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Business Risks in COVID-19 Crisis Dataset Modeling: Regulatory vs. Marketing Tools of Risk Management

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Abstract: The research aims to identify the most promising regulatory and marketing tools for business risk management in the COVID-19 crisis and develop recommendations for improving the practice of these tools from a post-pandemic perspective. This paper is devoted to the scientific search for answers to two research questions: RQ_1: What tactical tools of business risk management are most effective in the COVID-19 crisis? RQ_2: How to carry out strategic risk management of the business from a post-COVID perspective? The authors perform dataset modeling of business risks in the COVID-19 crisis and data analysis of the post-pandemic perspective of managing these risks, relying on data for 2016–2023, reflecting international experience in a representative sample. The key conclusion of this research is that the most complete and effective business risk management in times of COVID-19 crisis requires the integrated application of tools of state and corporate governance, that is, two-tier management: At the state and business levels. On this basis, the authors recommended applying the systemic approach to business risk management in times of the COVID-19 crisis, which includes a set of the most effective regulatory (financial support from the state budget and protectionism) and marketing (use of big data and analytics) tools of business risk management. The practical significance of the research results is that the recommended systemic approach to using regulatory and marketing tools can improve the effectiveness of tactical and strategic risk management in the COVID-19 crisis, thereby increasing business resilience to this crisis. The novelty is due to the fact that we selected the most effective tools of business risk management under the conditions of the COVID-19 crisis and proved the necessity to combine the tools of state and corporate management, which are substantiated, for the first time, not as mutually interchangeable, but complementary practices of risk management in the unique context of the COVID-19 crisis.

Keywords: business risks; COVID-19 crisis; regulatory tools; marketing tools; dataset modeling; data analysis; post-pandemic perspective; risk management

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1. Introduction

The COVID-19 crisis is notable because it triggered a long-wave recession, marking the downward wave of the great cycle of economic conditions (according to N. Kondratiev). As of the beginning of 2023, the pandemic is in its fourth year; despite mass vaccination, new outbreaks of COVID-19 continue to occur. According to the World Health Organization (2023), December 19 witnessed a new peak incidence of COVID-19

(44,265,843 confirmed cases). For comparison, the previous peak was registered on 17 January 2022 (23,309,763 confirmed cases); at the beginning of the COVID-19 pandemic, there were only 58,501 confirmed cases as of 11 March 2020. This indicates that there are no preconditions for the pandemic to end soon, and the risk of COVID-19 is consistently high.

Second, the nature of the crisis is unique in that it is caused by non-economic reasons related to health care for the first time in decades. Third, the pandemic was superimposed on the underlying contradictions of contemporary economic systems, which were probably manifested and exacerbated by the COVID-19 pandemic. These contradictions impose restrictions on business competition in world markets that cannot be overcome in the short and medium term, which emphasizes the lingering nature of the COVID-19 crisis.

For business, the COVID-19 pandemic has become a serious test, of which business risks are the most accurate measurement. Although these risks have many particular manifestations, their most common expression is the following two business risks in a COVID-19 crisis. The first risk is the risk of a decline in business activity and business income, accompanied by a decline in gross domestic product (GDP). Its danger lies in the incomplete realization of the potential of business development and a slowdown in economic growth (Ghosh et al. 2023).

The second risk is the risk of a decline in the export of goods. Its danger lies in the incomplete realization of the export potential of business and the economy. Scholars agree that these business risks have increased during the COVID-19 crisis (Heo and Choi 2023; Huang et al. 2023). This manifests itself in an increase in the danger of risks (the normal volatility has been replaced by a sharp decline in GDP and exports) and in the probability of risks (assessed through the prism of GDP and goods export variation among the countries). Simultaneously, there is still no consensus on the risk management tools for business in the COVID-19 crisis, although two alternative approaches have taken shape.

The regulatory approach gives the key role to the government, in connection with which the essence of risk management is to tighten state intervention in market processes to normalize the business environment. The advantage of this approach is that it makes it possible to extend universal government regulation to all markets, thereby providing economies of scale in the form of increased risk-management returns from the regulatory impact as the economy becomes more covered by this impact. The disadvantage of this approach is that the possibility of state support for businesses in the COVID-19 crisis is limited due to the emergence of the national budget deficit or its aggravation.

The second approach, the marketing approach, as opposed to the first approach, gives the key role directly to the business itself. In it, the essence of risk management is the implementation of business initiatives aimed at improving its market position. The advantage of this approach is the high flexibility of marketing tools and the possibility of adapting them to the specifics of each business structure. The disadvantages of this approach are the limited useful effects of the subjects of the implementation of marketing risk-management measures, as well as the limited opportunities for businesses to influence the market through marketing.

The vagueness of the scientific understanding of risk management tools, which is a gap in the literature, accounts for the continued high negative impact of the COVID-19 crisis on business risks. The need to fill the identified gap in the literature is due to the fact that highly effective risk management is needed to recover from the COVID-19 crisis. This research seeks to fill the noted gap in the literature, for which it performs data set modeling of business risks in the COVID-19 crisis and data analysis of the post-pandemic perspective of managing these risks.

The novelty of this research lies in the systemic coverage of regulatory and marketing tools of business risk management, considered separately in the existing literature, as delimited by alternative approaches. This research offers a holistic view and comprehensive recommendations for improving the practice of business risk management in terms of the COVID-19 crisis.

The novelty of his paper is due to its comparing, for the first time, the regulatory approach, which involves state management of business risks with the help of the measures of the subsidiary, tax support and protectionism, and the marketing approach, in which the business independently manages its risks with the help of branding, digital marketing and sales, as well as the fight against the viral threat and adaptation of business models to the conditions of the pandemic and lockdown.

Comparison of these approaches allows for an increase in the effectiveness of business risk management under the conditions of the ongoing COVID-19 pandemic and the conditions of future epidemics and pandemics due to the focus on the most efficient managerial tools. The study of regulatory and marketing approaches as alternatives to each other limits the possibilities of risk management of the business.

The proposed system approach combines regulatory and marketing tools, creating a complex impact on business risks from the state and business structures. This generates a synergistic effect in the form of an increase in the effectiveness of business risk management compared to the application of regulatory and marketing measures in isolation.

The existing literature does not allow for filling the discovered gap because of the limitations of the data that are taken into account. The lack of existing literature can be overcome by the use of the methodology of dataset modeling due to the involvement of a large array of data that covers a wide range of indicators and a large time frame (2018–2021).

This paper's contribution to the literature is as follows: Due to the improved methodology and the foundation on the economic and mathematical tools of the research, this paper allows measuring—with high precision—the change in business risks under the conditions of the COVID-19 pandemic and crisis and clarifying the tools of risk management in these conditions. The research aims to identify the most promising regulatory and marketing tools for business risk management in the COVID-19 crisis and develop recommendations for improving the practice of these tools from a post-pandemic perspective.

The idea of this paper consists of proposing the most effective tools for managing the risks for businesses under the conditions of the COVID-19 crisis. For this, we create a dataset that unifies relevant statistics. We perform a dataset analysis of the leading international experience and create an econometric model that mathematically describes the cause-and-effect relationships of the use of alternative (regulatory and marketing) tools and their contribution to the reduction in business risk during the COVID-19 crisis. Based on this model, the best practices for business risk management during the COVID-19 crisis are selected. The best-selected practices are systematized and set on the basis of the post-pandemic perspective of the risk management of business.

This paper is devoted to the scientific search for answers to the two following research questions. RQ_1: What tactical tools of business risk management are most effective in the COVID-19 crisis? RQ_2: How to carry out strategic risk management of the business from a post-COVID perspective? The paper's novelty lies in the identification of the most promising tools for managing business risks during the COVID-19 crisis.

The research is organized as follows. After the introduction, a literature review is carried out, which forms the theoretical basis of the research, defines its conceptual apparatus, and reviews tactical and strategic tools of business risk management during the COVID-19 crisis, identifying gaps in the literature, setting research questions, and formulating the research hypothesis. The literature review is followed by a description of the methodology and methods of the research, describing the methodology, research sample, control variables, time frame of the research, the research design, the research model, and the logic of hypothesis testing.

After that, the research results are sequentially solved into four research tasks:

- Task 1: To determine the impact of the COVID-19 crisis on business risks and select the most effective risk management tools.
- Task 2: To model the impact of selected tools separately on business risks in the COVID-19 crisis.

- Task 3: To conduct systemic modeling of the impact of a set of key tools on business risks in the COVID-19 crisis.
- Task 4: To predict the post-pandemic perspective of business risk management.

The discussion notes the contribution of the research to the literature and compares the new answers to the research questions with the existing answers presented in the literature. The conclusion draws key conclusions, noting the significance of the research, its limitations, and the prospects for future scientific research.

2. Literature Review

2.1. Determination of Business Risks and Effects of COVID-19 in a Broad Sense

The theoretical basis of this research is the concept of business risks. According to this concept, business risk is understood as unfavorable changes in business characteristics, primarily economic. Business risks have two dimensions: (1) Danger of risk: The scale of the negative change (usually a decline) in business performance; (2) probability of risk occurrence, determined by the analysis of the variation in the values of business performance indicators in the economy. The greater the danger and probability of risk, the greater its severity and the greater the need for risk management. Risk management refers to the development and implementation of management measures aimed at reducing the severity of risks.

Two key business risks can be identified—the decline in business and export activity. On the scale of entrepreneurship, the indicators that characterize this business activity are GDP and the export of goods. The existing literature provides a convincing and sufficient scientific argument that business risks have increased in the COVID-19 crisis: the risk of a decline in GDP has increased, which is reflected in the slowdown of economic growth; the risk of a decline in exports of goods has also increased.

The COVID-19 crisis refers to the destabilization of the world economic system against the background of the COVID-19 pandemic. The momentary effects of the COVID-19 crisis were already noticeable in 2020. The delayed effects of the COVID-19 crisis began to show up in 2021 and are likely to do so in the coming years. However, as long as official statistics for 2022 for most indicators have not been generated, it is advisable to focus on the time frame 2020–2021 when studying the COVID-19 crisis.

The effect of the influence of COVID-19 on business risks is manifested through the following channels. The risk of decline in business activity grows, first, due to customers' concerns of getting infected with the virus—an increase in social tension reduces the demand for the offered offline products (Wijaya and Rahmayanti 2023). Second, due to the toughening of official state requirements for sanitation: From disinfection and ventilation of premises to the medical masks and gloves regime and social distancing. The complexity of the observation of these requirements by the business is high from the organizational, financial, and technical positions. This creates a threat of termination of business activities.

Third, due to the forced temporary ban on business activities connected with mass gatherings of people: From cancelling of cultural mass events and the closure of catering facilities, hairdressers, and fitness centers to restrictions in the work of retail companies against the background of lockdowns. The risk of reduced export activity grows because of the disruption of global chains of supply and sales under the conditions of lockdowns, bankruptcy of companies, and termination of transport communication during the pandemic (Cepel et al. 2020).

2.2. Tactical Toolkit for Business Risk Management in the Conditions of the COVID-19 Crisis

The specifics of business risks in 2020 were predetermined by a dual context. First, this context was connected with the pandemic—as a viral threat—and the healthcare crisis. In the works by Chen et al. (2022), de Graaff et al. (2023), Metwally and Diab (2023), Park et al. (2023), Peng et al. (2023), and Yang et al. (2023), a traditional means of fighting against epidemics and pandemics is given as the implementation of complex measures aimed at the improvement of healthcare infrastructure. For example, an increase in the level of

sanitation at workplaces, the introduction of mandatory mask wearing by employees, and social distancing at workplaces allowed businesses to reduce the number of COVID-19 cases among employees.

At that, the main measures were undertaken by the government and included the opening of new hospitals, government procurement of lung ventilators, and state financing of the development of COVID-19 vaccines, as well as the introduction of lockdowns, mask regimes, and social distancing regimes.

Second, the 2020 context was connected with an economic crisis—a decline in GDP—which was called the COVID-19 crisis. Evenett (2019), Frias and Guerrero-Sanchez (2023), Heo and Choi (2023), Mavrot and Malandrino (2023), Nkemgha et al. (2022), and Shan et al. (2023) assign the main role in the reduction in business risks in the conditions of economic crises to the government. This role is connected with the implementation of protectionism measures aimed at increasing the favorability of the market environment for domestic businesses with the help of strengthening customs barriers, including an increase in customs fees.

The tactical risk management toolkit for the COVID-19 crisis is aimed at current and situational business risk management. Tactical risk management is necessary to reduce business risks, sharply exacerbated by the COVID-19 crisis, thus restoring business activity and maintaining its market position or presence in the market (national and global market).

The standard set of tools for business risk management is well known and broadly presented in the available literature, particularly revealing the experience of applying these tools in various crises, including the global financial and economic crisis of 2008–2009. However, the unique nature of the COVID-19 crisis, due to the fact that its catalyst was a pandemic, does not allow us to project onto it the experience of other crises of a predominantly economic nature.

This does not allow us to apply the risk management toolkit in a formulaic way because the applicability of this toolkit in the COVID-19 crisis is not known. This is a gap in the literature and raises the following research question. RQ_1: What tactical tools of business risk management are most effective in the COVID-19 crisis? The available literature does not provide a unified answer to this question. Instead, two alternative approaches to business risk management in the COVID-19 crisis have emerged.

The first approach assumes reliance on the tools of state regulation of business within the framework of public administration. First, these tools include financial tools involving subsidies, taxes, and other business support from the state budget (Vadlamannati et al. 2023). Second, these tools include non-financial tools related to customs regulation, the main one being protectionism (Wang and Wu 2021).

The second approach involves the use of marketing tools within the framework of corporate governance. The first tool is branding in national and international markets (Mishra and Mishra 2023). The second tool is the digitalization of business, particularly the use of technologies of intellectual support for management decision making (artificial intelligence and big data) (Botelho et al. 2023).

The existence of two alternative approaches forces business entities to disperse efforts, applying a wide range of management tools of different orientations and efficiency, which reduces the overall effectiveness of business risk management in the COVID-19 crisis. This determines the need to fill the identified gap and the relevance of the selection of business risk management tools that are most effective in the COVID-19 crisis, which is the subject of this research.

2.3. Strategic Business Risk Management in the Post-COVID Perspective

Developing a toolkit for strategic risk management for the COVID-19 crisis is necessary to combat the delayed, long-term consequences of this crisis. It also involves the implementation of preventive risk management measures for future pandemics to achieve the long-term effect of risk management and stay ahead of the curve (Wijaya and Rahmayanti 2023).

The standard toolkit for strategic business risk management comes down to the accumulation of reserves. The essence of this toolkit lies in the fact that reserves are accumulated in a booming economy and its stable development (Fatum and Yetman 2020; Fatum et al. 2023; Mo and Gao 2020). These reserves are subsequently spent on maintaining the normal functioning of business when a crisis arises. In cases of crisis, reserves are an insurance fund that can be created by the government and businesses (Benigno et al. 2022; Laser and Weidner 2022).

The problem lies in the fact that the established standard economic toolkit of business risk management in the COVID-19 crisis, which has a non-economic nature, is much less effective than historically in economic crises. This is explained by the fact that financial support can only mitigate, not completely neutralize, the impact of the COVID-19 crisis on businesses that are fundamentally deprived of the ability to carry out their activities when lockdowns are introduced, social distancing is announced, and workers are sick (Polinkevych et al. 2021; Sneddon 2022).

The uncertainty of the crisis-specific pandemic nature of the strategic business risk management toolkit acts as a gap in the literature and raises the following research question. RQ_2: How to carry out strategic risk management of the business from a post-COVID perspective? The existing literature (Achat et al. 2022; Lepore et al. 2023) suggests developing a public health infrastructure to increase its resilience to epidemics and pandemics (Krainer 2023).

