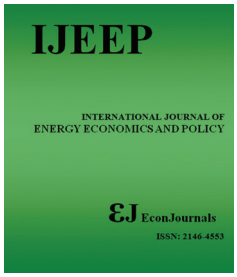

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Pricing in Oil Market and Using Probit Model for Analysis of Stock Market Effects

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ABSTRACT

The paper proposes the pricing in the oil market and the impact of oil prices on world stock indices. There is analysis of major trends in the oil market. We develop a model to predict the impact of oil prices on stock market indices for developed economies and Russia. This work propose a probit-model for forecasting capital markets trends using Brent pricing, three-month interest rates of the money market, consumer price index, GDP growth rate as a binary dependent variables. The trends of pricing in different stages of development of the oil market make the on stock indices, as developed countries and Russia. The practical significance of this work lies in the structuring of existing knowledge on the applicability of the probit-models in the context of the Russian economy. The paper also outlines the macroeconomic trends of supply and demand in the oil market and the characteristics of the modeling in the conditions of unstable economic situation in Russia. This work fills a gap in the use and implementation of the probit-models for the Russian economy. We make the forecast of supply and demand in the oil market in the next 1-3 years. We believe that oil prices are not likely to go up. The effect of oil prices on the stock markets is generally asymmetrical, except of the Russian and Canadian stock markets, because Russian and Canadian economies depend on oil export indeed.

Keywords: Oil Price Forecasting, Stock Market Returns, Probit-model
JEL Classifications: E37, F20, G15

1. INTRODUCTION

The relevance of studies on the influence of oil prices on the profitability of stock markets is not in doubt. Several previous studies have shown that sharp changes in oil prices have an impact, both on the macroeconomic variables and stock returns.

The main research hypothesis can be formulated as follows. The price of oil will not be subject to an upward trend in future years. And low oil prices will not contribute to the growth of the Russian stock market.

By 2014 there was a change of trends in the global oil market. Observed since 2002, a period of rising prices of mineral raw materials as a result of the global economic crisis of 2008-2009 has changed to a significant (more than a third) decline in oil prices (Figure 1). However, until 2013, and increase of the crisis phenomena in world economy, prices of oil grew to unprecedented size levels (average for 2012–104 $/barrel respectively). High prices in this period contributed to the increase in consumption efficiency in the world, and to increase the exploration and production (Figures 2 and 3) of crude oil (Driesprong et al., 2008; Du and He, 2015). In addition, they favored an increase in the use of alternative and renewable sources of energy.

2. LITERATURE REVIEW

Oil consumption in developed countries has been steadily decreasing since 2006. Oil consumption in other countries is growing, but not as fast as previously thought. In developing countries, primarily in China, increasing the efficiency of oil. But given the higher rate of economic growth this group of countries, the total consumption of oil is increasing (Engemann et al., 2011).

Changes in demand in the energy market determined the rate of extraction of fossil fuel in OPEC and outside of it.

Many researchers found a negative impact of oil prices on the real economy (Estrella, 1998; Hamilton, 1983). This sharp change in oil prices has a significant impact on stock returns in Canada, Japan, UK and USA (Hamilton, 1996).

In addition, we investigated the effect of oil prices on world indices and was found that positive shocks in oil prices negatively affect stock returns in all sectors except oil, gas and mining industries (Hamilton, 2011).

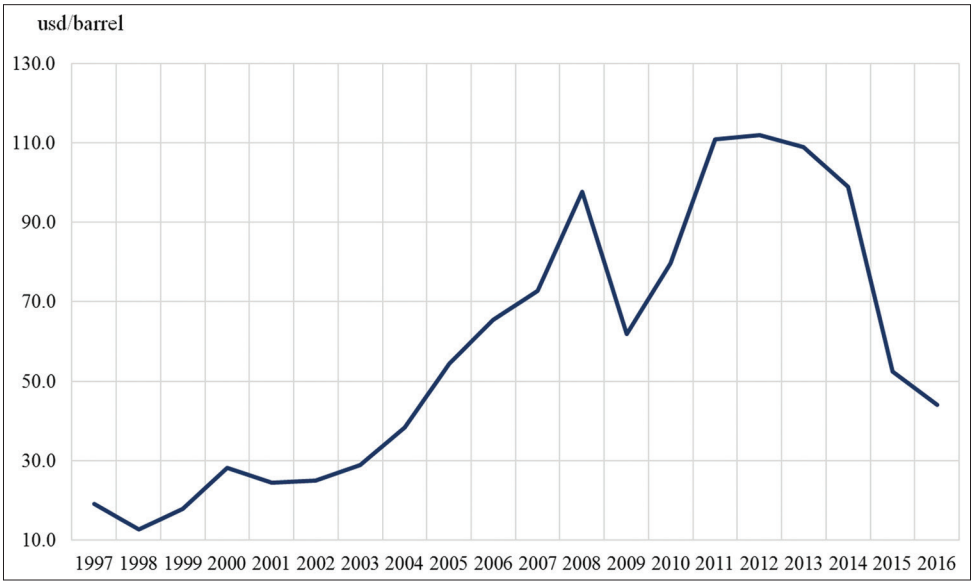
When using studies in a model long memory was discovered the effect of the lag dynamics of oil prices from daily returns of the stock market.

