Determinants of FX risk hedging: evidence from Hungary*

Barbara Dömötör
Associate Professor
Corvinus University
of Budapest,
Hungary
E-mail: barbara.domotor@uni-corvinus.hu

Erzsébet Kovács
Professor
Corvinus University
of Budapest,
Hungary
E-mail: erzsebet.kovacs@uni-corvinus.hu

The paper investigates the motives of FX (foreign exchange) risk management based on the changes in open forward positions among Hungarian corporations. The authors find that Hungarian companies were significantly more exposed in EUR short forward positions than in EUR long positions, probably due to the positive expected value of the former. Their linear regression model also proves that changing market conditions have a significant impact on EUR short forward positions. The analysis of the explanatory variables shows the dominant effect of foreign exchange rate changes. Expectations are found to determine risk-hedging decisions, demonstrating that financial risk management also has a speculative motive.

KEYWORDS:
Corporate hedging behaviour.
Forward hedge.
Multivariate linear regression.

DOI: 10.15196/hsr2018.01.en023

* The authors are thankful to the participants of the XXXII Hungarian Operations Research Conference for their valuable comments. They also thank the National Bank of Hungary for providing the aggregate data.

Financial risk management is one of the main tasks of corporate management not only in theory, but also in practice.[1]

The theory of corporate hedging explains the relevance of corporate-level risk management by certain market imperfections: taxes, transaction costs, costs of financial distresses, or asymmetric information (*Hommel* [2005]). Consequently, we can model corporate decision making by maximising the expected utility based on a concave utility function. In the mean-variance model of hedging, the optimal hedging ratio (w) (see the equation) is determined by the expected value of the hedge ($E(y)$) (speculative part) and the covariance of the underlying asset (x) and the hedging instrument, that is, the pure hedge (*Rolfo* [1980]). Here, the hedging instrument is supposed to be costless.

$$w = \frac{E(y)}{2a\,\mathrm{var}(y)} - \frac{\mathrm{cov}(x,y)}{\mathrm{var}(y)},$$

where a represents the corporate-specific risk aversion, while var denotes the variance.

Although for uninformed hedgers, the hedging ratio should be equal to the second part of the equation to minimise the variance of the whole portfolio (*Duffie* [1989]), in practice, non-financial firms do not use derivatives only for variance reducing purposes.

Stulz [1996] explains this fact by showing that some companies may not be uninformed and have a comparative advantage in predicting price movements and in bearing the better-known financial risk. Consequently, the aim of risk management for such firms is not necessarily to minimise the variance; they can use their information to take risks in areas in which they have comparative advantages. However, in this case, it is important to ensure the downside outcomes of significant costs at the required level. The concept of ERM (enterprise risk management) also highlights that corporations can create added value by taking certain types of risks (*Casualty Actuarial Society* [2003]).

The available information about the practice of corporate risk management is limited, considering that companies have no obligation to record or report on their hedging policy and activity. Thus, the empirical research on corporate risk management are based on either public databases and data from annual financial reports or the results of surveys.

[1] Corporate risk management practices from the corporate and banking perspectives are the object of many books, including *Walter* [2014].

Dominguez–Tesar [2006] examine aggregate company FX exposure based on the relationship between exchange rate changes and firm value. *Mian* [1996], *Nguyen–Faff* [2002], and *Yip–Nguyen* [2012] rely on annual reports in their analysis. *Tufano* [1996], *Adam* [2002], and *Brown–Crabb–Haushalter* [2006] analyse a risk management database for the gold mining industry collected by *Ted Reeve*[2].

Joseph–Hewins [1997] investigate UK multinationals, founding their research on both survey and financial data. *Bodnar–Hayt–Marston* [1998] and *Bodnar–Gebhardt* [1999] use a survey on the risk management practices of US and German companies. *Haushalter*'s [2000] study investigates the hedging behaviour of oil and gas producers based on surveys as well.

The results of these empirical studies show that corporations apply very diverse hedging solutions. Meanwhile, the hedging instruments and hedging ratio not only vary across industries and firms, but are also not stable over time within a given firm (*Brown–Khokher* [2007]).