However, the effectiveness of this measure has not yet received sufficient scientific argumentation and is, therefore, unknown. A critical view of the measure points to its limitations. For example, a vaccine against COVID-19 was developed in record time: The first vaccine ("Sputnik V") was registered on 11 August 2020, exactly five months after the declaration of the COVID-19 pandemic (11 March 2020). Nevertheless, as of early 2023, the prospect of humanity defeating COVID-19 is still unclear. The development of healthcare infrastructure will increase the number of medical workers, the number of hospital beds, and the stock of medical equipment and pharmaceutical products. However, this will not fundamentally reduce the viral threat or prevent future epidemics and pandemics (Ricardianto et al. 2023).

A more promising strategic measure of business risk management in the COVID-19 environment is the digitalization of business. Automation of business processes reduces human involvement and makes these processes less vulnerable to viral threats, to the point of complete independence, for example, achieved by fully robotic and autonomous smart industries (Popkova and Sergi 2022). Based on this, hypothesis H is put forward that it is advisable to carry out strategic business risk management from a post-COVID perspective through the digitalization of business.

To find answers to the RQs posed and test hypothesis H, this research conducts a dataset modeling of the impact of various management tools on business risks in the COVID-19 crisis, as well as a predictive data analysis of the post-pandemic perspective of business risk management. To implement the authors' idea, we create a dataset and then build a model based on it, which allows for selecting—precisely and correctly—the best practices for the management of risks for business during the COVID-19 crisis.

2.4. Systemic Vision of Business Risks, Governance and COVID-19

This paper is aimed at systematizing scientific knowledge in the sphere of business risks, governance, and COVID-19. Thus, the paper is based on the existing scientific publications, which contain the leading research and developments on these issues, which are considered systemically. Athari et al. (2023) presented a new view of the role of country governance in the achievement of the sustainability of the banking sector in vulnerable environments, performing the analytics of the experience of emerging economies. This new view consists of the necessity to combine financial and non-financial (e.g., fight against the pandemic during the COVID-19 crisis) measures of state support for the sustainable development of the banking sector to reduce its business risks.

In turn, Polman et al. (2023) generated conclusions from the COVID-19 pandemic in five low- and middle-income countries and developed a scientific approach to risk management to mitigate the risks of the food system during a crisis. The essence of this new approach consists of the active state interference with the processes of managing the business risks of agrarian companies through the combination of protectionism measures with the measures of fighting against the viral threat (development of the healthcare infrastructure).

Almustafa et al. (2023) proved the significant impact of COVID-19 on risk and companies' performance in MENA countries, as well as the key role of national governance quality in the management of business risks in the conditions of the COVID-19 crisis. Wang et al. (2022) compiled a model of public risk perception attribution and the path of management during COVID-19, presenting a view that is based on information on risks. In this model, the management of business risks takes place through the influence of the government and business on society.

Kulohoma (2021) proved that state regulation of the economy through the development of healthcare infrastructure plays an important role in the system of factors of the COVID-19 crisis and measures of risk management, together with protectionism and subsidizing of business (on the example of African countries). Al-Shboul and Maghyereh (2023) substantiated that real economic uncertainty drove risk connectedness in the oil-stock nexus during the COVID-19 outbreak.

Bakkeli (2023) used machine learning to prove that expectations (forecasts) and perceptions of COVID-19 exposure risk determined business risks and the course of the economic crisis in 2020 (in the example of New Zealand).

Van Ninh (2023) proved the strong impact of the COVID-19 pandemic on the perception of risk management in tourism businesses. Wijaya and Rahmayanti (2023) proved the important role of innovative potential in the mediation of COVID-19 risk perception and entrepreneurship orientation on business performance. This paper strives towards contributing to the literature through the specification of the approach to governance of business risks in the conditions of the COVID-19 crisis.

3. Materials and Methods

3.1. Methodology, Sampling, Control Variables, and Research Timeframes

The methodology of this research relies on the dataset modeling method. The essence of this method is that a dataset is formed for the research—a fairly large data set containing statistics on many variables in the dynamics of several years. The dataset is much larger than a standard data table (usually limited to 10–20 observations over 1–2 time periods) (Popkova et al. 2020; Popkova and Sergi 2021). Based on statistics from the dataset, the authors conduct econometric modeling of cause–effect relations between the use of various management tools and the severity of business risks in the COVID-19 crisis.

The first advantage of the dataset modeling method is that it makes it possible to establish a broad research timeframe, covering the pre-pandemic period (2018–2019) and the immediate period of the pandemic and COVID-19 crisis (2020–2021). The second advantage of the dataset modeling method is that it makes it possible to cover the whole complex of potential business risk management tools, not limited to individual tools, which is characteristic of alternative methods. Thanks to this, the list of control variables is large enough to obtain the most reliable results—the most accurate selection of effective business risk management tools in the COVID-19 crisis.

The empirical basis of the research—the source of data that are included in the dataset—is the materials of IMD statistics (IMD 2023). The choice of this empirical base is explained, first, by the credibility of the IMD as a source of official statistics. Second, the IMD materials contain international statistics that are not limited to certain countries. Third, the IMD materials contain statistics for all indicators needed for the research. Fourth, the data in IMD statistics are relevant, and historical data are available. Fifth, the collection

of statistics in the database "World competitiveness online" is automated; therefore, it is possible to create a small data table or a whole dataset.

The sample includes all 59 countries for which all necessary data are available (no data gaps) in IMD statistics (IMD 2023). The main econometric modeling calculations are based on merged data for 2020–2021 (to cover the COVID-19 crisis systemically), which increases the sample size to 118 observations (117 degrees of freedom), which guarantees reliable results. The sample includes countries from all parts of the world, representing various income and other criteria for categorizing countries; in particular, the sample includes developed (G7) and rapidly developing countries (BRICS).

The time frame of the research is 2016–2023. Implementation of the variable, included in the dataset, is performed through the content analysis of the existing literature on the topic of business risks and risk management, which allows the selection of the fullest and most relevant list of factors. After that, from the existing materials of the official statistics, we selected the appropriate indicators, which were included in the dataset. The following control variables are used in dataset modeling of risk and business risk management in the COVID-19 crisis environment:

- Gross domestic product (GDP), USD billion (R_1); as an indicator of business activity, the value, and the change in the dynamics of years and variation among the sample countries, which characterizes the risk of reducing business activity and business income.
- Exports of goods—growth, percentage change, based on USD values (R_2); as the change in the dynamics of the years and the variation in the sample countries characterize the risk of a decline in exports of goods.
- Government budget surplus/deficit, percentage of GDP (g_1); as a regulatory tool for financial (tax, subsidiary) state management of business risks. For example, subsidiary support allows for covering business losses, thus reducing its risks, which is also facilitated by tax vacations and other measures of state anti-crisis support for businesses. The basis for inclusion in the dataset and the research model of this control variable was its substantiation as a tool of risk management for businesses in the existing literature: Ma et al. (2023), Sidorkin and Srholec (2022), and Wan and Zhang (2023).
- Protectionism (g_2): "Protectionism of your government does not impair the conduct of your business" (IMD 2023); as a regulatory tool for non-financial (customs) state management of business risks. The basis for inclusion in the dataset and the research model of this control variable was its substantiation as a tool for the risk management of businesses in the existing literature: Chacko (2023), Mitrović and Mitrović (2023).
- Image abroad or branding (m): "The image abroad of your country encourages business development" (IMD 2023); as a marketing tool for corporate business risk management. For example, branding allows a socially responsible business to raise the loyalty of interested parties through the reflection of the implemented measures to fight the viral threat in marketing and PR. This enabled the business to retain the best personnel, attract investments, and increase sales volumes during the pandemic. The basis for inclusion in the dataset and the research model of this control variable was its substantiation as a tool of risk management for businesses in the existing literature: Sashittal et al. (2023), Siqueira Junior et al. (2023).
- Digital transformation in companies (dm_1): "Digital transformation in companies is generally well implemented" (IMD 2023); as a tool for corporate business risk management through digital marketing. For example, digital marketing of personnel allowed transferring employees to remote work and retaining business activity during the COVID-19 pandemic. Similarly, digital marketing allowed the business to sell products on electronic marketplaces, which allowed not only preserving but also increasing sales volumes during the pandemic. Due to digital marketing, the business was able to comply with high sanitary and epidemiological requirements during the pandemic. The basis for inclusion in the dataset and the research model of this control

variable was its substantiation as a tool of risk management for businesses in the existing literature: Hussain (2022), Ngo et al. (2022).

- Use of big data and analytics (dm_2): "Companies are very good at using big data and analytics to support decision-making" (IMD 2023); as a tool for corporate business risk management through digital marketing. For example, big data and big data analytics, in particular, with the help of artificial intelligence, can be used by businesses for intellectual decision support. This allows rationalizing—raising the objectivity and precision of managerial decisions and accelerating decision making, which is especially important during a crisis. Big data and smart analytics are actively used in digital marketing to develop a highly effective marketing mix (product design, optimization of pricing, segmentation of the market, use of the digital channels of product promotion, digital HRM, etc.). The basis for inclusion in the dataset and the research model of this control variable was its substantiation as a tool of risk management for businesses in the existing literature: Han (2023); Shang et al. (2021).
- Health infrastructure (h): "Health infrastructure meets the needs of society" (IMD 2023); as a tool for strategic business risk management in the COVID-19 pandemic and crisis. For example, based on the healthcare infrastructure, the business—during the pandemic—can manage risks through corporate voluntary medical insurance for employees. Another example is that, based on the existing healthcare infrastructure, the business can raise the level of sanitation at workplaces and places of product sales. Examples of the practical use of healthcare infrastructure in the practice of risk management of business during the pandemic include the possibility of the quick purchase of the necessary number of medical masks, gloves, sanitizers, and disinfectants (bactericidal recirculation) for employees and customers. It should be noted that at the very beginning of the COVID-19 pandemic, there was a large deficit of these types of medical products, due to which the capabilities of risk management of business in the sphere of the increase in sanitation levels were limited. Being unable to ensure sanitary-epidemiological safety (providing all employees and customers with medical masks, gloves, sanitizers, and disinfecting air on premises), many companies were forced to stop their activities, which led to losses. The development of the healthcare infrastructure will allow for the prevention of this in the future and will give the business the ability to flexibly manage risks in the sphere of the growth of sanitation under the conditions of epidemics and pandemics. The basis for inclusion in the dataset and the research model of this control variable was its substantiation as a tool of risk management of business in the existing literature: Muir et al. (2023); Reynolds and Bennett (2023), Schwatka et al. (2022).

The considered variables are systematized in Table 1.

Table 1. The system of the considered variables.

Indicator	Economic Sense (Definition) of the Indicator	Source of the Data	Measuring Units	Symbol Used in This Paper
Gross domestic product (GDP)	The aggregate volume of all goods and services produced in the country	IMD (2023)	USD billions	R_1
Exports of goods—growth	The aggregate volume of all goods and services exported by the country over a calendar year	IMD (2023)	Percentage change, based on USD values	R_2
Health infrastructure	Health infrastructure meets the needs of society	IMD (2023)	Points 1–10	h
Government budget surplus/deficit (%)	Balance of the government budget, calculated as the difference between its revenues and expenditures	IMD (2023)	Percentage of GDP	g_1

Table 1. *Cont.*

Indicator	Economic Sense (Definition) of the Indicator	Source of the Data	Measuring Units	Symbol Used in This Paper
Protectionism	Protectionism of your government does not impair the conduct of your business	IMD (2023)	Points 1–10	g_2
Image abroad or branding	The image abroad of your country encourages business development	IMD (2023)	Points 1–10	m
Digital transformation in companies	Digital transformation in companies is generally well implemented	IMD (2023)	Points 1–10	dm_1
Use of big data and analytics	Companies are very good at using big data and analytics to support decision making	IMD (2023)	Points 1–10	dm_2

Source: Compiled by the authors.

The research sample is shown in Supplementary Table S1. The explanatory variables gross domestic product (GDP), USD billion (R_1), exports of goods—growth, percentage change, based on USD values (R_2), and government budget surplus/deficit, percentage of GDP (g_1), are discrete since they can take any values. Other explanatory variables—protectionism (g_2), image abroad or branding (m), digital transformation in companies (dm_1), use of big data and analytics (dm_2), and health infrastructure (h)—are continuous since they belong to the non-fixed number of possible measurings between two realistic points: they are measured in points and take values from 0 to 10.

3.2. Research Order, Research Model, and Hypothesis Testing Logic

The main research is preceded by a case study of risk management in business under the conditions of the COVID-19 pandemic and crisis in 2020. The case method is used to consider the leading international experience of the influence of the pandemic on business risks and the management of business risks during the COVID-19 crisis in 2020. This allows a detailed description of the leading strategic and marketing tools of risk management. However, the case study allows for consideration of only certain companies' experiences. That is why the main research for the search for answers to the posed RQs is conducted at the macro-economic level. This allows for determining the total change in business risks under the conditions of the COVID-19 pandemic and crisis and discovering the universal tools of risk management. The order of the main research is shown in Table 2.

Table 2. Research order.

Elements of scientific research	Research tasks			
	Task 1: to determine the impact of the COVID-19 crisis on business risks and select the most effective risk management tools	Task 2: to model the impact of selected tools separately on business risks in the COVID-19 crisis	Task 3: to conduct systemic modeling of the impact of a set of key tools on business risks in the COVID-19 crisis	Task 4: to predict the post-pandemic perspective of business risk management
The research question, the search for an answer to which this task is intended to provide	RQ_1: What tactical tools of business risk management tools are most effective in the COVID-19 crisis?			RQ_2: How to carry out strategic risk management of the business from a post-COVID perspective?

Table 2. *Cont.*

Research subject	Data for 59 countries by year for 2016–2023	Combined data for 2020–2023 (236 observations)	Combined data for 2020–2023 (236 observations)	Combined data for 2020–2023 (236 observations)
Research methods	Horizontal analysis, analysis of variation, correlation analysis, and regression analysis	Regression analysis, including F-test and *t*-test	Structural equation modeling (SEM)	Simplex method
Economic sense of the research	Structural and factor analysis of business risks in the COVID-19 crisis in 2020–2023	Dataset modeling of business risk management in the COVID-19 crisis with the support of regulatory and marketing tools	Making a systematic SEM model of business risk management in the COVID-19 crisis with the support of regulatory and marketing tools	Data analysis (predicting) the post-pandemic perspective of business risk management with reliance on regulatory and marketing tools

Source: Compiled by the authors.

As shown in Table 2, the research is conducted in four consecutive steps, each corresponding to a specific objective of this research. The first task is to determine the impact of the COVID-19 crisis on business risks and the selection of the most effective risk management tools. For this purpose, the authors examined data for 59 countries by year for 2016–2023 (based on data from Supplementary Table S1). Using horizontal analysis and analysis of variation, we determine the change in the severity of business risks in the COVID-19 crisis and the post-COVID period (2020–2023) compared to the pre-pandemic period (2016–2019).

Correlation analysis is used to assess the relationship of business risks to alternative risk management tools separately with each tool and in each period from 2016 to 2023, as well as its change in the pandemic compared to the pre-pandemic period. Using the method of regression analysis, based on the data from Supplementary Table S2, the authors determined the dependence of business risks on the totality of risk management tools, resulting in the selection of the most effective risk management tools. In this case, the economic sense of this research is a structural and factor analysis of business risks in the COVID-19 crisis and the post-COVID period in 2020–2023.

