

# Determination of Influence of the oil production factor on the Russian economy

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**Abstract.** Macroeconomic indicators characterizing the development of Russia has been analyzed during the study. The position of the Russian Federation in the world arena on the indicators of oil production and export has also been determined. The article describes the results of statistical analysis and forecasting of the oil market of the Russian Federation. An analysis of the dependence of monetary aggregates on factors of oil production, export and the price of oil has been conducted using three-factor model. A close relationship between the factors of oil and monetary aggregates has been revealed. The obtained results of the study are of interest for forecasting the economic state of the country and monitoring oil production volumes.

## 1 Introduction

At a present time of economic instability and political difficulties in the world, it is necessary to conduct a study of the most important macroeconomic indicators of the development of our state and some developed foreign countries. The main purpose of such study is to identify effective methods of overcoming the crisis.

The most important macroeconomic indicators used for comparison are the oil production and the money supply in the state. The circulation of money in absolutely any state develops in accordance with its historical economic internal and external factors.

Internal factors include monetary policy at each specific stage of development, as well as the development of goods and services in the market.

External factors include participation of states in military activities, the number of monetary relations with other countries, the level of development of trade relations.

The conditions of the Russian economy, both external and internal, are subject to constant changes and are extremely unstable.

### 1.1 Relevance

The situation in the national economy of any state is determined by a set of specific macroeconomic parameters. Each of these parameters characterizes the economic situation of the country in its own way. The main macroeconomic indicators of the country's socio-economic development include gross domestic product, gross national product, national

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income, inflation index, unemployment rate, external and domestic public debt, foreign investment and other.

The study of the main macroeconomic indicators allows to evaluate the main processes that occur in the socio-economic life of any country. Understanding the obtained macroeconomic results, which reflect the trend and dynamics of functioning of the economic system, contribute to more efficient and reasonable decision-making, improve planning and forecasting of economic development.

The purpose of the study is to identify the main possible conditions for the dependence of the Russian economy on its natural wealth factors, i.e. the dependence of the availability of money supply on oil production.

## **1.2 Literature Review**

The number of studies of Russian and foreign scientists and specialists is devoted to substantiating the optimal methods for monitoring the development of oil fields, for example, the works of M.M. Ivanova, L.F. Demytyev, I.P. Cholovsky, I.T. Mishchenko. The ways of using graphical methods are described in detail (construction and analysis of graphs and development maps). Hydrodynamic research is examined in detail in the works of D. Bourdet, R.N. Horne, A.P. Telkov, M.L. Karnaukhov, V.A. Iktisanov, R.G. Shagiev, S.N. Buzinov, I.D. Umrikhin, A.I. Ipatov, M.I. Kremenetsky and others.

However, the known approaches have a number of disadvantages, which include the narrow focus of the tasks being solved, the lack of consideration of the complex multi-factor influence of geological and technological indicators on the peculiarities of the implementation of economic processes.

## **1.3 Problem Statement**

Analysis of scientific papers has shown that the main problems in terms of substantiating the interdependence of the geological and economic indicators of the state have not been solved. In this regard, the use of multivariable statistical modelling is relevant, which makes it possible to consider the factor of influence of the oil production indicator on the money supply in the state.

## **1.4 Aim, Objectives, and Hypothesis of the Study**

The purpose of the study is to identify the main possible conditions of dependence of the Russian economy on factors of its natural wealth, i.e. dependence of the availability of money supply on oil production.

The objectives of the study are:

- to analyze the state of Russia's macroeconomic situation in dynamics;
- to identify factors determining the interdependence of geological and economic indicators;
- to build a multivariable regression and justify its reliability.

The hypothesis can be formulated as follows. Based on the results of multiple regression, it is possible to estimate the degree of each factor and its relationship in combination with factors of different composition.

## 2 Methods

Materials from various sources relevant to the topic have been selected with a view to writing this paper. On the basis of these, an analysis of the problem has been carried out, ways of solving it have been identified and conclusions have been drawn. Empirical-theoretical research methods have been used, in particular the method of analysis, the method of analogy, the method of comparison and induction. I. Based on the data obtained, problems have been identified and analyzed, solutions have been identified and conclusions have been drawn.

## 3 Results

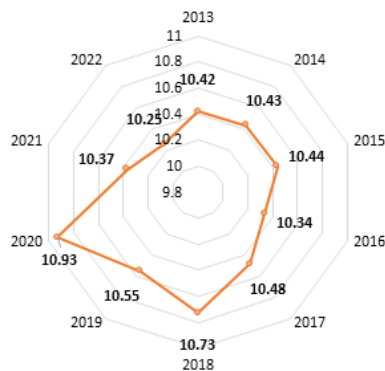
The study of macroeconomic indicators of the countries of the world acquires relevance and requires further study in connection with the rapidly changing operating environment, that is, the change of internal and external factors affecting the dynamics of economic development.

