Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Economics

Master's Thesis

Impact of COVID-19 on the Oil and Gas Industry in Russia in 2019 - 2021

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

Kristina Buzyka

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Thesis title

Impact of COVID-19 on the Oil and Gas industry in Russia in 2019 – 2021

Objectives of thesis

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The main aim of this Diploma Thesis is to examine the impact and changes in the oil and gas industry in Russia during COVID-19 and compare the results with the time before the breakout of coronavirus, in case there are any changes. The indicators that are going to be used during the research are crude oil and natural gas output and the change of the price during this period of time. Also, the impact on the employees of this industry will be examined.

Methodology

The information in this M.Sc. thesis will be collected from relevant and published scientific articles, periodicals, and papers in English and a particular amount of analysis that can be learned through the collection of data.

For the research will be used internet databases are Web of Science, Science Direct, Google Scholar…etc. In addition, relevant and published information from the Russian and UN organizations will be selected and treated. Information used in the research will be based on the latest news, periodicals, official statistical data, scientific researcher, and papers. Data collected will provide a clear understanding of what is going on in the oil and gas market in Russia. As well, the books related to the topic will be studied. The thesis will be relying on previously collected data and information that will come from the own experience of the author from the region from where the author is originally from.

The proposed extent of the thesis

50 -60 pages

Keywords

COVID-19, crude oil, natural gas, economy, crisis, Russia

Recommended information sources

Department of International and Regional Cooperation of the Russian Federation. (2020). Natural resources management during COVID-19.

Mitrova T., Grushevenko E. (2020). Coronacrisis: the impact of COVID-19 on FES in the world and Russia. Energy center – SKOLKOVO.

The Challenges of the Russia's Energy Policy during the Covid-19 Crisis Prisecaru, Petre PhD, Drăgoi, Andreea-Emanuela PhD. Global Economic Observer ; 8(2):94-102, 2020. Artigo em Inglês | ProQuest Central | ID: covidwho-1235581

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Declaration

I declare that I have worked on my master's thesis titled " Impact of COVID-19 on the Oil and Gas industry in Russia in 2019 – 2021" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the master's thesis, I declare that the thesis does not break any copyrights.

In Prague on 31.03.2022

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Bc. Kristina Buzyka

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Impact of COVID-19 on the Oil and Gas industry in Russia in 2019 – 2021

Abstract

The Oil and Gas Industry is one of the crucial pillars in Russian economy. The industry contributes a great part of Gross Domestic Product. Within past twenty years Russia has faced a lot of internal as well as global recessions which influenced country's economy and all the industries. Starting from the crisis in 1998 the Oil and Gas industry has been developing with its' ups-and-downs in production, new fields have been opened and reservoir engineering has never been stopped. During last years of a new global Covid – 19 pandemic (2019 – 2021) the world could see a decrease in production. Speaking globally Coronavirus is not the only reason of industry's recession, but also the political tensions in the world. Covid – 19 pandemic increased unemployment rate which triggered further concerns.

Obviously, the Oil and Gas industry will continue its' development. According to the previous experience we may predict its' performance in the future. Thus, Russia also has to cooperate on the global level in order to decrease further recessions.

Keywords: The oil and gas industry, Russia, Economy, COVID – 19, Crude Oil, Natural gas, GDP.

Dopad COVID-19 na ropný a plynárenský průmysl v Rusku v letech 2019 – 2021

Abstrakt

Ropný a plynárenský průmysl je jedním z klíčových pilířů ruské ekonomiky. Průmysl přispívá velkou částí hrubého domácího produktu. V posledních dvaceti letech Rusko čelilo mnoha vnitřním i globálním recesím, které ovlivnily ekonomiku země a všechna průmyslová odvětví. Počínaje krizí v roce 1998 se ropný a plynárenský průmysl rozvíjel se vzestupy a pády ve výrobě, byla otevřena nová pole a inženýrství zásobníků nebylo nikdy zastaveno. Během posledních let nové globální pandemie Covid – 19 (2019 – 2021) mohl svět zaznamenat pokles produkce. Globálně koronavirus není jediným důvodem recese průmyslu, ale také politického napětí ve světě. Pandemie Covid – 19 zvýšila míru nezaměstnanosti, což vyvolalo další obavy.

Je zřejmé, že ropný a plynárenský průmysl bude pokračovat ve svém rozvoji. Podle dosavadních zkušeností můžeme předvídat jeho výkon do budoucna. Rusko musí spolupracovat i na globální úrovni, aby snížilo další recese.

Klíčová slova: Ropný a plynárenský průmysl, Rusko, Ekonomika, COVID – 19, Ropa, Zemní plyn, HDP

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List of abbreviations

WHO – World Health Organization

GDP – Gross Domestic Product

USA – United States of America

UAE – United Arab States

USSR – Union of Soviet Socialist Republics

OPEC – Organization of the Petroleum Exporting Countries

VIOC system – Vertically Integrated Oil Company

PJSC – Public Joint Stock Company

LNG – Liquefied Natural Gas

TORC – Tyumen Oil Research Center

STC – Science & Technology Center

ABS plastic – Acrylonitrile butadiene styrene

MTBE – Methyl tert-butyl ether

LPG – Liquefied Petroleum Gas

NGL – Natural Gas Liquids

ACF – Autocorrelation functions

PACF – Partial autocorrelation functions

CO2 – Carbon Dioxide

IEA – International Energy Agency

GW - Gigawatt

1. Introduction

The relevance of the study is determined by the fact that the world economy is currently facing a serious challenge - the coronavirus pandemic, the negative consequences of which are expressed in a decrease in trade, production and investment activity of business units and business structures. This, in turn, worsens the conditions of corporate governance and leads to a decrease in the level of economic security and financial stability of business units.

These processes are reflected, in particular, in the development of the energy and energy complex of Russia, which is an important element of financial, economic and socio-political development, a system-forming and budget-forming factor in international relations, strengthens the position of the Russian Federation in the world energy markets, develops the national economy, providing a quarter of the gross domestic product directly per capita, more fifty percent of exports and about forty percent of federal budget revenues. The object of the study is the oil and gas industry of Russia.

2. Objectives and Methodology

2.1 Objectives

The main aim of this Diploma Thesis is to examine the impact and changes in the oil and gas industry in Russia during COVID-19 and compare the results with the time before the breakout of coronavirus, in case there are any changes. The indicators that are going to be used during the research are crude oil and natural gas output and the change of the price during this period of time. Also, the impact on the employees of this industry will be examined.

The subject of the study is the functioning of the Russian oil and gas industry in the context of the Covid-19 pandemic.

The aim of the work is to analyze the functioning of the Russian oil and gas industry in the context of the Covid-19 pandemic.

The purpose of the work identified a number of tasks, including:

- To study the impact of the Covid-19 pandemic on the economy of Russia and the world;
- Consider the structure of the oil and gas industry in Russia;
- To identify the impact of the Covid-19 pandemic on the oil and gas industry;
- Develop a statistical model of the oil and gas industry;
- To identify the problems of development of the Russian oil and gas industry in the context of Covid-19;
- Identify prospects for the development of the Russian oil and gas industry in the context of Covid-19.

2.2 Methodology

The methodological basis of the study are such methods as: the method of analysis, synthesis, generalization, analogies.

The theoretical and practical significance of the work lies in the possibility of using the results of the study in the further development of ways for the development of the oil and gas industry of the Russian Federation.

Work structure. The work includes three chapters, introduction, conclusion, list of references.

3. Literature review

3.1 Theoretical aspects of the Oil and Gas industry during the Covid-19 pandemic

3.1.1 The impact of the Covid-19 pandemic on the economy of Russia and the world

In the history of mankind, more than eleven global pandemics of various infectious diseases have destroyed the economy, politics and society and caused terrible damage. Known epidemics include Antonov plague, Justinian plague, black death, coccolithiasis, cholera, third plague, Spanish flu, Asian and Hong Kong flu, Ebola, HIV infection and Covid-19.

According to the website of the World Health Organization, as of November 12, 2020, 51.848.261 people were infected in the world, and 1.282.868 people died. The largest number of cases of coronavirus infection has been registered in the United States of America - more than ten million cases. The highest rates were recorded in Brazil (over five million) and Russia (over one million). The number of coronavirus deaths was highest in the US at 238.573 and Brazil at 162.829 as of November 12, 2020. Russia at 32.032, fewer than Italy, but one and a half to three times more than in Germany, China and Japan. Four thousand seven hundred and forty-nine deaths have been recorded in China. Global epidemiological trends are alarming. The spread is so great that health workers are not able to serve all those in need, and millions of people do not have access to basic health services.

Governments around the world today face two global challenges at once: Saving lives and protecting the economy.

In many countries, the pandemic has led to a slowdown in GDP growth. For example, in Brazil the fall was 11.4%, in Japan - 9.9%, in Singapore - 7%, and in Germany, the USA, Russia and Italy - three to four percent. Compared to these countries, only China and the UAE show GDP growth of 4.9% and 2.6%, respectively (Table 1). In many countries, GDP growth rates have slowed down as the production of most goods and services has

declined due to the closure of many economic units, teleworking and the self-isolation of many population groups (students, pensioners, schoolchildren). The restaurant, hotel, tourism, educational, cultural and sports sectors have been hit hard. [24]

Faced with the risk of rising unemployment, government agencies collectively invested more than ten trillion US dollars in their economies to ensure the livelihoods of the population.

The pandemic has led to factory closures in high-burden countries, an increase in demand for consumer goods, and a sharp drop in demand for non-food items.

By 2020, industrial production will decline in many countries of the world. In the USA it has already reached 7.3%, in Japan - 9%, in Germany - 7.3%, in Italy - 5.1%. At the same time, Singapore, China and Brazil are showing growth.

Given the fact that Russia's GDP fell by only 3.6%, while industrial production fell by five percent, we can conclude that this figure was achieved due to an increase in the level of prices for goods and services. Thus, in Russia, the pandemic led to a reduction in production, a decrease in the growth rate of gross domestic product per capita and an increase in prices for goods and services.

One of the key indicators for assessing the state of the country's economy, which allows one to judge its stability and has an impact on the state of GDP, is the index of business activity in the manufacturing sector PMI. This index is calculated based on statistical data, including the positions of production volume, purchases, stock levels, the number of new orders and employment in the manufacturing sector. Evaluation of the PMI index allows you to determine the prospect of the course of economic cycles in the country in the coming future periods. The value of the indicator reflects the level of economic stability in the country and provides an opportunity to predict the future value of GDP growth rates. If PMI < 50%, then we can judge the decrease in the positions of the national currency, which entail a slowdown in GDP growth.

When the value of the industrial activity index exceeds fifty percent, then the state manages to maintain the overall stability of the economy. Countries that achieve a PMI value of fifty percent or more have the right to believe that the maximum increase in economic cycles will be recorded after seven months. It is also necessary to highlight the fact that the states in which the index in question is less than thirty-five percent are located in a position of economic stagnation. This indicates noticeable problems in the economic sector, which is directly reflected in the course of the nat. currencies.

Table 1: Economic indicators Russia Germany Italy USA China Japan Singapore UAE Brazil

Economic indicators	Russia	Germany	Italy	USA	China	Japan	Singapore	UAE	Brazil
GDP growth rate (Q1 2020), in %	-3,6	-4,3	-4,7	-2,9	4,9	-9,9	-7,0	2,6	-11,4
GDP per capita, thousand dollars	12,0	47,6	35,6	55,8	8,3	41,4	97,3	41,4	11,1
Growth in industrial production, in % to the previous year	-5,0	-7,3	-5,1	-7,3	6,9	-9,0	24,2	N/A	3,4
Manufacturing PMI	48,9	58,0	53,2	53,3	53,0	48,0	50,3	51,0	64,9
Debt to GDP,%	12,2	59,8	134,8	106,9	50,5	237,0	126,0	18,6	75,8
The ease of doing business	28,0	22,0	58,0	6,0	31,0	29,0	2,0	16,0	124,0
USD/national currency rate	77,4	0,8	0,8	1,0	6,7	103,5	1,4	3,7	5,6
Unemployment rate, %	6,3	4,4	9,7	7,9	5,4	3,0	2,8	2,6	13,8
Inflation rate, %	3,7	-0,2	-0,6	1,4	1,7	0,0	0,0	-2,6	3,1
Wage growth, %	0,1	-4,7	0,5	-0,5	N/A	-1,3	N/A	N/A	N/A
Interest rate of the Central Bank, %	4,3	0,0	0,0	0,3	3,9	-0,1	0,1	1,5	2,0
Interest rate on deposits,%	3,2	N/A	N/A	N/A	0,4	-0,2	0,2	N/A	1,1
Cases of coronavirus, thousand people	1497	418	485	8528	92	96	58	122	5354
Coronavirus deaths, thousand people	25,8	10,0	37,0	223,2	4,6	1,7	0,0	0,5	156,5

Source:

According to the latest information, in America, the index of manufacturing activity is fifty-three percent, in Germany - fifty-eight percent, China, Brazil - fifty-three; sixty-four percent respectively. The low level of PMI can be observed in the Russian Federation - 48.9 percent, Japan - 48 percent. This aspect can be explained by the depreciation of the nat. currencies, which is caused by a significant degree of social financing. support for citizens within the framework of the specifics of covid, which was carried out mainly due to an increase in public debt within the state.

This debt for a large number of countries in 1 time in history exceeded one hundred percent - the total level of GDP, since the social. costs have increased markedly, and tax revenues from the population have decreased. For example, government debt of America as of October 2020 was one hundred and seven percent of the Gross Domestic Product, in Japan - 237 percent, in Singapore and Italy - 126 and 135 percent, respectively. [17]

Within the framework of the current market situation, one can observe high volatility in exchange rates. The exchange rates of a large number of currencies are linked to a significant extent with the dynamics of oil prices. Due to the shutdown of organizations, a decrease in the business activity of citizens in China, and later on a global scale, the demand for oil products has noticeably decreased. This leads to a decline in the price of the national state currencies of oil exporters.

The coronavirus has had a significant impact on the speed of improvement of national labor markets. In 2020, according to the International Labor Organization, there was an indicator of four hundred million unemployed (more than ten percent of the total population). The increase in unemployment was due to the impact of the coronavirus epidemic. In a large number of states, the unemployment rate exceeded the upper limit of the standard of six percent. In America, the figure was 7.9 percent, in Italy - more than 9 percent, in Brazil - 13.8 percent. In the Russian Federation, this figure was 6.3 percent by autumn 2020, which also exceeds the allowable limit.

Unemployment in the Russian Federation is not so significant in comparison with other states. The labor market in the country has adapted to the crisis not by reducing staff, but by reducing the level of salaries, as well as working hours. The increase in wages this year is 0.1 percent. This is many times less than in previous crisis periods. In a special way, wages decreased in the hotel, restaurant business, cultural, sports, and air transportation. However, salaries in the public sector continued to grow. The increased share of the public sector in the economy of the Russian Federation can be called a prerequisite for the fact that the incomes of citizens decreased more moderately in comparison with other states.

The increase in the unemployment rate indicator indicates a decrease in the growth rate of the financial market. This fact leads to the decline of the national currencies. For the country, this provides for various outcomes: a decrease in budget revenues, an increase in social security. the cost of benefits, the resulting decrease in the standard of living of citizens. For citizens, the results of unemployment are manifested in general tension, the likelihood of health problems, a phased loss of qualifications, professional suitability, problems with psychology, a decrease in the amount of savings, the expediency of looking for a new job, etc. earnings. [39]

In the current period, an increased degree of inflation can be called the optimal response to the crisis. However, a large number of states wish to maintain a low degree of inflation through the available tools of the Central Banks, which are aimed at the possibility of

slowing down the impact of inflation, despite the fact that this can lead to a decrease in economic growth rates.

Many states want to keep the interest rate of the Central Banks at a minimum level.

In 2020, the Russian Federation is experiencing the emergence of the 3rd world crisis, which is associated with the coronavirus. The 1st crisis was observed in 1998. It was the result of an unstable situation in the Russian Federation. The 2nd crisis began in 2008 due to the global financial decline. The 3rd crisis that is observed in the current period is interconnected with the results of the worldwide epidemic for the economic sector.

The crisis period (by analogy with past crises) is accompanied by a decline in oil prices, a rapid increase in the US dollar and euro.

It is possible to analyze the change in the characteristics of the economy of the Russian Federation during the period of these crises. The characteristics for evaluation should be presented in the second table.

The growth rates of the Gross Domestic Product within the framework of the 3 crises under consideration demonstrate that the most severe crisis for the economy of the Russian Federation was observed in 1998. In this time period, there is a negative growth in the Gross Domestic Product (-5.3 percent), which is accompanied by a decrease in industrial production by five percent compared to the previous year.

Today, the ability to keep a decrease in the level of the Gross Domestic Product, trying to minimize it, is made by increasing the cost in the local market for products and services for consumer use.

During the crisis of 1998, the price of the consumer basket increased by eighty-four percent, and during the crisis of 2008 - by fourteen percent.

Today, one can observe an increase in the price of the consumer basket by four percent. Accordingly, in the current crisis conditions, an increase in the cost of living for citizens of the Russian Federation is noted, however, in comparison with the previous two crises, this increase is less.

