

# The role of the exchange rate in monetary policy in Poland

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## 1. Introduction

As described by the “impossible trinity”, countries can choose only two out of three from among full monetary policy independence, full nominal exchange rate stability and full financial integration. Economic theory does not exclude intermediate regimes, yet the global tendency over recent decades has been rather towards increasingly free capital flows accompanied by a corner solution on the side of exchange rate flexibility. Since, as described by Frankel (1999), no single currency regime is necessarily right for all countries or at all times, policymakers have to address the trade-off between a fixed exchange rate and monetary policy independence by deciding on the role of the exchange rate in monetary policy.

In this respect, the Polish experience of the transformation period of 1990–2010 was of increasing openness to capital flows, accompanied by a gradual move from exchange rate targeting to monetary independence under an inflation targeting (IT) framework (Table 1). At the beginning of 1990, a fixed exchange rate was introduced to establish a credible commitment in the fight against hyperinflation. Even though the aim was partially reached, this led to a loss of external competitiveness of Polish producers. For that reason, in May 1991 the zloty was devalued, and a few months later the crawling peg system was introduced. The devaluation rate was set at levels lower than inflation differentials to help contain inflation. The system was supposed to constitute a compromise between anti-inflationary policy and a reinforcement of external competitiveness. A breakthrough in the exchange rate policy took place in May 1995, when a crawling band system with  $\pm 7\%$  fluctuation band was introduced. The reason was that partial capital account liberalisation, related to the OECD accession process, combined with relatively high domestic interest rates, triggered massive capital inflows. Consequently, the Polish authorities allowed for increased volatility of the exchange rate. During the years that followed, the fluctuation bands were several times expanded and monetary policy was heading towards an IT framework. In 1998, inflation in Poland fell into single-digit territory for the first time since the beginning of the transformation. In the same year, the newly created Monetary Policy Council set the first medium-term inflation target, and subsequently, in April 2000, the exchange rate of the zloty was free-floated (the zloty had been de facto free-floating for some time already, as the last foreign exchange intervention had taken place in 1998).

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Table 1

**Evolution of the exchange rate system in Poland, 1990–2010**

| Period            | Exchange rate system  | Characteristics  |
|-------------------|---|--|
| Jan 1990–Oct 1991 | Fixed rate against US dollar, and from May 1991 against a basket of five currencies. Devaluation in May 1991, by 16.8%.   | Exchange rate as anti-inflationary anchor.   |
| Oct 1991–May 1995 | Crawling peg with monthly rate of devaluation declining steadily from 1.8% to 1.2%. Two devaluations, by 12% in Feb 1992 and 8% in Aug 1993.  | Attempt to reconcile disinflation objective and maintaining competitiveness of exporters on the world market.  |
| May 1995–Apr 2000 | Crawling band system, with fluctuation band increasing from $\pm 7\%$ to $\pm 15\%$ . Steady decrease of monthly devaluation rate from 1.2% to 0.3%. Revaluation of the central parity by 6% in Dec 1995. | Higher flexibility of foreign capital inflow management. Steady move to independent monetary policy framework. |
| Apr 2000–         | Free-floating exchange rate system.   | IT monetary policy framework (the first inflation target was actually set in Jan 1999).                        |

Source: National Bank of Poland.

Does a free float imply that monetary policy is oblivious to exchange rate fluctuations? Certainly not. In this respect, however, there are a number of issues of rather limited consensus, both in the economic literature and among practitioners. Should the exchange rate affect policy reactions only to the extent that it affects inflation or constitute an additional target variable? Is there any room for foreign exchange intervention under inflation targeting? We shall discuss these issues from a theoretical standpoint in Section 2. Next sections present the Polish experience: Section 3 provides a brief overview of the transmission of the zloty exchange rate fluctuations into the economy, while Section 4 presents the experience of the National Bank of Poland in responding to these fluctuations. The last section concludes.

## 2. Inflation targeting and the exchange rate: some general reflections

In a nutshell, the IT framework in theory can be characterised by three key features (Svensson (2010)):

- announcement of a numerical inflation target;
- implementation of the policy that is based on the forecast targeting;
- a high degree of transparency and accountability.

Even though the IT framework has become increasingly popular among central banks over recent decades (Geraats (2009)), it is still unclear how exchange rate fluctuations should be included in monetary policy decisions under IT. In the following discussion we shall primarily concentrate on strict IT (Mishkin (2001)), as most of the conclusions hold also for flexible IT (Svensson (2010)).