The actions associated with the stabilization of monetary circulation, as well as the containment of the monetary system, have their own peculiarities. One of the main characteristics of Russia's macroeconomic development is the availability of oil reserves, as well as oil production and export. Russia is among the five richest countries in the world in terms of oil production (Table 1) [1].

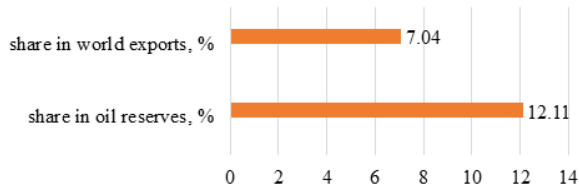
**Table 1.** List of countries by oil production in million tons according to “Statistical Review of World Energy 2022”.

No.	Country	2018	2019	2020	2021	2022	as a % of world reserves
1	USA	743.2	747.8	712.7	711.1	712.2	17.1
2	Russia	555.8	560.0	512.7	524.7	535.0	12.6
3	Saudi Arabia	553.1	556.6	519.6	515.0	517.3	12.5
4	Canada	259.6	263.5	252.2	267.1	269.7	6.1
5	Iraq	231.5	234.2	202.0	200.8	204.9	4.3

The Russian Federation is considered the richest country in terms of reserves not only of “black gold”, but also of other minerals. Oil is produced not only for export, but also for the production of fuel material. The total volume of its proven reserves amounts to more than 14 billion tons. More than 10 million barrels per day are extracted from fields every day, and this volume is constantly increasing (Figure 1). More than 12% of the world's total oil production comes from Russia (Figure 2).



**Fig. 1.** Dynamics of oil production in Russia in 2012-2022, million barrels per day [2].



**Fig. 2.** Russia's share in world oil exports and reserves as of 01.01.2023.

Therefore, a complex and balanced assessment of a comprehensive analysis of Russia's macroeconomic indicators will make it possible to find solutions for the recovery of its economy from the unstable state and to improve the socio-economic situation.

It is advisable to consider Russia's share in world exports (Figure 1), oil production (Figure 2) and its price (Figure 3) in the study to further determine the welfare of the state from the macroeconomic factors of the country's development.



**Fig. 3.** Dynamics of oil prices on the stock exchange (USD/bbl) [3].

The main indicators of the current state of Russia's economic development are clearly presented in Table 2 [4].

**Table 2.** Main economic indicators of Russia for 2015-2022.

Indicator	2015	2016	2017	2018	2019	2020	2021	2022
Population, (million)	146.27	146.55	146.80	146.88	146.78	146.75	146.17	146.42
GDP per capita, (USD)	6 844.00	11 039.00	11 099.00	11 441.00	11 729.00	11 931.00	10 216.00	11 273.00
BBII, (billion USD)	1 331.00	1 283.00	1 578.00	1 658.00	1 750.00	1 907.00	1 760.00	1 814.00
GDP, (billion USD)	5.2	5.8	5.3	5.1	4.8	4.5	4.29	3.79
Unemployment rate, (%)	15.9	10.7	5.50	1.90	4.60	4.9	8.39	11.94
Consumer Price Index	507.0	515.0	541.0	552.0	587.0	595.0	674.0	235.0

(CPI), (p.)								
Trade balance, (billion USD)	9.6	9.1	9.1	11.52	19.70	12.27	21.06	21.17
Export, (billion USD)	341.4	281.7	353.1	443.1	418.8	416.2	491.6	591.5
Import, (billion USD)	193.0	191.5	238.4	248.7	254.1	251.7	296.0	259
Corruption index, (p.)	29.0	29.0	29.0	28.0	28.0	28.0	29.0	28.0
Industrial production, (%)	-3.7	-4.5	3.20	-1.5	2.0	17.70	9.6	9.0
Oil production, (BBL/D/1K)	10 342.00	10 485.00	10 733.00	10 550.00	10 931.00	10 871.00	10 377.00	10 252.00

Table 2 shows that in recent years the Russian economy is not developing at the pace that would have ensured its stability:

1. Population in the period under review (from 2015 to 2022) in Russia increased slightly (0.1%).

2. GDP per capita in Russia is growing steadily. GDP per capita from 2015 (6,844.00 USD) to 2020 (11,931.00 USD) increased by 174%, and in 2021 and 2022 there is a slight decline.

3. Accordingly, there is a stable growth of the country's GDP from 2015 to 2020 (approximately 43%) and some decline over the past two years.

4. There is a noticeable decline in the unemployment rate by 1.4%.

5. Inflation rate in Russia has non-linear characteristics, for 2021-2022 there is a significant increase compared to previous periods.

