

The shaping channels of the currency swap prices on the PLN market

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Abstract

A currency basis spread (CBS) reflects the demand-supply balance in the cross-border secured deposits market. In emerging markets, it particularly indicates the balance of non-residents' flows and the liquidity exposure of local entities in foreign currencies. This article focuses on liquid instruments traded in the OTC market. The incentives to use short-term FX swaps and long-term cross-currency basis swaps are heterogeneous. The paper examines the information content embedded in changes in PLN currency basis prices. The research method involves comparing the directional sign of returns recorded simultaneously on the currency basis spread, asset swap spread, and foreign exchange spot. This information is analysed over five subperiods within a 23-year time series. Empirical results suggest the influence of currency speculation and bond investments on the short end of the currency swap curve, visible within a 10-day window. This evidence indicates that currency swaps play a significant role in refinancing local investments, both in Treasury securities and in carry trading.

Keywords: currency swaps, currency basis spread, asset swap spread, foreign exchange rates, emerging OTC market

JEL: F31, G12, G15, G19

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1. Introduction

Assets financing is a key traders' activity on the financial market that indirectly determines the liquidity of the market (Brunnermeier, Pedersen 2009). A crucial tool to obtain the efficient funding in the post-crisis environment are currency swaps (Pinnington, Shamloo 2016).

A price of currency swap is quoted as currency basis spread (CBS). The currency basis is the difference between the interest rate implied from a currency swap and the interest rate quoted directly on the money market. The reason for a non-zero currency basis arises from the specifics of the currency swap market in comparison to the other segments of the money market. It is evidence of the insufficient funding liquidity that hampers arbitrage (Mancini-Griffoli, Ranaldo 2012; Rime, Schrimpf, Syrstad 2017). The first cause of the divergence in interest rates comes from the fact that a currency swap is a secured loan. The collateral of such a loan is incarnated as the other currency flow. Therefore a relation in the liquidity demand on both currencies shapes the price of the currency swap and in consequence affects the currency basis (Bottazzi et al. 2012; Muchimba, Stenfors 2022). The second cause is related to the motivation of market participants. Currency swaps are usually the only efficient tool to borrow or lend a local currency for non-residents. As a result, interest rates embedded in the prices of currency swaps are influenced both by local and external users. Therefore demand and supply streams are heterogenous and may be not correlated with liquidity position of local financial institutions – in contrary to the internal money market (Imakubo, Kimura, Nagano 2008; Wong, Zhang 2018).

The significance of currency swaps increased after the Global Financial Crisis – GFC (Barkbu, Ong 2010; Goldberg, Kennedy, Miu 2010; Bräuer, Hau 2022). Firstly, the role of the unsecured money market diminished and is limited to overnight deposits (Brousseau, Chailloux, Durré 2009). Secured loans like repo and currency swaps have assumed the role of the key money market vehicle. Secondly, the augmented significance of non-resident investments on emerging markets is observed (Mayer 2010). On such markets repo is usually illiquid, so currency swaps are the unique liquidity tool for foreign borrowers of local currency. Thirdly, local banks had significant foreign currency assets (i.e. CHF mortgage loans) and currency swaps began to be the only way to refinance them. In some markets mortgage lending in local currencies is provided by international banks, therefore currency swaps are used to obtain local liquidity – a Swedish example is described by Eklund, Milton and Ryden (2012).

As a result, daily turnover in currency swaps peaked up. It was strongly visible in the PLN market (both local and off-shore). According to the newest NBP statistics, the currency swap market is the biggest financial market in PLN amounting to USD 30 bn, however 80% of deals are concluded off-shore (NBP 2023, p. 231).

2. Literature review

The significance of currency swaps necessitates the identification of valuation factors that shape their prices. The literature suggests that these factors vary over time and across markets. Firstly, the determinants of CBS change over time; secondly, they depend on market liquidity and risk perception, differing between mature and emerging markets.

A balance of demand and supply for local and foreign currency liquidity, generated by both local and foreign banks, causes fluctuations in currency swap prices (Amatatsu, Baba 2007; Baba 2009). Consequently, the currency basis changes. The scope of these changes can be calibrated based on

dollar order flows (Syrstad, Viswanath-Natraj 2022). These changes can signal rebalances in cross-border liquidity flows (Du, Tepper, Verdelhan 2017) or frictions related to the interbank market, such as illiquidity or increased counterparty credit risk (David-Pur et al. 2023). Moreover, cross-border funding can substitute local funding and, during periods of stress, transmit disequilibria in liquidity markets (Terajima, Vikstedt, Witmer 2010). This stress is particularly evident during liquidity squeezes accompanied by the weakening of the local currency (Genberg et al. 2011).

In some cases, natural liquidity flows can be distorted by central bank activities (Páles, Kuti, Csávás 2011). These activities can involve foreign exchange intervention or dedicated swap lines. The former can change the liquidity exposure of banks (Staniek 2020), while the latter can alleviate liquidity squeezes, having a persistent impact on currency swap prices (Csivis, Shabo 2010).

The heterogeneity of factors influencing currency basis spreads complicates the assessment of relationships between financial instruments. This research gap is particularly evident in emerging markets, where market sentiment and risk aversion play significant roles (Liu, Margaritis, Tourani-Rad 2012; Tong 2018).

