative consequences for economic growth. However, in our model the market equilibrium exchange rate remains to be time varying due to changing market perceptions. By all means, any given official reference rate $S_t^R$ will be sustainable only if it is credible for the markets. When $S_t^R$ and $S_t^M$ are different, the central bank will face a serious challenge of stabilizing the exchange rate.

Thus far, seven out of ten NMS have joined the ERM2 but only the case of Slovakia is relevant for Poland as its central bank embraced inflation targeting with a managed float prior to joining the ERM2 in November 2005.[12] Notably, its adopted reference rate was equal to the ECB fixing for the Slovak koruna on the eve of the ERM2 entry. In the case of Poland, to ensure that market exchange rate does not deviate markedly from the desired central parity level shortly before the ERM2 entry, the Polish Government and the central bank - jointly responsible for the exchange rate decisions - should probably guide financial markets towards this level, given their reaching a consensus about the ERM2 reference rate. This may require appropriate verbal communication and – as in the Slovak case – foreign exchange market interventions. It will pose a challenge for the NBP to ensure that the markets do not perceive the inflation target and the ERM2 central parity as conflicting goals. But first, the choice of the central parity must be such that it does not jeopardize the inflation target.

The additional complexities of ERM2 pertain to the intensity and frequency of foreign exchange market interventions. The related literature (M.Taylor 2004, Kubelec 2004, Neely 2004) proves that interventions have a stabilizing effect only when they are conducted at times of the actual market exchange rate deviating significantly from the equilibrium level. When conducted at times of a close proximity to the equilibrium, they could be destabilizing and ineffective. Therefore, a central bank is prone to intervene only when deviations from the market equilibrium are significant. In essence, interventions ought to be conducted only when they can successfully reduce the exchange rate volatility.

It remains debatable whether the observed degree of volatility ought to be disclosed to the public at large. First, such a degree will have to be derived from complex tests of volatility dynamics, and it will have to be reassessed on a rolling basis. Such frequent adjustments may send perplexing signals to market participants. Second, a predetermined volatility benchmark may become simply unattainable in the presence of exacerbated exogenous (fiscal and political) risks. If such risks are perceived by a central bank to be merely transitory, the bank should have a

[12] For the six remaining countries, setting the reference rate was a straightforward task as their currency regimes were based on hard pegs. Thus their prior administered exchange rate was adopted as the ERM2 reference rate.

discretionary authority to refrain from intervention. However, if such risks pose a danger of inflicting more permanent destabilizing effects, market interventions should take place.

## 6. Searching for the Equilibrium Exchange Rate – Cointegration and Volatility Dynamics Testing

For the purpose of determining a viable reference rate of PLN per euro (EUR) for the ERM2 entry we attempt to find the long-run market equilibrium exchange rate and, subsequently, to devise a target zone framework based on the concept presented in the previous section. Our long-run equilibrium is arrived at by using two alternative methods: the Johanssen trace and max-eigenvalue cointegration tests and the threshold GARCH with the in-mean conditional variance and generalized error distribution residuals (TGARCH-M-GED). In both cases we rely exclusively on the average daily data series for the January 3, 2000 – June 27, 2005 sample period[13]. We investigate the relationship between the PLN/EUR exchange rate $S_t$, the differential between the Polish and the German 10-year government bond yields $\left(i_t^{PL10Y} - i_t^{GER10Y}\right)$, and the spread between the Polish 5-year sovereign bonds and the 3-month money market rates $\left(i_t^{PL5Y} - i_t^{PL3M}\right)$. The relationship between the exchange rate and the Polish versus German bond yields allows finding a steady-state equilibrium exchange rate on the basis of the uncovered interest parity, while the inclusion of the domestic yield spread is a proxy of changes in macroeconomic fundamentals. The daily data frequency enables us to capture the impact of all disturbances to the exchange rate series that would be otherwise concealed if low frequency data were used instead. High frequency data is also required for inclusion of a sufficiently large number of observations that is indispensable for conducting the cointegration and the GARCH volatility dynamics analyses.

