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## FORMALIZATION THE ASSESSMENT PROCESS OF THE COVID-19 IMPACT ON THE COMPETITIVE MARKETS AND ECONOMIES

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**Keywords:** COVID-19, innovation technology, pandemic time and its effects, formalization of the assessment process of the COVID-19 impact.

*The article describes the influence of COVID-19 on different economic parameters such as FDI flows, unemployment, global partnership. It covers changes in the stock market, electronics, IT sphere, and industrial area. The main industrial results are shown through aircraft products, commodities sector, steel sector, car manufacture. The analysis of the impact of COVID-19 on economies proposed to be done via competitive markets. Since it has different degrees of depth and scale of research and, unfortunately, there is no approach that analyzes all aspects of the economy or market simultaneously, authors proposed their own approach. The proposals are based on integrated and systematic approaches with an economic analysis of the impact of coronavirus on a competitive market. It is a complex model since market conditions are very unstable and depend on numerous factors of internal and external influence, hence it should cover all aspects of market activities. The method is composed of proposed basic principles of formalizing the process of assessment. These principles build on the potential to contribute to finding solutions to problems caused by negative impact of the COVID-19 on markets and consequently on economies.*

**Introduction.** From the beginning of 2020, the whole world faced new challenges. An unknown epidemic, a complete lack of information, the inability to manage processes remotely, or sometimes the inability to perform operational activities at all have led to a decline in economic, business, and social activity. Economic indicators have deteriorated significantly in almost all areas — from the development of small businesses in some countries to big international cooperation. The 2021 year was marked by the fight against epidemiological waves, the invention of ways to digitalize many processes, the development of online activity beginning

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from education in schools and universities to address management issues at the international level remotely. And it is planned that 2022 will only deepen the trend of digitalization, promote 5G technology, increasing demand for informational equipment, tools, and technology. Understanding these processes makes it possible to properly redistribute resources and support relevant areas of activity. All this underscores the need to develop an appropriate methodology that will help to formalize the assessment process of the COVID-19 impact on different companies, countries, and markets. It helps reduce the negative impact on the economy, both within the global economy and within individual companies.

**Analysis of recent research and publications.** COVID-19 topic is very popular nowadays. All papers say that the COVID-19 has severely affected the economies worldwide but its impact on the global economic indicators has not been measured or explained. We offered the approach how to conduct this assessment. The most relevant papers are made by G. Farrugia, R. Plutowski [1] with their analysis of innovation during the crisis, collaboration with the government, and the digital legacy of COVID-19. P. Carlsson-Szlezak, M. Reeves, P. Swartz [2], were three transmission channels of possible decreasing social, economic, and financial activities under the pandemic influence are described. All world felt an enormous economic costs, resulting in unprecedented economic losses, which were covered by the group of researchers with V. M. Carvalho, J. R. Garcia, S. Hansen, A. Ortiz, T. Rodrigo, S. Rodriguez Mora, P. Ruiz de Aguirre [3], O. Coibion, Y. Gorodnichenko, M. Weber [4], P. Deb, D. Furceri, J. D. Ostry, T. Nour [5], IMF [6] and so on.

The pandemic effects on a wide range of international development processes were analyzed by E. Papyrakis, S. Murshed [7].

Fukao M., Shioji E. [8] designed a reaction function, which sets the level of economic activity as a function of the state of infection. And shows ways of a high possibility of an infection explosion to be eliminated.

According to the literature research [9], a market with externalities cannot recover by itself, the same we can say about economy. Thus, one of the most problematic places is to appropriately identify how the pandemic — COVID-19 is related to a market of any product and assess its impact on a market. Modeling this process is necessary to identify

possible negative / positive influences on the market's participants and the whole economy of a country.

Despite numerous and continued studies in this field of knowledge, it should be noted that the problem of determining an effective approach to assess the impact of COVID-19 on the competitive market remains not enough studied. It appears as an unresolved part of the overall problem due to the absence of well defined, clear, and transparent, automated rational assessment method, which led to the feasibility of further research.

