To what extent can central banks influence exchange rates with foreign exchange interventions? The case of Poland

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Abstract

The significant depreciation of the Polish zloty in the second half of 2011, difficult to explain by fundamentals, was accompanied by a large increase in exchange rate volatility. The foreign exchange interventions carried out by the National Bank of Poland at that time were aimed at reducing the volatility of the Polish currency and the risk of its disorderly depreciation. In this regard, the two event studies presented in this paper argue that the central bank's policy was effective. On the date of the intervention, the zloty typically appreciated against the euro while the implied volatility of the currency tended to decline.

Keywords: foreign exchange intervention, exchange rate volatility, central banks and their policies

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Introduction

In this paper we discuss the role and effectiveness of foreign exchange (FX) interventions in Poland during the intervention period of late 2011. By putting aside interventions conducted before 2011, we are able to focus on the recent external conditions, as well as monetary policy considerations, which are largely determined by the inflation targeting (IT) regime under which the National Bank of Poland (NBP) operates. Interventions are not considered to be the main monetary policy instrument in Poland. Indeed, since the introduction of IT they have been used only occasionally. The 2011 interventions were exercised when the zloty faced periods of heightened exchange rate volatility. The NBP's experience is that not only the level of the exchange rate, but also its volatility may be of great importance during times of crisis. Hence, we pay special attention to both characteristics of the EUR/PLN exchange rate.

When deciding whether to intervene, a central bank is interested in assessing not only the preconditions for interventions, but also their effectiveness. We deal with this question by presenting possible techniques for assessing the effectiveness of interventions in two event study frameworks. Applied to actions undertaken by the NBP, the methods confirm that the 2011 interventions were generally successful.

The paper is organised as follows: Section I describes the evolution of the exchange rate regime in Poland. Section II presents the economic background that was present during the recent intervention period. Section III summarises the zloty's behaviour before the interventions started and explains the main motives behind the interventions. Section IV analyses the effectiveness of the interventions, using the event study methodology.

I. Characteristics of the exchange rate regime in Poland within the IT framework

The free float exchange rate regime was introduced in Poland in April 2000, soon after adoption of the inflation targeting (IT) strategy. The decision to shift from an eclectic monetary policy towards a more coherent IT framework was announced by the newly established Monetary Policy Council (MPC) in September 1998 and implemented in 1999. In the IT framework, a central bank's objective of price stability is expressed as a numeric target for inflation in the medium term. It is worth noting that the MPC recognised from the beginning that the free float exchange rate regime was a necessary condition for effective implementation of a new inflation targeting regime (Szpunar, Pruski 2004).

There are several theoretical arguments justifying this approach. Firstly, one of the conclusions of the "impossible trinity" paradigm is that in the long run a central bank operating under full financial integration cannot target both inflation and the exchange rate. Otherwise, monetary policy authorities run the risk that economic agents will begin to doubt whether the central bank truly pursues its inflation target. Secondly, the free float regime contributes to the overall flexibility of the domestic economy, as it constitutes a self-adjusting mechanism which corrects imbalances in the economy by acting as a shock absorber during rapid changes in the external environment (Brzoza-Brzezina, Makarski and Wesołowski, 2012).

The Polish experience with the new monetary policy framework is in line with the theory-based assumption that IT under a free float system is beneficial for price stability. The disinflation process in Poland was successfully completed at the end of the 90s, with inflation falling into single-digit territory in 1998 for the first time since the beginning of the transition, with low and stable inflation achieved subsequently. Indeed, since the introduction of the inflation target of 2.5% ± 1pp in 2004, inflation has averaged 3%. The high level of monetary policy credibility is reflected in the fact that long-term expected inflation, as measured by the difference between yields on 10-year conventional and index-linked government bonds, is now close to the official NBP medium-term inflation target, which is set at 2.5% in year-on-year terms. Overall, the new monetary policy framework has proved to be adequate in terms of controlling inflation and anchoring inflation expectations at low levels.

On the exchange rate front, it must be underlined that the free float regime has proved effective in reducing economic volatility by acting as a shock absorber cushioning real economic shocks. There is evidence from the latest financial crisis that part of the reason why Poland did not experience recession in 2008–2009 was owing to the steep fall in the zloty's value, which helped to sustain Polish exports at a rising rate. Yet, even though the free float regime appears to reduce economic uncertainty, excessive exchange rate volatility may constitute one of its major costs. The empirical data on the volatility of the Polish zloty partially validates this opinion. While it is true that in the first years of pursuing IT, exchange rate volatility increased and the zloty's ranked among the most volatile exchange rates in the emerging markets, the developments of the last four years point to a more positive picture. As shown in Table 1, before the Lehman Bank's collapse the zloty's volatility was way above the median emerging market currencies' volatility. When the latest four years are taken into consideration, however, the zloty's volatility falls back to the group's median.