An explanation for these facts can be the role of expectations in risk management. In this study, we aim to capture this phenomenon by investigating corporate foreign exchange forward positions. We hypothesise that changing market circumstances affect both expectations and corporate hedging behaviour. We examine whether market movements have a significant impact on corporate forward positions, signalling that the role of expectations and speculation in corporate risk management cannot be ignored.

The paper proceeds as follows. Section 1 introduces the data and framework of the analysis, while the next section presents the results of the linear regression models. In Section 3, we investigate the explanatory variables, and finally, in the last section, summarise our findings.

1. Data and framework of the analysis

The most common assets for financial hedging are financial derivatives like options and forwards or futures. As the FX market is a typical OTC (over-the-counter, non-exchange) market and options are only seldom used in risk management (*Bodnar–Hayt–Marston* [1998], *Bodnar–Gebhardt* [1999]), our research focuses on the practice of forward FX hedge.

Hungarian domestic financial institutions report daily their forward positions to the NBH (National Bank of Hungary), the central bank of Hungary. Based on these

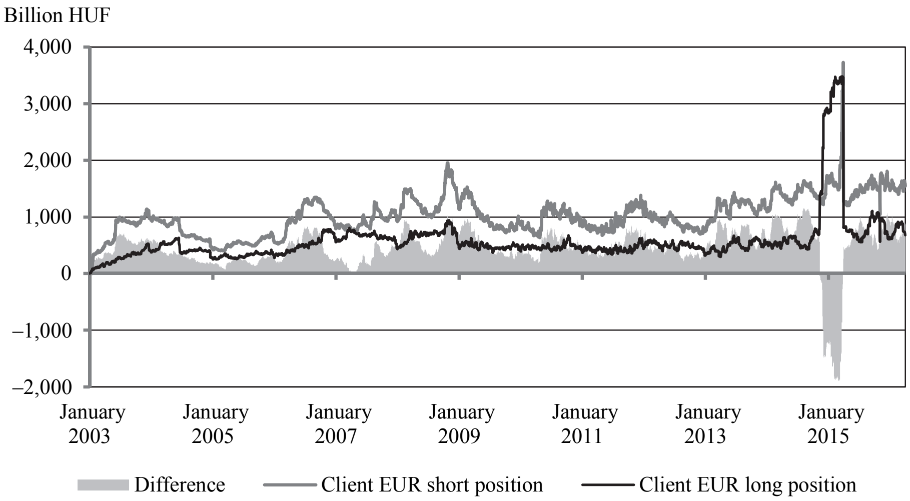
[2] Ted Reeve as an analyst at Scotia McLeod conducted quarterly survey of outstanding gold derivatives positions at major North American gold mining firms.

reports, the NBH sets up a database that contains the aggregate stocks of the forward transactions of the so-called other resident partners. This client type excludes the financial sector, but includes the retail sector as well as corporate clients. We suppose that the retail exposure is marginal, so we consider the data as corporate positions. We received the database for the period between January 2003 and March 2016. The database is unique as it also includes the positions' direction. We refer to the positions in which the resident clients of the bank buy the foreign currency for HUF (Hungarian forint) on forward as 'EUR long'; in this case, the firm is long in foreign currency. Similarly, 'EUR short' represents positions in which the client sells the foreign currency. Although there are foreign currencies besides the EUR, we use the EUR for simplicity and because it is the major trading currency in Hungary.

The 'EUR short' forward position can serve hedging purposes for exporters, or they can derive from speculation on the appreciation of the HUF. The 'EUR long' forward position can also serve both import hedging or speculative goals.

Figure 1 shows the evolution of the forward positions. We can see that foreign currency short positions are almost always higher than long positions are; the average value for the period between 2004 and 2016 was 1,047 billion HUF vs. 602 billion HUF, so the foreign currency forward sales exceeded the forward currency purchases by 74% on average.

Figure 1. Aggregate open forward positions



Source: Own calculation based on NBH data.

The period between November 2014 and March 2015 is an exception, probably due to the early repayment and compulsory conversion of the retail foreign currency mortgage loans.

