Assessing the effect of political statements on oil price volatility

Vladimir Nosov[1,2,6*], *Maria* Tindova[3], *Svetlana* Makar[4], *Lyudmila* Rudenko[5], *Galina* Zhdanova[6], *Natalya* Suray[1], and *Al'bina* Sulejmanova[7]

[1]Plekhanov Russian University of Economics, 117997 Moscow, Russia
[2]Academy of the Investigative Committee of the Russian Federation, 125080 Moscow, Russia
[3]Moscow University of Industry and Finance (Synergy University), 129090 Moscow, Russia
[4]Financial University under the Government of the Russian Federation, 125167 Moscow, Russia
[5]Moscow Witte University, 115432 Moscow, Russia
[6]K.G. Razumovsky Moscow State University of Technologies and Management, 109004 Moscow, Russia
[7]Samara State Transport University, 443066 Samara, Russia

Abstract. This research aims to show that statements made by politicians and public servants are a real tool for influencing the oil price. In the research, the authors used the technique for time series study that combines the consistent application of fractal analysis, regression analysis. According to the World Bank, the initial information base was created for daily Brent crude prices for the period from 29.04.2016 to 15.04.2020. A database for statements made by politicians and public servants via electronic media, information and telecommunication networks (including the Internet) was also created. Statements made by politicians and high-ranking military officers have a greater impact on the oil price than political, economic or social statements. All factors, except the one that characterizes politicians' and public servants' statements, affect the oil price, and it decreases by USD 0.02. The results suggest that if the oil price declines during a period of time, it will soon start to increase and this process will take about 18 days.

1 Introduction

For many years, budget revenues of many countries have been coming from oil extraction, allowing financing budget expenditures, achieving socio-economic stability and supporting political power. For instance, in Saudi Arabia, oil extraction accounts for 42% of GDP. Russian budget depends on oil prices. Thus, in 2020, due to a decrease in oil prices, budget deficit was about 0.9% GDP instead of expected surplus of 0.8%, the ruble weakened against the dollar, fueling inflation. The Russian Government had to postpone the ambitious Economy Investment program. Moreover, the state of the global oil market has a significant impact on sectors of global economy. Hence, studying oil price performance and pricing factors is vital.

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*Corresponding author: novla@list.ru

According to Bouri and Demirer [1], the world oil market is developing continuously, yet chaotically, therefore, there is a need to explore the causes of its fluctuations.

The movement of oil prices has been studied extensively by Burbridge and Harrison [2], Lee et al. [3], Huang et al. [4], Ferderer [5], Laopodis [6], Borenstein et al. [7], Backus and Crucini [8], Sadorsky [9], Gerogiorgis [10], Bielinskyi et al. [11], Monge and Cristóbal [12], etc.

Research by Elian, Kisswani [17], Muradov et al. [21] shows that the key factors affecting the oil price are the reduction of commercial crude oil inventories, weakening dollar, natural disasters, political and military tension in production countries and actions of oil speculators. However, the main factors of the oil market cannot affect the oil price, which changes monthly or even daily. Recent developments in the oil market only confirm the previous statement. A drop in crude oil demand caused by the coronavirus pandemic and oil-producing countries struggling to agree on production cuts resulted in the oil price crashing after the leaders of Saudi Arabia claimed they would increase output.

At that time, after President Donald Trump tweeted about his conversation on the oil price with the Crown Prince of Saudi Arabia Mohammed bin Salman, the oil price went up. Brent crude rose 23.36% to finish at $30.52 a barrel. There also were cases when Brent crude rose 40% to $35.99 per barrel. The above-mentioned statements are often used to manipulate the oil price, which poses a serious problem for oil market participants.

A lot of politicians, deputies and members of the parliament seem to be unaware of the seriousness of their statements or simply do not understand how their words influence the state of the stock market, exchange rates or the oil price. On the other hand, there is another group of people that knowingly makes certain political, economic and other statements to influence the trading in financial instruments, dollar exchange rate or the oil price and cause fluctuations that probably wouldn't take place without those statements.

Therefore, statements made via mass media including electronic media, information and telecommunication networks (including the Internet), are not only a way of competing and playing the market, due to the fact that many politicians and public servants own securities, stocks and shares in the authorized capitals of companies, but also massive leverage over the political and socio-economic situation in countries.

According to Pirrong [23], if we analyze the studies on this issue, most of them are devoted to various legal problems related to the deliberate spread of false information via mass media, i.e., market manipulation. In this paper, we do not determine the legal essence of those statements (besides, they do not always contain false information), but try to understand how they influence the oil price. Note that there are not enough studies devoted to mechanisms of statements and construction of econometric models to evaluate the impact of statements on econometric indicators

2 Materials and methods

In the research, we used the time series technique. Based on the data provided by the World Bank, the initial information base was created for daily prices of Brent crude from 29.04.2016 to 15.04.2020. We also created a database for statements made by politicians and public servants via electronic media, information and telecommunication networks (including the Internet). The oil price (Y) is an endogenous variable, and politicians' and public servants' statements (X) - an exogenous variable.