In line with IT, the National Bank of Poland does not target any particular exchange rate level. At the same time, FX interventions are not excluded from the monetary policy toolbox as long as they are subordinated to ensuring domestic macroeconomic and financial stability. This is confirmed in the NBP's Monetary Policy Guidelines for 2013, which state that FX interventions are not ruled out under the floating exchange rate regime pursued. Quite the opposite, for under specific circumstances they may be necessary to ensure economic stability, which in the medium term is conducive to meeting the inflation target. From April 2000 to 23 September 2011 Poland's exchange rate regime was classified by the IMF as a free float regime, as there had been only one FX intervention by the NBP in the period preceding September 2011. During the NBP interventions in the second half of 2011, the exchange rate regime was classified as "floating". In 2012 the NBP ceased to intervene, so the *de facto* exchange rate arrangement was reclassified again as "free floating". Sporadic FX interventions in Poland are consistent with its priority on targeting over other goals. The same conclusion could be drawn from empirical studies on the monetary policy reaction function, which find that interest rates in Poland do not respond to exchange rate fluctuations (e.g., Frömmel and Schobert, 2006, and Vasicek, 2009).

Bańbuła, Koziński and Rubaszek (2011) analyse the preconditions for considering FX interventions in Poland, and examine motives for intervention other than monetary stability. They conclude that in Poland the central bank has the necessary tools at its disposal for identifying substantial deviations of the exchange rate from the equilibrium level. They also highlight the fact that the zloty was the most volatile currency in Central Europe in the 2000–2010 period. Excessive and

long-lasting exchange rate volatility can potentially be very disruptive to the stability of the financial system.

Volatility of major Emerging Market floating currencies			Table 1
Currency	12/2000 – 10/2012	12/2000 – 9/12/2008	9/12/2008 – 10/2012
Turkish lira	20.1%	22.0%	15.6%
South African rand	18.3%	17.3%	20.1%
Brazilian real	17.3%	15.5%	20.5%
Korean won	11.9%	7.5%	17.8%
Indonesian rupiah	11.7%	11.6%	11.9%
Polish zloty	11.6%	10.4%	13.7%
Mexican peso	10.4%	7.3%	14.9%
Hungarian forint	10.3%	8.1%	13.7%
Czech koruna	7.2%	6.1%	9.1%
Philippine peso	7.2%	7.4%	6.7%
Indian rupee	6.1%	3.9%	9.1%
Thai baht	5.2%	5.5%	4.5%
Median	11.0%	7.8%	13.7%
Mean	11.4%	10.2%	13.1%

Note: Exchange rates are **nominal exchange rate natural crosses** (CZK, HUF, PLN quoted vs. EUR; remaining currencies quoted vs. USD). Volatility is measured as the annualised standard deviation of daily log rates of return. The most liquid exchange rates were identified using the BIS Triennial Central Bank Survey 2010.

Source: National Bank of Poland, data; Bloomberg.

II. Economic background of FX intervention in 2011

Poland has weathered the recent global financial crisis relatively well. It has avoided recession, with its slowest growth being 0.4% in Q1 2009, while other European countries have seen a sharp decline in economic activity. It has not experienced a crisis in its banking system due to the sector's sound financial condition. Nor has it fallen into deep fiscal problems, since the debt to GDP ratio has stabilised below 55% over the last years.

As a result, the Polish economy grew by an average of 3.7% in 2008–2011, while average growth in 2004–2007 was 5.5%. The reduced growth rate in the crisis period in comparison with the pre-crisis years seems to be moderate in comparison with other countries. In 2011, a year marked by the NBP's FX interventions, the country's economy enjoyed robust and well-balanced growth. Real GDP expanded by a solid 4.3% in 2011, driven by a strong rebound in fixed investment and net exports.

With strong economic performance and net exports contributing solidly to Poland's GDP, macroeconomic fundamentals should be an important factor in the stable behaviour of the Polish currency in 2011. In a more formal way, various equilibrium exchange rate models used at the National Bank of Poland come to the same conclusion. For example, the extended version of the fundamental equilibrium exchange rate model (Rubaszek, 2009) points to undervaluation of the Polish zloty at times of crisis. In the fourth quarter of 2011 the misalignment was as high as

14.3% based on the FEER model. Such a deviation from the equilibrium does not come as a surprise, given wide consensus in the literature that the fundamentals-based models explain exchange rate developments reasonably well only in the long run.