The higher volume of the short forward positions can derive either from hedging the positive trading balance or speculation on the Hungarian country risk premium. The profit of a forward speculation is the difference between the pre-agreed forward rate and the spot price at maturity. The modern portfolio theory states that the expected value of a forward position depends on the systemic risk of the currency. A positive correlation between the spot foreign exchange rate and other assets' prices results in a positive expected value of long foreign exchange positions due to the positive systematic risk. By contrast, if the correlation is negative, the negative systemic risk leads to a forward premium, so the forward foreign currency sale has a positive expected value (*Hull* [2007]).

In the sample period, Hungary's country risk premium was positive, which caused the forward rate to be higher than the expected spot rate. The greater extent of the short forward positions may reflect the speculation on the currency premium.

In the following, we investigate the forward positions, and through them, the corporate risk management behaviour in detail.

2. Regression analysis of forward positions

We applied multivariate linear regression analysis in SPSS 22 software package to find the factors that influence the long and short forward positions. The dependent variable of the models was the monthly percentage change in the forward positions. Although the database consisted of daily data, we investigated monthly changes to remove unsystematic effects and noise from the more frequent data. We thus took the first available data for each month and assigned the percentage change to the expiration date. We excluded the data for 2003, as the first year of the data collection seemed to be unstable. Therefore, we based our analysis on the 145 monthly changes for the period between January 2004 and March 2016.

The corporate foreign exchange position to be hedged usually derives from the foreign trade turnover, so we chose the monthly trading balance (difference between exports and imports)[3] as the first explanatory variable.

Because we aim to capture the speculative motives of corporate risk management and the risk hedging behaviour, our next group of explanatory variables covers market data. According to our expectations and market experience, the factors that affect the expected value of the derivative position, and through that, the speculation, are the FX rate, its volatility, the foreign and domestic interest rates, and the difference between the forward rate and the spot rate (swap difference).

[3] Data source: Bloomberg.

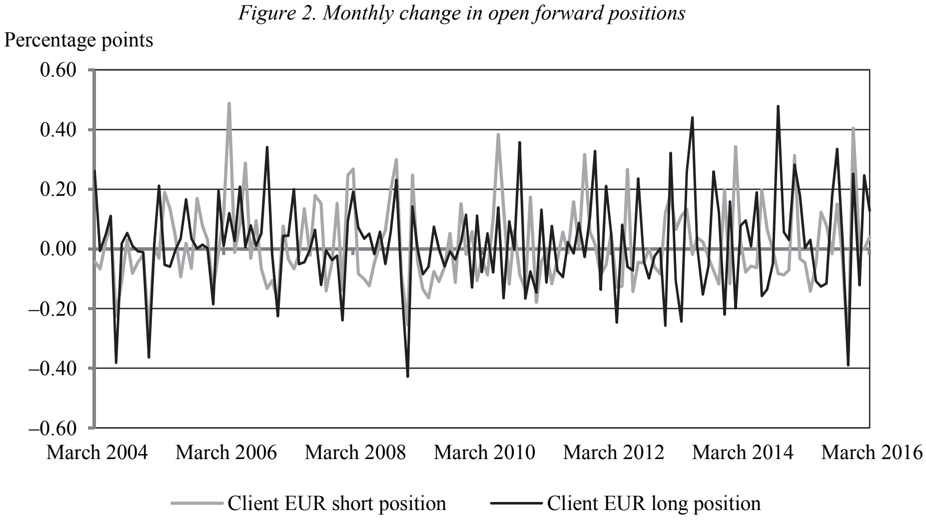
We used the time series of the spot foreign exchange rate of two currency pairs: EUR/HUF to represent the domestic FX market and EUR/USD to reflect global tendencies. Considering that a change in the spot rate also affects the forward rate, we expect that changes in the spot rate determine the hedging decision. An advantageous price movement improves the available hedging rates, so we expect that it will increase the hedging activity.

The next type of market data that can affect hedging is the volatility of FX rates. We downloaded the implied volatility of 30-day, 90-day, and 1-year at-the-money options for both currency pairs.[4] We expect that higher volatility in the risk in the foreign exchange rate will increase the utility of the hedge as well as the potential hedging needs.

