



*Research article*

## **Economic crisis as a consequence COVID-19 virus attack: risk and damage assessment**

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**Abstract:** The purpose of the research is to reveal the mechanism of influence of coronavirus on the economic crisis and to develop a method for assessing threats and risks. Understanding the mechanism of generating an economic crisis allows to develop methods of anti-crisis government policy. The research methodology is based on structural analysis and taxonomic approach. Their application makes it possible to distinguish activities with decreasing demand relative to initial supply, and with increasing demand, which generates deficits of goods. The results of the research at the theoretical level of analysis is the proposed method of assessing threats and risks from the spread of coronavirus, which allows the benefits of certain types of activities (pharmaceuticals and medicine), and consider the damage on other activities (tourism, transportation, education). The diagram of the ratio of benefits and losses from the spread of the virus attack allows to position different economies in different zones of the diagram, according to the reaction of a particular economy to the epidemic, with a different scale of influence. Using such a chart, estimating the expected damage and expected benefits, the impact of COVID-19 on the economy is assessed based on changes in the dynamics of investments in financial and non-financial assets. Analysis of financial and non-financial investments in some countries has led to the conclusion that the financial system that is less biased in terms of financial investment relative to the functioning of non-financial sectors is the least vulnerable in a crisis. The multiple excess of financial investments over non-financial ones for Russia creates the foundation of financial instability and recession. This is confirmed using econometric analysis and forecast. Therefore, overcoming the economic crisis caused by COVID-19 in addition to the current measures will require correcting, in particular, the structure of “financial-non-financial” investments.

**Keywords:** economic crisis; virus attack on the economy; damage assessment method; risk; supply and demand dynamics; government anti-crisis policy; financial stability; institutional rigidity of the “financial-non-financial” investment structure

**JEL Codes:** O11, G01, I15

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## 1. Introduction

Humanity is faced with a new threat to its development and survival is the appearance of viruses of natural generation, which can quickly spread and cause quite dangerous epidemics, which not only weaken people’s health, are characterized by a fairly high mortality rate, but also undermine the psychoemotional state of people. Moreover, COVID-19 is not the first threat, but its consequences, including for finance and the economy, are probably the most dangerous (Beutels et al., 2009). Moreover, the economy is experiencing quite significant damage, there is an effect of its inhibition due to the curtailment of certain activities, changes in the structure of labor (Alonso-Carrera and Raurich, 2018; Brancaccio et al., 2018), which provokes a curtailment of economic growth (Samaniego and Sun, 2016) and further economic crisis. The financial sector is also being destabilized. Agents are withdrawing their capital, bringing down financial markets<sup>1</sup>. At the same time, there was an explosive interest in how the crisis develops and what it can lead the economy to. While the events of the crisis are just unfolding, it is not possible to assess what it will lead to, what damage will occur. At the same time, the assessment of possible threats and risks associated with a virus attack on the economy is relevant. This is the first time that human society has faced such a large-scale virus attack. It is possible that such attacks will be repeated, acting as a kind of force majeure to provoke a financial and economic crisis. Despite the fact that a number of studies have made estimates of the costs of countering the pandemic, for example, with the N1H1 virus (Pasquini-Descomps, 2017) just three years ago, nevertheless, it did not lead to such severe economic consequences as are observed in 2020. The research provides recommendations for mild epidemics, but in the case of a pandemic and the global economic crisis that it causes, it requires justification of all possible measures of impact, and the very concept of “effectiveness” changes its meaning. The virus is capable of killing healthy adults, not to mention that virologists do not fully understand the possibility of mutating this virus over time (Gates, 2020). Therefore, we need to talk about a serious threat that requires profound changes in the economic life of people and the activation of microbiological and medical research.

The crisis unfolds in two directions. It’s macroeconomics in general and activities related to the spread of the virus and medical counteraction to this spread, for example, quarantine (closing theaters, concerts, educational institutions, tourism, traffic restrictions, etc.). Optimization methods can be used to select the necessary solutions, as well as network models (Yu and Aviso, 2020). Especially COVID-19 provokes a crisis in the health system, which requires additional funds to fight the virus and save people, including the construction of intensive care units for severe patients. (Singhal, 2020; Nicoll et al., 2010). Health care needs to work in an increasingly busy environment while resisting information noise and

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<sup>1</sup> The economic crisis refers to a significant deterioration in economic dynamics. It’s a decrease in the growth rate or the emergence of a recession (negative growth rate). The financial crisis is expressed in the collapse of stock prices on the stock market with the emergence and spread of damage in the economy, that is provokes an economic crisis.

widespread panic (Xie et al., 2020), which contribute to the deterioration of health in such circumstances. Thus, this research notes the existence of a global information crisis that precedes and accompanies the economic crisis (Xie et al., 2020). For this purpose, it is necessary to increase the production of medicines, develop a vaccine against the virus, and produce products necessary for quarantine, both medical and auxiliary purposes (Pasquini-Descompps et al., 2017, Chambers et al., 2012). The release of capacity in health care for hospitalization of patients with coronavirus will obviously lead to the fact that planned treatments will be delayed or curtailed for some time. Thus, these patients are deprived of the opportunity to correct those anomalies in their body that were subject to correction by standard methods of treatment. Thus, the concept of opportunity costs applies to medical choices when a disease that is more threatening to people acquires more resources and capabilities to resist it.

Thus, force majeure shocks to the economy usually generate innovations that no one had previously planned, and that cover not only the problem itself, but also, for example, organizational infrastructure, information, management, etc.

However, the high uncertainty of the situation and the crisis dynamics of the main indicators do not allow us to say whether the necessary efficiency of such innovations will be achieved and whether they will be able to work towards neutralizing the emerging crisis through joint actions.

Thus, it is also possible to resist the economic crisis in these areas. First, ensuring the stability of the macroeconomics, creating and stimulating industry development, primarily healthcare, pharmaceuticals, biotechnologies, as well as transport, and, secondly, eliminating the virus itself through medical measures, which is the most important optimistic signal for agents in the markets. The tourism sector will require special support, perhaps an anti-crisis program, or switching it to online mode.

To assess the impact of the crisis on the economy, researchers-economists use epidemiological models (Zhao and Chen, 2020; Yu and Aviso, 2020) that determine the speed of virus spread, including when certain quarantine measures are in effect, determining the actual task of assessing risks and potential damage. In addition, it is important to reduce risks when they affect the growth dynamics by structural analysis (Sukharev, 2020).