The second task is to model the impact of selected tools individually on business risks in the COVID-19 crisis. This is done by examining the pooled data for 2020–2023 (236 observations shown in Supplementary Table S2) using the regression analysis method. The reliability of its results is tested with Fisher's F-test and Student's *t*-test. In this case, the economic sense of this research is a dataset modeling of business risk management in the COVID-19 crisis, relying on regulatory and marketing tools. The research model is generally written as follows:

$$\begin{cases} R_1 = a + b_{11}g_1 + b_{12}g_2 + b_{13}m + b_{14}m_1 + b_{15}m_2 + b_{16}h, \\ R_2 = a + b_{21}g_1 + b_{22}g_2 + b_{23}m + b_{24}m_1 + b_{25}m_2 + b_{26}h, \end{cases} \quad (1)$$

For the model to be most clear, accessible, and useful, it was not made complicated—we used a simple OLS controlling for endogeneity, in which the dependent variable is clearly defined (based on literature, which is reflected in Section 3.1).

Hypothesis H has the following economic-mathematical expression: $b_{14} > b_{16}$ at $b_{15} > b_{16}$ at $b_{24} > b_{26}$ at $b_{25} > b_{26}$, as well as $b_{14} > 0$ at $b_{15} > 0$ at $b_{24} > 0$ at $b_{25} > 0$. Hypothesis H is considered proven if the factors of digital marketing (digital transformation in companies and the use of big data and analytics) show a statistically significant relationship with the resulting variables (business risks), which will be stronger than the relationship of business risks with health infrastructure (or this relationship will be statistically insignificant).

The above hypothesis H is verified by tables with the results of the regression analysis and proves that implementation of strategic risk management of business from a post-

pandemic perspective is recommended through the digitalization of business. Thus, non-negative values of the regression coefficients (b) at factor variables dm_1 and dm_2 prove the positive influence of the digitalization of business (digital transformation in companies and use of big data and analytics) on the reduction in business risks.

Excess of the values of the regression coefficients (b) at factor variables dm_1 and dm_2 over the value of the regression coefficient (b) at factor variable h shows that the digitalization of business (digital transformation in companies and use of big data and analytics) has a larger impact on the reduction in business risks than healthcare infrastructure, as a traditional tool of risk management for the economy and business in the conditions of the pandemic. If these conditions are observed, this is the basis for recommending the digitalization of business for the reduction in business risks.

The third task is systemic modeling of the impact of a set of key tools on business risks in the COVID-19 crisis. For this purpose, the combined data for 2020–2023 (236 observations given in Supplementary Table S2) are studied using structural equation modeling (SEM). In this case, the economic sense of this research is to make a systemic model of SEM business risk management in the COVID-19 crisis with the support of regulatory and marketing tools.

Regression and correlation analysis, whose results became the basis of the SEM model, was conducted in Microsoft Excel, the choice of which is explained by the striving towards ensuring the general accessibility of rechecking the results of this research. The SEM model was created in Microsoft Word.

To determine the fit of the SEM model for the observed data, we assessed it with the help of the Pearson approval criterion χ^2, also known as the chi-square goodness of fit test, in which the indicator of conditions is the chi-square test.

The fourth task is to predict the post-pandemic perspective of business risk management. For this purpose, the combined data for 2020–2023 (236 observations given in Supplementary Table S2) are studied using the simplex method with reliance on the previously obtained results of the regression analysis in the model (1). The economic sense of the research is in the data analysis (forecasting) of the post-pandemic perspective of business risk management with the support of regulatory and marketing tools.

4. Results

4.1. Case Study of Risk Management in Business under the Conditions of the COVID-19 Pandemic and Crisis in 2020

Under the conditions of the COVID-19 pandemic and crisis in 2020, the attention of the public and all parties interested in the activities of the business was drawn to the viral threat. The powerful marketing tool of risk management at the very beginning of the pandemic—spring 2020—was charity connected with the fight against the viral threat. For example, this charity was widespread in Russia and had a mass character in the business environment. The most widely implemented marketing tools were as follows (Bachinskaya 2020):

- Donations of transnational corporations (RUB 70 million): Coca-Cola, FosAgro, Mars, Henkel, Amway, MTS, and Phillip Morris International to the financial support of volunteer centers in the fight against the viral threat.
- Financing of the economy restoration after the pandemic: Bayer, Colgate-Palmolive Company, H&M Group, Hewlett-Packard Enterprise, Nestlé, and Henkel.
- Charitable contribution from Nornikel (RUB 10.5 billion) for the purchase of medical equipment, medicines, and personal protective equipment for medical establishments, companies, and employees of the group, as well as for the social support of employees and small and medium businesses in the territory of the company's presence.
- Financing (RUB 3.3 billion) by RUSAL for the construction of seven medical centers for patients with community-acquired pneumonia.
- Financing (RUB 3 billion) by Sberbank for the creation and production of vaccines and medicines against COVID-19, as well as the creation of conditions for their afford-

ability, support of regional organizations of healthcare, supply of medical equipment and personal protective equipment, and construction and equipment for medical establishments.

- Additional social support for employees and regions of presence (RUB 1.7 billion) from NLMK and FosAgro.
- Remote education for school pupils, informing the population, and all types of delivery services from Yandex.
- At the global level, Procter & Gamble allocated more than RUB 1 billion for the fight against COVID-19. In Russia, the company gave 76 tonnes of products to low-income families and retired and redeveloped a part of the production for the manufacture of medical masks and antiseptics.

The effect of risk management from charity, connected with the fight against the viral threat, was comprehensive. First, companies strengthened their brands as socially responsible businesses, thus raising the loyalty of interested parties and increasing sales volumes. Second, the elimination of the pandemic itself is a serious risk factor. Charity of the business in early 2020 made a large contribution to the growth of the efficiency of medical establishments and the effectiveness of the fight against the viral threat. This allowed for minimizing incidence rates and slowing down (as much as possible) the speed of the dissemination of COVID-19. This allowed for the periodic weakening of the coronavirus restrictions in 2020–2021, thus reducing business risks connected with lockdowns.

From international experience, the following successful examples of business risk management during the pandemic in 2020 deserve attention (Prikhodko 2023):

- Signature Brew brewery in the UK reoriented from the supply of beer to bars (which closed because of the lockdown) to selling beer boxes. The boxes were delivered by musicians, who had to cancel their shows due to the pandemic. They advertised the boxes on social networks and made videos, thus attracting a new audience. More music fans and other people, who had a lot of free time during the quarantine, started ordering the boxes, taking photos, and posting them on social media, creating a feeling of involvement in a common case.
- The British start-up Encore had been working as a platform for booking musicians for different events before the lockdown. During the pandemic, the company reoriented to the recording of personalized musical messages. During product testing, Encore received around 100 orders for videos, which made almost GBP 1000 for several musicians. At present, there are more than 20,000 musicians, who can record messages, on the platform.
- Before the lockdown, MyoMaster had been selling sports equipment for gyms and professional sports events. During the lockdown, all gyms were closed, and all sports events were cancelled. The company started providing services for home workouts; it took the company two weeks to go online (the entire business), which led to an increase in sales by 30 times.
- Rosie on Fire retrained from women's clothing delivery to the delivery of thematic boxes for quarantine leisure. In 2020, the company's website had more than nine categories, with 5–6 boxes in each category. SupplyDrop was available for delivery to the UK, Malaysia, and Australia.
- Club Vino organized events for wine tasting, which had been very popular before the pandemic. The COVID-19 crisis led to the ban on all public events and the closure of bars, restaurants, and hotels, which made the Club Vino business model irrelevant and unprofitable. The company made a quick change in its activities, and since 2020, its customers could order a box of home tasting at the company's website. Videos and sets were made to give the impression that they were very close to the offline events of the company. This new form of business is more scalable, and it ideally supplements offline business.

The above examples demonstrate the experience of the selected companies only. However, each business structure suffered from the pandemic in a specific way, and its risks, connected with the COVID-19 crisis, were largely predetermined by the specifics of

the business. That is why, to determine the total impact of the pandemic on business risks and to develop universal measures of management of business risks during the pandemic, it would be expedient to perform an econometric analysis of macroeconomic statistics.

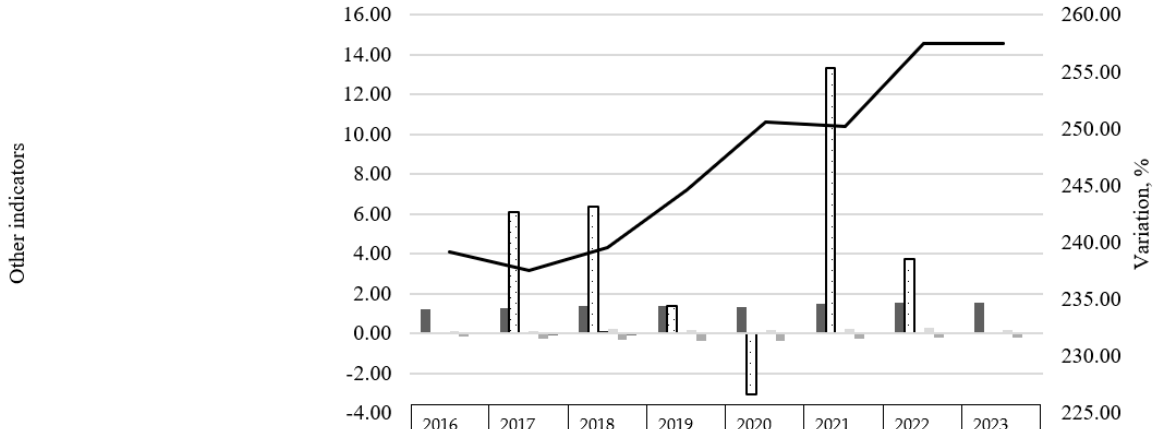
4.2. Impact of the COVID-19 Crisis on Business Risks

In the first research task, the authors conducted a structural and factor analysis of business risks in the COVID-19 crisis and the post-COVID period in 2020–2023 to determine the impact of the COVID-19 crisis on business risks (Figures 1 and 2 and Tables 3 and 4). The authors examined data for 59 countries by year for 2018–2023 (from Supplementary Table S1).

As shown in Figure 1, the arithmetic mean of the GDP of the countries in the sample before the pandemic demonstrated a trend towards growth. Thus, in 2017 (USD 1.26 trillion), it grew by 6.07%, compared to 2016 (USD 1.19 trillion). In 2018, the growth of the considered indicator equaled 6.38% (up to USD 1.35 trillion), and in 2019—1.36% (up to USD 1.36 trillion). In the conditions of the COVID-19 crisis, the GDP of the countries in the sample was reduced by 3.09% in 2020, down to USD 1.32 trillion, which was a sign of an increase in the danger of the risk of reduction in revenue and business activity in the conditions of the COVID-19 crisis.

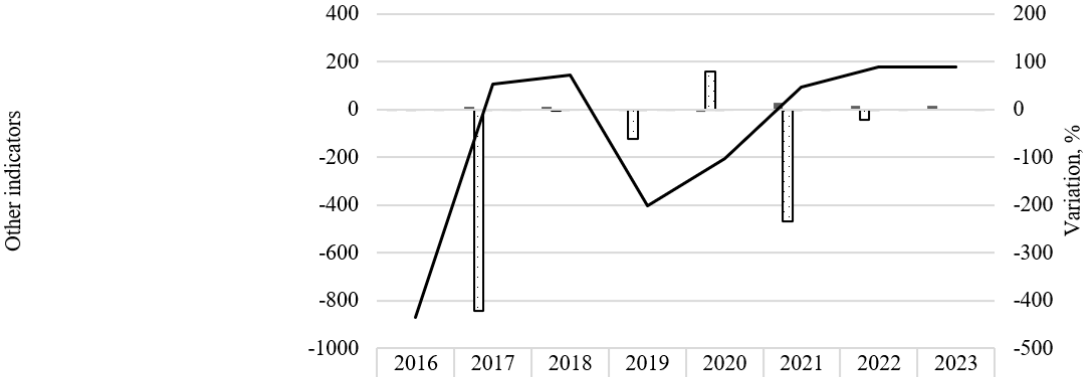
Variation in the GDP of the countries in the sample before the crisis was lower, equaling 239.18% in 2016, 237.47% in 2017, 239.50% in 2018, and 244.62% in 2019. In the conditions of the pandemic and the COVID-19 crisis, the variation in the GDP of the countries in the sample reached 250.52% in 2020 and 250.22% in 2021, which was a sign of an increase in the probability of the risk of the reduction in revenue and business activity in the conditions of the COVID-19 crisis. During the post-crisis recovery of the economy, the variation in the GDP of the countries in the sample turned out to be even higher, equaling 257.46% in 2022–2023.

Taken together, the results indicate a significant exacerbation of the risk of declining income and business activity in the COVID-19 crisis. Business risk management tools have demonstrated similar effectiveness before the pandemic (in 2016–2019) and in the COVID-19 crisis and the post-COVID period (in 2020–2023) for business revenue and business downside risk.



	2016	2017	2018	2019	2020	2021	2022	2023
Arithmetic mean	1.19	1.26	1.35	1.36	1.32	1.50	1.55	1.55
Growth rate, %		6.07	6.38	1.36	−3.09	13.33	3.71	0.00
Correlation with health infrastructure	0.04	0.03	0.10	0.06	0.02	0.08	0.03	0.08
Correlation with the use of big data and analytics	0.13	0.13	0.23	0.14	0.16	0.21	0.30	0.19
Correlation with the government budget surplus/deficit (%)	−0.14	−0.26	−0.32	−0.38	−0.39	−0.29	−0.23	−0.23
Correlation with protectionism	0.00	−0.12	−0.13	−0.04	−0.02	0.04	0.03	0.03
Variation, %	239.18	237.47	239.50	244.62	250.52	250.22	257.46	257.46

Figure 1. Change in gross domestic product (GDP) in the COVID-19 crisis, USD trillion. *Source*: Calculated and compiled by the authors.



	2016	2017	2018	2019	2020	2021	2022	2023
Arithmetic mean	-1.67	12.47	11.72	-2.92	-7.61	28.08	15.67	15.67
Growth rate, %		-845.07	-6.02	-124.93	160.34	-469.04	-44.19	0
Correlation with health infrastructure	-0.16	-0.38	-0.1	-0.07	-0.13	-0.01	-0.03	0.09
Correlation with the use of big data and analytics	-0.52	-0.19	-0.05	0.04	-0.2	0.18	0.31	0.27
Correlation with the government budget surplus/deficit (%)	0.08	-0.1	0.12	-0.21	0.12	0.43	0.52	0.52
Correlation with protectionism	-0.16	-0.23	0.03	-0.09	0	-0.08	-0.03	-0.06
Variation, %	-435.21	52.38	72.61	-200.76	-103.78	47.1	88.65	88.65

Figure 2. Change of exports of goods (growth, percentage change, based on USD values) in COVID-19. *Source*: Calculated and compiled by the authors.

As shown in Figure 2, the arithmetic mean of the expert of goods in the countries of the sample initially demonstrated the growth: In 2017 (12.47%), it grew by 845.07% compared to 2016 (−1.67%). The trend for its decrease started even before the pandemic: In 2018 (11.72%), it reduced by 6.02%, and in 2019 (−2.92%)—by 124.93%. In the conditions of the COVID-19 crisis, its decline accelerated visibly, reaching 160.34% in 2020 (−7.61%), as well as 469.04% in 2021, which was a sign of an increase in the danger of the risk of reducing the export of business in the conditions of the COVID-19 crisis. Though in the period of the post-crisis recovery, the decline slowed down to 44.19% in 2022 (15.67%), the downward trend remained.

Variation in the export of goods in the countries of the sample was negative before the crisis, equaling −435.21% in 2016 and −200.76% in 2019. In 2020, the variation reduced but remained negative, equaling −103.78%. This was a sign that the countries in the sample suffered differently from the COVID-19 crisis. From 2021 onward, the variation was moderate and positive. It equaled 47.1% in 2021. The growth of variation during the period of the post-crisis recovery of the economy (up to 88.65% in 2022 and 2023) reflects the delayed effect of the COVID-19 crisis on the considered business risk and shows an increase in the probability of the risk of reducing the export of business in the conditions of the COVID-19 crisis.