The exchange rate could affect the target variable, that is inflation, in two ways. There is an immediate direct impact of exchange rate movements on CPI inflation due to the fact that part of the goods entering the CPI basket are produced abroad. Exchange rate fluctuations affect CPI inflation also through many indirect channels: local currency depreciation means increased costs of domestic production due to higher prices of imported intermediate inputs, higher foreign demand for domestic goods as well as wage growth expectations. Therefore, even exclusive concentration on inflation as a target variable does not rule out the importance of the exchange rate – quite the contrary. The exchange rate fluctuations would simply be taken into account to the extent that they affect conditional inflation forecasts of the central bank and via this channel the fulfilment of the monetary policy goal. In practice, incomplete and delayed pass-through from exchange rate fluctuations into prices does make monetary policy challenging (Flamini (2007)), but it seems natural that central banks respond to exchange rate fluctuations.

The second reason why the exchange rate might be important in monetary policymaking is related to its informative value. If a central bank cannot perfectly observe the state of the economy, the nominal exchange rate, being a forward-looking and directly observable variable, can play the role of a leading indicator. This would create additional room for responses to exchange rate movements. If, however, the determinants of the exchange rate are poorly understood, this indicator becomes noisy, making extraction of information difficult. In other words, if the uncertainty of the foreign exchange process is high relative to the inflation process, the informative role of the exchange rate for interest rate path setting may be limited (Pavasuthipaisit (2010)). Our still elusive understanding of the determinants of the exchange rate would suggest that this may indeed be the case (Sarno (2005)).

The controversial question is whether the reaction of monetary policy should just reflect the impact of the exchange rate on inflation, as suggested eg by Bernanke and Gertler (2001), or whether monetary policy should also target currency misalignment, as advocated eg by Engel (2009). Economic theory suggests that monetary policy in an open economy under incomplete pass-through might indeed be concerned with targeting currency misalignments as an additional goal (for an overview, see Corsetti et al (2010)). On the other hand, weak anchoring of expectations, arising from their partial backward-lookingness, suggests that deviations from the inflation target should be given higher weight relative to other target variables in the loss function (Orphanides and Williams (2008)), at the same time bringing monetary policy closer to strict inflation targeting. Making trade-offs between inflation and exchange rate misalignments in monetary policy may also create additional inflation risk premium in long-term rates, which would reflect the uncertainty related to monetary policy goals. This can make such a policy more costly and potentially less effective.

The empirical results on whether central banks under IT target the exchange rate as a *separate goal* are mixed. For example, on the basis of estimated NOEM DSGE models, Lubik and Schorfheide (2007) found that the central banks of Australia and New Zealand do not include the exchange rate in their policy rules, whereas the Bank of Canada and the Bank of England do. In the latter case, the results would suggest that apart from inflation the central banks are also partly targeting the exchange rate.

An issue directly related to exchange rate misalignment is foreign exchange interventions. The literature on sterilised foreign exchange interventions suggests that out of the three currently contemplated channels of influence – portfolio balance, signalling and coordination – the last one might be the most effective (Reitz and Taylor (2008)). The coordination channel is essentially about prickling the bubble in the foreign exchange market, which may arise due to the existence of heterogeneity among investors (Frankel and Froot (1986) and numerous subsequent studies). Interventions lower the synchronisation risk among the so-called rational traders and thus eliminate one of the limits to arbitrage (Abreu and Brunnermeier (2003)). The precondition for the success of such interventions is that exchange rate misalignment is substantial, so that a large number of investors, including the central bank, are aware that the

bubble exists. In such a case, the central bank would coordinate actions of exchange rate market participants, who otherwise would inflate the bubble further.

