Regional structure of oil export from Russia with differentiation by directions of supplies

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Abstract. In the article, the authors analyzed the stable trends in the development of export oil supplies from Russia. The purpose of this article is a short-term forecast of the export of Russian oil with differentiations in the areas of supply. Based on the trend modeling until 2025, a forecast of the total volume of oil exports was made with differentiation in the directions of the supply of liquid hydrocarbons. For each direction of supply, forecast confidence intervals are defined within the limits of which Russian oil exports may be found. The authors showed that export supplies of oil to the energy market of the Asia-Pacific region will increase annually and exports to the European market will decline. The article shows that in the structure of oil supplies from Russia, the main growth is accounted for by foreign countries. In 2018, oil supplies in this direction amounted to 239.6 million tons. At the same time, the share of oil supplies to the European market is annually reduced, reaching only 64% in 2018 (80% in 2011), which is associated with the redirection of oil exports to the Asia-Pacific oil market, primarily to China. In this region, the demand for Russian oil is provided by its higher quality and corresponding chemical composition.

1. Introduction

The most authoritative and well-known organizations involved in analyzing and forecasting international oil supplies are the International Energy Agency (IEA), the US Department of Energy (EIA), the Organization of Petroleum Exporting Countries (OPEC), which publish their vision for the long-term development of energy markets. Forecasts of global energy development are also published by the largest transnational energy companies - British Petroleum, Exxon Mobil, Shell, etc.

The forecasts of different organizations often have their own specifics and can significantly differ in the presented estimates. In most cases, the North American agencies give rather optimistic forecasts regarding the prospects for the transportation of hydrocarbons. European agencies, by contrast, provide some of the most modest estimates of global energy supplies. The Organization of Petroleum Exporting Countries is extremely optimistic about the prospects for the development of the oil market and the role of OPEC countries in this process.

Institute of Oil and Gas Geology and Geophysics, Institute of Economics and Industrial Production Organization, Institute of Energy Research, Institute of Economic Forecasting, Institute of Energy Systems L.A. Melentyeva et al. are exploring models for predicting oil exports in Russia.

In the models of energy agencies, scientific organizations and oil and gas companies, the forecast of hydrocarbon exports is considered as one of the block in the structure of the forecast model of the world energy market. At present, there are few works on forecasting the export of energy resources
As models of oil export-import forecast, ARIMA, fractional least-squares regression, computable general equilibrium model, Bayesian linear regression method and Monte-Carlo method in Markov chains are used

The purpose of this article is a short-term forecast of the export of Russian oil with differentiations in the areas of supply.

To achieve this goal, the following tasks were formulated: (1) to identify trends and explore the current state of export supplies of Russian oil in different directions of supply; (2) to analyze existing approaches to forecasting oil exports; (3) on the basis of trend models and confidence intervals, give a forecast of the development of export oil supplies from Russia.

2. Methods of research

Stage 1. Choosing the best trend to describe the retrospective dynamics of oil exports from Russia.

In the work for the analysis of time series was used analytical alignment. The following trend models were considered: linear, logarithmic, exponential, and power. Exponential (1) and power (2) were reduced to linear using logarithms:

\[\ln y = \ln \beta + \gamma \cdot t + \varepsilon,\]  
\[\ln y = \ln \beta + \gamma \cdot \ln t + \varepsilon,\]

\(y\) – the level of energy intensity; \(\beta, \gamma\) – the parameters of the model.

Based on the conducted econometric analysis, the authors showed that the dynamics of the export of Russian oil in different areas can best be described by a power-law model.

Based on the analyzed time series, a forecast was made of changes in the volume of oil exports from Russia in the short term until 2025.

Stage 2. Building confidence intervals for trend models for forecasting Russian oil exports.

A significant indicator characterizing the quality of the performed forecast estimates is the divergence of the limits of the confidence interval from the trend value. The confidence interval for a trend in general form is determined by the formula [5]:

\[\tilde{y}_t \pm t_\alpha s_y\]  
\(\tilde{y}_t\) – the calculated value of \(y_t\); \(t_\alpha\) – the value of Student’s t-statistics; \(s_y\) – rms trend error.

At time \(t = T + L\), a confidence interval is determined for a trend extended by \(L\) units of time. The ratio can be rewritten as [6]:

\[\tilde{y}_t \pm t_\alpha s_y K^*\]  

As one of the indicators characterizing the accuracy and adequacy of forecasts, can be the ratio of the trend value and the upper value of the confidence interval [7]:

\[D = \left(\frac{u_{i,T+L}}{y_{i,T+L}} - 1\right) \times 100\]

\(u_{i,T+L}\) – boundary of the level of oil exports for \(i\) direction of supply at the end of the forecast \(L\); \(y_{i,T+L}\) – trend model for \(i\) direction at the final moment of the forecast \(L\).

The following sources became an information base for processing and using statistical information: the Federal State Statistics Service, the Federal Tax Service, the Ministry of Economic Development of Russia, the State Balance of Russia, reference, statistical information and publications on the results of the development of the fuel and energy complex of Russia.

In 2018, oil exports decreased by 0.2% and amounted to 276.2 million tons, which is mainly due to the reduction in oil supplies to the European market from 164.2 million tons to 153.3 million tons, as well as a decrease in transit from 19.6 million tons to 18.5 million tons. Russian oil exports to Europe
declined due to execution of a deal with OPEC countries to reduce production, redirect oil exports from west to east, as well as due to the growth of domestic oil refining.

