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The Relationship between the Oil Price Shocks and the Stock Markets: The Example of Commonwealth of Independent States Countries

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ABSTRACT

One can find many studies in the literature which examine the relationship between the oil price shocks and the macroeconomic activities. Moreover, we witness an increase in the number of studies which examine the effect of recent price fluctuations on the stock prices and returns. This work studies the relationship between the crude oil price shocks and the stock prices in Russia, Kazakhstan and Ukraine, all members of Commonwealth of Independent States, in the period of 2010:01–2017:04 using the autoregressive distributed lag cointegration test. Empirical results show that the crude oil price shocks and the fluctuations in the stock prices are cointegrated. Furthermore the results show that the rebalancement process is asymmetrical in the long run.

Keywords: Oil Price Shocks, Stock Price, Threshold Cointegration Test, Commonwealth of Independent States Countries
JEL Classifications: G12, Q4, Q43

1. INTRODUCTION

Oil price is a very important indicator for many national economies. All economies are directly or indirectly dependent to the oil prices. Therefore, oil price shocks affects many macroeconomic variables in both the oil importing and exporting countries such as the balance of payments, terms of trade, inflation level, real national income, exchange rates, interests rates, and stock market index.

On the other hand, the rise and fall of oil prices affect the importing and exporting countries very differently. Theoretically, high oil prices cause an income transfer from the importing countries to the exporting ones (Majidi, 2006). In the net oil importing countries, high oil prices cause an increase in the production costs, a decrease in the oil demand and a rise in the inflation due to the decreasing investments. In this circumstance, tax income decreases, thus budget deficit grows, and interest rates rise due to the fluctuations in the government spending. On the other hand, as the real wages resist against the fall, increased oil prices typically create a pressure on the real wage levels (Yaylalı and Lebe, 2012. p. 45). Increased oil prices create revenue opportunities for the exporting countries. On the other hand, it diminishes the total output in countries which use oil as a factor input as it creates a downward pressure on the aggregate supply curve (Darby, 1982).

The fact that changes in the oil price has the potential of effecting the real economy, implies that it may also have repercussions on the financial markets. Thus an interaction exists between the oil price and the performance of stock exchanges. This interaction depends on the dependency level of the relevant economy to the oil and it shows itself as the changes in the economical parameters (Syzdykova and Baimaganbetov, 2017. p. 311). Theoretically or according to the stock valuation models, stock values are equal to the expected revenue of a firm or the expected value of its cash flows. Therefore, changes in the oil price affect stock values through the expected cash flows and discount rates (Sattary, 2014. p. 1). The relation between the oil prices and the stock market changes depending on the industrial structure of a country and its dependency level to the oil either as an importing or an exporting country. One of the reasons for this difference is the causal relationship between the oil prices and the stock revenues. Another reason is that the oil price shocks (either on the supply or the demand side) cause various effects on the stock markets (Kilian and Park, 2009).

This study researches the effect of oil prices on the stock market indexes of the oil exporting (Russia and Kazakhstan) and importing countries (Ukraine) of CIS using the autoregressive distributed lag (ADL) threshold cointegration test developed by Li and Lee (2010). The study consists of three chapters. The first chapter studies the theoretical framework and the empirical literature about the relationship between the oil prices and stock markets. We selected the variables, econometrical method and research model based on the results obtained from the literature review. The second chapter explains the dataset and the econometrical method employed. The last chapter explains the empirical results.

2. THEORY AND LITERATURE REVIEW

The effects of oil prices on the stock markets can be explained with the discounted cash flow method, a method used in the finance theory to determine the asset values. Expected cash flows play a major role in the determination of asset prices. Therefore asset prices can be expressed with the following formula (Narayan and Narayan, 2010. p. 357).

$$p = \frac{E(c)}{E(r)} \quad (1)$$

In this equation, terms *p, c, r,* and *E (.)* represent stock prices, cash flow, discount rate and expectation operand, respectively. The expected revenue of the stocks can also be expressed as follows:

$$= \frac{d(E(c))}{E(c)} - \frac{d(E(r))}{E(r)} \quad (2)$$

In this equation, term *d(.)* represents the difference operand and this shows that the stock revenues are dependent on the expected cash flow and the discount rate.