Comparing the indicators of investment in fixed capital, it should be summed up that the existing crisis phenomena duplicate the scenario of the 1998 problems. Today, investment has significantly decreased. This can further lead to a decrease in income, the pace of business improvement. In general, for the Russian Federation, this leads to a reduction in the cost of renovation, construction of facilities, purchase of vehicles, equipment; to a decrease in financial contributions to intellectual property. [34]

Updated information on oil quotes shows that the cost of a barrel is declining, approaching the critical limit (thirty dollars). This is less than during the 2008 crisis.

The current market position in the oil products industry is not so much related to the coronavirus as it is considered a consequence of the geopolitical confrontation, in which a number of states are taking certain steps to fill the energy resource industry with shale products.

Table 2: Dynamics of economic indicators of the Russian Federation in 1998, 2008, 2020

Economic indicators	**1998**	**2008**	**2020 (as of 30.06.2020)**
GDP growth rate, in % to the previous year	-5,3	5,2	0,3
Industrial production, in % to the previous year	95,0	100,6	97,1
Investments in fixed capital, in % to the previous year	88,0	110,0	92,4
Domestic public debt of Russia, billion USD	490,9	1301,2	12402,3
External public debt of Russia, bln USD	188,5	479,8	461,2
Brent oil price, USD	9,8	41,6 (max within the year 133,90)	39,5 (min within the year 26,2)
Exchange rate USD/RUB1	20,7	29,4	67,0
Change in the USD/RUB exchange rate, in % to the previous year	346,5	119,8	127,3
Unemployment rate, %	13,3	5,6	6,3
Consumer price index, in % of the previous year	184,0	114,0	103,7
Wage growth, %	90,0	11,2	0,1
Interest rate of the Central Bank, %	60 (max within the year – 150)	13	4,3
Interest rate on deposits, %	17,1	5,8	3,2
Gold and foreign exchange reserves, billion USD	12,2	426,3	600,7 (august 2020)
Gold reserves, tons	458,5	519,6	2299,3

Source:

The ruble exchange rate is also affected by the fall in oil prices. Analysts predict that the ruble will collapse if oil prices fall to $30 a barrel.

The ruble may be supported by the timely reaction of the Russian Central Bank. Experts believe that government measures may be enough to prevent a sharp depreciation of the ruble.

Thus, the ongoing post-pandemic stagnation in manufacturing, trade and other sectors of the country, as well as the slow recovery of the economy, will contribute to the weakening of the Russian ruble and a steady return to previous levels. This dynamic became evident already after the 1998 crisis, which peaked with the collapse in oil prices in 1999 and the appreciation of the American currency by 2003.

In order to maintain its economic position in the current crisis, the Russian Federation has large reserves of financial and economic strength. [9]

Confidence in the future is also due to a significant increase in foreign exchange reserves. The increase in the monetary value of gold in central bank reserves comes despite the strong impact of the global drop in oil prices and the slowdown in economic growth caused by the almost complete halt in global economic activity.

The sudden rise in Russia's total foreign exchange reserves, driven in part by the rise in the value of gold as a stable medium of storage and reserve accumulation during the global economic downturn, contributed to a 0.45% increase in total reserves in April to a total of US $566 billion. While foreign currency assets fell $3.7 billion to $439.9 billion (to $439.9 billion) in the same month, after falling another $6.9 billion in March. Overall, Russian reserves have increased by 2.1% over the past four months, reaching a record high of $600.7 billion on October 1, 2020, while gold reserves stood at $2,299.3 tons.

The results of the cross-national study can be summarized as follows:

- The Covid-19 pandemic has affected national economies and led to a decline in macroeconomic indicators in most countries of the world;
- GDP declined significantly in the countries surveyed, between three and eleven percent, with only China and the United Arab Emirates showing growth;
- The decline in industrial production was observed in many countries of the world: in the USA, Japan, Germany and Italy. At the same time, growth was recorded in Singapore, China and Brazil;
- In many countries, the PMI index exceeds 50%, which indicates economic stability; only in Russia and Japan is this figure below 50%;
- In Singapore, America, as well as in Japan and Italy, public debt exceeds one hundred percent of total GDP;

- In many countries, unemployment has exceeded the threshold of six percent. This happened in the United States of America, as well as in Italy, Brazil and the Russian Federation;
- In these countries, wage growth has been low or non-existent, inflation has been kept to a minimum, and central banks are trying to keep interest rates low or even zero. The results of the analysis of the three main crises in Russia in the period from 1998 to 2008 and 2020 show that in 2020, the decline in gross domestic product compared to 1998 and 2008 minimum. However, it should be noted that this is due to an increase in domestic prices for goods and services;
- The cost of the consumer basket in Russia is growing this year, but not as much as in previous crises;
- During these three crises, fixed investment, oil prices and the exchange rate declined significantly;
- In the run-up to the 2020 crisis, the Russian National Bank provided the country with the most stable financial reserves since 1998 and 2008, thanks to a significant increase in foreign exchange reserves. [26]

For example, Covid's assessment of the impact of the pandemic on the development of the countries of the world shows that the epidemic is a serious social and psychological burden for the population. It is true that economic performance does not reflect a catastrophic recession. This is mainly due to the close monitoring of the process by national governments.

This crisis is also not one of the worst for Russia. The Russian government has taken important and timely steps to regulate and control it.

Russia still has a lot to overcome in terms of negative trends, but previous crises have given our country a lot of experience in managing such social and economic situations.

3.1.2 Structure of the Russian oil and gas industry

In the world economy, the oil industry is considered a very important industry, which seriously affects the growth in other areas. In the Russian Federation, the oil industry is actively developed, since this country has a 1/6 share of the total reserves of world reserves. Today, oil has a significant impact on the world economy and politics, namely,

the fuel and energy sector. The oil and gas industry is characterized by large capital investments; a wide range of wells around the world, which are used to extract the necessary resources, has reached the level of 1.0 million. The oil industry originated in the 19th century in Romania, the United States and Russia. Only one century has passed, and the oil refining industry has already actively developed in 20 states, and after another 40 years - in 40 states. The leading roles in the so-called mining sector in the last century were played by such countries as Iran, the USA, Venezuela and the USSR. With the rapid growth of production, the total volume of oil production increased significantly. Just half a century ago, various petroleum products were inexpensive, but after the energy crisis began, the cost of such a product increased significantly. A serious aspect in evaluating the oil sector is the location of the deposits. In the last century, it was said about 2 key points where the oil-producing states are located - the socialist and capitalist camps, since the overall management of production processes and sales took place almost completely formed by OPEC. [2]

Now OPEC maintains vigilant control over more than 40% of total oil production, and the size of the production of such a resource base in developing countries has reached the level of 66.0%, in developed countries - 19.0%. The Russian Federation occupies the role of one of the very important countries that is engaged in the extraction of petroleum products. The most promising locations where oil production is carried out in the Russian Federation are areas located in the European North and the Far East. Petroleum products are extracted using pumping and flowing techniques. Now the role of such a branch of modern industry in the fuel and energy complex is very important. There are a number of regions where the oil industry is actively developing.

About 60% of all oil products in the state are produced in the West Siberian region. Local deposits are characterized by the fact that oil reserves are close to the ground surface, the reserves are concentrated, drilling is easy, and the resulting oil products are of high quality.

The Ural region has significant reserves and large production capacities are concentrated in modern Bashkortostan.

In the North Caucasus, the main deposits are in Grozny and Dagestan, they are also here in the Krasnodar and Stavropol Territories.

There are over a hundred oil deposits in the Northern region, but they are not large, and it is quite difficult to drill. The largest oil deposit is located in a place called Timan-Pechora.

In the Far East region there are deposits on the island of Sakhalin and the seas surrounding it. [3]

The most important aspect of the country's oil industry is the quantity and quality of oil refineries. The main ones are located in such regions as - Central, Povolozhsky, Ural, East Siberian, Far East and West Siberian. 16 settlements of the Russian Federation are engaged in the extraction and processing of various petroleum products: Perm, Moscow, Yaroslavl, Komsomolsk-on-Amur, Saratov, Khabarovsk, Volgograd, etc. Now the oil and gas sector is considered a serious part in the Russian economy, which makes it possible to ensure the work of a wide range of other industries, as well as the level of well-being of the country's citizens. The level of people's well-being is an important factor for the systematic economic growth of the state, in its level of security, energy independence, in the field of agriculture and other similar areas. [12]

Recently, there have been serious problems in introducing the latest effective methods for the extraction of a variety of modern oil products and gas, since such raw materials are the basis of modern energy supply in various fields, and they may eventually be exhausted. The oil industry has a dependence on the location of enterprises. The factors that influence this are a system of conditions that allow for the selection of the most rational locations for the location of production and economic facilities. A wide range of conditions that are determined for the oil and gas industry when installing the necessary facilities can be classified according to their real origin. [1]

Natural factor – it usually means a comprehensive economic assessment of environmental factors - geology, seismic - and the volume of the resource base for the growth of industry and the location itself, in which there are deposits. [18]

Economic strength. Economic factors are considered that take into account the location and rationality of the cargo transportation of the received raw materials for its further processing, and besides this, its competent use and ensuring the protection of the external environment. This list also includes the existing infrastructure, economic and economic-geographical factors. The modern oil industry is dependent on sources of raw materials, which are often located in remote places. [6]

Demographic factor. In fact, it is a system for relocating personnel, ensuring proper working conditions, ensuring the overall security of the region, etc. When choosing a meta-construction of oil refining and fuel facilities, the overall level of economic resources is also taken into account. This list also includes mountain and geological conditions during

mining; thickness and density of layers; their depth, stock, quality level. To assess the quality indicators of the composition of raw materials, its total energy value is analyzed.

Fuel and energy complexes have a large territory-forming potential and there are conditions to effectively create fuel-intensive industries. The ecological strategy in them is selected so that it serves to reduce the negative impacts on the outside world. By sectoral composition - such a classification system is characterized by the fact that in it the relationship between production capacity is calculated within the boundaries of one field of activity; there can be more than 10 connections. Distinguish the following such sectoral compositions: horizontal type - links between industries from one base category. Vertical - if there is a certain structure of industries in order of growth. [14]

A striking example of a vertical type structure is the petrochemical and oil sectors and their components. Oil and gas production is an area that requires serious investments, but at the same time it is a serious replenishment of the state budget, which is engaged in the supply of petroleum products to other countries and regions. Changes in the cost of petroleum products have a significant impact on the ratio of exchange rates to shares of industrial giants. The economic and political picture of the world, spheres of influence in the world economy are characterized by the degree of growth of the oil industry. The oil industry usually has a strong influence on such areas as modern transport, organic, petrochemical, pharmaceutical and trade, since without such special raw materials the overall growth and real development of such industries is simply not possible. [15]

The Ministry of Energy of the Russian Federation has a federal basis. It is a structure that relates to the executive authorities, carrying out the functions for the development and implementation of state policy and regulatory, legal regulation in the fuel and energy sector, including tasks related to electric power issues in the oil production, oil refining, production of gas, coal, oil shale and peat, main pipelines and products for their general processing, renewable energy sources, development of deposits where there are hydrocarbons, based on agreements on the redistribution of raw materials, and in the petrochemical industry, and in addition, functionality for public services, regulation of state property in the manufacturing industry and the use of fuel, energy base. Based on the information of the Ministry, the level of oil production, taking into account gas condensate, at the very beginning of 2021 was 43,009.60 thousand tons, real growth over this time was about 1.0% (Fig. 1). Describing the basis of the market for the production of oil and gas products, it must be said that at the very beginning of 2020, about 107 structures were

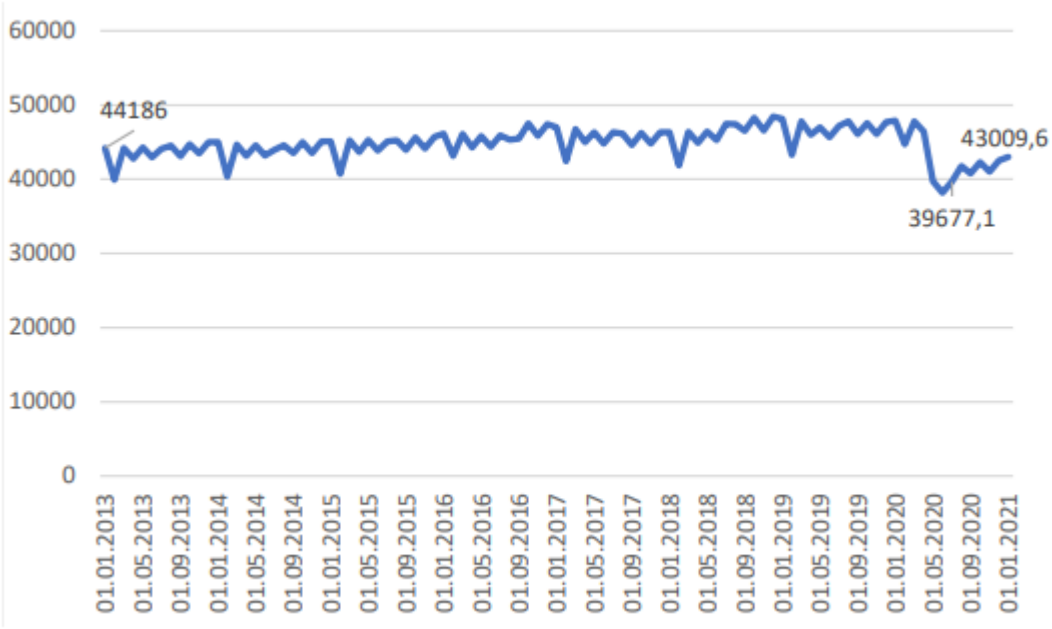
producing oil products and gas condensate (raw materials for oil) in the Russian Federation, which had a vertical integrated format of work. According to the results of the year, they accounted for approximately 84.70% of all oil production volumes; 185 modern specialized enterprises engaged in mining, having an independent format of work, which were not included in the VIOC system; 3 organizations that worked under agreements on the division of goods. Consequently, there is a general monopolization in this market and general prospects for its expansion are unlikely. [20]

The largest share in the increase in oil production and gas condensate in the Russian Federation in 2019 belonged to the fields in the Ural Federal District (+2.80 million tons compared to the previous year), which accounted for over 55.0% of the total production in the Russian Federation. Now there are about a hundred oil fields throughout the Russian Federation. In their general list, the most important ones should be highlighted:

- The Priobskaya deposit is located in the Khanty-Mansi Autonomous Okrug, not far from the village of Seliyarovo. Oil reserves are about 5.0 billion tons. Extraction of various oil products for about 60.0 million tons;[5]
- The Samotlor deposit is located in the Khanty-Mansi Autonomous Okrug, not far from the Samotlor reservoir. It took 6th place in the world ranking for the production of petroleum products. At the same time, the average level of the deposit depth is 1.80 kilometers. More than 27.0 billion dollars were spent on the development of this deposit. To date, the profits it has brought have reached $247.0 billion; [16]
- Russkaya deposit – the deposit is located in the Yamal-Nenets region. In 2018, it was planned to produce about 1.30 million tons of oil products. According to a number of independent estimates, the total volumes at this field are estimated at no less than 420.0 million tons.

The Romashkinskoye deposit is located on the territory of the Volga-Ural region. Experts estimate the reserves of this place at 5 billion tons. The average depth of oil reserves is 1.6 kilometers. At the time of the start of oil production, a sample was established, which was expressed in the form of an oil flow capable of producing about 120 tons per day. Today, Russia is dominated by the ten largest companies in the oil and gas industry (Table 3).

Figure 1: Dynamics of oil production including gas condensate in Russia 2013–2021



Source:

At the same time, the leading position both in terms of average growth rates of hydrocarbon production over ten years and in 2019 is occupied by Rosneft, whose share in national oil production is about 41%, and in the world - 6%. Key performance indicators of the largest oil companies for 2020:

1. ‘Rosneft’ is an oil company leading the country's energy industry. PJSC NK Rosneft is engaged in the search and development of hydrocarbon deposits, produces oil, gas, gas condensate, develops offshore fields, processes the extracted raw materials, sells oil, gas and products of their processing in Russia and abroad. The number of products sold by this company is 13.68 million rubles.
2. ‘Gazprom Neft’ is a Russian oil and gas organization that specializes in exploration, discovery and development of oil and gas deposits, resource processing, and the production and sale of gas and oil products. The organization is one of the leaders in the domestic and global energy markets.

Revenue decreased by twenty-two percent as a result of a decrease in the cost of oil, oil products in the global, local markets; reducing the number of products sold in global markets.

Table 3: The largest national companies in the oil and gas industry by sales volumes in 2019

№	Group of companies / company	Sales volume in 2019 (million rubles)
1	Rosneft	7 636 000
2	Gazprom	7 546 095
3	LUKOIL	7 415 483
4	Surgutneftegaz	1 570 876
5	Tatneft / group	932 296
6	NOVATEK	862 803
7	Sakhalin Energy	386 298,4
8	Slavneft / group	316 084
9	Yamal LNG	246 258
10	Alliance Oil Company Ltd	236 864,3

Source:

The Lukoil oil brand is one of the largest vertically integrated brands on a global scale. Its share is more than two percent of the world's oil production, about one percent of the available hydrocarbon reserves. [22]

Taking into account the information contained in the organization's annual reports for 2019, the brand's business concept is based on the principle of maximum vertical integration in order to create added value, ensure high business regularity when changing the macro environment using risky diversification. The number of products sold has a value of approximately thirteen million rubles.