6. Trade balance in Russia is relatively stable, in 2015 it was 9.6 billion USD, and in 2020 it was 12.27 billion USD. However, in 2016 and 2017 it fell to 9.1 billion USD, and in 2019 it reached 19.7 billion USD. The decline in the trade balance in 2020 is due to the global COVID-19 pandemic. Rapid growth is observed during 2021-2022.

7. Exports and imports over the period under review are relatively stable and moderate growth, only in 2022 there is a slight decrease in imports to Russia.

8. Corruption index throughout the period is kept at 28-29 points.

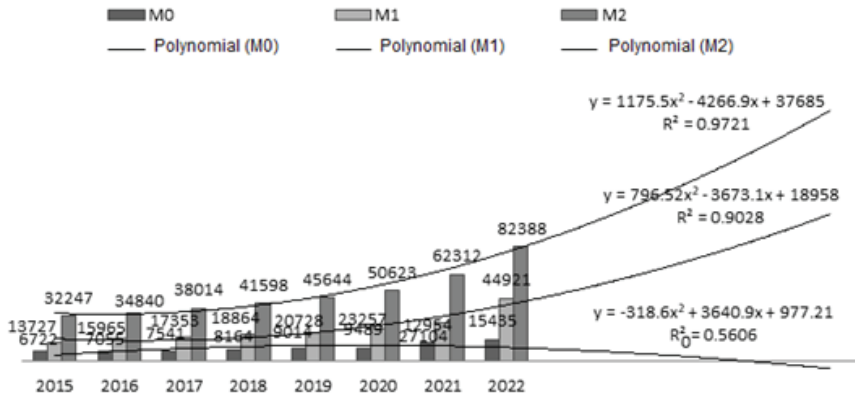
9. Indicator of industrial production in Russia has a positive trend, from 2015 (-3.7%) to 2020 (17.7%), and today it has decreased to 9.0%.

The stability of the economy is ensured primarily by the financial sphere, in particular, by monetary circulation and credit activity. Cash flows permeate all industries, the non-production segment, foreign economic relations, in the form of cash outside the banking system, in the form of transferable and other deposits. Having considered the main economic indicators of Russia, it is advisable to analyze, evaluate and identify the trend of monetary aggregates in the dynamics (Table 3), which are a tool for influencing inflation, and to a large extent, they are the result of changes in the operating conditions of the state.

**Table 3.** Monetary aggregates M0, M1, M2 of Russia for 2015-2022, billion rubles.

Monetary aggregates	2015	2016	2017	2018	2019	2020	2021	2022
M0	6722	7055	7541	8164	9014	9489	12954	15435
M1	13727	15965	17353	18864	20728	23257	27104	44921
M2	32247	34840	38014	41598	45644	50623	62312	82388

To do this, it is necessary to analyze how oil production affects the monetary aggregate M2 by constructing graphs of polynomial dependence for the period from 2015 to 2022 (Figure 4).



**Fig. 4.** Monetary aggregates M0, M1, M2 of Russia for 2015-2022, billion rubles.

The studied monetary aggregates have a polynomial dependence with a very high degree of data reliability, as evidenced by the results of  $R^2$ . Polynomial dependence of monetary aggregates in Russia shows a steady trend of growth, which is a negative phenomenon and entails an increase in the corruption index. The polynomial nature of the dependence of monetary aggregates on oil production represents a more natural form of general models of country development in the world.

It is possible to stabilize the level of macroeconomic development in Russia under certain conditions. Money from the sale of oil should not be invested in the business of foreign countries and not abused by fraud but should be developed to develop one's own country and the citizens living in it.

According to the World Bank, macroeconomic factors of the country's development are share in world exports, oil production and its price. These set of factors characterize Russia's position in the global space, which is in a difficult situation.

The authors propose that the dynamics of oil production in Russia should be considered as a factor determining the development of the country's economy adjacent to monetary aggregates. This study was based on the so-called hierarchy analysis method, which is the mathematical tool for a systematic approach to decision-making in complex situations. The objective of the study is to build a hierarchy of factors influencing the financial condition of the state. The authors propose a system of variables for inclusion in multivariate regression models (Table 4).

**Table 4.** Data for regression analysis of factors affecting the financial condition of Russia for 2015-2022.

Time period	Variables			
	M2	Oil production, million tons	Oil export, million tons	Oil price, USD/bbl
	Y	X1	X2	X3
1	2	3	4	5
01.01.2016	32247	534.1	244.5	30.8
01.01.2017	34840	547.5	254.9	55.98
01.01.2018	38014	546.8	252.8	68.77
01.01.2019	41598	555.18	260.6	57.8
01.01.2020	45644	560.2	269.2	62.48
01.01.2021	50623	512.7	238.6	53.99
01.01.2022	62312	524.0	229.9	90.93
01.01.2023	82388	535.0	242.0	87.5

To determine the dependence of monetary aggregates on the oil production factor in the country, let us build a model of multiple linear regression (without multicollinearity) based on the analysis of the matrix of paired correlation coefficients. This requires:

- I. Build a matrix of paired coefficients including all variables (Table 5).

