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Working Paper



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Role of the Exchange Rates in the Stock Price  
Development of Companies in Chemical Industry

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## **Abstract**

Jana Šimáková, Nikola Rusková: **Role of the Exchange Rates in the Stock Price Development of Companies in Chemical Industry**

*Company's involvement in global activities through international trade is the primary source of their foreign exchange exposure. The paper is focused on the relationship between the exchange rate and the value of the firm. The aim is to evaluate the effect of the exchange rates on the stock prices of companies in the chemical industry listed on the stock exchanges in the Visegrad Four countries. The empirical analysis is realized from September 2003 to June 2016 on the companies from petrochemical and pharmaceutical industry. The effect of exchange rate on the stock price is analyzed by Jorion's approach on the monthly data. Contrary to the selected petrochemical companies, pharmaceutical companies did not use any hedging instruments in the tested period. The effect of exchange rate on the stock price was proved only in the case of pharmaceutical industry. This fact suggests that exchange rate risk could be eliminated by the using of hedging instruments.*

### *Key words*

exchange rate, firm value, exchange rate exposure, Jorion's model, chemical industry

*JEL: F31, G12*

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## **Introduction**

Company's involvement in global activities through international trade is the primary source of their foreign exchange exposure. Companies could be exposed to this risk in different ways. If the company performs international sales or has purchases in foreign currencies, then change in the exchange rate would affect the value of international revenues. However, this company could reduce this risk by using different hedging strategies. Nevertheless, it is important to note that not only companies engaged in export and import activities are exposed to foreign exchange risk. Even pure domestic firms operating only in domestic currency could face this kind of risk. Indirect impact of the exchange rates is through the market competition, and domestic macroeconomic conditions such as development of aggregate demand, employment and output. Thus, a potentially wide range of firms could be exposed to movements in foreign exchange rates, regardless of their direct financial exposure (Flota 2014).

Many empirical studies suggest the negative impact of uncertainty about the development of the exchange rate on cash flow and profitability of companies, and thus their market values. Some economic studies show that foreign revenues are positively correlated with the exchange rate exposure and in a short period, currency depreciation negatively affects the market value of listed companies. On the other hand, there are studies that show no statistically significant links between the value of the companies and exchange rates. The effects of the exchange rates on the value of the company is still open to the further research.

The aim is to evaluate the effect of the exchange rates on the stock prices of companies in the chemical industry listed on the stock exchanges in the Visegrad Four (V4) countries. This group of countries includes Czechia (CZ), Hungary (HU), Poland (PL) and Slovakia (SK). These countries have experienced a transformation process to a market economy in last three decades and today they are characterized as open economies. The transformation process influenced their economic structure, involvement in international economic activities, capital markets and exchange rates regime as well. This study contributes to the current evidence by showing differences in the relationship between the exchange rate and stock prices of companies operating in an open economy with strong connections to the EU and the euro area. The topicality of this research is underlined by the fact that Slovakia is already member of the Eurozone, firms in Hungary have huge portion of debt denominated in foreign currency and Bank Board of Czech National Bank abandoned the exchange rate interventions as a monetary policy instrument in April 2017. Exchange rate effects are therefore important determinants of firm's value in the sample countries.

In order to estimate these effects, the paper applies Jorion's model (1990). In order to be able to compare the results between countries, the analysis includes only companies from the chemical industry, namely the petrochemical and pharmaceutical industry. The selected industry has a significant position in the V4 economies and is represented by companies listed in the V4 stock exchanges. The sample period is from September 2003 to June 2016.

### **1. Review of Relevant Literature**

Theoretical expectation of a link between firm performance and exchange rates has led to many empirical researches. Initial empirical studies predominately showed almost no impact of currency value on the stock prices of companies (e.g. Jorion 1990; Bartov and Bodnar 1994). However, more recent research provides mixed results. Dominguez and Tesar (2006) in their

study show that exposure is correlated with firm size, multinational status, foreign sales, international assets, and competitiveness and trade at the industry level. Foreign exchange exposure is specified as the slope coefficient resulting from relationship between stock returns and changes in the exchange rate. Exposure can be positive, negative, or zero if company's returns are uncorrelated with the exchange rate development.

Firstly, firm characteristics, especially international economic activities, hedging, size, leverage, liquidity and growth opportunities are shown to affect foreign exchange exposure. For example, Jorion (1990) find that companies with high levels of export activities reveal more positive exchange rate exposure in case of USA. Furthermore, Bodnar and Wong (2003) show that small firms are more exposed to currency value development than large companies. Some studies shows that exposure increases as firm size increases (He and Ng, 1998). This can be caused by the fact that larger firms can have more international activities, but also be more likely to hedge than the smaller firms (e.g. Brown and Minton 2010). Use of derivatives can reduce exchange rate exposure (Nguyen and Faff 2003). Nance et al. (1993) reveal that hedging is often used by companies with considerable growth opportunities. Exchange rate exposure can be furthermore determined by company's debt in foreign currency (e.g. Booth and Rotenbery 1990). However, direction of the impact of currency depreciation on the firm's value is ambiguous. De Jong et al. (2006) suggest that multinational companies with debt nominated in foreign currency can lead to decreasing of foreign exchange exposure. The overall impact of currency depreciation is largely dependent on proportion of coverage cost on foreign debt to profits derived from exports in the same foreign currency.