The purpose of this study is to verify the co-movement of the currency basis spread with other market segments in the Polish zloty market. Such verification can help answer the question: why does the currency basis change? The literature suggests that a divergence between IBOR rates and rates implied from currency swaps began after the GFC (Baba, Packer 2009b; Baran, Witzany 2017). Initially, this divergence was attributed to increased credit and liquidity risk of market counterparties (Suzuki 2016). However, the divergence persists and remains highly volatile (Borio et al. 2016). The rationale for these phenomena is twofold:

1. IBOR rates lost credibility due to the disappearance of the underlying market for term unsecured interbank deposits and proven manipulations of the financial benchmark (Duffie, Stein 2015).

2. The growing use of currency swaps by heterogeneous market participants increased the volatility of demand and supply flows, distorting the dependence of the cost of funds on local liquidity exposure (Baba, Packer 2009a; Ando 2012).

In small open economies with local currencies the situation is even more complex due to the significant share of foreign currency assets in local banks and the parallel presence of non-residents interested in local foreign exchange and fixed income markets (Park 2015; Staniek 2016; Zeev, Nathan 2023). Two key motivations for currency swap usage have been observed:

1. For local banks, currency swaps are a unique source of foreign currency liquidity. The GFC led to the evaporation of unsecured financing (such as interbank deposits and bank bonds). Simultaneously, banks hold foreign currency assets (in Poland, these assets are predominantly Swiss franc mortgage loans granted between 2005–2008). To fund these assets, currency swaps allow the creation of foreign currency liabilities.

2. For foreign banks, currency swaps are a practical tool for managing local currency liquidity. They allow borrowing PLN to invest in local securities without foreign exchange risk. Additionally, currency swaps facilitate liquidity management in Polish zloty arising from activities in the foreign exchange market. In some cases, local currency is borrowed for short-selling operations targeting speculative attacks following negative sentiment in emerging markets.

As Rinaldo (2023) noted, currency swaps are a crucial segment of the temporary money markets, directly influenced by financial flows in other market segments. Consequently, decisions made in the foreign exchange and fixed income markets impact currency swap prices. This occurs because both FX trading and bond trading require capital and refinancing of balance exposures. Therefore,

appropriate funding must be obtained. Given the significant credit risk, the secured market is selected to cover liquidity exposures, and currency swaps are an optimal choice.

The literature provides few analysis of the influence of the FX and bond markets on incomplete markets with unstable liquidity and significant risk aversion, such as the PLN market, highlighting a research gap. With this in mind, the author decided to verify the hypothesis that both foreign exchange and fixed income channels shape currency swap prices. The verification aims to recognize the influence of currency and bond markets on the currency basis spread. The paper presents the economics of currency swaps, the methodology of the research and empirical results based on long-term data from the PLN market.

3. The economics of currency swaps

There are various ways to calculate the currency basis spread. It depends on the observed financial instrument. On the short end, one trades foreign exchange swaps (FX swaps), and on the long end – cross-currency basis swaps (CCBS). The difference between them relates to the construction of bilateral flows. An FX swap consists of two foreign exchange transactions with different value dates and CCBS includes two capital exchanges and numerous interest flows. In effect, FX swaps are quoted in terms of swap points and CCBS in terms of currency basis spread. Therefore, in the latter case we have direct price information. In FX swaps the information is embedded into swap points and the currency basis must be obtained indirectly as an implied interest rate.

The general formula for FX swaps is as follows (Heidorn, Mamadalizoda 2019):

$$R_{Y,\tau}^{imp} = \frac{F_t \cdot \left(1 + R_{X,\tau}^{ref} \cdot \frac{n}{B_X} \right)}{S} - 1 \cdot \frac{B_Y}{n}$$

$$F_t = S + SP_t$$

$$CB_t = R_{Y,\tau}^{imp} - R_{Y,\tau}^{ref}$$

where:

- CB_τ – currency basis for maturity τ ,
- SP_τ – swap points for maturity τ ,
- F_τ – forward foreign exchange rate (in local currency Y per a unit of foreign currency X) for maturity τ ,
- S – spot foreign exchange rate (in local currency Y per a unit of foreign currency X),
- $R_{Y,\tau}^{imp}$ – interest rate of a local currency implied from the currency swap,
- $R_{Y,\tau}^{ref}$ – reference interest rate of a local currency,
- R_X – reference interest rate of a foreign currency,
- n – number of calendar days in the contract,
- B_X – fore-currency day-count basis,
- B_Y – counter-currency day-count basis.

The key issue is the type of data we input into the formula. Firstly, we have to choose the maturity. Secondly, we should decide what type of reference rate we use in the model. Usually we have two alternatives:

- IBOR benchmarks,
- risk free rates (OIS type).

The maturity choice must take into account the liquidity of the contracts and the investor's horizon. The reference rate also depends on the market liquidity and market standards for the given derivative contracts.

For the PLN market we take initially 1M and 3M maturities on the short end and 5Y for the long end. In both examples we assume IBOR benchmarks as a reference rate.

The maturities' choice is related to the fact that the majority of FX swaps are traded for very short term maturities (one day, maximum one week). On the other hand the investor's horizon is longer and short-term contracts are affected by random liquidity swings that augment the volatility of prices. Next, the reference choice is dependent on the illiquidity of OIS contracts and the predominance of the WIBOR benchmark as a reference rate in swaps and loans.

Having in mind the abovementioned motivation, one can distinguish two basic market states:

1. The rising cost of foreign currency loans in comparison to local currency loans – which means that foreign currency is heavily borrowed or local currency is significantly lent.
2. The rising cost of local currency loans in comparison to foreign currency loans – which means that local currency is heavily borrowed or foreign currency is significantly lent.