Fundamental equilibrium exchange rate misalignment

Figure 1
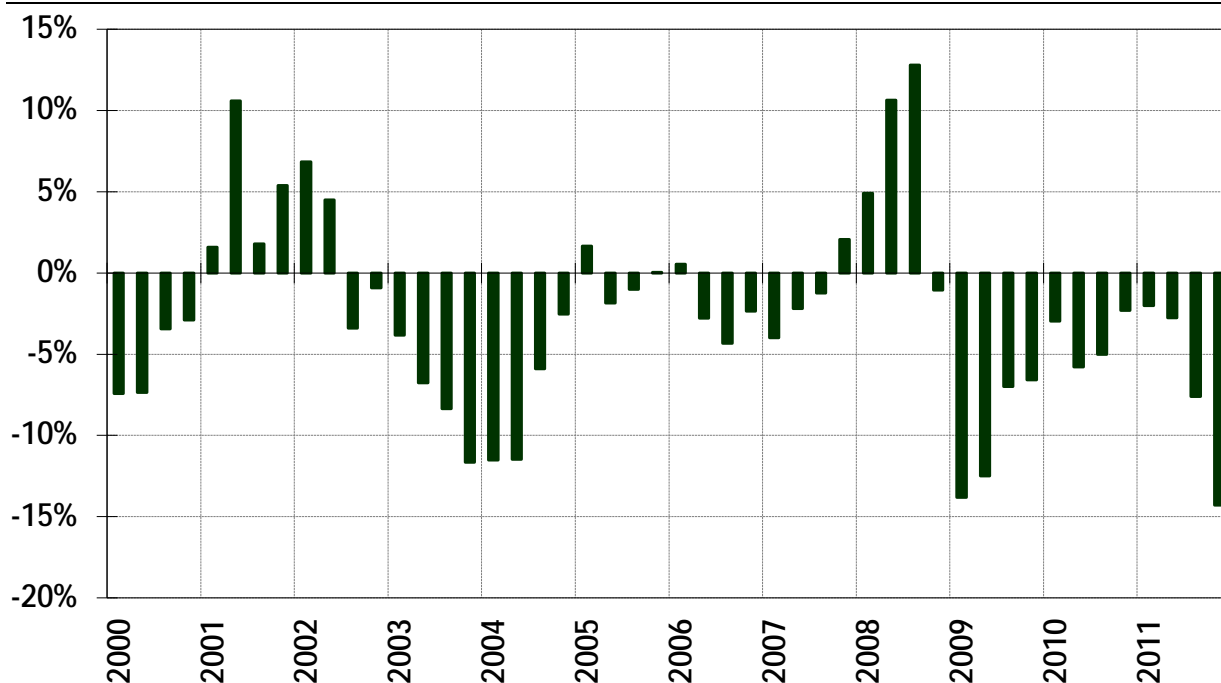
Note: Positive values stand for overvaluation. Misalignment is measured as the difference between the estimated FEER and the actual real effective exchange rate.

Source: National Bank of Poland.

## III. Exchange rate developments and motives behind FX interventions

While Poland managed relatively well during the global recession of 2008–2009 and avoided a domestic financial crisis, its financial market was to some extent affected by external shocks originating in major economies. The Polish economy was vulnerable to these shocks due to its close economic links with the rest of Europe and because of large external financing needs (Belka 2012). The second half of 2011 brought a sharp depreciation of the Polish zloty on the back of twin sovereign and banking crises in the euro area. Spillover effects led to currency market turbulence in Poland. However, it was a much broader phenomenon, as is evident from the sharp currency movements observed in many other emerging market countries. The National Bank of Poland responded to the exogenous shocks by starting FX interventions on 23 September 2011, and this decision coincided with other central

banks' activities in their domestic FX markets.[4] Between 23 September and 30 December 2011, the NBP stepped into the FX market several times.

One of the features of the Polish zloty movements before 23 September 2011 was its rapid depreciation compared to other emerging markets currencies. The zloty's high sensitivity to global risk factors could be partly attributable to its trading characteristics. The zloty's unusual weakness in 2011 despite Poland's solid macroeconomic fundamentals resulted from its relatively good liquidity and proxy hedge characteristic. During times of crisis, high liquidity can negatively impact currency stability, as investors are more inclined to close their positions in liquid currencies at the start of a crisis. Proxy hedge status refers to the idea that the most liquid market can often serve as a proxy hedge against adverse movements in illiquid markets. In the case of Poland, the zloty was used as a proxy hedge against other, less liquid regional currencies.