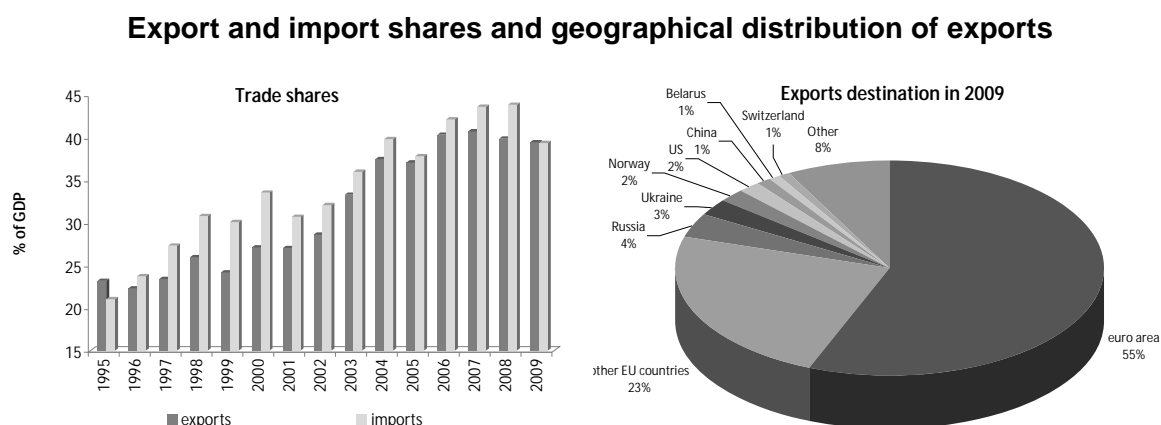
For obvious reasons, there is room for such interventions when one considers that central banks should target currency misalignment as a separate goal. However, there also seems to be a role for this kind of intervention even within a strict IT framework. A growing bubble in the foreign exchange market may put the inflation target at risk. Addressing such risk with interest rates may be quite costly for the rest of the economy and not necessarily effective – a point raised by proponents of not prickling the bubbles (Bernanke (2002)). The difference in the setting described above is that a central bank can resort to another and much more adequate tool – foreign exchange intervention. The important precondition for contemplating such a decision within a strict IT framework is that prickling the bubble should help to safeguard the monetary policy goal and should be consistent with all other interest rate related decisions.

Casting the above discussion into perspective, in the following section we present a brief survey of selected studies conducted in the National Bank of Poland that analyse the impact of the zloty exchange rate on key variables of the Polish economy.

### 3. The impact of the zloty on the Polish economy

The ongoing process of integration, crowned by the accession of Poland to the European Union in May 2004, has increased significantly the importance of the external environment and the exchange rate for the Polish economy. In the period 1995–2009, the value of exports of goods and services rose steadily from 23.2% to 39.5% of GDP, whereas the relevant import share rose from 21.0% to 39.4% (Figure 1, left-hand panel). At the same time, the geographical structure of Polish trade gradually shifted from the post-communist countries towards the EU countries. In 2009, about 56% of Polish exports were sold to the euro area and almost 80% on EU markets (Figure 1, right-hand panel). As a result, the external competitiveness of Polish products is currently determined mostly by the zloty rate against the euro. Moreover, taking into account the growing openness of Poland, the effects of zloty fluctuations on the economy might have increased for the last 15 years.

Figure 1



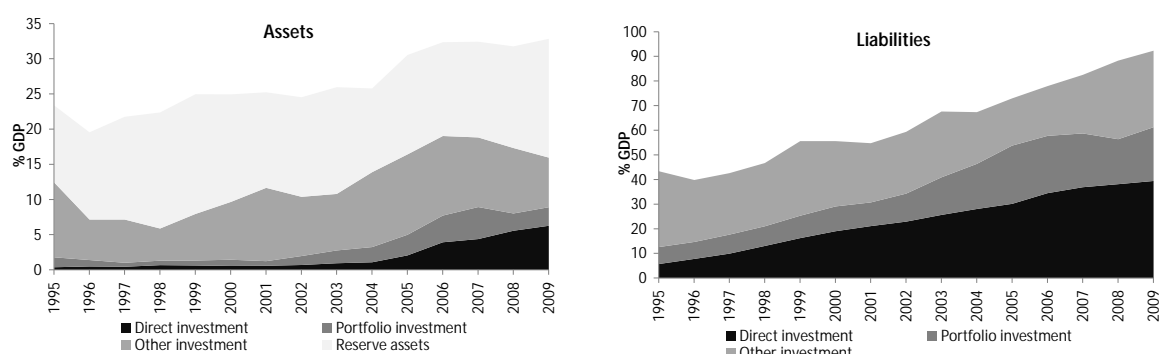
Sources: Eurostat; Central Statistical Office (2010).