PJSC “Surgutneftegas” is one of the largest private oil companies in the Russian Federation with vertical integration. It combines in its own structure research and design, geological, drilling, production departments, oil refining, gas processing departments; sales organization.

According to the information of the annual reporting for 2019, the company's income amounted to 1556 billion rubles. Tatneft is one of the largest oil companies with vertical integration. The directions of oil and gas production, oil refining, networks of filling stations, petrochemicals, design, manufacture of devices for the oil and gas sector are being improved. The company participates in the capital of institutions in the financial industry. This is one of the largest public organizations in the Russian Federation with a capitalization of more than twenty-eight billion dollars (data from the end of 2019). The total number of manufactured products is 2.3 million rubles. [28].

Public Joint Stock Company NOVATEK is one of the largest independent producers of natural gas in the Russian Federation. Exploration activities, production, processing, sale of natural gas and hydrocarbons are carried out. The company has been operating in its field for over twenty years. Revenue from the sale of gas and oil for the nine calendar months of 2020 decreased by more than twenty-three percent compared to 2019.

The Sakhalin Energy oil and gas brand is developing a number of mineral deposits on the northeast shelf of Sakhalin Island. The goals of the organization are the production, transportation, processing of oil and gas; marketing activity. According to reporting information, thirty-nine million oil barrels were shipped from 1 of the ports during the period of 2019. The organization's main importers are:

- Japan,
- China,
- Taiwan,
- South Korea.

‘Slavneft’ is part of the 10 largest oil companies in the Russian Federation. The brand structure with vertical integration makes it possible to ensure the overall production cycle - from exploration, production of hydrocarbons to oil refining. The company manages licensing for subsurface geostudy, oil and gas production at thirty-five specialized sites in the west and east of Siberia. The total income in 2019 amounted to 4.722.401 rubles. This is twenty-seven percent more than in 2018. [38]

Yamal LNG is a project for the production, liquefaction and sale of natural gas. It involves the construction of an LNG plant. The plant's capacity is approximately sixteen and a half million tons based on the resources of the South Tambeyskoye field [19]. The construction of the plant is carried out in 3 phases within 3 years. The project involves the production of approximately sixteen million tons of gas; up to 1.2 million of gas condensate, which will be supplied to the countries of the Asia-Pacific Region and Europe. In the current period, active work is underway on this project. Alliance Oil Company is one of the main separate oil and gas organizations with vertical integration of activities in the Russian Federation, Kazakhstan. [7]

Taking into account the general interim reporting on income and expenses, it can be noted that the proceeds from the sale of crude oil and gas for the nine months of 2020 almost halved; proceeds from the sale of petroleum products decreased by fifteen percent.

“Bashneft” is one of the oldest organizations in the oil industry in the Russian Federation. Mining has been carried out since 1932. The amount of products sold is two million rubles. RN-Holding (Rosneft) is one of the largest oil organizations in Russia. The brand is among the top 10 largest private oil institutions worldwide in terms of raw materials production. According to the company's financial statements, revenues for 2019 amount to three hundred and fifty-two billion rubles. At the same time, the growth rate decreases - from 1.7 percent in 2018 to nine-tenths of a percent a year later [21]. As part of the structure of oil production in the Russian Federation, in a larger number of the main regions of oil production, growth is observed, which is interconnected with the ability to develop other fields. The biggest increase is seen in:

- Yakutia;
- Yamal-Nenets Autonomous Region

The export of oil to the Russian Federation increased in 2019 by more than three percent, amounting to two hundred and sixty-six million rubles. The main export volume is carried out using navigable vehicles of the tanker fleet [33].

In the same year, the number of deliveries by this method increased by eleven percent. But one could observe a decrease in export deliveries to Poland, Germany; increase in deliveries to Holland. This affects the change of the main export structure of the Russian Federation. The domestic use of oil also decreased in the year under review. According to the information received from January to October 2020, the total amount of oil and gas condensate produced in the Russian Federation decreased by eight percent, compared with the same period a year earlier, and amounted to four hundred twenty-nine million tons. Production on average per day is fixed at the level of ten million barrels. Since the beginning of the period, Rosneft has been able to produce one hundred and fifty million tons, “Lukoil” - sixty-one million tons (more than five in October), “Surgutneftegaz” - forty-six million tons (more than four in October), “Gazpromneft” - thirty-two million tons (more than three million in October); “Tatneft” - twenty one million; "Bashneft" - eleven million tons; NOVATEK - 6.6 million tons; RussNeft - 5.3 million tons; Slavneft - more than eight million tons. [31]

Design organizations work out project documentation, form programs for geological and technical activities for subsidiaries of TNKVR; resolve the goals of supporting the development of oil and gas fields, manage the development of development, interpret the results of seismic exploration, examine the reporting of contractors as part of the seismic

component of exploration of new fields. In the Russian Federation, the largest organizations include the following:

- TORC,
- Gazpromneft STC,
- SamaraNIPIneft.

Organizations designing software develop applications, provide technical support for software in the field of exploration and development of hydrocarbon deposits. For example, for a limited liability company GridPoint Dynamics, which is considered a resident of Skolkovo, the main product can be called the Geoplat Pro application, which is used to integrate and expand software functionality within the framework of seismic recognition, 3D modeling in the field of geology. [21]

There are 3 organizations from the Russian Federation for the manufacture of equipment:

- OZNA-Measuring Systems. Sphere of work org. departments - measurement of multiphase flows in the oil and gas industry.
- The Novomet group of organizations is one of the largest holdings in the Russian Federation among those engaged in the production of oil submersible devices, including reservoir pressure support mechanisms.

Among the companies of the Russian Federation, as examples of enterprises in the field of consulting, one can single out:

- TRIAS Company providing supervising, engineering and consulting services in the field of oil and gas field development.
- Rosgeologiya – a company that provides a general list of services related to geological exploration – from surveys in the regions to parametric drilling, tracking the specifics of the subsoil. Responsibilities in the field of marine geology are also carried out.

Leasing organizations are organizations that lease oil and gas equipment in Russia. There are also several government programs that are being implemented by the Industrial Improvement Fund under the Ministry of Industry and Trade of the Russian Federation. They are discussed below.

The Leasing Projects state program is used to support technical re-equipment, to renew the main production assets of Russian enterprises. As part of the support for the re-equipment of the companies, leasing financing programs are used. Considering org. programs that offer loans at one percent per annum for amounts up to five hundred million rubles.

Lending can be considered targeted. You can make from ten to ninety percent of the advance payment according to the leasing agreement, but not more than twenty-seven percent of the price of the equipment [36].

The specialized program Standard Leasing is a convenient solution with a quick period for studying a leasing application by applying the general characteristics of transactions within a leasing. In the current period in the Russian Federation, the oil and gas industry of the fuel and energy complex is considered as one of the engines of the economic industry. The significance of the presence of a significant resource base is expressed by the fact that the fuel and energy complex of the Russian Federation occupies one third of the total industrial production of products and services, which is fifteen percent of the country's gross domestic product. The oil and gas industry has been nationalized and its expansion seems unlikely. [27]

4. Statistical analysis of the peculiarities of the Oil and Gas industry in the context of Covid-19

4.1 Impact of the Covid-19 pandemic on the oil and gas industry

The global epidemic of covid-19 caused a global economic crisis in 2020, the results of which affected the activities of all industries without exception. This essay shows the impact of the global covid-19 epidemic on the petrochemical industry in the Russian Federation and around the world. Under the influence of the coronavirus, the consumption of goods in the petrochemical industry in general has decreased, and the structure has changed. In the first half of 2020, the consumption of goods for the automotive industry, the construction industry, and the aircraft industry decreased, but at the same time there was a small compensation due to the growth in the consumption of personal protective equipment, epidemiological and medical essentials. In the same way, the global market for petrochemical products has been strongly affected by changes in the cost of raw materials. [11]

The Russian petrochemical industry in the first half of 2020 was less affected by the impact of the covid-19 epidemic than the entire global industry as a whole. This was facilitated by the opening of new production facilities, the timely re-profiling of enterprises into market segments with increasing demand, as well as an increase in the supply of goods abroad. But at the same time, over the first three months, the results of financial operations of the petrochemical industry in Russia showed a negative trend, investors gradually began to leave this market. This year turned out to be difficult for this segment of the economy. In connection with the current situation, Russian companies are forced to adapt to the current economic conditions, and the authorities must do everything to restore this industry.

The economic shock caused by actions to contain the spread of the coronavirus covil-19 has affected the petrochemical industry in almost all countries of the world. The main shock of the coronavirus covid-19 has become visible in the global petrochemical industry due to the downturn in business activity and the volatility in the cost of petrochemical raw materials. [29]

In May 2020, workload in the petrochemical industry decreased by 0.2 percentage points to 75.1%, which is significantly less than the average for previous years and was the lowest

value since March 2009. According to the American Council on Chemistry, in January-May 2020, compared to the same period in 2019, there is a noticeable decrease in the production of chemical products by 3.3%. However, the monthly rate of decline in production in May decreased to 0.5%, while in April it was 1.3%, and in March 3.2%. The decrease in the production of the petrochemical industry became noticeable in almost all products of this industry segment. But for each group of goods, the coronavirus hit differently. [25]

The construction industry has become the most vulnerable among all consumers of petrochemical products. The decline in production in the construction industry has a negative impact on the consumption of polypropylene, polyvinyl chloride, polystyrene and many other petrochemical products. In many countries, many companies in the automotive and tire industries have suspended their work. The decrease in goods from these industries will lead to a decrease in demand for polypropylene, polyethylene, ABS plastic and many other goods. The problems of the tire industry leave their mark on the production of synthetic rubber. According to the calculations of Nizhnekamskneftekhim, in 2020 this will cause a decrease in demand for rubber by more than 2 percent. Due to the decrease in the turnover of formaldehyde resins and additives, MTBE led to a decrease in demand for methanol. The decrease in oil prices in the last months of 2019 is a reflection of actions to limit the spread of covid-19 and caused a drop in prices for LPG, naphtha and natural gas - the basic raw material for the production of petrochemicals. At the same time, in the first three months of 2020, a unique decrease in demand was noticed in the fuel market due to the coronavirus, as a result, manufacturers needed to repurpose their enterprises, making changes in their activities. Two months after the start of 2020 the decrease in the cost of naphtha and LPG turned out to be 60-80 percent. As a result, the margin of petrochemical products increased in the first three months of 2020. But the situation changed by the first days of May. The cost of raw materials began to increase as a result of rising prices on the global oil market due to a decrease in the supply of raw materials and the removal of travel restrictions, which is a natural result of gasoline consumption and, as a result, naphtha. This began to negatively affect the margins of producers of petrochemical products. [23]

The most important reason for the increase in the cost of oil was the joint, united agreements of the leading oil exporting countries. In April 2020, members of OPEC +, which includes the Russian Federation, agreed to reduce oil production due to a decrease in the consumption of refined oil products due to the covid-19 epidemic. Due to the new

OPEC+ agreement, the Russian Ministry of Energy believes that the decrease in oil production in Russia in 2020 will exceed 10 percent compared to 2019. As a result, this will cause a decrease in gas production, and this will affect the production of LPG and NGLs.

By July 2020, the most important changes had taken place in the industry:

1. Due to the covid-19 pandemic, damage was caused to the main consumers of goods in the petrochemical industry. Most of all, demand fell in the following sectors (among consumers of petrochemicals): the construction industry, the automotive industry, and the aircraft industry. [30]

The petrochemical industry also suffered losses due to a decrease in demand for plastics, complex resins, methanol, etc. But in some segments, on the contrary, the consumption of petrochemical products increased, also due to the coronavirus, due to the demand for personal protective equipment, epidemiological and medical essentials. The increased demand for packaging for some time suspended the environmental trend for the abstinence of packaging products, thereby pushing the consumption of polyethylene, polyethylene terephthalate, etc. [37]

2. In the first three months of 2020, the coronavirus caused a decrease in the cost of raw materials for the petrochemical industry, but by July the cost partially returned to previous levels, which, together with a decrease in demand, negatively affected the margins in the industry. The OPEC+ agreement, which was in April 2020, will keep oil prices in the near future.
3. Reducing oil production will reduce the availability of raw materials for some time and this will affect the Russian Federation to some extent, but this problem does not exist for the petrochemical industry in the future.
4. In the first six months, measures to combat coronavirus least of all affected the petrochemical industry of the Russian Federation due to ZapSibNeftekhim reaching its design capacity; export goods. But, despite this, the results of the turnover of many petrochemical companies in the Russian Federation in the first three months of 2020 had negative results.

In the second half of 2020, the situation should change for the better, but this year will be difficult for the petrochemical industry. The restoration of many industries-consumers of petrochemical products will take several years. Under the current conditions, the petrochemical industry needs to adjust to the current market relations, and the authorities

should support this industry in every possible way, providing all kinds of assistance to enterprises that already have a lot of problems, in addition to the global epidemic. [40]

4.2 Statistical model of the oil and gas industry

Table 4: Oil and gas production in Russia for the period 2019 – 2020

year	month	Oil dehydrated, desalinated and stabilized, including gas condensate, thousand tons	Natural and associated gas, million m3
2019	january	48078,131	67749,002
	february	43288,445	61969,72
	march	47803,395	67808,703
	april	46048,451	64512,726
	may	47054,696	61584,487
	june	45747,901	54580,055
	july	47260,482	54856,72
	august	47884,769	55692,925
	september	46211,371	56377,594
	october	47649,287	62081,895
	november	46195,178	64660,497
	december	47795,721	67550,051
2020	january	47921,8	65638,3
	february	44750,6	60411,2
	march	47808,5	59583,8
	april	46438,9	55385,2
	may	39803,4	52580,5
	june	38223,1	48154,8
	july	39707,9	49612,7
	august	41773,3	53747,9
	september	40823,5	56000,6

	october	42266	63236,8
	november	40987,9	63279,6
	december	42571,5	66862
2021	january	43189,995	68682,011
	february	38688,516	62578,421
	march	43230,187	67056,431
	april	42964,894	64515,571
	may	44244,979	63220,132
	june	42703,856	58842,54
	july	44271,049	56744,18
	august	44153,515	58029,026
	september	43988,999	62166,453
	october	45897,007	66461,017
	november	44660,005	66565,829
	december	46237,598	69330,969

Source: Rosstat, 2022

Let us sequentially carry out a statistical analysis (with the construction of a model) of time series of oil and gas production.

Let us start, as usual, with descriptive statistics for the variable n - oil production and the variable g - gas production.

Table 5: Descriptive statistics, observations used 2019:01 - 2021:12 for variable n (36 observations)

Average	**Median**	**Min**	**Max**
44398,	44466,	38223,	48078,
Stat. deviation	Var.	Asymmetry	Excess
2838,6	0,063936	-0,48854	-0,72576
5%	95%	IQ range	Missed Observations
38619,	47945,	4296,2	0

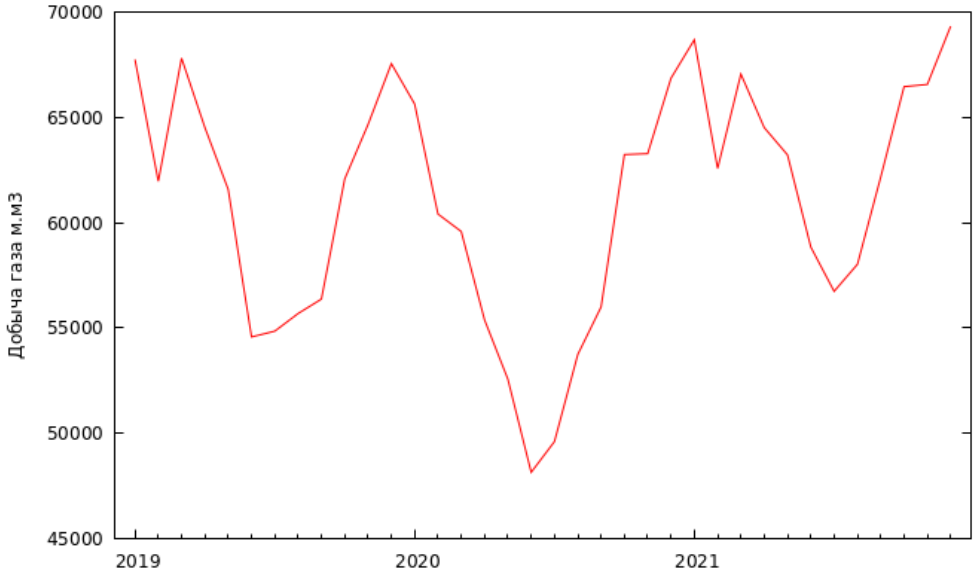
Source:

Average	Median	Min	Max
61059,	62124,	48155,	69331,
Stat. deviation	Var.	Asymmetry	Excess
5639,4	0,092360	-0,47841	-0,71334
5%	95%	IQ range	Missed Observations
49394,	68779,	10160,	0

Lest us plot the time series graphs:

Figure 2: Dynamics of oil production for the period 2019 - 2021

Figure 3: Dynamics of gas production for the period 2019 – 2021



Visual analysis of the chart suggests the absence or presence of seasonality, as well as the presence of an increasing trend. This assumption can be checked on the basis of the analysis of the sample autocorrelation function of the series - it allows, in particular, to determine how close the considered series is to the stationary series. The autocorrelations of the stationary series decay with increasing lag. Analysis of the autocorrelation (ACF) and partial autocorrelation functions (PACF) also allows us to draw conclusions about the component composition of the time series.

