

## INFLATION AND CURRENCY FLUCTUATIONS: COMPARATIVE STUDY WITH THE POLISH ZLOTY

Marcin MROWIEC

University of Economics in Katowice, Department of Mathematics and Optimization Methods;  
Marcin.Mrowiec@edu.uekat.pl, ORCID: 0009-0001-0362-5319

**Purpose:** The study investigates the impact of inflation on exchange rate dynamics between 2000-2023, with special attention to PLN-based currency pairs.

**Design/methodology/approach:** Panel data econometric modeling was applied for 120 currency pairs (including 15 pairs with the Polish zloty).

**Findings:** The research confirms significant influence of current and lagged inflation on exchange rates. For current inflation, the direction of the relationship was positive, suggesting appreciation, while for lagged inflation the direction of the relationship was negative. The PLN pairs showed stronger effects.

**Research limitations/implications:**  $R^2$  values below 0.25 suggest existence of other unexplained macroeconomic determinants.

**Practical implications:** The results provide important guidance for both institutional and individual market participants. Accurate forecasts of inflation and understanding how central banks react to inflation surprises can help firms and investors better manage exchange rate exposure and hedge currency risks.

**Originality/value:** The article provides a comprehensive assessment of the directional effects of both current and lagged inflation over the period 2000–2023 and offers an additional perspective on the impact of consumption on exchange rate dynamics. Furthermore, it enables a comparative analysis of the specific characteristics of PLN-denominated currency pairs relative to other currencies under study.

**Keywords:** currency market, inflation, exchange rate determinants, Polish zloty, panel data analysis.

**Category of the paper:** Research paper.

### 1. Introduction

This study analyzes the impact of inflation on exchange rate dynamics between 2000 and 2023, with a particular focus on currency pairs involving the Polish zloty. The primary objective of the research was to examine the effect of current and lagged inflation on exchange rates and

to compare the strength of this impact in the case of PLN-based currency pairs relative to other currency pairs. Based on this, the following research questions were formulated:

- a) What is the impact of current inflation on exchange rate dynamics?
- b) What is the impact of lagged inflation from the previous period on exchange rate dynamics?
- c) Are there significant differences in this impact between currency pairs with PLN and other currency pairs?
- d) What other factors significantly affect the prepared models?

The research methodology was based on panel data analysis for 120 currency pairs, of which 15 comprised PLN-based pairs. Econometric modeling was employed using Driscoll-Kraay standard error estimators, which are robust to autocorrelation and cross-sectional dependence. The dependent variables collected were the absolute differences of annual changes in exchange rates. The independent variables are the dynamics of inflation (current and lagged), interest rates, and, as control, other selected macroeconomic variables.

The results confirmed a significant impact of inflation on exchange rates. Current inflation demonstrates an expected relationship—an increase in inflation leads to currency depreciation (coefficient close to 1). Unexpectedly, lagged inflation exhibits a stronger, opposite effect leading to currency appreciation. For PLN-based pairs, the impact of inflation was stronger, and the significance of the VIX index indicates capital outflow from the zloty during periods of uncertainty. The findings have practical implications—accurate inflation forecasts support investment and operational decisions of enterprises and individuals.

## **2. Inflation as a factor influencing the exchange rate**

Exchange rate quotations depend on a multitude of factors. One classification divides these factors into three categories: economic, institutional, and psychological (Świder, 2018).

The first category appears relatively straightforward to measure using various economic indicators such as gross domestic product and inflation. The remaining two categories—institutional and psychological factors—are more challenging to quantify. Institutional factors include aspects such as political stability and central bank interventions. Psychological factors pertain to expectations regarding future economic changes and may also result from various behavioral influences. Investors might also seek to hedge portfolio value by relying on characteristics of safe haven assets (Mrowiec, 2024). Table 1 presents a summary of these factors.

**Table 1.***Types of Assets Considered as Safe Havens*

<b>Economic factors</b>	<b>Non-economic factors</b>
GDP growth Inflation rate Interest rate changes Unemployment rate Development level Structure of the economy and its level of competitiveness Level of technical support	Political Factors Degree of Political Stability Political Shocks Systemic Solutions Monetary and Fiscal Policy
	Psychological factors (market participants' expectations)

Source: Matuszewska-Janica, Witkowska, 2008, pp. 55-75.

Inflation itself is thus categorized within the group of economic factors, and its influence on exchange rates has been extensively studied. Numerous studies confirm the expected effect of inflation leading to the depreciation of a given currency. Dornbusch (1976) described a relationship in which monetary expansion causes an immediate currency depreciation that overshoots its long-term equilibrium value, followed by a gradual return to equilibrium. Frenkel (1976) and Mussa (1976) referenced the rational expectations hypothesis, according to which monetary expansion not only induces depreciation but may also sustain it due to changes in expectations of future monetary growth. The study by Lothian and Taylor (1996) demonstrated that despite short-term deviations from purchasing power parity, in the long term (several years), differences in inflation rates between countries correspond proportionally to exchange rate changes.