The empirical results of the Johanssen trace and max-eigenvalue tests are shown in Table 2. It shall be noted that all three variables, namely, the exchange rate, the 10-year bond differential and the yield spread, are non-stationary at their levels thus suitable for contegration

[13] The beginning of the sample period matches the inception of the Polish 10-year sovereign bond market.

testing[14]. In order to find the steady-state equilibrium exchange rate, the tests include the constant term but no deterministic trend in the data, and the maximum of a two-period lag. The trace test indicates the existence of a single cointegrating vector, while the max-eigenvalue test suggests a possibility of two vectors.

**Table 2:** Johanssen Trace and Maximum-Eigenvalue Cointegration Tests: The Zloty-Euro Exchange Rate, Polish vs. German 10-Year Bond Yields and the Polish 5-year over 3-Month Yield Spread. (January 3, 2000-June 27, 2005 data series).

| Hypothesized No. of Cointegrating Eqs. | Trace and Max-Eigen Statistics | 0.05 Critical Value | Probability |
|---|---|---|---|
| *Trace test* | | | |
| None * | 37.23 | 35.19 | 0.03 |
| At most 1 | 18.37 | 20.26 | 0.09 |
| *Max-Eigen. Test* | | | |
| None | 18.86 | 22.30 | 0.14 |
| At most 1 * | 16.27 | 15.89 | 0.04 |

Note: the trace test indicates a single cointegrating equation and the maximum-eigenvalue test implies two equations.

Data Source: Bloomberg (supplemented with Reuters data on Polish ten-year yields for Jan 3 - Feb 3, 2000 and Dec 7, 2001 – Nov 25, 2002 due to unavailability of Bloomberg Generic Network prices for these periods) and Eurostat for German MCBY (Maastricht Conditions Bond Yields).

The single-vector cointegrating equation (with standard errors in parentheses) is given by

$$S_t = \underset{(0.150)}{4.406} - \underset{(0.047)}{0.029}\left(i_t^{PL10Y} - i_t^{GER10y}\right) + \underset{(0.043)}{0.099}\left(i_t^{PL5Y} - i_t^{PL3M}\right) \quad (24)$$

The cointegrating relationship implies the long-run equilibrium exchange rate at 4.406 PLN per EUR, which is the weaker level for PLN (stronger EUR) than the period-average rate of 4.091. However, from the standpoint of the monetary convergence process it is advisable to find the

[14] The augmented Dickey-Fuller (ADF) unit root test statistics are -1.411 for the PLN/ EUR exchange rate, -0.648 for the Polish versus German 10-year bond yield differential and -2.050 for the examined yield spread, while the McKinnon critical ρ-value is -2.863 at 5 percent probability, which indicates that all three variables at their levels suffer from the unit root (non-stationarity) problem.

steady-state exchange rate under the assumption of the completed compression of domestic relative to foreign long-term bond yields, thus for a cointegrating equation with the bond yield differential equal to zero[15]. The corresponding cointegrating equation is specified as

$$S_t = 4.330 + 0.131\left(i_t^{PL5Y} - i_t^{PL3M}\right) \qquad (25)$$

(0.076) (0.027)

Under the assumption of a complete convergence of Polish into German bond yields the long-run equilibrium exchange rate is at 4.330. In addition, the cointegration equation (25) suggests a strong long-run relationship between a steeper yield curve stemming from elevated inflation expectations and the PLN depreciation. Adversely, a flatter yield curve resulting mainly from a tighter monetary policy is strongly associated with the PLN appreciation (declining $S_t$).

In sum, the cointegration exercise implies that the long-run equilibrium exchange rate is around 4.330. However, this analysis is seemingly biased by the excessive volatility of the exchange rate and high levels of bond yields during the first three years of the sample period and may no longer be relevant at the present time, by which the early financial market vicissitudes have largely disappeared. For this reason, the examined relationship between the exchange rate and bond markets needs to be verified by testing its volatility dynamics. We employ the TGARCH-M-GED procedure with the carefully chosen data generating process assumption after testing its various functional forms for overall robustness (by maximizing the likelihood ratio and minimizing the Akaike and Schwartz information criteria) and for autocorrelation (on the basis of the Breusch-Godfrey LM test). We test the exchange rate at its level in order to determine its forecast conversion or the dynamic steady state equilibrium level. In order to at least partially defuse the non-stationarity problem, we insert a high-order moving average (MA) smoothing into the mean equation.

