

Dependence of Stock Return in the Prague Stock Exchange on the Oil Price

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Abstract

The aim of this paper is to examine the effect of oil price development on the selected securities traded in the Prague Stock Exchange. Although, there are many studies, which examine the impact of oil price, most of these studies focused on Western markets or important and large emerging markets. The Czech Republic belongs rather to the marginal countries in terms of economic significance. Further, the PSE is characterized by several specific features. The applied models are based on the linear dependence between an equity risk premium and the systematic risk and the development of oil price. The influence of the oil price development is examined from two perspectives. First, the impact of oil prices was analyzed without any decomposition. Afterwards, the oil prices in USD and the exchange rate were examined separately. It was found out that the exchange rate has a more significant impact on the equity excess return than the price of oil. Further, the effect of demand and supply shocks of oil was analyzed. The results confirmed with the exception of NWR, that the demand shocks are a significant price factors for the examined stocks. In the case of NWR supply shocks were significant for the price process as well.

Keywords: Price, return, oil, exchange rate, shocks.

JEL codes: C32, G11, G12

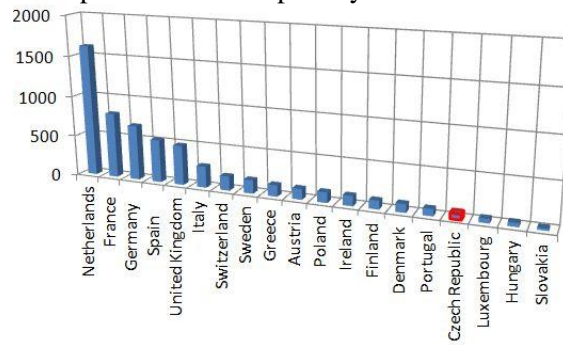
1. Introduction

Oil as an important factor plays a crucial role in the economy of all countries. In according to some authors, the consumption of oil makes up 4% of GDP (Behrens and Glover, 2012). It would be logical to expect that crude oil as an important production factor will have a significant impact on the economy and figuratively on the capital markets. Intuitively, it might be assumed that if the production costs rise, there will be an overall deterioration in the financial situation of a particular company in the form of subsequent drop in its share price or dividend payment. But there is an exception of companies, which are operating in petroleum industry.

The Czech Republic is a relatively small, open economy with specific features. The country belongs to emerging markets with transition economy. As a result of privatization process the development of joint stock companies has begun. This resulted in reopening of the stock exchange in Prague. In the overall comparison with the developed economies the PSE lags far behind other markets. The low market liquidity and the small number of listed companies are particularly apparent. Especially, comparison to the neighbor represented by stock exchange in Germany or Poland.

The Czech Republic is characterized, in comparison with other EU countries, to be below-average dependence on imported energy commodities. This trend is typical for the Czech Republic in the long run and corresponds to the energy strategy of the country. The main reason is the domestic production of hard coal and the share of nuclear energy in the total production and consumption. The inadequate components of the energy mix of the Czech Republic are oil and natural gas. Those commodities are imported from the Russia at most. Thus, the Czech Republic in oil import belongs to peripheral countries.

Figure 1: Import of crude oil per day in thousands of barrel (2011)



Sources: Eurostat

In the academic community exists papers dealing with the causality between oil and stock markets (Ready, 2013). Much effort is devoted to the causality in emerging markets (Masih et al., 2011) or (Stringham et al., 2008). Some studies are focused on a detailed analysis of an impact of oil price development on the capital markets in Asia (Nadhaa and Hammoudehb, 2007). Similarly, study focused on the market in Vietnam (Narayan and Narayan, 2010). Accordingly there could be found studies about the stock markets in Arab Countries (Mohantya et al., 2011).