**The article's aim** is a theoretical and practical analysis of the impact of coronavirus on the global economy. The object of research is how the COVID-19 affects markets for many products, therefore the economy of the countries, and the world overall. This impact can be associated with externalities, consequently, neither markets cannot be considered efficient markets nor economies.

**Results.** According to the World Health Organization (WHO) and World Bank report from 2019 noted that deadly respiratory pathogen pandemic could wipe out 50 to 80 million people and nearly 5 % of the world economy [10]. A global pandemic of this magnitude could have catastrophic consequences, creating widespread chaos and economic instability [11]. On 31.12.2019, the authorities of Wuhan, China, informed WHO of an outbreak of pneumonia. On 11.02.2020, the disease was named COVID-2019, a new coronavirus disease; on 11.03.2020, the WHO announced that the outbreak had become pandemic. On 20 April 2020, about 2.5 million people were infected with the new coronavirus. Nearly 166,000 people died [12]. In January 2022 it is known 370 million COVID cases (in Ukraine — 4 206 731), 5 652 965 total deaths (in Ukraine — 106 690), but additionally, we have total vaccine doses administered, which is 9 939 117 635 cases [13].

The epidemiological literature has already established the effectiveness of COVID-19 vaccines in curbing severe infections, reducing viruses, hospitalizations [14]. This is good news for an economic increase in 2023, but 2022 will not be very profitable.

The response to the pandemic created a new type of partnership that reimagine traditional organizational boundaries. So, it mixed different large health care organizations, academic institutions, private industries, and startups in one big Healthcare Coalition. It includes the University of California

health care system, Mayo Clinic, Microsoft, Amazon Web Services, Epic [1].

The OECD report on the impact of the coronavirus on international trade notes that countries are exacerbating the situation by their own actions, as economic activity remains the key to saving lives and overcoming the crisis. One such manifestation is the restrictions on exporting medical equipment, food, and other essential goods, which undermine confidence in the global market and trade and prevent further recovery.

Even with governments' commitment to strict restrictive measures to reduce the infection rate, the degree of such influence varies depending on the sector of the economy and the specific conditions of production.

The introduction of quarantine measures in Ukraine had a negative impact on the work of consulting companies in Ukraine compared with other areas of services. Most of all the work of consulting companies was affected by the reduction of business activity in Ukraine. Analysis of data on the opening and closing of companies in the period from March 12 to April 15, 2020, demonstrates a decrease in the rate of creation of new companies in the domestic business space. The rate of companies created during the study period decreased by 54.7 % compared to the same period in 2019. If in the previous year the data of the Unified State Register demonstrated the registration of 5452 new companies, now the number of such companies reaches 2,471 units. In addition, quarantine restrictions have marked

a trend of more frequent closures of the respective firms — some days there were up to 50 cases of business closures.

It is assumed that in the case of extension of quarantine restrictions until the end of fall of 2022, companies providing professional services (marketing, consulting, design) will be less affected — the extension of quarantine will not affect 36% of surveyed enterprises in this area.

Among other industries seeking a resumption of activity, car manufacturers stand out, also working on additional safety measures. German companies planning to restart production have upgraded production processes to try to convince workers that it is safe to return to production sites. Volvo offers workers blood oxygen tests, and Hyundai Motor Co's workers have to go through a chamber that measures temperature.

The risks and fears associated with the coronavirus have had a negative impact on investor sentiment (fig. 1).

As we can see from figure 1 the level of FDI in 2020 is one of the lowest for the 2014-2020 period. Even more, we can say that it is lower than in the 2005 year in five times [15]. In the EU in 2005 the total level of FDI was 0,56 million US dollars, in 2021 — 0,12 million US dollars.

