Has exchange rate flexibility of the Polish zloty been conducive to shock absorption?

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Abstract

The paper examines whether the flexible exchange rate of the Polish zloty has acted as a shock absorber or a shock-propagating mechanism. The analysis is founded on macroeconomic model of an open economy which is is used to derive sign restrictions that are applied to identify structural shocks. In an empirical part structural Bayesian VAR models with common serial correlation are employed. Sample covers quarterly data from 1998 to 2013 on real GDP, interest rate, real exchange rate and price level. We demonstrate that the shocks identified match well the description implied by the theory. Moreover, even though financial shocks are the single most important type of shock behind the exchange rate variability, the joint contribution of supply and demand shocks is greater. Finally, it is uncovered that financial shocks were behind the precrisis appreciation but afterwards their contribution to exchange rate misalignment was either nil or in line with that from real shocks. Overall, we find more evidence in support of the hypothesis that the flexible exchange rate in Poland acted as a shock absorber than for an alternative that it acted as a shock-propagating mechanism.

Keywords: *open economy macroeconomics, real exchange rate, monetary integration, Bayesian structural VAR*

JEL Classification: JEL F41, C11

1. Introduction

Poland adopted flexible exchange rate regime in April 2000 and since then the Polish zloty fluctuated widely against the euro. Episodes of both strong real appreciation, e.g. by 16 per cent in the run-up to the global financial crisis (GFC), and deep depreciation, e.g. by 28 per cent at the outbreak of the GFC, have been observed. The Polish zloty is quite a volatile currency both in tranquil and uncertain times even if compared to other floating European currencies like the Czech koruna or Swedish koruna (for a measure of exchange rate volatility see, e.g., ECB, 2014). In that respect the zloty is more like the US dollar or Hungarian forint (Table 1).

The natural question to ask is whether the exchange rate variability of the Polish zloty was connected to financial processes or can be justified by real processes. In other words, we ask whether the flexible exchange rate has acted as a shock-propagating mechanism or as a shock absorber. Empirical evidence on this issue is not unambiguous. Kuijs and Borghijs (2004)

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found that the nominal (LM) shocks contributed significantly to both nominal and real nominal exchange rate variability in five Central European countries, with their contribution particularly high in the smaller, more open economies and concluded that “the results cast doubt on the usefulness of the exchange rate as shock absorber”. Similarly Shevchuk (2014) was skeptical about the shock-absorbing properties of exchange rates in Central and Eastern European countries. Stążka-Gawrysiak (2009) in turn demonstrated that it was real shocks (mainly the IS shocks) that were behind the exchange rate variability in Poland. In an earlier study Dibooglu and Kutan (2001) found that the short-run changes in the real exchange rates were under the influence of nominal shocks in Poland and real shocks in Hungary (in the long run real shocks dominated). In our previous studies we have shown that the exchange rate in Poland was indeed driven by real shocks but financial shocks were much more important that suggested in the extant studies (Dąbrowski and Wróblewska, 2014; Wróblewska and Dąbrowski, 2014).

	Denmark	**Sweden**	**Czech Rep.**	**Hungary**	**Poland**	**United States**
2005-2007	0.2	4.1	4.3	7.0	7.3	7.5
2008-2009	0.3	8.3	9.2	12.8	12.1	12.0
2010-2013	0.2	6.8	5.6	9.3	7.5	9.1

Note: Annualized monthly standard deviation (as a percentage) of daily percentage changes in the exchange rate against the euro. Average of three-year period.

Table 1. Exchange rate volatility.

Source: Own calculations based on data from the ECB website.

A conventional empirical approach is to apply a structural vector autoregression (VAR) model with short-run zero restrictions to identify shocks and assess whether the exchange rate has been driven by its own shocks. The problem, however, is that the ordering of variables in the VAR model matters, so a theory is needed to choose the most plausible model. Unfortunately, shocks identified are only roughly consistent with the theory. For example, an empirically identified output shock can possibly hide supply and demand shocks which are implied by a conventional macroeconomic model. This problem was overcome in the studies referred to above by imposing long-run restrictions along the lines suggested by Blanchard and Quah (1989). The main drawback of that approach, however, was that VAR models were either too parsimonious, i.e. too few types of shocks were uncovered, or additional ad hoc zero restrictions which were not founded on the theory were introduced in order to identify shocks. One solution is to impose long-run sign restrictions (see e.g. Dąbrowski and Wróblewska, 2015). In this paper a different approach is adopted: using the open economy macroeconomic model we derive sign restrictions which are imposed on short-run responses of underlying variables.