At the same time, in 2018 Russian oil supplies to the Asia-Pacific market increased, due to the expansion of the branch pipe from the ESPO pipeline (Eastern Siberia – Pacific Ocean) to China – Skvorodino – Mokhe, as well as an increase in deliveries through Kazakhstan (Priirtyshk – Atasu – Alashankou). The main trading partner for the east is China. Thus, in 2018, oil exports to China increased by 20.2% (table 1).

Table 1. Supplies of Russian and transit oil by destinations and sources of supply in 2011-2018, mln. tons.

| Delivery direction | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|--------------------|------|------|------|------|------|------|------|------|
| Russian oil exports| 242.1| 239.7| 235.0| 221.3| 241.8| 254.2| 257.0| 257.7|
| Far abroad         | 212.2| 211.5| 206.7| 199.1| 220.2| 236.1| 239.0| 239.6|
| Asia Pacific       | 42.5 | 44.0 | 49.5 | 61.4 | 68.8 | 72.1 | 74.8 | 86.3 |
| Atlantic direction | 169.7| 167.5| 157.2| 137.7| 151.4| 164.0| 164.2| 153.3|
| Near Abroad        | 29.9 | 28.2 | 28.3 | 22.2 | 21.6 | 18.1 | 18.0 | 18.0 |
| Transit            | 22.6 | 22.8 | 21.6 | 18.9 | 18.0 | 19.9 | 19.6 | 18.5 |
| TOTAL              | 264.7| 262.5| 256.6| 240.2| 259.8| 274.1| 276.7| 276.2|

Source: The results of the production activities of the sectors of the fuel and energy complex of Russia, Fuel and Energy Complex of Russia. No. 1. 2011-2018; aggregate indicators of energy production in the Russian Federation, Info TEK. No. 1. 2011-2018.

The Asia-Pacific market, primarily China, is the main strategic direction for increasing oil exports from Russia [8-9]. The volume of oil supplies to the relevant market is largely determined by the development of transport infrastructure. The supply of oil in the European direction is of a regulatory nature. All additional volumes associated with possible production growth, which are not sold on the Asian-Pacific area market, are sent to Europe.

Oil is transported to Russia through the Transneft’ pipeline system – a natural monopolist in the field of oil transportation through pipelines. In 2018, the total volume of oil transportation through the Transneft’ system amounted to 480.4 million tons (in 2017 – 477 million tons), including to Russian refineries – 249.9 million tons (in 2017 – 244 million tons), for export – 230.4 million tons (in 2017 – 233 million tons). All indicators recorded a decline. Transneft’ will compensate for the annual reduction in the volume of oil exports by increasing the transfer of oil products to foreign markets.

The modern system of transport of oil and oil products in Russia is an important part of the global energy supply system and factors for the sustainable development of the oil and gas industry and the country’s economy as a whole.

Transformation of world energy markets and state fiscal policy sets new challenges for the Russian transport system in the medium and long term.

Solving these problems will give a significant multiplicative effect on all sectors of the economy and will allow for reliable planning of state revenues, foreign borrowing and covering them, creating international reserves, fulfilling international obligations and implementing sustainable social policies.

3. Results and discussion
Based on the analysis of statistical indicators of various trend models (linear, logarithmic, exponential, and energy), the authors obtained that the change in the volume of oil exports from Russia in different supply directions throughout the entire period is well approximated by power dependence (figure 1).

With selected trends in changes in Russian oil exports, a forecast of oil supplies from Russia until 2025 was built based on the methodology for determining interval estimates.
Figure 1. Confidence intervals for trends in the export of Russian oil in different directions of supply until 2025.

For all directions of supply, the width of the confidence interval is less than 25%, which is a good indicator characterizing a qualitatively selected model and an adequate predicted trend value (table 2).

Thus, based on the forecast, the total export volume of Russian oil by 2025 will amount to more than 280 million tons of oil. At the same time, about 100 million tons of oil will be supplied to the Asia-Pacific market, while about 150 million tons to the European market.

Table 2. The main parameters characterizing the quality of forecasts for the export of Russian oil in the short term.

| Regions             | 2025 Upper line | Trend | 2025 Bottom line | Spacing width |
|---------------------|-----------------|-------|------------------|---------------|
| Asian-Pacific direction | 121             | 99    | 77               | 22.3          |
| Atlantic direction  | 181             | 150   | 119              | 20.7          |
| Near Abroad         | 19.2            | 15.2  | 11.1             | 26.7          |
| Transit             | 21.6            | 17.4  | 13.3             | 23.7          |
| TOTAL               | 342.8           | 281.5 | 220.3            | 93.4          |

* – confidence level – 95 %

Source: calculated by the authors
The drop in oil supplies to the European market is due to an increase in domestic consumption of liquid hydrocarbons in the domestic market, imposed by the United States and Europe by sanctions against Russia, and sacred with an increase in the sulfur content in Urals oil, which is transported via the Druzhba pipeline.

The growth of oil supplies to the Asia-Pacific market is associated with the expansion of the capacity of the ESPO pipeline.

4. Conclusion
The article shows that in the structure of oil supplies from Russia, the main growth is accounted for by foreign countries. In 2018, oil supplies in this direction amounted to 239.6 million tons. At the same time, the share of oil supplies to the European market is annually reduced, reaching only 64% in 2018 (80% in 2011), which is associated with the redirection of oil exports to the Asia-Pacific oil market, primarily to China. In this region, the demand for Russian oil is provided by its higher quality and corresponding chemical composition.

Thus, based on the forecasts, the authors showed that export supplies of oil to the APR market by 2025 could grow to 100 million tons (86 million tons in 2018), while the total export volume of Russian oil could grow to 280 million tons.

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