Emerging market currencies' performance in 2011	Figure 2
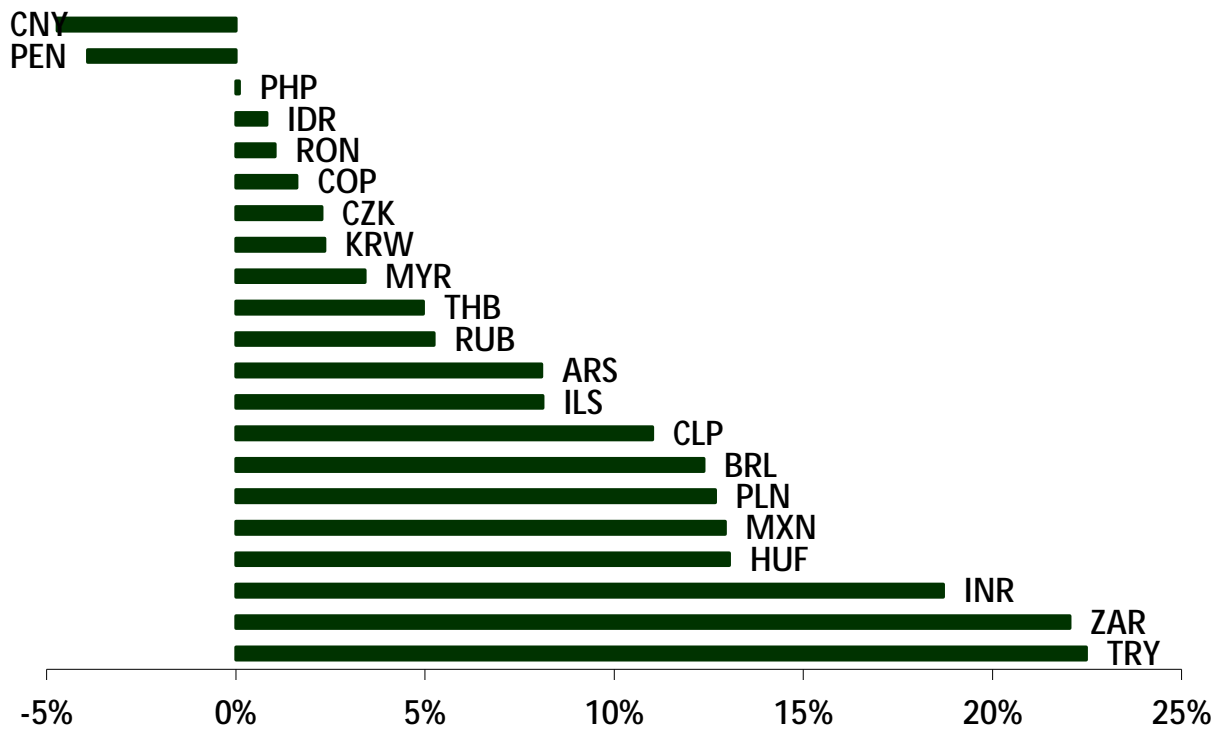
Note: Performance calculated as rate of return on nominal spot exchange rate natural cross.

Source: National Bank of Poland, data; Bloomberg.

The sharp depreciation of the zloty in the second half of 2011, difficult to explain by fundamentals, was associated with a large increase in exchange rate volatility. On 22 September 2011, one day before the first NBP FX intervention, the one-week implied EUR/PLN volatility reached a high of 18.6%. It remained at elevated levels until the end of the year. However, it stopped growing during the intervention period.

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[4]   At that time FX interventions were conducted by central banks in Brazil, South Korea, Russia and Turkey, inter alia.

The interventions were conducted at a time of increased exchange rate volatility and depreciation pressures on many emerging market currencies. The Polish monetary authorities made the decision to intervene in order to reduce the volatility of the Polish currency and the risk of further depreciation. This decision should be also viewed in the broader context of maintaining monetary stability. Owing to their positive impact on exchange rate volatility, the interventions should also contribute to lowering the risk of higher future inflation. Interventions were conducted at a time when inflation was markedly above the target of 2.5% (inflation in 2011 and in the first half of 2012 averaged 4.2% in annual terms). To curb inflation pressure, the NBP in early 2011 embarked on a monetary policy tightening cycle, which concluded in May 2012. For these reasons there was hardly any conflict between the objectives of the FX interventions and the monetary policy stance at the time.

IV. Assessment of the effectiveness of FX interventions

To complete the picture of the interventions conducted by the NBP in the second half of 2011, we must analyse their effectiveness. However, due to the complicated nature of such interventions this task is anything but trivial. The characteristics of the interventions include their sporadic and irregular nature, which results in unusual distribution, and the possibility of changes to intervention policy over longer periods. Fatum and Hutchison (2003) suggest that standard time-series studies are not particularly well suited for application in such a context. Therefore, it is common practice to rely on two advances in the field, namely, event study methodology and the possibility of using both daily and high-frequency (intraday) data.