The integration measured by the value of Poland's foreign assets and liabilities was also impressive. According to the international investment position statistics, the value of Polish

foreign assets increased from 23.4% of GDP at the end of 1995 to 32.9% at the end of 2009. Even though about half of the assets are held in the form of foreign reserves of the central bank, there is a visible trend among Polish firms to invest abroad: since the EU accession, the value of direct investment has increased from almost null to about 6.3% of GDP (Figure 2, left-hand panel). As regards the stock of Poland's liabilities, its value grew from 43.4% at the end of 1995 to 92.4% at the end of 2009. The main reason for this rise was that foreign companies started to consider Poland as a country worth investing in: in the period 1995–2009, the stock of foreign direct investment increased from 5.7% to 39.5% of GDP (Figure 2, right-hand panel). Taking into account the high current value of foreign assets and liabilities, fluctuations of the zloty affect the economy through valuation effects.

Figure 2

### Stock of foreign assets and liabilities



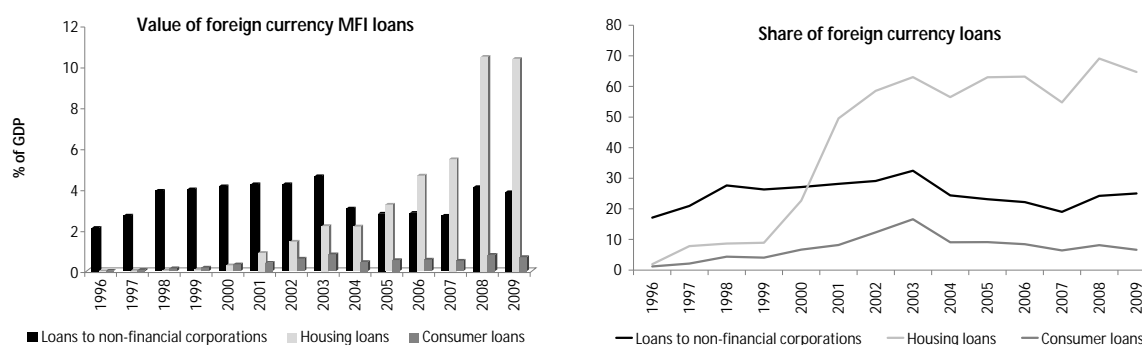
Source: National Bank of Poland.

The next channel through which changes in the value of the zloty might affect the functioning of the Polish economy is related to the fact that a sizeable fraction of loans granted by monetary financial institutions (MFIs) to the private sector is denominated in foreign currencies. As regards foreign currency loans to the corporate sector, their value was relatively stable in the years 1996–2009, fluctuating between 2.1% and 4.6% of GDP, which constituted from 17.1% to 32.5% of total loans to the corporate sector. The value of foreign currency consumer loans, albeit increasing, was negligible and never exceeded 1% of GDP. A different picture emerges in the case of foreign currency housing loans. Starting from the early 2000s, their value surged from almost null to 10.4% of GDP at the end of 2009. What is interesting is the fact that at the end of 2009 the share of foreign currency housing loans amounted to 64.7% of total housing loans (Figure 3).

The high popularity of foreign currency housing loans has two effects. First, exchange rate fluctuations can affect the economy through their impact on the value of foreign currency loans in domestic currency terms. In the event of zloty depreciation, some creditors might experience liquidity problems or even become insolvent. Second, monetary policy might become less effective. As shown in Brzoza-Brzezina et al (2010), restrictive monetary policy in four central European countries, Poland included, leads to a decrease in domestic currency lending, but simultaneously accelerates foreign currency credit. To the extent that monetary policy tightening (loosening) translates into appreciation (depreciation) of the domestic currency, the impact of policy decisions on households having foreign currency denominated loans could well be the opposite to the one intended.

Figure 3

### Foreign currency loans granted by domestic monetary financial institutions



Source: National Bank of Poland.

Taking into account the above considerations, a natural question arises: what is the impact of exchange rate movements on the Polish economy? This question was addressed in numerous studies conducted in the National Bank of Poland, a brief survey of which is presented below.