At the same time, it is necessary to set the task of developing a common approach to assess the alleged threats and risks and their measurement with confirmed risks and realized threats, which is the main goal of this research, which is to develop such a method as one of the possible tools for analyzing force majeure situations arising in the economy. It should be noted that along with provoking losses, the virus attack provides an increase in demand for certain activities that may well develop and act in the direction of countering the general economic crisis. In this regard, it is important to approach the distribution and co-measurement of losses and benefits from the current situation in a methodical way, developing methods for eliminating risks and reducing losses and increasing the possibility of extracting benefits even from such a situation, which has a clear negative halo. Therefore, we will conduct further research by sequentially outlining the intended mechanism for the deployment of the crisis and its consequences, and then propose a method for assessing the threats and risks from the coronavirus epidemic, which affects the curtailment of economic growth and provoking the crisis. In conclusion, we will discuss the pre-crisis dynamics in the field of financial investments that affect the financial stability of the economy.

## 2. Mechanism for the deployment of the economic crisis: research methodology

Many countries have experienced financial and economic crises at various times, which were caused by a set of internal factors related to the functioning of capitalist institutions that regulate the development of the financial market and economic sectors.

With the spread of COVID-19, the destabilization of these institutions, the growing dysfunction of financial markets, the curtailment of investments in the financial and non-financial sectors, and the decline in demand provoke the emergence of an economic crisis. This is, to a certain extent, a completely new circumstance that affects the life of people, issues of survival and mode of life and the realization of their needs, many of which are subject to severe restrictions. It is these restrictions that cause additional destabilization, but become vital for fighting infection.

As noted by Martin Muhleisen<sup>2</sup>, an economist at the IMF, the experience of previous financial crises is useful in eliminating the unfolding crisis associated with capital outflows from emerging markets. The IMF is considering helping the poorest countries with special loans. Raw materials are quickly becoming cheaper, which is beneficial for importers, but not for exporters. Therefore, countries that specialize in exporting raw materials will suffer, and raw material importers will benefit. Thus, the distribution of damage and benefits occurs, as the damage of some turns into the benefits of others. The spread of damage in the economy is multiplying, for example, the collapse of the restaurant business, tourism, leads to a decrease in orders in the field of food, the hotel business is experiencing a crisis, the need for energy and other services is decreasing.

However, the current crisis also leads to the restriction of transactions (including due to quarantine), which curtails economic activity even in countries where the scale of the virus epidemic is not so large or absent (due to global connections). The transaction sector in many advanced countries makes the main contribution to the rate of economic growth, and occupies in the GDP structure from 60 to 80%. For this reason, curtailing the opportunities for transactional activity will mean limiting the impact of this sector on economic dynamics, which causes first a slowdown in the growth rate, then a negative rate of economic growth. This means a full-fledged economic crisis.

The quarantine restricts people's work, which affects production volumes, although if remote work is well organized, then in the field of IT technologies, computer services and other similar transactions, a decrease in supply can be avoided and even an increase in supply can be obtained. It operates in a disintegrating manner, so it is an important task to preserve European interaction within the Union (Cutrini, 2019).

Emerging pessimistic expectations increase the cost of lending and investment in securities, which makes it difficult to provide and repay loans. If the macroeconomic policy is restrictive, it can increase the cost of loans, which will not improve, and the worst-off will therefore have to implement a policy of cheap loans to support the supply and at the expense of low interest rates and consumer spending, that is demand, which is also able to fall. The overall result will be determined by the ratio of supply and demand shock. The spread of the crisis is carried out through the health care system and the financial market, which most quickly perceives the crisis manifestations associated with the spread of the virus.

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<sup>2</sup> Muhleisen M (2020) Mitigating Economic Fallout of Coronavirus. URL: <https://www.imf.org/~media/Files/News/Transcript/martin-muhleisen-transcript-imf-podcast.ashx>.



The supply shock is unlikely to be offset by the amount of supply that may increase over time due to increasing demand in certain areas (Figure 1). Structural shocks are becoming less predictable, as well as their impact on economic prospects (Vu, 2017), both developed and underdeveloped countries (Landesmann and Stödlinge, 2019). As many activities are curtailed, the level of economic diversification decreases, the risk of conducting economic activities increases, and efficiency decreases, which affects the course of endogenous technological changes (Freire, 2019).

Figure 1 is intended to show the types of activities that are the first to be hit by a “virus attack” on the economy. This impact is then distributed across sectors and activities, some increasing production (protective equipment, masks, equipment), others reducing production (tourism, transport). Along the multiplier chain, these types of impacts are transmitted to other sectors of the economy, indicated generically in Figure 1 by the letters A, B. Thus, different sectors of mechanical engineering provide services in each of the blocks A and B, as the production of medical equipment expands, but the purchase of parts and components for transport systems and its infrastructure is reduced. Over time, industries such as metallurgy will also respond, and demand for them may change due to the General recession when the total impact becomes clear. The fact that different parts of the same production (engineering) end up in both block A and block B indicates the difficulty of accounting for the impact of a virus attack on the economy. Its overall impact will be determined by the time of the virus attack itself and the effectiveness of economic and medical policies to counter the spread of the virus. Although quarantine measures will slow down the economic dynamics.

As can be seen from Figure 1, the demand shock should be resisted in two directions-D1, D2, and stimulating the demand D1, leading to the launch of the corresponding supply. In addition, it is necessary to counteract the financial and currency crisis by eliminating the decline in energy prices. Although for countries that import oil and gas, such a decrease will be a very significant help in the fight against coronavirus, and it is likely that the damage to these countries will eventually be less than the peak. Having a currency that has the status of a reserve international requirement, the country provides a higher level of stability in the face of the crisis.

If aggregate demand  $D = D1 + D2$  at the initial stage, then the decrease in aggregate demand  $dD/dt < 0$  gives the condition that the decrease in demand for component D2 must exceed the increase in demand for component D1. The demand component D3 cannot remain unchanged for long. If the population’s income is significantly reduced, it also replenishes the D1 components, stimulating the deployment of the crisis. An important factor is how the value of GDP reacts to changes in demand-one and the second components. If the product is more sensitive to D2, it will lead to its rapid decline, which will increase the scale of the crisis. If the gross domestic product is more sensitive to the demand component D1, then the economic crisis may follow a tangent trajectory. The reason is that the production will be able to deploy capacity, loading people with work, supporting their income, which eliminates the crisis. The faster it is possible to reduce the spread of the coronavirus virus, reducing the number of cases, the less likely the crisis to take a chronic form and turn into a prolonged crisis. Based on Figure 1, it is necessary to support transactional activities in remote mode (this is attempted by the governments of individual countries), and in such a way that it allows people to increase their income and earn money. In this case, given the significant contribution of the transactional sector to the growth rate before the crisis, the efforts made will clearly be aimed at overcoming the crisis and supporting the rate of economic growth in its main component.