The expected profit of a forward transaction also depends on the swap difference quoted in the interbank market and available on Bloomberg. The swap difference is determined by the difference in the interest rate levels of the two currencies. Therefore, we added the 1-year BUBOR (Budapest interbank offered rate) to reflect the HUF interest level, and the 1-year EURIBOR (Euro interbank offered rate) and 1-year USD LIBOR (London interbank offered rate) data for foreign interest levels to the analysis.

To obtain a stationary time series, both the dependent variable and the explanatory variables consist of the percent change in the given factor. We found that the long and the short positions were significantly reduced between December and January in most cases. (See Figure 2.)

Figure 2. Monthly change in open forward positions



Source: Own calculation based on NBH data.

[4] Data source: Bloomberg.

This fall of the stock positions can be explained by the effort of most corporations to avoid reporting high derivative positions in their annual statements. Thus, firms usually time the maturity of their hedging positions to the reporting date, or they terminate the positions beforehand.

To catch this periodicity, we added the 'December effect' to the market factors as a binary explanatory variable, with 1 for the period from December to January, and 0 otherwise. Table 1 summarises the explanatory variables in the regression model.

Table 1

Variables in the regression model

Variable cluster	Variable	Short name
Foreign trade	Monthly trading balance (difference between exports and imports)	*Trade*
Market price	EUR/HUF spot rate	*EURHUF*
	EUR/USD spot rate	*EURUSD*
	12-month BUBOR	*BUBOR*
	12-month EURIBOR	*EURIBOR*
	12-month USD LIBOR	*USDLIBOR*
	12-month EUR/HUF swap difference	*EURHUF_swap*
	12-month EUR/USD swap difference	*EURUSD_swap*
Market volatility	EUR/HUF 30-day implied volatility	*EURHUF1MV*
	EUR/HUF 90-day implied volatility	*EURHUF3MV*
	EUR/HUF 1-year implied volatility	*EURHUF12MV*
	EUR/USD 30-day implied volatility	*EURUSD1MV*
	EUR/USD 90-day implied volatility	*EURUSD3MV*
	EUR/USD 1-year implied volatility	*EURUSD12MV*
December effect	The period is December	*December*

The explanatory variables within a variable group should be strongly correlated, but we listed more variables quantifying the same factor to find those with the highest explanatory power. However, it is possible that the variables were also correlated between the groups. To address the collinearity among the explanatory factors, we chose the stepwise method in the regression to exclude the redundant variables from the model.

We expect that the exchange rate will affect EUR short positions (export hedge) positively, and the EUR long positions (the hedge of imports) will correlate negatively with EUR/HUF.

After the first run, we found that one observation, 3rd November 2008, had a critical influence on the regression model. The centred leverage and Cook's distance values of this observation were higher than acceptable. Therefore, we excluded this month from further analysis. The extremity of this special date is due to the liquidity crisis in the Hungarian market in October 2008.

2.1. Modelling EUR short positions

The *F*-statistics of the regression model shows that the model is significant at any conventional confidence level (*p*-value 0.000). Table 2 presents the results of the analysis: the R^2 coefficient is 0.59, so the 3 explanatory variables explained nearly 60% of the total variance. The stepwise method includes the independent variables gradually according to their explanatory power, as long as the new explanatory variable significantly improves the model. Based on Model variant 3, the factors affecting the short forward positions are the change in the 90-day implied volatility of EUR/HUF, the EUR/HUF FX rate, and the December effect. (See Table 2.)

The changes in foreign trade turnover did not affect the derivative stock. We can explain this finding by the fact that foreign trade dates are based on the monthly amount of products crossing the economic border of the country, while firms make hedging decisions in advance of the sale. Moreover, we had data on the net value of the foreign trade. From the risk management perspective, the export and import activities should be considered separately.

Table 2

Summary of the linear regression model of short FX forward positions

Model variant	R	R^2	Adjusted R^2	Standard error of the estimate	Change statistics					Durbin–Watson test
					R^2-change	F-change	df_1	df_2	Significant F-change	
1	0.678*	0.46	0.46	0.10	0.46	120.66	1.00	142.00	0.00	
2	0.735**	0.54	0.53	0.09	0.08	25.05	1.00	141.00	0.00	
3	0.768***	0.59	0.58	0.09	0.05	16.67	1.00	140.00	0.00	2.18

* Predictors: *Constant, EURHUF3MV*. Here and hereinafter, for the name of variables see Table 1.