The first strand of research was investigating the scale of pass-through from the exchange rate to prices on the basis of structural vector autoregressions, a method proposed by McCarthy (1999). The results presented in Przystupa (2002) and in Przystupa and Wróbel (2009) indicate that the long-term pass-through to import prices amounts to 0.7–0.8, and for producer prices stands at 0.5–0.6. These estimates were relatively stable between 2002 and 2008. In the case of consumer prices, it was found that the long-term pass-through declined from about 0.4 in 2002 to about 0.2 in 2008. Moreover, Przystupa and Wróbel found that the response of consumer prices to exchange rate depreciations is higher than the response to zloty appreciations, and that the scale of the pass-through effect depends on the phase of the business cycle.

The second strand of the literature applied the medium-scale macroeconomic models ECMOD (Fic et al (2005)) and NECMOD (Budnik et al (2009)), which have been used for forecasting purposes and policy simulations conducted at the National Bank of Poland, to calculate the effect of exchange rate changes on the economy. According to the results from the ECMOD, an increase of the exchange rate risk premium, translating into a depreciation of the nominal effective exchange rate of the zloty (NEER) by over 1%, leads to a steady increase of the consumer price level by 0.67% within five years, and to a temporary increase of GDP peaking at 0.2% after two years from the occurrence of the impulse. In the case of the NECMOD, the exchange rate impulse was defined as a temporary 1% depreciation of the zloty triggered by changes in the risk premium, which entirely dies out after eight quarters. In response to the shock, consumer prices increase by 0.08% and 0.12% in the first two years from the occurrence of the shocks. The reaction of output is somewhat smaller than in the case of ECMOD, and amounts to only 0.03% in the first year after the depreciation of the zloty (Table 2).

Table 2

**Reaction of the Polish economy to the exchange rate impulse**

| Year | ECMOD |             |             | NECMOD |             |             |
|------|-------|-------------|-------------|--------|-------------|-------------|
|      | NEER  | CPI (level) | GDP (level) | NEER   | CPI (level) | GDP (level) |
| 1    | 1.18  | 0.10        | 0.14        | 0.66   | 0.08        | 0.03        |
| 2    | 1.22  | 0.26        | 0.21        | 0.10   | 0.12        | -0.01       |
| 3    | 0.59  | 0.46        | 0.17        | -0.01  | 0.07        | -0.02       |
| 4    | 0.19  | 0.61        | -0.01       | 0.02   | 0.02        | -0.02       |
| 5    | 0.42  | 0.67        | -0.15       | 0.04   | 0.00        | -0.02       |

The reaction of the economy to the exchange rate risk premium shocks is not comparable between the models due to the fact that the definitions of shocks differ.

Sources: Fic et al (2005); Budnik et al (2009).

The third strand of the literature applied an estimated DSGE model of the Polish economy (SOE-PL, Grabek and Kłos (2008)) to calculate the contribution of exchange rate shocks to the volatility of key macroeconomic variables. This contribution is evaluated by calculating forecast error variance decomposition, which shows to what extent random forecast errors at different horizons are due to exchange rate risk premium shocks. The results, which are presented in Table 3, show that in the short term, defined as four quarters, exchange rate shocks are responsible for 10.8% of the forecast error variance of output and for 5.9% of the forecast error of consumer prices. In the case of the long-term horizon, exchange rate shocks explain between 4.1% and 8.4% of the variance of key macroeconomic variables.

Table 3

**Contribution of ER risk premium shocks to forecast error variance in SOE-PL model**

(%)

| Horizon                      | 1q   | 4q   | 8q   | 20q  | 40q  |
|------------------------------|------|------|------|------|------|
| Private consumption deflator | 11.4 | 5.9  | 4.3  | 1.4  | 5.1  |
| GDP                          | 17.0 | 10.8 | 5.1  | 5.2  | 4.1  |
| Private consumption          | 3.3  | 3.7  | 4.6  | 7.1  | 7.3  |
| Investment                   | 6.1  | 7.6  | 9.0  | 15.3 | 8.4  |
| Employment                   | 13.5 | 12.6 | 6.3  | 9.5  | 7.9  |
| Real wages                   | 2.3  | 2.8  | 3.2  | 4.7  | 5.6  |
| Domestic interest rate       | 12.5 | 8.6  | 2.9  | 4.2  | 5.9  |
| Real exchange rate           | 26.3 | 18.7 | 19.9 | 24.3 | 27.4 |

Source: Grabek and Kłos (2008).