The pandemic also affects stock markets in three ways:

- a decline in business activity;
- a decrease in local market activity;
- stress on financial markets;
- reduced bond yields.

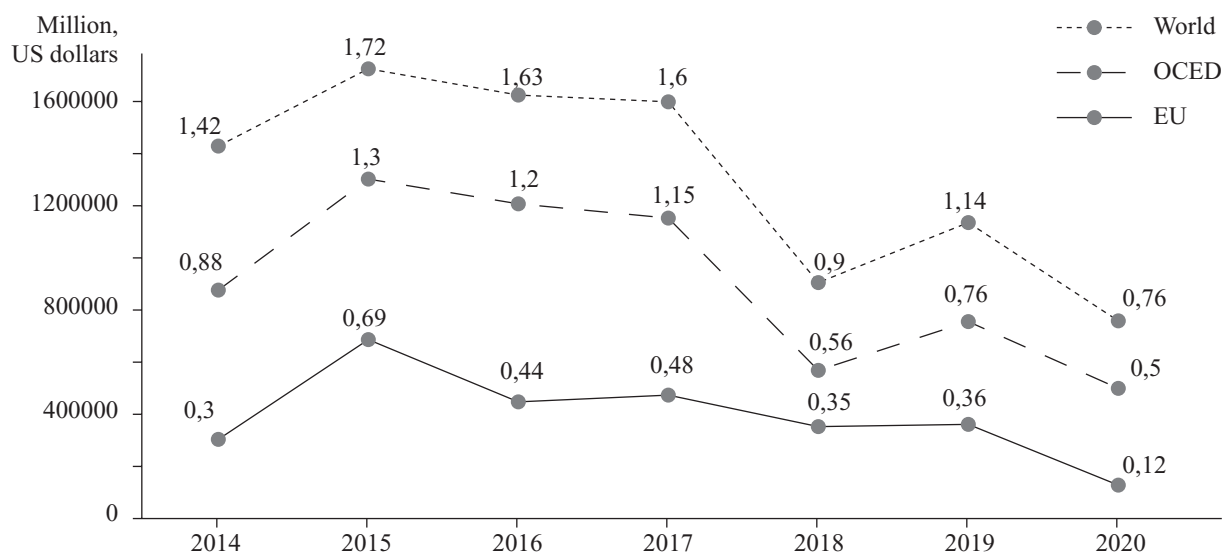
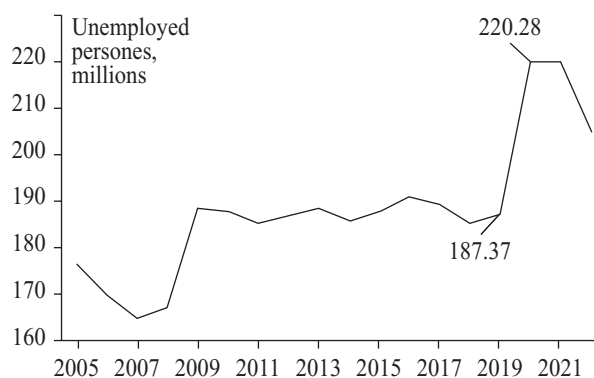


Fig. 1. FDI flows in the world, OECD and EU [15]



**Fig. 2.** Number of unemployed persons worldwide 2005–2021 [18]

Fears over the spread of the virus have depressed bond yields. Treasuries in the US are considered safe assets, which investors prefer in times of volatility and uncertainty. In America, bond yields have fallen to less than 1 % in seven days. This had not happened before. The yield on 10-year securities reached 0.3 %.

**Impact of the pandemic on industrial areas.** As the 2020 COVID-19 crisis unfolds, ferrous metals producers will have to improve their methodological approaches to forecasting due to the potential weakening of demand among steel consumers, especially in sectors that can be classified as «nonessential». For example, the EU automotive industry, the leading consumer of European steel, is already gradually slowing down production at numerous plants [16].