Table 6: Autocorrelation function for Oil Production t.t, ***, **, * shows significance at 1%, 5%, 10% levels using standard error 1/T^0.5

lag	ACF		PACF		Q stat.	[p value]
1	0,6185	***	0,6185	***	14,9497	[0,000]
2	0,5774	***	0,3156	*	28,3627	[0,000]
3	0,4708	***	0,0562		37,5528	[0,000]
4	0,3961	**	0,0035		44,2616	[0,000]
5	0,2952	*	0,0652		48,1068	[0,000]
6	0,1547		0,1691		49,1984	[0,000]
7	0,1628		0,0826		50,4483	[0,000]
8	0,0394		0,0943		50,5243	[0,000]

Columns ACF and PACF show the numerical values of the sample autocorrelation and partial autocorrelation functions of the corresponding order (lag). In columns Q-stat. and [p-value] are the values of Ljung-Box Q-statistics and the achieved level of significance p for the hypothesis of the absence of autocorrelation of the corresponding order.

Figure 4: Correlogram for n

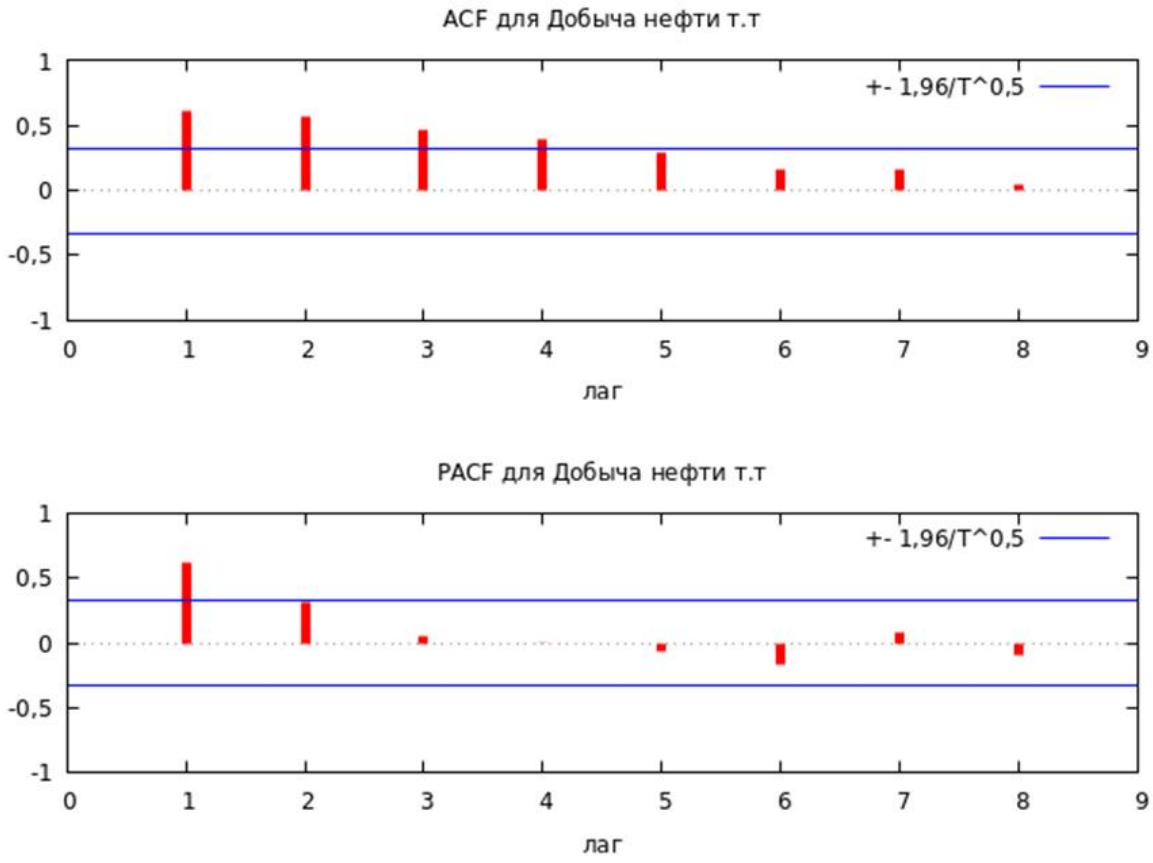


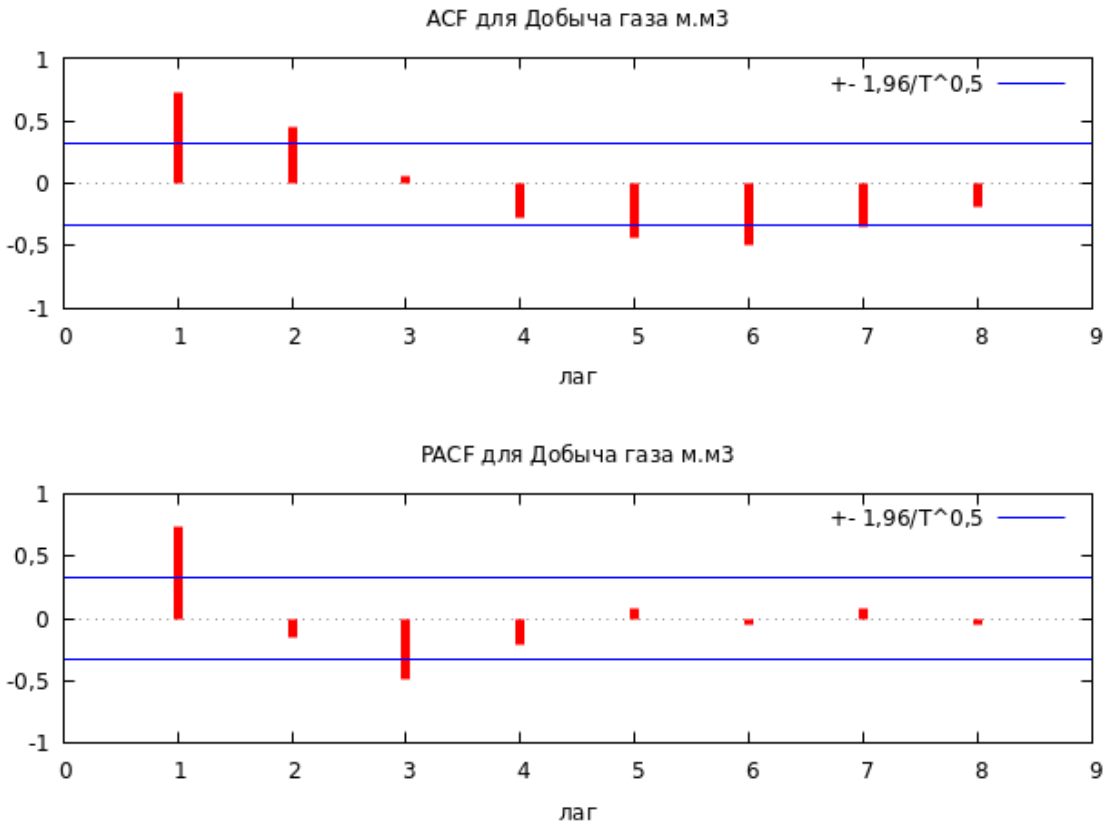
Figure 4 shows plots of the sample autocorrelation and partial autocorrelation functions with their respective confidence intervals (dashed lines), which are equal to two standard deviations and are calculated as ± 1.96 T. If the kth value of the sample autocorrelation (or partial autocorrelation) function is within this interval, then we can say that the kth order autocorrelation coefficient approximately at the significance level α = 0.05 is not significantly different from zero.

As can be seen from Table 6 and Figure 4, the series under study is stationary, because the autocorrelation function tends to decay. The presence of a trend component is evidenced by the fact that the partial autocorrelation coefficient of only the first order turned out to be significant. Thus, we are dealing with a stationary time series.

Table 7: Autocorrelation function for Gas production m.m3, ***, **, * shows significance at 1%, 5%, 10% levels using standard error 1/T^0.5

Lag	ACF		PACF		Q stat.	[p value]
1	0,7299	***	0,7299	***	20,8204	[0,000]
2	0,4609	***	0,1536		29,3682	[0,000]
3	0,0532		0,4882	***	29,4856	[0,000]
4	0,2713		0,2143		32,632	[0,000]
5	0,4428	***	0,0782		41,2838	[0,000]
6	0,4913	***	0,045		52,291	[0,000]
7	0,3483	**	0,0874		58,0139	[0,000]
8	0,1826		0,0572		59,6428	[0,000]

Figure 5: Correlogram for g



From Table 7 and Figure 5 it can be seen that we are dealing with a non-stationary time series with pronounced seasonality and with the presence of a trend component.

Let us identify the ARIMA model.

To determine the order of the difference d, we first check whether the series of first differences is not stationary.

Table 8: Values of the first differences d_ for variables n and g

time	d_n	d_g
2019:01:00		
2019:02:00	4789,686	5779,282
2019:03:00	4514,95	5838,983
2019:04:00	1754,944	3295,977
2019:05:00	1006,245	2928,239
2019:06:00	1306,795	7004,432
2019:07:00	1512,581	276,665
2019:08:00	624,287	836,205
2019:09:00	1673,398	684,669
2019:10:00	1437,916	5704,301
2019:11:00	1454,109	2578,602
2019:12:00	1600,543	2889,554
2020:01:00	126,079	1911,751
2020:02:00	3171,2	5227,1
2020:03:00	3057,9	827,4
2020:04:00	1369,6	4198,6
2020:05:00	6635,5	2804,7
2020:06:00	1580,3	4425,7

time	d_n	d_g
2020:07:00	1484,8	1457,9
2020:08:00	2065,4	4135,2
2020:09:00	949,8	2252,7
2020:10:00	1442,5	7236,2
2020:11:00	1278,1	42,8
2020:12:00	1583,6	3582,4
2021:01:00	618,495	1820,011
2021:02:00	4501,479	6103,59
2021:03:00	4541,671	4478,01
2021:04:00	265,293	2540,86
2021:05:00	1280,085	1295,439
2021:06:00	1541,123	4377,592
2021:07:00	1567,193	2098,36
2021:08:00	117,534	1284,846
2021:09:00	164,516	4137,427
2021:10:00	1908,008	4294,564
2021:11:00	1237,002	104,812
2021:12:00	1577,593	2765,14

Let us find sample ACF and PACF for the variable d_n and d_g.

Table 9: Autocorrelation function for d_n and d_g

Lag	ACF		PACF		Q stat.	[p value]
d_n						
1	0,3806	**	0,3806	**	5,5163	[0,019]
2	0,0027		0,1725		5,5166	[0,063]
3	0,0044		0,0753		5,5173	[0,138]
4	0,0163		0,0132		5,5285	[0,237]
5	0,0789		0,0996		5,7974	[0,326]
6	0,2262		0,1817		8,0815	[0,232]
7	0,16		0,0098		9,2653	[0,234]
8	0,1027		0,0857		9,7713	[0,281]
d_g						
1	0,1229		0,1229		0,5751	[0,448]
2	0,2383		0,2266		2,8027	[0,246]
3	0,0715		0,1305		3,0094	[0,390]
4	0,2384		0,2944	*	5,3837	[0,250]
5	0,1628		0,0735		6,5284	[0,258]
6	0,4765	***	0,3851	**	16,6667	[0,011]
7	0,1382		0,0937		17,5497	[0,014]
8	0,1954		0,0963		19,3819	[0,013]

Figure 6: Correlogram for d_n

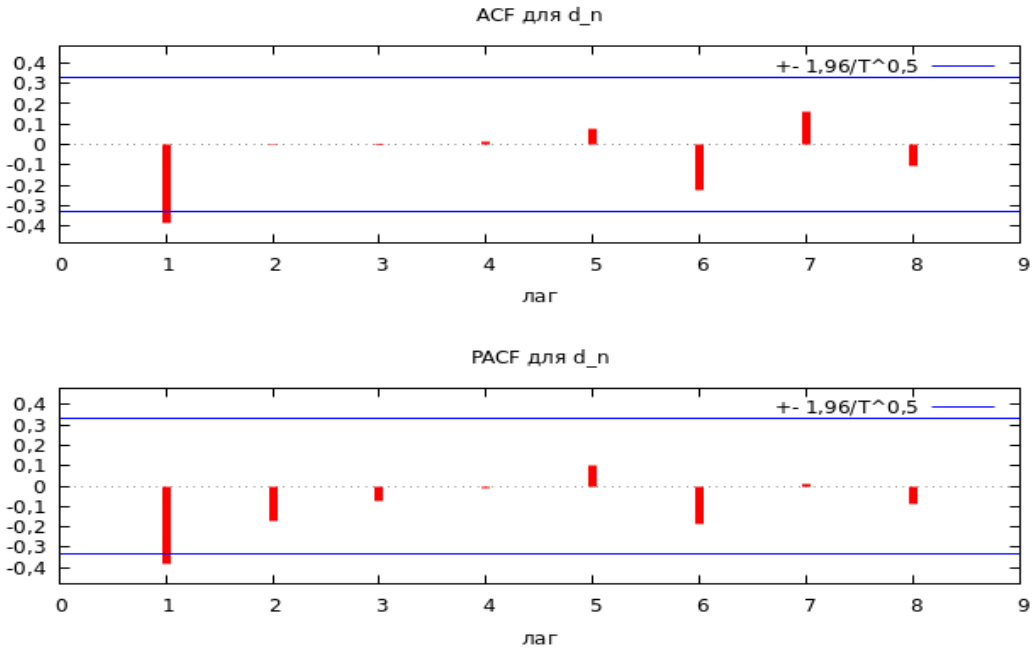
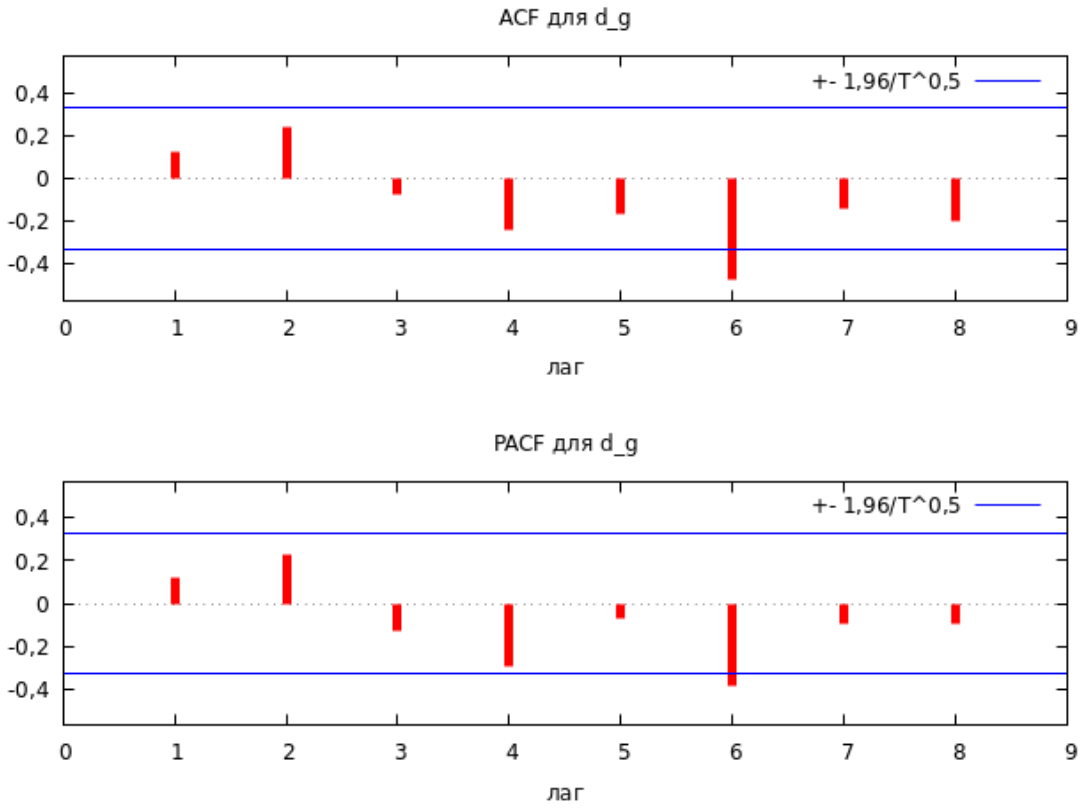