[15] Orlowski and Lommatzsch (2005) provide evidence that the German long-term bond yields have become significant drivers of sovereign long-term bond yields of Poland, Hungary and the Czech Republic. The ongoing yield compression implies that the three NMS are ready to adopt the euro without risking a disruptive shock to their financial stability.

**Table 3:** TGARCH(6,1,1)-M-GED estimation representations.
*Dependent variable*: Polish Zloty-Euro Exchange Rate
*Independent variables*: Polish vs. German 10-Year Bond Yields, Polish 5-Year over 3-Month Yield Spread. (Both variables are in first differences).
(January 3, 2000-June 27, 2005 data series).

| Variable | Coefficient | Standard Error | z-Statistics | Probability |
|---|---|---|---|---|
| *Mean equation:* | | | | |
| Constant term | 4.344 | 0.026 | 169.525 | 0.000 |
| $\Delta(i^{PL10Y}-i^{GER10Y})$ | 0.007 | 0.004 | 1.986 | 0.047 |
| $\Delta(i^{PL5Y}-i^{PL3M})$ | 0.002 | 0.002 | 0.772 | 0.440 |
| Log(GARCH) | 0.007 | 0.001 | 14.687 | 0.000 |
| MA(1) | 1.411 | 0.031 | 45.983 | 0.000 |
| MA(2) | 1.690 | 0.051 | 33.364 | 0.000 |
| MA(3) | 1.883 | 0.066 | 28.300 | 0.000 |
| MA(4) | 1.987 | 0.077 | 25.933 | 0.000 |
| MA(5) | 1.885 | 0.083 | 22.821 | 0.000 |
| MA(6) | 1.664 | 0.082 | 20.263 | 0.000 |
| MA(7) | 1.341 | 0.076 | 17.550 | 0.000 |
| MA(8) | 0.898 | 0.063 | 14.248 | 0.000 |
| MA(9) | 0.541 | 0.046 | 11.661 | 0.000 |
| MA(10) | 0.247 | 0.027 | 9.302 | 0.000 |
| *Cond. variance equation:* | | | | |
| Constant term | 0.000 | 0.000 | 2.743 | 0.006 |
| ARCH(1) | 0.194 | 0.043 | 4.482 | 0.000 |
| ARCH(2) | -0.021 | 0.049 | -0.418 | 0.676 |
| ARCH(3) | 0.063 | 0.041 | 1.553 | 0.121 |
| ARCH(4) | -0.096 | 0.036 | -2.637 | 0.008 |
| ARCH(5) | 0.006 | 0.038 | 0.166 | 0.868 |
| ARCH(6) | 0.044 | 0.033 | 1.338 | 0.181 |
| TARCH(1) | -0.133 | 0.038 | -3.535 | 0.000 |
| GARCH(1) | 0.848 | 0.039 | 21.909 | 0.000 |
| GED parameter | 2.103 | 0.131 | 16.004 | 0.000 |
| Adjusted $R^2$= 0.988, Log likelihood = 2779.69, AIC = -3.857, SIC = -3.768, DW = 1.49 | | | | |

Notes: The number of included observations after the adjustment is 1429; backcasting of MA terms is turned on with the -8 backward and +1 forward recursion; AIC and SIC are Akaike and Schwartz information criteria; DW is Durbin-Watson statistics.

Data Source: as in Table 2.