** Predictors: *Constant*, *EURHUF3MV*, *EURHUF*.

*** Predictors: *Constant*, *EURHUF3MV*, *EURHU*F, *December*.

Note. Dependent variable: monthly percentage change in the short FX forward stock. The stepwise method improved the model with new explanatory variables (see model variants 2 and 3).

Source: Own calculation based on NBH data.

Table 3 shows the details of the regression model. Based on the high *t*-statistics and low *p*-values, the constant and all explanatory variables in the table are significant at all conventional significance levels. From the volatility data, the 90-day (3 month-) volatility of the EUR/HUF exchange rate proved to be significant; due to the correlation of the volatility data, additional volatility time series do not provide further explanatory power. A 1% rise in the EUR/HUF market volatility increases the portfolio by 0.475%. A 1% increase in the EUR/HUF exchange rate, meaning a depreciation of the HUF against the EUR, as expected, increases the sold foreign currency portfolio by 1.896% in the period. The short forward positions declined by 11% on average in December.

Although the expected value of the forward sale increases with the higher EUR/HUF swap difference, we did not include this factor among the explanatory variables of the model. The higher forward rate due to the difference in the interest levels do not cause linear changes in the forward portfolio itself, possibly due to the strong relationship between the EUR/HUF spot rate – which is the second explanatory of the model – and the swap difference.

The multiple correlations among the explanatory variables are acceptable; the tolerance values are close to 1, as its inverse, the variance inflation factors (VIF) is.

Table 3

Coefficients of the linear regression model of short FX forward positions

Model variant 3		Variable			
		Constant	*EURHUF3MV*	*EURHUF*	*December*
Unstandardized coefficient	*B*	0.018	0.475	1.896	–0.110
	Standard Error	0.008	0.068	0.350	0.027
Standard coefficient	*β*		0.471	0.363	–0.221
t		2.340	7.021	5.412	–4.083
Significance		0.021	0.000	0.000	0.000
95.0% confidence interval for *B*	Lower bound	0.003	0.341	1.203	–0.163
	Upper bound	0.033	0.608	2.588	–0.057
Zero-order	correlation		0.678	0.631	–0.188
Partial	correlation		0.510	0.416	–0.326
Part	correlation		0.380	0.293	–0.221
Collinearity statistics	Tolerance		0.651	0.651	0.998
	VIF		1.535	1.537	1.002

Note. Here and in Table 5, VIF: variance inflation factors.
Source: Own calculation based on NBH data.

The partial correlations removed from the effects of other explanatory variables are moderate.

The distribution of the residuals deviates slightly from normal, but we cannot reject normality based on the result of the Kolmogorov–Smirnov test, where the *p*-value is 0.00.

Overall, the model is appropriate for examining the relationship between the short forward positions and the major market factors, though other factors, possibly the foreign trade or unsystematic effects, influence about 40% of the variance.

2.2. Modelling EUR long positions

Similar to our explanations of the changes in short forward positions, we also analyse the changes in long FX forward positions with a linear regression model. The explanatory variables were the market, foreign trade and calendar factors above, while the dependent variable was the change in the long forward stock. The extreme jump in the EUR long positions in October 2014 and the sudden fall in March 2015 were caused by a political action, specifically, the change in regulations on foreign currency-denominated loan portfolios. We, therefore, substituted the values of the reference month by the average monthly change in the forward positions.

Although the model is significant at all conventional significance levels, the *p*-value of the *F*-statistics is 0.001; the model (Model variant 3) explains only 20% of the total variance, according to the R^2 indicator, as Table 4 shows.