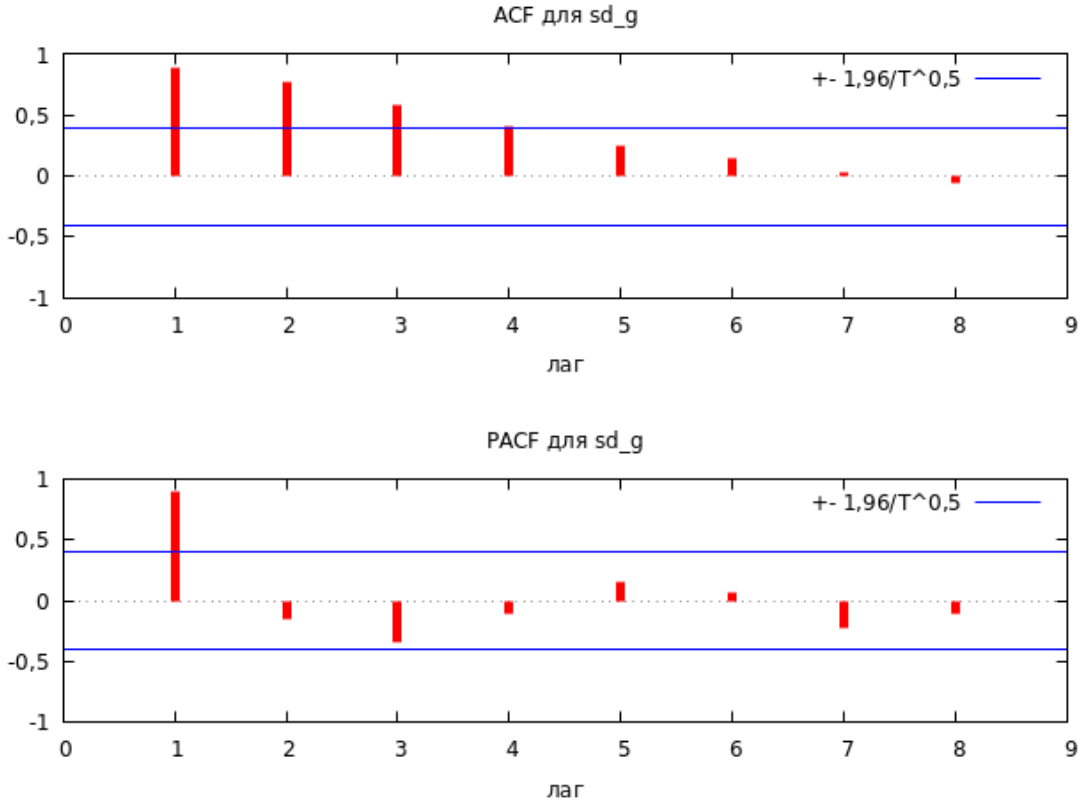
Figure 7: Correlogram for d_g



From the last table, we determine that d_n is a stationary series with a significant value for 1 lag. Since both the ACF and the FACF have an outlier only at lag 1, then most likely the desired ARIMA model will contain no more than 1 autoregressive (or moving average) component. Therefore, first of all, it is necessary to evaluate and check the adequacy of the model with one parameter of autoregression ARIMA(1,1,0), with one parameter of moving average ARIMA(0,1,1) and mixed model ARIMA(1,1,1). Further, if there are several adequate models, you can choose only one of them, focusing on information criteria and model accuracy indicators.

For the d_g variable, everything is wrong, since the release occurs on the 6th lag. In this case, we analyze the seasonal difference for g.

Figure 8: Correlogram for sd_g



In this case, we have the same variant as the first difference n, so we can build the same ARIMA models.

Building ARIMA models.

Model 1: *ARIMA, 2019:02-2021:12 observations used (T = 35)*

Dependent varible: (1-L) n

Standard errors calculated from the Hessian

	coefficient	*Std. error*	*t-ratio*	*P-value*	
const	−25,6025	260,575	−0,09825	0,9217	
phi_1	−0,422408	0,161545	−2,615	0,0089	***

Mean dependent var	−52,58666	S.D. dependent var	2414,325
Sum squared resid	−44,99138	S.E. of regression	2173,219
R-squared	0,451860	Adjusted R-Squared	0,451860
Log-likelihood	−318,6999	Akaike criterion	643,3998
Schwarz criterion	648,0658	Hannan-Quinn	645,0105

In the Coefficient column, estimates of these parameters are given, in the St. error is the asymptotic standard error of estimates, in the t-statistics column are the values of the t-test used to test the null hypothesis that the corresponding parameter is equal to zero, in the [p-value] column is the achieved significance level for this hypothesis. The *** sign indicates that the parameter is significant at the 0.01 level, ** - at the 0.05 level, * - at the 0.1 level. The following are the values of the statistics and criteria that make it possible to judge the quality of the estimated model and compare the model with others, in particular:

- art. off innovation - the standard error of the model;

- log. likelihood - the value of the logarithmic likelihood function. In the Coefficient column, estimates of these parameters are given; in the column St. error is the asymptotic standard error of estimates, in the t-statistics column are the values of the t-test used to test the null hypothesis that the corresponding parameter is equal to zero, in the [p-value] column is the achieved significance level for this hypothesis. The *** sign indicates that the parameter is significant at the 0.01 level, ** - at the 0.05 level, * - at the 0.1 level. The following are the values of the statistics and criteria that make it possible to judge the quality of the estimated model and compare the model with others, in particular:

- Art. off innovation - the standard error of the model;

- log. likelihood - the value of the logarithmic likelihood function, calculated at the point corresponding to the obtained estimates of the model parameters;

- values of the information criteria of Akaike, Schwartz and Hennan-Quinn.

Range used for model evaluation: 2019:02 - 2021:12

Standard error of residuals = 2173.22

	n		Residuals
2019:02	43288,4	47606,6	-4318,19
2019:03	47803,4	45275,2	2528,16
2019:04	46048,5	45859,8	188,625
2019:05	47054,7	46753,3	301,359
2019:06	45747,9	46593,2	-845,332
2019:07	47260,5	46263,5	996,997
2019:08	47884,8	46585,1	1299,63
2019:09	46211,4	47584,6	-1373,28
2019:10	47649,3	46881,8	767,476

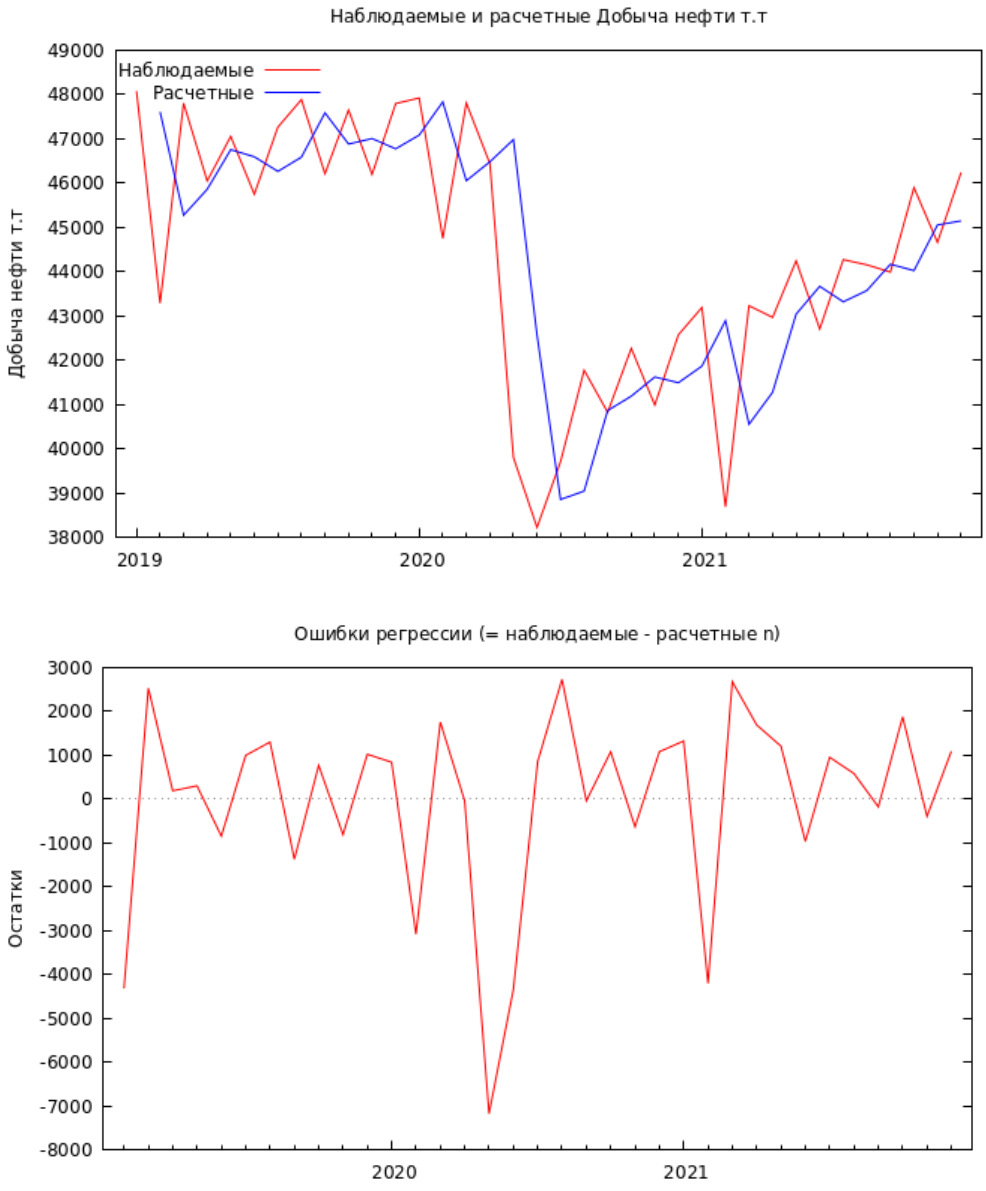
2019:11	46195,2	47005,5	-810,304
2019:12	47795,7	46773,0	1022,73
2020:01	47921,8	47083,2	838,579
2020:02	44750,6	47832,1	-3081,53
2020:03	47808,5	46053,7	1754,78
2020:04	46438,9	46480,4	-41,5007
2020:05	39803,4	46981,0	-7177,61 *
2020:06	38223,1	42569,9	-4346,77
2020:07	39707,9	38854,2	853,686
2020:08	41773,3	39044,3	2729,01
2020:09	40823,5	40864,4	-40,9408
2020:10	42266,0	41188,3	1077,71
2020:11	40987,9	41620,3	-632,359
2020:12	42571,5	41491,4	1080,14
2021:01	43190,0	41866,2	1323,84
2021:02	38688,5	42892,3	-4203,80
2021:03	43230,2	40553,6	2676,63
2021:04	42964,9	41275,3	1689,56
2021:05	44245,0	43040,5	1204,44
2021:06	42703,9	43667,8	-963,987
2021:07	44271,0	43318,4	952,627
2021:08	44153,5	43572,6	580,878
2021:09	43989,0	44166,7	-177,746
2021:10	45897,0	44022,1	1874,93
2021:11	44660,0	45054,6	-394,626
2021:12	46237,6	45146,1	1091,49

Note: * means that the remainder is beyond 2.5 standard errors

Statistics for evaluating the forecast.

Mean error (ME)	-44,991
Root-mean-square error (RMSE)	2173,2
Mean absolute error (MAE)	1578,3
Mean Percentage Error (MPE)	-0,25873
Mean absolute percentage error (MAPE)	3,6832
U-statistics (Theil's U)	0,91552

Figure 9: Fact and calculation for n

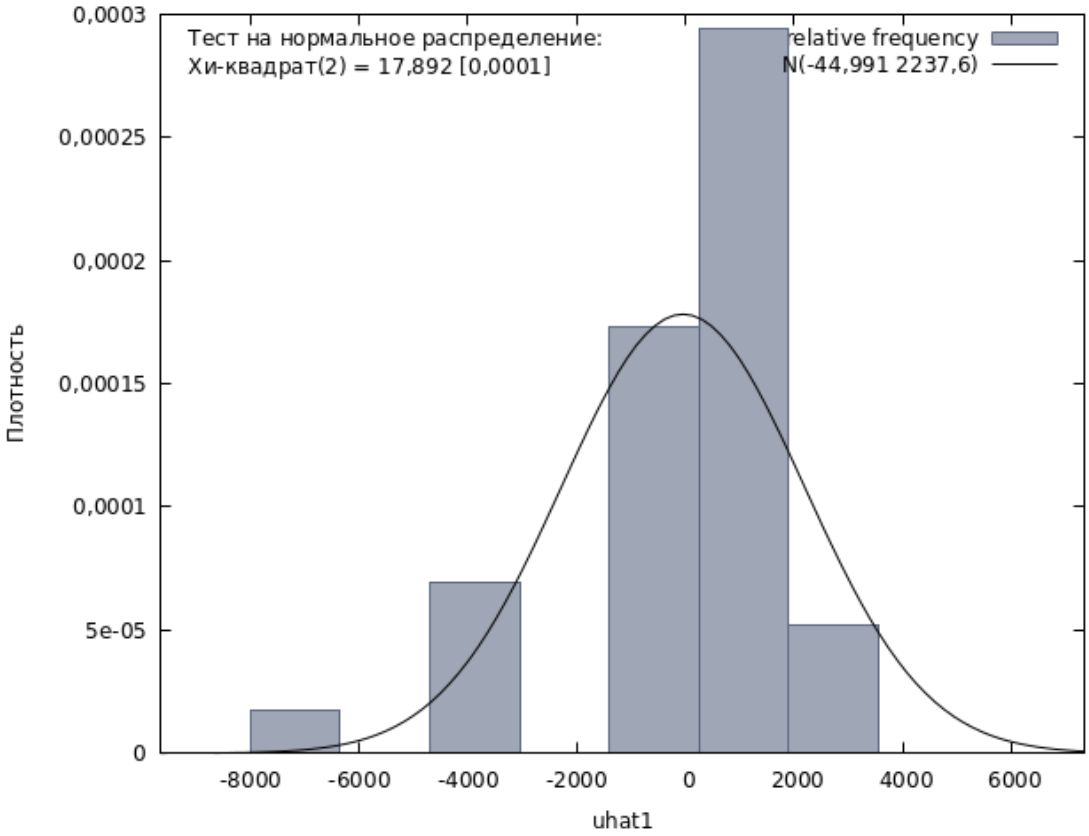


To check the adequacy of the model, it is necessary to make sure that the residuals of the model are close to normal white noise.

H0: The distribution of regression residuals does not differ from normal.

H1: The distribution of regression residuals is different from normal.

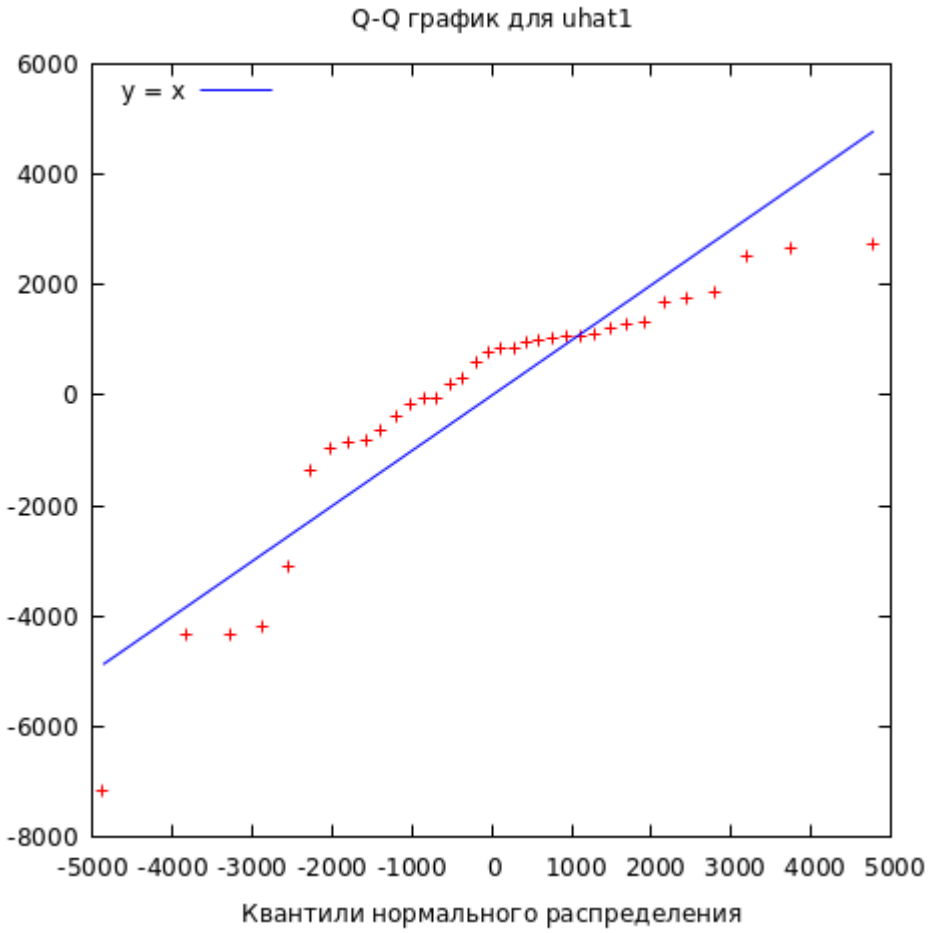
Figure 10: Histogram for residuals of the ARIMA(1,1,0) model



Thus, the observed value of the chi-square statistic was 17.9, the achieved significance level (p-value) = 0.00013, which is much less than the established significance level α = 0.05, so the null hypothesis of the normal distribution of the residuals is rejected.

