

ANALYSIS OF FACTORS AFFECTING FLUCTUATIONS IN THE EXCHANGE RATE OF POLISH ZLOTY AGAINST EURO

Katarzyna Twarowska
Maria Curie Skłodowska University, Poland
k.twarowska@poczta.umcs.lublin.pl

Magdalena Kałol
Maria Curie Skłodowska University, Poland
mkakol@hektor.umcs.lublin.pl

Abstract:

In recent decades, one can observe a rapid development of global financial market and financial services. In these circumstances, the dynamics of exchange rates have an increasing impact on the overall macroeconomic situation in countries around the world. This applies particularly to countries such as Poland, where domestic monetary policies cannot influence the world interest rates. For these countries, the exchange rate becomes a major tool in adapting to changing external conditions. Therefore, identification of the factors that determine exchange rate levels is an important theoretical task, having great practical significance. Poland's exchange rate policy evolved from the fixed exchange system to the pure float. Till the end of the 1990s, two kinds of the stable exchange rate regime were used in this country: the crawling peg (1991-94) and the crawling band (1995-99). The official floating of the Polish currency was announced in April 2000, when the band was abandoned. As in many other countries, Poland was pushed toward floating exchange rate due to the cost of having stable exchange rate in the environment of the increased mobility of international capital flows (Sławiński, 2008, p. 414). The main objectives of this study are to analyse the determinants of the exchange rate of the Polish zloty against euro and to find which of them play the most important role as factors affecting the zloty values. To achieve these goals, the following tasks are identified:

- presenting the content and the evolution of theoretical approaches to determine the factors influencing exchange rate levels,
- presenting the results of some econometric studies concerning the factors affecting fluctuations in exchange rate levels,
- analysing the factors affecting volatility of the EUR/PLN exchange rate and determining directions of its fluctuations on the basis of statistical data and regression function.

In the study the authors used such research methods like literature review, comparison of statistical data as well as regression analysis.

Keywords: exchange rate, knowledge on factors affecting fluctuations in exchange rate levels, impact of the main economic indicators, cross-border cooperation and convergence process of the Polish economy with the euro area on the exchange rate of Polish zloty against euro

1. THE THEORIES OF EXCHANGE RATE

The theories of the exchange rate began to flourish in the beginning of 1960s. However, despite their large number and considerable diversity, most of them consider only some selected issues and there are few works carried out, conducting a comprehensive analysis of the factors influencing the exchange rate levels.

The modern explanation of the long-term exchange rate determination is based upon the theory of purchasing power parity (PPP) between different currencies, that derives its essential validity from the law of the single price. According to the purchasing power parity theory, in the long run, identical products and services in different countries should cost the same. This is based on the principle that exchange rates will adjust to eliminate the arbitrage opportunity of buying cheaper goods or services in one country and selling it at increased prices in another (Boykorayev, 2008, pp. 8-9). The theory only holds for tradable goods and ignores several real world factors, such as transportation costs, tariffs and transaction costs. The other assumption is existence of competitive markets for the goods and services in all countries.

The relative version of the PPP doctrine avoids some of the weaknesses characteristic of its absolute version and continues to serve as the foundation for the theory of evolution of exchange rates over time. It assumes a causal link between the path of the price of a unit of one currency in terms of another and the relative dynamics of price levels in the respective two countries within a lengthy period of time. The determinants of the long-term behavior of exchange rates through time are essentially reduced to the same factors which govern the evolution of the domestic value of money. However, specific factors like changes in the structure of production (e.g. shift in relative weights of tradables and non-tradables), differences in dynamics of labour productivity or changes in the magnitude and composition of aggregate demand are liable to induce not only temporary but also relatively durable divergences of exchange rates away from their presumed long-term equilibrium (or PPP) levels (Lutkowski, 2007, p. 56).

Short-term behaviour of exchange rates can be explained by the uncovered interest parity (UIP) condition (Montiel, 2012, p. 82-87). The characteristic feature of this approach is regarding currencies basically as assets. Assuming free cross-border capital mobility and perfect substitutability of the domestic and currency deposits, the relative demand for currencies is largely determined by the expected yields, which they offer. That yield is dependent upon the rates of interest at home and abroad and upon the expected change in the rate of exchange of the two currencies (Rubaszek and Serwa, 2009, p. 131-133).