Thus, markets that are losing liquidity need to be provided with this liquidity, which requires solving the problem of resource allocation in the economy. It is necessary to identify the areas of greatest damage and find ways to compensate for it. In addition, it will be useful to identify areas where there may be benefits during this crisis, in order to support these areas, encouraging its accumulation and distribution in the economy to solve related problems. For example, there is an increasing demand for medicines that needs to be met, so it is necessary to support production that would provide new and required medicines and auxiliary equipment to resist a virus attack. It is important to increase the production and not the prices of scarce products, which will only exacerbate the economic crisis. Supply-side incentives can also support demand for raw materials, and therefore act as a counter-measure to lower energy prices, thereby preventing a crisis in financial markets that are highly dependent on oil price fluctuations. A decrease in the oil price may lead to a devaluation of the national currency, capital outflow with the financial market destabilization, and a decrease in quotations. Therefore, measures to support both demand and supply will help overcome such a crisis, in addition to the current measures to maintain currency stability.

In assessing the depth of the crisis and its duration, it is useful to have a method for assessing threats and risks that change dynamically, but which are measured by specific activities. Moreover, this method can be used as a forecast, and then based on the fact of what happened. We will present this method in the next paragraph as a set of theoretical positions and an algorithm that can be implemented using a diagram that reflects the combination of real and potential damage and benefits as the crisis caused by the coronavirus unfolds.

### **3. COVID-19 pandemic threat and risk assessment method in provocation of economic crisis**

Threat and risk are considered as the most important categories that can be used to characterize the situation of virus influence on the economic crisis.

A threat is something that can cause damage to the economy, which is why it is not committed (potential) and has already taken place, implemented, that is an actual threat. It is the realized threat that is related to the damage caused, and it reproduces it. As long as the threat is potential, there is no real damage. In this case, we can talk about the risk to the economy from the development of certain events. The development of an epidemic involves a set of potential threats that are completely dependent on their implementation and transformation into an actual threat in the form of damage caused by the nature of this development. The damage is usually expressed in the fact that the parameters of the functioning of the economy significantly deteriorate, and losses in various types of activities increase. However, as shown above, there are possible dynamics in which some activities in a situation of sharply increased demand may respond by increasing production. In this regard, there are two processes of causing significant and poorly predictable losses and acquiring certain benefits from the spread of the epidemic. The excess of losses over benefits is an expression of the economic crisis. It is expressed in a significant slowdown in the rate of economic growth up to negative values of GDP dynamics. The economy is moving to a different state, where some activities are curtailed and degraded, while others are increasing sharply, often forcibly. This is a rapid structural change, the scale of which depends on the duration, coverage, lethal consequences of the epidemic, as well as quarantine measures, the speed of production of the vaccine and protective drugs. The effectiveness of the economy's behavior in such a crisis, provoked by a virus attack, depends on the safety margin available in this economy, the level of stable development of various

sectors, accumulated reserves and reserves, as well as on the extent to which negative exogenous influences and endogenous mechanisms are counteracted.

If the threat can turn into real damage, then the risk is the expected amount of loss of income that occurs with a certain probability, depending on many factors and circumstances. The problem of quantifying this probability determines the complexity of risk assessment. The risk value can be written as follows:  $R = p * Z$ , where  $Z$  is the expected damage,  $p$  is the probability of the specified damage  $Z$ . In general, the risk acts as a quantitative characteristic of the specified concept of threat (potential), indicating how possible it is to turn a potential threat into a real threat that is the occurrence of this damage. The real losses to the economy may be higher or lower than the expected losses, the risk of which is assessed.

As for the COVID-19 epidemic, a special feature is that the threat associated with this virus is high, but its spread is not controlled by the government of a particular country, which can only affect the reduction of coverage of people affected by the epidemic and only at the cost of a fairly strict quarantine, affecting the functioning of many sectors of the economy. The threat always has a main content and with it there is a list of related threats, just as the expenditure multiplier shows the spread of expenditures to the economy that increase GDP, threats can also limit the growth of GDP by spreading their influence.

The threat carries with it the expected losses distributed across various sectors of the economy, organizations, and institutions. In addition to the damage, the condition of these objects and their quality change, which can only be assessed by experts. In case of force majeure for the economy caused by a viral epidemic, this quality may decrease for some subsystems, but it may increase for others, due to the need to fight the epidemic. It is particularly important that the efficiency of the economic management system does not decrease, and that the basic functions are not disrupted, since in a situation of dysfunction of management and the main economic institutions, the costs will be significantly higher than they could have been. Consequently, the economic crisis will be more painful to bear than it could have been in the case of a well-established management system and making the necessary decisions.

Usually, the threat does not occur in a single instance, generating a set of threats distributed in other areas of functioning. For the  $k$ -th threat that led to damage, taking into account the fact that when the threat occurred, not only damage is possible, but also some benefit:

$$V_k = W_{ik} - Z_{jk} \quad (1),$$

where  $V_k$  is the net amount of damage or benefits from the threat that occurred, equal to the difference in benefits  $W_{ik}$  and costs  $Z_{jk}$ , где  $i \neq j$ , since the benefits and costs arise not only in one sector, but also in different sectors in different ways,  $k$  is threat number from 1 to  $N$  (the total number of threats).

Similarly, for a potential threat ( $V_{ko}$  is potential threat), we can write, taking into account the probability of damage (costs) and benefits, respectively  $p_{jk}$ ,  $p_{ik}$ , that is:

$$V_{ko} = p_{ik} * W_{ik} - p_{jk} * Z_{jk} \quad (2).$$

As the risk of damage increases, the probability of  $p_{jk}$  increases, and the value of  $Z_k$  also increases. If the possibility of getting a benefit increases, the probability of getting a benefit increases, as does the value of the benefit  $p_{ik}$ ,  $W_{ik}$ , which reduces the value of the potential net loss  $V_{ko}$ .



The government's economic policy in the period of a virus attack provoking an economic crisis should work to reduce risks, that is the probability of increasing damage, and increase the probability of acquiring benefits in those areas that allow this benefit to be obtained. Measures are needed at the stage of considering the value of the  $V_{ko}$ , but when there is a net loss of  $V_k$ , we can only talk about eliminating its consequences, since the damage has already been done. At the same time, countering the crisis and the depth of damage is one type of policy, while eliminating the consequences of the crisis and the net damage already caused to the economy is a completely different policy. It should be noted that the first type of policy prevents the need for the second type of policy, since it reduces the overall amount of net losses for the economy. For this reason, the order of actions in the context of crisis deployment and preparation for it, when the virus attack has not yet arrived in this country, is highly relevant.