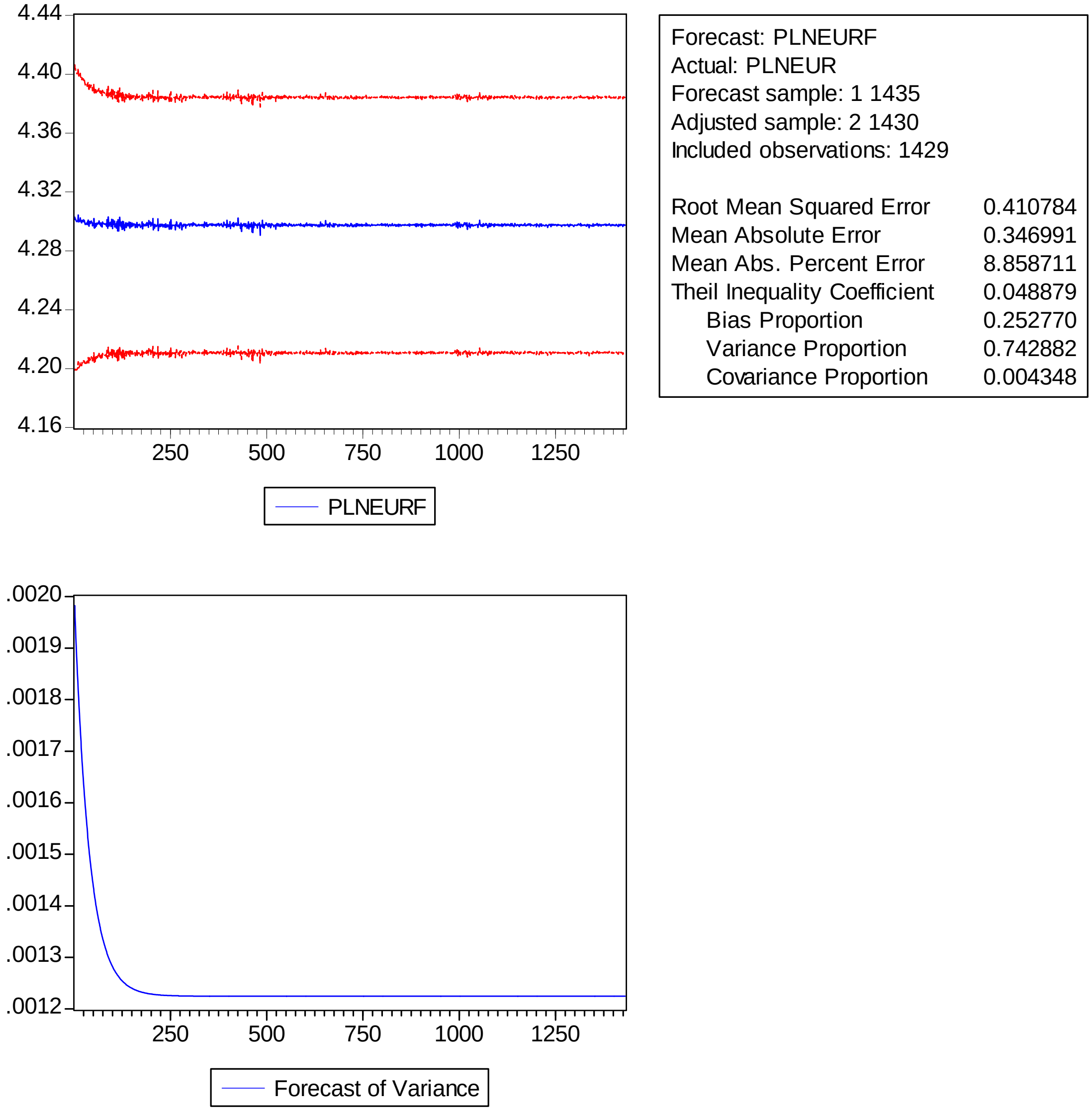
The mean equation of the TGARCH(6,1,1)-M-GED process includes the differential between the Polish and the German 10-year bond yields and the interest rate spread between the 5-year bonds and the 3-month money market rates, both stated in first differenced terms in order to account for non-stationarity at their levels. It also includes the log of the GARCH conditional variance (the M regressor) as an indication of the directional change in the risk premia associated with the conditional dynamic exchange rate volatility, as well as the MA terms. The conditional variance equation incorporates the impact of the previous period(s) shocks or 'news' to volatility depicted by the ARCH-terms, the GARCH term reflecting the degree of persistency in volatility and the first-order TARCH component showing the asymmetric impact of the preceding day negative versus positive shocks to volatility. The GED parametrization allows for assessing a departure from the normal (Gaussian) data distribution.