There is a large body of work concerning the effectiveness of FX interventions in the event study framework. Neely (2005) surveys methodological differences in that body of work, pointing to several reasons which may find interventions successful in some studies but not in others. To minimise the impact of the choice of a particular method, we decided to use simple parametric and non-parametric methods. Both describe the behaviour of the exchange rate and/or its volatility around periods of intervention, and hence may be described as event studies. We leave aside the discussion of possible channels through which exchange rates may be influenced, and limit ourselves to studying the price impact of interventions in the short term only, as most studies do. It needs to be stressed, however, that the medium- to long-term effectiveness of interventions is of significant importance as well, and has also been tested in the literature (e.g., Fratzscher, 2008). To begin with, we describe the results of a parametric study using daily data. Then we proceed to the second study, which uses intraday data in a non-parametric framework. The event set consists of six interventions: those of 23 September, 30 September, 3 October, 23 November, 29 December and 30 December 2011.[5] Each was limited to a single day.

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[5]   In general, the NBP announced the interventions on its website by stating that it had bought a certain amount of foreign currency for zlotys.

Event study using daily data

In the first study we look at the 5-day windows following the interventions. For the purpose of calculating normal returns we use a market model in which we regress log returns of the EUR/PLN exchange rate on a constant, as well as log returns of EUR/USD, EUR/CZK and EUR/HUF. The latter two variables serve as proxies for the regional factors influencing the zloty, while the EUR/USD exchange rate approximates the global factor. We use standard ordinary least squares (OLS) technique. Under fairly general assumptions, the OLS is a consistent and efficient estimation procedure for the market model parameters. The estimation sample spans the period from 6 June 2011 to 22 September 2011, providing the same number of observations as the sample containing all the intervention periods. The exchange rate data are Bloomberg close of business day quotes. From Table 2 we conclude that the model for EUR/PLN log returns is reasonably well-specified, and that it passes standard autocorrelation of the error term (Breusch-Godfrey) and heteroskedasticity (ARCH) tests with a conventional number of lags.

| Market model for EUR/PLN exchange rate (OLS)			Table 2
Variable	Coefficient	Std. Err.	p-value
Const.	0.000	0.000	0.12
EUR/USD	–0.179	0.087	0.04
EUR/CZK	0.337	0.159	0.04
EUR/HUF	0.629	0.090	0.00
R-squared	0.63		
ARCH (1 lag)			0.11
ARCH (3 lags)			0.24
BG (1 lag)			0.18
BG (3 lags)			0.50

Notes: The dependent and explanatory variables are log rates of return. ARCH and BG denote ARCH heteroskedasticity and Breusch-Godfrey serial correlation tests respectively. Sample: 6/16/2011 – 9/22/2011.

Source: National Bank of Poland.

Next, we calculate abnormal returns by subtracting expected returns from actual (observed) returns and analyse their performance (Figure 3). The results indicate that in the five-day window following each intervention the zloty strengthened vs. the euro by 0.6% on average. Moreover, in period t1 (intervention day) the zloty appreciated in five out of six interventions, with the strongest reaction on 3 October 2011. The stabilising effect of central bank intervention was most visible during the September-October interventions, as the zloty appreciated further or remained at stronger levels for at least five days after the initial (t1) reaction.

Cumulative abnormal returns of EUR/PLN exchange rate

Figure 3

(a)