A few years ago we studied the impact of price shocks on the probability that the economy enters into a recession. However, the total predictability of returns and the predictive power of changes in oil prices varied significantly between markets (Mihajlov, 2012; Jiménez-Rodríguez, 2015).

3. METHODS

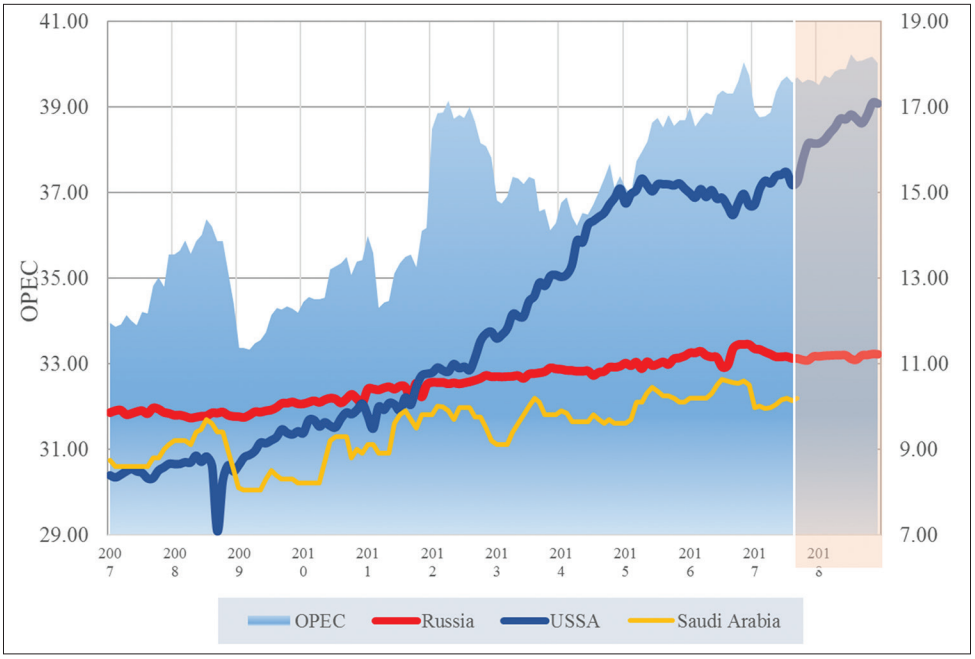
Binary choice models assume that there is some hidden (not observable) variable, depending on the values for which the observed variable takes the value 1 or 0. In our case, if the portfolio return is positive, then y is 1. If the portfolio return is negative, equal to 0.

Figure 1: Price dynamics of Brent oil in 1997–2016



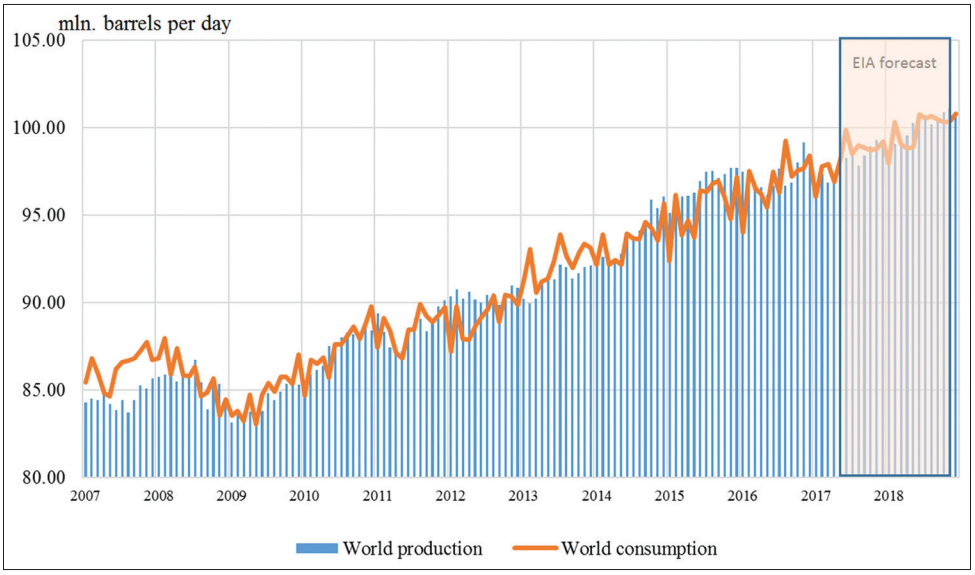
Source: Compiled according to the World Bank. Electronic resource http://www.worldbank.org/en/research/commodity-markets