Taken together, the results indicate a significant exacerbation of the risk of the decline of business exports in the COVID-19 crisis. In the conditions of the COVID-19 crisis, the correlation between the export of goods and the healthcare infrastructure reduced from 0.07 in 2019 to −0.13 in 2020, down to −0.01 in 2021, and down to −0.03% in 2022, which was a sign of the reduction in the effectiveness of this tool of risk management. Contrary to this, in the conditions of the COVID-19 crisis, the correlation between the export of goods and protectionism ceased to be negative and became zero, which was a sign of an increase in the effectiveness of this tool of risk management.

Budget deficits allowed assuaging the negative influence of the crisis on the business environment, reducing the business risks of export, which was proven by the positive values of the correlation coefficients in 2020 (0.12%), 2021 (0.43%), 2022, and 2023 (0.52%), while before the pandemic and crisis, the correlation was negative (e.g., −0.10% in 2017 and −0.21% in 2019).

At that, other tools of risk management of business demonstrated similar effectiveness before the pandemic (in 2016–2019) and in the conditions of the COVID-19 crisis (in 2020–2023) regarding the risk of the reduction in exports. To select the most effective risk management tools, the authors conducted a regression analysis of the data from Supplementary Table S2.

Results of the regression analysis (Tables 3–9) allow for high (exceeding 100) values of the estimated coefficients. The reason is that GDP is measured in USD billion (R_1) and can take very high values, while the values of other control variables are within the range of 0–100. Thus, exports of goods (R_2) and government budget surplus/deficit (g_1) are measured in per cent, and other indicators—protectionism (g_2), image abroad or branding (m), digital transformation in companies (dm_1), use of big data and analytics (dm_2), and health infrastructure (h)—in points from 0 to 100.

Table 3. Regression analysis of GDP dependence on a set of risk management instruments in 2020–2023.

Regression statistics						*df*
Multiple R	R^2	Adjusted R^2	Standard error	Observations (n)	$k_1 = m$	$k_2 = n - m - 1$
0.3843	0.1477	0.1253	3509.0298	236	6	229
F-test						
F-observed	F-table	Significance of F	Level of significance	F-test		
6.6127	2.8815	1.837×10^{-6}	0.01	F-test was passed at the level of significance of 0.01 (6.6127 > 2.8815)		
Parameters of the regression model and t-test						
	Coefficients	Standard error	t-Stat	*p*-value	Lower 95%	Upper 95%
Constant	−5196.6084	1650.6404	−3.1482	0.0019	−8448.9926	−1944.2241
h	95.1523	178.8986	0.5319	0.5953	−257.3453	447.6500
g_1	−222.9554	49.1371	−4.5374 *	9.19424×10^{-6} *	−319.7741	−126.1368
g_2	−409.4890	287.1722	−1.4259	0.1552	−975.3266	156.3485
m	257.4290	301.7609	0.8531	0.3945	−337.1540	852.0119
dm_1	−663.8232	563.4372	−1.1782	0.2400	−1774.0071	446.3608
dm_2	1889.1011	535.5879	3.5272 *	0.0005 *	833.7909	2944.4114

* The *p*-value is within 0.15. *Source*: Calculated and compiled by the authors.

According to Table 3, in the aggregate, the considered management tools determine the acuteness of the profitability risk and business activity decrease in 2020–2023 by 38.43% (multiple R, and $R^2 = 0.1477$). The *p*-value was within 0.15 for only two factor variables: for government budget surplus/deficit (9.19424×10^{-6}) and the use of big data and analytics (0.0005).

Statistically significant values of the regression coefficients (b) are as follows: −222.9554 at g_1 and 1889.1011 at dm_2. The economic sense of these values of the regression coefficients is that an increase in government budget surplus/deficit by 1 leads to a decrease in the percentage of GDP gross domestic product by USD 222.9554. An increase in the activity of the use of big data and analytics by 1 point leads to an increase in the gross domestic product by USD 1889.1011 billion.

Table 4. Regression analysis of the dependence of commodity export on a set of risk management tools in 2020–2023.

Regression statistics						*df*
Multiple R	R^2	Adjusted R^2	Standard error	Observations (n)	$k_1 = m$	$k_2 = n - m - 1$
0.5306	0.2815	0.2627	15.3845	236	6	229
F-test						
F-observed	F-table	Significance of F	Level of significance	F-test		
14.9549	2.8815	2.02×10^{-14}	0.01	F-test was passed at the level of significance of 0.01 (14.9549 > 2.8815)		
Parameters of the regression model and t-test						
	Coefficients	Standard error	t-Stat	*p*-value	Lower 95%	Upper 95%
Constant	24.4652	7.2368	3.3807	0.0009	10.2059	38.7245
h	0.6212	0.7843	0.7920	0.4292	−0.9243	2.1666
g_1	1.8233	0.2154	8.4637 *	3.1112×10^{-15}	1.3988	2.2478
g_2	−2.0673	1.2590	−1.6420 *	0.1020 *	−4.5481	0.4135
m	−1.8316	1.3230	−1.3844	0.1676	−4.4384	0.7752
dm_1	2.0985	2.4703	0.8495	0.3965	−2.7688	6.9658
dm_2	0.4877	2.3482	0.2077	0.8357	−4.1391	5.1144

* The *p*-value is within 0.15. *Source*: Calculated and compiled by the authors.

According to Table 4, in the aggregate, the considered management tools determine the acuteness of the risk of a 53.06% decline in exports of goods in 2020–2023 (multiple R, and $R^2 = 0.2815$). The *p*-value was within 0.15 for only two factor variables: government budget surplus/deficit (3.11124×10^{-15}) and protectionism (0.1020).

Statistically significant values of the regression coefficients (b) are as follows: 1.8233 at g_1 and −2.0673 at g_2. The economic sense of the given values of the regression coefficients is that an increase in government budget surplus/deficit by 1 leads to an increase in the percentage of GDP exports of goods growth by 1.8233%. An increase in the level of protectionism by 1 point leads to a decrease in exports of goods growth by 2.0673%.

Thus, the severity of the risk of declining profitability and business activity of the business has increased significantly during the COVID-19 crisis. The most promising tools to manage this risk are government budget surplus/deficit (regulatory tool for financial state management of business risks) and the use of big data and analytics (a corporate risk management tool for business risk through digital marketing). Similarly, the severity of the risk of declining exports of business goods has increased significantly during the COVID-19 crisis. The most promising tools to manage this risk are government budget surplus/deficit and protectionism as regulatory tools for financial and non-financial state management of business risk.

4.3. Dataset Modeling of Business Risk Management in the COVID-19 Crisis with Reliance on Regulatory and Marketing Tools

In the second task of the research, the authors conducted a regression analysis of data from Supplementary Table S2 to model the impact of selected regulatory and marketing tools separately on business risks in the COVID-19 crisis. As a result, the following system of equations was obtained:

$$\begin{cases} R_1 = 6173.8427 - 235.6905 g_1 + 1296.5733 m_2, \\ R_2 = 33.2111 + 1.9073 g_1 - 2.3356 g_2, \\ dm_2 = -13.3430 + 1.6619 dm_1, \\ g_1 = 0.5138 + 0.8914 dm_1, \\ g_2 = 0.4235 + 0.8223 dm_1. \end{cases} \quad (2)$$

According to the system of Equation (1), if the government budget surplus/deficit increases by 1%, the annual increase in exports of goods increases by 1.9073%. A one-point increase in protectionism reduces the annual increase in exports of goods by 2.3356 (thus, free trading is preferable). If the activity of using big data and analytics increases by one point, GDP increases by USD 1296.5733 billion. If the activity of digital transformation in companies increases by one point, the government budget surplus/deficit increases by 1.6619%, protectionism—by 0.8914 points, and the use of big data and analytics—by 0.8223 points. The results of the regression analysis are shown in Tables 5–9.

Table 5. Regression analysis of the dependence of GDP on selected risk management instruments in 2020–2023.

Regression statistics						*df*
Multiple R	R^2	Adjusted R^2	Standard error	Observations (n)	$k_1 = m$	$k_2 = n - m - 1$
0.3684	0.1357	0.1283	3503.1615	236	2	233
F-test						
F-observed	F-table	Significance of F	Level of significance	F-test		
18.2887	4.6974	4.191×10^{-8}	0.01	F-test was passed at the level of significance of 0.01 (18.2887 > 4.6974)		
Parameters of the regression model and t-test						
	Coefficients	Standard error	t-Stat	*p*-value	Lower 95%	Upper 95%
Constant	−6173.8427	1507.8423	−4.0945 *	5.8×10^{-5} *	−9144.5899	−3203.0955
g_1	−235.6905	48.2579	−4.8840 *	1.9×10^{-6} *	−330.7680	−140.6130
dm_2	1296.5733	273.1162	4.7473 *	3.6×10^{-6} *	758.4804	1834.6662

* The *p*-value is within 0.01. *Source*: Calculated and compiled by the authors.

According to Table 5, the change in GDP in the sample countries in 2020–2023 by 36.84% (multiple R, and R^2 = 0.1357) is explained by changes in government budget surplus/deficit and the use of big data and analytics. The significance of F is 4.191×10^{-8}. Consequently, the results of the regression analysis correspond to a significance level of 0.01. At a given significance level with 118 observations and two factor variables ($k_1 = 2$; $k_2 = 236 - 2 - 1 = 233$), the tabular F is 4.6974. The observed F equals 18.2887, which is higher than the tabular F. Thus, Fisher's F-test is passed.

The tabular t for 235 degrees of freedom is 2.5969. The observed t is −4.8840 for government budget surplus/deficit and 4.7473 for the use of big data and analytics. That is, it exceeds the table modulo for both factor variables. Consequently, the Student's *t*-test is passed, and the results are reliable and valid at the 0.01 significance level.

Statistically significant values of the regression coefficients (b) are as follows: −235.6905 at g_1 and 1296.5733 at dm_2. The economic sense of the given values of the regression coefficients is that an increase in government budget surplus/deficit by 1 leads to a decrease in the percentage of GDP gross domestic product by USD 235.6905 billion. An increase in the activity of the use of big data and analytics by 1 point leads to an increase in gross domestic product by USD 1296.5733 billion.

Table 6. Regression analysis of the dependence of the export of goods on selected risk management instruments in 2020–2023.

Regression statistics						*df*
Multiple R	R^2	Adjusted R^2	Standard error	Observations (n)	$k_1 = m$	$k_2 = n - m - 1$
0.5187	0.2690	0.2627	15.3841	236	2	233
F-test						
F-observed	F-table	Significance of F	Level of significance	F-test		
42.8720	4.6974	1.4×10^{-16}	0.01	F-test was passed at the level of significance of 0.01 (42.8720 > 4.6974)		
Parameters of the regression model and t-test						
	Coefficients	Standard error	t-statistics	*p*-value	Lower 95%	Upper 95%
Constant	33.2111	4.2122	7.8845 *	1.2×10^{-13}	24.9123	41.5099
g_1	1.9073	0.2090	9.1274 *	3.4×10^{-17}	1.4956	2.3191
g_2	−2.3356	0.6723	−3.4739*	0.0006	−3.6603	−1.0110

* The *p*-value is within 0.01. *Source*: Calculated and compiled by the authors.

According to Table 6, the change in the export of goods in the sample countries in 2020–2023 by 51.87% (multiple R, and $R^2 = 0.2690$) is explained by changes in government budget surplus/deficit and protectionism. The significance of F is 1.4×10^{-16}. Consequently, the results of the regression analysis correspond to a significance level of 0.01. At a given significance level with 236 observations and two factor variables ($k_1 = 2$; $k_2 = 236 - 2 - 1 = 233$), the tabular F is 4.6974. The observed F equals 42.8720, which is higher than the tabular F. Thus, Fisher's F-test is passed.

The tabular t for 235 degrees of freedom is 2.5969. The observed t is 9.1274 for government budget surplus/deficit and −3.4739 for protectionism. That is, it exceeds the table modulo for both factor variables. Consequently, the Student's *t*-test is passed, and the results are reliable and valid at the 0.01 significance level.

Statistically significant values of the regression coefficients (b) are as follows: 1.9073 at g_1 and −2.3356 at g_2. The economic sense of the given values of the regression coefficients is that an increase in government budget surplus/deficit by 1 leads to an increase in the percentage of GDP exports of goods growth by 1.9073%. An increase in the level of protectionism by 1 point leads to a decrease in exports of goods growth by 2.3356%.

Table 7. Regression analysis of the dependence of government budget surplus/deficit on digital transformation in companies in 2020–2023.

Regression statistics						*df*
Multiple R	R^2	Adjusted R^2	Standard error	Observations (n)	$k_1 = m$	$k_2 = n - m - 1$
0.3100	0.0961	0.0923	4.6837	236	1	234
F-test						
F-observed	F-table	Significance of F	Level of significance	F-test		
24.8826	6.7444	1.188×10^{-6}	0.01	F-test was passed at the level of significance 0.01 (24.8826 > 6.7444)		
Parameters of the regression model and t-test						
	Coefficients	Standard error	t-Stat	*p*-value	Lower 95%	Upper 95%
Constant	−13.3430	1.9805	−6.7372 *	1.2×10^{-10}	−17.2448	−9.4411
dm_1	1.6619	0.3332	4.9882 *	1.2×10^{-6}	1.0055	2.3182

* The *p*-value is within 0.01. *Source*: Calculated and compiled by the authors.

According to Table 7, the change in government budget surplus/deficit in the sample countries in 2020–2023 by 31.00% (multiple R, and R^2 = 0.0961) is explained by changes in digital transformation in companies. The significance of F is 1.188×10^{-6}. Consequently, the results of the regression analysis correspond to a significance level of 0.01. At a given significance level with 236 observations and two factor variables ($k_1 = 1$; $k_2 = 236 - 1 - 1 = 234$), the tabular F is 6.7444. The observed F equals 24.8826, which is higher than the tabular F. Thus, Fisher's F-test is passed.

The tabular t for 235 degrees of freedom is 2.5969. The observed t is 4.9882 for the factor variable. That is, it exceeds the table modulo. Consequently, the Student's *t*-test is passed, and the results are reliable and valid at the 0.01 significance level.

The regression coefficient for the factor variable dm_1 tool has a value of 1.6619, and its influence is statistically significant. The economic sense of the given value of the regression coefficient is that the growth of the level of digital transformation in companies by 1 point leads to a decrease in government budget surplus/deficit by 1.6619 points.

Table 8. Regression analysis of the dependence of protectionism on digital transformation in companies in 2020–2023.

Regression statistics						*df*
Multiple R	R^2	Adjusted R^2	Standard error	Observations (n)	$k_1 = m$	$k_2 = n - m - 1$
0.5350	0.2863	0.2832	1.2936	236	1	234
F-test						
F-observed	F-table	Significance of F	Level of significance	F-test		
93.8484	6.7444	7.056×10^{-19}	0.01	F-test was passed at the level of significance of 0.01 (93.8484 > 6.7444)		
Parameters of the regression model and t-test						
	Coefficients	Standard error	t-Stat	*p*-value	Lower 95%	Upper 95%
Constant	0.5138	0.5470	0.9393	0.3485	−0.5639	1.5914
dm_1	0.8914	0.0920	9.6875 *	7.1×10^{-19}	0.7101	1.0727

* The *p*-value is within 0.01. *Source*: Calculated and compiled by the authors.

According to Table 8, the change in the export of goods in the sample countries in 2020–2023 by 53.50% (multiple R, and R^2 = 0.2863) is explained by changes in digital transformation in companies. The significance of F is 7.056×10^{-19}. Consequently, the results of the regression analysis correspond to a significance level of 0.01. At a given significance level with 236 observations and two factor variables ($k_1 = 1$; $k_2 = 236 - 1 - 1 = 234$), the tabular F is 6.7444. The observed F equals 93.8484, which is higher than the tabular F. Thus, Fisher's F-test is passed.