French-American mathematician Benoit B. Mandelbrot [13], the creator of fractal geometry, often is credited with introducing the notion of fractal analysis of equity market. However, the first person who applied fractal analysis into practice in researching financial and commodity markets was B. Williams [14]. Afterwards, this method has become widely applied in many countries. In Russia, the fractal theory became popular after its application

in developing financial market strategies by Almazov [15]. Fractal analysis of financial markets is based on dependence of future prices on their previous changes, which differs from the efficient market theory. Hence, the pricing process on markets is directly proportional to initial terms.

On the other hand, if trend pattern of one time series may be influenced by trend of another value, i.e., if there is a constant similar or not similar trend of time series, then there is a cointegrating relation between time series, known as Franchi and Paruolo cointegration. Thus, we can describe not just the long-run equilibrium, but the trend towards the long-run equilibrium as well.

In accordance with the purpose of the study and the research by Sottinen [26], we carried out a fractal analysis based on the relationship between future prices and their previous changes to determine the length of the forecast period. In order to conduct a fractal or R/S analysis to determine the time interval and politicians' and public servants' statements that influence the oil price, we need to converse the series and proceed with the determined price increment.

$$\Delta y_i = ln\ ln\ \left(\frac{y_{i+1}}{y_i}\right), \tag{1}$$

which can be considered as the impact of a certain statement. Next, we normalize and center the values:

$$\Delta Y_i = \frac{\Delta y_i - \bar{\Delta}}{\sqrt{var}}, \tag{2}$$

where $\bar{\Delta}$ is an average value for $\otimes yi$, var is the $\otimes yi$ dispersion. The next step is to calculate the average accumulated values:

$$M_t = \frac{1}{t+1}\sum_{u=0}^{t}\ \Delta Y_u, \tag{3}$$

at t=0, 1, ..., n-2, and the cumulative deviation:

$$X_t = \sum_{u=0}^{t}\ (\Delta Y_u - M_u). \tag{4}$$

The following step is to determine the cumulative deviation range, which is $R_t = (\ M_t) - (\ M_t)$, the standard deviation is:

$$S_t = \sqrt{\frac{\sum_{u=0}^{t}\ (\Delta Y_u - M_u)^2}{t+1}}, \tag{5}$$

and the standardized range of the cumulative deviation for n periods is:

$$R/S_t = \frac{R_t}{S_t}\qquad . \tag{6}$$

The obtained function should be compared to the Hurst exponent:

$$R/S = aN^H, \tag{7}$$

which shows the deviation of the process from the random walk H=0.5. If H differs from 0.5, the observations are independent. Each observation contains memories about all previous events, such dependence is called long-range and it theoretically persists, unlike

the short-range (or Markov) dependence. The impact of present on future can be expressed by a correlation ratio:

$$C = 2^{2H-1} - 1, \qquad (8)$$

where C is the measure of correlation, H is the Hurst exponent. The Hurst exponent can be determined by the following equation:

$$H = \frac{lnln\ (\ R/S)}{lnln\ (\ n/2)}. \qquad (9)$$

If H-0.5, the series is random and the events are uncorrelated, C=0 and present does not affect the future. If 0<H<0.5, such series is called ergodic, i.e., if the system was showing an increase over the previous period, then there will probably be a drop in the next period. The stability of behavior depends on how close H is to 0: the closer H is to 0, the closer C is to (-0.5), i.e., the negative correlation. If 0.5<H<1, the series is persistent, which means that it sustains the trend in the future. The closer H is to 1 (C to 1), the stronger the trend is expressed.

To characterize the impact of statements made by politicians and public servants of economically developed countries via mass media, we constructed a regression equation with a dummy variable [29, 30]:

$$\tilde{Y}_t = a + bt + c_1 x_1 + c_2 x_2 + c_3 x_3 + c_4 x_4, \qquad (10)$$

where *t* is time,

$$x_1 = \{1,\ economic\ 0,\ other\ ;$$
$$x_2 = \{1,\ political\ 0,\ other\ ; \qquad (11)$$
$$x_3 = \{1,\ social\ 0,\ other\ ;$$
$$x_4 = \{1,\ military\ 0,\ other\ .$$

3 Results

The fractal analysis is based on the dependence of future prices on previous change. The purpose of the analysis is to determine the length of the forecast period. The cumulative deviation range in our case is $R_t = 0{,}2665$, the standard deviation is $S_t = 1{,}002$ and the standardized range of the cumulative deviation for n periods is: $R/S_t = 0{,}2671$, the Hurst exponent H=0.1788 and the measure of correlation C=0.609.