You can also build a Quantile-Quantile plot for the residuals of Model 1, which allows you to compare the distributions of two random variables. If the random variable under study is normally distributed, then all values on the graph should fall on one line (fitting line). Thus, the less the points on the graph deviate from one straight line, the less the distribution of the random variable differs from the normal one (Figure 11).

Figure 11: Quantile-quantile plot for the residuals of the ARIMA model (1,1,0)

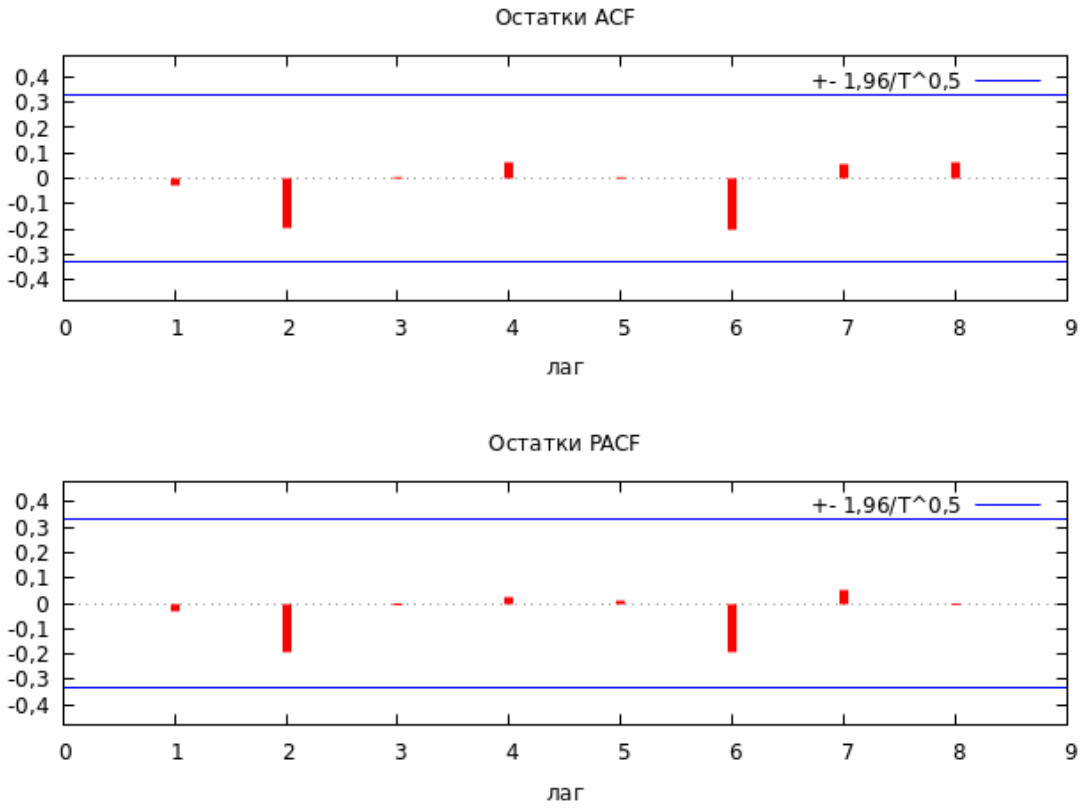


As can be seen from the figure, not all points of the graph are located close enough to the straight line, which indicates the difference between the law of distribution of the residuals of the model from the normal one.

We investigate the uncorrelatedness of the residuals of the model. The absence of outliers (values of sample autocorrelation coefficients and partial autocorrelation coefficients that go beyond the limits of ± 1.96/T^0.5) allows us to consider the residuals as uncorrelated (Figure 4.2.10).

Checks for the absence of the effect of volatility clustering. The statistical value was 3.75, the achieved significance level was 0.88, which is much higher than the established significance level of 0.05, so the null hypothesis of the absence of ARCH effects is not rejected.

Figure 12: Graphs of sample ACF and PACF of the residuals of the ARIMA(1,1,0) model



Thus, the model can be considered sufficiently adequate.

Let us move on to the analysis of the next ARIMA(0,1,1) model.

Model 2: *ARIMA, observations used 2019:02-2021:12 (T = 35)*

Dependent varible: (1-L) n

Standard errors calculated from the Hessian

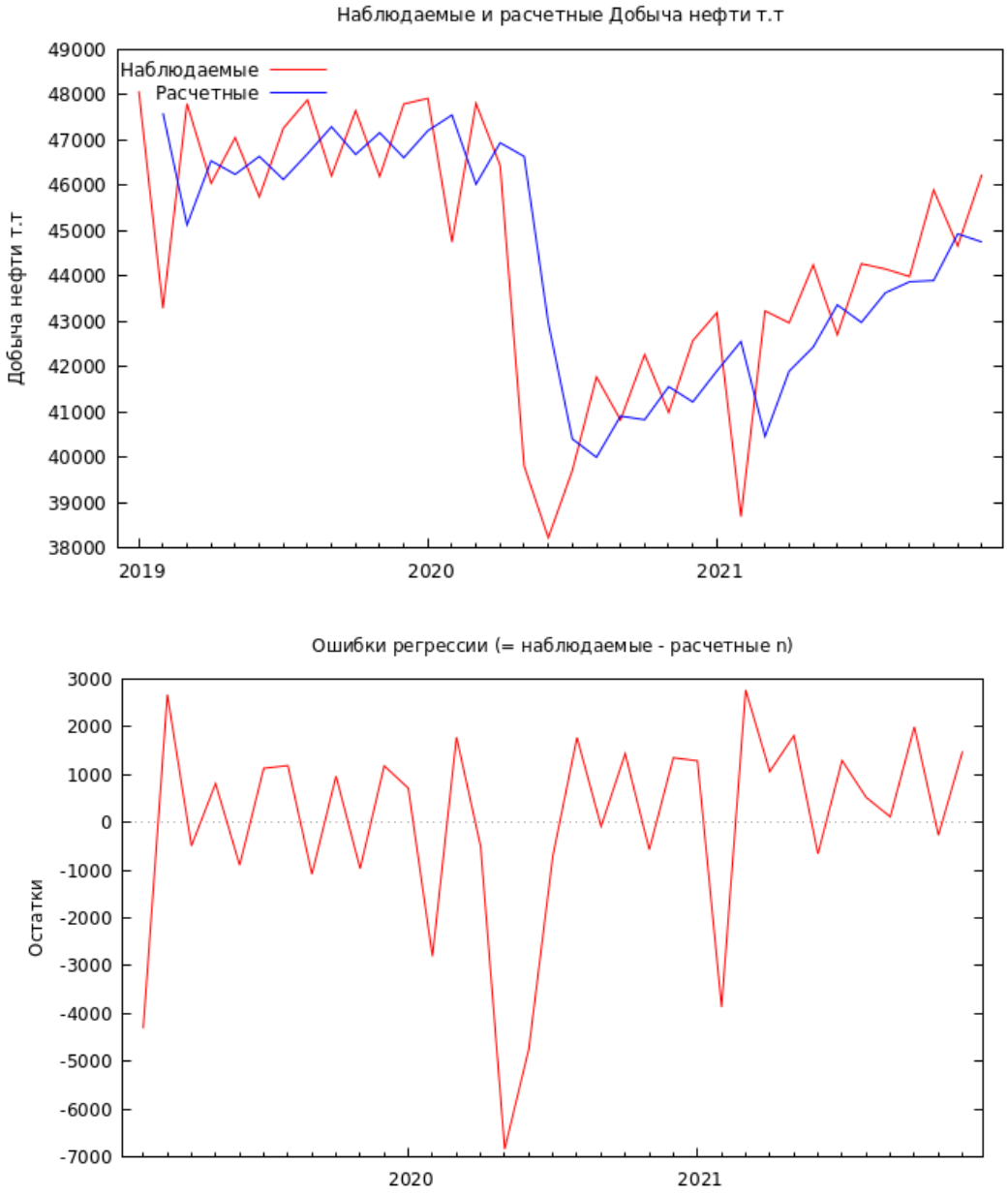
	Coefficient	*Std.error*	*t-ratio*	*P-value*	
const	−35,2358	197,879	−0,1781	0,8587	
theta_1	−0,467604	0,146604	−3,190	0,0014	**
					*

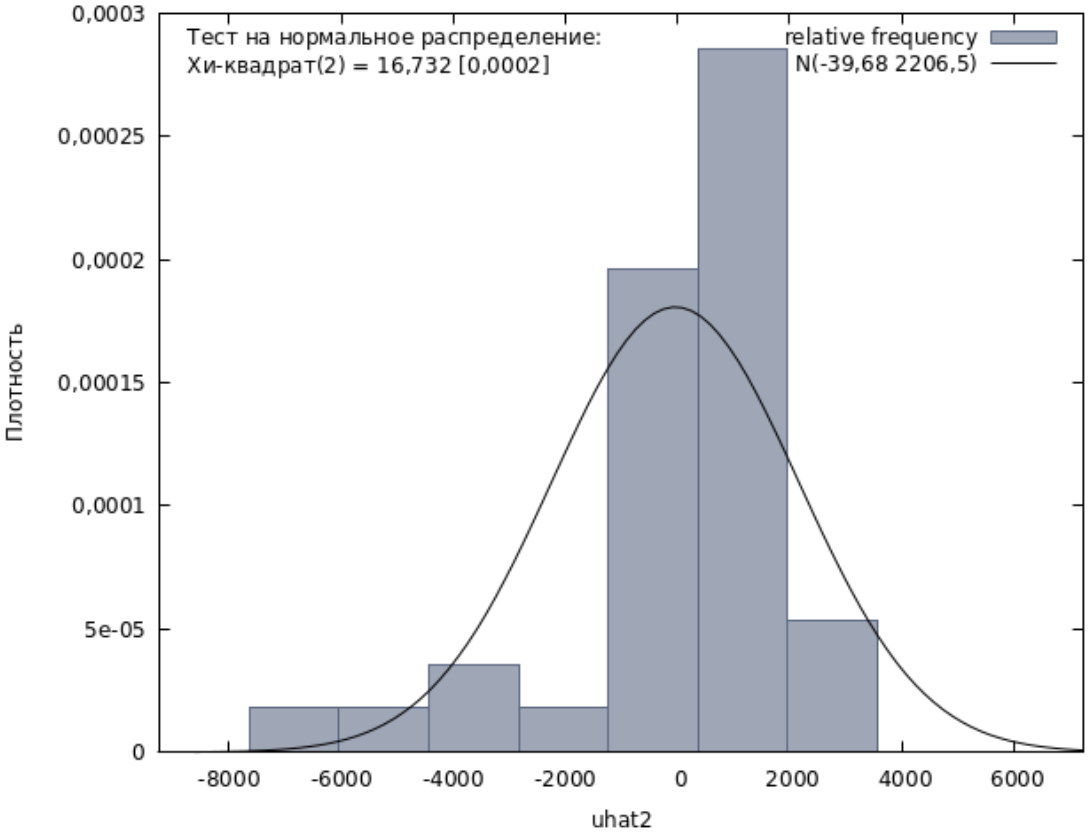
Mean dependent var	−52,58666	S.D. dependent var	2414,325
Sum squared resid	−39,67972	S.E. of regression	2142,906
R-squred	0,447641	Adjusted R-Squared	0,447641
Log-likelihood	−318,2333	Akaike criterion	642,4667
Schwarz criterion	647,1327	Hannan-Quinn	644,0774

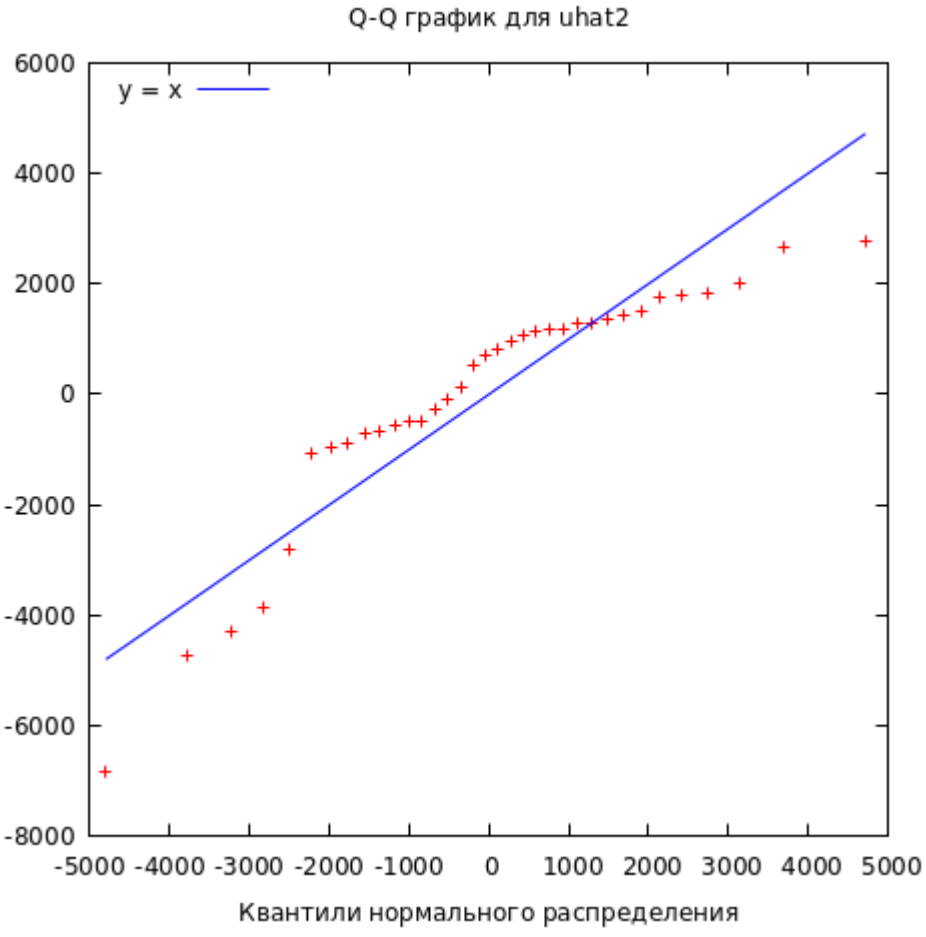
Statistics for evaluating the forecast.

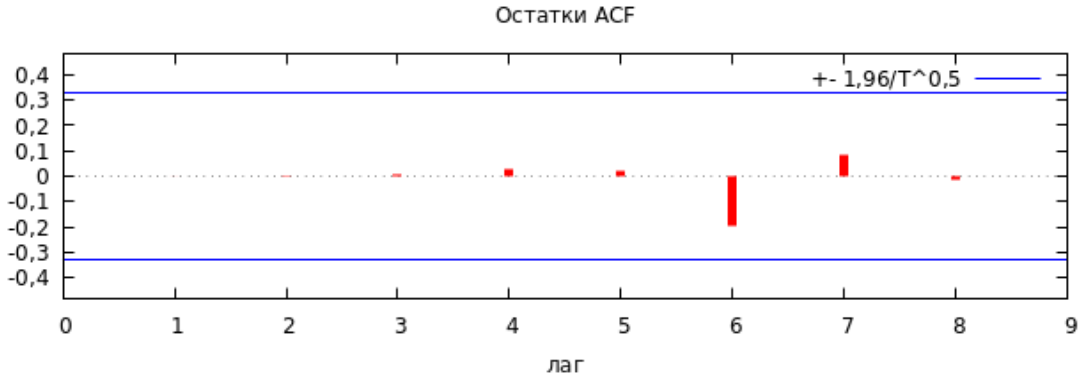
Mean error (ME)	-39,68
Root-mean-square error (RMSE)	2142,9
Mean absolute error (MAE)	1603,7
Mean Percentage Error (MPE)	-0,26135
Mean absolute percentage error (MAPE)	3,7271
U-statistics (Theil's U)	0,90401

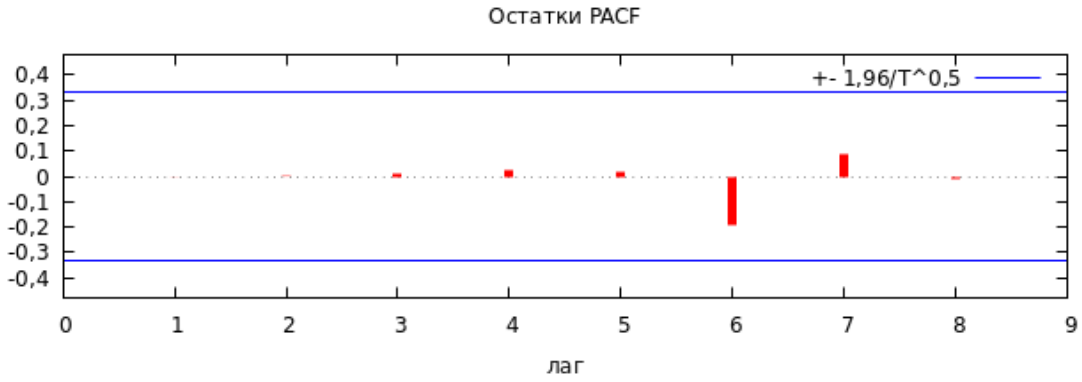
Figure 13: all test plots of model 2




Тест на нормальное распределение:
Хи-квадрат(2) = 16,732 [0,0002]
relative frequency
N(-39,68 2206,5)
Плотность
0,0003
0,00025
0,0002
0,00015
0,0001
5e-05
0
-8000
-6000
-4000
-2000
0
2000
4000
6000
uhat2


Q-Q график для uhat2
y = x
6000
4000
2000
0
-2000
-4000
-6000
-8000
-5000 -4000 -3000 -2000 -1000 0 1000 2000 3000 4000 5000
Квантили нормального распределения





All graphs and tests indicate that this model differs slightly in adequacy from the first model.