(b)
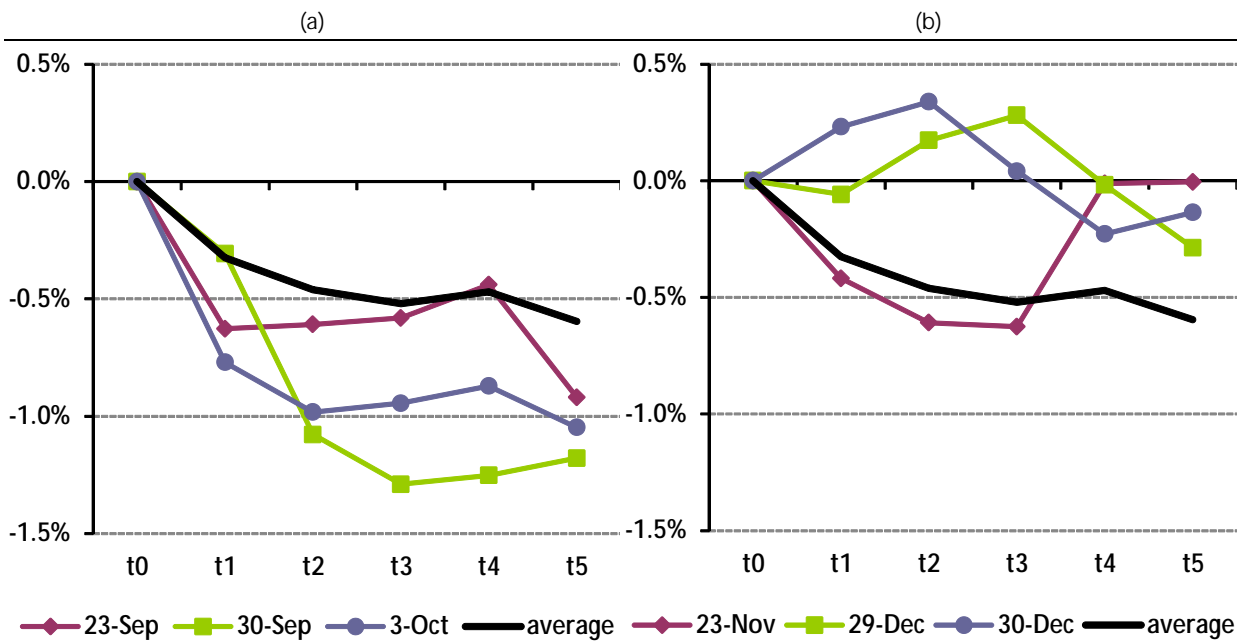
Notes: Abnormal returns are the returns obtained by subtracting expected EUR/PLN log returns (implied by the market model) from observed log returns. t0 is the day before intervention, t1 up to t5 are the days after the intervention.

Source: National Bank of Poland.

We recognise that the GARCH framework would be an appropriate way of testing together the effects of interventions on both the mean and volatility of the zloty. Our sample of interest, however, is not large enough to obtain reasonable estimates. Therefore, we decided to analyse the volatility of the EUR/PLN exchange rate via a simple linear regression model. To this end we use a market model, similar to the previous one, in which we relate the difference of the 1-month implied volatility of EUR/PLN to their global (EUR/USD) and regional (EUR/CZK, EUR/HUF) equivalents. The estimation sample is from 6 June 2011 to 22 September 2011, and the data are Bloomberg close of business day quotes. Table 3 provides the results of the estimation.

Market model for 1-month implied volatility of EUR/PLN exchange rate (OLS)

Table 3

| Variable	Coefficient	Std. Err.	p-value
C	0.001	0.035	0.99
EUR/USD_1M	0.047	0.062	0.45
EUR/CZK_1M	0.148	0.166	0.38
EUR/HUF_1M	1.008	0.101	0.00
R-squared	0.80		
ARCH (1 lag)			0.36
ARCH (3 lags)			0.78
BG (1 lag)			0.71
BG (3 lags)			0.68

Note: The dependent and explanatory variables are in first differences. ARCH and BG refer to the ARCH heteroskedasticity and the Breusch-Godfrey serial correlation tests respectively. Sample: 6/16/2011–9/22/2011.

Source: National Bank of Poland.

In a similar manner we calculate abnormal changes by subtracting expected changes from actual (observed) changes in volatility and analyse their behaviour (Figure 4). The average abnormal change in the five-day window is negative (–1.4 pp.), which means that following the NBP interventions the zloty's implied volatility decreased, particularly in the t3–t5 period. In four out of six cases the volatility dropped on the intervention day, while in all but one it turned out to be lower after five days. The largest one-period effects are visible for the September-October interventions. The volatility argument may also be considered in terms of one of the criteria of successful interventions, the smoothing criterion (Humpage, 2000). In general, lower expected volatility of the currency means lower expected risk of excessive currency movements, including depreciation. To conclude, interventions decreased the volatility of the EUR/PLN expected by currency options traders, which was one of the objectives of the central bank in late 2011.

Cumulative abnormal changes of 1-month implied volatility of EUR/PLN exchange rate