Table 4

Summary of the linear regression model of long FX forward positions

Model variant	R	R^2	Adjusted R^2	Standard error of the estimate	Change statistics					Durbin–Watson test
					R^2-change	F-change	df_1	df_2	Significant F-change	
1	0.324*	0.10	0.10	0.15	0.10	16.63	1.00	142.00	0.00	
2	0.405**	0.16	0.15	0.14	0.06	10.03	1.00	141.00	0.00	
3	0.452***	0.20	0.19	0.14	0.04	7.03	1.00	140.00	0.01	2.17

* Predictors: *Constant*, *December*.
** Predictors: *Constant*, *December*, *EURHUF*.
*** Predictors: *Constant*, *December*, *EURHUF*, *EURHUF12MV*.
Note. Dependent variable: monthly percentage change in the long FX forward stock.
Source: Own calculation based on NBH data.

Table 5 summarises the explanatory variables, the regression coefficients, and the other associated statistics of the model.

Table 5

Coefficients of the linear regression model of long FX forward positions

Model variant 3		Variable			
		Constant	*December*	*EURHUF*	*EURHUF12MV*
Unstandardized coefficient	*B*	0.036	–0.180	–2.334	0.475
	Standard Error	0.012	0.043	0.559	0.179
Standard coefficient	*β*		–0.319	–0.393	0.250
t		2.941	–4.228	–4.176	2.651
Significance		0.004	0.000	0.000	0.009
95.0% confidence interval for *B*	Lower bound	0.012	–0.264	–3.439	0.121
	Upper bound	0.061	–0.096	–1.229	0.829
Zero-order	correlation		–0.324	–0.259	–0.004
Partial	correlation		–0.336	–0.333	0.219
Part	correlation		–0.319	–0.315	0.200
Collinearity statistics	Tolerance		0.996	0.642	0.641
	VIF		1.004	1.558	1.560

Source: Own calculation based on NBH data.

In explaining the long forward positions, the constant proved to be significant; thus, if all other factors remain unchanged, then the monthly portfolio increases by 3.6%.

For long forward positions, the December effect is the most significant, thus this was the first involved variable. The year-end position maturities and closings reduce the overall portfolios by almost 18% on average. The other two explanatory variables, similar to the model in the previous section, are the change in the EUR/HUF exchange rate and the 12-month volatility of EUR/HUF. The weakening of the HUF against the EUR by 1% reduces the portfolio by 2.334%, in line with our expectations.

The growth of volatility has a positive correlation with the portfolio increase; however, in the case of long positions, the 1-year implied volatility had the highest explanatory power, so we included it in the model as an explanatory variable. All the three explanatory variables are significant at a level above 99%, tolerance is close to one, and the VIF value indicates that the explanatory variables are uncorrelated. The distribution of the residuals cannot be considered normal; the p-value of the Kolmogorov–Smirnov test is 0.004.

We did not include the foreign trade turnover and the EUR/HUF swap difference as explanatory variables for reasons similar to those discussed for short positions: the foreign trade turnover and the timing of the hedging decisions are different or may vary, and the swap difference does not have a significant additional effect on the development of the portfolio due to its co-movement with the EUR/HUF exchange rate.

The effect of the explanatory variables developed in line with our expectations, but the model explains only one-fifth of the total variance, which indicates the possibility of non-linear effects and further explanatory factors as well as the importance of individual factors in the case of long positions.

3. Further analysis of the variables

Since the explanatory variables are not independent, we investigated their connections by principal component analysis, which is similar to multiple regression, except that the dependent variables are the observed variables, and the regressors are the unobserved factors. Our key factor that moves hedging decisions is based on the expectations, which are not directly measurable.

Table 6

Summary of the principal component analysis of the explanatory variables

Component	Initial eigenvalue			Extraction sum of squared loadings			Rotation sum of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	4.519	30.129	30.129	4.519	30.129	30.129	3.605	24.031	24.031
2	2.295	15.300	45.429	2.295	15.300	45.429	2.860	19.068	43.099
3	1.245	8.301	53.730	1.245	8.301	53.730	1.362	9.080	52.178
4	1.149	7.657	61.387	1.149	7.657	61.387	1.293	8.618	60.796
5	1.085	7.236	68.623	1.085	7.236	68.623	1.107	7.378	68.174
6	1.022	6.814	75.437	1.022	6.814	75.437	1.089	7.263	75.437
7	0.941	6.271	81.708						
8	0.878	5.856	87.564						
9	0.679	4.525	92.089						
10	0.455	3.034	95.123						
11	0.345	2.299	97.422						
12	0.172	1.149	98.571						
13	0.157	1.047	99.618						
14	0.035	0.231	99.849						
15	0.023	0.151	100.00						

Source: Own calculation based on NBH data.