The fundamental importance of the long-term rate of exchange, as explained by the PPP doctrine with all the attendant qualifications, resides within this context in anchoring the current exchange rate in expectations for the future, after accounting for the difference in the foreign and domestic interest rates. However, long-run general equilibrium implies, that both the PPP condition and the UIP condition hold simultaneously (Lutkowski, 2007, p. 56).

2. LITERATURE REVIEW ON THE FACTORS DETERMINING EXCHANGE RATE VOLATILITY

The topic of currency exchange rates and factors influencing their changes have been reviewed by many scholars in the last decades and still remains to be one of the hot topics in international economic studies.

The first attempts to analyse exchange rates behavior were done by Rudiger Dornbusch in 1973, Richard Meese in 1979 and Kenneth Rogoff in 1983. The Dornbusch (or overshooting) model analyses exchange rate adjustments considering sticky prices and rational expectations (Marrewijk, 2007, p. 540-556). In the essay on purchasing power parity (1987) Dornbusch made clear that it remains an important concept, though the evidence in recent years is more remarkable for deviations from, than observance of, such parity (Boykorayev, 2008, p. 22-23).

The combination of exchange rate analysis and the factors that determine nominal exchange rates was clearly performed by Philip Lane. He did theoretical and empirical research on long-run exchange rates and built own model. He analysed long run nominal and real exchange rates of 107 countries in

1974-1992, and added to his model such variables like trade openness, country size, central bank independence and government debt (Lane, 1999, p. 118-138). Before him all the works had considered a smaller number of developed countries within less time period. His econometric results show that the most important factor affecting nominal exchange rate is inflation and factors driving long-run inflation. Moreover, openness, output growth and the terms of trade resulted to be significant, but country size was insignificant. In overall, results show that the debt effect is most important for high depreciation/inflation countries. Openness, size, and the stock of nominal government debt - variables that affect the tendency to inflate - are significant in explaining the rate of nominal depreciation. However, the results for the terms of trade, another factor that ought to affect the nominal exchange rate via its influence on the real exchange rate, are mixed. For the OECD countries, the factors driving inflation appear to dominate the determination of the nominal exchange rate (Lane, 1999, p. 130).

In 1993 David Romer pointed at the great influence of openness on the exchange rate trends. In work titled "*Openness and inflation: Theory and Evidence*" he conveys correlation between inflation and openness, but it is as important for exchange rates as for inflation. Unanticipated monetary expansion leads to real exchange rate depreciation, and because the harms of real depreciation are greater in more open economies, the benefits of unanticipated expansion are decreasing in the degree of openness (Romer, 1993, p. 869-904).

R. MacDonald and L. Ricci studied the long-term determinants of real exchange rate including economic openness, capital flows and terms of trade (MacDonald and Ricci, 2003). R.A. Ejaz, A. Abbas and A.R. Saeed showed a direct relationship between exchange rate and budget deficit under the managed floating exchange system (Ejaz, Abbas and Saeed, 2002, p. 839-842).

Some researchers do not agree with the statement that the exchange rate is determined exclusively by fundamentals. J.A. Frankel and K.A. Froot argue that the high value of the US dollar in 1984 and 1985 can best be explained as speculative bubble, based on the self-confirming market expectations driven by the increase in forecasting weight given to the chartist as a result of their previous forecasting success (Frankel and Froot, 1990, p. 182).

According to G. Galati and C. Ho news may play an important role in fluctuations of the euro exchange rate against dollar. The results of the study show that good news brings appreciation while bad news depreciates currency (Galati, Ho, 2003, p. 371-398). J.R. Sanchez-Fung also studied the same relationship and stated that exchange rate is more responsive in case of depreciation (Sanchez-Fung, 2003, p. 247-250).

In the literature, three principal views on the factors determining exchange rate levels have been presented, depending on the time horizon and the main conditions for the functioning of economy. Proponents of **the first** view indicate that macroeconomic fundamentals play an important role in explaining the behaviour of exchange rates. Some authors hold that these fundamentals are important only in the long run but have little to offer in explaining short-term movements, while others believe that macroeconomic fundamentals have explanatory power both in the long- and the short run (McDonald, 1999, p. F673-F691).