It should be added that the above models do not incorporate the effects stemming from foreign currency denominated loans, and therefore might misestimate the effect of the

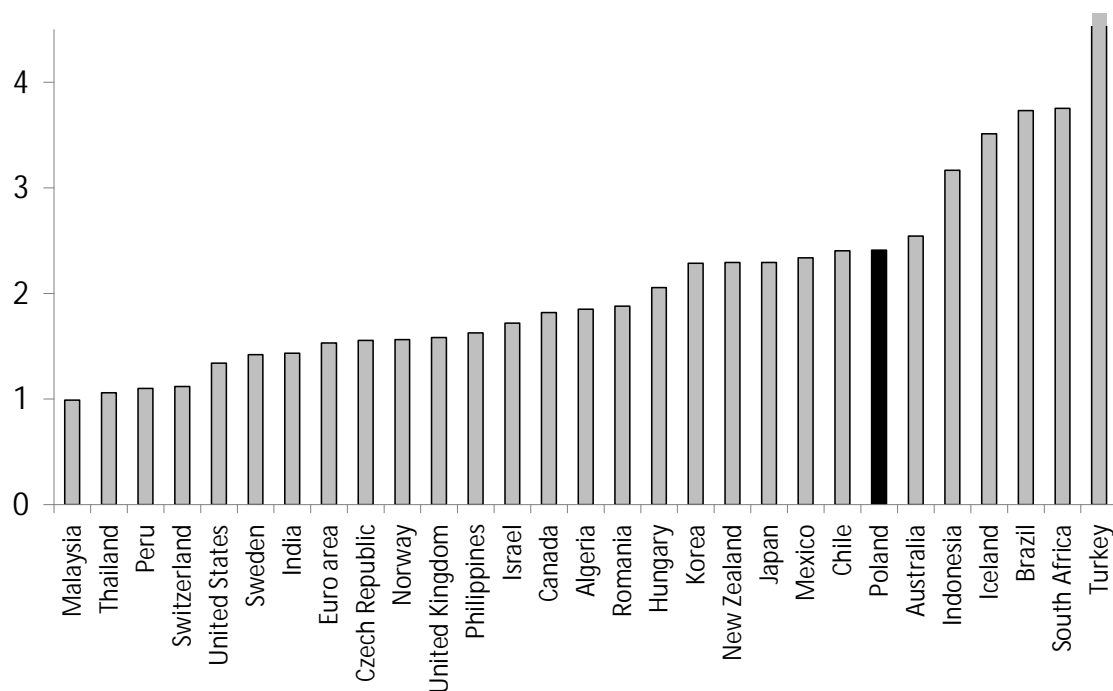
exchange rate on the economy. In these models, the depreciation of the zloty supports exports and GDP. However, when some loans are denominated in foreign currencies, the depreciation has an adverse balance sheet effect, at the same time negatively affecting the cost of financing faced by domestic institutions. This potentially might more than offset the positive impact from increased price competitiveness, especially if the exchange rate is substantially misaligned (Kolasa et al (2010)).

#### 4. The role of the exchange rate in monetary policy in Poland

Given the impact of the Polish zloty on inflation, as highlighted in the previous section, the exchange rate plays an important role in the decision-making process – indeed, the zloty is often mentioned in the Monetary Policy Council (MPC) minutes. Still, the impact on the level of interest rates is limited to the extent to which the fluctuations of the zloty affect inflation, though many channels of transmission are taken into consideration. While a central bank might target the exchange rate indirectly by setting the interest rate at levels consistent with a specified value of the exchange rate level, this is not the case of Poland. This is confirmed by various studies on the monetary policy reaction function, which show that interest rates in Poland do not respond to exchange rate fluctuations (Frömmel and Schobert (2006); Vasicek (2009)).

Figure 4

Exchange rate volatility of major world floating currencies



Exchange rate volatility is measured as the standard deviation of log changes for the monthly index of the nominal effective exchange rate in the period 2000:1–2010:8. Selection of currencies was done on the basis of the IMF classification of Exchange Rate Regimes in 2008.

Source: Bank for International Settlements.



The fact that the zloty was allowed to fluctuate freely over the last 10 years is confirmed by the data related to exchange rate variability. In the period 2000–10, the volatility of the zloty was the highest in the central Europe region: the standard deviation of monthly changes of the zloty nominal effective exchange rate was 17%, 28% and 55% higher than that of the Hungarian forint, Romanian leu and Czech koruna, respectively (Figure 4). Even though the zloty is allowed to float freely, it should be noted that EU funds and proceeds from foreign bond issuance by the Ministry of Finance are exchanged by the National Bank of Poland rather than on the market. This, being a relatively common practice also among other new EU member states, increases foreign exchange reserves and the monetary base. In principle it isolates the zloty from some of the state-related flows. However, only a few world IT currencies were more volatile than the zloty.