It is worth saying that in some cases the market is neutral. This happens when the changes in the currency basis spread are small and short lasting, which proves the temporary and technical origin of the price volatility. The currency basis can be affected by one-off events like the issuance of foreign bonds by local entities (that impose swapping the foreign currency to the local one in order to fund daily liquidity) or mergers and acquisitions performed on the local market by foreign entities (as foreign direct investments need to obtain local funding from foreign sources). All these activities can shift the currency basis upwards (which means a relative hike of local currency cost), which is observed periodically on the market.

However, as far as trading on the financial market is concerned, currency borrowing activities can have two possible channels of origin (Novák, Sereg 2022):

- carry trading or speculative attack on foreign exchange market,
- refinancing of foreign currency assets by local banks (i.e. franc mortgage) and local assets by foreign banks (investing or disinvesting in local bonds or equities).

In an emerging market quotation, a CBS increase means the rising cost of the local currency as the difference between the implied rate and the reference rate broadens (for FX swaps) or the currency basis spread added to the local currency index grows (for CCBS). Having that in mind and matching the two market states with the two motivations of flows, we can map four possible scenarios. These are presented in Table 1.

If we focus on the abovementioned channels, one can see that the direction of the CBS change can have an ambiguous origin. It straightens the econometric analysis of direct determinants of the change. Therefore an alternative methodology is assumed, which is described in the following section.

4. Methodology of research

The first step is the mapping of the changes of the currency basis spread, both on the foreign exchange and asset channels. Initially we have to assume the market prices that represent the state of the foreign exchange and asset markets. The foreign exchange price is represented by a simple FX spot rate. On the asset side, we chose the most liquid segment – Treasury bonds. However, the fixed income market (FI) cannot be presented in yield terms as they are dependent on the current cycle in interest rates. The optimal method to assess the state of the fixed income market is a calculation of the relative yield represented by the asset swap spread (ASW), which is the difference between bond and swap yields.

The election of the particular time series was firstly based on a market liquidity analysis. For the asset swap a 5-year benchmark was chosen for the analysis. However for currency swaps the liquidity is dispersed. For short-term contracts (FX swaps) it is concentrated in a pair USD/PLN (the dollar is the first choice currency for refinancing short-term investments). However, for long-term contracts (CCBS) the most liquid is the EUR/PLN pair (as long-term investments in EU countries are related to the reference currency in convergence terms, i.e. the euro).

Having that in mind, the most adequate CBS time series were selected on the basis of the analysis of statistical moments. The results are presented in Table 2.

The excess volatility is especially visible on a short-term currency basis implied from FX swaps. However, an analysis of a longer-term currency basis brings other problems. Its volatility is lower at the cost of a much higher kurtosis. The basis spread quoted as the direct price of CCBS contracts exhibits a strong inertia connected with limited liquidity. Rare transactions cause a step-changing price of the contract.

Having regard to these limitations, the author decided to analyse a longer window for short-term contracts. The optimal parameters exhibit a 10-day accrued return on 3M CBS. This approach allows to distinguish stable trends in the changes of CBS prices evading random volatility that interferes the causality.

Having that in mind, an objective of the analysis is to identify a sign of 10-day changes of the following time series:

- CBS – calculated as a basis point change of the currency basis spread implied from 3M USD/PLN FX swaps with the reference benchmark on 3M IBOR rates. IBOR for PLN is the WIBOR benchmark (published by ACI Polska till 30 June 2017 and by GPWB after this date) and IBOR for USD is the LIBOR benchmark (published by BBA till 31 January 2014 and by ICE after this date, discontinued on 30 June 2023 and published in a synthetic formula afterwards).
- ASW – calculated as a basis point change of the asset swap spread between the 5Y benchmark Treasury bond yield and interest rate swap 5Y6M.
- FX – calculated as a log return on the EUR/PLN spot close rate.

As a result, the three different price time series are taken as a representative of the given market segments. The secured money market is represented by USD/PLN FX swaps, the fixed income by PLN Treasury bonds and foreign exchange by the EUR/PLN spot rate. The choice can be explained by liquidity reasons as the most liquid prices have the highest credibility. This heterogeneity of chosen financial markets can be explained as follows:

– the liquidity of the short-term currency swap curve is concentrated in the USD/PLN currency pair as the dollar is a crucial funding currency in the global financial market,

- the liquidity of the long-term interest rate is focused on benchmark debt securities and interest rate swaps,
- the liquidity of FX trading is the highest in EUR/PLN as the euro is treated as a natural convergence currency for the Polish zloty.¹

The data for the CBS, ASW and FX market are collected for the period 29 August 2000 – 24 October 2023, which brings 5,853 daily observations. All of the time series were collected in the Refinitiv Eikon database. A summary of the data used in the analysis is presented in Table 3.

All three times series exhibit symmetrical density functions with zero mean. The statistics are presented in Table 4.

The statistics are evidence of unbiased changes and even distribution of the direction of daily changes. This feature allows the analysis that is performed in Section 4 of the paper.

The time series of CBS is presented in Figure 1. The subperiods described in Section 4 are presented in order to underline the different level and variance of the analysed variable in the consecutive periods.

The interdependence analysis does not exhibit any directional trends. The lack of directional dependence is visible in Figure 2.