The second approach is applicable in short time horizons and for countries without high inflation. According to this view, exchange rate models that include macroeconomic fundamentals do not perform better than a random walk in out-of-sample forecasting. Exchange rate volatility is simply the standard deviation of the error term (Frankel and Rose, 1995; Rogoff, 1999, p. F655-F659).

Adherents to **the third** view think that neither macroeconomic fundamentals nor the random walk model adequately account for exchange rate behaviour at short horizons. Rather, short-run exchange rate movements are attributed to market microstructure factors, including inventory management and information aggregation by foreign exchange dealers. Specifically, the microstructure approach suggests that non-dealers learn about fundamentals affecting the exchange rate, and this knowledge is reflected in the orders they place with dealers. Dealers in turn learn about fundamentals from order flow. The outcome of this two-stage learning process results in the formation of a price (Lyons, 2001)

3. THE CLASSIFICATION OF FACTORS AFFECTING EXCHANGE RATE LEVELS

The nominal exchange rate is the home-country currency price of a foreign currency. It measures the relative price of two countries' currencies (in a given moment in the foreign exchange market). The real exchange rate can be defined as the rate at which two countries' goods trade against each (Reinert, 2012, p. 229-232; Krugman, Obstfeld, 2007, p. 47). Like any price, exchange rate deviates from the valuation basis - the purchasing power of currencies - under the influence of demand and supply of currency. The correlation of such supply and demand depends on several factors. Exchange rate reflects its relationship with other economic categories - cost, price, money, interest rate, the balance of payments (Boykorayev, 2008, p. 9).

There is no consensus in the literature on the factors affecting exchange rates and their volatility. Usually they are divided into two groups: economic and non-economic factors. In the first group, we can distinguish the long-term and short-term factors. Analysing the impact of various factors on exchange rate, the relative values (in relation to situation abroad – especially in main trading partners' countries) should be taken into account.

Table 1: Factors affecting exchange rate fluctuations

Economic factors	
Short-term	<ul style="list-style-type: none"> – rate of economic growth – inflation rate – interest rate in the country and abroad – current account balance – capital account balance – currency speculation
Long-term	<ul style="list-style-type: none"> – level of economic development of the country – competitiveness of the economy – technical and technological development – size of the foreign debt – budget deficit – relative domestic and foreign prices – capital flows
Non-economic factors	
<ul style="list-style-type: none"> – political risk (e.g. risk of armed conflict) – natural disasters – policy approaches – psychological factors 	

Source: own work based on: (Bożyk, 2008, p. 190 – 193; Jantón-Drozdowska, 2009, p. 132-135; Syczewska, 2007, p. 67).

Recently, global factors have been becoming more and more important. It also concerns the Polish currency market, that in comparison to the world market, is characterised by a relatively high share of foreign entities. The dominance of transactions with non-residents¹ indicates that the Polish foreign exchange market is gaining features of extra-territorial market. This phenomenon causes the zloty exchange rate fluctuations are strongly influenced by changes in the financial performance of the global market (Bilski, Janicka, 2009, p. 99).

¹ In 2007, 38% of turnover in the global foreign exchange market constituted transactions with local entities, and 62% were cross-border transactions. In Poland, these proportions were as follows: 21% - domestic transactions, 79% - foreign transactions (Bilski, Janicka, 2009, p. 99).