Since 0<H<0.5, the series is ergodic. In other words, the result indicates that, firstly, if the oil price is decreasing continuously, then soon it will start to rise and this process will take about 18 days.

Secondly, since the Hurst exponent did not reach 0.5, we cannot discard the fact that the oil price is influenced by previous statements made by politicians and public servants. We believe that this can be explained by the data considered in the x variable (most statements were related to sanctions imposed on Russia, Iran and China).

To model regression dependence between indicators, we use the regression equation. The results are presented in Table 1.

Table 1. Parameters of the regression equation, impact of factors on the oil price correct for the time factor.

Indicators	Regression equation coefficient	Standard error of the regression coefficient	Student's *t*-test	*p*-significance level
The intercept	78.309	0.950	82.440	0.0000
t	-0.022	0.001	-21.751	0.0000
x_1	8.366	2.140	3.910	0.0001
x_2	14.114	2.783	5.071	0.0000
x_3	4.786	2.786	1.718	0.0860
x_4	18.898	4.033	4.686	0.0000

Calculated by authors based on the author data base using the STATISTICA package. $R^2=0.282$; $F(0.05;5;1533)=120.26$; $p=0.0000$.

The F-test exceeds the table value, which indicates the significance of the equation. All coefficients of the equation are statistically significant at the 10% significance level.

Politicians' and public servants' statements result in the oil price increase. Economic statements lead to an increase of USD 8.34, political – USD 14.11, social – USD 4.79, military – USD 18.90. The model parameter $t=-0.022$ indicates that all factors, except the information factor, affect the oil price and it decreases by 0.022 USD.

4 Discussion

The decrease in the oil price during the period under review is of technical nature due to the futures mechanism and lack of storage places. The feature of futures is that the trader who cannot close the contract on time is expected to make an actual delivery of crude oil. Oil is commonly delivered to the Cushing terminal in Oklahoma. However, as demand for oil sinks, the storage capacity is getting closer to its upper limits due to the economic slump and coronavirus pandemic. To avoid the physical delivery of oil, the traders try to sell oil by the end of the trading day and send prices down. Hence, prices crash at the moment of contract execution.

The main condition for the recovery of the oil market is a gradual removal of restrictions and quarantine. Only after that, the demand and oil prices could recover.

According to Carmalt [20], if we consider the long-term oil price change, we can see that the decrease in the oil price is due to the qualitative transformation in the world economy related to changes in consumer preferences, regulators' and investors' policies influenced by the moral and ethical transition to low-carbon energy systems and sustainable development. In their research, Renne and Fields [19] note that the growth of decentralization of energy consumption along with digital technologies increases the interest of consumers in stand-alone power systems, and the politics of decarbonization of energy in its turn increases the interest in achieving self-supply based on nonhydrocarbon energy resources. According to Zhichkin [28], the new generation of consumers, so-called "millennials", are strongly inclined to pursue the goal of rejection of hydrocarbons and goods produced using them. Greta Thunberg is an outstanding representative of this generation. At the end of 2016, one of the world's largest IT corporations – Google – announced that its data centres and offices would be powered entirely by renewable energy from 2017 (URL: https://www.google.ru/about/values-in-action/renewable). Companies such as Facebook, Amazon, Apple and Microsoft have also entered long-term renewable energy agreements.

Therefore, according to Yoshino and Taghizadeh-Hesary [22], the decline in demand for oil is due to policies of governments of the world's leading countries aimed at the restriction of climate policy and regulation of the hydrocarbons market. This results in the decline in demand for oil and the development of electrification and low-carbon energy technologies, especially in the sphere of renewable energy sources.

Oil prices plummeting to the level of the reporting period is very unprofitable for the US slate industry. Median break-even prices for slate producers in the USA were 45-47 dollars/barrel. Therefore, at that price, there is no incentive for the US slate industry to develop, which can affect the increase in the oil price, as well as political and militaristic statements made by US politicians. Moreover, the President of the USA Donald Trump, in addition to his tweets, with support from oil companies, started to eliminate energy regulations adopted during the Obama years aimed at the development of "green" energy and climate policy.

5 Conclusion

To sum up, we can safely assume that the global economy will gradually phase out oil consumption. The prospects for the future developments of the global oil market are linked to energy and climate policies of developed countries, demographic changes, technological development and the global economic upturn. The political environment has a great influence on pricing in the global oil market as oil production plays an important role in many countries' economies. Therefore, the oil price is always a primary focus for political leaders.

The research provides new analytic solutions given the analysis of oil market prices, based on the synthesis of the fractal analysis and regression analysis. Statements made by politicians and high-ranking military officers have a greater impact on the oil price than political, economic or social statements. Moreover, all factors, except the one that characterizes politicians' and public servants' statements, affect the oil price, and it decreases by USD 0.02. The result shows that the oil price declines during a period of time, however, in 18 days, it starts to rise.

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