THE IMPACT OF COVID-19 ON RUSSIAN ECONOMY*

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Abstract

This article examines the impact of Covid-19 on the Russian economy. The pandemic has caused global changes in both our daily lives and economies. Enterprises were forced to close, resulting in decreased production volumes and oil prices. Capital outflows also occurred as a result of the pandemic, and the consequences of quarantine and measures taken in the country were significant, although not as extensive as those experienced by Europe or the United States. Furthermore, the method of correlation-regression analysis was employed to determine the mutual influence of various factors on the development of the Russian economy, including the exchange rate of the Russian ruble, world oil prices, and the level of unemployment. Based on the results, it is essential to monitor and control the level of unemployment in the country, especially under the conditions of Covid-19 restrictions.

Keywords: correlation-regression analysis, Covid-19, global challenges, preventing measures, quarantine, RTS index,

1. Introduction

The Coronavirus crisis has resulted in unprecedented worldwide challenges, human being suffering and financial disruption (Connolly et al., 2020; Quiroz-Gomez et al., 2022). This so-called pandemic has disrupted lives across all communities and countries and adversely impacted global economic development over the year 2020. The effect of this pandemic on the economy of the state was the issue of consideration of practitioners and scientists (Chudik et al., 2020; Finston and Thompson, 2021). Evidence indicates the pandemic decreased worldwide economic growth in 2020 to an annualized rate of -3.4% to -7.6%, with a recovery of 4.2% to 5.6% projected for 2021. Global business and trade is predicted to have dropped by nearly 5.3% in 2020, however, is projected to rise by roughly 8.0% in 2021. Considering a forecasts consensus, the economic downturn in 2020 was not as adverse as firstly anticipated, partially because of the fiscal and monetary policies...
governments adopted in 2020 (Abuselidze and Mamaladze, 2020; Bobylev, 2020; Cooper et al., 2021).

In Russia, the greatest damage due to the introduction of measures to fight the outbreak of Covid-19 infection was incurred by the sphere of market services to the population: by the end of 2020, their volume decreased by 17.3%. The volume of retail trade decreased by 4.1%, freight turnover of transport - by 4.9% (Kalugina and Ryapukhin, 2021; Okon, 2021). The first wave of the epidemic started in the spring months. To prevent the spread of the virus, the government had introduced a strict quarantine regime in Russia, lasted from the beginning of April until May 12, a non-working day regime was in effect (Biswas et al., 2021). Compared to 2019, the industrial production index decreased by 2.9 points. The government took measures to support the population and business. According to the president, the consequences of the pandemic also provoked a noticeable increasing of unemployment in Russia. According to Rosstat, from January to August, the corresponding figure rose from 4.7% to 6.4%. The value was the highest since 2012. However, in autumn, the situation on the labor market began to stabilize. In September, unemployment fell to 6.3%, and in November 2020 it was 6.1% (Kitrar, 2021; Setyani et al., 2021; Vasiljeva et al., 2020).

According to the Accounts Chamber, the government spent 562 billion rubles on anti-crisis support of citizens - this is only 4% of all incomes of the population in the first quarter of 2020. “In general, 4.6 trillion rubles were allocated to support citizens and industry in the fight against the pandemic. For us, this is unprecedented money, it is 4.5% of the country's GDP. The volume of financing of direct business support amounted to 282 billion rubles. In addition, enterprises were provided with fiscal incentives - concessional lending programs and exemption from tax, insurance and rental payments. By the end of the year, the situation in the economy improved slightly, the oil price returned to levels of $ 50 per barrel thanks to an agreement to limit production, which was concluded by the OPEC + countries (OPEC members and several other producing states, including Russia). Many economists have improved forecasts for the dynamics of GDP and other indicators in 2021.

2. Methods

Predicting the development of the epidemic process of the new coronavirus infection COVID-19 at the international and national levels is currently in great demand to determine the needs of practical health care and to carry out effective anti-epidemic and preventive measures. Taking into account the rapidly changing initial information and the ambiguous quality of data obtained from various sources, it is necessary to quickly optimize the applied predictive models, including using more complex algorithms.

A correlation-regression analysis is one of the most widespread and flexible methods for processing statistical data. Correlation-regression analysis consists in the construction and analysis of an economic and mathematical model in the form of a regression equation (correlation relationship), which characterizes the dependence of a feature on its determining factors. Thanks to the use of these methods, among other things, it was possible to get an idea of the consequences that Covid-19 caused both to the world economy and the economy of Russia, which was the focus of the current article.