Ideally, it should aim for a situation where  $W_{ik} \neq 0$ , as well as  $W_{ik} > Z_{jk}$ , either the goal is to maximize the net benefit, or minimize the damage or minimize the risk. Since the distribution of resources in different areas of use can be considered for solving such problems, the optimization problem resembles a portfolio method for solving similar problems. Moreover, one resource allocation provides the highest revenue, the other is the least risk, and then need to choose the most acceptable distribution structure (Sukharev, 2019). When a virus attack is launched on the economy, usually, depending on the characteristics of the virus, the impact spreads quite quickly. Countries that experienced this for the first time and unexpectedly are in a less fortunate position relative to countries that took the virus attack later and had some time lag to prepare. They could not take advantage of this time lag, or it was not enough to implement all the preventive effects on the economy, however, there was some time. Another point is that many markets are organized in such a way, in particular, financial markets, that pessimistic expectations due to the global effect spread like lightning, bringing down the financial market, the consequences of such destabilization affect the functioning of the economy, the deployment of the crisis. In principle, a given country may not yet have a strong epidemic, and due to the destabilization of its currency and financial market, it may experience an economic crisis. Of course, the high level of autonomy of its development, the low degree of structural, technological and other types of dependence increase the ability to resist the crisis. However, due to the pervasive nature of modern global trade and services, the spread of the crisis will affect such countries in one way or another. For them, the severity of the crisis may be less, the damage-lower. Those who provide the world with a vaccine and the necessary drugs will get an additional boost in the development of their pharmacology and medicine.

If the actual<sup>3</sup> cumulative benefit or loss of  $V_r$ , the potential loss or benefit of  $V_o$ , is not difficult to write, using expressions (1) and (2):

$$V_r = \sum_{k=1}^N V_k,$$

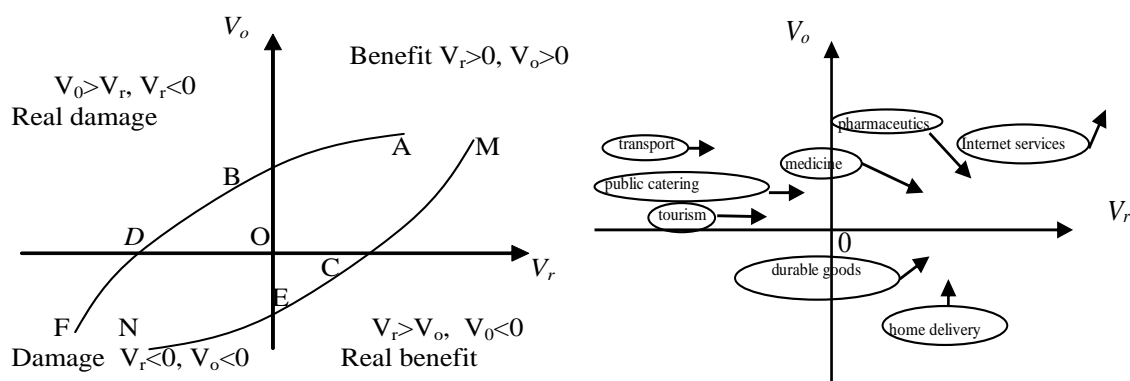
$$V_o = \sum_{k=1}^N V_{ko},$$

<sup>3</sup> Measurement of the actual damage (benefit) will become possible after it has taken place. At the initial stages of a virus attack, we can only talk about potential damage or benefits for certain activities and the economy as a whole. In addition, it is not clear the duration of the epidemic, which also determines the amount of damage and possible benefits.

$$\begin{aligned}
 H &= V_r - V_o, \\
 v_k &= \frac{V_{ko}}{V_k}, \\
 w_k &= \frac{V_{ik}}{Z_{jk}}, z_k = \frac{p_{ik} * W_{ik}}{p_{jk} * Z_{jk}}
 \end{aligned}
 \tag{3}.$$

Thus, Equation (3) gives an estimate of the total damage/benefits to the economy—real— $V_r$  and potentially is  $V_o$ . A real loss or benefit is defined as an exact measurable amount in monetary units. Potential benefit or damage is the expected benefit or damage also in monetary form, which is calculated and estimated approximately. Thus, the real value is the actual value, and the potential value is the possible value, according to experts or the government. Then the difference between these values (H) is determined, showing the ratio of real and potential damage or benefit. The parameters  $v_k$ ,  $w_k$ ,  $z_k$  represent the ratio of net potential damage (benefit) to real, real benefits to costs, and potential benefits to costs.

Thus, it is important to reduce the difference between potential and actual damage, eliminate the risk, reducing the probability of damage and its magnitude, while increasing the benefits for other sectors, activities and agents. This means that the crisis management model should lead to the use of threats for their own purposes, in fact, turning them into benefits (ideally) that outweigh the damage caused. Using this idea in market management will increase the stability of the economy. Also important is the principle of excluding the worst-case situation for the economy. It is achieved by following the Equations (1) and (2), when  $V_r < 0$ ,  $V_o < 0$ , that is there is damage both potential and real. It is important to note that the actual damage must be greater than the potential damage, i.e.  $V_r > V_o$ , then the situation is actually worse than expected. If the actual benefit is higher than the potential benefit, it means that the situation is better than expected in terms of net benefit.



**Figure 2.** The combination of benefits and losses in the economy (the theoretical composition on the left, possible a realistic assessment of the sectors on the right) during a virus attack<sup>4</sup>.

Figure 2 on the left shows all possible options for the emerging situation if there is a threat to economic development (the emergence of a crisis due to, for example, a virus attack). In the first quadrant (line segments AB, CM), the net benefits of a potential and real threat are positive, that is

<sup>4</sup> This approach and the proposed model can be used to analyze threats at any level, in particular, the spread of a virus attack.

the benefits exceed the costs of implementing the threat ( $V_o > 0$ ,  $V_r > 0$ ). However, on the AB section, the potential benefit exceeds the real one, and on the SM section, the opposite is true. Of course, the best option for the economy is when the real benefits exceed the potential benefits.