The conditional mean equation shown in Table 3 indicates a positive interaction between changes in bond yield differentials and the exchange rate. Thus evidently, a declining yield differential (the ongoing yield compression) is associated with the PLN appreciation. There is also a significant positive relationship between the log(GARCH) and the exchange rate proving that the declining conditional exchange rate volatility corresponds with the Polish currency appreciation. It shall be further noted that the MA-terms in the reported estimation are subject to active backcasting with the backward recursion of 8 and the forward recursion of 1. The application of the MA(10) process seems justifiable as its underlying roots have modulus getting close to zero, although they are clearly declining only for higher than the fourth-order MA terms.

The conditional variance equation reveals ambiguous high-order ARCH effects, which implies an unstable impact of the previous-period shocks on the conditional volatility of the exchange rate. There is a positive, highly significant first-order ARCH effect, which indicates propagation of volatility induced by the previous day shocks. In addition there is also a somewhat puzzling fourth-order ARCH effect. The TARCH(1) asymmetric leverage effect is quite pronounced. Its negative sign suggests that the shocks suppressing volatility in the preceding period further reduce the actual volatility of the exchange rate series and that this impact is much stronger than a possible propagation of volatility induced by positive shocks. As it might be expected, there is a strong GARCH(1) effect indicating a high degree of persistency in the exchange rate volatility. In addition, the sum of ARCH and GARCH coefficients seems to exceed the unity, suggesting the absence of volatility convergence to the steady-state. This result sends a message to policy-makers that a possible departure from the pure float and a more serious attention to exchange rate stability would be a prudent move at this time as it would likely help expedite the monetary convergence process. In addition, the presented test shows the GED parameter slightly exceeding 2, which indicates a somewhat platykurtic data distribution or a thick-tailed concentration of the exchange rate volatility. This finding reaffirms the U-shaped data distribution assumed in the original Krugman model and upheld in our analysis of the target zone framework.

Further insights about the volatility dynamics and the market equilibrium exchange rate are provided by the forecast developed on the basis of the TGARCH(6,1,1)-M-GED test, which is shown in Figure 2. The generated forecast of the PLN/EUR exchange rate is clearly converging to the steady-state equilibrium rate of 4.298, which appears to be more realistic than the equilibria obtained from the above-examined cointegration tests. The computed band of +/-2 standard deviations implies a 2.1 percent fluctuations range around the equilibrium rate, i.e. from 4.208 to 4.388. The variance forecast converges rather quickly to the constant value that is slightly exceeding 0.0012, thus the forecast appears to be quite precise; this is also confirmed by the low root mean squared error (RMSE) and the low mean absolute error (MAE).

**Figure 2:** Dynamic forecast of the PLN per EUR exchange rate based on the estimated TGARCH-M-GED process shown in Table 3.

