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Does Oil Prices Uncertainty Affect Stock Returns in Russia: A Bivariate Generalized Autoregressive Conditional Heteroskedasticity-in-Mean Approach

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ABSTRACT

In this article, we explore the dependence of the volatility of stock returns and the world oil prices on the example of Russia. Using weekly data for the variables for the period from January 01, 2003 by May 01, 2017, we define the uncertainty of oil prices as the conditional standard deviation of the one-step-ahead forecast error for changes in oil prices. A bivariate generalized autoregressive conditional heteroskedasticity-in-mean vector autoregressive model is used for the study. The results of the study show that, given oil prices are denominated in US dollars, the uncertainty of oil prices has a positive and statistically significant impact on stock returns. Also as a result of research, we come to the conclusion that in case of Russia, the uncertainty of oil prices in the equation "oil price-stock returns" leads to an increased positive response of stock returns to a positive oil price shock, while increasing the sensitivity of stock returns to negative oil price shock in comparison with the model, not taking into account the uncertainty of oil prices. The analysis also showed that the response of stock returns to positive and negative oil price shocks uncertainty is asymmetric.

Keywords: Oil Prices, Stock Returns, Volatility, Generalized Autoregressive Conditional Heteroskedasticity, Emerging Market

JEL Classifications: C32, G10, G15, Q43

1. INTRODUCTION

Modern economic environment is characterized by high volatility and uncertainty. World energy market is no exception. Volatility is an important characteristic of world oil prices. This is due to the widespread use of energy as a source for the production of goods of intermediate and final consumption (Swanepoel, 2006). In this context, the volatility in world oil prices has the potential to substantially impact on world markets of goods, services and capital. On the other hand, the volatility in world oil prices may be detrimental to the development of national markets, which is causing concern in the political, economic and expert circles. In this regard, the research community has been devoting considerable attention to this issue. Particularly significant is the question of the relationship between the volatility of oil prices and the macroeconomic state of the economy. Speaking about the state of research can be divided into two main areas. Some researchers dedicate work to the search of the impact of world oil prices on investment, economic growth, household behavior, the other on the background of the global financial crisis and its consequences increasingly focused on stock market, loan capital markets. This study aims to test the hypothesis on the relationship between volatility of oil prices and the securities market on the example of Russia. It is no secret that Russia, being an oil exporter is exposed to volatility in oil prices. The question is to determine the positive or negative nature of this effect and its magnitude.

In the classical theory, asset prices depend on expected discounted cash flows (Fisher, 1930; Williams, 1938). According to this theory we can assume that the combination of endogenous and exogenous factors with a potential impact on expected discounted flows can affect asset prices traded in markets. So, a positive shock in oil prices should lead, ceteris paribus, increase the cost of production, reduction of potential profit. For the holders of the securities (excluding the holders of the shares of oil companies), this shock may lead to reduction of capitalization of the shareholder. Then, we can assume that a positive shock in oil prices may lead to a drop in the stock price (Filis et al., 2011). In the case of oil-exporting countries, a positive demand shock in the oil prices should lead to an increase in the cost of securities and economic growth. To such conclusions came Bjornland (2009) and Jimenez-Rodriguez and Sanchez (2005). The increase of yield national securities leads to an increase of macroeconomic variables, which leads to an increase in aggregate expenditure and investment, leading to employment growth and labor efficiency i.e., in the case of oil-exporting countries, the effect should be the opposite.

However, these laws do not apply to oil-importing countries. A positive shock in oil prices will have a more negative impact (LeBlanc and Chinn, 2004; Hooker, 2002). This negative effect is due to the fact that oil is one of the major factors of production used by entrepreneurs and households. This leads to a rise in costs (Filis et al., 2011; Arouri and Nguyen, 2010; Backus and Crucini, 2000; Kim and Loungani, 1992). This price increase is transferred to entrepreneurs and households, leading to bouts of inflation (rising prices) and falling demand from households with a high elasticity demand function (Bernanke, 2006; Hamilton, 1988). Falling demand and rising inflation expectations lead to a decline in production and employment (Lardic and Mignon, 2006; Brown and Yücel, 2002; Davis and Haltiwanger, 2001). The logical conclusion of this spiral is the deterioration of the macroeconomic environment and the negative reaction of the stock market (Sadorsky, 1999; Jones and Kaul, 1996). Filis et al. (2011) pointed out that shocks in oil prices can influence the stock market through the uncertainty, which in turn affect the stock market depending on the side: On the supply side or the demand. If the shock in oil prices from the demand side - the reaction of the stock market can be positive, if on the supply side, it is negative. The importance of oil prices for the stock market as a source of information also emphasizes and Ross (1989).