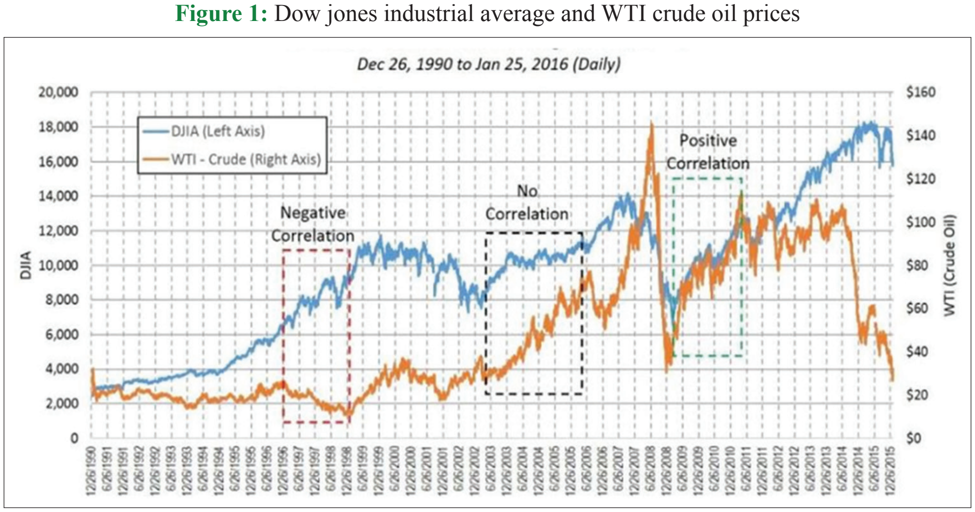
In the literature, there are works that discuss how the oil price changes affect the expected cash flow and discount rate (Huang et al., 1996). First of all, oil is a factor input just like the labor and capital, thus an increase in its price implies an increase in the expected input costs. As the input costs rise, the profits of firms fall. Therefore, one can expect a fall in the stock prices.

Secondly, stock revenues may also be effected from the changes in the discount rate. The expected discount rate is determined by the expected inflation rate and the expected real interest rate. In an oil importing country, any rise in the oil prices increases the deficit in the balance of payments and may cause an increase in the exchange rates and the national inflation rates. An increase in the expected national inflation rate increases the discount rate and may cause a fall in the stock revenues. On the other hand, the increase in the inflation rates may cause an additional increase in the oil prices. The systematical relationship between the oil prices and the inflation rates may cause a long-term relationship between the oil price and the stock revenues. In the oil exporting countries, an increase in the oil price may increase firm revenues and employment, thus may cause an increase in the stock revenue expectation (Yıldırım, 2016).

On the other hand, oil-stock relationship is not always stable. Figure 1 proves that the correlation is not always same furthermore it shows that they may not show a correlation at all.

As seen, the relationship between the oil prices and stock market indexes varies to the point of no correlation. When we reviewed the literature, we found that while some studies claim a relationship (either positive or negative) between the oil prices and the stock indexes, others claim that they have no correlation at all. For example, while Lescaroux and Mignon (2008), Bjornland (2009),

Figure 1: Dow jones industrial average and WTI crude oil prices



Mendoza and Vera (2010), Arouri and Rault (2012), and Wang et al. (2013) claim that there is a strong relationship between the oil prices and stock indexes, Huang et al. (1996), Cong et al. (2008), Jammazi and Aloui (2010), Sayılgan and Süslü (2011) state that they found no correlation in their studies.

The number of studies, which investigate the relationship between the oil prices and the stock prices in the countries we selected, is limited and the existing ones are concentrated on the Russia. Hayo and Kutan (2005) showed that the fluctuations in the oil prices destabilize the Russian stock exchange. Asteriou et al. (2013) found that the oil prices predict the Russian stock prices just like in the other oil exporting countries. The study of Chung and Shih (2014) showed that the increases in the oil prices caused by the precautionary demand shocks also increase the prices of Russian stocks. Yalçın (2015) studied the effects of the oil prices changes caused by the supply or the demand shocks between January 2000 and July 2013 on the Russian, Kazakhstan and Ukrainian stock exchange markets using the SVAR model. The author found that the supply and demands shocks failed to explain the short-term movements in the Kazakhstan stock exchange market but can explain the long-term movements better. He also found that the oil price shocks can explain both short and long-term movements in the Russian and Ukrainian stock exchange markets. Syzdykova (2017) studied the long-term effects of the oil prices on the Kazakhstan stock exchange market between January 2000 and March 2017. In this study, Johansen found a significant long-term relationship between the variables using the cointegration test. Granger causality test showed an unidirectional relationship between the oil and stock prices.