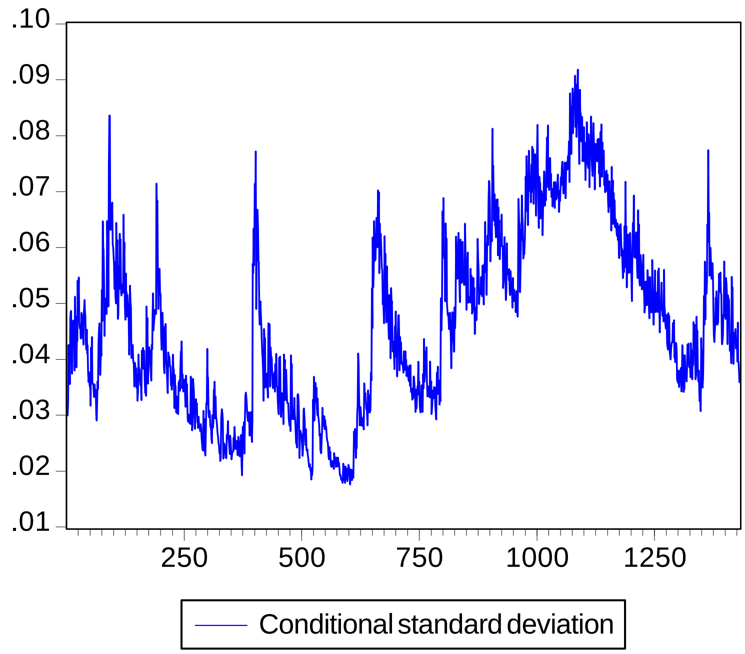



Note: the forecast convergence rate is 4.298 and the forecast band is +/- 2 standard deviations, which implies an observed normal +/- 2.1 percent fluctuations band.

Source: the authors.

Apart from the definite path of the forecast variance, the actual volatility of the investigated series is quite turbulent. As shown in Figure 3, the GARCH conditional standard deviation has jumped several times to the level of 0.09, although recently it seems to be oscillating around 0.05. This suggests that a possible application of a 5 percent symmetric, inner (no-intervention) band of currency fluctuations would be a pragmatic solution, particularly when the present purely floating currency regime becomes replaced with the managed float[16].

**Figure 3:** GARCH conditional standard deviation from the test shown in Table 3.




Data Source: as in Table 2.

The above empirical analysis implies that the dynamic market equilibrium exchange rate is around 4.298 PLN per EUR. Nevertheless, we have argued that the official reference rate for the ERM2 entry might be set at a somewhat stronger level for the Polish currency in order to account for the existing risk premia and to underpin the central bank's continuous commitment to prioritizing the inflation target. The volatility dynamics analysis seems to indicate that the reference rate can be safely determined at an up to 5 percent stronger level than the equilibrium rate, i.e. not lower than 4.08. Correspondingly, the no-intervention inner band of permitted

[16] A compelling exercise aimed at determining the optimal band of currency fluctuations for Poland, Czech Republic, Slovakia, Hungary as well as Denmark and the original ERM members is presented by Crespo-Cuaresma, Égert and MacDonald (2005). They employ a three-regime self-exciting threshold autoregressive (SETAR) model with a non-stationary central band and the GARCH(1,1) conditional variance for this purpose. They draw on the SETAR modelling framework used by Bessec (2003) who examines currency fluctuation bands of the original ERM members.

fluctuations could be chosen at 5 percent around the reference rate, given the outer ERM2 band at 15 percent.

In sum, the above exercise indicates that it is entirely possible to determine the long-run market equilibrium exchange rate, as well as the appropriate ERM2 reference rate in close relation to the inflation path and the inflation target. Needless to say, our analysis and exchange rate computations are merely indicative and will have to be repeated in the future when the Polish Government proclaims a full commitment and a definite time table for entering the ERM2 and, subsequently, the euro.

## 7. A Synthesis and Further Policy Direction

The analytical framework of this paper assumes a gradual transition from the current DIT policy in Poland to the ERM2 with the ultimate goal to adopt the euro. This it pertains to the period preceding entry into ERM2, as well as the two-year confinement to this interim monetary arrangement.

In order to ensure a smooth transition to the euro, the present DIT strategy needs to be modified by incorporating the exchange rate stability objective. For the purpose of ensuring a successful price convergence, we advocate adopting a monetary policy framework based on relative inflation forecast targeting that can combine the predominant inflation target with exchange rate stability objective. Within the proposed framework, interest rate adjustments are applied to steer the domestic inflation forecast towards the euro area inflation forecast, while exchange rate stability is secured mainly with foreign exchange market interventions.

A proper design of the exchange rate policy within ERM2 is a perennial and fertile topic for policy discussion and research that makes inroads into an untested territory, since evidence on similar episodes in the world economy remains scant. We touch upon selected complexities of such policy design, including the fluctuations band asymmetry, intentional deviation of the official reference rate from the market-perceived long-run equilibrium rate, and comparable exchange rate volatilities at asymmetric boundaries of the fluctuations band.