An important aspect of the research question is the symmetry or asymmetry of the effect of the shock of oil prices on stock markets. In other words, is a proportionate (balanced) response of stock markets to positive and negative oil shocks. Sadorsky (1999) cites two possible explanations for an asymmetric reaction of the stock market to positive and negative shocks. The first explanation is due to the fact that the shocks are sectoral in nature and affect individual sectors of the economy. In other words, the main role is played by the change in relative prices. The second explanation is associated with irreversible investments under uncertainty. Under this approach, an important role time preferences play in investing. For example, Hamilton (1988), using a multi-sector model of the economy, concludes that the movement of labor and capital across sectors is costly, in connection with the costs of the training and mobility of labor in the national economy. In the given conditions, the relative price shock reduces the employment rate: Workers in the affected sectors will likely be left temporarily unemployed until recovery of the sector, rather than move on to another. In the case of the assumptions about the irreversible investment, the organization may face a dilemma: In the case of oil shock, increase of the basic capital at the expense of energy efficient or energy inefficient capital. The growing uncertainty of energy prices, when triggered by the volatility of oil prices leads to the necessity of determining the optimum time for investment. The decline in oil prices may be offset by higher uncertainty. Many authors come to the conclusion that the sharp jumps in oil prices (both growth and decline) lead to higher volatility, and that, in turn, leads to volatility in investment, production and consumption. Also sharp spikes in oil prices lead to asymmetric responses in different sectors (Guo and Kliesen, 1995; Elder and Serletis, 2010; Baskaya et al., 2013).

Unfortunately, today a large part of the literature on the topic investigates the impact of shocks in oil prices on different sectors of the real economy. For example, the impact of oil prices on exchange rate and economic growth for oil exporting countries is studied in Burakov (2016). For the real sector of oil exporting countries of great importance is the emigration concerns. E.g., Burakov (2016) has identified a transmission channel of oil shocks in economic growth and emigration decisions of the population. A brilliant study by Ozturk and Feridun (2010) shows that a positive oil shock tends to increase inflation on domestic markets in case of Turkey as an oil-importing country.

The impact of the uncertainty of oil prices on the stock market of the national economy are investigated insufficiently. The paucity of such studies basically apply to developing countries. This study aims to empirically test and determine the quantitative parameters of the oil price shock effect on the profitability of the Russian stock market. Unlike existing studies, we apply impulse response analysis to assess the recovery rate of stock returns to the state preceding the shock. We also set ourselves the task to determine the presence/absence of symmetry in the reaction of stock market to a shock in oil prices uncertainty. Framework the study is based on the use of two-dimensional. In the framework of structural vector autoregression (VAR) is modified to accommodate bivariate generalized autoregressive conditional heteroskedasticity (GARCH)-in-mean errors. This platform is characterized by the fact that all parameters are estimated simultaneously by full information maximum likelihood in order to avoid the generated regressor problems, which was written in Pagan (1984). The measurement of uncertainty in this study, the conditional standard deviation of the one-step-ahead forecast error for the change in the price of oil.

2. LITERATURE REVIEW

This section aims to reveal the current status of research on the question of the relationship of uncertainty of oil prices and stock market prices and oil-exporting countries. Unfortunately, to date most of the research on this issue is carried out on the example of developed countries. A number of studies of developing countries are limited and scarce. A brief literature review on the research question is presented in Table 1.

Given the presented in Table 1 results of literature review of the study, we can draw several conclusions. First, research, concentrated specifically on developing countries is few, which underlines the relevance and significance of our research. Second, existing studies are mostly devoted to the analysis of the relationship between oil prices and the market value of the securities. Studies of the impact of the shock of uncertainty of oil prices on stock markets, are almost absent. Thirdly, the results of previous studies are of somewhat ambivalent nature, and the

