

## ICEST 2021

## II International Conference on Economic and Social Trends for Sustainability of Modern Society

**DYNAMIC TRENDS OF SOCIO-ECONOMIC CONSEQUENCES  
OF THE COVID-19 PANDEMIC**

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**Abstract**

The spread of SARS-CoV-2 coronavirus pneumonia (COVID-2019), remains an international public health and health economy emergency, resulted in more than 65560680 infection cases and 1512255 deaths. The quarantine measures taken have aggravated the already existing sectoral economic crisis with systematically unprecedented socio-economic shocks to national economies and with a projected damage estimate of more than 35 trillion US dollars to the world economy. Generalization of current trends, the formation of an analysis model, and forecasting of socio-economic consequences of the spread of COVID-19 pandemic. The state of the spread of infection requires the development of an Excel forecasting model of COVID-19 trends (research Microsoft Excel methods for the calculation of the socio-economic damage from the impact of coronavirus infection). The proposed methodology makes it possible to establish global trends and the loss from people morbidity and its impact on the world economy. Our studies have revealed several main consequences of the COVID-19 pandemic: forecast of the Decreased production activeness; stagnation and decrease in all socio-economic sectors; stock market chaos and the decrease in bond yields; world economic crisis and recession and systematic global social and economic risk. The extrapolation of these indicators made it possible to predict the decrease trends in macroeconomic indicators of countries.

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*Keywords:* SARS-CoV-2, world COVID-19 pandemic, socio-economic implications, economic losses, decrease in GDP and economic parameters



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## 1. Introduction

The ongoing spread of SARS-CoV-2, the new type of coronavirus pneumonia disease 2019, and was named COVID-2019 on February 11, 2020, firstly, was identified in November 2019 in Wuhan, Hubei province in China, and, rapidly spread to become a global pandemic, affecting all sectors of people activities and all aspects of societies live, even for those who weren't affected directly by the COVID-19 (Al-Jabir et al., 2020). The disease COVID-19 which was able to infect the respiratory, digestive and nervous systems of both humans and animals, "continue to walk" around the world, causing, systematically, the most complex consequences in terms of form and content, which affect all spheres of human life and society, socio-economic, demographic, socio-medical, etc. Hundreds of people are infected every day.

According to WHO, the percentage of deaths due to COVID-19 infection is 3.4%. This exceeds the mortality rate from seasonal flu (Al-Jabir et al., 2020). Although vaccine prototypes developed in Russia, Japan, France have already appeared, and a systematic approach to the clinical treatment of coronavirus infection, the victory of mankind against the coronavirus is still far and the consequences of its spread throughout the world are most depressing, affecting all sectors of human activity.

As a result of the COVID-19 coronavirus pandemic, the world economy has plunged into the deepest recession in eighty years. Emerging markets, and emerging economies in Europe, North America and Central Asia are expected to experience a 4.2-5.2% decline in GDP in 2020. This article provides a brief overview of recent developments and provides a forecast for the future development of the region. Besides, one of the most pressing issues of our research is human capital, an issue that requires serious attention due to the profound impact of the pandemic on people's health and education.

The COVID-19 coronavirus pandemic has dealt a direct blow to the human capital of all countries in North America, Europe and the Eurasian zone in general, and in particular in Russia, with a negative impact on both education and health. The disease has already claimed so many lives and caused long-term health problems for some of the surviving patients. Recovery from the pandemic will require major investments in both the education and healthcare sector (COVID-19 pandemic and economic ferecast, 2020). If the pandemic continues to develop, which will require restrictions for a long period and / or lead to increased geopolitical tensions, the recovery process may be slower than expected (Hafiz et al., 2020).

The purpose of this analysis is to assess the socio-economic losses from the systemic socio-economic as a result of the spread of the COVID-19 pandemic.

This includes the reduced consumption associated with preventive (avoidance) behaviors by citizens and the reduced production by firms due to the border control and lockdown policies, financial charges for the stimulus measures provided by governments, such as interest-free loans, tax relief, and cash subsidies to the unemployed, etc. The excitement and panic around the epidemic continue to negatively affect the global economy, tourism, and mass sporting events. In the context of our work, we would like to raise the question of the potential or projected economic damage from this pandemic. The dynamic rate of spread raises serious concerns about the impending socio-economic crisis and the systemic global recession. The quarantine measures taken around the world did not lead to the desired results, but on the contrary, in many countries, led to an increase in unemployment. All sectors of the economy were in deep stagnation (Nicola et al., 2020).