Among Polish researchers, Wojciech Świder (2018) examined the relationships between nominal interest rates, real interest rates, and inflation with the exchange rates of three currency pairs: USD/JPY (1971-2013), GBP/USD (1959-2013), and GBP/JPY (1971-2012). Inflation was found to be a strong factor contributing to currency depreciation in the long run, consistent with theoretical assumptions. A similar verification was conducted by Wdowiński (2010), whose analysis confirmed the presence of relative purchasing power parity for the EUR/PLN currency pair in the period 1995-2008, taking into account changes in PPI indices. Rubaszek and Serwa (2009), analyzing the behavior of the Polish złoty during the period 1989-2005, also devoted considerable attention to inflationary changes, which were particularly significant in the early years of Poland's economic transformation.

### 3. Methodology

In the first part of the analysis, the selection of currencies to be analyzed was performed. The selection criteria included the availability of economic data for the economies using the respective currencies, the size of these economies, and the availability of exchange rate quotations against the USD. Based on these criteria, 16 currencies were selected in Table 2.

**Table 2.**  
*Currencies analyzed*

Country symbol (OECD database)	Currency code	Currency
CZE	CZK	Czech koruna
AUS	AUD	Australian dollar
BRA	BRL	Brazilian real
CAN	CAD	Canadian dollar
CHE	CHF	Swiss franc
SWE	SEK	Swedish krona
GBR	GBP	British pound
HUN	HUF	Hungarian forint
ISR	ILS	Israeli shekel
JPN	JPY	Japanese yen
MEX	MXN	Mexican peso
NOR	NOK	Norwegian krona
NZL	NZD	New Zealand dollar
POL	PLN	Polish zloty
USA	USD	US dollar
EA19	EUR	Euro

Source: own study.

The selection allowed for the construction of 120 different currency pairs, including 15 pairs containing PLN.

The next stage involved selecting the variables for the model. In addition to inflation data, six additional control variables were chosen. The purpose of their selection was to isolate the effect of inflation by controlling for other significant economic factors that could distort the relationship. The selected control variables are visible in Table 3.

**Table 3.**  
*Selected variables for the model*

Variable	Purpose
Inflation rate (CPI)	Measuring changes in price levels
Inflation rate for the previous period (CPI n-1)	
Long-term interest rate	Measuring the price of credit and deposits
Short-term interest rate	
Expenditures on consumer goods and services	Consumption level
Balance of payments current account	The volume of foreign exchange
Net exports in relation to GDP	
VIX Index	Global measurement of uncertainty in financial markets

Source: own study.

The data were collected using databases from the OECD, stooq.pl, and the Federal Reserve Bank of St. Louis.

Following the variable selection, the next step involved computing the relevant variables and their relationships among the analyzed economies. This process yielded the endogenous variable in the form of absolute differences of annual changes in exchange rates between two currencies against the USD.

The dependent variables included:

- Absolute differences in annual changes of inflation dynamics in period N (CPI).
- Absolute differences in annual changes of inflation dynamics in period N-1 (CPI\_lag1).
- Absolute differences in annual changes of long-term interest rates (L\_interest).
- Absolute differences in annual changes of short-term interest rates (S\_interest).
- Absolute differences in annual dynamics of expenditures on goods and services consumption (Consumption).
- Absolute differences in the ratio of current account balance to GDP (Current\_account).
- Absolute differences in the ratio of net exports to GDP (Netexport).
- Average annual level of the CBOE Volatility Index: VIX (VIXCLS).

Subsequently, panel data econometric modeling was conducted (Baltagi, 2008) using Driscoll-Kraay standard error estimators (Driscoll, Kraay, 1998), which are robust to autocorrelation and cross-sectional dependence in panel data. Based on Hausman tests and tests for the intercept, a fixed effects model was applied. This modeling was performed separately for 15 currency pairs containing PLN and for the remaining 105 pairs excluding this currency.

#### 4. Panel model without PLN

The results of the panel model without PLN are presented in the Table 4.

**Table 4.**

*Panel model estimation results without PLN*

Variable	Estimator	Standard error	t-statistic	p-value
CPI	0.92539	0.27636	3.3484	0.0008264***
CPI_lag1	-1.4369	0.41538	-3.4593	0.000552***
L_interest	-0.0006579	0.0031726	-0.2074	0.83574
S_interest	-0.0010755	0.002259	-0.4761	0.6340377
Consumption	-0.49974	0.11875	-4.2082	2.678e-05***
Current_account	-0.097027	0.11049	-0.8781	0.3799592
VIX	6.5409e-05	0.00045495	0.1438	0.885695
Netexport	-0.10172	0.13904	-0.7316	0.4644663

Source: own study.