The Granger causality test indicates the lack of influence on CBS of the selected variables. The causality cannot be rejected for influencing FX (see Table 5a). The results are very similar for the 10-day average; however, one sees two-way interdependence between ASW and FX (see Table 5b). It is worth noting that correlations have a different sign for one-day and 10-day returns (despite amounting to very low levels anyway, see Tables 6a and 6b). The reason for this phenomenon is the different horizon of the transmitting channel for daily and longer-run transactions. The first are used mostly for speculative trades and the latter for liquidity management.

Such evidence is confirmed in OLS regressions based on the full samples (see Tables 7a and 7b), however the model calibrated on 10-day returns is much more credible (see p-values). This confirms that speculative activities are more erratic than strategical management of the cross-border cost of funds.

Nevertheless the OLS models exhibit a very low explanatory value of the CBS changes. Such a phenomenon is an analytical challenge that imposes an alternative approach. This approach has the following stages:

1. An estimation of the possible scenarios of directional co-movements of the three chosen time series (if we take two possible directions: up and down, we obtain $2^3 = 8$ scenarios).
2. A calculation of the share of each scenario both for the full sample and for the elected sub-periods.
3. An assessment of this share with the random proportions of the scenarios and an identification of surpluses and shortages.

Such an approach is possible under the assumption of the independent binominal distribution of the analysed directional changes. Such an assumption is justified taking into account the following features of the time series:

- insignificant correlations between the CBS and other time series,
- lack of Granger causality for CBS data,

¹ The proof of the crucial role of the EUR/PLN currency pair in Poland is both recorded volumes (the highest share in daily turnover) and calculated volatilities (both historical and implied), which are the lowest from all currency pairs for PLN.

– symmetrical distribution of positive and negative changes and long-run returns are close to zero (see Table 4),

– the close price is for each observation of the equilibrium (demand equals supply as the probability of upward and downward changes is equal to 50%).

Moreover the Chi-Square test was performed for signs of the three time series. Chi-Squared statistic 18.73 suggests p-value of 0.283, which implies that we do not have enough evidence to reject the null hypothesis of independence. This means that the signs of variables appear to be independent of each other.

The results of this comparison are presented in the following section.

5. Empirical results and discussion

Taking into account CBS changes, ASW changes and local FX rate returns, one can distinguish eight possible scenarios of simultaneous directional returns – see Table 8.

Half of the scenarios can be explained by a consistent influence of investors' decisions on market prices in both market segments (FI and FX). The other half suggest random alignment of currency liquidity exposures of market participants. It means, that apart from the FI and FX channels, changes in the CBS related to short-term swings of the cross-border liquidity are observed. These changes can be treated as a white noise hindering a precise analysis of the causality.

The author has distinguished 5 subperiods in order to analyse periodical trends within the time series. The threshold dates for these subperiods are:

1 May 2004 – accession of Poland to the European Union,

14 September 2008 – bankruptcy of Lehmann Brothers,

12 March 2012 – credit event default on the Greek debt,

11 March 2020 – implementation of the lockdown in Poland due to the COVID-19 epidemic.

The subperiods contain the following stages of the development of the PLN market:

Subperiod 1 – an emerging market preparing for EU accession,

Subperiod 2 – a converging market benefiting from EU accession,

Subperiod 3 – a crises era (the Global Financial Crisis caused by the US subprime crisis and the PIIGS crisis in Europe),

Subperiod 4 – a recovery period after the crises era,

Subperiod 5 – the market affected by numerous external shocks (COVID-19, war in Ukraine, energy crisis).

The share of each scenario was calculated for the full sample and all subperiods. Then this share was compared with the even share of eight scenarios (equal to 12.5%) and the excess share was obtained (positive for the higher share – over 1/8 and negative for the lower share – below 1/8). The results of the analysis are presented in Table 9.

All scenarios based on inconsistent moves of the analysed time series (5–8 in Table 8) are underrepresented. For the whole sample their share is 1.2–1.8 percentage points below the random one. Moreover this underrepresentation is particularly visible in recent subperiods. On the contrary, early subperiods (before the GFC) were characterized with a more significant share of such erratic scenarios. This is proof of the immaturity of the market.

The scenarios referring to the pre-defined market strategies are overrepresented. Scenarios 3 and 4 in subperiod 3 have the highest overrepresentation. This is evidence of the significant influence of investors focused on the PLN fixed income market and evading the foreign exchange risk. Non-resident investors entered and exit PLN Treasury bonds using FX swaps as a funding tool (so without entering the FX conversion). Simultaneously, the crises period meant increased instability of flows – so both directions (an investment and a sell-off) were strongly represented in the sample.

Another overrepresented strategy is carry trading on the zloty after the EU accession. This strategy (accompanied with some short selling activities in the FX market) was observed again in the last subperiod.

One should also note the overrepresentation of scenarios 2 and 3 in subperiods 4 and 5. This may be connected with intensive investments in positive-yield markets (both on FX and FI) caused by over-liquidity accompanied by negative rates in the dollar and euro market determined by the quantitative easing policy of key central banks.

The empirical evidence reveals a market segmentation scheme that remains consistent, despite changing economic environments. The dominant coincidence of price change directions indicates the significance of order flows motivated by FX or bond investments, aligning with observations in other markets reported in the literature. Concurrently, a non-negligible share of other motivations demonstrates the existence of erratic factors influencing currency swap prices.

It is also noteworthy that the overrepresentation of predefined market scenarios has increased over time, indirectly indicating market maturity and its connection to global capital flows. Moreover, capital flows related to FX markets appear to be somewhat stronger than those connected with sovereign debt, a typical feature of small open economies with local currencies.