Economic theory further suggests industrial sector affiliation correlated with exposure (Marston 2001), even some empirical studies confirm the assumption that foreign exchange exposure is significantly different across industries. Bodnar et al. (2002) discuss company's exposure as a dependent variable of its ability to pass on the increased expenses or prices caused by exchange rate changes to the consumers. As Ampomah et al. (2013) states, this, depends on industry competitiveness, which determines the price elasticity of demand, and the degree of substitutability of the goods.

Country's macroeconomic fundamentals and their impact on company's exchange rate exposure is examined for example by Patro et al. (2002). They find that imports, exports, credit ratings and tax revenues significantly affect currency risk. Even the openness can have an impact on the company's degree of foreign exchange rate exposure. Significantly positive relationship between openness of the domestic country and a company's exposure to the exchange rate changes is revealed for example by De Jong et al. (2006) or Hutson and Stevenson (2010). However, currency depreciation can increase competitiveness even of the purely domestic companies. This situation can occur if the company competes with import-oriented companies. Hence, depreciation might lead to a net positive impact on its stock prices. However, this indirect impact is limited by the characteristic of the depreciation as depreciation often signals more fundamental problems. Therefore, declines in the currency value might often be accompanied by economic contractions and stock prices decreasing.

We can find many studies concerning the effects of exchange rates on stock prices. They differ in the nature of companies, industries, countries of estimation, sample period, or methodology used. In empirical literature, we can also find several studies dealing with V4 countries. The overview of these studies can be seen in Tab. 1.

**Tab. 1: Studies on the Relationship between Exchange Rates and Stock Value in the V4**

Study	Methodology	Period	Country	Relationship
Stavárek (2005)	Granger causality	1970-1992 1993-2003	CZ, HU, PL, SK	NO
Stavárek and Tomanová (2014)	Jorion's model	2003-2014	CZ	54% tested firms
Tomanová (2014)	Jorion's model	2000-2006 2007-2014	HU	4.5% and 18.4% tested firms
Akel (2014)	Linear Granger Causality	1995-2011	CZ, HU, PL	NO
Akel (2014)	Non-linear Granger Causality	1995-2011	CZ, HU, PL	YES
Tomanová (2016)	Jorion's model	2003-2006 2007-2014	PL	6.7% and 27.3% tested firms

Source: own procakelessing

In summary, results of the few previously published studies concerning the V4 countries indicate mixed results for the evidence of relationship between exchange rates and firm values. As compared to other papers, this study uses the most recent available data on the firm level to avoid the aggregation bias problem which can influence the results. Furthermore this paper takes into account last financial crisis what allows to test the persistency of exchange rate exposure. Therefore, this study substantially contributes to scientific discussion in this field and fills the gap in literature about the exchange rate exposure of companies operating in chemical industry.

## 2. Methodology and Results

According to Adler and Dumas (1984), exchange rate exposure is a regression coefficient. Jorion (1990) followed this assumption in the pilot study explaining changes in stock prices by changes in the market index and exchange rates. Market approach for foreign exchange exposure identification based on Jorion (1990) has been used with various modifications according to the methodological development continually by applying for various geographic areas and timeframes. It is a two-factor model (1), where the return on the market index is the first factor and exchange rate change is the second factor. Exchange rate and market index represents the independent variables. The model is formed into equation as follows:

$$R_{it} = \alpha_i + \beta_i RM_t + \delta_i RFX_t + \varepsilon_{it} \quad (1)$$

where  $\alpha_i$  is the constant term,  $R_{it}$  is the stock return of firm  $i$  over time period  $t$ ,  $RM_t$  is the return of the market index,  $\beta_i$  is the firm's market beta and  $RFX_t$  is the relevant exchange rate. Hence, the coefficient  $\delta_i$  reflects the change in returns that can be explained by movements in the exchange rate after recognition on the market return.

All time series used for estimation are on a monthly frequency, due to the exposure of foreign exchange rate the impact can be even indirect and comes from the competitive situation. The measures of change in exchange rate coefficients provide the relationship through the effect of the exchange rate on stock return. Real effective exchange rate indexes (REER) are used as variables  $REX$  and are obtained from Eurostat database. REER represents the trade-weighted average of a country's currency relative to basket of other major currencies, adjusted for the effects of inflation. Deflators for computing REER are consumer

price indices and trade-weighting is based on 18 major trading partners of each tested country. Data for market indices are obtained also from the OECD statistical database. Sample period for the estimation covers the period from from September 2003 to June 2016. This period covers data after the transformation period, thus the capital markets are based more on the market rules without significant market deformation. Analysis involves stock companies listed in official stock exchange in V4 countries. Their selection and basic characteristics can be seen in Tab. 2. Data for the stock price development are obtained from the portal Investing.com.