1.1 Models and Data

This paper will examine the impact of oil price development on stock returns of listed companies on the Prague Stock Exchange (PSE). The study includes eleven stocks (AAA, CETV, CEZ, ERSTE GROUP, KOMERCNI BANKA, NWR, ORCO, PEGAS NONWOVENS SA, PHILIP MORRIS CR, TELEFONICA, VIG). The reason for choosing these stocks was the continuously trading throughout the whole period. Moreover, referred stocks also represents almost the whole PX index.

The Brent crude oil with its largest concentration and impact on the European continent was chosen for the analysis as a relevant indicator for commodity price.

The first analysis will be based on two factors model. The explanatory variables will be market portfolio represented by stock index and the other explanatory variable will be the price of crude oil (eq. 1). The investigated period is 2008-2012. For the data analysis is used one-day return. Since the crude oil is traded in USD, the effect of exchange rate has to be adjusted. Thus, the oil price will be expressed in Czech crowns (CZC). We will conduct the analysis twice. At first the oil price will be expressed in CZC and then we will make the decomposition on oil price in USD and exchange rate (eq. 2). Further, the oil shocks will be analyzed as well (eq. 5). The shocks will be divided between demand and supply shocks (eq. 3,4).

Two factors model:

$$R_{it} = \alpha_i + \beta_1 R_{mt} + \gamma_i OILR(CZC)_t + \varepsilon_{it} \quad (1)$$

R_{it} return on the i th asset in day t ,

R_{mt} return on the market index in day t , represented by PX,

$OILR(CZC)_t$ return on oil price in day t expressed in Czech crowns,

$$OIL(CZC)_t = OIL(USD) * XR(CZC/USD)$$

$OIL(USD)$ price of crude oil expressed in USD,

$XR(CZC/USD)$... the CZC/USD exchange rate,

$OILR(CZC)_t = \ln[OILR(CZC)_t / OILR(CZC)_{t-1}]$, then apply:

$OILR(CZC)_t = \ln[(OILR(USD)_t * XR(CZC/USD)_t) / (OILR(USD)_{t-1} * XR(CZC/USD)_{t-1})]$, and obviously is true:

$$OILR(CZC)_t = \ln[OILR(USD)_t / OILR(USD)_{t-1}] + \ln[XR(CZC/USD)_t / XR(CZC/USD)_{t-1}]$$

$$OILR(USD) = \ln[OILR(USD)_t / OILR(USD)_{t-1}]$$

$OILR(USD)$ return on oil price in day t expressed in USD

$$XRR = \ln[XR(CZC/USD)_t / XR(CZC/USD)_{t-1}]$$

XRR return on exchange rate CZC/USD

Model with the decomposition of crude oil price:

$$R_{it} = \alpha_i + \beta_1 R_{mt} + \gamma_i OILR(USD)_t + \delta_i XRR_t + \varepsilon_{it} \quad (2)$$

Model for demand and supply shocks:

$$\Delta d_t = \beta_t * R_t^{PI} \quad (3)$$

Δd_t demand shock

β_t coefficient from a regression of changes in oil prices on oil returns, β_t is calculated using the rolling regression with lag of 20 trading days.

R_t^{PI} return on oil (Data are used from Bloomberg World Oil and Gas Index)

$$\Delta s_t = \Delta p_t - \Delta d_t \quad (4)$$

Δs_t supply shock

Δp_t change of oil price

$$R_{it} = \alpha_i + \beta_i \Delta d_t + \gamma_i \Delta s_t + \varepsilon_{it} \quad (5)$$

2. Finding

There is 1170 observations from eleven stocks. For all models, it is possible to observe a small explanatory power of indicator R^2 . The strongest explanatory power was manifested by the stock NWR and VIG. A possible reason may be the underlying model assumptions for asset pricing model. If we consider oil as an explanatory variable, dependence of asset return on oil was clearly demonstrated in one case only. The effect was confirmed by the stock NWR. Moreover, the level of significance was 99% for all models.