The increased demand for medicines remains unsatisfied. In response to this global outbreak, we investigate the socio-economic impact of COVID-19 on certain market-related aspects of the global economy and forecast its future development. Therefore, our proposed approach to Microsoft excel predicting the spread of the pandemic is of particular importance.

The available statistical data on the spread of coronavirus infection in the world and trends in the global population were used to calculate the socio-economic damage from the coronavirus and its impact on the world economic parameters (a global crash in primary, secondary, and tertiary sectors).

## **2. Problem Statement**

Coronavirus turned out to be one of the most passive of all identified to date the type of viruses that spawned the respiratory apparatus of a person and which spread throughout the world with incredible speed. The COVID-19 pandemic has resulted in 65560680 infected cases, resulting in 1512255 deaths compared to 64036320 cases and 1483480 deaths in the same period in 2020. The statistics are about 13,041,698 cases with 571660 deaths and 7588,094 recovered. The deterioration of the main socio-economic indicators of the countries, being a direct result of stagnation and a systemic crisis caused by the systematic spread of coronavirus infection, has become a problem for the theme of slowing development trends and impoverishment of all sectors of human activity.

## **3. Research Questions**

Generalization of current trends, the formation of a model for analysis and forecasting of socio-economic consequences of the spread of the COVID-19 pandemic for the future.

The study design: both existing and potential socio-economic consequences of COVID-19 pandemic. The state of the spread of infection requires the development of Excel Extrapolation of COVID-19 trends.

A systematic study of methods for calculating in the Excel environment the socio-economic damage from the incidence of coronavirus infection. The proposed methodology makes it possible to establish global trends and calculate the loss from people morbidity and its impact on the world economy.

## **4. Purpose of the Study**

The spread of the Coronavirus pandemic is a matter of concern due to the impending systemic economic crisis and recession. The taken measures of social distancing and self-isolation and restrictions on human activity all led to certain socio-economic shocks that paralyzed all spheres of production, consumption, exchange and accumulation. The extrapolation of these indicators made it possible to predict the decrease trends in macroeconomic indicators of countries. In the context of our work, we would like to raise the question of the potential or projected economic damage from this pandemic. The COVID-19 pandemic has led to more than 65.6 million active cases. Thus, the purpose of this article is to study the actual dynamics of the parameters of the coronavirus pandemic, to predict its further spread and justify its impact on the deterioration of socio-economic indicators and trends of the onset of the crisis and recession of the world economy.

## 5. Research Methods

A systematic quantitative analysis of the current state of high morbidity of the population as a result of the spread of coronavirus infection. The formation of a calculation method and the justification of an improved approach to assessing economic damage due to an unfavourable situation caused by a pandemic of the coronavirus are relevant. The formation of an integrated approach to the calculation and forecasting of economic damage from the COVID-19 pandemic based on the available statistical data on the incidence of the population of state statistics committees and or international compulsory medical insurance organizations.

An analysis of the known methods for assessing the economic damage to the population's morbidity showed that the development of a computer program that allows the most accurate calculation of economic damage, based on the available statistical data, has not been carried out to date. The method for assessing the economic impact (loss) from the incidence of the population is described in the works of many researchers, based on the summation of the damage for each case and type of incident, it is not possible to accurately calculate the economic damage due to the lack of some statistics (Denisov, 2008; Leshchuk et al., 2013; Soldatova & Pivkina, 2020).

The assessment method described by some scientists does not consider the loss of the budget due to lost taxes due to the incidence of the economically active population when calculating the economic damage from the incidence of the population.

The method of assessing the economic damage from the incidence of the population described in the work of many researchers, not adapted to the available statistics on the incidence of the population. After analyzing all of the above authors' methods for assessing economic damage from the morbidity of the population, we consider that the basics of the Revich-Sidorenko method (Revich & Sidorenko, 2006). are used as a more systematic study of the problem of economic damage from the coronavirus, and we have supplemented the structure of the evaluation criteria for considering the current problem of the COVID-19 pandemic.

Our method of economic and mathematical modelling developed consist on the identification of factors economic damage from coronavirus pandemic, the system method for a computer program for its determination consists of the calculation of the budget losses due to under-received taxes due to the incidence of the economic active population:  $N_{dtd} \cdot T_{dtd} + N_{ivl} \cdot T_{dpp}$

$$C_t = \left( \frac{GDP_1}{365} \cdot \frac{VAT}{100} \cdot \frac{Sr}{30} \cdot \frac{TA_{Sr}}{100} \right) \cdot \frac{(N_{dtd} \cdot T_{dtd} + N_{ivl} \cdot T_{dpp})}{1000000}$$

where  $C_t$  – The annual amount of lost taxes, million dollars;  $GDP_1$  – gross domestic product per worker, dollars; VAT – value-added tax, %; Sr – average wage, \$;  $TA_{Sr}$  – personal income tax, %.