ARIMA(1,1,1) model

Model 3: *ARIMA, observations used 2019:02-2021:12 (T = 35)*

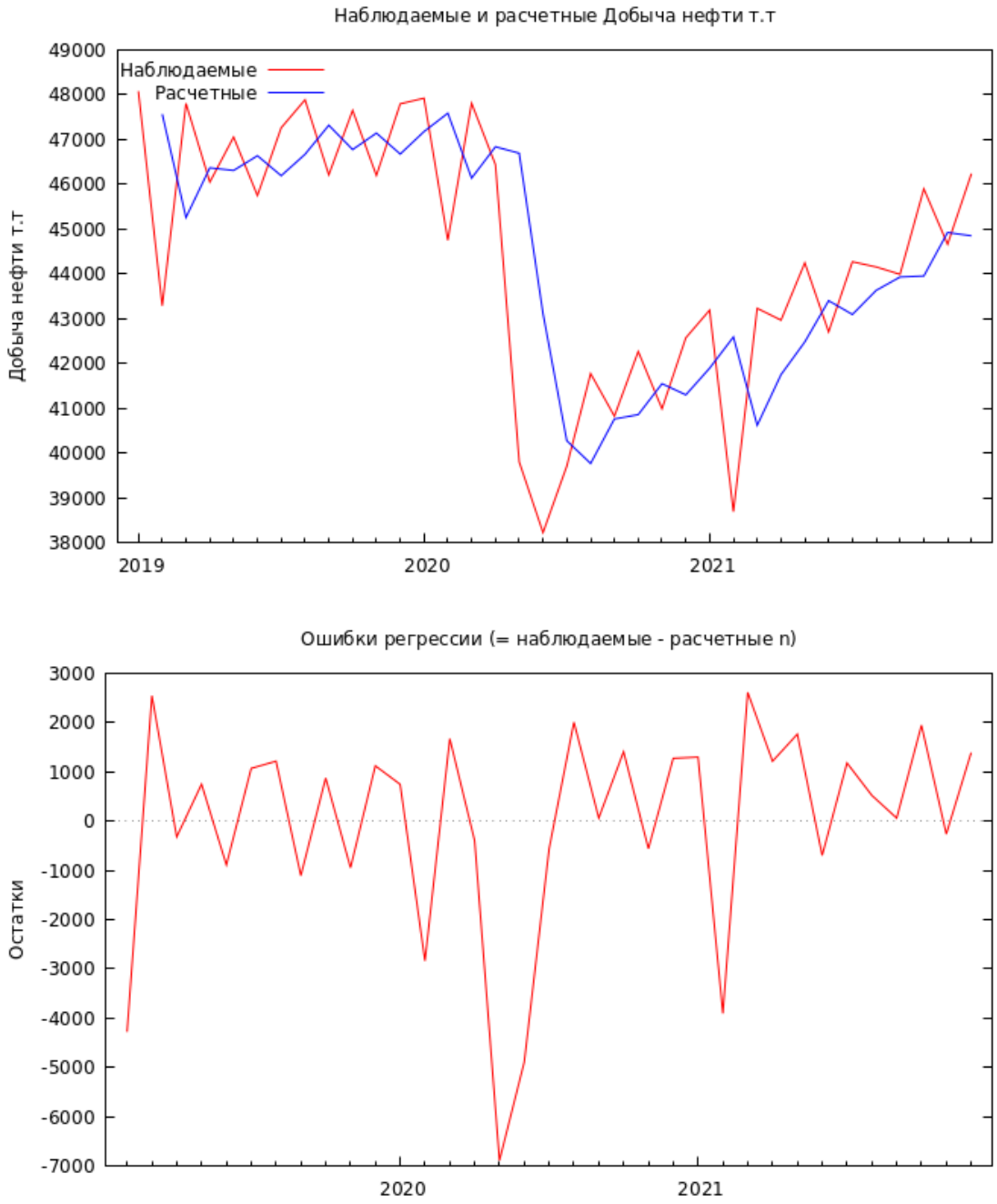
Dependent variable: (1-L) n

Standard errors calculated from the Hessian

	Coeffiient	*Std. error*	*t-ratio*	*P-value*
const	−26,3103	205,058	−0,1283	0,8979
phi_1	−0,0919925	0,376344	−0,2444	0,8069
theta_1	−0,395662	0,341283	−1,159	0,2463

Mean dependent var	−52,58666	S.D. dependent var	2414,325
Sum squared resid	−51,80011	S.E. of regression	2141,037
R-squared	0,450343	Adjusted R-Squared	0,433687
Log-likelihood	−318,2046	Akaike criterion	644,4091
Schwarz criterion	650,6305	Hannan-Quinn	646,5568

Figure 14: all test plots of model 3



And again, even without going too deep into the analysis, it is clear that model 3 is very similar to 1 and 2.

Conclusion: any of the considered 3 ARIMA models can be used to describe and predict oil production.

ARIMA(1,1,0) model for variable g – gas production.

Model 4: *ARIMA, observations used 2020:02-2021:12 (T = 23)*

Dependent variable: (1-L)(1-Ls) g

Standard errors calculated from the Hessian

	Coefficient	*Std.error*	*t-ratio*	*P-value*	
const	71,0810	289,426	0,2456	0,8060	
phi_1	0,0305023	0,205816	0,1482	0,8822	
Phi_1	−0,748310	0,134749	−5,553	<0,0001	***

Mean dependent var	199,1161	S.D. dependent var	2669,922
Sum squared resid	84,17174	S.E. of regression	1749,858
R-squared	0,924281	Adjusted R-Squared	0,920676
Log-likelihood	−209,3092	Akaike criterion	426,6184
Schwarz criterion	431,1603	Hannan-Quinn	427,7606

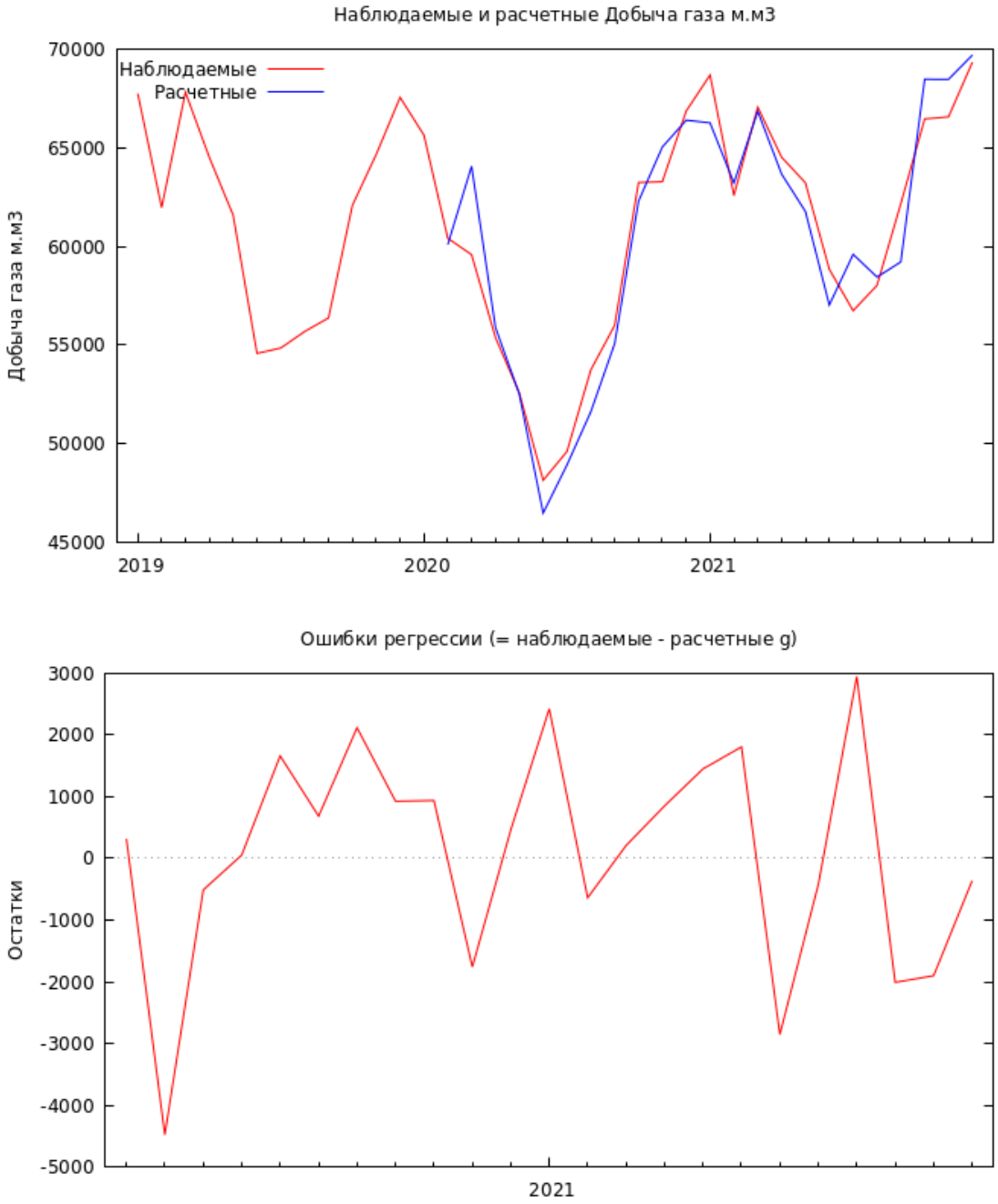
23 observations were used to estimate the forecast

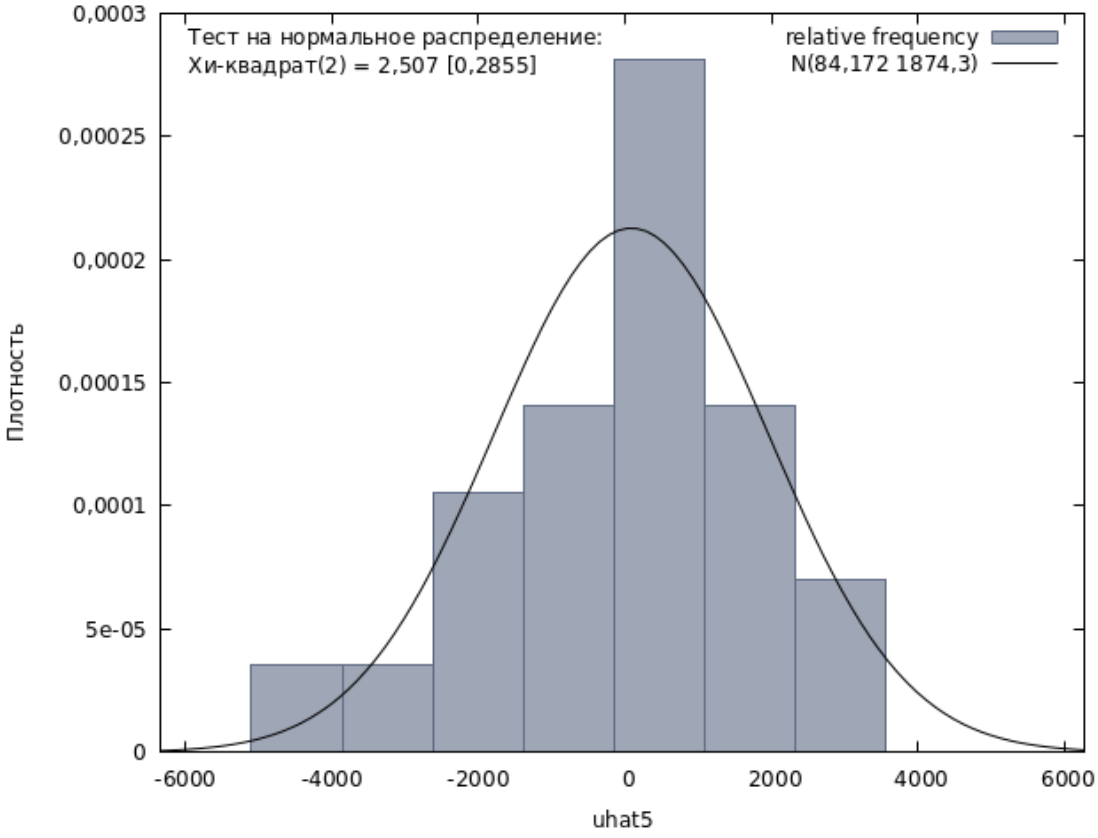
Mean error (ME)	84,172
Root-mean-square error (RMSE)	1749,9
Mean absolute error (MAE)	1382,6
Mean Percentage Error (MPE)	0,17963
Mean absolute percentage error (MAPE)	2,3005
U-statistics (Theil's U)	0,50333

It can be immediately noted that, judging by the R-squared values close to 1, the logical likelihood criteria, Akaike, Schwartz and Hennan-Quinn, as well as statistics for evaluating the forecast, this model describes gas production much more adequately than previous oil production, since in it pronounced seasonality was smoothed out. The price of this greater adequacy was a reduction in the range of calculated values (due to the mechanism of building the model taking into account seasonality), which, however, will not affect the quality of forecasting based on it.

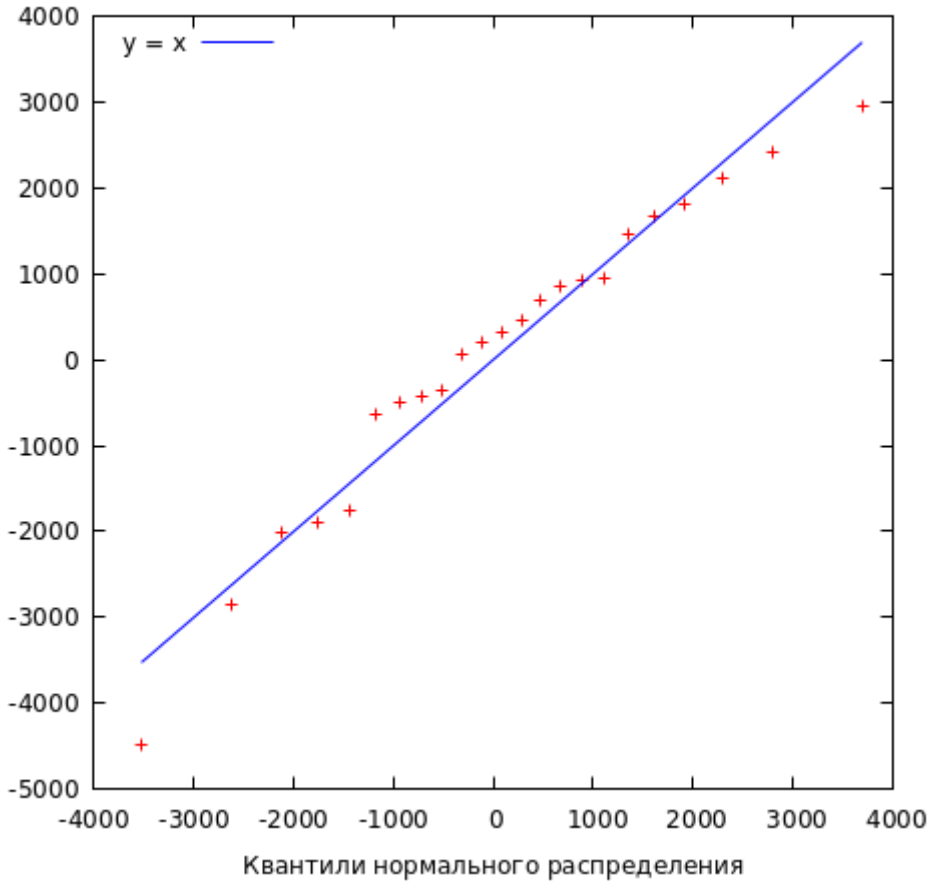
We confirm this statement with the test plots of model 4:

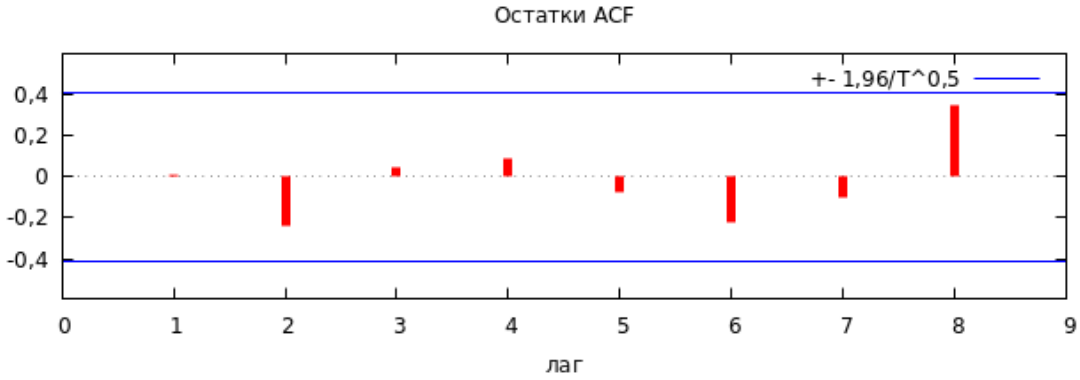
Figure 15: all test plots of model 4

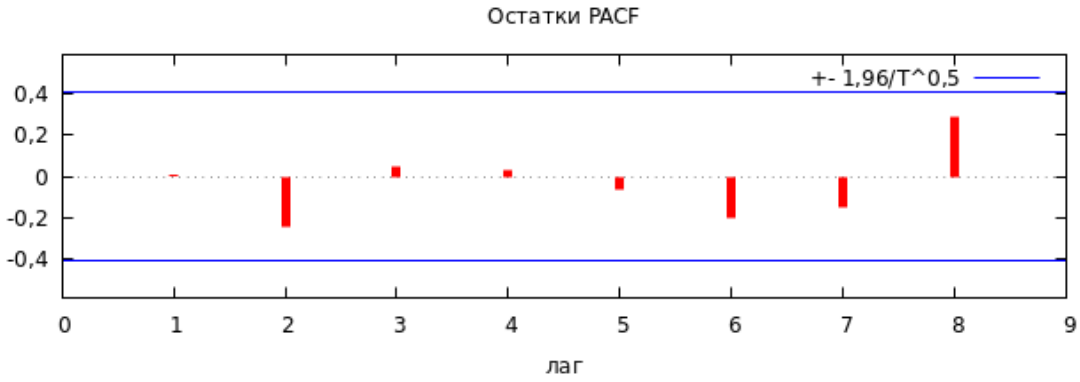




Q-Q график для uhat5







Even without resorting to the values, it is clearly seen from the consideration of the graphs that the model describes the actual values more accurately (this is especially clearly seen in the test graph for the normality of the distribution of residuals and the quantile-quantile graph of residuals).