4. MAIN FACTORS AFFECTING FLUCTUATIONS IN THE EUR/PLN EXCHANGE RATE IN 2000-2013

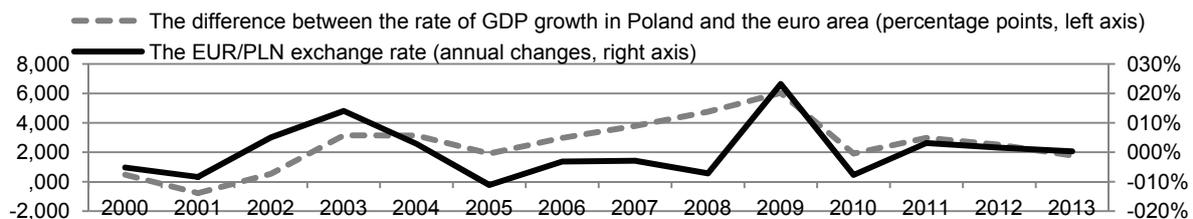
4.1. Rate of economic growth

In this section the relationship between the rate of economic growth and exchange rate volatility is analysed. The EUR/PLN exchange rate has been chosen because of the growing integration of the Polish economy with the European Union and the euro area in XXI century. The EU has the largest share in Poland's foreign trade (above 80% in 2004), thus, the foreign investors and FX dealers perceive the zloty as a currency closely tied with the euro (Sławiński, 2008, p. 416). This appears to have a dampening effect on zloty volatility.

In the whole analysed period, except 2001, economic growth in Poland was greater than in the euro zone. Analysing the variables shown in picture 1, it can be concluded that the trends and direction of changes between the GDP and the exchange rate were similar. In most cases, faster GDP growth in Poland in comparison to the euro area was accompanied by depreciation of the zloty. That was in 2003, 2009 and 2011.

This process can be explained by the income effect. It causes an increase in demand for imports of goods and services as a result of the increase in disposable income of the population. The growth in imports will increase supply of the zloty and its depreciation (Mińska-Struzik, 2012, p. 211).

Picture 1: The relationship between changes in the rate of GDP growth and the EUR/PLN exchange rate



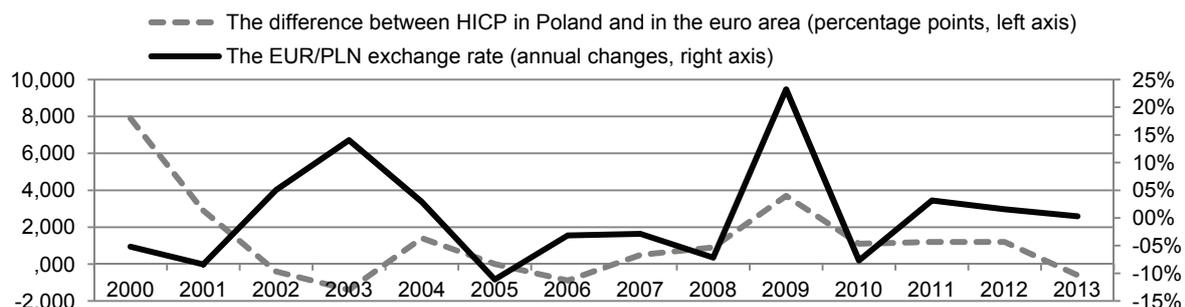
Source: own calculation based on: (Eurostat, 2014)

The importance of changes in GDP for exchange rate volatility is also confirmed by the results of a study conducted by Boykorayev, which show that GDP growth is significant in explaining the rate of nominal depreciation for countries with not very high inflation (inflation rate less than 30%) (Boykorayev, 2008, p. 42-43).

5.2. Inflation rate

In theory, the exchange rate should reflect the trends in inflation and productivity (Sławiński, 2008, p. 415). Increase in the price level in Poland causes depreciation of the zloty, as the more expensive products at the domestic market encourage consumers to import products from abroad, and thus the supply of currency increases (Mińska-Struzik, 2012, p. 212-213). In practice the zloty was fluctuating widely in 2000-2013 and was disconnected from fundamentals (picture 2).

Picture 2: The relationship between inflation rate and the EUR/PLN exchange rate



Source: own calculation based on: (Eurostat, 2014)

According to data presented in picture 2, there is no clear relationship between changes in inflation and exchange rate. In 2009, inflation rate in Poland was higher than the average for the euro zone by 3,7 percentage points. In this period the zloty depreciated by 23% on average, which confirms the theoretical relationship shown above. Inverse relationship took place in 2003, when inflation in Poland was lower than inflation in the euro area, but the zloty depreciated.

It can be stated, that a rise in expected inflation produces exchange rate depreciation. However, such reasoning describes the long-term relationship. In short run other factors, such as carry trade and speculations, have significant role (Sławiński, 2008, p. 421).