The economic impact of the people morbidity during the period (t) is determinate by indicators:

$$E_{i(d)} = C_{mch} + C_{mcup} + C_{tmcup} + C_t$$

On a global scale, the total amount of the specified economic impact (damage) corresponds to the decrease (or loss) of Gross Regional Product (GRP) per capita, or calculated per worker working on the number of economically active population  $N_w$ :

$$GDP = GDI_1 \cdot N_w$$

The economic negative impact from the morbidity of the population in comparison is found by:

$$Y_{ZGRP} = \frac{Y_z}{GRP} \cdot 100\%$$

In particular, the losses of the entire system of the national economy and the world economy, losses in the formation of budget revenues and development, budget funds, etc. were considered. Also, besides, the above methods use various designations of variables in formulas. We tried to standardize the parameters of our approach to calculate the economic loss from COVID-19 pandemic. In the description of the augmented methodology, the notation of variables in a standardized form is used (Hafiz et al., 2020).

We, therefore, should congratulate Itai Atar (Alsafi et al., 2020), George J.M. Hourston (George, 2015; Hourston, 2020), Leshchuk's team (Leshchuk et al., 2013), Maria Nicola's team (Nicola et al., 2020), and Shaul Atar (Atar & Atar, 2020), for the excellent up-to-date review on the socio-economic outcomes of the COVID-19 pandemic, who proposed a very interesting mathematical-programmed method for assessing the economic damage from the morbidity of the population with the impact of epidemics.

The research is based on the use of statistical and predictive analysis methods, which were summarized using the following methods: statistical observation of General trends COVID-19; summary and grouping of statistical observation materials; absolute and relative statistical values; variation series; sampling; correlation and regression analysis with Microsoft Excel; dynamics series (Ciotti et al., 2020; Revich & Sidorenko, 2006). Making a forecast will be the result of applying system methods of extrapolation forecasting and trend modelling.

## 6. Findings

Systematic analysis data indicate that the COVID-19 pandemic has rapidly affected 213 countries and territories around the world. With severe complications and deaths from the coronavirus, infections have been confirmed in more than 200 countries. The rate of spread of coronavirus infection is such that since the beginning of January, more than 5.8 million people have fallen ill and more than 360 thousand have died. And across more than forty countries, there have been over 10,000 confirmed cases, and more than 25 countries have reported more than 1,000 coronavirus deaths. New cases of COVID-19 are reported worldwide every day (Atar & Atar, 2020; Sohrabi et al., 2020). And at least over 13 million cases have been confirmed in 188 countries and territories of which 7,302,048 new active cases, including 23.7% in Europe, 21.1% in Asia, 38.4% in North America, 13.8% in South America and 3.0% in Africa (UNWTO, 2020).

The statistical data reflecting the general state of morbidity, mortality and recovery of people on a particular continent and in the world as of September-December 2020 is formulated in the table (Table 1).

**Table 1.** Reported Cases, Deaths and Recovered by Continents and active COVID-19 cases

Regions / Continents	Total infected		Deaths		Recovered		Now sick	
	December-September	+/-	December-September	+/-	December-September	+/-	December-September	+/-
Europe	17955716	13716676	413136	198594	7891983	5600141	9650497	7917841
Asia	17173192	8155424	267620	97066	15205298	7895058	1670274	133300
North America	16891596	8750162	420483	126321	10327387	5286991	6143726	3336849
South America	11361557	4066633	329257	96369	10141778	4086090	890522	-115826
Africa	2231170	849562	52945	19615	1892156	760041	286069	69906
Australia and Oceania	45691	15396	1020	153	33127	6674	11544	11520
World	65659643	35553853	1514576	567918	45492435	23635051	18652632	11350584

Source: (Timkiv, 2020).