While the National Bank of Poland does not target any particular exchange rate level, various equilibrium exchange rate models are available at the Bank (eg Rubaszek 2009). These models can provide indications about the likely future exchange rate trends, particularly when the deviations from the so-called equilibrium are substantial. Indications from these models can also be considered in relation to foreign exchange interventions, which remain one of the available tools.

The preconditions for considering interventions have evolved over time, but in general they have been subordinated to the overarching goal of price stability. This is reflected in the National Bank's *Monetary Policy Guidelines*. Documents published up to 2008 state (NBP (2008)) that "the MPC pursues this strategy under a floating exchange rate regime. Floating exchange rate regime does not rule out foreign exchange interventions should they turn out necessary for the inflation target implementation." This means that interventions could have been considered if and only if there would be risks to achieving the inflation target in the forecastable future.

The global financial crisis and related extreme developments in various segments of the market, foreign exchange included, have highlighted the importance of financial stability for the overall performance of monetary policy. Wide fluctuations of the zloty can often act as a shock absorber. However, very large, bubble-like deviations from levels seen as sustainable over the medium term can act in the opposite direction. As a result, the guidelines for 2010 and 2011 state (NBP (2010)) that "the [Monetary Policy] Council pursues the strategy under a floating exchange rate regime. However, the floating exchange rate regime does not rule out foreign exchange interventions should they turn out necessary to ensure domestic macroeconomic and financial stability, which is conducive to meeting the inflation target in the medium term". This leaves more space to intervene on the foreign exchange market, making such intervention less directly conditioned on threats to the inflation target. Actually, on 9 April 2010 the National Bank decided to intervene on the foreign exchange market. It should be emphasised that this has been the first and only intervention since 1998. The Bank's aim was to lower the high fluctuations of the zloty and increase the riskiness of momentum trading strategies.

## Conclusions

Over recent decades, there has been a visible tendency among central banks to introduce an inflation targeting framework combined with a flexible exchange rate regime. This tendency was also observed in Poland; since April 2000, the zloty has been a free-floated currency and the explicit target of monetary policy has been price stability. Despite the worldwide popularity of the IT framework, it is still unclear how exchange rate fluctuations should be included in monetary policy decisions under IT. Some argue that a central bank should react to exchange rate fluctuations only to the extent that they affect inflation, whereas others claim that the central bank should, to some degree, target the exchange rate.

The above discussion is also present at the National Bank of Poland. In particular, the Bank extensively analyses the channels through which the exchange rate affects the economy, estimates the level of the equilibrium exchange rate and thoroughly monitors exchange rate developments. Even though the mainstream opinion is that in stable times monetary policy should react to zloty fluctuations only to the extent that they affect inflation and output, there are also views that it should also partly target the exchange rate.