We conducted the correlation matrix extraction of factors by eigenvalue-eigenvector decomposition. As Table 6 shows, six components explain more than 75% of the variance of the 15 explanatory variables, 13 of which are market variables. The first principal component explains 30% of the total variance, and the second principal component captures a further 15%. Table 7 provides the component matrix.

Table 7

Rotated component matrix

Variable	Component					
	1	2	3	4	5	6
EURUSD	–0.258	–0.225	0.016	–0.698	–0.110	0.194
EURHUF	**0.761**	0.090	–0.025	0.167	0.217	–0.047
EURUSD1MV	0.125	**0.935**	–0.054	0.112	–0.005	–0.042
EURUSD3MV	0.144	**0.970**	0.002	0.065	–0.008	–0.005
EURUSD12MV	0.194	**0.931**	0.029	0.051	0.003	–0.072
EURHUF1MV	**0.903**	0.138	–0.003	0.092	–0.081	0.040
EURHUF3MV	**0.922**	0.152	0.043	0.074	–0.107	0.052
EURHUF12MV	**0.869**	0.222	0.103	0.028	–0.114	0.068
Trade	–0.006	–0.028	–0.005	–0.016	**0.865**	0.024
EURIBOR	0.020	–0.161	0.044	0.050	–0.294	**0.634**
USDLIBOR	0.027	0.013	0.074	**0.858**	–0.106	0.147
BUBOR	0.333	–0.002	**0.746**	0.036	–0.200	0.073
EURUSD_swap	–0.096	–0.013	**0.771**	0.033	0.082	–0.048
EURHUF_swap	**0.585**	–0.017	0.428	–0.008	0.175	–0.064
December	0.040	0.057	–0.060	–0.042	0.306	**0.773**

Note. Extraction method: principal component analysis; rotation method: varimax with Kaiser normalization. Rotation converged in five iterations. The bold numbers indicate strong positive correlation.
Source: Own calculation based on NBH data.

The first principal component has a strong positive correlation to the EUR/HUF exchange rate and the implied volatility of the currency pair, as well as the 12-month EUR/HUF swap difference. Thus, this component incorporates the market circumstances of the Hungarian FX market. In the second principal component, the EUR/USD volatility is the main determining factor; we can consider this as a measure of global market volatility.

The eigenvalues of the further principal components are close to one, so the contribution of components 3 to 6 correspond to that of a single variable. These components reflect the following effects: Hungarian interest level (*BUBOR*) and EUR/USD swap; US interest level (*USDLIBOR*); foreign trade balance; and *December* effect and *EURIBOR*, respectively.

As both regression models contain the EUR/HUF exchange rate, EUR/HUF volatility, and the December effect, we can conclude that the first and the sixth principal components affect the EUR short and long forward positions.

4. Conclusions

We analysed the aggregate long and short forward positions of non-financial resident clients of Hungarian banks to detect the motives of corporate FX hedging and speculation. We built a linear regression model and found that market movements have an important impact on the change in the forward positions. As we expected, trading activity increased following favourable spot rate changes and long (short) forward positions correlated negatively (positively) with the spot price. Higher volatility in the exchange rate caused an increase in forward positions in both directions. We found that both positions fall significantly at the end of the year.

We investigated the relationship of the explanatory variables with principal component analysis. The first principal component that describes the Hungarian FX market explains 30% of the total variance. This component includes those market factors that affect the forward positions. We could explain the changes in the short foreign currency positions by 60%, but the explanatory power of the model was only 20% for long FX positions.

Our analysis confirmed that market variables have a significant impact on corporate hedging decisions. In the Hungarian market, short forward positions were more exposed to speculation during the sample period.