Table 1: Results of the two factors model

	coefficient	p-value		coefficient	p-value
AAA	R ² =0,161229			R ² =0,165263	
const	0,000256	0,7451		0,000243	0,7571
PX	0,596884	1,07E-41 ***		0,634344	1,47E-47 ***
OILR(CZC)	0,052674	0,129			
OILR(USD)				0,036101	0,3067
XRR(CZC/USD)				0,219326	0,0051 ***
CETV	R ² =0,003184			R ² =0,026310	
const	-0,002503	0,0579 *		-0,00246	0,0599
PX	0,12984	0,0676 *		-0,00788	0,9162
OILR(CZC)	0,008863	0,8787			
OILR(USD)				0,069792	0,2335
XRR(CZC/USD)				-0,60383	3,47E-06 ***
CEZ	R ² =0,001334			R ² =0,012014	
const	-0,000616	0,3022		-0,0006	0,3115
PX	0,039981	0,214		-0,00237	0,9445
OILR(CZC)	-0,012024	0,6476			
OILR(USD)				0,006715	0,8014
XRR(CZC/USD)				-0,20046	0,0007 ***
ERSTE GROUP	R ² =0,017914			R ² =0,050817	
const	-0,000488	0,643		-0,00044	0,6694
PX	0,262299	4,12E-06 ***		0,130132	0,0289 **
OILR(CZC)	-0,057729	0,2133			
OILR(USD)				0,000744	0,9872
XRR(CZC/USD)				-0,64572	4,84E-10 ***
KB	R ² =0,013613			R ² =0,021103	
const	0,0000629	0,9351		0,0000789	0,9184
PX	0,162349	0,0000986 ***		0,116233	0,0086 ***
OILR(CZC)	-0,00178	0,9582			
OILR(USD)				0,018623	0,5899
XRR(CZC/USD)				-0,20695	0,0069 ***
NWR	R ² =0,510164			R ² =0,511839	
const	-0,001039	0,173		-0,00103	0,1769
PX	1,32024	2,77E-163 ***		1,28966	1,92E-143 ***
OILR(CZC)	0,172704	3,14E-07 ***			
OILR(USD)				0,186232	6,27E-08 ***
XRR(CZC/USD)				0,036666	0,6279
ORCO	R ² =0,002142			R ² =0,002540	
const	-0,002728	0,0425 **		-0,00272	0,043 **
PX	-0,108883	0,1324		-0,12728	0,0993 *
OILR(CZC)	0,051284	0,386			
OILR(USD)				0,059421	0,3249
XRR(CZC/USD)				-0,03055	0,819
PEGAS	R ² =0,000156			R ² =0,000818	
const	0,0000392	0,9506		0,0000431	0,9458
PX	0,006213	0,8554		-0,00496	0,8914
OILR(CZC)	0,00914	0,743			
OILR(USD)				0,014084	0,6204
XRR(CZC/USD)				-0,04058	0,5188
PHILIP MORRIS	R ² =0,003615			R ² =0,004690	
const	0,000581	0,2801		0,000585	0,2766
PX	0,059399	0,0402 **		0,047294	0,1255
OILR(CZC)	-0,016902	0,475			
OILR(USD)				-0,01155	0,6323
XRR(CZC/USD)				-0,07075	0,1851

TELEFONICA,	R ² =0,000631		R ² =0,002267	
const	-0,00035	0,4587	-0,00035	0,4643
PX	-0,021629	0,3953	-0,03474	0,2006
OILR(CZC)	0,007169	0,7304		
OILR(USD)			0,012969	0,541
XRR(CZC/USD)			-0,05115	0,2758
VIG	R ² =0,374390		R ² =0,374644	
const	-0,000318	0,6566	-0,00031	0,6616
PX	0,09722	0,0116 **	0,082996	0,0432 **
OILR(CZC)	-0,051548	0,1013		
OILR(USD)			-0,04525	0,1584
XRR(CZC/USD)			-0,11483	0,1057

Source: Input data from Patria

This effect of oil price was not demonstrated by other stocks. An interesting finding was the demonstration of the significance of the exchange rate on the price of five stocks (AAA, CETV, CEZ, ERSTE GROUP, KOMERCNI BANKA). Additional contribution was that the second model gave better results based on R² only in two cases (AAA, CETV). Otherwise, there has been deterioration in this indicator, or it remained unchanged.