Figure 2: Oil production of the world in the years 2007–2018, million barrels per day



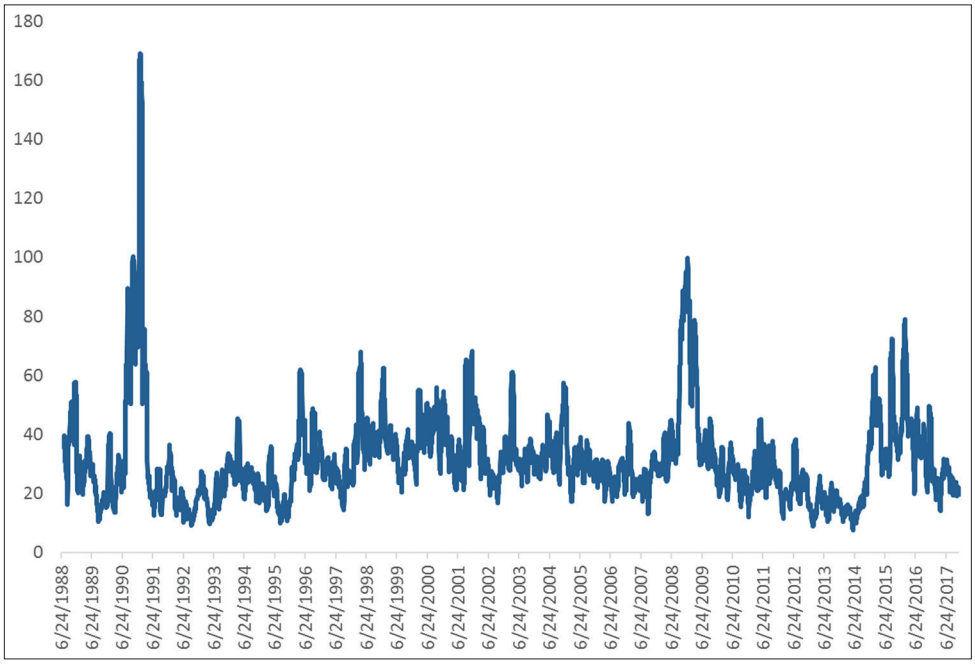
Source: Compiled from information EIA Short-term Outlook Electronic resource https://www.eia.gov/outlooks/steo

Figure 3: Production and consumption of oil in the world, 2007–2018



Source: Compiled from information EIA Short-term Outlook Electronic resource https://www.eia.gov/outlooks/steo

Figure 4: 23-days volatility of oil price Brent, 1988–2017



Source: Thomson Reuters

The probability of obtaining a certain monthly income in the stock market:

$$p_{jt} = \Phi(\pi_{jt}) \quad (1)$$

Where Φ is the normal distribution function, π_{jt} is a linear function of variables, where

$$\pi_{jt} = \omega_j + \chi'_{j,t-1}\beta_j \quad (2)$$

Where $\chi_{j,t-1}$ is predictable variables, ω_j is a constant for the market j, β_j is the beta factor for market j.

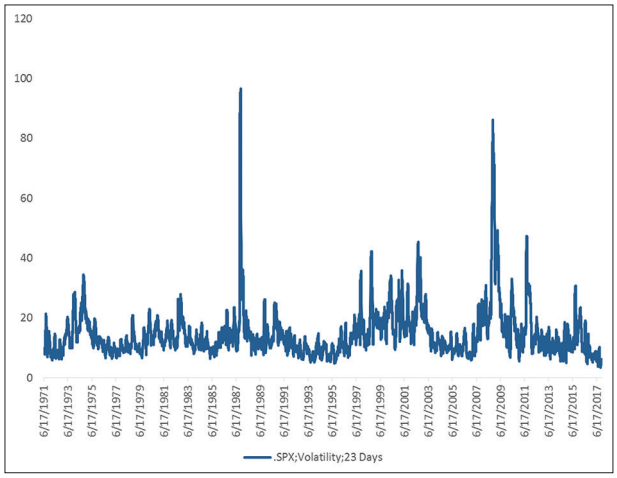
The level of predictability of stock returns, as a rule, quite low. A statistically significant improvement in likelihood compared to 0.5 means predictability, which can lead to economic benefits in trading strategies.