3. Results and discussion

3.1. Evolution of the economic situation associated with Covid-19 occurrence

According to the actual and forecast data of the OECD, IMF and World Bank Economic, changes in Real GDP as a percentage in Russia in 2019 amounted to 1.3%, in 2020 - minus 4%, in 2021 (forecast) - 2.6%. At the same time, in the world as a whole, the situation regarding the change
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in Real GDP in percentage was in 2019 - 2.3%, in 2020 - minus 4.3%, in 2021 (forecast) - 4%. That is, data on changes in real GDP in Russia are comparable to changes in real GDP in the world.

Let's look at the data on the change of Russian stock market index. For clarity, in Fig. 1, we displayed the changes in the RTS index from January 2020 to July 2021.

![Fig. 1. Dynamics of the RTS index from January 2020 to July 2021](image)

From Fig. 1, we can see that a significant decrease in the value of the RTS index took place in March 2020, that is, during the period of the introduction of the "self-isolation" regime in Russia and in other countries. The essence of self-isolation was in working remotely, to temporary vacations with the preservation of wages to slow or terminate the outbreak of a new coronavirus infection. Business activity in certain sectors of the economy (hotel services, catering, etc.) was suspended. But the activities of banking, insurance companies, as well as the activities of industrial enterprises, including those from the oil and gas chemical sector did not stop. In this regard, it is obvious that the fall in the RTS index in March 2020 is not associated with negative events occurring at enterprises in those sectors of the economy whose securities are included in the RTS index calculation base. Obviously, the impact of the new coronavirus infection on the RTS index is insignificant.

The Bank of Russia has observed a decline in the amount of loans extended to small and medium-sized enterprises (SMEs) throughout Russia during May and June of 2020. However, since July of 2020, loan volumes have returned to pre-pandemic levels and continued to increase. Moreover, interest rates on loans with a duration of more than a year for SMEs throughout Russia have decreased from 9.92% to 7.46% between April 2020 and April 2021. It is evident that the impact of the COVID-19 pandemic on lending to entrepreneurs in Russia has been relatively minor. The key rate of the Bank of Russia has also decreased from 6.25% in January 2020 to 4.25% in July 2020 and has since increased to 6.75% as of October 1, 2021. Therefore, the monetary policy of the Central Bank of the Russian Federation has been a significant factor in the reduction of interest rates for entrepreneurs.

Moving on to inflation rates in Russia, there has been a noticeable increase from 3.05% in 2019 to 4.91% in 2020. As of the first six months of 2021, the inflation rate has been recorded at 4.19%. Additionally, the consolidated budget revenues of the Russian Federation, along with the budgets of state extra-budgetary funds, experienced a decrease of 6.4% in comparable prices in 2020. For instance, the volume of revenues dropped from 39,110.3 billion rubles in 2019 to 37,856.7 billion rubles as of January 1, 2021. This sharp decline can be attributed to the decrease in tax revenues, which was primarily associated with the production and sale of oil and oil products. Nevertheless, during the pandemic, the low level of public debt and high reserve levels have been the primary factors contributing to macroeconomic stability in Russia (Baryshnikova et al., 2021).
Moreover, partially the depth of the recession in Russia was limited by the structural features of the economy. According to Oxford Economics, economic activity in Russia rebounded strongly after the restrictions were lifted and reached 95% of the pre-coronavirus level.

If we turn to the indicators of economic damage caused by the Covid-19 pandemic and related restrictive measures, then among the most affected countries of the G20 should be included, first of all, South Africa, Italy and France, where there was the greatest decline in industrial production, as well as India, The USA and Canada, where there was a significant increase in unemployment. Russia, on the other hand, is among the relatively prosperous countries - along with Saudi Arabia, China and Korea (Kuzyk and Zudin, 2020) (Table 1).