6. Conclusions

The objective of this research was to identify the factors influencing the pricing of currency swaps. Empirical evidence was employed to test the hypothesis that order flows in the foreign exchange and fixed income markets are key determinants of demand and supply in the currency swap market.

Analysing currency swaps presents a significant scientific challenge due to their diverse applications, which complicates the identification of explanatory variables for currency swap prices. Currency swaps are used not only for quoting FX forwards and executing rollovers on value dates in currency contracts, but also for refinancing portfolios of foreign currency securities, engaging in carry trading, meeting liquidity needs for foreign bond issues or foreign direct investments, and refinancing local banks' foreign currency mortgage loans. Consequently, price changes can reflect various motivations of market participants.

The key component of currency swap prices is the currency basis spread (CBS), a unique pricing factor independently generated in the currency swap market (like implied volatility in the options market). As an endogenous factor, CBS must be extracted from market prices in advance and then analysed against external factors to investigate the dependencies shaping its level and changes.

This paper aims to identify the dominant factors influencing changes in CBS in the PLN market over the past 23 years. To achieve this, the author extracted appropriate spreads representing currency swap prices, selected the most relevant time series, and compared these with prices recorded in the

local fixed income and foreign exchange markets. The quantitative analysis does not rely on regression due to confounding factors that obscure interdependencies, such as short-term local and cross-border liquidity fluctuations, which introduce significant white noise into the observed time series. Therefore, the share of directional co-movements across three interconnected markets was chosen as the research method. This approach revealed certain overrepresentations, indicating periodic market trends.

The results suggest heterogeneity in the external factors shaping the trajectory of currency swap prices. Literature indicates that the currency swap market serves as a liquidity management centre for various market participants. Consequently, cross-border capital flows motivated by liquidity management are crucial for understanding CBS changes.

The research confirmed the predominance of bond and foreign exchange channels in shaping currency swap prices. This phenomenon aligns with the motivations of market participants, who seek liquidity management tools with optimal cost and moderate credit risk. The secured market provides an adequate source of liquidity required for activity in the currency and fixed income markets. Therefore, demand and supply in the FX and bond markets impact currency basis spreads. However, the influence of random fluctuations related to short-term cross-border liquidity was also observed. Recognizing this, further research is needed to explore the interconnectedness between currency swaps and other market segments.

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Appendix

Table 1

Scenarios that imply CBS changes

	FX channel	Asset channel
CBS increase	speculative attack	securities investments
CBS decrease	carry trading	securities disinvestments

Source: own evaluation.

Table 2

Statistical moments calculated on currency swap time series

Moments calculated on daily returns	1M implied from FX swap	3M implied from FX swaps	5Y CCBS	1M implied – 10-day window	3M implied – 10-day window
Standard deviation	23	12	2.3	5	2
Skewness	3.1	0.9	-1.7	2.0	-0.4
Kurtosis	81	33	238	60	22

Note: returns calculated as the difference in basis points, FX swaps on USD/PLN for period 29 August 2000 – 24 October 2023; CCBS on EUR/PLN for period 28 September 2012 – 24 October 2023.

Source: own evaluation.

Table 3

Description of variables

Variable	Description	Modelling data
CBS	3-month currency basis spread (in bp)	first differences
ASW	5-year asset swap (T-bond vs IRS)	first differences
FX	EUR/PLN spot rate	log returns

Source: own evaluation.

Table 4

Statistics for chosen variables

	CBS	ASW	FX
Mean	0.0002	0.0002	0.0023%
Share of positive observations	50.15%	48.97%	48.50%
Share of zero observations	0.02%	0.96%	0.36%
Share of negative observations	49.83%	50.07%	51.14%

Source: own evaluation.

Table 5a

Granger causality tests (for daily returns)

	CBS	ASW	FX
CBS		0.1704 [0.8433]	6.8042 [0.0011]*
ASW	1.9025 [0.1493]		6.5933 [0.0014]*
FX	0.0771 [0.9258]	3.8663 [0.0210]*	

* Means rejection of the hypothesis about the lack of causality at 0.10 confidence level.

The table presents F-statistics for a test that variables in a left-hand column Granger cause variables in a top row.

Table 5b

Granger causality tests (for 10-day returns)

	CBS	ASW	FX
CBS		0.5446 [0.5801]	6.4079 [0.0017]*
ASW	0.5520 [0.5758]		4.9472 [0.0071]*
FX	0.1558 [0.8558]	3.8669 [0.0206]*	

* Means rejection of the hypothesis about the lack of causality at 0.10 confidence level.

The table presents F-statistics for a test that variables in a left-hand column Granger cause variables in a top row.

Table 6a

Pearson correlation matrix (for daily returns)

	CBS	ASW	FX
CBS	100%	-1%	-4%
ASW		100%	5%
FX			100%

Source: own calculations.

Table 6b

Pearson correlation matrix (for 10-day returns)

	CBS	ASW	FX
CBS	100%	7%	7%
ASW		100%	19%
FX			100%

Source: own calculations.

Table 7a

OLS model (for daily returns)

	const	dASW	dlnFX
dCBS	0.0261 [0.1541]	-0.010 [0.3010]	-90.6009 [27.0637]
p-value	0.8653	0.7453	0.0008

MSE 11.7919
 R² corrected 0.0016
 p-value for test F 0.0032
 DW test 2.4318

Source: own calculations.