Today, many academic institutions and analytical agencies are developing possible scenarios for developing the world economy under the impact of the pandemic. The approaches defined by McKinsey & Company analysts as the most realistic development options depending on the course of the COVID-19 pandemic were used as the basis for the developed foreign trade strategy of export-oriented enterprises [17].

Optimistic — an effective health system response helps control the impact of the virus on health, and the economic momentum of robust, backed-up fiscal and monetary mechanisms allow for considerable «adjustment» of economic processes with the minimal economic downturn.

The industry had been proved to be particularly vulnerable to the coronavirus-induced crisis because most employees are directly employed in manufacturing, and work is often difficult or impossible to do remotely. Moreover, given the nature of the sector, it is not always possible in

principle to ensure social distance in workplaces in production plants, warehouses, logistics, etc. That's why the world economy faced bad results in the unemployment level.

COVID-time has rapidly decreased the total number of companies and possibilities to find jobs, thus, the total number of unemployed people worldwide increased from 187,3 million to 220,47 between 2019 and 2021 (fig. 2).

As we can see from figure 1 unemployment level increased by almost 33 million in 2020. This had a bad influence on the development of companies.

The adverse effects of the crisis are particularly pronounced in the energy, automotive, and aviation industries. Due to the COVID-19 epidemic worldwide, manufacturers of cars, electronics, and aircraft face problems related to the availability of raw materials and components became very expensive (fig. 3).

In the electronics sector, smartphone and appliance companies have begun to reduce manufacturing operations and postponing new product launches because of broken supply chains. The electronics industry has been hit hard by the COVID-19 pandemic, as in China, the epicenter of the epidemic accounts for about 85 % of the total cost of components used in smartphones and almost 75 % in televisions.

All essential elements such as boards, displays, LED chips, memory devices are imported from China [15, p. 7–8].

After growing more than 10 % in 2021, IT is projected to grow, albeit at a more modest 6,3 %, in 2022. It represents demand for the acceleration of enterprise spending, cloud services, and the adoption of new technologies [20].

China also provides a significant share of the global market for automotive, pharmaceuticals, and clothing components. Most Chinese factories have been closed for a long time, and as a result, suppliers have significantly increased the prices of components. This has negatively affected the electronics and automotive manufacturing sector worldwide. Nevertheless, the biggest threat in this regard is not short-term losses but the potential long-term disruption of supply chains.

Demand for aircraft products is also falling amid a crisis in the aviation industry, linked to the shutdown of air services around the world.

The commodities sector has also been affected by the crisis. China is the largest oil importer. The country consumes around 14 million barrels per