General conclusion for the section.

Using statistical methods (GRETL statistical package), 3 (approximately equivalent) models were built for the variable n - oil production, which adequately describe the behavior of this variable.

Also, using statistical methods, a model was built for the variable g - gas production, which describes the behavior of this variable much more adequately (compared to other models).

All models are suitable for forecasting at least 3-4 months with a reasonable degree of accuracy.

5. Problems and prospects for the development of the Russian oil and gas industry in the context of Covid-19

In today's environment, it can be said that the coronavirus pandemic has created an unprecedented emergency in terms of both health and economics. Therefore, in the conditions of an unstable economic situation and in connection with the ongoing economic sanctions, the oil and gas industry and the fuel and energy complex of Russia are in a state where it is important to correctly set and solve problems, as well as quickly adjust the country's energy development strategy, which are the government's top priorities.

The fuel and energy complex is the largest customer of goods, services and high technologies, a driver of innovation; it provides about 33% of investments (about 5 trillion rubles per year). Oil and gas companies must optimize existing business processes, including managing costs, investment and innovation risks. As a result, the identification of current problems and adjustment in accordance with the directions of the strategic development of companies, taking into account a wide range of risk factors, seem to be especially relevant. Organizing the work of these authors, it is necessary to highlight the main problems of the development of the fuel and energy complex of Russia. [8]

1. High energy intensity of GDP, mainly due to the cold climate and vast territory. Due to the location of a large number of energy companies in a cold climate zone that requires more fuel consumption, significant energy efficiency is required to overcome climatic conditions. Territory is the most important feature of Russia, which means that, given the low population density in the center of the country, it is necessary to build long power lines and ensure the transport of energy to the required destinations.

2. Lagging behind the leading countries in the development of mining. This problem is associated with a low availability of high-tech equipment and high wear and tear of existing equipment (from 40 to 80% in the oil and gas industry), which affects the level of production of the necessary energy resources, especially in low-temperature climatic conditions. Due to the orientation of Russian enterprises of the fuel and energy complex towards the import of equipment, the country is underdeveloped in mechanical engineering and in the supply of Russian equipment to companies in the industry. Since the provision of imported high-quality equipment is expensive, enterprises try to use the available equipment as much as possible and for the maximum period. As a result, the risk of

accidents increases, which can lead to massive damage to people and the environment. Obsolescence also affects equipment that consumes more energy than new and high tech equipment. [13]

3. Backlog in the use of production capacities of the fuel and energy complex due to poor scientific and technical support. In the context of continued focus on imported equipment, the limitation of its supplies due to Western sanctions has led to additional difficulties and increased costs for supplying the fuel and energy complex with new equipment.

4. Providing the necessary energy resources to all regions of the country. The large area of the country and low population density creates difficulties in providing the necessary energy resources to all regions, which leads to insufficient development of settlements and the country in whole.

5. Weak development of the scientific sphere. The low interest and investments of enterprises in Russian developments, the development of innovative technologies lead to the stagnation of the scientific sphere. As a result, the weak interest of scientists in the study and development of new technologies due to low funding for development leads to the fact that fuel and energy companies are forced to import and turn to Western technologies. These problems are interrelated, which complicates their solution even in the medium term. A new problem facing global enterprises in the fuel and energy complex is the development of the coronavirus pandemic in 2020-2021. Companies and enterprises had to reorganize within a few months, given the unstable situation. Restrictions in movement have led to a sharp decrease in energy and fuel consumption. In order to prevent the depreciation of oil products and technical gas, the OPEC+ member countries adopted an agreement on April 12, 2020 to reduce oil production by 9.7 barrels per day from 05/01/2020. Accordingly, Russian fuel and energy companies had to urgently reduce production, which, in conditions of continuous production and exposure to harsh low-temperature conditions, threatened to completely stop production. The prospects for further development of many oil and gas fields are also diminishing. It is important to note that, along with the above problems, the pandemic is exacerbating the situation with the development of innovative technologies in the fuel and energy complex. The forced decrease in the level of production and sale of petroleum products leads to a decrease in the revenue of enterprises and, as a result, a decrease in the volume of investments in innovative products of the industry. It is worth considering in more detail the prospects for the development of Russian fuel and energy companies in the current and potential

conditions. A number of authors noted the presence of promising opportunities for "digitalization" and technologies such as digital twins and modeling of oil and gas production facilities, laser scanning and the use of artificial intelligence and drones to control the progress of construction. [32]

It is also worth considering the use of 3D modeling in seismic exploration and identification of the geological structure of developed areas, development of hard-to-recover oil reserves, improvement of processing and utilization up to 100% of associated petroleum gases. However, given the current socio-economic difficulties, many energy companies find it difficult to rapidly implement these technology leap proposals. Considering the prospects for the development of the fuel and energy complex of Russia in the short and medium term, it is also worth noting the studies of T.V. Britva, which can be used to form the following recommendations for the development of the fuel and energy complex:

1) reducing the energy intensity of GDP through the construction and technical re-equipment of oil pipeline transport and power lines;

2) increasing competitiveness by increasing the production of energy resources;

3) replacement, technical re-equipment and modernization of equipment at enterprises;

4) compliance with environmental requirements and the introduction of technical means designed to prevent environmental disasters, the development of scientific research and innovation;

5) improving the design of existing and new Russian innovative technology in order to reduce dependence on imports;

6) maintaining a balance in the implementation of the agreement of the OPEC + member countries between maintaining the viability of deposits in hard-to-reach places and reducing the level of oil production in order to prevent the depreciation of oil products on the market due to a decrease in their consumption. Among the fundamental drivers of the restructuring of the world oil market, one can single out the desire of holders of oil reserves for rapid monetization, a steady stream of technological innovations and the displacement of oil from consumption in economically developed and developing countries as a result of an active “climate agenda”.

In this regard, the risk of a future peak in oil demand and changes in demand in quasi-market economies can be considered as elements of a new paradigm for the development of the world oil market. The development strategy of the Russian oil and gas sector should

take into account the factor of the growing global energy transition, the essence of which is to transform the energy system through the formation of a clean, decentralized and digital energy of the future. The energy transition is driven by regulatory trends and the “climate agenda”, the active social status of consumers, which has been further strengthened during the pandemic, as well as technological innovations that reduce the cost of not only electricity, but also develop new types of business for consumers.

The global energy transition has three main aspects.

1. Decarbonization. As of February 2020, 189 states have signed the Paris Agreement, which aims to keep the average temperature below 2°C, and ideally - 1.5°C, increase adaptive capacity to the effects of climate change and ensure low-carbon development. The parties to the Agreement have voluntarily set targets for net decarbonization: as of September 2019, sixty-five countries and the EU have declared their intention to become carbon neutral by 2050. Many of them already have or plan to introduce CO2 emissions trading schemes in the near future or other forms of "carbon taxes". More than seventy percent of investors today systematically assess the sustainability aspects of companies, and for many of them, decarbonization can be a decisive factor in their investment decisions. Decarbonization is also a problem for Russia: average annual temperatures in Russia are rising about two and a half times faster than the global average. This leads to an increase in the number of forest fires, desertification, pests and floods. Russia is one of the six regions in the world that account for more than 60% of global greenhouse gas emissions.

2. Decentralization. The global market for distributed energy technologies (small distributed generation, demand management, energy storage systems, energy efficiency, etc.) is growing at 7.5% per year. It is expected that by 2025 the commissioning of distributed generating capacities will be three times more than centralized ones. According to IEA estimates, by 2030 distributed energy will account for up to 75% of new connections to the global power grid. The mass adoption of electric vehicles predicted by Ernst & Young between 2027 and 2030 immediately, when the electric motor equals the price and performance of the internal combustion engine, will lead to increased energy consumption and make the overall energy system much more decentralized and complex than at present, changing the normal load profile. The development of microgrids makes it possible to install autonomous energy-consuming devices that are not connected to the central network. Russia is also actively developing electricity transmission and similar

processes. However, according to various forecasts, distributed generation can cover more than half of Russia's needs for new generating capacities - 54-66 GW - by 2035. Consumer self-sufficiency is about 13 GW, demand management - up to 4 GW, energy efficiency - up to 1.5 GW, and renewable microgeneration - up to 0.6 GW. [35]

3. Digitalization. The rapid growth of predominantly digital technology, fueled in part by the pandemic, is fundamentally changing the business model of players in the energy sector. Predictive analytics are used in manufacturing to optimize the management of assets throughout their lifecycle: This increases operational flexibility and extends maintenance intervals. Technologies are being developed to manage the life cycle of digital assets: Technologies for optimizing operating modes and loads, as well as creating virtual assets. The role of transmission networks as asset and infrastructure managers is complemented by managing complex assets and smart digital systems, as well as balancing different resources and needs, and storing energy. The business model of the distribution network will also change significantly - it will turn into an ecosystem of producers, suppliers and suppliers of electricity, requiring greater flexibility through digitalization, cybersecurity and the development of digital markets for energy products and services. Ultimately, distribution will become a platform where consumers receive energy and value-added services (“connected home”, energy management, appliances and installations), while consumption control and metering (“smart meters”) and digital interaction with customers (collection and analysis systems customer data, online services) will be automated using third-party technology partners outside the energy sector. For Russian energy companies, "digitization" is also a win-win option, as they can increase their efficiency and create new sources of income through the sale of digital products (services). [4]

The development of smart accounting systems, which will reach 75% by 2030 in many regions, predictive analytics and artificial intelligence to increase reliability and reduce costs, the Internet of things and cloud computing are not only a new step towards increasing efficiency, but also a barrier to entry of new players in the energy market and the possibility of creating a potential consumer-driven digital ecosystem. This new environment places new demands on reservoir development, which in turn increases the need for high-tech equipment, software, and process systems to enable efficient development in complex geological and/or geographic conditions. In this context, continuous import substitution of foreign technologies has become an important tool. The

volume of the Russian oil and gas engineering market in 2019 is 497 billion rubles, imports accounted for 45% of the consumption of finished products and technologies. Nevertheless, the active work of the Russian government together with the industry contributed to the development of new high-tech solutions for the industry. Since 2014, more than 640 billion rubles have been invested in import substitution projects, of which 20 billion rubles have been invested in Russian fuel and energy projects.

6. Conclusion

Research findings:

To ensure the sustainability of domestic enterprises in the financial plan of the energy complex in a pandemic, it is advisable to apply anti-crisis financial management measures. The main task of the anti-crisis financial management system is to analyze the probability of insolvency (bankruptcy) of enterprises and develop measures to reduce the risk of bankruptcy and restore the solvency and financial stability of enterprises.

The main guideline for Russian companies in the fuel and energy sector is to increase technological efficiency through a qualitative change in the business model in terms of innovation. This may include

Improvement of operations:

1. innovation management to make the process of assessing innovation needs at all levels more efficient and to set research objectives aligned with the overall strategy of the company,

2. researching technologies with different levels of maturity to solve business problems,

Creating an environment conducive to innovation by changing the internal culture of the company (preparing for growth and innovation at all levels),

1. Aggregates of continuous search for appropriate technologies to solve business problems,

2. Targeted engagement with accelerators and incubators,

Creation of test centers for innovative technologies in the core business, so that they can be replicated in the company and commercialized outside of it.

Technological development in the oil and gas industry should be carried out on a systematic basis to achieve the goals set in the Energy Strategy of Russia until 2035. The

state will invest significant resources in quality control, compliance monitoring and acceptance of state-supported fuels and energy products. Given that the oil and gas industry is a high-tech industry, it is necessary to strengthen state control over the acceptance of products from this complex.

Regional scientific and technical councils for the development of industrial production for the needs of the fuel and energy complex (an advisory body established in the constituent entities of the Russian Federation) can become an important tool for consolidating efforts to address the priority tasks of the technological development of the oil and gas industry. Due to the gradual depletion of the resources of traditional oil and gas fields, there is a need to explore and develop hydrocarbons in hard-to-recover fields and in new geographical areas, including the Arctic shelf, which in turn requires the development of new production technologies.

5. One of the main aspects of the value-based management approach in the oil and gas industry is to improve operational performance, namely efficiency, through the effective optimization of corporate financial management and short-term and long-term strategic planning. Given the current economic environment, it appears that particular attention needs to be paid to the balance between capital expenditure cuts and future benefits from investment projects and business development programs. Increasing the value of the company should be a strategic goal. To achieve this goal, it is possible to develop and implement a "medium-term value creation plan" as an integral part of the existing strategic and financial management system. This plan should include objectives and measures to improve the efficiency of operating and investing activities, both under the control of management and dependent on external factors. It is also advisable to identify the key areas of activity of the fuel and energy company, which will contribute to greater openness and direct transparency for market members and reduce the gap directly between the fundamental and also the market value.

A value-driven approach to corporate governance ensures that management processes, systems and decisions are focused on maximizing value while providing operational confidence to balance the company's key strategic objectives. The cost management approach is not a result, but a process of continuous improvement that allows a company to effectively maximize key value points.

The epidemic is having a negative impact on the Russian economy, which has affected the financial stability of the country's oil and energy companies at the micro level. To ensure

the financial stability and stability of enterprises, it is necessary to improve financial management and corporate governance by increasing the equity ratio, paying off debts on time and reducing receivables. These measures reduce the risk of business failure and optimize capital management by reducing financial and reputational risks. It is necessary to modernize the energy and energy complex and invest in new Russian scientific achievements and technological innovations in order to reduce dependence on imports and significantly reduce transportation costs. In today's increasingly competitive economic environment, a company can only function effectively if it develops a comprehensive investment strategy to improve its competitiveness. Such a strategy is aimed at improving management efficiency in order to allow the company to emerge from the crisis and ensure profitability, modernize assets, create a common basis for asset management directly and reduce various dangers, namely risks, and attract capital investment.

Research findings.

1) Despite the fact that the oil and energy complex plays a crucial role in the structure of the Russian economic activity (economy), including the federal budget, it is necessary to solve a number of important unresolved problems as soon as possible. In particular, it is important to understand that the fuel and energy companies themselves do not focus enough attention on optimization, improvement (modernization) and formation, preferring to effectively support the assets that already exist and those that are not used.

2) The emerging coronavirus pandemic and also the end result of OPEC+ will complicate this development by lowering the corresponding revenues. It is known that organizations of the fuel and energy complex are struggling to maintain the necessary pre-crisis level of activity and entrepreneurial activity (business). The coronavirus pandemic may force many companies to directly review all of their formation and development strategies in order to effectively increase global competitiveness.

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8. Appendix

South Tanbey LNG – the biggest LNG plant up the Arctic circle / Summer – Polar Day

LNG Cisterns of South Tambey / Yamal LNG Plant

South Tanbey LNG – the biggest LNG plant up the Arctic circle / Polar Night. The red color of the sky is because of HP Flare (750 – 800 Celsius)