## References

- Abreu, Dilip and Markus K Brunnermeier (2003): “Bubbles and crashes”, *Econometrica* 71(1), pp 173–204.
- Bernanke, Ben S (2002): “Asset price bubbles and monetary policy”, Remarks before the New York Chapter of the National Association for Business Economics, New York.
- Bernanke, Ben S and Mark Gertler (2001): “Should central banks respond to movements in asset prices?”, *American Economic Review* 91(2), pp 253–57.
- Brzoza-Brzezina, Michał, Tomasz Chmielewski and Joanna Niedzwiedzińska (2010): “Substitution between domestic and foreign currency loans in Central Europe. Do central banks matter?”, *ECB Working Paper Series* 1187, European Central Bank.
- Budnik, Katarzyna, Michał Greszta, Michał Hulej, Marcin Kolasa, Karol Murawski, Michał Rot, Bartosz Rybaczyk and Magdalena Tarnicka (2009): “The new macroeconomic model of the Polish economy”, *NBP Working Papers* 62, National Bank of Poland.
- Central Statistical Office (2010): *Yearbook of Foreign Trade Statistics of Poland*, Warsaw.
- Corsetti, Giancarlo, Luca Dedola and Sylvain Leduc (2010): “Optimal monetary policy in open economies”, in B M Friedman and M Woodford (eds), *Handbook of Monetary Economics*, vol 3, Amsterdam: North-Holland.
- Engel, Charles (2009): “Currency misalignments and optimal monetary policy: a reexamination”, *NBER Working Paper* 14829, National Bureau of Economic Research.
- Fic, Tatiana, Marcin Kolasa, Adam Kot, Karol Murawski, Michał Rubaszek and Magdalena Tarnicka (2005): “ECMOD model of the Polish economy”, *NBP Working Papers* 36, National Bank of Poland.
- Flamini, Alessandro (2007): “Inflation targeting and exchange rate pass-through”, *Journal of International Money and Finance* 26(7), pp 1113–50.
- Frankel, Jeffrey A and Kenneth A Froot (1986): “Understanding the US dollar in the eighties: the expectations of chartists and fundamentalists”, *The Economic Record*, The Economic Society of Australia (Supplement), pp 24–38.
- Frankel, Jeffrey A (1999): “No single currency regime is right for all countries or at all times”, *NBER Working Papers* 7338, National Bureau of Economic Research.
- Frömmel, Michael and Franziska Schobert (2006): “Monetary policy rules in Central and Eastern Europe”, *Diskussionspapiere* dp-341, Universität Hannover.
- Geraats, Petra M (2009): “Trends in monetary policy transparency”, *International Finance* 12(2), pp 235–68.
- Grabek, Grzegorz and Bohdan Kłós (2008): “Wybrane skutki przystąpienia małej otwartej gospodarki do Unii Walutowej. Optyka modeli DSGE SOE-EUR i SOE-PL”, [http://www.nbp.pl/publikacje/o\\_euro/re17new.pdf](http://www.nbp.pl/publikacje/o_euro/re17new.pdf).

Kolasa, Marcin, Michał Rubaszek and Daria Taglioni (2010): “Firms in the Great Global Recession: the role of foreign ownership and financial dependence”, *Emerging Markets Review* 11(4), pp 341–57.

Lubik, Thomas A and Frank Schorfheide (2007): “Do central banks respond to exchange rate movements? A structural investigation”, *Journal of Monetary Economics* 54(4), pp 1069–87.

McCarthy, Jonathan (1999): “Pass-through of exchange rates and import prices to domestic inflation in some industrialised economies”, *BIS Working Papers* 79, Bank for International Settlements.

Mishkin, Frederic S (2001): “Inflation targeting”, in B Vane and H Vine, *An Encyclopedia of Macroeconomics*, Edward Elgar.

National Bank of Poland (2008): *Monetary Policy Guidelines for 2009*.

——— (2010): *Monetary Policy Guidelines for 2011*.

Orphanides, Athanasios and John C Williams (2008): “Learning, expectations formation, and the pitfalls of optimal control of monetary policy”, *Journal of Monetary Economics* 55 (Supplement), pp S80–S96.

Pavasuthipaisit, Robert (2010): “Should inflation-targeting central banks respond to exchange rate movements?”, *Journal of International Money and Finance* 29, pp 460–85.

Przystupa, Jan (2002): “The exchange rate in the monetary transmission mechanism”, *NBP Working Papers* 25, National Bank of Poland.

Przystupa, Jan and Ewa Wróbel (2009): “Asymmetry of the exchange rate pass-through: an exercise on the Polish data”, *MPRA Paper* 17660, University Library of Munich.

Reitz, Stefan and Mark P Taylor (2008): “The coordination channel of foreign exchange intervention: a nonlinear microstructural analysis”, *European Economic Review* 52(1), pp 55–76.

Rubaszek, Michał (2009): “Economic convergence and the fundamental equilibrium exchange rate in Poland”, *Bank i Kredyt* 40(1) pp 7–23.

Sarno, Lucio (2005): “Viewpoint: Towards a solution to the puzzles in exchange rate economics: where do we stand?”, *Canadian Journal of Economics* 38(3), pp 673–708.

Svensson, Lars E O (2010): “Inflation targeting”, in B M Friedman and M Woodford (eds), *Handbook of Monetary Economics*, vol 3, Amsterdam: North-Holland.

Vasicek, Borek (2009): “Monetary policy rules and inflation process in open emerging economies: evidence for 12 new EU members”, *Working Papers Series* wp968, William Davidson Institute.