Table 1. The indicators of economic damage caused by the COVID-19 pandemic (Kuzyk and Zudin, 2020)

<table>
<thead>
<tr>
<th>Country</th>
<th>Industrial production index-minimum monthly value for January May 2020 to the corresponding month in 2019, %</th>
<th>Dynamics of unemployment - the maximum monthly increase in January - May 2020 compared to the corresponding month in 2019, %</th>
<th>GDP dynamics in 2020 to the level of 2019, p.p. (forecast)</th>
<th>The total volume of financial support of the economy, in % to GDP</th>
<th>Restrictions severity index (maximum value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>75.0</td>
<td>0.8</td>
<td>-7.0</td>
<td>40.9</td>
<td>73.2</td>
</tr>
<tr>
<td>Italy</td>
<td>52.4</td>
<td>-0.9</td>
<td>-9.1</td>
<td>37.5</td>
<td>93.5</td>
</tr>
<tr>
<td>Japan</td>
<td>74.7</td>
<td>0.5</td>
<td>-5.2</td>
<td>35.4</td>
<td>47.2</td>
</tr>
<tr>
<td>UK</td>
<td>69.4</td>
<td>0.2</td>
<td>-6.5</td>
<td>23.0</td>
<td>75.9</td>
</tr>
<tr>
<td>France</td>
<td>57.3</td>
<td>0.2</td>
<td>-7.2</td>
<td>18.8</td>
<td>90.7</td>
</tr>
<tr>
<td>USA</td>
<td>83.7</td>
<td>11.1</td>
<td>-5.9</td>
<td>14.8</td>
<td>72.7</td>
</tr>
<tr>
<td>Korea</td>
<td>90.4</td>
<td>0.5</td>
<td>-1.2</td>
<td>12.8</td>
<td>88.0</td>
</tr>
<tr>
<td>Brasil</td>
<td>76.7</td>
<td>0.6</td>
<td>-5.3</td>
<td>11.9</td>
<td>81.0</td>
</tr>
<tr>
<td>Australia</td>
<td>-</td>
<td>1.9</td>
<td>-6.7</td>
<td>10.7</td>
<td>73.2</td>
</tr>
<tr>
<td>South Africa</td>
<td>50.6</td>
<td>-</td>
<td>-5.8</td>
<td>9.5</td>
<td>82.4</td>
</tr>
<tr>
<td>Turkey</td>
<td>68.7</td>
<td>-0.8</td>
<td>-5.0</td>
<td>9.4</td>
<td>77.8</td>
</tr>
<tr>
<td>Canada</td>
<td>80.7</td>
<td>8.3</td>
<td>-6.2</td>
<td>8.9</td>
<td>74.5</td>
</tr>
<tr>
<td>India</td>
<td>81.7</td>
<td>16.5</td>
<td>1.9</td>
<td>6.1</td>
<td>100</td>
</tr>
<tr>
<td>Argentina</td>
<td>66.6</td>
<td>-</td>
<td>-5.7</td>
<td>4.8</td>
<td>100</td>
</tr>
<tr>
<td>China</td>
<td>86.5</td>
<td>1.0</td>
<td>1.2</td>
<td>4.6</td>
<td>81.9</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>93.3</td>
<td>-</td>
<td>-2.3</td>
<td>3.3</td>
<td>94.4</td>
</tr>
<tr>
<td>Russia</td>
<td>90.4</td>
<td>1.6</td>
<td>-5.5</td>
<td>2.9</td>
<td>87</td>
</tr>
<tr>
<td>Mexico</td>
<td>69.3</td>
<td>1.2</td>
<td>-6.6</td>
<td>1.1</td>
<td>82.4</td>
</tr>
</tbody>
</table>

The foregoing permits us to make conclusions concerning the absence of a direct impact of COVID-19 on the economy of Russia. At the same time, the openness of modern economic systems and the peculiarities of their relationship with each other have an impact on the financial stability of the state. We will offer formulas for assessing the effect of external factors, including COVID-19, on the economy of the state.

In general, the formula can be represented by the relationship (1):  

Current State of the State + Impact of COVID-19 = Altered State of State  

(1)

The altered state of the state (formula (1)) will be positive if the state begins to "earn" on COVID-19, including through:
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- the introduction of new penalties for citizens and legal entities for violations related to Covid-19, and the receipt of income from these fines (for example, for not wearing medical masks and / or gloves);
- organization of production of medical masks, gloves, antiseptics;
- organizing the production of vaccines against Covid-19 and the sale of these vaccines to third countries (in Russia, vaccination of Russian citizens is free of charge);
- and etc.