The tabular t for 235 degrees of freedom is 2.5969. The observed t is 9.6875 for the factor variable. That is, it exceeds the table modulo. Consequently, the Student's *t*-test is passed, and the results are reliable and valid at the 0.01 significance level.

The regression coefficient for the factor variable dm_1 took the value of 0.8919, and its influence is statistically significant. The economic sense of the given value of the regression coefficient is that the growth of the level of digital transformation in companies by 1 point leads to an increase in the effectiveness of protectionism by 0.8914 points.

Table 9. Regression analysis of the dependence of the use of big data and analytics on digital transformation in companies in 2020–2023.

Regression statistics						*df*
Multiple R	R^2	Adjusted R^2	Standard error	Observations (n)	$k_1 = m$	$k_2 = n - m - 1$
0.8682	0.7537	0.7526	0.4320	236	1	234
F-test						
F-observed	F-table	Significance of F	Level of significance	F-test		
716.0235	6.7444	3.811×10^{-73}	0.01	F-test was passed at the level of significance of 0.01 (716.0235 > 6.7444)		
Parameters of the regression model and t-test						
	Coefficients	Standard error	t-Stat	*p*-value	Lower 95%	Upper 95%
Constant	0.4235	0.1827	2.3184	0.0213	0.0636	0.7834
dm_1	0.8223	0.0307	26.7586 *	3.8×10^{-73}	0.7617	0.8828

* The *p*-value is within 0.01. *Source*: Calculated and compiled by the authors.

According to Table 9, the change in the use of big data and analytics in the sample countries in 2020–2023 by 86.82% (multiple R, and $R^2 = 0.7537$) is explained by changes in digital transformation in companies. The significance of F is $F = 3.811 \times 10^{-73}$. Consequently, the results of the regression analysis correspond to a significance level of 0.01. At a given significance level with 236 observations and two factor variables ($k_1 = 1$; $k_2 = 236 - 1 - 1 = 234$), tabular F equals 6.7444. The observed F is 716.0235, which is higher than the tabular F. Thus, Fisher's F-test is passed.

The tabular t for 235 degrees of freedom is 2.5969. The observed t is 26.7586 for the factor variable. That is, it exceeds the table modulo. Consequently, the Student's *t*-test is passed, and the results are reliable and valid at the 0.01 significance level.

The regression coefficient at the factor variable dm_1 took the value of 0.8223, and its influence is statistically significant. The economic sense of the given value of the regression coefficient is that the growth of the level of digital transformation in companies by 1 point leads to an increase in the activity of the use of big data and analytics by 0.8223 points.

Thus, the results of dataset modeling revealed the most promising risk management tools for business in the COVID-19 crisis, which included regulatory (government budget surplus/deficit and protectionism—preferably free trading) and marketing tools (mainly digital marketing tools, namely digital transformation in companies and use of big data and analytics). An in-depth analysis of the cause-and-effect relationships of the selected variables revealed that the systemic management of them in aggregate is possible through increasing the activity of digital transformation in companies.

4.4. SEM of Business Risk Management in the COVID-19 Crisis with Reliance on Regulatory and Marketing Tools

As part of the third research task, to systemically model the impact of a set of key instruments on business risks in 2020–2023, the authors compiled the SEM model of business risk management in the COVID-19 crisis (Figure 3).

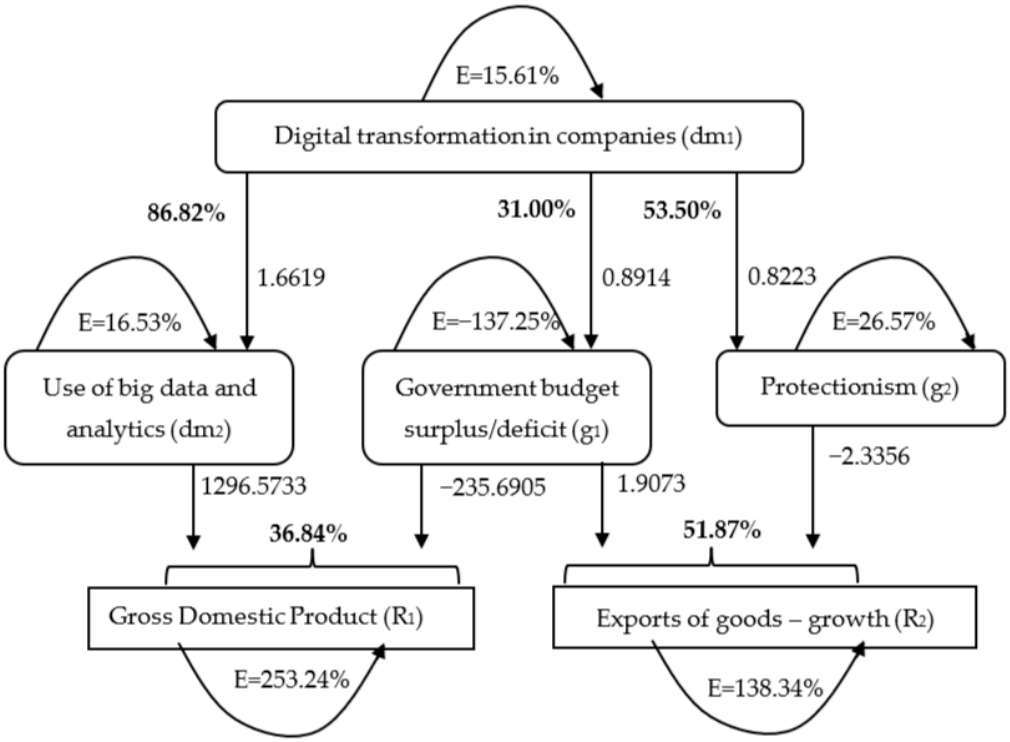


Figure 3. SEM model of business risk management in the COVID-19 crisis with reliance on regulatory and marketing tools. The bold font indicates the multiple correlation coefficients. *Source*: Calculated and compiled by the authors.

The SEM model presented in Figure 3 reflects the regression relationships (shown by straight arrows) from the system of Equation (1) and the correlation relationships (shown in bold) from Tables 4–8, as well as the variation in the values of all indicators (E), characterizing the degree of their dispersion and, accordingly, the model error.

The SEM model shows that GDP and exports of goods are highly differentiated (coefficients of variation are 249.84% and 204.65%, respectively), which indicates the great severity of business risks in the COVID-19 crisis. The risk of a decline in income and business activity by 39.23% is determined by the influence of the considered management tools, which also, by 52.02%, determine the risk of a decline in exports of goods. The availability and effectiveness of risk management tools depend heavily on the digital transformation of business, which determines the use of AI and big data by 87.20%, the national budget balance by 26.84%, and protectionism by 54.12%.

To determine the fit of the SEM model for the observed data, we assessed it with the help of the Pearson approval criterion χ^2, also known as the chi-square goodness of fit test, in which the indicator of conditions is the chi-square test. The detailed calculations for all 256 observations for each factor variable are presented in Tables A1 and A2. The final results are presented in Table 10.

Table 10. Final results of the assessment of the quality of the SEM model with the help of the Pearson approval criterion χ^2.

Factor Variable	Resulting Variable on the t-Stat of Which the Test Is Conducted	Observed t-Stat	χ^2	*p*-Value
g_1	R_1	−4.88	−125.86	1.00
	R_2	9.13	−657.21	0.00

Table 10. *Cont.*

Factor Variable	Resulting Variable on the t-Stat of Which the Test Is Conducted	Observed t-Stat	χ^2	*p*-Value
g_2	R_2	−3.47	−1253.20	0.00
dm_1	g_1	4.99	83.79	1.00
	g_2	9.69	−175.82	0.99
	dm_2	26.76	−368.39	0.00
dm_2	R_1	4.75	50.31	1.00

Source: Calculated and compiled by the authors.

The results of the use of the Pearson approval criterion (from Table 10) showed that the SEM model is reliable on the whole. It fits the observed data the best: (1) for the factor variable g_1 at the resulting variable R_2 ($\chi^2 = -657.21$; *p*-value strives towards zero); (2) for the factor variable g_2 at the resulting variable R_2 ($\chi^2 = -1253.20$; *p*-value strives towards zero); (3) for the factor variable dm_1 at the resulting variable dm_2 ($\chi^2 = -368.39$; *p*-value strives towards zero).

The advantage of the SEM model is that it is the most detailed and comprehensive disclosure of the cause-and-effect relationship of business risk management in the COVID-19 crisis. Thanks to the SEM model, the authors managed to clarify and demonstrate that the regulatory and marketing tools of business risk management are closely linked. The effectiveness of applying regulatory and marketing tools of business risk management during the COVID-19 crisis is largely determined by the scale and success of the digital transformation of the business.

The potential role of the selected most promising universal tools of risk management consists of the following: The selected most promising regulatory tools allow for improving the business climate. Thus, an increase in government budget surplus (prevention of budget deficit) expands the capabilities of the tax and subsidiary support for businesses. State subsidies allow covering the losses of the business caused by the termination of activities during the lockdown, in particular, covering rent to retain the commercial areas known to customers and covering expenditures for wages to retain the personnel. Free trading (refusal from protectionism) allows for preserving "healthy" market competition under the conditions of the COVID-19 crisis and supporting (indirectly influencing) the adaptability of business and its flexibility for post-crisis recovery.

The selected most promising marketing tools allow for a direct increase in the flexibility and adaptability of the business. The use of big data and analytics ensures intellectual support for managerial decisions and allows for the systemic improvement of the marketing mix. Digital transformation in companies allows for digital marketing and sales. This allows retaining business activities even during the lockdown—instead of closing the business, it is possible to transfer it online for promotion (e.g., advertising in social networks), distribution (call centers, marketplaces), and sales (home delivery services).

Thus, neither marketing nor regulatory tools are self-sufficient and exhaustive for business risk management in the COVID-19 crisis. To increase business resilience to risks and reduce their severity in the COVID-19 crisis, it is necessary to combine marketing and regulatory management tools flexibly, the key of which is the use of AI technology and big data for intelligent decision support and financial support for businesses from the state budget and free trading.

4.5. Data Analysis of the Post-Pandemic Business Risk Management Perspective with Reliance on Regulatory and Marketing Tools

In the framework of the fourth research task, to determine the post-pandemic perspective of business risk management, the authors carried out data analysis (prediction) of the strategic implications of systemic business risk management based on regulatory

and marketing tools (Figure 4) using the simplex method based on the results of regression analysis in the system of Equation (1).

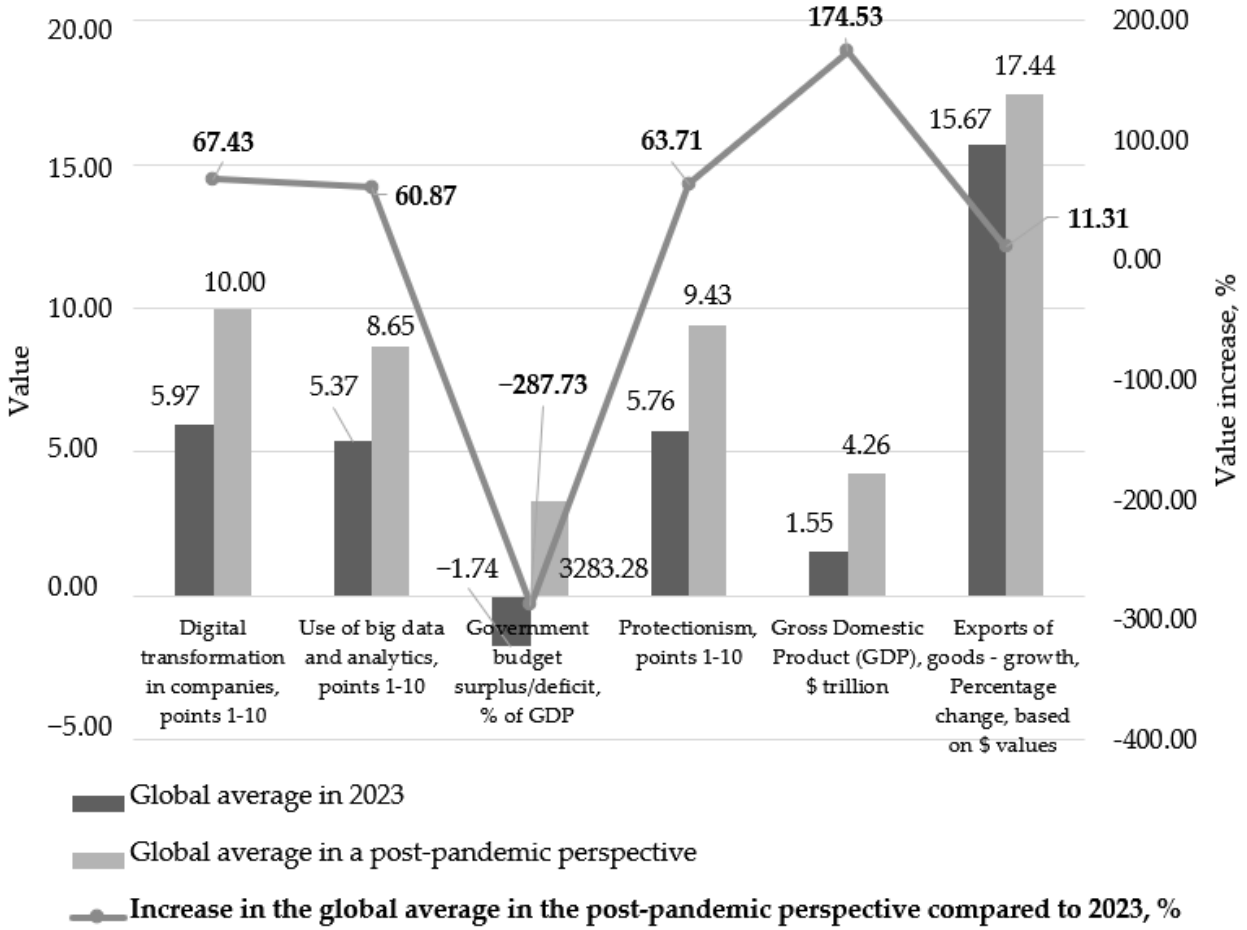


Figure 4. A post-pandemic business risk management perspective with reliance on regulatory and marketing tools. *Source*: Calculated and constructed by the authors.

The initial point of the authors' forecast in Figure 4 is the maximization of the level of digital transformation of business—its increase from 5.79 points on average for the sample in 2023 up to 10 points (+67.43%). This allows for expansion of the opportunities for using the tools of risk management of business: the activity of the use of AI and big data grows by 60.87% (from 5.37 points in 2023 to 8.65 points), a deficit of state budget is reduced by 287.73% (from −1.74% GDP to 3.28% GDP), but protectionism grows by 63.71% (from 5.76 points in 2023 to 9.43 points).

As a result of the intensification and systemic use of the regulatory and marketing tools of risk management, the following advantages for businesses are achieved. First, the risk of the reduction in revenues and business activity is reduced—the GDP grows by 174.53% (from USD 1.55 trillion in 2023 to USD 4.26 trillion). Second, the risk of the reduction in the export of goods decreases—the rate of its annual growth increases by 11.31% (from 15.67% in 2023 to 17.44%). Thus, the post-pandemic perspective of business risk management is favorable, providing a comprehensive reliance on regulatory and marketing tools, as demonstrated by the author's forecast.

5. Discussion

The contribution of the research to the literature consists of the development of scientific provisions for the concept of business risks. The research clarified the causal relationship between the use of various risk management tools for business resilience to

the COVID-19 crisis. Because of this, the research clarified the scientific understanding of the risk management toolkit and opened an opportunity to reduce the impact of the COVID-19 crisis on business risks. The new answers to the RQs obtained in this research are compared with the answers in the existing literature in Table 11.