3. DATA AND THE ECONOMETRICAL METHOD

3.1. Data and the Model

In this study, I studied the effects of oil price changes on the Russian, Kazakhstan and Ukrainian stock exchange markets[1] using the ADL threshold cointegration test. In the literature, one can find many variables affecting the stock prices; economic activity and exchange rates play especially significant roles. Thus, we included oil prices as well as national industrial production indexes and real effective exchange rates into our model. All variables were monthly and belonged to 2010:01–2017:04 period.

Real stock prices are regressed using national CPIs; world real crude oil prices are also computed by regressing the nominal prices with the U.S. CPI. We obtained the crude oil prices from the EIA, CPI values from the IFS and all the other variables from the Bloomberg database.

1 The abbreviations used for the Russian, Kazakhstan and Ukrainian stock exchange markets are respectively MICEX, KASE and PFTS. The Moscow Stock Exchange was established in 1992 and is the biggest in Eastern Europe. KASE was established in 1993 and is the biggest and most organized financial market in the Central Asia. PFTS was established in 1997 and is the biggest in Ukraine.

Our equation was as follows:

$$stockp_t=\beta_0+\beta_1 reer_t+\beta_2 ip_t+\beta_3 oilp_t+\varepsilon_t t = 1,2,3\ldots T \quad (3)$$

In the Equation (3), terms $stockp_t$, $reer_t$, ip_t and $oilp_t$ represent respectively the real stock prices, the real effective exchange rate, the industrial production index and the real crude oil price series. ε_t is the stochastic error term.

3.2. Research Method

In this work, we studied the long-term relationship between the oil price shocks and stock exchange prices using the ADL threshold cointegration test developed by Li and Lee (2010) as well as asymmetrical adjustment method.

In the literature, there is no study that shows a compulsory symmetrical adjustment process in the long-term. Balke and Fomby (1997) state that the linear cointegration tests are not very powerful in the asymmetrical adjustment processes. Traditional cointegration tests do not take asymmetrical adjustments into consideration. This lack of consideration causes the symmetrical adjustment assumption to give insufficient results in cases of long-term balancing (Chang and Xu, 2012. p. 2). Enders and Granger (1998) showed that standard root and cointegration tests give weak results under wrongly determined dynamics (Pan et al., 2012. p. 858).

Standard cointegration tests used in the econometrical analyses require series to be in the same integration level. Moreover, standard cointegration tests are adversely affected in the cases of structural break and non-linearity (Güriş, 2013. p. 50). The ADL threshold cointegration test developed by Li and Lee (2010) has many superiorities compared to the general cointegration analysis and unit root analysis methods, which are accepted as the best methods by Engle and Granger (1987) and Johansen-Juselius (1990) (Zortuk and Bayrak, 2016. p. 14). Besides, this approach helps us to evade weakness problem seen in the Harris's (1995) work. It permits us to study the simultaneous cointegration and non-linearity as well as small samples (Chang and Xu, 2012. p. 3).

The greatest advantage of this test is to have a predetermined cointegration vector (Liu et al., 2012. p. 570). This test has two steps. In the first step, cointegration vector is estimated using the Equation (3). In the second step, the threshold ADL regression model is estimated using the estimated cointegration vector.

$$\Delta stockp_t=\beta_0+\beta_1 stockp_{t-1}I_t+\beta_2 stockp_{t-1}(1-I_t)+\beta_3 reer_{t-1}I_t+\beta_4 reer_{t-1}(1-I_t)+\beta_5 ip_{t-1}I_t+\beta_6 ip_{t-1}(1-I_t)+\beta_7 oilp_{t-1}I_t+\beta_8 oilp_{t-1}(1-I_t)+\beta_9\Delta reer_t+\beta_{10}\Delta ip_t+\beta_{11}\Delta oilp_t+\beta_{12}\Delta stockp_{t-1}+\beta_{13}\Delta reer_{t-1}+\beta_{14}\Delta ip_{t-1}+\beta_{15}\Delta oilp_{t-1}+\varepsilon_t \quad (4)$$

Here the term I_t represents the indicator function, and represents the differential term. Li and Lee (2010) used two indicator functions in their study. These were the Indicator A $I_t^{\alpha} = u_{t-1} < u_{t-1}^{*}(\tau)$ and Indicator B $I_t^{b} = \Delta u_{t-1} < \Delta u_{t-1}^{*}(\tau)$. $u_t^{*}(\tau)$ represents the threshold value. τ is the τ^{th} percentage of the empirical distribution of u_{t-1} and Δu_{t-1} τ value is obtained by maximizing the test statistic for the zero hypothesis between the 15% up and down of the u_{t-1} and Δu_{t-1} consecutive series.