Since the state consists of a set of subjects (citizens, legal entities, state and municipal authorities), then formula (1) should be divided into parts (2 and 3):

\[
\text{The financial condition of the majority of citizens in the country + } \\
+ \text{ the impact of Covid-19 = Deterioration in the financial condition of the majority of citizens} \tag{2}
\]

\[
\text{Financial condition of most business entities + impact of Covid-19 = } \\
+ \text{ Changed financial condition of business entities} \tag{3}
\]

The financial condition of business entities (see formula (3)) depends on the scope of the business, on the participation of entrepreneurs in current trends (for example, the production of medical masks, gloves, antiseptics, the organization of a delivery service under conditions of Covid restrictions etc.).

The financial stability of the state's economy in the mid-term in the context of the Covid-19 pandemic can be determined by two key factors:

1) tax revenues from business entities that have received state support exceed tax revenues from entrepreneurs who have not received support and cover the amount of funds allocated by the state for support;

2) state revenues from the sale of vaccines, other medical and related products, and tax revenues from citizens who survived after the disease of Covid-19 citizens surpass the amount of budgets dedicated for the production and development of vaccines against Covid-19, and for additional material incentives for medical workers.

In Table 2, we will display the indicators for calculating the effect of Coronavirus on the Russian economy.

| Table 2. Indicators for calculating the impact of various economic factors on Russia's GDP under COVID-19 conditions (Hassen et al., 2021) |
|---|---|---|---|---|
| No. | Indicator | 2018 | 2019 | 2020 | 2021 |
| 1 | Ruble - U.S. dollar exchange rate | 57.6002 | 69.4706 | 61.9057 | 73.8757 |
| 2 | The price of Brent oil | 68.89 | 61.08 | 56.62 | 51.8000 |
| 3 | Unemployment rate | 4.8 | 4.6 | 4.5 | 4.5 |
| 4 | GDP, % | 2.3 | 1.3 | 1.7 | 3.1 |

3.2. Regression analysis

Given the information in Table 1, we will conduct a correlation-regression analysis.

Let us determine the estimates vector of the regression coefficients.

Based on the least squares approach, the vector \( s \) is acquired from the expression: \( s = (X^T X)^{-1} X^T Y \).

Add a single column to the matrix with variables \( X_j \):
Matrix Y

<table>
<thead>
<tr>
<th></th>
<th>2.3</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Matrix \(X^T\)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>1</th>
<th>1</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>57.6002</td>
<td>69.4706</td>
<td>61.9057</td>
<td>73.8757</td>
</tr>
<tr>
<td></td>
<td>68.89</td>
<td>61.08</td>
<td>56.62</td>
<td>51.8</td>
</tr>
<tr>
<td></td>
<td>4.8</td>
<td>4.6</td>
<td>4.5</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Multiplying matrices, \((X^TX)\)

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>262.8522</th>
<th>238.39</th>
<th>18.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>262.8522</td>
<td>17433.88204738</td>
<td>15543.20402</td>
<td>1207.06202</td>
<td></td>
</tr>
<tr>
<td>238.39</td>
<td>15543.20402</td>
<td>14365.6629</td>
<td>1099.53</td>
<td></td>
</tr>
<tr>
<td>18.4</td>
<td>1207.06202</td>
<td>1099.53</td>
<td>84.7</td>
<td></td>
</tr>
</tbody>
</table>

Given the matrix, \((X^TX)\), the number 4 lying at the intersection of the 1st row and 1st column is acquired as the overall amount of the products of the elements of the 1st row of the matrix \(X^T\) and the 1st column of the matrix \(X\).

Multiply matrices, \((X^TY)\):
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Find the inverse matrix \((X^TX)^{-1}\)

\[
(X^T X)^{-1} =
\begin{pmatrix}
2242.675 & 0.343 & 11.882 & -646.318 \\
0.343 & 0.017 & 0.025 & -0.641 \\
11.882 & 0.025 & 0.106 & -4.307 \\
-646.318 & -0.641 & -4.307 & 205.463
\end{pmatrix}
\]

The vector of the regression coefficients estimation is:

\[
Y(X) =
\begin{pmatrix}
2242.675 & 0.343 & 11.882 & -646.318 \\
0.343 & 0.017 & 0.025 & -0.641 \\
11.882 & 0.025 & 0.106 & -4.307 \\
-646.318 & -0.641 & -4.307 & 205.463
\end{pmatrix} \begin{pmatrix}
8.4 \\
557.0466 \\
494.685 \\
38.62
\end{pmatrix}
\]

Regression Equation (Regression Equation Estimation) is:

\[
Y = -53.746 - 0.04966X_1 - 0.4138X_2 + 18.2106X_3
\]

3.3. Hypotheses testing concerning the regression equation coefficients

The number \(v = n - m - 1\) is named the degrees of freedom number. When estimating multiple linear regression, it is believed that statistical reliability requires the number of observations to be at least 3 times the number of parameters being estimated.