Table 1: Summary of relevant literature sources

Author (year)	Sample	Methodology	Results
Agren (2006)	Stock markets of Japan, Norway, Sweden, the UK, and the US	Asymmetric BEKK model	Volatility spillover from oil prices to stock markets exist, excluding Sweden; volatility spillovers are quantitatively small although statistically significant
Sadorsky (1999)	Oil price risk and 21 emerging stock market returns	International multi-factor model	Evidence that oil price risk positively impacts stock price returns in emerging markets is found
Malik and Ewing (2009)	Oil prices and three equity sector returns in the US (technology, healthcare and consumer services)	Bivariate GARCH models	Existence of negative and significant relationship between the sector index returns and volatility of oil prices
Arouri et al. (2011)	Volatility transmission between oil and stock markets in Europe and the United States at the sector level	Generalized VARGARCH approach	A widespread direct spillover of volatility between oil and stock sector returns is found. Volatility cross effects run only from oil to stock sectors in Europe while bilateral spillover effects are observed in the United States
Lee and Chiou (2011)	Relationship between WTI oil prices and S and P 500 returns	Univariate regime switching GARCH model	Results show, that when there are significant fluctuations in oil prices, the resultant unexpected asymmetric price changes lead to negative impacts on S and P 500 returns, but the result does not hold in a regime of lower oil price fluctuations
Choi and Hammoudeh (2010)	The US	Symmetric DCC-GARCH model	Results show increasing correlations among Brent oil, WTI oil, copper, gold and silver but decreasing correlations with the S and P 500 index
Filis et al. (2011)	Time-varying correlation between stock market prices and oil prices for oil-importing (US, Germany and Netherlands) and oil-exporting Countries (Canada, Mexico and Brazil)	Contemporaneous correlation analysis	Results show that time-varying correlation does not differ for oil-importing and oil-exporting economies, the correlation increases positively (negatively) in respond to important aggregate demand-side (precautionary demand) oil price shocks, arising from global business cycle's fluctuations. Lagged correlation results show that oil prices have a negative effect in all stock markets
Masih et al. (2011)	South Korea	VEC model	Negative impact of oil price volatility on real stock returns
Jouini (2013)	World oil price and stock sectors in Saudi Arabia	VAR-GARCH approach	Volatility transmission between oil price and stock sectors is found
Chang et al. (2009)	Volatility spillovers between WTI crude-oil futures returns and stock returns of 10 worldwide oil companies	Multivariate GARCH models	Results show no volatility spillover effect
Arouri et al. (2012)	Volatility spillovers between oil and stock markets in Europe	VAR-GARCH approach	Significant volatility spillovers between oil price and sector stock returns are found. Observed spillover effects come entirely from spillovers of shocks, and that spillovers of volatilities are all insignificant
Jiranyakul (2014)	Impact of oil price uncertainty on the Stock Exchange of Thailand	A bivariate GARCH model, pairwise Granger causality tests	Results show that movement in real oil price does not adversely affect real stock market return, but stock price volatility does affect real stock return. A positive one-directional volatility transmission running from oil to stock market is found
Olson et al. (2014)	Relationship between the energy and equity markets of the Goldman Sach's Energy Index and the US S and P 500	Multivariate BEKK model	Results show that low S and P 500 returns cause substantial increases in the volatility of the energy index; however, they find only a weak response from S and P 500 volatility to energy price shocks
Lin et al. (2014)	Dynamic volatility and volatility transmission between oil and Ghanaian stock market returns	VAR-GARCH, VAR-AGARCH and DCC-GARCH	Existence of positive and significant volatility spill-over and interdependence between oil and the two stock market returns is found
Basher and Sadorsky (2006)	Impact of oil price changes on a set of 21 emerging stock market returns	Pooled regression analysis	A strong and statistically significant impact is found
Gupta and Modise (2013)	Oil price shocks impact on stock market returns, South Africa, 1973-2011	Structural VAR approach	For oil-importing country stock returns increase as a result of an oil price increase only when global economy is rising. In case of speculative demand and oil supply shocks – stock returns decline

VAR-GARCH: Vector autoregressive generalized autoregressive conditional heteroskedasticity, DCC: Dynamic conditional correlation identified relationship between variables is undefined enough. Thus, some researchers have come to the conclusion that the connection exists, others come to the conclusion that the causal link is missing. Fourthly, quite a few studies are devoted to the analysis of the symmetry of the reaction of the stock market to positive and negative shocks of uncertainty in oil prices, including the example of Russia, which also reinforces the relevance and necessity of this research. In this regard, we apply a general bivariate framework in which a VAR is modified to accommodate GARCH-in-mean errors, thus avoiding the generated regressor problem, by simultaneously estimating all the parameters by the full information maximum likelihood following Elder (1995; 2004) and Elder and Serletis (2010).