The paper is structured as follows. The underlying theoretical model, empirical strategy and data are briefly discussed in Section 2. Empirical results are presented in Section 3. Last section concludes.

2. Model, data and methodology

A stochastic macroeconomic model of an open economy developed by Clarida and Galí (1994) is used as a theoretical framework for our analysis. We use an extended version of their model (for details see Dąbrowski, 2012). Four building blocks of the model are the IS relation, LM relation, uncovered interest rate parity condition augmented by the risk premium and the price setting relation that allows for price stickiness. The model can be solved for the relative output, real interest rate differential, real exchange rate and relative price level (for details see Dąbrowski and Wróblewska, 2015). Using this solution it is possible to derive restrictions on instantaneous responses of macro variables to four types of shocks: supply, demand, financial and monetary. These are depicted in Table 2.

Variable/shock	**supply**	**demand**	**financial**	**monetary**
Relative output	+	+	+	+
Real interest rate differential	–	+	+	–
Real exchange rate	–	+	–	–
Relative price level	–	+	+	+

Note: In empirical part financial and monetary shocks are assumed to have no instantaneous impact on the relative output.

Table 2. Instantaneous indentifying restrictions.

The empirical results are obtained within the framework of the set of SVAR models. In order to identify four types of shocks we impose 14 sign restrictions on the instantaneous reactions of the analyzed variables to the structural shocks (see Table 2). Two zero restrictions are introduced as well: taking into account that output reacts with a lag to financial and monetary shocks we assume that these shocks have no instantaneous impact on the relative output. It should be noted that the results with sign restrictions only are quite similar (not reported though available upon request).

The algorithm proposed by Arias et al. (2013) is employed. The analysis starts with the Bayesian Gaussian stable reduced-form VAR(k) model with three seasonal dummies and known starting points. We impose the commonly known Normal-Wishart prior structure on the parameters. The matrix Normal distribution is centred around zero with the shrinking covariance structure making VARs with lower order more preferable. The inverted Wishart distribution is centered around the diagonal matrix $0.01I_4$.

Additionally, we test whether the analyzed series may be treated as realization of the 4-dimentional process with common serial correlation, which in the framework of VAR models leads to the reduced rank restriction imposed on the matrix model parameters:

$$y_t = \gamma\delta_1 y_{t-1} + \gamma\delta_2 y_{t-2} + \ldots + \gamma\delta_k y_{t-k} + \Phi D_t + \varepsilon_t, \quad \varepsilon_t \sim iiN\left(0,\Sigma\right), \quad t = 1,2,...,T \qquad (1)$$

where γ is of full column rank (see Engle and Kozicki, 1993) and D_t collects the deterministic components. Such a Bayesian VAR-CC model has been already analyzed by Dąbrowski and Wróblewska (2015).

Taking the advantage of the Bayesian Model Comparison technique we compare a set of models consisting of 40 non-nested VAR specifications, which may differ in number of lags (5 throughout 9), number of common features (0 throughout 3) and whether or not there is a constant in the model. The below presented results are obtained within the model with the highest posterior probability.

We use quarterly data spanning from 1998Q1 to 2013Q4. Real GDP is used as a measure of output. Real interest rate is calculated as a difference between 3-month money market nominal interest rate and actual inflation. Real exchange rate is based on average quarterly nominal exchange rate defined as the price of national currency in terms of the euro, so its rise is an appreciation of the domestic currency. A harmonised index of consumer prices is used as s measure of the price level (the index is also used for inflation). Relative output and relative price level are constructed as the log-differences between domestic and foreign (euro area) levels. Real interest rate differential is the difference between domestic and foreign rates. The data are from the Eurostat database.