The model fit statistics are as follows:

$R^2$  (within): 0.1735

Adjusted  $R^2$ : 0.1313

AIC: -4943.06

BIC: -4885.61

According to the p-values, the statistically significant parameters at the 0.05 significance level were the Consumer Price Index (CPI), the one-period lagged CPI, and expenditures on goods and services consumption. For the CPI, the estimated coefficient was positive as

expected, with a value of 0.92. In contrast, the lagged inflation parameter took on a negative sign, amounting to -1.44.

## 5. Panel model with PLN

In the panel model for currency pairs involving PLN, besides CPI, lagged CPI, and expenditures on consumer services, the VIX index also emerged as a significant model component. The estimator for CPI was 1.06, while for lagged CPI it was -1.54. Detailed parameters are shown in Table 5.

**Table 5.**  
*Panel model estimation results with PLN*

Variable	Estimator	Standard error	t-statistic	p-value
CPI	1.0580719	0.3202097	3.3043	0.001065 **
CPI_lag1	-1.5436796	0.3510851	-4.3969	1.516e-05 ***
L_interest	-0.0024563	0.0023350	-1.0519	0.293665
S_interest	0.0016800	0.0022681	0.7407	0.459417
Consumption	-0.3900103	0.1385123	-2.8157	0.005182 **
Current_account	-0.2072831	0.2214035	-0.9362	0.349894
VIX	-0.0039980	0.0014636	-2.7316	0.006668 **
Netexport	0.4690990	0.6423056	0.7303	0.465742

Source: own study.

The model fit statistics are as follows:

$R^2$  (within): 0.2343

Adjusted  $R^2$ : 0.1794

AIC: -728.32

BIC: -690.32

## 6. Discussion

In both models for currency pairs with and without PLN, the current period CPI is statistically significant and positively signed, consistent with prior research (e.g., Monadjemi, Lodewijks, 2021; Coakley, Fuertes, Taylor, 2005). A coefficient close to 1 would even indicate a model effect aligned with purchasing power parity. Inflation and depreciation occur simultaneously and on a similar scale, suggesting that investors rapidly incorporate inflationary conditions into their investment decisions.

Lagged inflation was also statistically significant. However, in both models it exhibited a negative sign. This result is less intuitive. A potential explanation for this phenomenon may lie in the fact that when central banks conduct credible inflation-targeting policies, they respond to higher-than-expected inflation releases from the previous period by raising real interest rates (Clarida, Waldman, 2008). Consequently, the market anticipates monetary policy tightening, which favors domestic currency appreciation following the data announcement, even though it pertains to an already concluded period (Engel, Wu, 2024). This effect arises from a mechanism whereby higher inflation leads investors to anticipate interest rate increases by the central bank, resulting in an appreciation of the domestic currency in the short term. The expectation of restrictive measures and the signaling of monetary policy credibility can reverse the classical negative relationship between inflation and exchange rates. These findings may also find support in Dornbusch's overshooting model (Dornbusch, 1976). In the context of inflation's impact and central bank response, Dornbusch's model explains that following unexpected inflation information (particularly lagged inflation), the foreign exchange market may initially overreact (with substantial exchange rate changes), followed by gradual stabilization and return to equilibrium as monetary policy actions unfold and prices adjust. Davis and Sagner (2024) note that responses to inflation shocks vary depending on the perceived level of monetary policy transparency. In their analysis, Poland, like other developed economies, exhibits a positive correlation between inflation shocks and exchange rate changes.

Beyond inflation variables, a significant variable in both models proved to be the difference in the dynamics of changes in the value of goods and services consumed by households and by non-profit institutions serving households. In the model without PLN, the estimator for this variable was -0.5, while in the model with PLN it was -0.39. The direction of changes was consistent, indicating that increased consumption translated into domestic currency appreciation. In this aspect, studies present divergent perspectives on the relationship between consumption's impact and exchange rates. Contrasting with these results are studies suggesting that the effect of elevated demand should result in currency depreciation due to, among other factors, increased expenditures on imported goods (Iyke, Ho, 2020). On the other hand, there are studies focusing on the relationship between productivity growth and accompanying consumption, which translates into rising prices of non-tradable goods and, consequently, domestic currency appreciation (Harding, Stefański, Toews, 2020; Corsetti, Dedola, Leduc, 2004).