3. MATERIALS AND METHODS

To achieve the objectives in this study we use a model developed by Elder (1995; 2004) and used in Elder and Serletis (2010). This model is a model of bivariate month growth stock market (in market prices) and the rise in oil prices. The model is based on a structural VAR modified to account for conditional heteroscedasticity in parametric form bivariate GARCH-in-mean. The working assumption is that the dynamics of the structural system can be summarized by a linear function of the variables of the sample and terms related to the conditional variance, which can be represented as follows:

$$Ay_t = K + \Gamma_1 y_{t-1} + \Gamma_2 y_{t-2} + \ldots + \Gamma_n y_{t-p} + (\Omega M)\sqrt{H_t} + \varepsilon_t \qquad (1)$$

Where dim (A)=Dim(Γ_1) are $p \times p$ matrices, $\sqrt{H_t}$ is a diagonal and Ω (M) is a matrix polynomial in the lag operator. y_t is a vector containing real oil price and real stock price growth rates (returns), $\varepsilon_t | |\Pi_{t-1} \sim$ iid $(0, H_t)$ represents uncorrelated structural disturbances in the system where Π_{t-1} is the available information set at time $t-1$.

The above specification allows the conditional matrix of standard deviations impact ($\sqrt{Ht}$) on the conditional mean. For empirical verification of the hypothesis about the impact of the uncertainty of oil prices on stock prices, a test of restrictions on the elements of Ω (M) that relate the conditional standard deviation of stock prices, given by the element $\sqrt{H_t}$, to the conditional mean of y_t is performed. In the case that the volatility of oil prices has a negative impact on stock prices, the negative and statistically significant coefficients on the conditional standard deviation of oil in the stock price equation.

The conditional variance H_t is modelled as bivariate GARCH of which a general version is represented in Engle and Kroner (1995) as:

$$h_t = C_v + \sum_{j=1}^{J} F_i vec\left(\varepsilon_{t-j}\varepsilon'_{t-j}\right) + \sum_{i=1}^{I} G_i h_{t-i}, \qquad (2)$$

$\varepsilon_t \sim \sqrt{H_t} z_t ; z_t \sim iidN(0, I)$ where C_v is $N^2 \times 1$ matrix, F and G are $N^2 \times N^2$ matrices and $h_t = vec(H_t)$. This specification does not however guarantee that H_t is a positive definite. According to Elder (2004), when we apply a common identifying assumption in structural VAR, we substantially simplify the variance function, written in terms of the structural disturbances. Under a zero simultaneous correlation of structural disturbances, the conditional variance matrix H_t is diagonal, reducing the requisite number of variance function parameters. By dimensioning the variance function parameter matrices C_v F and G, the variance function is reduced to the following:

$$diag(H_t) = C_v + \sum_{j=1}^{J} F_i diag(\varepsilon_{t-j}\varepsilon'_{t-j}) + \sum_{i=1}^{I} G_i diag(H_{t-i}), \qquad (3)$$

Where, *diag* is the operator that extracts the diagonal from a square matrix. The second and third terms of equation (3) represent the ARCH and GARCH terms. Imposing an additional restriction that the conditional variance of $y_{i,t}$ depends only on its own past squared errors and its own conditional variances, the parameter matrices F_j and G_i are also diagonal. The variance function (equation (3)) is then estimated with $J = I = 1$, which is the specification for a GARCH model (1,1)-in-mean VAR model.

The bivariate GARCH-in-mean VAR model is represented by equations (1) and (3), which are estimated by full information maximum likelihood in order to avoid Pagan's generated regressor problem related to estimating the variance function parameters separately from the conditional mean parameters (Pagan, 1984). The procedure is to maximize the log likelihood with respect to the structural parameters A, K, Γ_1, Γ_2 …, Γ_n, Ω, F and G, where,

$$l_t = -\left(\frac{N}{2}\right)\ln(2\pi) + 1/2ln|B|^2 - 1/2ln|H|_t - 1/2(\varepsilon'_t H_t^{-1}) \qquad (4)$$