3. Empirical results

Impulse response functions of the real exchange rate are depicted in Figure 1. Empirical results match reasonably well out theoretical model. First, reactions to all the shocks are significant and, as expected, demand shocks result in an appreciation whereas the other shocks depreciate the zloty in real terms. Second, real and financial shocks exert a permanent impact on the exchange rate, e.g. in the wake of a demand shock the zloty appreciates by 2.4 per cent and the effect persist in the long run. Third, the reaction to monetary shock is twice as weak as the reaction to other shocks and it ceases to be significant in the long run. It should be emphasized that the *long-run* restriction excluding the impact of a monetary shock on the real exchange rate has not been employed to get this result. Thus, it can be interpreted as evidence of money neutrality.

An insignificant reaction of the relative output to a monetary shock lends support to this finding as well (Figure 2): changes in the nominal sphere have no influence on real variables in the long run. It should be explained that the zero-identifying restriction has been imposed on the on impact reaction of output only and there is no long-run restrictions. There is, however, an important departure from money neutrality: the real interest rate differential decreases by 0.8 percentage point in the long run in response to a positive monetary shock (not reported in Figures). On the one hand this is a bit worrisome but on the other hand it is line with other empirical studies. For instance, Farrant and Peersman (2006) found that money was not neutral since monetary shocks had permanent impact on output (in the U.K. and Canada) and on the real exchange rate (in the U.K., euro area and Japan).

Interestingly, financial shocks do not affect the relative output either in the long run – which is perfectly in line with the theoretical model – or in the short run. The latter finding could be interpreted as a symptom of relatively weak linkages between real economy and financial sphere. The response to both supply and demand shocks matches very well the model: supply shocks permanently change the relative output whereas the impact of demand shocks peters out gradually.

In order to assess the relative importance of shocks the forecast error variance decomposition is used. Results collected in Table 3 clearly indicate that the forecast error variance (FEV) of the relative output was mainly accounted for by real shocks: the joint contribution of supply and demand shocks more than 85 per cent across all the horizons. Consistently with the results on the impulse response functions financial shocks turned out to be relatively unimportant with the contribution to the FEV around 6 per cent in the long run.

The same can be concluded about the monetary shocks. This is one more argument in favour of money neutrality and relatively weak links between real economy and financial markets.