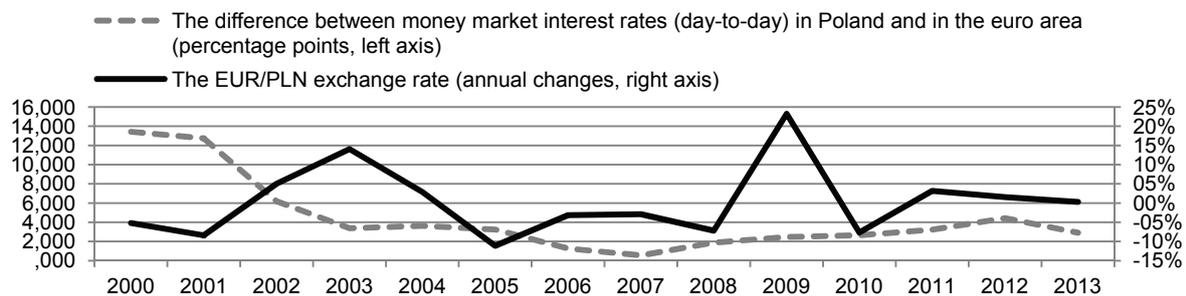
5.3. Interest rate

If a country keeps its interest rates at a relatively high level, it usually attracts large short-term capital flows and the currency of this country appreciates (Mińska-Struzik, 2012, p. 212-213). Empirical data do not unequivocally confirm such a relationship.

In 2000-2001, the interest rate in Poland was significantly higher than in the euro area and during this period the zloty appreciated, which is supported by the theory. In 2002-2003, the difference between interest rate levels decreased, and the zloty depreciated. In subsequent years, there has been no longer such a clear relationship.

In 2007-2008, the zloty exchange rate fluctuated in accordance with the interest rate parity condition, but towards the end of 2008 the trend of the EUR/PLN exchange rate was reversed. It was a consequence of the global financial crisis and increase in foreign investors' aversion to invest in emerging markets (Bilski, Janicka, p. 101). In 2010, the zloty was appreciating, which could not be justified by changes in interest rates.

Picture 3: The relationship between interest rate and the EUR/PLN exchange rate



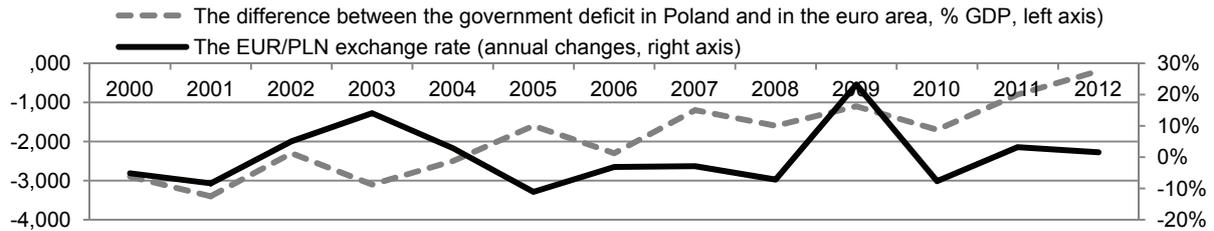
Source: own calculation based on: (Eurostat, 2014)

5.4. Government deficit

Generally, a high budget deficit in Poland increases the government borrowing in the money market. The foreign banks and investors along with the domestic banks and financial institutions are the main creditors who buy government bonds and treasury bills to cover this deficit. High borrowing by the government and bond buying by the foreign investors generates high foreign currency inflow in the domestic market that supports the fiscal expansion. It increases demand of the zloty and its appreciation.

Analysing the relationship between government deficit and exchange rate, it should be taken into account, that it is complex and multidirectional. According to S. Wijnbergen, under floating exchange rates, external shocks or internal structural reforms may cause jumps in inflation and the exchange rate through their impact on the government budget (Wijnbergen, 1987, p. 1-36). In order to achieve a sustainable reduction in inflation, a fixed exchange rate is used to require restrictions not only on domestic credit, but also on the rate of increase in interest—bearing public debt.