There is no predetermined rule for the selection of Indicator A and B for the model estimation. Indicator selection should be made using model selection criteria such as Akaike information criterion or Scwartz information criterion. According to the principle of parsimony, we included only one lag of the parameters $\Delta stockp_t$, $\Delta reer_t$, Δip_t and $\Delta oilp_t$ to the model. Selection of the lag is based on the partial autocorrelation function of the parameter $\Delta stockp_t$. Above all, threshold model permits to the changes in the adjustment speed which converges with the long-term balance measured with $\beta_i (i = 1,2,3,4,5,6,7,8)$.

Li and Lee (2010) proposed two tests to determine the cointegration relation: BO and BDM tests. BO test, proposed by Boswijk (1994), is used to test $stockp_{t-1}$, $reer_{t-1}$, ip_{t-1} and $oilp_{t-1}$ coefficients found in the ADL regression model. BDM test, proposed by Banerjee et al. (1998), is used in the case where it is invalid when all $stockp_{t-1}$, $reer_{t-1}$, ip_{t-1} and $ooilp_{t-1}$ are added to the regression model. Therefore, asymmetrical results are valid when there is no rigid exogeneities. Basic hypotheses of BO and BDM test used in the threshold ADL test are as follows:

For the BO test; $H_0=\beta_1+\beta_2+\beta_3+\beta_4+\beta_5+\beta_6+\beta_7+\beta_8=0$

For the BDM test; $H_0=\beta_1=\beta_1=0$

Li and Lee (2010), using Monte Carlo method, showed that BO test gives better results than BDM test both in terms of power and size. Therefore, we used the results of BO test.

4. EMPIRICAL RESULTS

This study examines the long-term relation between the changes in the crude oil price and stock prices and employs ADL threshold cointegration test, which is developed by Li and Lee (2010) and does not require the knowledge of the stationarity levels of series. We compared the BO test statistic obtained for every country according to the indicator function determined according to the model selection with the critical values obtained by Li and Lee (2010). BO test is used to test the long-term coefficients of $stockp_{t-1}$, $reer_{t-1}$, ip_{t-1} and $oilp_{t-1}$ parameters used in the ADL regression model. The results are presented in Tables 1 and 2.

According to the results summarized in Tables 1 and 2, when Indicator A is used, BO test statistic is greater than the critical value for Russia and Kazakhstan and there exists a cointegration relation; but when Indicator B is used, BO test statistics are under the critical value in all significance levels and one cannot mention about a cointegration relation. For Ukraine, when Indicator B is used, there is a cointegration relation at the 5% significance level.

Table 1: ADL threshold co-integration test results with the indicator A

Countries	β_0	β_1	β_2	β_3	β_4	β_5	β_6	β_7
Russia	2.11 (1.0)	1.50 (3.9)	5.97 (3.9)	−3.71 (−7.8)	−8.68 (−3.4)	7.03 (6.1)	−3.97 (4.0)	−8.06 (−6.9)
	β_8	β_9	β_{10}	β_{11}	β_{12}	β_{13}	β_{14}	β_{15}
	−1.08 (−2.4)	−3.05 c(−1.0)	1.87 (3.0)	−0.75 (−3.3)	0.09 (0.1)	4.21 (1.0)	3.35 (2.2)	1.89 (2.9)
*BO test=29.5875***		$u^*_{t-1}(\tau) = -0.031$		(τ)=0.409			*AIC*=−0.05929	
Kazakhstan	2.89 (1.5)	10.09 (8.9)	8.78 (3.8)	−10.76 (−8.9)	−5.07 (−4.0)	9.11 (7.9)	−4.76 (−5.6)	−1.99 (−3.1)
	−5.01 (-2.2)	7.44 (5.7)	1.09 (0.1)	−0.87 (−3.3)	1.01 (2.8)	2.06 (0.6)	0.53 (3.3)	2.02 (3.8)
*BO test=30.6798***		$u^*_{t-1}(\tau) = -0.072$		(τ)=0.379			*AIC*=−0.08721	
Ukraine	5.53 (4.8)	6.54 (4.9)	14.34 (5.5)	−6.34 (−7.8)	−8.56 (−5.9)	3.45 (4.1)	−8.23 (−5.8)	−3.23 (−4.2)
	−8.45 (−4.6)	4.23 (1.0)	−1.76 (−0.9)	−0.34 (−1.5)	−0.41 (−0.8)	8.22 (1.3)	1.56 (3.0)	0.70 (1.2)
BO test=19.5279		$u^*_{t-1}(\tau) = 0.021$		(τ)=0.581			*AIC*=−0.10227	