The final variable that proved significant in one of the models was VIX dynamics. It exhibited a negative significant coefficient for the model with PLN, indicating that this currency tends to weaken during periods of increased stock market volatility. This tendency is consistent with research on carry trade unwinding. Higher-yielding currencies, often associated with greater risk, tend to weaken during times of mounting uncertainty (Brunnermeier, Nagel, 2008).

## 7. Conclusions

The conducted analysis confirmed a significant impact of inflation on exchange rate dynamics during the period 2000-2023. The research findings both corroborate previous studies by other researchers and provide new insights into ambiguous issues.

### 7.1. Impact of current inflation on exchange rates

Current inflation demonstrates a strong and statistically significant impact on exchange rate dynamics, consistent with theoretical predictions. A coefficient close to 1 (0.93 for pairs without PLN and 1.06 for pairs with PLN) indicates an almost proportional translation of inflation differentials into exchange rate changes, which confirms the operation of the purchasing power parity mechanism in the short term. This result suggests that foreign exchange market participants quickly and efficiently incorporate current inflation data into their investment decisions, leading to concurrent depreciation of the currency of the country with higher inflation.

### 7.2. Impact of lagged inflation on exchange rates

A surprising finding of the study was the strong, opposite effect of inflation lagged by one period (coefficient -1.44 for pairs without PLN and -1.54 for pairs with PLN). This phenomenon, though seemingly contrary to economic intuition, finds explanation in the mechanism of credible monetary policy. The publication of data indicating higher-than-expected inflation from the previous period may trigger anticipation of monetary policy tightening by the central bank, leading to domestic currency appreciation in the subsequent period. This effect illustrates how expectations regarding future monetary policy actions can reverse the classical relationship between inflation and exchange rates.

### 7.3. Differentiation of impact for pairs with PLN

The analysis revealed significant differences in the strength of inflation's impact between currency pairs containing the Polish zloty and other pairs. The coefficients for pairs with PLN are higher for both current inflation (1.06 vs 0.93) and lagged inflation (-1.54 vs -1.44), indicating greater sensitivity of the zloty to inflation changes. Additionally, for pairs with PLN, the VIX index proved to be a significant factor (coefficient -0.004), with its negative sign confirming the tendency for the zloty to weaken during periods of increased uncertainty in financial markets. The higher coefficient of determination for the model with PLN ( $R^2$  within: 0.23 vs 0.17) further confirms that for this currency, the selected macroeconomic variables better explain exchange rate variability.

#### **7.4. Role of other macroeconomic factors**

Beyond inflation, consumption dynamics proved to be a significant factor in both models (coefficient -0.50 for pairs without PLN and -0.39 for pairs with PLN). The negative sign of this parameter suggests that consumption growth is accompanied by domestic currency appreciation, which may result from productivity growth and the associated increase in non-tradable goods prices. The remaining control variables, including interest rates and current account balance, did not demonstrate statistical significance, which may stem from the fact that their impact is already partially absorbed by other variables in the model or that their influence is more complex and nonlinear.

#### **7.5. Practical implications**

The research findings have significant practical implications for various groups of market participants. For enterprises conducting international operations, accurate inflation forecasts and anticipation of central bank reactions can provide a foundation for effective foreign exchange risk hedging. Foreign exchange market entities — such as investors and businesses — should consider not only current inflation data, but above all the manner in which the market interprets these data in the context of future monetary policy. For Polish market participants, awareness of the zloty's heightened sensitivity to inflation changes and its tendency to weaken during periods of global uncertainty is particularly important.

#### **7.6. Limitations and directions for future research**

Despite the application of advanced econometric methods robust to autocorrelation and cross-sectional dependence, the study has certain limitations. Relatively low coefficients of determination ( $R^2$  within below 0.25) suggest that other significant factors affecting exchange rates exist that were not included in the models. Future research would benefit from including explicit measures of market expectations, such as forward-looking indicators derived from interest rate futures, central bank communication indices, or survey-based inflation expectations. This would allow for a more direct test of the proposed mechanism linking past inflation to currency appreciation through expected policy responses. This may be more feasible with a more detailed analysis, narrowed to a smaller number of currencies, which will facilitate the collection of relevant data on future monetary actions. An additional limitation of the study is the lack of comprehensive statistical tests that would allow for a more precise assessment of how significantly the impact of inflation differs between currency pairs including PLN and those without it.

In summary, the study provides empirical evidence of the complexity of the relationship between inflation and exchange rates. Investors and entrepreneurs should take into account both current and past inflation trends. However, they should be aware that their significance may have opposite implications. Additionally, the sensitivity of the Polish zloty to inflation factors

and global uncertainty confirms its status as an developing market currency, requiring particular attention in foreign exchange risk management.

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