Figure 2 on the right shows possible sectors (the location is conditional for demonstrating the method) that can be located in one of the quadrants under consideration. This allows us to correlate the estimated damage and benefits with the actual values (in fact), on the basis of which we can then modify the methods of economic policy that affect the situation. Understanding approximately the ratio of damage and possible benefits with real parameters, you can both use some preventive methods of influence, and after the situation has developed and somehow changes, that is, the decision is subject to correction on a continuous time scale. The assessment method involves determining the benefits/losses for a particular type of activity (sector) for a quarter (if statistics are available), half-year or year, relative to the previous time period (for the same period of time last year). In addition, the “virus attack” is an obvious force majeure for the economy, and estimates for the growth of sectors and the dynamics of their production for the planned period of development were at least approximate or can be given for the same period of the previous year. Therefore, the actual benefit or damage (with a negative value) of  $V_r$  in the course of a virus attack and the value of  $V_0$  is the potential benefit or damage that could have been expected or planned without deploying a virus attack on the economy. In this regard, the diagram in Figure 2 on the right shows (in our case arbitrarily) the location of sectors or activities, which gives a picture of the structure of activities, which of them, and what impact they are experiencing during the COVID-19 virus attack. If for pharmaceuticals and Internet services it is possible to indicate the need to increase the real benefit (but without speculative contribution to increasing the price of medicines), then for medicine, which the real value of the benefit may be negative, so this type of activity should be moved to the right arrow due to the necessary subsidies and improving the supply of equipment, including through the help of the world community. Activities such as tourism, transport, and catering require minimizing damage by shifting the arrows to the right. However, under strict quarantine, even minimization of losses becomes problematic and relative. To support these types of businesses, it is necessary to defer the payment of debts, leases, i.e. normalization of current payments and delay in repayment of obligations for vouchers that have already been sold. Thus, there are various options for impacts associated with supporting curtailing activities by the nature of the quarantine (there are no other options) and stimulating production for those activities that should meet the needs for quarantine and treatment. Production of long-term products with a high level of automation and capable of ensuring efficiency without involving a significant number of employees can work in the warehouse during the quarantine period, in order to provide some backlogs of products by the time the quarantine is lifted and to preserve the production.

In the third quadrant, in contrast to the first quadrant, there is a net loss, i.e., the cost exceeds the benefit, both in potential and real dimensions. It is this quadrant that symbolizes the worst variant of crisis development. On the FD line, the expected damage is lower than the actual damage. This fact indicates that all risks were not taken into account, or that preventive measures are working with low efficiency. On the NE line, the expected damage is higher than the real one, which may characterize the measures taken to counter the crisis and eliminate risks. The deepest crisis characterizes the third quadrant, and the least effective economic policy measures—the second quadrant, since it is in this quadrant that the expected net benefit is positive, and the real negative, that is there is damage, while it was not expected. In the fourth quadrant, there is an expected loss ( $V_o < 0$ ), but the real situation is

that the net benefit is positive, meaning that the potential for a crisis is overestimated ( $V_r > 0$ ). Therefore, in this case, it is possible to evaluate as effective those measures that are aimed at preventing the spread of a virus attack and the economic crisis. In other words, ideally, the first and fourth quadrants should serve as reference points for moving the situation, if the situation initially developed so that the country occupies a position in the second or third quadrant (Figure 2). Estimates of potential benefits and losses that vary by economic sector and activity can be made based on the expected change in demand (reduction or increase) that affects output. By changing the volume of production and the amount of demand, it can be estimate the amount of reduction in revenue and profit. The real benefits and losses are actual values that can be tracked over time and the development of a crisis situation with the spread of the virus and the epidemic. With the emergence of the crisis actualizes objective of the managed allocation of resources in the economy, and part of the resources released by crises, but on another part need to work to direct it up at the necessary channels and deal with the crisis. It is probably worth focusing on the implementation of optimization models for resource allocation in a crisis economy on the distribution that gives the least risk (Sukharev, 2019; Nkeki, 2018), which will reduce the amount of damage and dampen the financial crisis, use portfolio models for analyzing the risk of investments and the expected income from them (Guerard et al., 2015). This will allow to evaluate the distribution of global efficiency. Therefore, the allocation of resources that meets the target function of maximum revenue should be replaced with search distributions that minimize risk. This approach will help to neutralize threats by allocating available resources accordingly, with existing restrictions on their use. This approach will improve financial stability in conditions where it is disrupted and the unstable functioning of the financial sector worsens. Let's discuss the problem of financial dynamics and the impact of investment on GDP dynamics, since this influence can be used to assess losses, and investment is most responsive to the increase in risk that occurs during the spread of a viral infection.

#### 4. Financial dynamics. Discussion of results

Financial dynamics, provided by the predictable operation of financial markets, without great volatility, in the performance of the main functions of such markets, is the key to non-crisis economic dynamics. Strong volatility, declining stock prices, capital flight, and financial market dysfunction provoke an economic crisis and increase its risks. For example, the expansion of financial investment<sup>5</sup> and the superiority of such investments over non-financial ones, while destabilizing financial markets, can lead to very significant losses.

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<sup>5</sup> Investments in financial assets (financial investments) according to the IMF (Source: 6th edition of the IMF balance of payments and international investment position guide, <http://data.imf.org/regular.aspx?key=61545867>), means equity instruments and investment fund units, debt securities, options, forward contracts and other financial assets and liabilities. According to Rosstat (Source: <https://www.gks.ru/folder/14476> investments of organizations in state and municipal securities, securities of other organizations, including debt securities in which the date and cost of repayment is determined (bonds, promissory notes); contributions to the authorized (stock) capitals of other organizations (including subsidiaries and dependent business entities); loans granted to other organizations, deposits in credit organizations, receivables acquired on the basis of assignment of the right of claim, deposits of a partner organization under a simple partnership agreement, etc. Investments in non-financial assets (Sources: world Bank <https://data.worldbank.org/indicator/NE.GDI.TOTL.ZS>, Rosstat