Figure 4
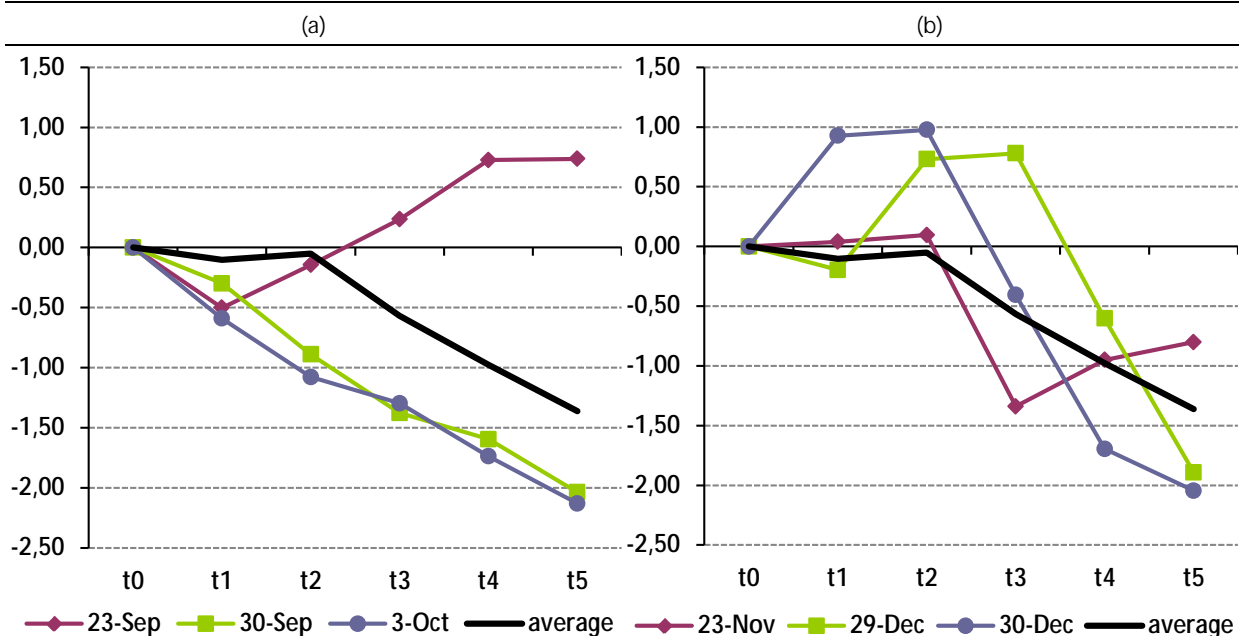
Notes: Abnormal changes are the changes obtained by subtracting expected EUR/PLN volatility changes (implied by the market model) from observed volatility changes. t0 is the day before intervention, t1 up to t5 are the days after the intervention.

Source: National Bank of Poland.

Event study using intraday data

In the second event study we analyse the reaction of the zloty-vs.-euro to the interventions conducted by the NBP, using high-frequency data. By giving up the market model approach we lose the possibility of controlling for global or regional forces influencing the zloty contemporaneously with interventions. On the other hand, shorter event windows allow us to escape the problem of overlapping intervention periods. Here, the event windows are of various lengths, and we define them as lasting 15, 30 and 60 minutes from the beginning of the intervention, as well as 15, 30 and 60 minutes from the last transaction. We complement these results by reporting the change in the EUR/PLN rate up to 5 pm CET, approximately

close of business on the intervention day. Table 5 and Figure 5 contain the results. The data on exchange rate levels comes from the Reuters service. The average reaction of the exchange rate is negative regardless of the event window definition. The most pronounced average effect occurs 30 minutes after the beginning of the intervention or in 15 minutes if measured from the end of the intervention. From Figure 5 we also conclude that the interventions either reversed the zloty's depreciation trend, or supported its appreciation trend, on a given day.

Intraday reaction of EUR/PLN exchange rate   Table 5

Intervention date	Change since beginning of intervention			Change since end of intervention			Change up to 5 pm CET
	15 minutes	30 minutes	60 minutes	15 minutes	30 minutes	60 minutes	
23-09-2011	–0.60%	–1.12%	–1.03%	–1.10%	–1.01%	–	–1.01%
30-09-2011	–0.32%	0.03%	–0.03%	–0.06%	–0.16%	0.04%	0.18%
03-10-2011	–0.67%	–0.56%	–0.40%	–0.51%	–0.39%	–0.28%	–0.56%
23-11-2011	0.11%	–0.35%	–0.15%	–0.23%	–0.15%	–0.15%	0.52%
29-12-2011	–0.03%	–0.86%	–0.94%	–1.09%	–1.11%	–1.13%	–0.94%
30-12-2011	–0.24%	–0.37%	–0.49%	–0.34%	–0.35%	–0.36%	–0.36%
Average	–0.29%	–0.54%	–0.51%	–0.55%	–0.53%	–0.38%	–0.36%

Note: Changes calculated as rates of return.

Source: National Bank of Poland.