Table 7b

OLS model (for 10-day returns)

	const	dASW	dlnFX
dCBS	0.0128 [0.0320]	-0.1317 [0.0378]	92.7516 [19.7411]
p-value	0.6889	< 0.0001	< 0.0001

MSE 2.4456
 R2 corrected 0.0081
 p-value for test F 1.61e-11
 DW test 0.4382

Source: own calculations.

Table 8

Scenarios of changes recorded on CBS, ASW and FX market

Scenario	CBS move	ASW move	FX move	Comment
1	↑	↑	↑	Borrowed PLN on the FX swap market used to sell PLN on the FX market. Negative sentiment pushes bond yields upward
2	↓	↓	↓	Carry trading on the PLN FX market implies lending of PLN on the FX swap market. Positive sentiment decreases bond yields
3	↑	↓	↓	Borrowed PLN are used to invest in bonds, which increases their prices (so decreases yields). Positive sentiment decreases the FX rate (which means local currency appreciation)
4	↓	↑	↑	Bonds sell-off increases the supply of PLN on the lending market in FX swaps. Negative sentiment increases the FX rate (which means local currency depreciation)
5	↑	↑	↓	Inconsistent moves on fixed income and foreign exchange markets. Random changes of cross-border liquidity
6	↓	↓	↑	
7	↑	↓	↑	
8	↓	↑	↓	

Source: own evaluation.

Table 9

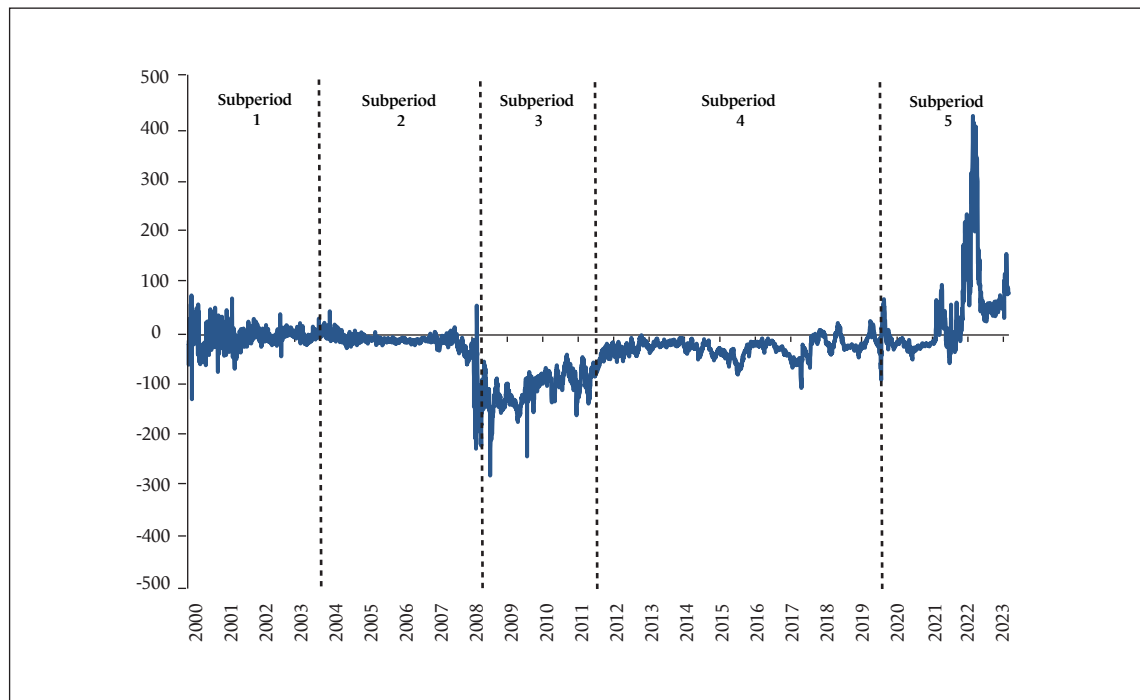
Results calculated as an excessive share of the given scenario (in percentage points)

Scenario/subperiod	1	2	3	4	5	6	7	8
Full sample	0.0	1.7	3.0	0.7	-1.3	-1.8	-1.4	-1.2
Subperiod 1	0.2	-0.5	-1.7	0.8	-1.3	-1.2	1.7	1.7
Subperiod 2	-1.8	4.5	0.6	-4.3	3.9	-4.2	-2.5	3.4
Subperiod 3	-3.3	-3.1	9.5	7.2	-3.2	0.4	-2.3	-5.4
Subperiod 4	0.9	2.6	3.8	1.1	-2.9	-1.4	-1.7	-2.8
Subperiod 5	2.9	3.3	2.6	-0.5	-2.3	-2.7	-1.6	-1.9

Source: own evaluation.