**Tab. 2: Basic Characteristics of Selected Stock Companies (March 2017)**

Industry	Company	Market capitalization	% of market index
Petrochemical	UNIPETROL (CZ)	1 466 380 459	2.98
	MOL(HU)	6 878 831 928	31.13
	PKN ORLEN (PL)	7 022 066 065	9.59
	SLOVNAFT (SK)	1 600 000 000	20.86
Pharmaceutical	ZENTIVA* (CZ)	-	-
	RICHTER GEDEON (HU)	3 844 051 426	17.38
	PELION (PL)	960 556 845	0.13
	BIOTIKA (SK)	22 600 000	11.88

\* listed on the Prague Stock Exchange only until 04/2009

Source: own processing

Selected companies are quoted on major V4 stock exchanges and all are from the chemical industry, namely petrochemical and pharmaceutical industries. The same industry was chosen for a possible comparison of the results across the V4 countries. Furthermore, chemical industry represents significant industry for the all V4 economies. In Czechia, chemical industry is the third largest industrial sector, in Slovakia it is the fourth largest industry and in Hungary it is the fifth largest sector and covers 17% of all industrial export. In Poland, it is even second most important production. The importance of selected companies can be seen also from their market capitalization and shares on the respective official market index.

**Tab. 3: Estimated Coefficients of Regression Analysis**

Company	Whole period		Pre-crisis period		Post-crisis period	
	RM	FX	RM	FX	RM	FX
UNIPETROL (CZ)	0.70 <sup>a</sup>	0.26	1.19 <sup>a</sup>	1.46	0.52 <sup>a</sup>	0.03
MOL(HU)	0.91 <sup>a</sup>	-0.18	1.08 <sup>a</sup>	-0.32	0.82 <sup>a</sup>	-0.06
PKN ORLEN (PL)	0.79 <sup>a</sup>	0.22	0.76 <sup>a</sup>	0.13	0.80 <sup>a</sup>	0.30
SLOVNAFT (SK)	1.13 <sup>a</sup>	-0.48	1.13 <sup>a</sup>	-1.12 <sup>c</sup>	1.12 <sup>a</sup>	1.15
ZENTIVA* (CZ)	-	-	0.70 <sup>a</sup>	-0.00	-	-
RICHTER GEDEON (HU)	0.65	-0.39	0.73	-0.62	0.60 <sup>a</sup>	-0.22
PELION (PL)	0.89 <sup>a</sup>	1.36 <sup>b</sup>	0.26 <sup>c</sup>	0.79	1.16 <sup>a</sup>	1.44 <sup>c</sup>
BIOTIKA (SK)	0.33 <sup>c</sup>	0.77	0.17	1.56	0.66 <sup>b</sup>	0.78

Source: own processing

The individual company regressions were estimated for three periods: whole sample (2003/09-2016/06), pre-crisis period (2003/09-2008/09) and post-crisis period (2008/10-2016/06). This splitting allows to test the persistency of exchange rate exposure.

## Discussion

Company's involvement in global activities through international trade is the primary source of its foreign exchange exposure. The aim of this paper was to evaluate the effect of the exchange rates on the stock prices of companies in the chemical industry listed on the stock exchanges in the Visegrad Four countries. Paper applies Jorion's model for the sample period 2003-2016. Some empirical studies suggest the negative impact of uncertainty about the development of the exchange rate on cash flow and profitability of companies, and thus their market values. Some economic studies show that foreign revenues are positively correlated with the exchange rate exposure and in a short period, currency depreciation negatively affects the market value of listed companies. On the other hand, there are studies that show no statistically significant links between the value of the companies and exchange rate.

This paper showed that there is no statistically significant impact of exchange rates on stock prices for petrochemical companies. However, the impact of market indices on the share prices for them was demonstrated. The results for market indices were similar also for the pharmaceutical companies. Furthermore, there was detected a direct relationship between the exchange rate and the share price in the case of Polish company PELION, where this influence was demonstrated for the whole period, and in the post-crisis period this effect seems to be even stronger. The results showed that the depreciation of the Polish zloty leads to increases of the share prices of this company. Depreciation of Polish zloty seems to have a positive effect on the volume of the company's exports, what increases profit, and ultimately increases stock prices.

The fact is that foreign exchange risk strategy is different for petrochemical and pharmaceutical companies. Petrochemical companies use automatic hedging tools against this risk. While pharmaceutical companies do not automatically use them, they only actively access the tools provided by regular monitoring of the development of the exchange rate. Therefore, it can be stated that in the case of petrochemicals, where the effect of the exchange rate on the share price was not confirmed, appropriate hedging instruments likely reduce the foreign exchange exposure. Contrary to the selected petrochemical companies, pharmaceutical companies did not use any hedging instruments in the tested period. This fact suggests that exchange rate risk could be eliminated by the using of hedging instruments.

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