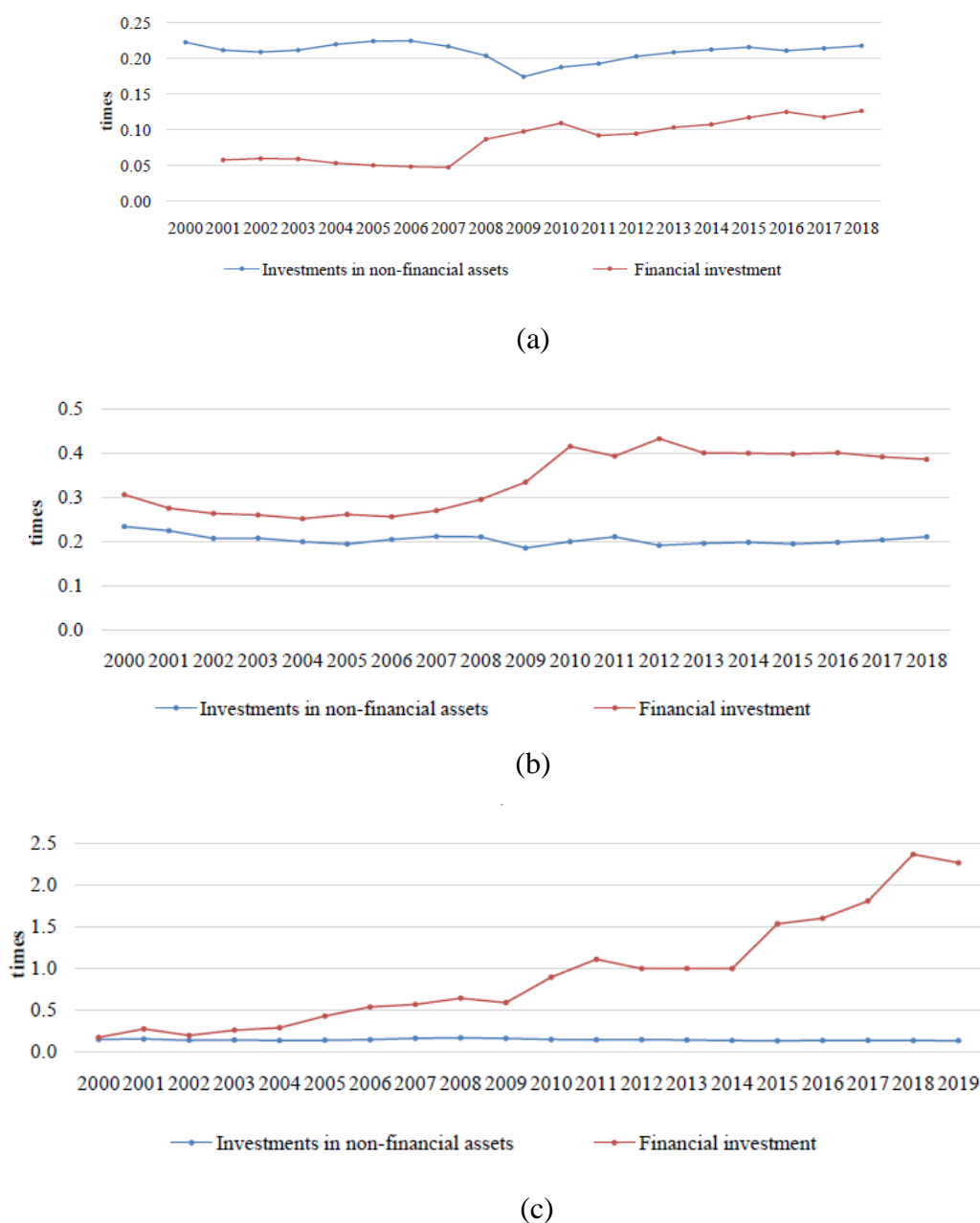
The presented analysis gives reason to believe (according to Equations (1) and (2)) that the lower the damage and its probability, as well as the lower the dynamics (change) of damage and probability, the more favorable the situation for the economy in countering the virus. In this regard, an important condition for countering the virus is to reduce the speed of spread of the virus attack. The reduction in the volume of the transaction sector and its rate of dynamics will also affect the downward pace of economic growth. Therefore, it is necessary to stimulate transactions, since the transaction sector makes a fundamental contribution to the economic dynamics of most developed countries that have been subjected to a virus attack. In addition, ensuring the stable functioning of the financial system is also a condition for countering the crisis that is being deployed due to the COVID-19 virus attack.

The financial market and financial investments are strongly affected by changes in risk, which in turn is determined, among other things, by events such as COVID-19, i.e., a virus attack. The increase in risk during the COVID-19 virus attack and the deployment of the crisis, and quite quickly, affects investments—financial and non-financial. Therefore, having an econometric model of the relationship between GDP and financial and non-financial investments, as well as evaluating the bias towards certain investments, for example, when financial investments exceed the value of GDP as in Russia, we can talk about the possible impact of the structure of “financial-non-financial” investments on the depth of the crisis. Since we are talking about damage during the crisis, the decline in GDP leaves this damage, and the reduction can be estimated using the model of the relationship between GDP and investment in financial and non-financial assets, which will be attempted below. Thus, the ratio in favor of financial investments, which are most sensitive to the risk that increases with a virus attack, can significantly decrease, which will affect the economic dynamics and the amount of GDP losses, including non-financial investments. We will show the dynamics of non-financial and financial investments made in the financial markets in the pre-crisis period. Let's give an estimate of these investments relative to the GDP of the three countries of the United States, Germany and Russia (Figure 3).

Figure 3 shows that investment in non-financial assets in the US was 1.5–2 times higher than financial investments. For Germany the excess was also 2 times, only in favor of financial investments. Moreover, if the difference in the US decreased by 2018, in Germany it increased in favor of financial investments. A completely different model is shown in Russia, where financial investment is ten times higher than non-financial investment, while it is 2 times higher than GDP. Over the time interval considered, this difference only increased.

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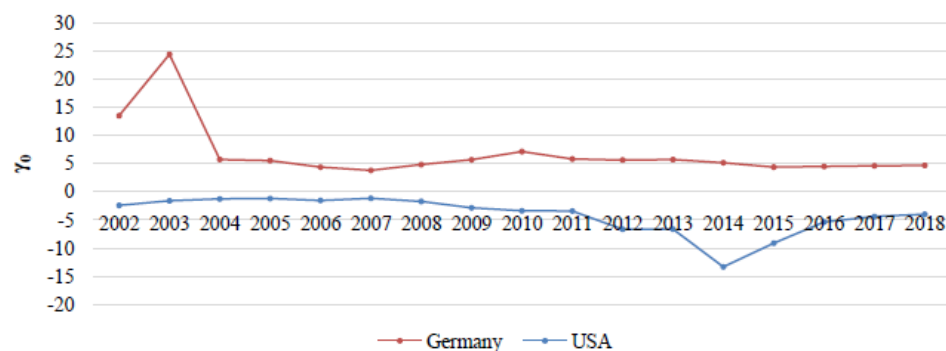
<https://www.gks.ru/accounts>) are gross accumulation of fixed capital and changes in working capital stocks and net acquisition of valuables.



**Figure 3.** The ratio of financial investments and investments in non-financial assets to GDP in the United States (a)<sup>6</sup>, Germany (b)<sup>7</sup>, 2000–2018, Russia (c)<sup>8</sup>, 2000–2019.

<sup>6</sup> Source: calculated from World Bank data <https://data.worldbank.org/indicator/NE.GDI.TOTL.KD>, <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD>, International monetary Fund <https://data.imf.org/regular.aspx?key=61545853>.