We use a dataset from Thomson Reuters (daily close prices of Brent and stock indices) with a sampling period 1997–2017. For 11 markets of the developed countries of the world and Russia, by analogy with study of Jones and Kaul (2010), which focus on the lag of stock returns of the US market in developed countries.

Binary dependent variables can be distinguished:

1. The real price of oil Brent (it is important to consider how

Figure 5: 23-days volatility of S&P 500, 1971–2017



Source: Thomson Reuters

the effect of positive dynamics of oil prices and the impact of negative dynamics),
2. Three-month interest rate on the money market,
3. The consumer price index,
4. The GDP growth rate.

Additionally, we studied the effect of growth rates on the money market, consumer price index, the acceleration of GDP growth, but all studied markets are not discovered linkages (Table 1).

In this section, we focus on the results of the selection probit regression, in particular, the additional predictive power of changes in oil prices.

The dividend yield is statistically significant only for the markets of the USA and the Netherlands (Kauppi and Saikkonen, 2008). In General, the level of predictability is rather modest.

The model shows a statistically significant coefficient in ten of the eleven markets. Thus, real growth in oil prices is a useful signal to change the dynamics of return of the stock market.

To explore the values of our model, we use the trading strategy of "buy and hold" on the stock markets. Decisions on portfolio gives a higher annual portfolio returns than a strategy without taking into account the dynamics of oil prices in six of the 12 markets.

Our study supports the conclusions about the negative impact of changes in oil prices on future stock returns. Previously it was found a nonlinear relationship between shocks in oil prices and the return on some stock markets.

For example, negative changes in oil prices have a statistically significant (at least at the 10% level) impact on the markets of Sweden, while positive developments have an impact on German and Dutch markets. For the Italian market important positive and negative changes (Kilian, 2009). In General, the effect of oil prices is asymmetric with the exception of the Russian and Canadian stock markets, where the coefficient is positive. This is because Russia and Canada are net exporters of oil (Kilian and Park, 2009).

4. RESULTS

The simulations confirm the strong dependence of oil and gas revenues of the Russian companies from asset prices in commodity markets. While ruble-denominated revenues from the extraction and export of oil products will negate the positive impact and will lead to total decline in revenues of companies.

In the recent years often discussed the dependence of the Russian economy from commodity exports. Given the characteristics of institutional development in Russia, the crisis may be an opportune moment for restructuring the economy towards increasing the share of innovative products and technologies in the structure of production and exports.

Thus, we extended the literature on the impact of oil prices on stock markets by examining the predictive power of changes in real oil prices on stock returns in the United States and ten other markets using the model of probit regression (Leung et al., 2000; Mikhailov, 2014).

Our findings indicate that real oil prices do provide useful signals of changes of stock returns for several stock markets.

To find volatility spillover effect we make monitoring of volatility of oil prices and S&P 500 (Figures 4 and 5).

The results show that the directional volatility spillover effect from oil price Brent to the stock market is typical for Russia. Investors in Russia stock market are very alert and react to the good news about the oil price. This effect is observed also for the financial markets of Canada too. Investors in emerging markets remember that the profit from the stock market may be reduced or lost quite because of the sharp devaluation of the national currency.

Investors in the U.S. stock market, by contrast, are not worried about oil prices. Volatility spillover effect is not crucial.

The volatility spillover effect from oil market to the stock market is much stronger for all the analyzed markets.

5. CONCLUSION

Thus, while little evidence was found symmetric effects from the increase and decrease in oil prices, but we are not able to draw General conclusions because the results differ substantially between markets (Mikhailov, 2012).

Thus, based on this analysis, the price of oil will not be subject to an upward trend in future years because of steadily growing supply in the oil market due to the introduction of new production technologies from the United States and other developed countries (Mork, 1989; Mork et al., 1994).

In the course of the analysis it is revealed that the Russian stock market is exposed to the positive impact of rising oil prices to a greater extent than the markets of Canada and Australia. And the current oil prices will not contribute to the growth of the Russian

Table 1: The power of influence of factors on dynamics of profitability of national stock market

Country of market	Fall in oil prices (Brent)	Fall in oil prices (Brent)	Fall in oil prices (Brent)	Fall in oil prices (Brent)	Fall in oil prices (Brent)
Australia	0.014	−0.010	−0.022		
Canada	0.012	0.010			0.075
France	0.011	−0.017			
Germany	0.013	−0.023			
Italy	0.015	−0.029			
Japan	0.011	−0.003			
Netherlands	0.013	−0.024			
Sweden	0.010	−0.011			
Switzerland	0.014	−0.021			
UK	0.011	−0.007		−0.084	
USA	0.012	−0.011			
Russia	0.040	0.030			

Source: Author calculations

stock market in the medium term that is consistent with previous studies (Nandha and Faff, 2008; Narayan and Sharma, 2011).

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