Table 11. Comparison of new answers to RQs obtained in the research with answers in the existing literature.

Research Questions	Answers in the Existing Literature	New Answers Received in the Research
RQ_1: What tactical tools of business risk management are most effective in the COVID-19 crisis?	Either regulatory (Vadlamannati et al. 2023; Wang and Wu 2021), or marketing (Botelho et al. 2023; Mishra and Mishra 2023) – separately	A combination of regulatory (financial support from the state budget and protectionism) and marketing (use of big data and analytics) tools
RQ_2: How to carry out strategic risk management of the business from a post-COVID perspective?	Through the development of healthcare infrastructure (Achat et al. 2022; Lepore et al. 2023)	Based on digital marketing

Source: Developed by the authors.

As shown in Table 11, this research provided a new response to RQ_1. In contrast to the existing literature, which suggests applying either regulatory (Vadlamannati et al. 2023; Wang and Wu 2021) or marketing (Botelho et al. 2023; Mishra and Mishra 2023) tools separately, this research argues that a tactical combination of regulatory (financial support from the state budget and protectionism) and marketing (use of big data and analytics) business risk management tools is appropriate in the COVID-19 crisis.

The research also provided a new response to RQ_2. In contrast to the existing literature, which suggests strategic business risk management from a post-consumer perspective through developing healthcare infrastructure (Achat et al. 2022; Lepore et al. 2023), this research recommends conducting strategic business risk management based on digital marketing. A detailed study of broad international experience based on a representative sample in 2018–2021 found no statistically significant contribution of healthcare infrastructure to business risk reduction. Simultaneously, the digitalization of business has been proven to increase the availability and effectiveness of the selected most effective risk management tools.

The novelty of the results obtained is that they allowed selecting the most effective tools of managing the risks for business during the COVID-19 crisis: (1) Digital transformation in companies (in support of Hussain 2022; Ngo et al. 2022); (2) the use of big data and AI technologies for intellectual decision support (in support of Han 2023; Shang et al. 2021); (3) financial support for business from state budgets (in support of Ma et al. 2023; Sidorkin and Srholec 2022; Wan and Zhang 2023) and (4) freetrading (instead of protectionism—unlike Chacko 2023), (Mitrović and Mitrović 2023). We proved the ineffectiveness of such existing tools for the risk management of business, such as image abroad or branding (unlike Sashittal et al. 2023; Siqueira Junior et al. 2023) and the development of health infrastructure (unlike Muir et al. 2023; Reynolds and Bennett 2023; Schwatka et al. 2022).

The scientific and practical value of the author's findings is that they prove that the regulatory and marketing approaches are not alternatives, and their tools should complement each other in a systemic approach to business risk management in the COVID-19 crisis. The combination of the proposed regulatory and marketing tools will make it possible to avoid the dispersion of efforts and focus them on the most effective management tools, guaranteeing the best tactical and strategic results of business risk management in times of the COVID-19 crisis.

The paper clearly contrasts with the existing literature, opening a new view of risk management of business in the context of 2020. Unlike Chen et al. (2022), de Graaff et al. (2023), Metwally and Diab (2023), Park et al. (2023), Peng et al. (2023), and Yang et al. (2023), who, in the context of the pandemic, consider government measures of the development of healthcare infrastructure and business measures of an increase in sanitation, the introduction of a mandatory mask regime among employees, and social distancing to be the main measures, this paper substantiated that these measures provide only a small, limited effect. A stronger and more vivid effect in 2020 was achieved with the help of digitalization measures, including the transfer of employees to remote employment, the development of electronic financial operations and online trade, and other automatization in business.

Unlike Evenett (2019), Frias and Guerrero-Sanchez (2023), Heo and Choi (2023), Mavrot and Malandrino (2023), Nkemgha et al. (2022), and Shan et al. (2023), who deem the protectionism measures the main ones in the context of an economic crisis, this paper proved that market freedom reduced business risks to a greater extent than protectionism. Marketing in the conditions of market freedom is more effective in the conditions of the COVID-19 crisis, unlike other economic crises, including the 2008 world financial and economic crisis, when protectionism did not have alternatives and was sorely needed.

Thus, an essential difference from the existing literature is that this paper shifted the role of risk management in the conditions of the pandemic and the COVID-19 crisis from the government to private business and offered the emphasis—instead of traditional tools (healthcare and protectionism)—on flexible marketing tools—digital marketing (automatization of production, remote employment, and online trade).

6. Conclusions

Thus, the research goal is achieved: We identified the most promising regulatory and marketing tools for business risk management in the COVID-19 crisis and developed recommendations for improving the practice of these tools from a post-pandemic perspective. The obtained answers to both research questions. The authors' answer to RQ_1 is that a combination of regulatory (financial support from the state budget and protectionism) and marketing (use of big data and analytics) tools is the most effective tactical tool of business risk management tools in the COVID-19 crisis. The authors' answer to RQ_2 is that to carry out strategic risk management of the business from a post-COVID perspective, it is necessary to use digital marketing.

Dataset modeling of business risks in the COVID-19 crisis and data analysis of the post-pandemic perspective of managing these risks, relying on 2016–2023 data that reflect international experience in a representative sample, proved hypothesis H that implementing strategic business risk management in the post-pandemic perspective is advisable through the digitalization of business.

The key conclusion of the research is that the most complete and effective risk management of the business in the COVID-19 crisis requires the application of the tools of state and corporate governance in an integrated manner, that is, two-tier management: At the state and business level. Based on this, the authors recommended a systemic approach to business risk management in times of the COVID-19 crisis, which includes a set of the most effective regulatory (financial support from the state budget and protectionism) and marketing (use of big data and analytics) tools of business risk management.

Theoretical implications for state economic policy are connected with the substantiation of the necessity for closer cooperation between state regulators and business structures for the most flexible and effective management of business risks in crisis conditions, in particular, during the COVID-19 crisis. Independent efforts of state regulators in the reduction in risks for business through the improvement of the business environment should be replaced with the coordination of efforts of risk management with the business.

Empirical implications for state economic policy are connected, first, with the necessity for flexible change in the deficit of the national budget—either its reduction (noninterference with market processes) to support economic growth, or its increase (more active

subsidiary support for business structures that face the crisis) to support the development of the export potential of domestic business.

Second, reconsidering the spheres of subsidiary support for business structures that face the crisis. Instead of the traditional strengthening of national brands, it is recommended to focus on new spheres, which are stimulation of the digital transformation of companies and expansion of the use of big data and analytics.

Third, refusing the policy of protectionism even in the conditions of economic crises, since it does not reduce but raises the risks for business, as the experience of the COVID-19 crisis showed. Fourth, reconsidering the measures of state reduction in business risks through the exclusion of the development of the healthcare infrastructure from the list of these measures. Development of the healthcare infrastructure is necessary for the fight against the pandemic, but it does not contribute to the reduction in business risks, as the experience of the COVID-19 crisis showed.

The theoretical significance of the author's conclusions is that they have specified a list of the most effective tools of business risk management, making it possible to reduce the severity of the risk of declining income and business activity and the risk of reduced exports of goods. The authors proved the low effectiveness of traditional marketing (branding) and the preference for digital marketing based on big data, AI, and the general digitalization of business.

The practical significance of the results is that the recommended systemic approach to the application of regulatory and marketing tools makes it possible to increase the effectiveness of tactical and strategic risk management in the COVID-19 crisis, thereby increasing the resilience of businesses to this crisis. The author's forecast outlined quantitative benchmarks for the application of risk management tools and revealed a post-pandemic perspective on business risk management.

In conclusion, the results are limited to a focus on business risk and risk management. Although the research does not identify a statistically significant positive contribution of healthcare infrastructure to reducing the risk of declining income and business activity and the risk of reduced exports of goods, this does not mean that healthcare is unrelated to business risks. Thus, the author's conclusions and recommendations refer exclusively to microeconomics, which is a limitation that does not allow them to be extended to macroeconomics and the global economy.

This allows us to outline two areas for further research. The first area is the in-depth study of the impact of COVID-19 incidence and health care with business risks, the connection of which does not lie on the surface but is logical and needs to be proven. The second area includes a study of the role of healthcare infrastructure in addressing the COVID-19 crisis on the scale of society and the economy. On the scale of business (microeconomics), this role has proved to be of little importance. However, it seems that this role is critically important on the scale of macroeconomics and, therefore, needs to be studied in detail.

Future research implications are connected with the fact that this paper selected the most promising tools for risk management of business during the COVID-19 pandemic. Thus, the paper supports the ongoing scientific discussion on the issues of business risk management in the context of epidemics and pandemics. Future studies should perform similar research on the example of other epidemics and pandemics to specify whether the obtained results apply only to COVID-19 or universal to any economic crisis of pandemic nature.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/risks11110190/s1, Table S1: The research sample; Table S2: The dependence of business risks on the totality of risk management tools.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Intermediary (detailed) results of the assessment of the quality of the SEM model with the help of Pearson approval criterion χ^2 for factor variables g_1 and g_2.

Observed	Factor Variable g_1				Factor Variable g_2 at the Resulting Variable R_2		
	At the Resulting Variable R_1		At the Resulting Variable R_2		At the Resulting Variable R_2		
	Expected (t-Stat at R_1)	Chi-Square	Expected (t-Stat at R_2)	Chi-Square	Observed	Expected (t-Stat at R_2)	Chi-Square
−8.63	−4.88	1.53	9.13	−3.89	2.35	−3.47	−3.35
−4.34	−4.88	−0.22	9.13	−2.95	7.45	−3.47	−6.29
−8.05	−4.88	1.29	9.13	−3.76	7.39	−3.47	−6.25
−9.04	−4.88	1.70	9.13	−3.98	7.35	−3.47	−6.23
−13.60	−4.88	3.57	9.13	−4.98	4.14	−3.47	−4.38
−3.98	−4.88	−0.37	9.13	−2.87	4.36	−3.47	−4.51
−10.83	−4.88	2.44	9.13	−4.37	6.95	−3.47	−6.00
−7.13	−4.88	0.92	9.13	−3.56	8.00	−3.47	−6.61
−10.82	−4.88	2.43	9.13	−4.37	5.51	−3.47	−5.17
−6.98	−4.88	0.86	9.13	−3.53	4.02	−3.47	−4.31
−7.32	−4.88	1.00	9.13	−3.60	4.10	−3.47	−4.36
−5.76	−4.88	0.36	9.13	−3.26	6.00	−3.47	−5.45
−5.78	−4.88	0.37	9.13	−3.27	5.55	−3.47	−5.19
−0.18	−4.88	−1.93	9.13	−2.04	8.56	−3.47	−6.93
−5.60	−4.88	0.29	9.13	−3.23	7.08	−3.47	−6.08
−5.51	−4.88	0.26	9.13	−3.21	8.43	−3.47	−6.85
−8.93	−4.88	1.65	9.13	−3.96	6.62	−3.47	−5.81
−4.31	−4.88	−0.23	9.13	−2.95	7.69	−3.47	−6.43
−10.15	−4.88	2.16	9.13	−4.22	5.73	−3.47	−5.30
−7.88	−4.88	1.23	9.13	−3.73	4.23	−3.47	−4.43
−8.67	−4.88	1.55	9.13	−3.90	6.76	−3.47	−5.89
−13.52	−4.88	3.54	9.13	−4.96	5.81	−3.47	−5.35
−1.99	−4.88	−1.18	9.13	−2.44	4.99	−3.47	−4.87
−5.13	−4.88	0.10	9.13	−3.12	7.88	−3.47	−6.53
−9.54	−4.88	1.91	9.13	−4.09	5.07	−3.47	−4.92
−9.60	−4.88	1.93	9.13	−4.10	6.52	−3.47	−5.75
−8.95	−4.88	1.67	9.13	−3.96	5.55	−3.47	−5.20
−7.03	−4.88	0.88	9.13	−3.54	5.88	−3.47	−5.38
−7.04	−4.88	0.88	9.13	−3.54	5.77	−3.47	−5.32
−2.24	−4.88	−1.08	9.13	−2.49	4.62	−3.47	−4.66

Table A1. *Cont.*

Observed	Factor Variable g_1				Factor Variable g_2 at the Resulting Variable R_2		
	At the Resulting Variable R_1		At the Resulting Variable R_2		At the Resulting Variable R_2		
	Expected (t-Stat at R_1)	Chi-Square	Expected (t-Stat at R_2)	Chi-Square	Observed	Expected (t-Stat at R_2)	Chi-Square
−0.45	−4.88	−1.82	9.13	−2.10	5.69	−3.47	−5.28
−7.28	−4.88	0.98	9.13	−3.60	5.88	−3.47	−5.39
−3.42	−4.88	−0.60	9.13	−2.75	7.65	−3.47	−6.41
−6.19	−4.88	0.53	9.13	−3.36	5.31	−3.47	−5.06
−4.47	−4.88	−0.17	9.13	−2.98	3.35	−3.47	−3.93
−9.24	−4.88	1.78	9.13	−4.02	3.03	−3.47	−3.74
−3.70	−4.88	−0.48	9.13	−2.81	7.97	−3.47	−6.59
−4.03	−4.88	−0.35	9.13	−2.88	7.80	−3.47	−6.49
−2.61	−4.88	−0.93	9.13	−2.57	7.20	−3.47	−6.15
−8.33	−4.88	1.41	9.13	−3.83	5.53	−3.47	−5.19
−5.73	−4.88	0.35	9.13	−3.26	4.70	−3.47	−4.70
−6.95	−4.88	0.85	9.13	−3.52	4.95	−3.47	−4.85
−5.84	−4.88	0.39	9.13	−3.28	6.02	−3.47	−5.47
1.03	−4.88	−2.42	9.13	−1.77	7.27	−3.47	−6.18
−9.31	−4.88	1.81	9.13	−4.04	4.47	−3.47	−4.57
−4.00	−4.88	−0.36	9.13	−2.88	5.09	−3.47	−4.93
−11.26	−4.88	2.61	9.13	−4.47	6.88	−3.47	−5.96
−10.82	−4.88	2.43	9.13	−4.37	7.63	−3.47	−6.39
−5.47	−4.88	0.24	9.13	−3.20	2.06	−3.47	−3.19
−8.30	−4.88	1.40	9.13	−3.82	6.22	−3.47	−5.58
−9.73	−4.88	1.99	9.13	−4.13	4.06	−3.47	−4.34
−10.27	−4.88	2.20	9.13	−4.25	5.32	−3.47	−5.06
−2.67	−4.88	−0.91	9.13	−2.58	7.97	−3.47	−6.59
−2.82	−4.88	−0.85	9.13	−2.62	7.64	−3.47	−6.40
−4.78	−4.88	−0.04	9.13	−3.05	5.27	−3.47	−5.03
−5.09	−4.88	0.08	9.13	−3.12	4.89	−3.47	−4.81
−5.22	−4.88	0.14	9.13	−3.14	7.38	−3.47	−6.25
−12.76	−4.88	3.23	9.13	−4.80	6.50	−3.47	−5.74
−14.49	−4.88	3.93	9.13	−5.18	5.59	−3.47	−5.22
−4.55	−4.88	−0.13	9.13	−3.00	1.54	−3.47	−2.89
−6.18	−4.88	0.53	9.13	−3.35	6.25	−3.47	−5.60
−5.92	−4.88	0.42	9.13	−3.30	5.53	−3.47	−5.18
−5.52	−4.88	0.26	9.13	−3.21	7.47	−3.47	−6.30
−4.42	−4.88	−0.19	9.13	−2.97	3.18	−3.47	−3.83
−4.09	−4.88	−0.32	9.13	−2.90	3.87	−3.47	−4.23
−4.52	−4.88	−0.15	9.13	−2.99	6.50	−3.47	−5.74
−7.52	−4.88	1.08	9.13	−3.65	6.69	−3.47	−5.85