Table 2: The impact of oil shocks

	coefficient	p-value
AAA	R ² = 0,054931	
const	7,12E-05	0,92883
Δd	5,26E-01	0,00037 ***
Δs	8,19E-02	0,11605
CETV	R ² = 0,057266	
const	-2,54E-03	0,06421 *
Δd	8,54E-01	0,00001 ***
Δs	-4,86E-02	0,62045
CEZ	R ² = 0,043645	
const	-7,01E-04	0,14384
Δd	3,24E-01	<0,00001 ***
Δs	-4,79E-02	0,20896
ERSTE GROUP	R ² = 0,061152	
const	-4,64E-04	0,64214
Δd	7,09E-01	<0,00001 ***
Δs	-3,53E-02	0,64952
KB	R ² = 0,032161	
const	1,22E-04	0,86528
Δd	3,77E-01	<0,00001 ***
Δs	-6,67E-03	0,89569
NWR	R ² = 0,271252	
const	-1,77E-03	0,07919 *
Δd	1,48E+00	<0,00001 ***
Δs	2,76E-01	<0,00001 ***
ORCO	R ² = 0,000392	
const	-2,47E-03	0,07882 *
Δd	-1,35E-02	0,94451
Δs	4,03E-02	0,63284
PEGAS	R ² = 0,024073	
const	2,46E-04	0,65687
Δd	2,47E-01	0,00295 ***
Δs	-5,03E-02	0,26682
PHILIP MORRIS	R ² = 0,011148	
const	7,23E-04	0,14452
Δd	1,43E-01	0,01106 **
Δs	-2,59E-02	0,56277
TELEFONICA,	R ² = 0,003560	
const	-3,34E-04	0,43065

Δd	7,40E-02	0,10987
Δs	-9,64E-03	0,79316
VIG	$R^2=$ 0,175098	
const	-1,13E-04	0,8639
Δd	8,53E-01	<0,00001 ***
Δs	0,0973923	0,09471 *

Source: Input data from Patria

From the analysis is evident that with the exception of two companies (Telefonica - operating in telecommunications and Orco - real estate) the demand shocks of oil prices had a significant explanatory power by the price-setting process. Regarding the supply shock, this affected only the price for a one company - NWR.

3. Conclusion

In this study the effect of the oil price developments on the PSE was analyzed. The explanatory power of the oil rate of return on the stock rate of return was examined. There were used different models for analysis. The first model expressed the oil price directly in national currency. In the second model the oil price was expressed in USD and the exchange rate were studied separately. Only in the case of NWR the significant influence was confirmed. The significant explanatory power of oil was confirmed in both models of this stock. The referred company operates in the sector of coal mining, so there is a certain consistency to the oil price. Interestingly, two other companies (CEZ, UNIPETROL) are also from the energy sector, but there was no evidence of the importance of oil for their stock price.

Another finding was the inclusion of exchange rate as an additional explanatory variable. The significance of this factor was demonstrated in five stocks. The last model examines the impact of oil shocks on the stock returns. Excluding two companies (Orco, Telefonica) the demand shock was demonstrated as a significant explanatory factor for the price process. In the case of the stock of NWR the supply shock was significant as well.

However, in all cases the coefficient R^2 was relatively low. This indicates the limited ability of the explanatory power of the used models. A better result of the models could be achieved by the conditional version of asset pricing model according to Pettengil (Pettengil et al., 1995). The results were considerably affected by the low energy dependency of the country. Other factors include the underdevelopment of PSE in comparison to other developed markets.

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