<sup>7</sup> Source: calculated from World Bank data <https://data.worldbank.org/indicator/NE.GDI.TOTL.KD>, <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD>, International monetary Fund <https://data.imf.org/regular.aspx?key=61545853>.



(a)



(b)

**Figure 4.** Offset parameter for financial investments in the United States, Germany (a)<sup>9</sup> and Russia (b)<sup>10</sup>.

If enter the parameter  $\gamma_0 = If/(S-Inf)$ , where  $If$  is financial investment,  $Inf$  is investment in non-financial assets, and  $S$  is the amount of savings, it characterizes the ratio between financial and non-financial investment in the economy. The growth of this parameter indicates the expansion of financial investments. A negative value indicating that non-financial investments exceed the available savings amount.

Figure 4 shows the results of calculating the parameter  $\gamma_0$ , which is called the “institutional bias” of the “financial–non-financial” investment structure.

Since in Germany there was an increase in financial investment without a noticeable increase in non-financial investment (Figure 3, b), the stable dynamics of the parameter  $\gamma_0$  (Figure 4, a), indicates an increase in the value of savings. In the US, the parameter  $\gamma_0$  is negative, increasing by 2014, then decreasing in the negative region (Figure 4, a), which indicates the excess of non-financial investments

<sup>8</sup> Source: calculated from Rosstat data [https://www.gks.ru/investment\\_nonfinancial](https://www.gks.ru/investment_nonfinancial), <https://www.gks.ru/folder/14476>, [https://www.gks.ru/storage/mediabank/tab1\(2\).htm](https://www.gks.ru/storage/mediabank/tab1(2).htm).

<sup>9</sup> Source: calculated from World Bank data <https://data.worldbank.org/indicator/NE.GDI.TOTL.KD>, <https://data.worldbank.org/indicator/NY.GNS.ICTR.ZS>, <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD>, International Monetary Fund <http://data.imf.org/regular.aspx?key=61545865>.

<sup>10</sup> Source: calculated from Rosstat data [https://www.gks.ru/investment\\_nonfinancial](https://www.gks.ru/investment_nonfinancial), <https://www.gks.ru/folder/14476>, [https://www.gks.ru/storage/mediabank/tab1\(2\).htm](https://www.gks.ru/storage/mediabank/tab1(2).htm).

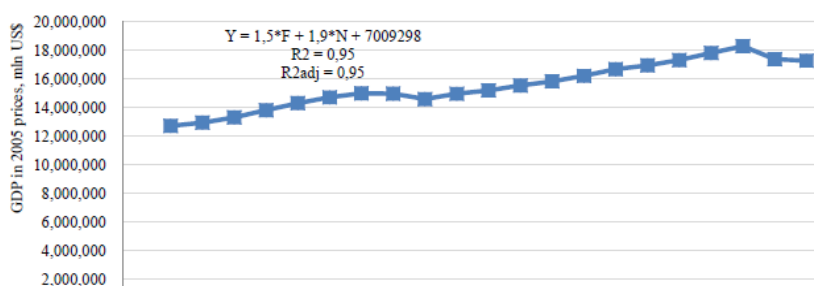
over savings. In Russia (Figure 4, b), the parameter  $\gamma_0$  increases, which is a characteristic of a large-scale increase in financial investment. This superiority of the financial market, given the high dependence of the country's currency market on the world price of hydrocarbons, lays a very weak Foundation for development, especially in the conditions of financial market destabilization and financial and economic crisis. The American economy shows the best readiness to resist a recession by this parameter. For Germany when the financial market is highly volatile, financial investments will suffer as a result of the epidemic. This is a destabilizing factor for economic development. Thus, in a country characterized by the smallest possible value of  $\gamma_0$  and not a large ratio of financial and non-financial investments, the margin of stability in a crisis situation is, all other things being equal, higher for the reasons mentioned above. The collapse of the financial market, when financial investment exceeds, say, the value of GDP, is fraught with a more serious crisis. Therefore, a measure to counteract the crisis is to reduce the gap between the financial and non-financial sectors, between financial and non-financial investments. Determining the impact of non-financial investments and the financial sector on economic growth, estimating the expected decline in these investments during the crisis, it is possible to determine the value is not created by gross domestic product, and will be in conjunction with an absolute loss in GDP decrease the amount of damage to the economy due to the crisis. The real damage is certainly higher, since we must add to it the lost lives of people who, even from a cynical economic point of view, have no value (are priceless).

The superiority of financial investments over non-financial investments cannot but affect economic dynamics, especially in a crisis. The main total losses of the economy during the crisis are expressed in the amount of GDP. Therefore, having obtained an econometric model of the relationship between the GDP of the countries in question and financial and non-financial investments, we will show what will happen to GDP in these countries when investment of each type decreases, for example, by 5% (in 2020). In the next year, we will put an increase in financial investment by 1% and a reduction in non-financial investment by 2% due to the inertia of negative phenomena (we also take not the best option for economic recovery).

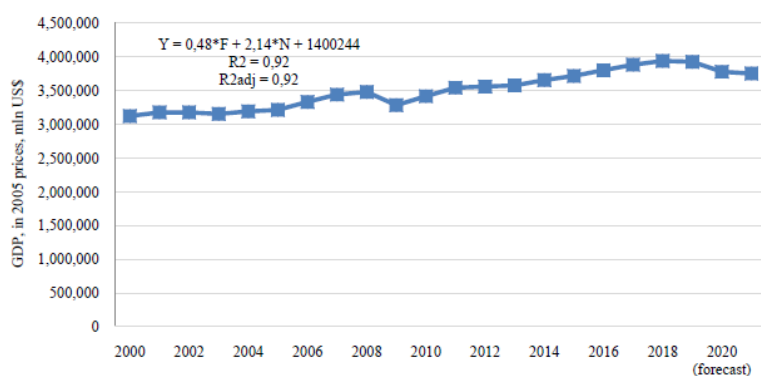
For each country (USA, Germany, Russia), econometric models were selected that link GDP with financial and non-financial investments, using the best statistics method (the models are shown in the graphs in Figure 5). Financial investments in the graphs in Figure 5 are indicated by F, non-financial investments by N, and gross domestic product by Y.

As can be seen from Figure 5, each country is experiencing the decline in GDP, with Russia experiencing the largest decline in the considered scenario. Thus, by estimating the amount of decline in gross product, it is possible to estimate the total losses from the economic crisis, when the results will be summed up, and potential or assumed based on the considered scenario. A significant reason for the largest losses in Russia is the shift of the financial market relative to the non-financial one, since financial investment exceeds GDP in size. This creates an imbalance in development, which is very vulnerable in terms of increasing investment risks in the event of a virus attack on the economy.