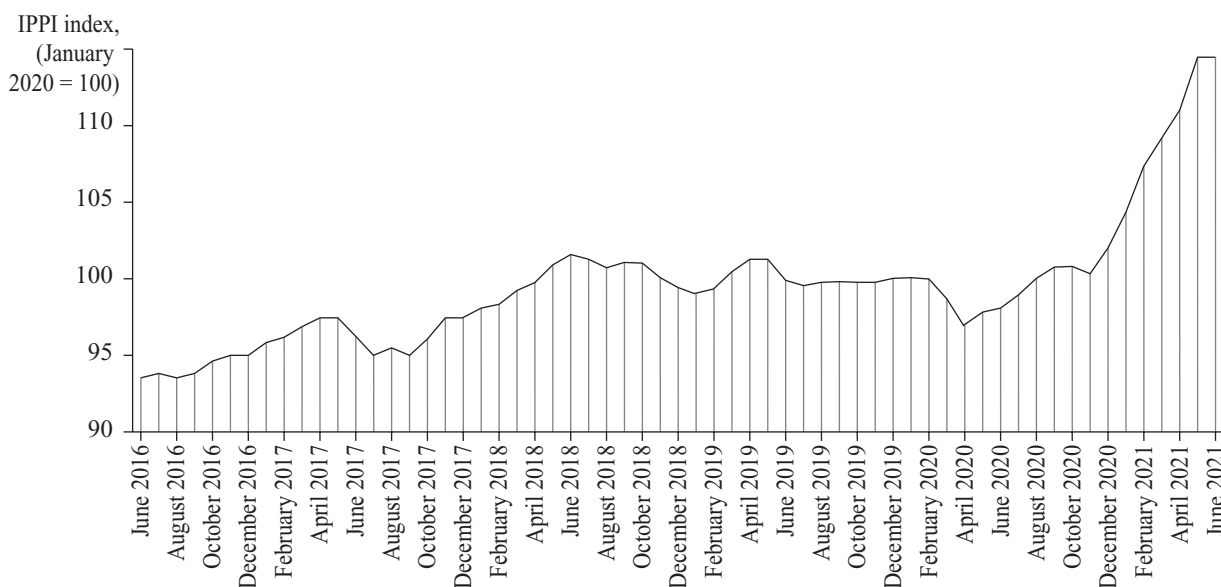


Fig. 3. Industrial Product Price Index [19]

day, equal to the combined demand of the UK, Germany, Italy, Spain, France, South Korea, and Japan. Oil demand has fallen sharply amid the crisis caused by the spread of the coronavirus, particularly in China. Oil prices have reacted negatively to the spread of the coronavirus.

Analysts point out that industrial stagnation is fraught with losses for crucial suppliers of fossil fuels — Australia and Brazil.

In general, industrial production will not suffer from the «coronavirus» crisis as much as the service sector, Standard & Poor's Global (S&P) experts say. Small and medium-sized businesses will hardly cope with it, while large manufacturers with practical strategies for surviving the crisis will quickly overcome it [11].

China has now passed the peak of the third wave of COVID-19 and has begun to recover its economy. Manufacturing capacity in the industrial sector is up to 90 % of pre-crisis levels, and workers are gradually returning to the shop floor.

At the same time, another critical global player, the United States of America, had experienced the economic shock. The most extended economic growth in the USA ended in an anti-record decline in economic activity since the Second World War. Because of COVID-19, more than 90 % of the US population was isolated, which negatively impacted output.

Estimates of the impact of COVID-19 on the steel sector and the economy are vague and may change depending on the course of the pandemic. According to preliminary projections, industry

output in Ukraine in 2021 (and consequently exports) will remain at 2020 levels 10 % lower than in 2019 (assuming positive control of COVID-19), which is a somewhat optimistic forecast in the current situation [21]. Adhering to a strategy of sharply freezing several non-productive expenditures would allow businesses to reduce costs and channel them into efficient and vital areas. A significant part of the funds can be raised by selling unprofitable (service) assets (e.g., vehicle fleet) which in principle cannot generate income, reducing payments to non-production staff and top managers of enterprises.

Economic and industrial recovery from the crisis caused by the coronavirus will be uneven across countries. S&P said countries that have not taken timely action to contain the epidemic and have not implemented sufficient stimulus programs would have a weaker and longer recovery.

**New opportunities for growth.** Due to the impact of the COVID-19 crisis, some non-medical companies began manufacturing medical products such as masks, artificial lung ventilators, and their components, disinfectants. However, this is not a long-term survival strategy, and companies must focus on innovation to survive the pandemic.

At the request of the British government, Mercedes Formula One developed and began production of an adapted respiratory pressure device to provide continuous positive pressure in the airways. A device that delivers oxygen to the lungs without invasive IVL devices will allow patients with coronaviruses to be treated in the units of standard therapy.

South Korean automobile manufacturer Hyundai Motor manufactured oxygen respirators to help India overcome the spread of coronavirus infection. The company intends to produce thousands of respirators in cooperation with manufacturers of medical equipment.