**Table 5.** Matrix of paired correlation coefficients.

	M2	Oil production, million tons	Oil export, million tons	Oil price, USD/bbl
M2	1			
Oil production, million tons	-0.366805089	1		
Oil export, million tons	-0.474961882	0.913922602	1	
Oil price, USD/bbl	<b>0.793401535</b>	-0.108001564	-0.323973388	1

The matrix indicates that the greatest influence on monetary aggregates (M2) in Russia is exerted by such factor as oil price (0.79), while the oil production factor has a weak effect on the monetary aggregates of the state (-0.36).

- II. Using the selected variables, let us build a regression model for a more reliable analysis of macroeconomic factors of the country's development (Table 6):

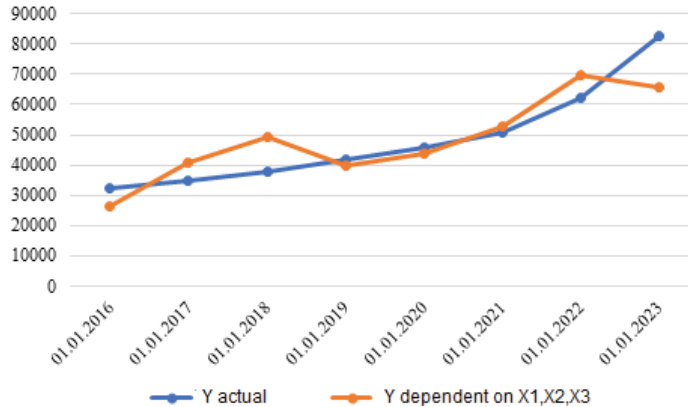
**Table 6.** Results of the regression analysis of factors affecting the monetary aggregates of Russia.

Depend cy factor	Variable	Regression statistics				Correlation between X and Y
		Multiple R	Tightness of relationship (R <sup>2</sup> )	Coefficients of intersection with Y	Average approximation error	
<b>Three-factor model</b>		0.847654988	0.718518979		13.71364305	positive
Oil production, million tons	X1			-0.366805089		negative
Oil export, million tons	X2			-0.474961882		negative
Oil price,	X3			0.793401535		positive

When analyzing the obtained data of the regression model in Table 6, it can be noted that the tightness of the relationship (R<sup>2</sup>) of the variable Y from the three variables X is  $\approx 0.72$ . This indicates that the M2 variable is 72% dependent on oil production, export, and price. However, when analyzing each factor in detail, it can be seen that the existing dependence is provided by the oil price factor, which has a value of  $\approx 0.79$ . And the coefficient of the oil production factor has a negative influence ( $\approx -0.37$ ) on the M2 monetary aggregate. Therefore, the average approximation error in the three-factor model is 13.71%.

As a result of quantitative and qualitative analysis, factors influencing the economic situation of Russia have been evaluated, the weight of each of them is represented in absolute value. Based on the results of the multiple regression, it has been possible to estimate the degree of each factor and its relationship in combination with factors of different composition.

We will check the quality of the regression model graphically, consider the results of the actual and predicted data for the variables X visually (Figure 5).



**Fig. 5.** M2 in Russia actual and predicted depending on factors.

The regression equation in the three-factor model has little approximation value. That is, the oil production factor has showed a negative effect on Russia's M2. The point of slight rebound from the actual values in the presented model is observed according to data 2017-2019 and 2022.

Here the regression model is supported by empirical evidence. It can be used successfully, both for further analysis and forecasting, and for practical application.

## 4 Conclusion

Considering the specific features of the functioning of the Russian economy (the presence of oil reserves, as well as its production and export) based on the expert opinions of the World Bank, authors have built an algorithm of dependence of monetary aggregates on factors of availability of oil reserves, as well as their extraction and export. It is proposed to consider the dynamics of oil production in Russia as a factor determining the development of the country's economy adjacent to the money supply. Multivariate regression modelling of the dependence of factors affecting M2 showed a significant dependence on the price of oil, which has a value of  $\approx 0.79$ . And the coefficient of the oil production factor has a negative impact ( $\approx -0.37$ ) on the M2 monetary aggregate. Therefore, the average approximation error in the three-factor model is 13.71%. The logical scheme for the implementation of the study to determine the degree of influence of development factors has been formed based on the analysis of aggregated analytical data, including information on the availability, sustainability and efficiency of the Russian economy.

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