Table A1. *Cont.*

Observed	Factor Variable g_1				Factor Variable g_2 at the Resulting Variable R_2		
	At the Resulting Variable R_1		At the Resulting Variable R_2		At the Resulting Variable R_2		
	Expected (t-Stat at R_1)	Chi-Square	Expected (t-Stat at R_2)	Chi-Square	Observed	Expected (t-Stat at R_2)	Chi-Square
−5.90	−4.88	0.42	9.13	−3.29	5.73	−3.47	−5.30
−6.83	−4.88	0.80	9.13	−3.50	4.28	−3.47	−4.46
−2.88	−4.88	−0.82	9.13	−2.63	3.32	−3.47	−3.91
−1.66	−4.88	−1.32	9.13	−2.36	5.63	−3.47	−5.24
−5.87	−4.88	0.40	9.13	−3.29	5.57	−3.47	−5.20
2.35	−4.88	−2.96	9.13	−1.49	8.05	−3.47	−6.63
−2.35	−4.88	−1.04	9.13	−2.52	6.42	−3.47	−5.70
−2.58	−4.88	−0.94	9.13	−2.57	8.00	−3.47	−6.61
−6.48	−4.88	0.65	9.13	−3.42	6.53	−3.47	−5.76
−3.71	−4.88	−0.48	9.13	−2.81	6.76	−3.47	−5.89
−7.43	−4.88	1.04	9.13	−3.63	5.81	−3.47	−5.35
−6.77	−4.88	0.77	9.13	−3.48	4.22	−3.47	−4.43
−8.92	−4.88	1.65	9.13	−3.95	6.27	−3.47	−5.61
−9.81	−4.88	2.02	9.13	−4.15	5.33	−3.47	−5.07
−5.93	−4.88	0.43	9.13	−3.30	5.57	−3.47	−5.21
−1.92	−4.88	−1.21	9.13	−2.42	7.80	−3.47	−6.49
−3.92	−4.88	−0.39	9.13	−2.86	4.98	−3.47	−4.87
−7.23	−4.88	0.96	9.13	−3.58	6.48	−3.47	−5.73
−7.62	−4.88	1.12	9.13	−3.67	5.35	−3.47	−5.08
−5.39	−4.88	0.21	9.13	−3.18	6.96	−3.47	−6.01
−4.10	−4.88	−0.32	9.13	−2.90	5.64	−3.47	−5.25
−0.64	−4.88	−1.74	9.13	−2.14	4.84	−3.47	−4.79
−0.74	−4.88	−1.70	9.13	−2.16	5.69	−3.47	−5.28
−1.00	−4.88	−1.59	9.13	−2.22	5.64	−3.47	−5.25
0.89	−4.88	−2.36	9.13	−1.81	7.35	−3.47	−6.23
−6.40	−4.88	0.62	9.13	−3.40	4.57	−3.47	−4.63
−3.80	−4.88	−0.44	9.13	−2.83	2.52	−3.47	−3.45
−3.46	−4.88	−0.58	9.13	−2.76	2.83	−3.47	−3.63
−2.61	−4.88	−0.93	9.13	−2.57	7.85	−3.47	−6.52
−4.94	−4.88	0.02	9.13	−3.08	7.58	−3.47	−6.36
9.09	−4.88	−5.72	9.13	−0.01	7.31	−3.47	−6.21
−2.61	−4.88	−0.93	9.13	−2.57	4.33	−3.47	−4.49
−6.46	−4.88	0.65	9.13	−3.42	4.37	−3.47	−4.51
−1.88	−4.88	−1.23	9.13	−2.41	3.57	−3.47	−4.05
−2.83	−4.88	−0.84	9.13	−2.62	5.34	−3.47	−5.08
4.09	−4.88	−3.68	9.13	−1.10	7.07	−3.47	−6.07

Table A1. *Cont.*

Observed	Factor Variable g_1				Factor Variable g_2 at the Resulting Variable R_2		
	At the Resulting Variable R_1		At the Resulting Variable R_2		At the Resulting Variable R_2		
	Expected (t-Stat at R_1)	Chi-Square	Expected (t-Stat at R_2)	Chi-Square	Observed	Expected (t-Stat at R_2)	Chi-Square
−7.10	−4.88	0.91	9.13	−3.56	4.27	−3.47	−4.46
0.72	−4.88	−2.29	9.13	−1.84	4.91	−3.47	−4.83
−2.45	−4.88	−1.00	9.13	−2.54	6.03	−3.47	−5.47
−0.93	−4.88	−1.62	9.13	−2.20	6.70	−3.47	−5.86
−6.15	−4.88	0.52	9.13	−3.35	3.63	−3.47	−4.09
−5.20	−4.88	0.13	9.13	−3.14	5.44	−3.47	−5.13
−6.38	−4.88	0.61	9.13	−3.40	3.13	−3.47	−3.80
−6.87	−4.88	0.81	9.13	−3.51	5.02	−3.47	−4.89
−0.24	−4.88	−1.90	9.13	−2.05	8.33	−3.47	−6.80
−1.93	−4.88	−1.21	9.13	−2.42	7.49	−3.47	−6.31
−7.77	−4.88	1.18	9.13	−3.70	5.43	−3.47	−5.13
−3.48	−4.88	−0.57	9.13	−2.76	3.45	−3.47	−3.98
0.33	−4.88	−2.14	9.13	−1.93	7.62	−3.47	−6.39
−7.99	−4.88	1.27	9.13	−3.75	6.06	−3.47	−5.49
−10.18	−4.88	2.17	9.13	−4.23	5.92	−3.47	−5.41
−3.88	−4.88	−0.41	9.13	−2.85	1.45	−3.47	−2.84
−5.37	−4.88	0.20	9.13	−3.18	7.52	−3.47	−6.33
−3.19	−4.88	−0.69	9.13	−2.70	5.97	−3.47	−5.44
−3.86	−4.88	−0.42	9.13	−2.85	6.94	−3.47	−5.99
−4.64	−4.88	−0.10	9.13	−3.02	3.71	−3.47	−4.14
−2.81	−4.88	−0.85	9.13	−2.62	4.49	−3.47	−4.59
−0.70	−4.88	−1.71	9.13	−2.15	6.13	−3.47	−5.53
1.33	−4.88	−2.55	9.13	−1.71	5.88	−3.47	−5.39
−7.60	−4.88	1.11	9.13	−3.67	5.30	−3.47	−5.05
−6.68	−4.88	0.73	9.13	−3.46	3.76	−3.47	−4.16
0.39	−4.88	−2.16	9.13	−1.91	4.79	−3.47	−4.76
2.11	−4.88	−2.86	9.13	−1.54	5.54	−3.47	−5.19
−3.65	−4.88	−0.51	9.13	−2.80	7.02	−3.47	−6.04
3.32	−4.88	−3.36	9.13	−1.27	8.54	−3.47	−6.92
−0.93	−4.88	−1.62	9.13	−2.20	7.22	−3.47	−6.16
−0.86	−4.88	−1.65	9.13	−2.19	8.80	−3.47	−7.07
−4.72	−4.88	−0.07	9.13	−3.04	7.15	−3.47	−6.12
−2.62	−4.88	−0.93	9.13	−2.57	7.42	−3.47	−6.27
−2.27	−4.88	−1.07	9.13	−2.50	5.63	−3.47	−5.24
−6.24	−4.88	0.56	9.13	−3.37	5.02	−3.47	−4.89
−4.29	−4.88	−0.24	9.13	−2.94	6.65	−3.47	−5.83

Table A1. *Cont.*

Observed	Factor Variable g_1				Factor Variable g_2 at the Resulting Variable R_2		
	At the Resulting Variable R_1		At the Resulting Variable R_2		At the Resulting Variable R_2		
	Expected (t-Stat at R_1)	Chi-Square	Expected (t-Stat at R_2)	Chi-Square	Observed	Expected (t-Stat at R_2)	Chi-Square
−8.90	−4.88	1.64	9.13	−3.95	5.69	−3.47	−5.28
−4.43	−4.88	−0.19	9.13	−2.97	5.43	−3.47	−5.13
1.60	−4.88	−2.65	9.13	−1.65	7.46	−3.47	−6.29
−0.44	−4.88	−1.82	9.13	−2.10	4.98	−3.47	−4.87
−7.96	−4.88	1.26	9.13	−3.74	6.57	−3.47	−5.79
−7.82	−4.88	1.20	9.13	−3.71	5.28	−3.47	−5.04
−4.61	−4.88	−0.11	9.13	−3.01	6.08	−3.47	−5.50
0.09	−4.88	−2.04	9.13	−1.98	5.46	−3.47	−5.14
−0.92	−4.88	−1.62	9.13	−2.20	5.02	−3.47	−4.89
−0.51	−4.88	−1.79	9.13	−2.11	5.71	−3.47	−5.29
−0.64	−4.88	−1.74	9.13	−2.14	5.73	−3.47	−5.30
0.18	−4.88	−2.07	9.13	−1.96	6.91	−3.47	−5.98
−5.56	−4.88	0.28	9.13	−3.22	4.10	−3.47	−4.36
−4.25	−4.88	−0.26	9.13	−2.93	2.94	−3.47	−3.70
0.79	−4.88	−2.32	9.13	−1.83	2.98	−3.47	−3.72
−1.12	−4.88	−1.54	9.13	−2.24	7.93	−3.47	−6.57
−4.18	−4.88	−0.29	9.13	−2.92	6.85	−3.47	−5.94
25.97	−4.88	−12.63	9.13	3.69	6.68	−3.47	−5.85
−1.37	−4.88	−1.44	9.13	−2.30	3.37	−3.47	−3.94
−5.24	−4.88	0.14	9.13	−3.15	4.43	−3.47	−4.55
−3.75	−4.88	−0.46	9.13	−2.82	3.37	−3.47	−3.94
−0.39	−4.88	−1.84	9.13	−2.09	5.67	−3.47	−5.27
13.49	−4.88	−7.53	9.13	0.96	7.25	−3.47	−6.18
−6.18	−4.88	0.53	9.13	−3.35	4.41	−3.47	−4.54
0.72	−4.88	−2.29	9.13	−1.84	4.91	−3.47	−4.83
2.51	−4.88	−3.03	9.13	−1.45	7.45	−3.47	−6.29
−0.66	−4.88	−1.73	9.13	−2.14	7.31	−3.47	−6.21
−0.98	−4.88	−1.60	9.13	−2.21	3.86	−3.47	−4.22
−3.02	−4.88	−0.76	9.13	−2.66	5.59	−3.47	−5.22
−4.49	−4.88	−0.16	9.13	−2.98	3.66	−3.47	−4.11
−4.81	−4.88	−0.03	9.13	−3.05	5.34	−3.47	−5.07
0.74	−4.88	−2.30	9.13	−1.84	8.22	−3.47	−6.73
0.21	−4.88	−2.08	9.13	−1.95	7.60	−3.47	−6.38
−5.45	−4.88	0.23	9.13	−3.19	5.33	−3.47	−5.07
−1.64	−4.88	−1.33	9.13	−2.36	4.33	−3.47	−4.49
9.01	−4.88	−5.69	9.13	−0.03	6.57	−3.47	−5.78

Table A1. *Cont.*

Observed	Factor Variable g_1				Factor Variable g_2 at the Resulting Variable R_2		
	At the Resulting Variable R_1		At the Resulting Variable R_2		At the Resulting Variable R_2		
	Expected (t-Stat at R_1)	Chi-Square	Expected (t-Stat at R_2)	Chi-Square	Observed	Expected (t-Stat at R_2)	Chi-Square
−6.26	−4.88	0.56	9.13	−3.37	5.83	−3.47	−5.36
−5.51	−4.88	0.26	9.13	−3.21	6.23	−3.47	−5.59
−3.88	−4.88	−0.41	9.13	−2.85	1.59	−3.47	−2.91
−5.37	−4.88	0.20	9.13	−3.18	7.14	−3.47	−6.11
−3.19	−4.88	−0.69	9.13	−2.70	5.95	−3.47	−5.43
−3.86	−4.88	−0.42	9.13	−2.85	7.43	−3.47	−6.28
−4.64	−4.88	−0.10	9.13	−3.02	3.19	−3.47	−3.83
−2.81	−4.88	−0.85	9.13	−2.62	4.03	−3.47	−4.32
−0.70	−4.88	−1.71	9.13	−2.15	6.35	−3.47	−5.66
1.33	−4.88	−2.55	9.13	−1.71	5.88	−3.47	−5.38
−7.60	−4.88	1.11	9.13	−3.67	5.53	−3.47	−5.18
−6.68	−4.88	0.73	9.13	−3.46	3.76	−3.47	−4.16
0.39	−4.88	−2.16	9.13	−1.91	4.26	−3.47	−4.46
2.11	−4.88	−2.86	9.13	−1.54	5.46	−3.47	−5.14
−3.65	−4.88	−0.51	9.13	−2.80	8.00	−3.47	−6.61
3.32	−4.88	−3.36	9.13	−1.27	8.30	−3.47	−6.78
−0.93	−4.88	−1.62	9.13	−2.20	7.29	−3.47	−6.20
−0.86	−4.88	−1.65	9.13	−2.19	8.44	−3.47	−6.86
−4.72	−4.88	−0.07	9.13	−3.04	7.03	−3.47	−6.04
−2.62	−4.88	−0.93	9.13	−2.57	7.25	−3.47	−6.17
−2.27	−4.88	−1.07	9.13	−2.50	5.72	−3.47	−5.29
−6.24	−4.88	0.56	9.13	−3.37	5.04	−3.47	−4.90
−4.29	−4.88	−0.24	9.13	−2.94	6.24	−3.47	−5.59
−8.90	−4.88	1.64	9.13	−3.95	5.45	−3.47	−5.14
−4.43	−4.88	−0.19	9.13	−2.97	5.63	−3.47	−5.24
1.60	−4.88	−2.65	9.13	−1.65	8.63	−3.47	−6.97
−0.44	−4.88	−1.82	9.13	−2.10	5.26	−3.47	−5.03
−7.96	−4.88	1.26	9.13	−3.74	6.74	−3.47	−5.88
−7.82	−4.88	1.20	9.13	−3.71	5.42	−3.47	−5.12
−4.61	−4.88	−0.11	9.13	−3.01	6.17	−3.47	−5.55
0.09	−4.88	−2.04	9.13	−1.98	5.35	−3.47	−5.08
−0.92	−4.88	−1.62	9.13	−2.20	4.81	−3.47	−4.77
−0.51	−4.88	−1.79	9.13	−2.11	5.08	−3.47	−4.93
−0.64	−4.88	−1.74	9.13	−2.14	6.04	−3.47	−5.48
0.18	−4.88	−2.07	9.13	−1.96	7.10	−3.47	−6.09
−5.56	−4.88	0.28	9.13	−3.22	5.27	−3.47	−5.04
−4.25	−4.88	−0.26	9.13	−2.93	3.05	−3.47	−3.76

Table A1. *Cont.*

Observed	Factor Variable g_1				Factor Variable g_2 at the Resulting Variable R_2		
	At the Resulting Variable R_1		At the Resulting Variable R_2		At the Resulting Variable R_2		
	Expected (t-Stat at R_1)	Chi-Square	Expected (t-Stat at R_2)	Chi-Square	Observed	Expected (t-Stat at R_2)	Chi-Square
0.79	−4.88	−2.32	9.13	−1.83	3.16	−3.47	−3.82
−1.12	−4.88	−1.54	9.13	−2.24	7.80	−3.47	−6.49
−4.18	−4.88	−0.29	9.13	−2.92	7.51	−3.47	−6.32
25.97	−4.88	−12.63	9.13	3.69	6.35	−3.47	−5.66
−1.37	−4.88	−1.44	9.13	−2.30	4.73	−3.47	−4.72
−5.24	−4.88	0.14	9.13	−3.15	4.02	−3.47	−4.31
−3.75	−4.88	−0.46	9.13	−2.82	3.90	−3.47	−4.25
−0.39	−4.88	−1.84	9.13	−2.09	5.52	−3.47	−5.18
13.49	−4.88	−7.53	9.13	0.96	7.26	−3.47	−6.18
−6.18	−4.88	0.53	9.13	−3.35	4.72	−3.47	−4.72
0.72	−4.88	−2.29	9.13	−1.84	4.91	−3.47	−4.83
2.51	−4.88	−3.03	9.13	−1.45	7.31	−3.47	−6.21
−0.66	−4.88	−1.73	9.13	−2.14	6.03	−3.47	−5.47
−0.98	−4.88	−1.60	9.13	−2.21	5.03	−3.47	−4.89
−3.02	−4.88	−0.76	9.13	−2.66	5.56	−3.47	−5.20
−4.49	−4.88	−0.16	9.13	−2.98	3.27	−3.47	−3.88
−4.81	−4.88	−0.03	9.13	−3.05	5.24	−3.47	−5.02
0.74	−4.88	−2.30	9.13	−1.84	7.33	−3.47	−6.22
0.21	−4.88	−2.08	9.13	−1.95	7.59	−3.47	−6.37
−5.45	−4.88	0.23	9.13	−3.19	5.45	−3.47	−5.14
−1.64	−4.88	−1.33	9.13	−2.36	3.84	−3.47	−4.21
9.01	−4.88	−5.69	9.13	−0.03	7.07	−3.47	−6.07
−6.26	−4.88	0.56	9.13	−3.37	6.12	−3.47	−5.53
−5.51	−4.88	0.26	9.13	−3.21	6.17	−3.47	−5.55

Source: Calculated and compiled by the authors.