Picture 4: The relationship between government deficit and the EUR/PLN exchange rate



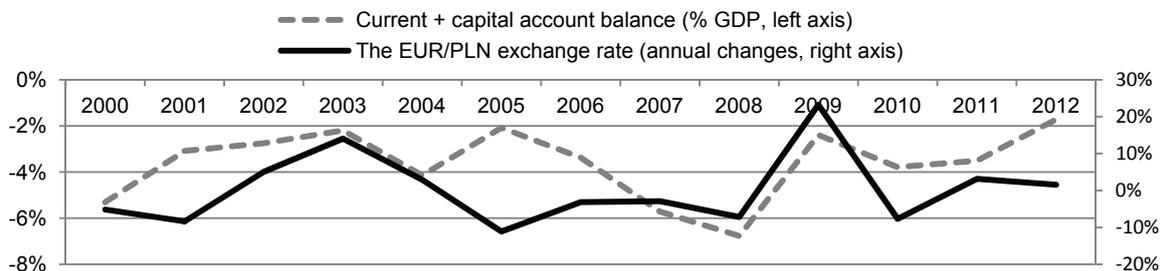
Source: own calculation based on: (Eurostat, 2014)

As shown in picture 4, an increase in the difference between the government deficit in Poland and in the euro area was attended by the appreciation of the zloty. That situation occurred in 2000-2001, 2007-2008, 2009-2010. The reduction of the government deficit in Poland resulted in depreciation of the zloty in the period of 2001-2002, 2006-2007, 2008-2009 and 2010-2011. In turn, the relationship between the government deficit and the exchange rate in 2002-2006 and 2011-2012 was the opposite in comparison with the situation described above.

5.5. Balance of payment

Floating exchange rate is determined on foreign exchange market by supply of and demand for currency. Demand for a currency comes from net export while supply of the currency comes from net foreign investment, so balance of payment is an important determinant of exchange rate volatility. Researches show that international trade has the greatest impact on exchange rate levels for countries that export mainly low-processed goods (such as Brazil, Australia). The growing demand for raw materials contribute to a rise in their prices on world markets. It leads to increase in exports and to appreciation of the national currency value (Chisholm, 2013, p. 101).

Picture 5: The relationship between Poland's balance of payment and the EUR/PLN exchange rate



Source: own calculation based on: (Eurostat, 2014)

Analysing the relationship between Poland's balance of payments and changes in the EUR/PLN exchange rate we can notice that there were years when the exchange rate level followed in a way different than expectations. In 2002-2003, there was a constant fall of the zloty value despite the improvement in balance of payments. In 2004, the balance of payments deficit was growing, but the zloty was appreciating. In 2005-2006, the directions of changes in the balance of payments and the exchange rate of zloty against euro concurred with expectations, but in subsequent years the trend has changed again, which indicates that the exchange rate is influenced more by other factors.

5.6. The level of forex market (FX) development and speculative capital flows

The Polish currency market is relatively small compared to the developed countries. Immaturity of the Polish foreign exchange market increases its sensitivity and scale of response to external shocks. The total value of transactions in the zloty (daily turnover on the foreign exchange market)² accounted for 7.63% of the Polish GDP³. The share of transactions in the euro in relation to the euro area's GDP is 14.74% and for the United States the analogous ratio is 28.64% (BIS, 2014).

² OTC foreign exchange turnover, daily averages in April 2013.

³ Estimated GDP in 2013 (IMF, 2013).

Globalization and the development of linkages between countries contribute to the growing importance of such factors like short-term investments and currency speculation, that affect considerably the fluctuation of exchange rates. In 2000-2004, the zloty was fluctuating widely. NBP worried that the volatility of the zloty might be augmented by the low level of development of the Polish FX market, which became liquid enough to attract large foreign investors, but not deep enough to dampen the impact of their transactions on the zloty value.

In 2004, the zloty appreciated sharply due to a permanent fall in risk premium on the Polish forex market after the country's joining the European Union. In 2005-2007 the volatility of the zloty became much lower, but in 2008 the zloty depreciated significantly, which was strongly related to turmoil on the global financial market, the increase in market risk and the outflow of foreign capital from Poland.