EUR/PLN exchange rate movements around the events   Figure 5
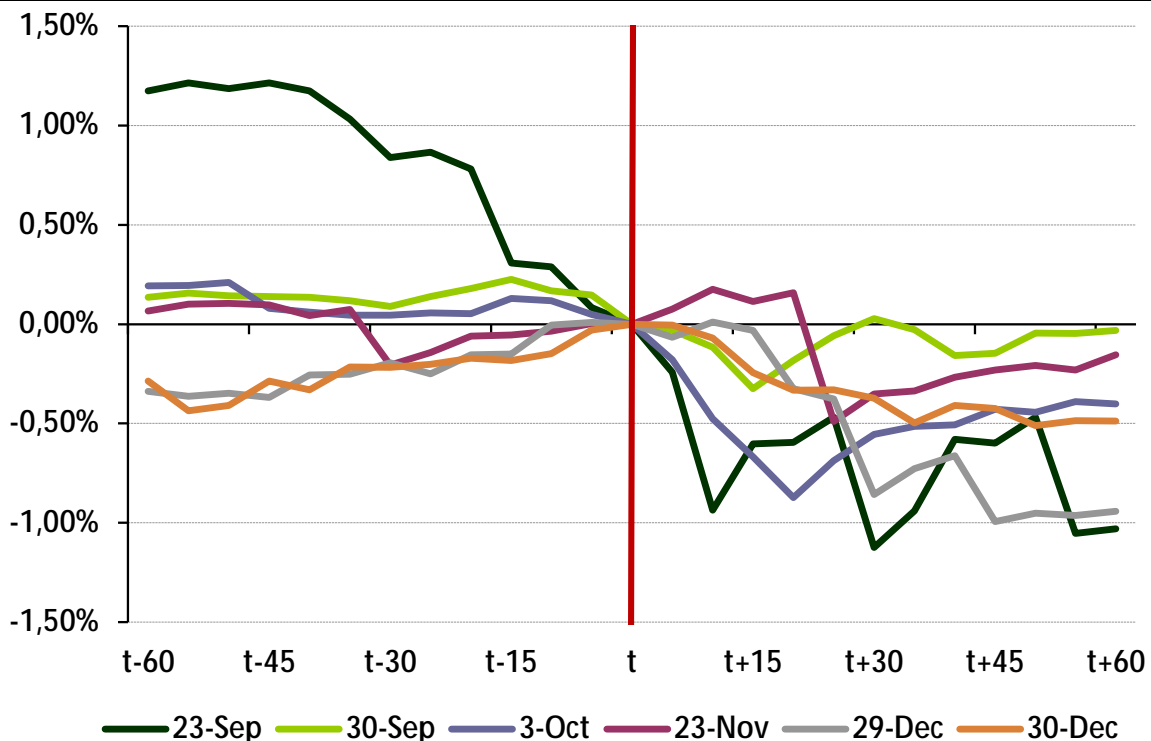
Notes: Movements calculated as rates of return. t denotes the time closest to the beginning of a given intervention.

Source: National Bank of Poland.

Although both of these studies can be classified as event studies, a straightforward comparison of their results is not feasible for several reasons. They use different data sets, not only provided by different services, but quoted in different frequencies. As a consequence, the definitions of event and post-event windows do not match. Additionally, the first study is based on a regression model to control for external conditions while the second is not. However, both studies suggest that the interventions were largely effective in influencing the EUR/PLN exchange rate level. Depending on the definition of the event window, there is a minimum 66% success rate in influencing the exchange rate to move in the desired direction. Importantly, no NBP intervention could be identified as being a failure in majority of the event windows.

Conclusions

Strong economic fundamentals should have been an important driving force of stable behaviour of the Polish currency in 2011. However, the rate of the zloty's depreciation in Q4 2011 in comparison to other EM currencies threatened, inter alia, the stability of the currency and the achievement of the inflation target pursued by the NBP. Having FX interventions in its monetary policy toolbox, the central bank stepped into the market several times between September and December 2011, buying foreign currency for zlotys.

To evaluate whether the intervention policy of late 2011 was effective, we rely on an event study framework, looking at both daily and high-frequency data in various settings to minimise the impact of a given method. Even though the event set is rather limited, the results prove to be consistent and confirm that the interventions of the NBP were successful in that they tended to move the EUR/PLN exchange rate in the desired direction. As a result, the Polish zloty on a given day was slowing its depreciation path against the euro or strengthening its appreciation trend. The stabilising effect of intervention was most visible during the September-October period, as confirmed by the declining implied volatility of the EUR/PLN currency pair. More importantly, no NBP intervention could be identified as unsuccessful in all the event windows. Although not straightforwardly comparable, the results vary somewhat between settings, which highlights the complex nature of interventions and the difficulties involved in assessing their true effects.

Quite aside from methodological aspects of the event studies, we admit that more in-depth analysis is needed to get the complete picture of the FX interventions. One of the issues that must be explored is the medium- and long-term influence on the exchange rate. In this paper we studied only the short-term impact. What is more important for the inflation outlook is the ability of central bank interventions to contain the non-desired exchange rate pass-through, which obviously exceeds our event study horizon.

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