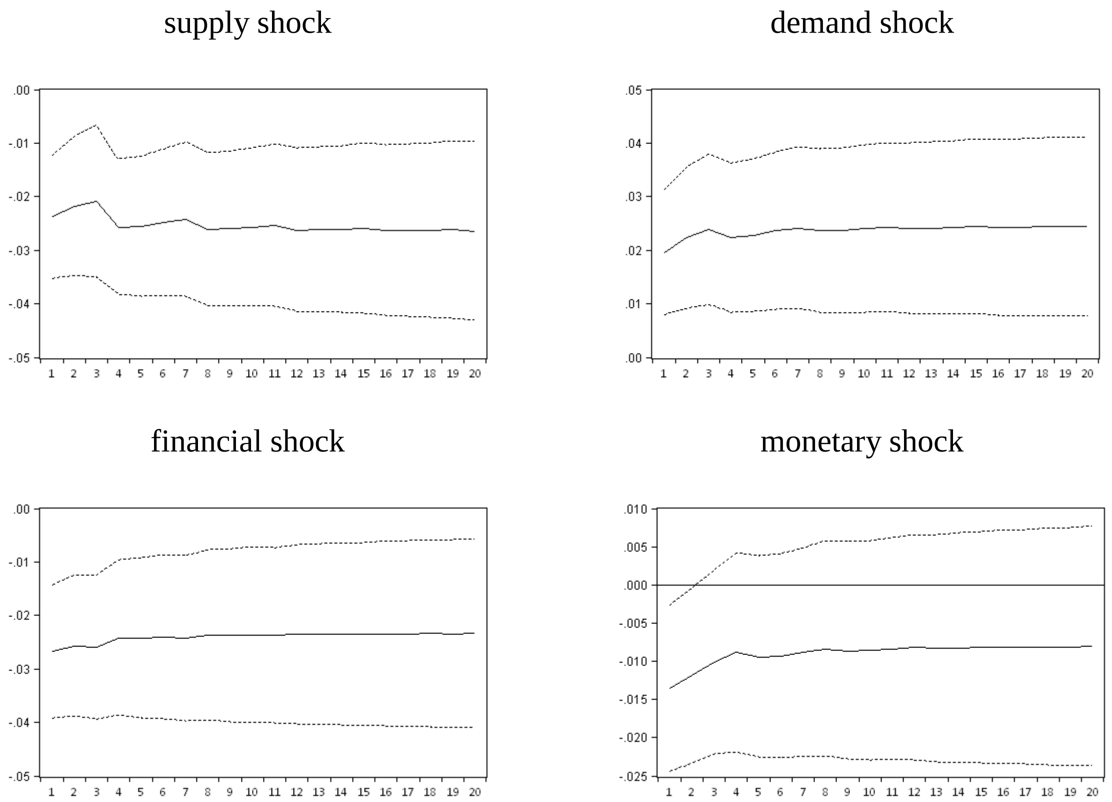

Fig. 1. Impulse response functions of the real exchange rate.

Financial shocks were the single most important type of shocks behind the FEV of real exchange rate. It does not, however, mean that the other shocks were unimportant. Quite the opposite: the joint contribution of real shocks (supply and demand) was close to or above 50 per cent across all forecast horizons. The conservative interpretation would therefore be that the real sources of exchange rate variability were at least as important as (if not more than) financial and monetary factors (the latter alone accounted for just around 10 per cent of FEV).

In order to trace the importance of shocks in time historical simulations are used. Figure 3 illustrates the contribution of particular shocks to real exchange rate deviation from the undisturbed path. In 2005-2008 supply shocks exerted an upward pressure on the exchange rate. Till the end of 2007 it was roughly offset by demand shocks. In 2008 the contribution of both real shocks increased and on the eve of the outbreak of global financial crisis it exceeded 5 pp (the overall deviation was 17.6 per cent). The main source of precrisis real appreciation, however, was due to financial shocks: their contribution rose from virtually zero in 2005 to

9.7 pp in autumn 2008 which is consistent with the intuition about the nature of the GFC. Monetary shocks were in general relatively unimportant. A non-negligible influence of these shocks on the exchange rate was observed just before and just after the outbreak of the crisis.