Against the background of socio-economic problems arising from the pandemic, even such political and economic processes as Brexit of Great Britain and the US trade war with China seem to have faded into the background. Without setting forth in this work the mathematical-software apparatus mentioned above for calculating the economic damage from COVID-19, it is important to jerk the direction of the main articles of damage that make up the main sectors of the GDP of national economies:

- Primary sector (agrarian branch). The resilience of the agrarian branch has been tested by the COVID-19 proliferation. A global crash in the agricultural market caused the decline of demand and supply prices by 20% (Al-Jabir et al., 2020; Baldwin & Weder di Mauro, 2020).
- Secondary sector (mining and manufacturing industry). The situation is about to mention how COVID-19 pandemic impacted manufacturing branches in Italy, France, United Kingdom, Russian, etc. The decline in the manufacturing industry is predicted by 3.2-5%, and all complexes have had to delay their activities, contributing to a slowdown in predicted growth (Denisov, 2008).
- Tertiary sectors. All branches of the tertiary sector were fundamentally affected and in less than three months plunged into the phase of full stagnation. COVID-19 has affected all levels of the education system.

Table 2 and Figure 1 justification of the trends we have conducted for the economic loss to the world economy indicate an overall decline in GDP of 2.4% in 2020 and 4% in 2021. Considering the increase in morbidity and the stagnation of the world economy and its main sectors of activity, the reduction in GDP according to our forecasts, based on Excel-extrapolation, will be 10837 \$US with a forecasted annual reduction of its value by 4.2-5.3% until December 2021 (Table 2).

**Table 2.** Dynamics of the increase of morbidity, mortality from COVID-19 and decrease in world GDP in 2020, \$US

Period of analysis	COVID-19 reported cases	Recovered	Deaths	Estimates loss of Global GDP, million	Dynamics of the monthly decline in world GDP
January	896.5	33.25	25.75	0.02	
February	18138	557.75	384.75	0.35	0.32
Marth	90841.75	46910	3111.5	2.81	2.46
April	1058828	218243.5	55779	50.36	47.55
May	3463914.75	1107548.75	245307.75	221.49	171.12
June	6447663	2774341.75	383200.5	345.99	124.50
July	10976333.25	5813334.5	523627	472.78	126.79
August	18193712.5	10823070.75	692337	625.10	152.33
September	26205752.75	17406795	866112.5	782.01	156.90
October	34773469.75	24202633.25	1030894	930.78	148.78
November	47335322.5	31518254.75	1212357	1094.63	163.84
December	64837160.25	42499544.5	1499224	1353.64	259.01
GDP per capita	11375	11429	x	10837 (4.2-5.2%)	x
Average GDP per cap (per month)	947.92	952.42	x	902.89 (4.2-5.2%)	x

Source: (Chen et al., 2011; Timkiv, 2020)

Table 3 and Figure 1 justification of the trends we have conducted for the economic loss to the world economy indicate an overall decline in GDP of 3,9-4.2% in 2020 and 4.2-5.2% in 2021. "The economic impact of COVID-19 turned out to be longer and stronger than expected, and we again worsened our macro forecasts ... Now we expect global GDP to fall by 2.4% this year", the agency said (Al-Jabir et al., 2020; Denisov, 2008). At the same time, S&P announced on March 31 that it had lowered its forecast for world GDP growth to 0.4% from the previously expected 3.3%. At the same time, the new forecast for 2021 implies a growth of the world economy by 5.9% against March 4.9% (Duffin, 2020; Sohrabi et al., 2020).

Including the agency's analysts expect the eurozone GDP to decline by 7.3% year-on-year from the previously expected decrease of 2%. In 2021, S&P predicts an increase in the economy of the euro area by 5.6% against the March forecast of growth of 3%. The German economy, they believe, will decrease by 6% from the previously projected decline of 1.9% in 2020.

**Table 3.** The population and GDP of the world, 2010-2021, billion, US dollars

Years	Population	Population Growth, %	GDP, billion	Current market prices	
				GDP per capita	The decrease in GDP p/c
2012	7 057 203 973	1.20	73 631	10402	57
2013	7 141 558 332	1.20	75 566	10553	151
2014	7 226 178 654	1.18	78 037	10799	246
2015	7 310 729 390	1.17	73 502	10054	-745
2016	7 397 835 935	1.19	75 213	10167	113
2017	7 515 284 153	1.11	80144	10664	497
2018	7632819325	1.02	84740	11102	438
2019	7714576923	1.01	87265	11375	273
2020	7758156792	1.01	85171.64 (3.9-4.2%)	11429	54
2021	7874965731	1.02	81794.7744 (4.2-5.2%)	10387	-1042

Source: (Chen et al., 2011).