1st-statistics:

\[
T_{\text{table}} (n-m-1; \alpha/2) = (0; 0.025) = 0
\]

\[
t_i = \frac{b_i}{S_{bi}}
\]

\[
t_0 = 74570817479.424 > 0
\]

The statistical significance of the \(b_0\) regression coefficient is approved.
The statistical significance of the $b_1$ regression coefficient is approved.

The statistical significance of the $b_2$ regression coefficient is approved.

The statistical significance of the $b_3$ regression coefficient is approved.

**Confidence interval for the coefficients of the regression equation**

Let us calculate the regression coefficients’ confidence intervals, which with a reliability of 95% is as defined below:

$$(b_i - t_i^*S_{bi}; b_i + t_i^*S_{bi})$$

$b_0$: $(-53.746 - 0*0; -53.746 + 0*0) = (-53.746; -53.746)$

$b_1$: $(-0.0497 - 0*0; -0.0497 + 0*0) = (-0.0497; -0.0497)$

$b_2$: $(-0.414 - 0*0; -0.414 + 0*0) = (-0.414; -0.414)$

$b_3$: $(18.211 - 0*0; 18.211 + 0*0) = (18.211; 18.211)$

3.4. Checking the total quality of the multiple regression equation.

**F statistics. Fisher's criterion**

$$R^2 = 1 - \frac{0}{1.84} = 1$$

Let us test the hypothesis of overall significance - the hypothesis of the simultaneous equality of all regression coefficients to zero for the explanatory variables:

$H_0$: $R^2 = 0; \beta_1 = \beta_2 = ... = \beta_m = 0$.

$H_1$: $R^2 \neq 0$.

This hypothesis is tested using the F-statistic of the Fisher distribution (right-hand test). If $F < F_{kp} = F_{n;m-1}$, then there is no reason to reject hypothesis $H_0$.

$$F = \frac{R^2 / (1 - R^2)}{(n-m-1)} \times \frac{n-m-1}{m} = \frac{1}{1-1} \times \frac{4-3-1}{3} = 0$$

Tabular value with degrees of freedom $k_1 = 3$ и $k_2 = n-m-1 = 4 - 3 - 1 = 0$, $F_{kp} (3;0) = 0$

Since the actual value is $F > F_{kp}$, the coefficient of determination is statistically significant and the regression equation is statistically reliable.

As a consequence of equations and calculations, the multiple regression equation was acquired:

$$Y = -53.746 - 0.04966X_1 - 0.4138X_2 + 18.2106X_3$$

An economic interpretation of the model parameters is likely: a rise in $X_1$ by 1 unit of measure results in a fall in $Y$ by a mean of 0.0497 units; rise in $X_2$ by 1 unit results in a fall in $Y$ by a mean of 0.414 units; rise $X_3$ by 1 unit results in a rise in $Y$ by a mean of 18.211 units. Based on
The maximum coefficient $\beta_3=3.288$, it can be concluded that the factor $X_3$ holds the biggest impact on the outcome $Y$. The statistical significance of the equation was checked utilizing the determination coefficient and Fisher's test. It has been discovered that in the examined situation, 100% of the overall variability of $Y$ is defined by a alteration in the factors $X_j$. It has also been discovered that the parameters of the model are statistically significant.

5. Conclusions

Based on the analysis of the impact of Covid-19 on the Russian economy, several conclusions can be drawn. Firstly, it is important to control the level of unemployment in the country and promote better payment services to support both individuals and businesses. Secondly, actions taken by public authorities must be transparent, and support should be provided to ensure the continuity of production processes. The temporary lockdowns, social distancing measures, and remote work were insufficient to combat the virus, and more comprehensive solutions are needed. Additionally, it is necessary to question the actions of the Central Bank of the Russian Federation, which limited the availability of credit resources for entrepreneurs by increasing the key rate.

Although many questions remain unanswered, it is clear that getting out of this situation will take a long time. Currently, the government is focused on vaccinating the population as a means of controlling the spread of the virus.

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References