Figure 1

Currency basis swap based on 3M USD/PLN FX swaps

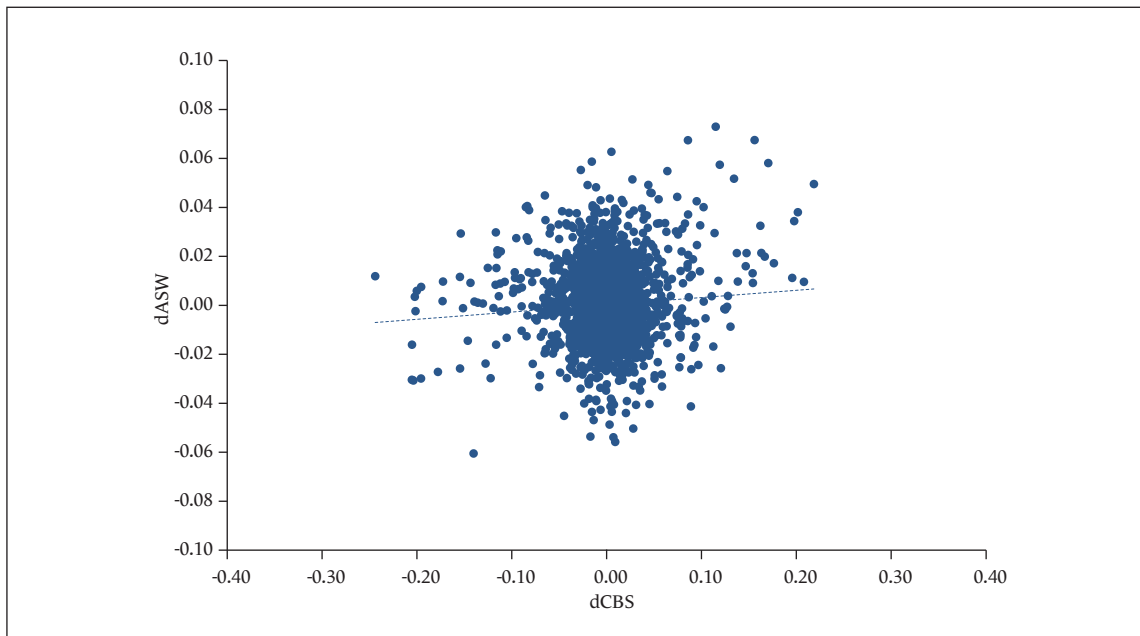


Note: subperiods are described in Section 4.

Source: own evaluation.

Figure 2a

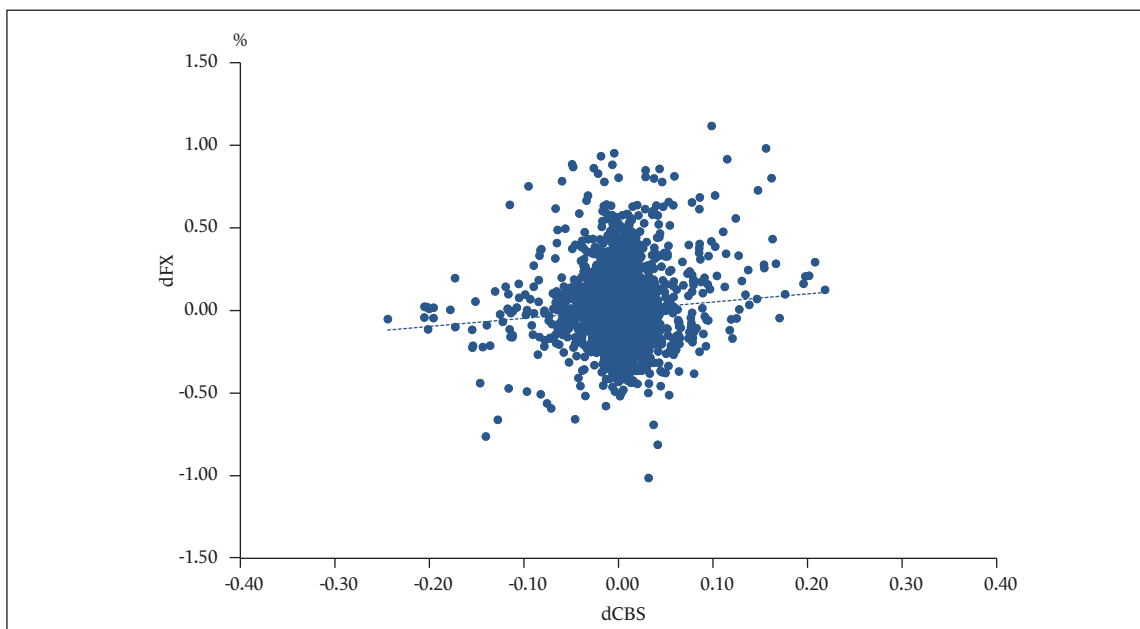
Plot of asset swap (ASW) and currency basis (CBS) 10-day returns



Source: own evaluation

Figure 2b

Plot of FX spot (FX) and currency basis (CBS) 10-day returns



Source: own evaluation.

Kanały kształtujące ceny swapów walutowych na rynku złotego

Streszczenie

Artykuł jest próbą wyjaśnienia dynamiki zmian walutowego spreadu bazowego (ang. *currency basis spread*, CBS) na rynku złotego. Walutowy spread bazowy jest różnicą pomiędzy stopą procentową wyliczaną z ceny swapów walutowych a dominującym indeksem rynku pieniężnego (dla złotego jest nim WIBOR). Spread ten pośrednio wskazuje, jakie jest bieżące saldo płynności transgranicznej, a więc ujawnia względną strukturę popytu i podaży na rynku złotego i euro (jako głównej waluty referencyjnej) z uwzględnieniem potrzeb zarówno rezydentów, jak i nierezydentów.