Based on the above said, it is possible to simulate, by extrapolating forecasting, general trends in the Microsoft Excel environment, the reduction in the main economic indicators and the global gross domestic product. The Extrapolation forecast of GDP per capita of the world population is presented in Figure 1.

Reasonable indicators point to a forecast of a decline in GDP with an acceleration coefficient (-2.79%) and a reliable approximation value of 46.9%. This fact is a direct result of the impact of the propagation of the pandemic on economic activity. The COVID-19 crisis is crushing global economic growth, Fitch Ratings points out in its latest quarterly "Global economic Outlook" (GEO). The level of world GDP is falling. We are in the territory of a global recession (Chen et al., 2011; Timkiv, 2020).

The calculation relating to the determination of the economic loss caused by the pandemic is such that all the European economies and Russia are negatively affected, which is shown by the trend of the statistical data even if they are less reliable. Available statistics for the city of Russia for 2013-2020 were used to calculate the economic damage from respiratory diseases of the population according to our proposed method and the above formulas. In this step the extrapolation of statistical data and economic loss from population morbidity is actual.

The statistical data extrapolation and economic impact from the people morbidity in the periods for which complete statistics are not available, or in the future, is carried out by linear approximation by the least square method using the Excel statistical function Trends (Table 4). To extrapolate data, empty cells are selected for which a forecast is necessary.

**Table 4.** Extrapolation of economic loss from the of the people morbidity with COVID-19 in Russia

Indicators	2013	2014	2015	2016	2017	2018	2019	2020
Cost of medical care in hospitals, million \$US	6.85	7.57	8.10	8.49	9.20	10.48	11.17	10.67
Cost of outpatient medical care, million \$US	37.60	41.47	44.35	46.45	50.30	57.28	60.98	58.24
Total <i>Atd</i> *, million \$US	72.05	79.30	84.68	88.56	95.79	108.95	115.90	110.69
Lost taxes, million \$US	31.70	34.38	36.27	37.53	40.23	45.38	47.95	45.79
Economic impact from population morbidity, billion \$US	148.01	162.81	173.72	181.61	196.37	223.28	235.00	245.58
GRP, billion \$US	988.30	1070.27	1126.85	1162.30	1244.45	1400.36	1477.86	1411.36
Economic loss from human morbidity to the trend of GDP, %	15	15.2	15.4	15.6	15.8	15.9	15.9	17.4

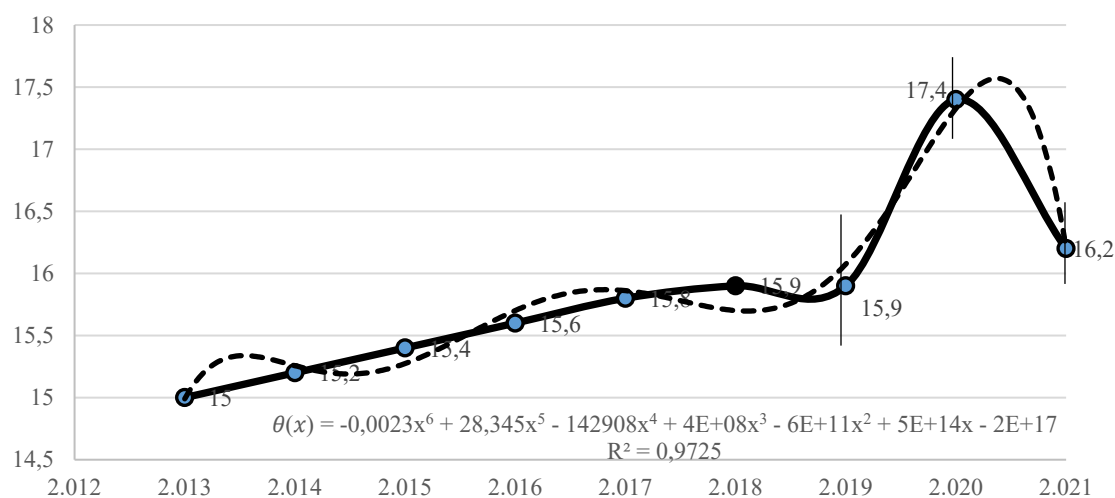
\*Allowances for temporary disability.

After clicking the "Insert function" button, "Category: Statistical" is selected in the drop-down list; in the "Select function:" window, the Trend function is selected using the scroll bar and the "OK" button is pressed. In the appearing dialogue window "Function Arguments", the fields are filled with towing a range of the corresponding cells from the statistical table. In the known values field, a range of known statistics is substituted (Lenzen et al., 2020). In the "New Values" field, a range of years with known



statistics is substituted. In the “New Values” field, a pre-filled range of years for which statistical data is to be predicted is substituted. The economic loss from morbidity due to the COVID-19 is 15,0-17,4% of Russia's GDP.