As in the case of other emerging currencies, the volatility of the zloty is correlated with the volatility of the S&P500 (Sławiński, 2008, p. 416). This correlation is the product of globalisation. When global investors take profits on the US capital market, they buy all assets that are in their global benchmark portfolios. This produces a rise in prices of many different assets including emerging markets currencies. The reverse situation produces a fall in investors' risk appetite and causes a fall in exchange rates of emerging currencies.

6. REGRESSION ANALYSIS

6.1. Data description and methodology

In empirical analysis the following variables are used for the period of 2000–2013:

- EUR/PLN (Y) – annual average exchange rate,
- GDP (X1) - the difference between the rate of GDP growth in Poland and in the euro area,
- HICP (X2) - the difference between inflation rate (HICP) in Poland and in the euro area, percentage points,
- IR (X3) - the difference between money market interest rates (day-to-day) in Poland and in the euro area, percentage points,
- CA (X4) - current account balance in Poland (% GDP),
- FA (X5) – financial account balance in Poland (direct foreign investments, portfolio investments and other investments including currency speculation, % GDP).
- Deficit (X6) - the difference between government deficit as % GDP in Poland and in the euro area, percentage points.

In order to identify the factors affecting the EUR/PLN exchange rate, a linear regression function has been used. The two stage least square method has been applied for estimating the important linear regression equation for the further analysis:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \hat{\epsilon}$$

Where $\hat{\epsilon}$ is the residual term (including factors not covered by the model, e.g. non-economic factors such as political factors).

6.2. Results of regression analysis

The regression equation is:

$$Y = 4,471 + 0,043 (\text{GDP}) + 0,084 (\text{HICP}) - 0,056 (\text{IR}) + 3,751 (\text{CA}) - 9,016 (\text{FI}) - 0,058 (\text{Deficit}) + \hat{\epsilon}$$

$R^2 = 62,3\%$, standard error of estimate is $25,2\%$.

Table 2: Regression analysis coefficients

Variable	Coefficient β	Standard deviation	Significance
GDP	0,043	0,098	0,675
HICP	0,084	0,074	0,296
IR	-0,056	0,069	0,443
CA	3,751	9,500	0,707
FA	-9,016	7,539	0,277
Deficit	-0,058	0,114	0,627

Source: own calculation based on: (Eurostat, 2014)

The coefficient of determination (R^2) accounted for 62,3% shows that the model is not a perfect fit. It means that only two third of variations in the EUR/PLN exchange rate in 2000-2013 can be explained by this model. The fluctuations were caused by six factors, that is GDP, HICP interest rate, current account balance, financial account balance and government deficit, whereas only 37,7% of the variation in exchange rate was dependent on other factors that have not been taken into account. The obtained results confirm that a relative increase in the price level and faster economic growth in Poland comparing to the euro area caused the zloty depreciation. The rise in the current account deficit and financial account surplus as well as a relative increase in Polish market interest rate and government deficit contributed to the appreciation of the zloty. However, drawing conclusions from this analysis should be made with caution, because the model is a simplified picture of reality, accompanied by errors.

7. CONCLUSIONS

Exchange rates are basically the prices of one currency in terms of other currencies driven by the normal forces of supply and demand. The empirical studies relating to the link between exchange rate variability and its factors are not conclusive.

The conducted analysis reveals that the financial account balance and inflation rate are the most important factors determining the level of EUR/PLN exchange rate. While a rise in Poland's financial account surplus contributes to appreciation of the country's currency, an increase in inflation rate has a negative effect and reduces the value of Polish currency.

The market interest rate is the third most important factor determining the zloty exchange rate level. The relative rise in interest rates contributes to appreciation of the Polish currency, because it encourages foreign investors to invest in Poland. The fourth important variable which bring more variation in the zloty exchange rate is the government deficit, while the economic growth and the current account are less significant.

Based on these evidence it is clear that in Poland fiscal and monetary policies play an important role in affecting the zloty exchange rate changes. It is recommended to harmonize these both policies and to make an effective link between them and other economic policies (like investment or trade policy). Effective and smooth running of fiscal and monetary policies are required to reduce inflation and boost up economic growth.

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