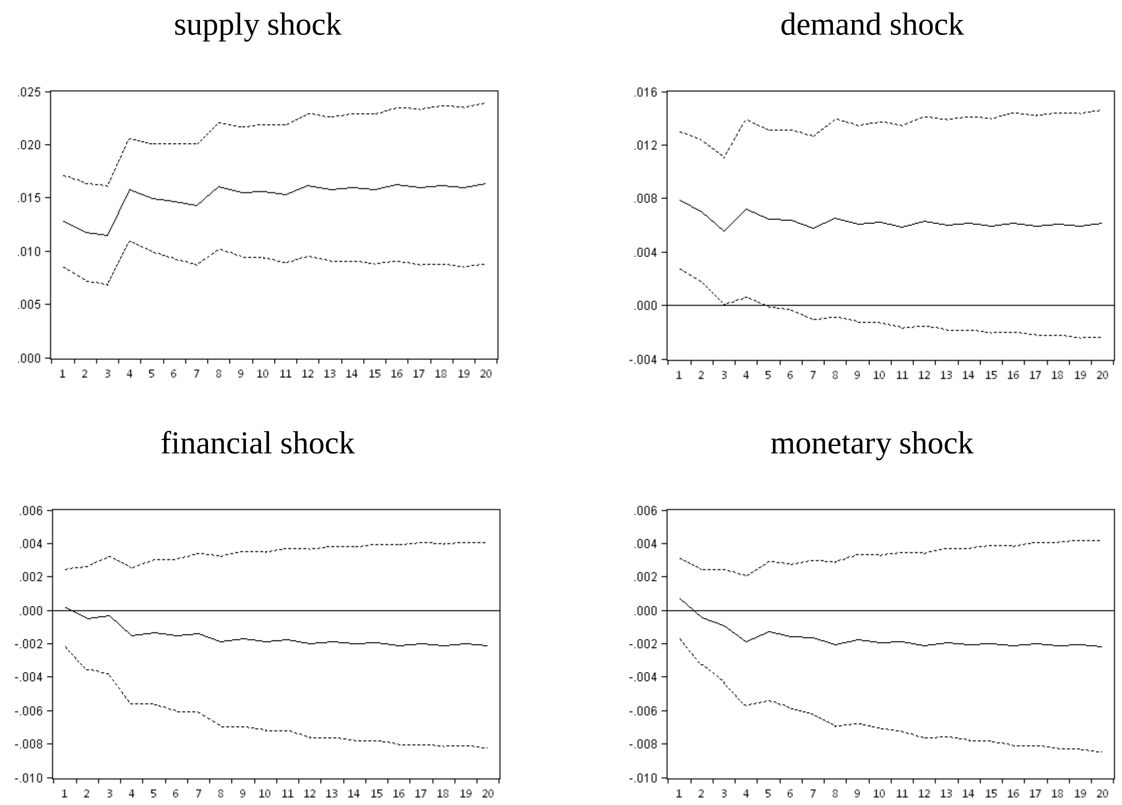

Fig. 2. Impulse response functions of the relative output.

Note: ‘Deviation’ is a deviation from the path without any shocks.

Fig. 3. Real exchange rate and contributions of structural shocks.

Forecast horizon *h*	Proportions of forecast error variance, *h* periods ahead, accounted for by			
	supply shocks	**demand shocks**	**financial shocks**	**monetary shocks**
Real exchange rate				
1	31.67	17.25	39.19	11.99
4	28.55	23.91	36.19	11.44
20	31.23	26.67	31.92	10.27
Relative output				
1	61.16	38.94	0.00	0.00
4	61.88	32.73	2.68	2.80
20	64.35	23.68	5.85	6.22

Table 3. Posterior expected value of forecast error variance decomposition of the real exchange rate and relative output.

The precrisis appreciation was sharply reversed at the beginning of 2009. The adjustment, however, took a form of an overreaction with the deviation from the undisturbed path plummeting by almost 30 pp (to -11.1 per cent). The fall in the exchange rate was mainly driven by financial shocks whose contribution decreased by 12.0 pp. Interestingly, the reduction in the joint contribution of real shocks was comparable, 11.7 pp, suggesting that the real processes were an important factor behind the adjustment as well. This is again consistent with an intuition because the crisis spread on emerging market economies, including Poland, both via financial channel as capital started to flow out (capital flight) and via trade channel as main trading partners were plunged into the economic crisis.

In 2010-2013 the contribution of supply shocks was negative, rather stable (-2.8 pp on average) and partly compensated by demand shocks. The influence of financial shocks was almost nil till the debt crisis in Greece deepened starting in 2011Q3 when the Greece's rating was cut to a level associated with a substantial risk of default in July. The negative contribution of financial shocks to the exchange rate remained in 2012 and 2013 and was in line with the joint influence of real shocks (-2.8 pp and -2.7 pp on average, respectively).

Conclusion

The answer to the title question about the shock absorbing property of the flexible exchange rate in Poland is rather positive. The problem with the flexible exchange rate is that it could be a propagator (or even a source) of shocks rather that the shock absorption mechanism. This is the case if the main driving force behind the exchange rate fluctuations are financial and monetary shocks, or to put it informally, the exchange rate lives its own life and is unconnected to real processes.

Our findings are threefold. First, we have identified four types of shocks and demonstrated – by examining the impulse response functions – that they match well the description of shocks implied by the macroeconomic stochastic model of an open economy. In particular, money neutrality holds in the long run even though we have not imposed the relevant restrictions on the long-term responses of real variables. Second, admittedly, financial shocks are the single most important type of shock that accounts for the forecast error variance of the exchange rate but the joint contribution of real shocks is even greater and increases with the forecast horizon to almost 60 per cent. Thus, the conservative interpretation is that real shocks are not less important driver of real exchange rate fluctuations than nominal shocks. Third, it is found that financial shocks were behind the strong precrisis appreciation. This, however, cannot be taken as the clinching argument against shock absorption property. One can doubt whether the stabilized (nominal) exchange rate, e.g. within the Exchange Rate Mechanism, would have insulated against the excessive real appreciation. The case of Slovakia is a good example here: the koruna appreciated more than the zloty in 2005-2008. Moreover, financial shocks have been rather "neutral" in their contribution to the exchange rate misalignment after the adjustment in 2009 and starting in 2011 their impact has conformed with that of real shocks. Overall, our results lend more support to the hypothesis that the flexible exchange rate in Poland acted as a shock absorber than to an alternative that it acted as a shock-propagating mechanism.

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