The extrapolation analysis data substantiated in Table 4 and Figure 1 indicate that in 2020 the economic damage from mortality due to coronavirus infection is the largest (17.4%) in dynamics compared to 2018 and 2019, which is level of 15.9%. And at the same time, the forecast extrapolation data show that this indicator, although it will decrease in 2021, remains high at 16.2%. The global economic damage from the spread of coronavirus, expressed by a systematic fall in the gross regional product, takes place with an acceleration index of -2.3% and a coefficient of reliable approximation of 97,25% (Figure 1).



**Figure 1.** Economic loss from population morbidity in comparison with GRP, %

The results of extrapolation of statistical data on trends in the consequences of the spread of coronavirus – the predicted values of economic losses due to the pandemic are 15.0-17.4% of Russia's GDP. We can tell exactly about the economic damage from the global COVID-19 pandemic: it will have severe negative impacts on the global economy; we estimate, most major economies will lose at least 2.4% of their GDP. The global GDP was estimated at around 86.6 trillion U.S.\$ in 2019 – meaning that just a 0.4% drop in economic growth amounts to almost 3.5 trillion U.S.\$ in lost economic output (COVID-19 pandemic and economic forecast, 2020; Soldatova & Pivkina, 2020).

The predicted trend of economic damage from the morbidity of the population, from the point of view of a decrease in the regional product, is reflected by the following expression:

$$\theta(x) = -0.023x^6 + 28.345x^5 - 142908x^4 + (4E + 08)x^3 - (6E + 11x^2)x + (5E + 14)x - (E + 17); R^2 = 0.9725.$$

Currently, there is a deterioration in the sanitary-epidemiological situation in the world. Time will tell how many countries around the world and mainly Russia will survive this pandemic, and what damage will be done to the economy. This is precisely the scientific significance of our forecast. By the foregoing, an important point is that he has proposed several measures aimed at supporting the economy in the context

of accelerating the spread of COVID-19, regardless of the percentage of population infection (Canelli et al., 2020; Worldometer, 2020).

## 7. Conclusion

Based on the results of the study, we carried out a systematic analysis of the state of the main socio-economic indicators due to the spread of coronavirus, using the method of statistical extrapolation, we predicted the overall dynamics of the world economy (a decrease in world GDP), and as a result, we proposed a model at the level of the world economy for assessing the socio-economic impact of COVID-19 and its impact on all economic sectors, production, consumption and savings per capita.

In our opinion, there are 5 significant consequences of coronavirus for the global economy: the coronavirus epidemic has led major institutions and banks to lower their forecasts for global economic growth. The decline in the global economy (GDP estimation) by 2.4-4.2% in 2020 and by 5.2% in 2021; the decrease in production had a negative impact on the economies of countries that are closely cooperating with China, in particular Vietnam, Singapore and South Korea; the coronavirus epidemic negatively impacted the services sector as well, as lower consumer spending hurt retail, restaurants and aviation, etc...; the fears related to the spread of COVID-19 negatively affected investor sentiment, which in turn led to a sharp decline in stock prices. The yield on 10-year bonds reached a historically low level of 0.3%; the world tourism, the largest sector of the world economy, employing over 319 million, or about 10% of the world's population, with a total income of US \$ 5.7 trillion. But world tourism is the most vulnerable to the coronavirus epidemic. Our forecast proves that the achieved level of socio-economic decline in 2020 will lead to an increase in poverty in all countries of the world. It is estimated that an additional 2.2 million people could become poor at the \$ 3.20 per day poverty line. With a poverty line of \$ 5.50 per day, which is commonly used in upper-middle-income countries, this number can reach 6.0 million people.

Summarizing the above it should be said that the various points cited reflect the negative impact of the spread of the COVID-19 epidemic on the world economy in general, and the socio-economic development of peoples, in particular. However, the prospects for a successful fight against coronavirus globally, and in Russia, consist mainly in the immediate process of vaccination. In this process, major advances have been made in Russia, which has developed and tested three vaccines, CoviVac, EpiVacCorona and Sputnik V, which to date, by its effectiveness and reliability, represents the hope for the survival of all humanity. The vaccination process will create a condition for the preservation of human capital, which is one of the most important resources for the effectiveness of any economic activity.

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