It shall be emphasized that our analysis weights heavily on monetary authorities' ability to contain risk, in particular the exchange rate and inflation risk premia as originally suggested by Orlowski (2003). Although our analytical issues are based on the prevalent monetary policy, as well as economic conditions and political risks of Poland, it is transferable to the circumstances of other new Member States of the EU that currently pursue DIT regimes.

We realize that our analytical model is based on a number of rigorous, yet realistic assumptions. Nevertheless, we believe that our analysis may provide useful guidance for designing proper monetary convergence policies for a smooth adoption of the euro. Without doubt, more in-depth policy analysis and empirical testing ought to be conducted in a very short period of time to achieve such an ambitious goal.

***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.

Beetsma, R.M., van der Ploeg, F., 1994. Intramarginal interventions, bands and the pattern of EMS exchange rate distribution. International Economic Review 35 (3), 583-602.

Bertola, G., Caballero, R.J., 1992. Target zones and realignment. American Economic Review 82 (3), 520-536.

Bessec, M. 2003. The asymmetric exchange rate dynamics in the EMS: a time-varying threshold test. European Review of Economics and Finance 2 (2) 3-40.

Błaszkiewicz, 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, Warszawa.

Bofinger, P., Wollmershäuser, T., 2001. Is there a third way to EMU for the EU accession countries?. Economic Systems 25 (3), 253-274.

Bofinger, P., Wollmershäuser, T., 2002. Exchange rate policies for the transition to EMU, in: Sepp, U., Randveer, M., (eds.), Alternative Monetary Regimes in Entry to EMU. Bank of Estonia, Tallinn, Estonia, pp. 95-132.

Crespo-Cuaresma, J., Égert, B., MacDonald, R., 2005. Non-linear exchange rate dynamics in target zones: A bumpy road towards a honeymoon – some evidence from the ERM, ERM2 and selected new EU Member States. William Davidson Institute Working Paper No. 771, University of Michigan School of Business.

DeGrauwe, P., Schnabl, G. G., 2004. Nominal versus real convergence wit respect to EMU accession: How to cope with the Balassa-Samuelson dilemma. *Paper to the International Atlantic Economic Society convention,* Lisbon, March 11-14.

Delgado, F.A., Dumas, B., 1992. Target zones broad and narrow. In: Krugman, P.R. and M. Miller (eds.) *Exchange rate targets and currency boards.* Cambridge University Press.

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.

Domaç, I., Mendoza A., 2004. Is there room for foreign exchange market interventions under inflation targeting framework?: Evidence from Mexico and Turkey. World Bank Policy Research Working Paper No. 3288.

Eichengreen, B. L. 2005. Can emerging markets float?: Should they inflation target? In: Driver, Rebecca L., Peter J. N. Sinclair and Christoph Thoenissen (eds.) *Exchange rates, capital flows and policy.* Routledge Publ. Co., London, pp. 10-38.

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.

Engle, R. F., Ng V.K., 1993. Measuring and testing the impact of news on volatility. Journal of Finance 48, pp. 1749-1778.

European Central Bank, 2004a, The Monetary Policy of the ECB, Frankfurt, Germany.

European Central Bank, 2004b, Convergence Report 2004, Frankfurt, Germany.

Golinelli, R. Rovelli R.R., 2005. Monetary policy transmission, interest rate rules and inflation targeting in three transition countries. Journal of Banking and Finance 29 (1), 183-201.

Haldane, A.G., 1997. Some issues in inflation targeting. Bank of England, London, U.K.

Holtemöller, O., 2003. Uncovered interest rate parity and analysis of monetary convergence of potential EMU accession countries. Humboldt University Berlin – Discussion Paper of Interdisciplinary Research Project No. 373.

Hunt, B., 1999. Inter-forecast monetary policy implementation: fixed-instruments versus MCI-based strategies. Reserve Bank of New Zealand Discussion Paper No. G99/1.