Critical levels for the BO statistic are tabularized in the study of Li and Lee (2010). For the Indicator A, critical values for the significance levels 1%, 5% and 10% are respectively 31.75, 29.35 and 26.50. Values in the parenthesis are the results of robust statistics. **Represents the 5% significance level

Table 2: ADL threshold co-integration test results with the indicator B

Countries	β_0	β_1	β_2	β_3	β_4	β_5	β_6	β_7
Russia	5.09 (2.0)	−6.92 (−1.9)	3.42 (1.2)	−4.98 (−2.3)	−6.06 (−0.9)	8.92 (4.9)	5.41 (3.1)	0.89 (2.6)
	β_8	β_9	β_{10}	β_{11}	β_{12}	β_{13}	β_{14}	β_{15}
	6.36 (3.0)	2.04 (0.5)	1.83 (0.9)	−0.51 (−1.9)	−6.25 (−2.5)	6.05 (3.2)	3.27 (3.1)	1.93 (2.7)
BO test=19.0539		$u^*_{t-1}(\tau) = 0.969$		(τ)=0.620			*AIC*=−0.02431	
Kazakhstan	1.33 (1.1)	−7.92 (3.1)	5.61 (3.4)	−5.63 (−2.9)	−7.65 (6.8)	9.32 (4.5)	6.34 (3.2)	2.04 (2.8)
	3.93 (2.9)	7.89 (6.4)	−1.47 (−0.6)	−0.53 (−1.7)	−5.99 (−3.2)	7.52 (−3.2)	4.84 (−3.5)	6.21 (3.4)
BO test=20.9018		$u^*_{t-1}(\tau) = 0.040$		(τ)=0.489			*AIC*=−0.01023	
Ukraine	3.12 (2.1)	−8.48 (−3.2)	6.77 (0.8)	−3.98 (-1.2)	−3.43 (-2.2)	8.98 (6.7)	−8.16 (−0.8)	1.43 (0.5)
	3.41 (1.2)	4.05 (1.3)	−2.43 (−3.8)	−0.42 (−1.2)	−4.36 (−0.4)	5.23 (0.3)	4.12 (1.4)	4.28 (5.2)
*BO test=29.8981***		$u^*_{t-1}(\tau) = 0.021$		(τ)=0.619			*AIC*=−0.14956	

Critical levels for the BO statistic are tabularized in the study of Li and Lee (2010). For the Indicator B, critical values for the significance levels 1%, 5% and 10% are respectively 33.16, 27.91 and 25.15. Values in the parenthesis are the results of Robust statistics. **Represents the 5% significance level

Li and Lee (2010) showed that Akaike criterion can be used to select the relevant indicator and the one with the lowest Akaike criterion can be selected as the appropriate model. From this information, we saw that whereas Indicator A is the appropriate model for Russia and Kazakhstan, Indicator B is the appropriate model for Ukraine. According to the results in the tables, the basic hypothesis that claims there is no cointegration relation between the variables of ADL threshold regression model estimated separately for each country is refuted. Thus, we showed that there is a long-term relation between stock prices and the changes in the oil prices, and industrial production index and interest rates.

5. CONCLUSION

Although many thinks that sudden changes in the oil prices effect stock exchange market and even believe that stock exchange index moves according to the oil price, studies that investigate the relation between these two failed to reach a common conclusion. This can be explained by the fact that oil price shocks effect the importing and exporting countries differently.

In this study, we investigated the relation between the crude oil price shocks and stock exchange markets both in an exporting (Russia and Kazakhstan) and importing (Ukraine) by using monthly data from 2010:01 to 2017:04 period and using the threshold cointegration analysis developed by Li and Lee (2010). We included crude oil prices and stock prices as well as real effective exchange rates and industrial production index to the ADL regression model.

The results show that crude oil price shocks effected the stock prices of the all CIS countries. The adjustment process between the crude oil prices and the stock prices is asymmetrical in the long-term. Future studies may concentrate on the short-term effects of the oil prices on the stock prices of these countries.

Finally, although the effect of oil prices on the stock prices is appreciated, there are very few studies that investigate the distribution of this effect to various sectors. Considering that various sectors are affected from the oil prices very differently, it is very important in terms of portfolio risk management to show the heterogenous responses given to the changes in oil prices by different sectors. Therefore, future studies that will determine its research subject as the sectoral analysis of the effect of oil prices on stock prices will contribute to the literature.

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