Ze względu na złożony zestaw czynników wpływających na wahania spreadu i ich niestabilność modelowanie zmian spreadu jest utrudnione, zwłaszcza dla gospodarek wschodzących z ograniczoną i zmienną płynnością. Skutkiem tego jest stosunkowo niewielka liczba opracowań na ten temat. Dominują prace dotyczące głównych walut w gospodarkach dojrzałych, obejmujące okres kryzysu finansowego w latach 2007–2009, kiedy omawiany spread zaczął być niestabilny i istotnie różny od zera. W ten nurt badań wpisują się następujące artykuły: Mancini-Griffoli i Ranaldo (2012), Pinnington i Shamloo (2016) oraz Rime, Schrimpf i Syrstad (2017), które skupiają się na specyfice swapa walutowego jako pożyczki zabezpieczonej. Z kolei różnice w strukturze popytu na rynku lokalnym i zagranicznym zbadano w pracach: Imakubo, Kimura, Nagano (2008), Bottazzi i in. (2012), Wong i Zhang (2018) oraz Muchimba i Stenfors (2022). Czynniki te nie wystarczają jednak do objaśnienia wahań spreadu w małej gospodarce otwartej, jaką jest Polska. Prace z podobnych gospodarek regionu skupiały się na wpływie polityki banku centralnego na wahania spreadu – np. Csivs i Shabo (2010) oraz Staniek (2020).

Złotowe swapy walutowe służą przede wszystkim do finansowania bilansu – dla nierezydentów są kluczowym źródłem płynności przy refinansowaniu inwestycji złotych, natomiast dla rezydentów stanowią jedyne źródło pokrycia krótkiej pozycji płynności z tytułu udzielonych w przeszłości kredytów walutowych. Zmienność popytu po obu stronach transakcji wpływała nie tylko na poziom CBS, lecz także na jego znak (który z silnie ujemnego stał się dodatni na początku 2015 r.).

W artykule skupiono się zatem na kluczowych czynnikach, które kształtują sentyment na rynku finansowym złotego, a więc pośrednio wpływają na awersję do ryzyka i przepływy finansowe ze strony nierezydentów. Transakcje nierezydentów dominują bowiem w transakcjach na rynku swapów walutowych (co potwierdza NBP w corocznym *Raporcie o rozwoju rynku finansowego*). Doboru czynników dokonano na podstawie analizy literatury i obejmują one dwa podstawowe rynki: rynek walutowy oraz rynek obligacji skarbowych. Hipoteza badawcza brzmi, że zmiany cen na tych rynkach są przyczyną przesunięcia walutowego spreadu bazowego. Ze względu jednak na częste zmiany sentymentu i – co za tym idzie – wysoki poziom zmienności kursu walutowego i cen papierów dłużnych bezpośrednie modelowanie ekonometryczne nie pozwala na wyciągnięcie w pełni umotywowanych wniosków. Modelowanie jest tym bardziej utrudnione, że na ceny swapów walutowych wpływają w krótkim okresie czynniki lokalne, niezwiązane ze zmianami sentymentu, a szeregi cen obejmują produkty o zróżnicowanej zapadalności (od 1 dnia do 10 lat). Zmiany cen w tych szeregach mają inną charakterystykę i tym samym nie są spójne czasowo. Ilustrują to podstawowe modele regresji i ich parametryzacja, co zostało zaprezentowane w pracy.

Mając to na względzie, autor zastosował alternatywną metodę badania polegającą na porównaniu znaku zmiany ceny w wybranym szeregu CBS (10-dniowe okno czasowe dla cen implikowanych z trzymiesięcznych swapów walutowych) z kierunkiem zmian cen na rynku walutowym (logarytmiczne zwroty EUR/PLN) i rynku papierów dłużnych (zmiana różnicy rentowności pomiędzy stałokuponową obligacją pięcioletnią a swapem typu IRS, czyli tzw. *asset swap*). O wyborze zmiennych zadecydowała ich płynność i znaczenie przy podejmowaniu decyzji inwestycyjnych przez nierezydentów.

Analizę podzielono na pięć okresów w 23-letnim oknie czasowym. Dzięki temu wyodrębniono podstawowe czynniki kształtujące walutowy spread bazowy w poszczególnych okresach.

Wnioski z przeprowadzonego badania są następujące:

- Wykazano dominujące znaczenie zmian cen na rynku walutowym i obligacji na zmianę walutowego spreadu bazowego – dla całej próby scenariusze kierunkowe niezwiązane z rynkiem walutowym i obligacji stanowią poniżej 50% próby, a ich udział spada wraz z rozwojem rynku, a więc dla późniejszych okresów.
- Najwyższy udział scenariuszy wskazujących na wykorzystanie rynku CBS do inwestowania na rynku obligacji bez ryzyka walutowego (a więc pożyczania złotych za pośrednictwem swapów FX) widać w czasie globalnego kryzysu finansowego (GFC) oraz występującego po nim kryzysu peryferyjnych gospodarek UE.
- Istotna rola *carry trading* (lokowania złotego przez nierezydentów w swapach FX w celu wykorzystania różnicowania stóp procentowych w zależności od waluty) jest widoczna w okresie po wstąpieniu Polski do UE oraz w ostatnich latach.
- Częste wykorzystywanie swapów FX do inwestowania w polskie aktywa (waluty lub obligacje) obserwujemy zwłaszcza w środowisku pokryzysowym, a więc po odzyskaniu przez rynki równowagi na skutek ekspansywnej polityki pieniężnej prowadzonej przez banki centralne.

Słowa kluczowe: swapy walutowe, walutowy spread bazowy, rynek *asset swap*, kurs walutowy, pozagiełdowy rynek wschodzący