According to Elder and Serletis (2010), pre-sample values of the conditional variances matrix H_0 are determined according to their unconditional expectation and condition on pre-sample values of y. The restrictions, listed below, are imposed to ensure a positive definite and covariance stationary H_t and ε_t. Firstly, C_v is wise-positive. Secondly, F are non-negative wise-element. Thirdly, Eigen-values of (F+G) are less than on in modulus. Given that the conditions of standard regularity hold, full information maximum likelihood gives asymptotically normal and efficient estimates, with the asymptotic covariance due to inverse if the Fisher's matrix. When we introduce usual identifying procedure in vector autocorrection models, we can estimate free terms in B subject to a rank condition. To fulfill this requirement, we follow Edelstein and Kilian (2007), as well as Elder and Serletis (2010) – stock returns are able to respond to simultaneous shocks in oil prices.

To test the hypothesis about presence or absence of asymmetry in stock returns to oil price shocks we employ impulse response technique. This method helps in identifying the response of the variable to shocks in explaining variable. Impulse response technique for the GARCH-in-mean VAR is used in the manner of Elder (2003). Confidence intervals are determined according to Monte Carlo method (Hamilton, 1994). Responses to the simulated shocks are derived using maximum likelihood estimates of the model. Base on parameter values drawn randomly from the sampling distribution of the MLEs, confidence intervals are generated by simulating 1000 impulse responses.

Table 2: Results of unit root testing

Variables	ADF		PP		NP		KPSS	
	Intercept	Intercept and trend	Intercept	Intercept and trend	Intercept	Intercept and trend	Intercept	Intercept and trend
OilP	−2.53	−3.49	−1.29	−3.45	1.02	−21.22	3.50	0.89
SP	−0.68	−1.98	−0.67	−0.92	2.56	−13.45	4.02	0.93
Δ*OilP*	−34.12*	−33.29*	−29.74*	−30.09*	−28.40*	−46.68*	0.09	0.13
Δ*SP*	−63.42*	−45.12*	−46.90*	−34.51*	−123.05*	−123.93*	0.08	0.05

*Indicate significance at 5% level and rejection of the null hypothesis. PP: Phillips-Perron, KPSS: Kwiatkowski, Phillips, Schmidt and Shin, ADF: Augmented Dickey Fuller

The study is conducted on the example of Russia. To reflect world oil prices are used, spot prices of crude oil Brent (Europe). Base period is 1 week. The source of information is the statistical database of the US Energy Information Administration. To reflect the uncertainty of oil prices is used the standard deviation of the one step ahead forecast errors, conditional on various information sets. This approach is consistent with proposed in Elder and Serletis (2010).

For data evaluation the market price of Russian shares, we use the average of the weekly composite data of the MICEX Index, denominated in Russian roubles. Data on market value of shares of the largest traded companies, covering the main sectors of the economy, is obtained from the statistical database of the Moscow Exchange.

To conduct the study, it is necessary to determine the stationarity of the used time series on the one hand and the degree of cointegration on the other. To check time series for stationarity requirement, we use augmented Dickey–Fuller test, Phillips–Perron test, Ng–Perron test, and the test of Kwiatkowski-Phillips-Schmidt-Shin.

4. RESULTS AND DISCUSSION

As can be seen from the results of the analysis of sampled variables (Table 2), when using raw data, all tests indicate the nonstationarity of the time series. When translating the time series in logarithmic values, the data becomes stationary in any test for the presence of unit root. Thus, the analysis uses the time series of the logarithmic values of oil prices and stock market prices. The time period of the sample includes the range from January 01, 2003 on May 01, 2017. It is also important to note that the world price of oil (Brent) is denominated in US dollars instead of Russian rubles. This choice is justified by the desire to avoid the impact of exchange rate on stock returns and to use the oil price as exogenous variable.

To build the model it is also necessary to determine the optimal magnitude of the time lag with which oil prices can affect stock returns. We use the Akaike information criterion. According to the results of the analysis, the optimal lag may be a lag of 7 weeks. The next step in the study and analysis of the obtained results is the choice of a suitable model. It is necessary to determine the advantages of one model specification over another. In our case the choice is between GARCH (1,1)-in-mean VAR and traditional VAR models homoscedasticity. To determine the type of model best suited for the analysis of our variables, we use the Schwartz information criterion and appropriate values of the statistics.