Jonas, J., 2004. Euro adoption and Maastricht criteria: Rules or discretion?. University of Bonn-Center for European Integration Studies (ZEI): *Working Paper B14/2004.*

Jonas, J., Mishkin F.S., 2003. Inflation targeting in transition economies: Experience and prospects. NBER *Working Paper,* No. 9667.

Kenen, P., Meade, E.E., 2003. EU accession and euro: Close together or far apart?. Institute for International Economics: International Policy Briefs No. PB03-9.

Kočenda, Evžen, Ali M. Kutan and Taner M. Yigit (2005). Pilgrims to eurozone: how far, how fast. mimeo.

Krugman, P.R., 1991. Target zones and exchange rate dynamics. Quarterly Journal of Economics 106 (3), 669-682.

Kubelec, C., 2004. FOREX trading strategies and the efficiency of sterilized intervention. University of Warwick – Department of Economics, mimeo.

Kutan, A., M., Yigit, T.M., 2002. Nominal and real stochastic convergence within the transition economies and to the European Union: evidence from panel data. University of Bonn-Center for European Integration Studies (ZEI): Working Paper B21/2002.

Natalucci, F. M., Ravenna F., 2002. The road to adopting the euro: monetary policy and exchange rate regimes in EU candidate countries, Board of Governors of the U.S. Federal Reserve System, International Finance Discussion Papers: 741.

Neely, C.J., 2004. The case for foreign exchange market intervention: the government as a long-term speculator. Federal Reserve Bank of St. Louis: *Working Paper 2004-031A.*

Orlowski, L.T., 2003. Monetary convergence and risk premiums in the EU accession countries. Open Economies Review 14 (3), 251-267.

Orlowski, L.T., 2004a. Money rules for monetary convergence to the euro. Journal of Policy Modeling, 26 (7), 817-837.

Orlowski, L.T., 2004b. Exchange rate risk and convergence to the euro. University of Bonn-Center for European Integration Studies (ZEI): *Working Paper B25/2004*.

Orlowski, L.T., 2005a. 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.

Orlowski, L.T., 2005b. Targeting relative inflation forecast as monetary policy framework for adopting the euro. William Davidson Institute Working Paper No. 754, University of Michigan School of Business.

Orlowski, L.T., Lommatzsch, K., 2005. Bond yield compression in the countries converging to the euro. William Davidson Institute Working Paper No. …, University of Michigan School of Business.

Schadler, Susan, 2004. European macroeconomic challenges and EU enlargement. Paper to the 17 Symposium Moneda y Credito, Madrid, November 18-19.

Svensson, Lars E.O. and Michael Woodford, 2000. Indicator variables for optimal policy. NBER Working Paper No. 7953.

Svensson, Lars E.O., 2003. What is wrong with Taylor Rules? Using judgment in monetary policy through targeting rules. Journal of Economic Literature, 41 (2), pp. 426-477.

Szapáry, G., 2000. Maastricht and the choice of exchange rate regime in transition countries during the run-up to EMU. National Bank of Hungary: *Working Paper 2000/7*, October.

Taylor, J.B., 2000. Inflation targeting and monetary policy rules: Experience and research. Paper to the 12th Meeting of Latin American Network of Central Banks and Finance Ministers – Inter-American Development Bank, May 12.

Taylor, M., 2004. Is official exchange rate intervention ineffective? Economica 71 (1), pp. 1-11.

Tristani, O., 1994. Variable probability of realignment in a target zone. Scandinavian Journal of Economics 96 (1), 1-14.

Us, V. 2004. Monetary transmission mechanism in Turkey under the Monetary Conditions Index: an alternative policy rule. Applied Economics 36 (9), 967-976.

Walsh, Carl E., 2003. Implications of a changing economic structure for the strategy of monetary policy. In: The Federal Reserve Bank of Kansas City, *Monetary policy and uncertainty: adapting to a changing economy.* A Jackson Hole, Wyoming, Symposium sponsored by The Federal Reserve Bank of Kansas City, pp. 297-348.

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