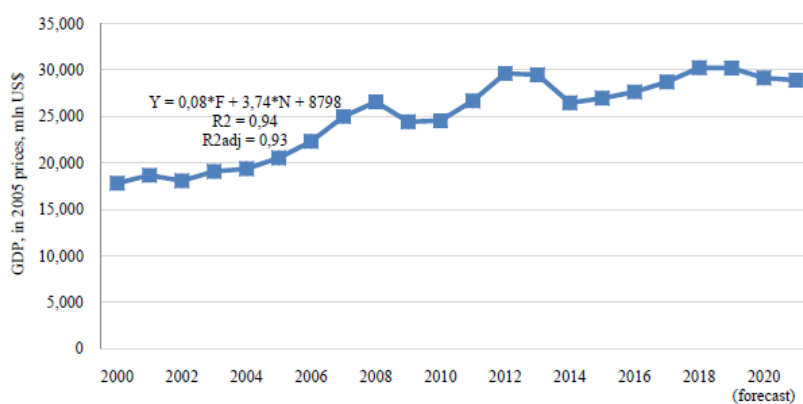




(a)



(b)



(c)

**Figure 5.** GDP Dynamics of the United States (a)<sup>11</sup>, Germany (b)<sup>12</sup>, Russia (c)<sup>13</sup> from the value of financial and non-financial investments<sup>14</sup> with a forecast for 2020–2021<sup>15</sup>.

<sup>11</sup> Model statistics for the United States: F-criterion = 147; D-Wcalculation. = 1,8 € [1,53; 2,47]; White test:  $\chi^2$  calc. = 3,9;  $\chi^2$  crit. = 27,6.

<sup>12</sup> Model statistics for the Germany: F-criterion = 88.3; D-Wcalculation. = 1,9 € [1,53; 2,47]; White test:  $\chi^2$  calc. = 4.6;  $\chi^2$  crit. = 28.9.

<sup>13</sup> Model statistics for the Russia: F-criterion = 125.3; D-Wcalculation. = 1,4 € [1,4; 2,6]; White test:  $\chi^2$  calc. = 1.5;  $\chi^2$  crit. = 30.1.

## 5. Conclusion

Of course, one article could not cover all the issues of such a complex phenomenon as the impact of a virus attack on the economy and provoking an economic crisis. This is a new phenomenon that has never happened on a global scale, and the reaction of the economy, given the synchronicity of the virus spread among the leading economic players, is one of the significant factors. In addition, the identity and simultaneity of all types of activities during the crisis is a feature that has not previously been encountered. This was not typical of past crises. In this regard, the analysis can not claim to be complete, however, it reveals some important points in the author's opinion, which allow, on the one hand, in the conditions of chaotic decisions, methodically justified work on the formation of economic policy to counter the crisis. On the other hand, it allows us to estimate, at least approximately, possible GDP losses for the countries under consideration due to changes in the dynamics of investment. The multi-factor nature of the crisis and the complex interactions in the global economy during its unfolding were not taken into account here, of course.

In the theoretical part of the study, an approach to the correlated analysis of potential and actual (real) benefits and losses was proposed not only for the diagnosis of the situation, but also for the adoption of selective differentiated measures for each type of activity and economic sector (according to the diagram in Figure 2). Two important points were shown.

Summing up the research, we note the following most important results.

Firstly, the worst situation for the economy is when the real damage exceeds the potential. It should be eliminated by pre-emptively reducing risks and the amount of damage. Therefore, macroeconomic policy and the functioning of financial markets should play a role in maintaining stable dynamics, or not allow it to fall to certain critical parameters. This can be achieved not only by greater regulation of the financial market, but also by shifting the focus of industry policy to industries that benefit from the spread of the virus, as demand for their products increases. We need to use this growth to expand production. The withdrawal of capital from the financial market that exposes the decline in the development of some sectors and companies should be transferred to other sectors and companies that become locomotives in overcoming the crisis. Of course, measures that hinder the withdrawal of capital should also be taken. The solution to the problem of optimal allocation of resources in a crisis economy prone to a virus epidemic should be reduced to the search for minimal risk, making this criterion the criterion of efficiency in decision—making. At the same time, eliminating the amount of possible damage.

Secondly, in addition to neutralizing the damage, it is necessary to influence the increase in the benefits of the crisis situation. This is the most reasonable strategy for economic development.

The expansion of benefits is seen through a policy of multiplying demand in sectors and activities that require increased production. To this end, while maintaining quarantine measures and selective employment in combination with remote work practices, it is necessary to encourage the expansion of relevant industries that serve the quarantine. This applies to the agricultural and food

<sup>14</sup> Source: calculated from Rosstat [https://www.gks.ru/investment\\_nonfinancial](https://www.gks.ru/investment_nonfinancial), <https://www.gks.ru/folder/14476>, [https://www.gks.ru/storage/mediabank/tab1\(2\).htm](https://www.gks.ru/storage/mediabank/tab1(2).htm), World Bank data <https://data.worldbank.org/indicator/NE.GDI.TOTL.KD>, <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD>, International Monetary Fund <https://data.imf.org/regular.aspx?key=61545853>.

<sup>15</sup> GDP in 2005 prices.

sector, safe delivery services, Internet work and its communications infrastructure, and instrumentation that provides equipment to the medical industry. To solve such problems, it is necessary to subsidize or open credit lines by saturating the banking system with liquidity at reduced interest rates. These points of production growth have a multiplier effect and are able to provide loading to the types of activities that depend on them. An important circumstance in terms of stimulating the benefits of the crisis is to prevent speculative price growth on the effect of the deficit, so quarantine measures should be measured against the possibility of functioning of individual industries that increase production.

Analysis of the financial market bias has shown that a strong imbalance, for example, for the Russian economy, is very dangerous from the point of view of the emerging depth of the recession. Consequently, for some countries, the structural task of balancing the dynamics of the financial and non-financial markets will have to be addressed.

The prospects of the research are seen in the study of the relationship between investments in financial and non-financial assets when the parameter of institutional bias of the financial sector changes, as well as in determining the impact of the dynamics of this parameter on the rate of economic growth. In addition, it would be useful to take into account changes in various indices that characterize the situation in the financial markets of countries, with an emphasis on the possible impact of changes in this situation, for example, on inflation and GDP dynamics.

Thus, the economic crisis provoked by such a force majeure factor as the COVID-19 virus attack requires to eliminate systemic economic impacts and integrate the efforts of various countries in the era of global interactions that ensure rapid spread of the crisis and transmission to countries that are not subjected to a large-scale virus attack.

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## Conflict of interest

The author declares no conflict of interest in this paper.

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