Table 3: Results of model specification test

Bivariate VAR model	Schwarz criterion value	
	VAR	GARCH-in-mean VAR
Oil prices and stock returns	9078.12	8742.98

GARCH: Generalized autoregressive conditional heteroskedasticity, VAR: Vector auto regression

Schwartz information criterion is not adapted to the use of additional parameters in the assessment GARCH model, so the optimal, according to Elder and Serletis (2010) is the use bivariate GARCH (1,1)-in-mean VAR specifications. Table 3 presents the results of comparative analysis of advantages of different model specifications. As can be seen from Table 3, the criterion Schwarz spoke in favor of the VAR model GARCH-in-mean.

Further proof of the benefits of bivariate GARCH-in-mean VAR model over traditional are the results of the estimation of the parameters of variation, which are presented in Table 4. As can be seen from Table 4, the null hypothesis of the absence of ARCH and GARCH-M can be rejected. More precisely, from the test results it is seen that GARCH is present in stock returns and ARCH is present in oil prices. Also from the data analysis we can see at the level of weekly data that the volatility of oil prices is sustainable and permanent.

The shocks of uncertainty in oil prices are reflected as the conditional standard deviation of changes in oil prices $\sqrt{H_t}$. It is the ratio of conditional standard deviations in the equation of stock returns provides evidence of the effect of oil price uncertainty on stock returns. As can be seen from Table 4, a positive uncertainty shock in oil prices leads to a positive impact on stock returns in the Russian stock market with a value of 0.48, the value of t-statistics and probability −1.98 and probability P = 0.04. The statistical significance of this coefficient is marginal in nature. Thus, the results confirm previous research on the issue, the results of which confirm the existence of dependence of stock returns in the oil-exporting country on the level of oil prices. In the case of rising oil prices, the return on the stock market is growing. The insignificance of growth may be explained by the heterogeneity of tradable shares and a plurality of sectors of the economy, or dominance of the oil sector on the stock market.

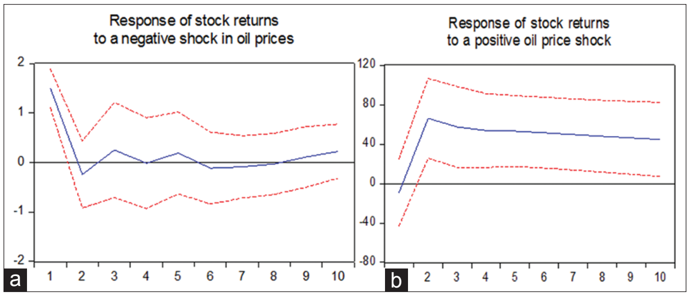
To assess the degree of symmetry/asymmetry in the reaction of stock returns to a shock of uncertainty in oil prices one should apply to the analysis of the results of impulse response functions that are simulated from maximum likelihood estimates of the parameters of the model. In order to obtain comparable to homoscedastic VAR

Table 4: Coefficient estimates for variance of GARCH-in-mean VAR

Equation Type	Conditional variance	Constant	$\varepsilon_i (t-1)^2$	$H_{i,i} (t-1)$
OILP equation	$H_{1,1} (t)$	12.34* (21.39)	0.48* (5.12)	0.00
SP equation	$H_{2,2} (t)$	0.17* (1.82)	0.19* (5.69)	1.05* (32.44)

Asymptotic t-statistics are in parentheses. *Indicates significance at 5% level. GARCH: Generalized autoregressive conditional heteroskedasticity, VAR: Vector auto regression

Figure 1: (a and b) Response of stock returns to positive and negative oil price shocks



model, impulses, the magnitude of the impulse response should be based on the shock in oil prices, which is the unconditional standard deviation of changes in oil prices. In order to establish whether the response to positive and negative shocks is symmetric or asymmetric, we analyze the sensitivity of stock returns to both positive and to negative shocks of uncertainty in oil prices. The results of the sensitivity of stock returns to negative and positive shocks of uncertainty in oil prices are presented in Figure 1a and b.

As can be seen from the data analysis of the sensitivity of stock returns to shocks in oil prices, a positive shock in oil prices leads to a significant and rapid growth of profitability of shares traded on the Moscow Exchange. It is important to note that this result is achieved within the first 2 weeks. In the medium term, the effect fizzles, i.e., is short-term.

If we turn to the results of the simulation of a negative oil shock, we can see that the fall in oil prices leads to a significant drop in stock returns in the short term and that the effect lasts longer than in the case of recovery. When analyzing the presence of symmetry, we can state that the response to positive and negative shock of crude oil prices from the yield of Russian shares is disproportionate, as not identical in absolute values. The negative effect is bigger than the positive shock.