Technology companies are well placed to recover from a COVID-19 impact as they stabilize response operations to the crisis. Companies are preparing for a future in which telecommuting will be more widely used than traditional on-site work. According to PWC, technology companies are more likely to reduce their real estate (38 % compared to 26 % for other sectors), and 55 % plan to make remote work permanent for all positions for which this is possible.

For many companies, the epidemic has encouraged the deployment of automation technologies (introduction of robots, industrial use of the Internet of things) to reduce employee participation throughout the production cycle.

In 2022 strong demand will cause the global semiconductor shortage to persist, but conditions may loosen by the end of the year in certain markets as supply begins to come online. Emerging technologies will be widespread in 2022 as their capabilities and benefits feed off one another, providing another boost to both enterprise and consumer tech demand [20].

Overall, the following conclusions can be drawn from this study:

1. The IT industry has been affected by negative macroeconomic factors during the 2020 coronavirus pandemic, with severe disruption in supply chains and, consequently, the production of knowledge-intensive products.

2. Negative trends were also reflected in the reduction or complete cancellation of international experience-sharing activities among IT industry professionals, which affected the implementation of joint projects and resulted in many missed partnership and cooperation opportunities.

3. Simultaneously, the coronavirus pandemic has demonstrated the market's demand for early mass deployment of 5G, virtual reality, and smart city technologies. It is to be expected that these technologies have a strategic development perspective that will lead to increased investment in these sectors of the IT industry in the quarantine situation that is ongoing in many countries, as well as in the post-crisis period.

Since the COVID-19 affects markets for different products ambiguously we need an effective

approach to assess these impacts. Due to the research [22], it appears as an unresolved part of the overall problem due to the absence of well defined, clear, and transparent, automated rational assessment method, which can be applied easily by specialist (policy makers, economists, managers of business firms). All these constituents together lead to feasibility of further research.

**The process of assessing the impact of COVID-19 on the competitive market** is complex since market conditions are very unstable and depend on numerous factors of internal and external influence, hence it should cover all aspects of market activities. In the economic literature there are such basic methods of estimating the impact of an externality problem on a market as graphical, matrix and computational [22].

Considering the existing methods, we can say that majority of them can be applied to solve one part of the problem — assessing the impact of COVID-19 on a competitive market(s), but there is no single economically feasible approach that simultaneously analyzes all aspects of the market. Further, to solve the problem towards increasing economic efficiency, the development of alternative plans should be followed. The plan should be developed on received outcomes from the assessment. Hence, the problem can be characterized as not studied enough, which, in turn, provides a large field of activity for its further study.

Because the analysis of the impact of COVID-19 on the competitive market assessment has different degrees of depth and scale of research, in addition, there is no single approach that analyzes all aspects of the market simultaneously, the author recommends her own approach.

The assessment combines integrated and systematic approaches with an economic analysis of the externality problem (impact of COVID-19 on the competitive market) than modeling market failure.

Thus, the author proposes the following basic principles of formalizing the process of assessment:

1. Conducting an economic analysis of the impact of COVID-19 as an externality problem and compiling a database of indicators, duplication should be avoided; it is necessary to include direct indicators of COVID-19 issue in combination with the basic indicators of its market activity, thus, to consider the complex influence of factors of the certain period.

COVID-19 is an externality because it is mainly caused by the economy's participants and has an

impact on other economic agents (such as households, customers, etc.) without receiving compensation. On the other hand, we should admit that the impact is not necessarily negative, therefore COVID-19 is an externality with an ambiguous impact on the market. This fact defiantly complicates the further analysis.

2. The modern approach requires intangible factors (indicators). Market participants are forced to form new competitive advantages under unfavorable conditions (changes in consumers' preferences, substitution bias, etc.) associated with a high image, qualified staff, long-term relationships with suppliers, intermediaries, and consumers. Therefore, the methods of assessing the impact of COVID-19 on a competitive market should be supplemented with a base of indicators that characterize the human resources in the enterprise, its image, access to the new technologies, organizational culture, etc.