References

ADAM, T. R. [2002]: Do firms use derivatives to reduce their dependence on external capital markets? *Review of Finance*. Vol. 6. No. 2. pp. 163–187. https://doi.org/10.1023/A:1020121007127

BODNAR, G. M. – HAYT, G. S. – MARSTON, R. C. [1998]: 1998 Wharton survey of financial risk management by US non-financial firms. *Financial management*. Vol. 27. No. 4. pp. 70–91. https://doi.org/10.2307/3666414

Bodnar, G. M. – Gebhardt, G. [1999]: Derivatives usage in risk management by US and German non-financial firms: a comparative survey. *Journal of International Financial Management & Accounting*. Vol. 10. No. 3. pp. 153–187. https://doi.org/10.1111/1467-646X.00049

Brown, G. W. – Crabb, P. R. – Haushalter, D. [2006]: Are firms successful at selective hedging? *The Journal of Business*. Vol. 79. No. 6. pp. 2925–2949. https://doi.org/10.1086/508004

Brown, G. W. – Khokher, Z. [2007]: *Corporate Risk Management and Speculative Motives Available at SSRN*. https://doi.org/10.2139/ssrn.302414

Casualty Actuarial Society [2003]: *Overview of Enterprise Risk Management*. Study of Enterprise Risk Management Committee. https://www.casact.org/area/erm/overview.pdf

Dominguez, K. M. – Tesar, L. L. [2006]: Exchange rate exposure. *Journal of International Economics*. Vol. 68. No. 1. pp. 188–218. ttps://doi.org/10.1016/j.jinteco.2005.01.002

Duffie, D. [1989]: *Futures Markets*. Prentice Hall. Englewood Cliffs.

Haushalter, G. D. [2000]: Financing policy, basis risk, and corporate hedging: evidence from oil and gas producers. *The Journal of Finance*. Vol. 55. No. 1. pp. 107–152. https://doi.org/10.1111/0022-1082.00202

Hommel, U. [2005]: Value-based motives for corporate risk management. In: *Risk Management*. Springer. Berlin, Heidelberg. pp. 455–478. https://doi.org/10.1007/3-540-26993-2_23

Hull, J. C. [2007]: *Options, Futures, and Other Derivatives*. Pearson. Harlow.

Joseph, N. L. – Hewins, R. D. [1997]: The motives for corporate hedging among UK multinationals. *International Journal of Finance & Economics*. Vol. 2. No. 2. pp. 151–171. https://doi.org/10.1002/(SICI)1099-1158(199704)2:2<151::AID-IJFE41>3.0.CO;2-N

Kovács, E. [2009]: *Statistical Analysis of Financial Data*. Tanszék Kft. Budapest.

Mian, S. L. [1996]: Evidence on corporate hedging policy. *Journal of Financial and Quantitative Analysis*. Vol. 31. No. 3. pp. 419–439. https://doi.org/10.2307/2331399

Nguyen, H. – Faff, R. [2002]: On the determinants of derivative usage by Australian companies. *Australian Journal of Management*. Vol. 27. No. 1. pp. 1–24. https://doi.org/10.1177/031289620202700101

Rolfo, J. [1980]: Optimal hedging under price and quantity uncertainty: the case of a cocoa producer. *Journal of Political Economy*. Vol. 88. No. 1. pp. 100–116. https://doi.org/10.1086/260849

Stulz, R. M. [1996]: Rethinking risk management. *Journal of Applied Corporate Finance*. Vol. 9. No. 3. pp. 8–25. https://doi.org/10.1111/j.1745-6622.1999.tb00027.x, https://doi.org/10.1111/j.1745-6622.1996.tb00295.x

Tufano, P. [1996]: Who manages risk? An empirical examination of risk management practices in the gold mining industry. *The Journal of Finance*. Vol. 51. No. 4. pp. 1097–1137. https://doi.org/10.1111/j.1540-6261.1996.tb04064.x

Yip, W. H. – Nguyen, H. [2012]: Exchange rate exposure and the use of foreign currency derivatives in the Australian resources sector. *Journal of Multinational Financial Management*. Vol. 22. No. 4. pp. 151–167. https://doi.org/10.1016/j.mulfin.2012.06.003

Walter, Gy. [2014]: Corporate risk management. In: *Walter*, *Gy*. (ed.): *Corporate Financing in Practice: Possibilities and Decisions in the Hungarian Market*. Alinea. Budapest. pp. 225–238.