5. CONCLUSION

In this article we set ourselves the task to conduct a study to identify the relationship between the volatility of world oil prices and stock returns traded on the Moscow Exchange on the example of Russia. The study showed that positive and negative shocks of oil prices have a statistically significant impact on the profitability of stocks traded on the Moscow Exchange. In the case of oil-exporting countries, which Russia is, a positive shock in oil prices leads to significant growth of stock returns, while negative shock in oil prices leads to a fall in stock returns. A logical explanation for this empirical relationship is, in our opinion, the large-scale presence and the proportion of oil companies among the total pool of tradable shares.

Another finding of the study is the identification of asymmetric reactions of stock returns to positive and negative shocks of volatility of oil prices. In the case of a negative shock in oil prices, the effect is short, but significant. In the case of a positive shock in oil prices, the effect is long-term, but less in scale. The reasons for such asymmetry is related to many exogenous and endogenous factors and is a question requiring further research.

REFERENCES

Agren, M. (2006), Does Oil Price Uncertainty Transmit to Stock Markets? Working Paper, Department of Economics, Uppsala University, No. 2006, 23. Available from: http://www.econstor.eu/bitstream/10419/82778/1/wp2006-023.pdf.

Arouri, M.E.H., Jouini, J., Ngugen, D.K. (2011), Volatility spillovers between oil prices and stock sector returns: Implications for portfolio management. Journal of International Money and Finance, 30(7), 1387-1405.

Arouri, M.E.H., Jouini, J., Ngugen, D.K. (2012), On the impacts of oil price fluctuations on European equity markets: Volatility spillover and hedging effectiveness. Energy Economics, 34, 611-617.

Arouri, M.E.H., Nguyen, D.K. (2010), Oil prices, stock markets and portfolio investment: Evidence from sector analysis in Europe over the last decade. Energy Policy, 38, 4528-4539.

Backus, K.D., Crucini, M.J. (2000), Oil prices and the terms of trade. Journal of International Economics, 50, 185-213.

Basher, S.A., Sadorsky, P. (2006), Oil price risk and emerging stock markets. Global Finance Journal, 17, 224-251.

Baskaya, Y.S., Hülagü, T., Küçük, H. (2013), Oil price uncertainty in a small open economy. Central Bank of the Republic of Turkey 2013, Working Paper No. 13/09.

Bernanke, S.B. (2006), The Economic Outlook. New York: Remarks before the National Italian American Foundation.

Bjornland, C.H. (2009), Oil price shocks and stock market booms in an oil exporting country. Scottish Journal of Political Economy, 2(5), 232-254.

Brown, P.A.S., Yücel, M.K. (2002), Energy prices and aggregate economic activity: An interpretative survey. The Quarterly Review of Economics and Finance, 42, 193-208.

Burakov, D. (2016), Oil prices, economic growth and emigration: An empirical study of transmission channel. International Journal of Energy Economics and Policy, 7(1), 90-98.

Burakov, D. (2016), Oil prices, exchange rate and prices for agricultural commodities: Empirical evidence from Russia. AGRIS On-line Papers in Economics and Informatics, 8(2), 33-47.

Chang, C.L., McAleer, M., Tansuchat, R. (2009), Volatility Spillovers between Crude Oil Futures Returns and Oil Company Stock Returns, Working Paper CARF-F-157, University of Tokyo.

Choi, K., Hammoudeh, S. (2010), Volatility behavior of oil, industrial commodity and stock markets in a regime-switching environment. Energy Policy, 38, 4388-4399.

Davis, J.S., Haltiwanger, J. (2001), Sectoral job creation and destruction responses to oil price changes. Journal of Monetary Economics, 48, 465-512.