3. The method should be reliable (if possible, expert assessments should be avoided or minimized in the analysis of statistically significant samples of information), practical, systematic, comprehensive, algorithmic, and not expensive. At the same time, it should visualize the outcomes to facilitate the process of constructing a plan of alternative solutions.

**Conclusions.** The socio-economic impact of the COVID-19 and the slowdown in economic growth affected most countries in the world and requires unprecedented action at individual, national and international levels.

Consumers are reducing their spending in the face of declining incomes, fear of contagion, or increased uncertainty, resulting in a solvent shock. The adverse effects of the COVID-19 spread affected the breakup of significant value chains in China, the United States, and Europe. This has led to a decline in industrial production, exports and imports, and a halt in production.

The crisis has affected 81 % of the global workforce, including 463 million workers in the industry. Reduced supply and demand lead to a fall in revenues for businesses, cutting wages and laying off employees. All industrial sectors are experiencing similar problems holding back production: reduced demand, staff shortages, limited supply and forced closures. The industries most affected by the crisis are the automotive, aircraft, electronics, and extractive industries. As a result of the negative impact of the spread of COVID-19, global foreign direct investment (FDI) flows are expected to fall by 30–40 %, the most significant drop in two decades.

Despite numerous and continued studies in this field of knowledge, it should be noted that the problem of determining an effective approach to assess the impact of COVID-19 on the competitive market remains not enough studied. Thus, the authors offered their own approach to the assessment. The approach has been introduced as a list of principles needed to formalize the procedure of estimation.

We should admit that the given list of principles concerning formalization of procedure of estimation is not final as conditions of functioning of markets and their participants during a pandemic are temporary and cause the dynamic change of priorities for criterion selection.

Today, the implementation of such principles can be effectively carried out by means of modern information technology, the most appropriate of which is developing a special DSS — decision support system that can make rational decisions under conditions of uncertainty, lack of time, and limited resources. Such a DSS like «Solon-2» will allow considering a powerful set of external and internal factors of heterogeneous nature (quantitative and qualitative factors) and will allow assessing the degree of impact of COVID-19 on the global and domestic markets under the impact of a constantly changing set of influencing factors.

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#### ФОРМАЛІЗАЦІЯ ПРОЦЕСУ ОЦІНКИ ВПЛИВУ COVID-19 НА КОНКУРЕНТНІ РИНКИ ТА ЕКОНОМІКУ

Описано вплив COVID-19 на різні економічні параметри, зокрема прямі іноземні інвестиції, безробіття, глобальне партнерство. Розглянуто зміни на фондовому ринку, у сферах електроніки, інформаційних технологій та промисловій сфері. Основні результати в промисловості відображаються в показниках діяльності авіаційної сфери, сировинного сектору, металургійного сектору, автомобілебудування.

Аналіз впливу COVID-19 на економіку пропонується проводити через конкурентні ринки, оскільки вони мають різні ступені глибини та масштабу дослідження і, на жаль, не існує окремого підходу, який би аналізував усі аспекти країн, економік чи ринку одночасно.

Саме тому автори запропонували власний підхід із розв'язання таких проблем. Пропозиції авторів базуються на комплексних і системних підходах з економічним аналізом впливу COVID-19 на конкурентний ринок. Розглядається складна модель, оскільки ринкова кон'юнктура дуже нестабільна і залежить від численних факторів внутрішнього та зовнішнього впливу, тому вона має охоплювати усі аспекти ринкової діяльності.

Метод складається із запропонованих основних принципів формалізації процесу оцінювання. Ці принципи ґрунтуються на потенціалі пошуку шляхів із вирішення проблемних питань, спричинених негативним впливом COVID-19 на ринки та, як наслідок, на економіку.

**Ключові слова:** COVID-19, інноваційні технології, час пандемії та її наслідки, формалізація процесу оцінки впливу COVID-19.