Edelstein, P., Kilian, L. (2007), The response of business fixed

investment to changes in energy prices: A test of some hypothesis about the transmission of energy price shocks. The B.E. Journal of Macroeconomics, Berkeley Electronic Press, 7(1), 35.
Elder, J. (1995), Macroeconomic and Financial Effects of Monetary Policy and Monetary Policy Uncertainty. Unpublished Doctoral Dissertation, Department of Economics University of Virginia.
Elder, J. (2003), An impulse response function for a vector auto regression with multivariate GARCH-in-mean. Economic Letters, 79, 21-26.
Elder, J. (2004), Another perspective on the effects of inflation volatility. Journal of Money, Credit, and Banking, 36, 911-928.
Elder, J., Serletis, A. (2010), Oil price uncertainty. Journal of Money Credit and Banking, 42(6), 1137-1159.
Engle, R.F., Ng, V. (1995), Multivariate simultaneous generalized ARCH. Economic Theory, 11(1), 122-150.
Filis, G., Degiannakis, S., Floros, C. (2011), Dynamic correlation between stock market and oil prices: The case of oil-importing and oil-exporting countries. International Review of Financial Analysis, 20, 152-164.
Fisher, I. (1930), The Theory of Interest. New York: Macmillan.
Guo, H., Kliesen, K.L. (2005), Oil price volatility and U.S. Macroeconomic activity. Federal Reserve Bank of St. Louis Review, 87(6), 669-683.
Gupta, R., Modise, M.P. (2013), Does the source of oil price shocks matter for South African stock returns? A structural VAR approach. Energy Economics, 40(1), 825-831.
Hamilton, D.J. (1988), A neoclassical model of unemployment and the business cycle. Journal of Political Economy, 96, 593-617.
Hamilton, J.D. (1994), Time Series Analysis. Princeton, NJ: Princeton University Press.
Hooker, A.M. (2002), Are oil shocks inflationary? Asymmetric and nonlinear specifications versus changes in regime. Journal of Money, Credit and Banking, 34(2), 540-561.
Jimenez-Rodriguez, R., Sanchez, M. (2005), Oil price shocks and real GDP growth: Empirical evidence for some OECD countries, Applied Economics, 37(2), 201-228.
Jiranyakul, K. (2014), Does Oil Price Uncertainty Transmit to the Thai Stock Market? MPRA Paper No. 56527. Available from: http://www.mpra.ub.uni-muenchen.de/56527.
Jones, M.C., Kaul, G. (1996), Oil and stock markets. The Journal of Finance, 51(2), 463-491.
Jouini, J. (2013), Return and volatility interaction between oil prices and stock markets in Saudi Arabia. Journal of Policy Modeling, 35(6), 1124-1144.
Kim, I.M., Loungani, P. (1992), The role of energy in real business cycle models. Journal of Monetary Economics, 29, 173-189.
Lardic, S., Mignon, V. (2006), Oil prices and economic activity: An asymmetric cointegration approach. Energy Economics, 34, 3910-3915.
LeBlanc, M., Chinn, D.M. (2004), Do high oil prices presage inflation? The evidence from G5 countries. Business Economics, 34, 38-48.
Lee, Y.H., Chiou, J.S. (2011), Oil sensitivity and its asymmetric impact on the stock market. Energy, 36, 168-174.
Lin, B., Wesseh, P.K.Jr., Appiah, M.O. (2014), Oil price fluctuation, volatility spillover and the Ghanaian equity market: Implication for portfolio management and hedging effectiveness. Energy Economics, 42, 172-182.
Malik, F., Ewing, B. (2009), Volatility transmission between oil prices and equity sector returns. International Review of Financial Analysis, 18(3), 95-100.
Masih, R., Peters, S., de Mello, L. (2011), Oil price volatility and stock price fluctuations in an emerging market: Evidence from South Korea. Energy Economics, 33(5), 975-986.
Olson, E., Vivian, A.J., Wohar, M.E. (2014), The relationship between energy and equity markets: Evidence from volatility impulse response functions. Energy Economics, 43, 297-305.
Ozturk, I., Feridun, M. (2010), Impact of oil prices on inflation in oil-importing countries: The case of Turkey. Journal of Economic Computation and Economic Cybernetics Studies and Research, 2, 201-208.
Pagan, A. (1984), Econometric issues in the analysis of regressions with generated regressors. International Economic Review, 25, 221-247.
Ross, S. (1989), Information and volatility: The no-arbitrage martingale approach to timing and resolution irrelevancy. Journal of Finance, 44, 1-17.
Sadorsky, P. (1999), Oil price shocks and stock market activity. Energy Economics, 21, 449-469.
Swanepoel, J.A. (2006), The impact of external shocks on South African inflation at different price stages. Journal for Studies in Economics and Econometrics, 30(1), 1-22.
Williams, B.J. (1938), The Theory of Investment Value. Cambridge: Harvard University Press.