Table A2. Intermediary (detailed) results of the assessment of the quality of the SEM model with the help of Pearson approval criterion χ^2 for factor variables dm_1 and dm_2.

Observed	Factor Variable dm_1						Factor Variable dm_2 at the Resulting Variable R_1		
	At the Resulting Variable g_1		At the Resulting Variable g_2		At the Resulting Variable dm_2		Observed	Expected	Chi-Square
	Expected	Chi-Square	Expected	Chi-Square	Expected	Chi-Square			
5.16	4.99	0.07	9.69	−0.94	26.76	−1.61	4.53	4.75	−0.09
5.34	4.99	0.14	9.69	−0.90	26.76	−1.60	5.22	4.75	0.20
5.50	4.99	0.21	9.69	−0.86	26.76	−1.59	5.00	4.75	0.11

Table A2. *Cont.*

Factor Variable dm_1							Factor Variable dm_2 at the Resulting Variable R_1		
Observed	**At the Resulting Variable g_1**		**At the Resulting Variable g_2**		**At the Resulting Variable dm_2**		**Observed**	**Expected**	**Chi-Square**
	Expected	**Chi-Square**	**Expected**	**Chi-Square**	**Expected**	**Chi-Square**			
5.32	4.99	0.13	9.69	−0.90	26.76	−1.60	5.13	4.75	0.16
4.84	4.99	−0.06	9.69	−1.00	26.76	−1.64	4.17	4.75	−0.24
5.56	4.99	0.23	9.69	−0.85	26.76	−1.58	4.89	4.75	0.06
7.03	4.99	0.82	9.69	−0.55	26.76	−1.47	6.59	4.75	0.78
4.97	4.99	−0.01	9.69	−0.97	26.76	−1.63	4.29	4.75	−0.19
6.93	4.99	0.78	9.69	−0.57	26.76	−1.48	6.42	4.75	0.70
5.20	4.99	0.09	9.69	−0.93	26.76	−1.61	4.83	4.75	0.04
4.00	4.99	−0.40	9.69	−1.17	26.76	−1.70	3.26	4.75	−0.63
5.35	4.99	0.14	9.69	−0.90	26.76	−1.60	4.50	4.75	−0.10
5.89	4.99	0.36	9.69	−0.78	26.76	−1.56	5.35	4.75	0.25
7.27	4.99	0.92	9.69	−0.50	26.76	−1.46	6.12	4.75	0.58
6.34	4.99	0.54	9.69	−0.69	26.76	−1.53	4.93	4.75	0.08
6.60	4.99	0.65	9.69	−0.64	26.76	−1.51	6.00	4.75	0.53
4.71	4.99	−0.11	9.69	−1.03	26.76	−1.65	4.57	4.75	−0.07
4.39	4.99	−0.24	9.69	−1.09	26.76	−1.67	4.59	4.75	−0.07
5.15	4.99	0.06	9.69	−0.94	26.76	−1.62	4.27	4.75	−0.20
4.65	4.99	−0.13	9.69	−1.04	26.76	−1.65	4.06	4.75	−0.29
7.39	4.99	0.96	9.69	−0.47	26.76	−1.45	5.85	4.75	0.46
5.88	4.99	0.36	9.69	−0.79	26.76	−1.56	5.11	4.75	0.15
6.41	4.99	0.57	9.69	−0.68	26.76	−1.52	5.98	4.75	0.52
6.85	4.99	0.75	9.69	−0.59	26.76	−1.49	5.92	4.75	0.49
6.90	4.99	0.77	9.69	−0.58	26.76	−1.48	6.63	4.75	0.79
4.57	4.99	−0.17	9.69	−1.06	26.76	−1.66	4.07	4.75	−0.28
4.34	4.99	−0.26	9.69	−1.10	26.76	−1.68	3.17	4.75	−0.66
6.35	4.99	0.54	9.69	−0.69	26.76	−1.53	6.18	4.75	0.60
6.11	4.99	0.45	9.69	−0.74	26.76	−1.54	6.09	4.75	0.57
7.26	4.99	0.91	9.69	−0.50	26.76	−1.46	6.00	4.75	0.53
6.13	4.99	0.46	9.69	−0.73	26.76	−1.54	5.20	4.75	0.19
6.82	4.99	0.74	9.69	−0.59	26.76	−1.49	6.05	4.75	0.55
6.00	4.99	0.41	9.69	−0.76	26.76	−1.55	4.90	4.75	0.06
5.97	4.99	0.39	9.69	−0.77	26.76	−1.55	5.47	4.75	0.30
4.87	4.99	−0.05	9.69	−1.00	26.76	−1.64	4.50	4.75	−0.11
5.22	4.99	0.09	9.69	−0.92	26.76	−1.61	4.41	4.75	−0.14
6.46	4.99	0.59	9.69	−0.67	26.76	−1.52	5.75	4.75	0.42
5.00	4.99	0.00	9.69	−0.97	26.76	−1.63	4.54	4.75	−0.09
7.05	4.99	0.83	9.69	−0.54	26.76	−1.47	6.51	4.75	0.74
5.42	4.99	0.17	9.69	−0.88	26.76	−1.60	4.36	4.75	−0.16

Table A2. *Cont.*

Factor Variable dm_1							Factor Variable dm_2 at the Resulting Variable R_1		
Observed	**At the Resulting Variable g_1**		**At the Resulting Variable g_2**		**At the Resulting Variable dm_2**		**Observed**	**Expected**	**Chi-Square**
	Expected	**Chi-Square**	**Expected**	**Chi-Square**	**Expected**	**Chi-Square**			
5.38	4.99	0.16	9.69	−0.89	26.76	−1.60	5.02	4.75	0.12
5.82	4.99	0.33	9.69	−0.80	26.76	−1.57	5.63	4.75	0.37
5.59	4.99	0.24	9.69	−0.85	26.76	−1.58	4.35	4.75	−0.17
7.34	4.99	0.94	9.69	−0.48	26.76	−1.45	7.26	4.75	1.06
5.35	4.99	0.15	9.69	−0.89	26.76	−1.60	4.76	4.75	0.01
4.77	4.99	−0.09	9.69	−1.02	26.76	−1.64	5.04	4.75	0.12
6.77	4.99	0.71	9.69	−0.60	26.76	−1.49	5.54	4.75	0.34
6.63	4.99	0.66	9.69	−0.63	26.76	−1.50	6.21	4.75	0.62
4.33	4.99	−0.26	9.69	−1.11	26.76	−1.68	4.46	4.75	−0.12
5.65	4.99	0.26	9.69	−0.83	26.76	−1.58	5.23	4.75	0.20
4.76	4.99	−0.09	9.69	−1.02	26.76	−1.64	4.76	4.75	0.01
4.35	4.99	−0.26	9.69	−1.10	26.76	−1.67	3.98	4.75	−0.32
7.38	4.99	0.96	9.69	−0.48	26.76	−1.45	6.42	4.75	0.70
5.90	4.99	0.37	9.69	−0.78	26.76	−1.56	5.50	4.75	0.32
5.90	4.99	0.36	9.69	−0.78	26.76	−1.56	5.02	4.75	0.12
5.56	4.99	0.23	9.69	−0.85	26.76	−1.58	4.76	4.75	0.01
7.26	4.99	0.91	9.69	−0.50	26.76	−1.46	6.65	4.75	0.80
5.97	4.99	0.39	9.69	−0.77	26.76	−1.55	5.56	4.75	0.34
6.37	4.99	0.55	9.69	−0.69	26.76	−1.52	6.26	4.75	0.64
4.96	4.99	−0.01	9.69	−0.98	26.76	−1.63	4.51	4.75	−0.10
5.39	4.99	0.16	9.69	−0.89	26.76	−1.60	4.93	4.75	0.08
5.85	4.99	0.35	9.69	−0.79	26.76	−1.56	5.38	4.75	0.27
5.59	4.99	0.24	9.69	−0.85	26.76	−1.58	4.93	4.75	0.08
5.00	4.99	0.00	9.69	−0.97	26.76	−1.63	4.09	4.75	−0.28
4.58	4.99	−0.16	9.69	−1.05	26.76	−1.66	4.04	4.75	−0.30
6.62	4.99	0.65	9.69	−0.63	26.76	−1.51	6.21	4.75	0.61
5.63	4.99	0.26	9.69	−0.84	26.76	−1.58	4.70	4.75	−0.02
6.67	4.99	0.67	9.69	−0.62	26.76	−1.50	5.97	4.75	0.51
5.18	4.99	0.08	9.69	−0.93	26.76	−1.61	4.43	4.75	−0.13
4.46	4.99	−0.21	9.69	−1.08	26.76	−1.67	3.75	4.75	−0.42
5.11	4.99	0.05	9.69	−0.94	26.76	−1.62	4.00	4.75	−0.31
5.63	4.99	0.26	9.69	−0.84	26.76	−1.58	4.83	4.75	0.04
7.52	4.99	1.02	9.69	−0.45	26.76	−1.44	5.95	4.75	0.51
5.88	4.99	0.36	9.69	−0.79	26.76	−1.56	5.02	4.75	0.11
6.87	4.99	0.75	9.69	−0.58	26.76	−1.49	5.82	4.75	0.45
5.15	4.99	0.06	9.69	−0.94	26.76	−1.62	4.33	4.75	−0.18
4.52	4.99	−0.19	9.69	−1.07	26.76	−1.66	4.21	4.75	−0.23

Table A2. *Cont.*

Factor Variable dm_1							Factor Variable dm_2 at the Resulting Variable R_1		
Observed	**At the Resulting Variable g_1**		**At the Resulting Variable g_2**		**At the Resulting Variable dm_2**		**Observed**	**Expected**	**Chi-Square**
	Expected	**Chi-Square**	**Expected**	**Chi-Square**	**Expected**	**Chi-Square**			
5.19	4.99	0.08	9.69	−0.93	26.76	−1.61	4.53	4.75	−0.09
4.82	4.99	−0.07	9.69	−1.01	26.76	−1.64	4.07	4.75	−0.28
7.00	4.99	0.81	9.69	−0.55	26.76	−1.48	5.58	4.75	0.35
6.62	4.99	0.66	9.69	−0.63	26.76	−1.50	5.83	4.75	0.46
6.45	4.99	0.59	9.69	−0.67	26.76	−1.52	5.12	4.75	0.16
6.07	4.99	0.43	9.69	−0.75	26.76	−1.55	5.25	4.75	0.21
6.55	4.99	0.63	9.69	−0.65	26.76	−1.51	6.31	4.75	0.66
4.80	4.99	−0.07	9.69	−1.01	26.76	−1.64	4.46	4.75	−0.12
4.50	4.99	−0.20	9.69	−1.07	26.76	−1.66	3.31	4.75	−0.61
6.73	4.99	0.70	9.69	−0.61	26.76	−1.50	6.71	4.75	0.83
6.45	4.99	0.59	9.69	−0.67	26.76	−1.52	6.56	4.75	0.77
6.81	4.99	0.73	9.69	−0.59	26.76	−1.49	5.39	4.75	0.27
5.47	4.99	0.19	9.69	−0.87	26.76	−1.59	5.40	4.75	0.27
6.26	4.99	0.51	9.69	−0.71	26.76	−1.53	5.46	4.75	0.30
6.46	4.99	0.59	9.69	−0.67	26.76	−1.52	5.49	4.75	0.31
6.43	4.99	0.58	9.69	−0.67	26.76	−1.52	5.48	4.75	0.31
5.04	4.99	0.02	9.69	−0.96	26.76	−1.62	4.47	4.75	−0.12
5.83	4.99	0.34	9.69	−0.80	26.76	−1.56	3.62	4.75	−0.47
6.66	4.99	0.67	9.69	−0.62	26.76	−1.50	5.73	4.75	0.41
5.77	4.99	0.32	9.69	−0.81	26.76	−1.57	5.06	4.75	0.13
7.37	4.99	0.96	9.69	−0.48	26.76	−1.45	6.17	4.75	0.60
5.01	4.99	0.01	9.69	−0.97	26.76	−1.63	4.48	4.75	−0.11
5.27	4.99	0.11	9.69	−0.91	26.76	−1.61	4.87	4.75	0.05
4.78	4.99	−0.08	9.69	−1.01	26.76	−1.64	4.70	4.75	−0.02
5.49	4.99	0.20	9.69	−0.87	26.76	−1.59	4.05	4.75	−0.29
7.01	4.99	0.81	9.69	−0.55	26.76	−1.48	6.71	4.75	0.83
5.10	4.99	0.04	9.69	−0.95	26.76	−1.62	4.73	4.75	−0.01
4.56	4.99	−0.17	9.69	−1.06	26.76	−1.66	5.17	4.75	0.18
6.70	4.99	0.69	9.69	−0.62	26.76	−1.50	5.38	4.75	0.26
6.82	4.99	0.74	9.69	−0.59	26.76	−1.49	5.85	4.75	0.47
4.21	4.99	−0.31	9.69	−1.13	26.76	−1.69	4.48	4.75	−0.11
5.35	4.99	0.15	9.69	−0.90	26.76	−1.60	4.65	4.75	−0.04
4.49	4.99	−0.20	9.69	−1.07	26.76	−1.66	4.73	4.75	−0.01
4.68	4.99	−0.12	9.69	−1.03	26.76	−1.65	4.11	4.75	−0.27
7.46	4.99	0.99	9.69	−0.46	26.76	−1.44	6.00	4.75	0.53
6.07	4.99	0.43	9.69	−0.75	26.76	−1.55	5.47	4.75	0.31
5.98	4.99	0.40	9.69	−0.76	26.76	−1.55	5.30	4.75	0.23

Table A2. *Cont.*

Factor Variable dm_1							Factor Variable dm_2 at the Resulting Variable R_1		
Observed	At the Resulting Variable g_1		At the Resulting Variable g_2		At the Resulting Variable dm_2		Observed	Expected	Chi-Square
	Expected	Chi-Square	Expected	Chi-Square	Expected	Chi-Square			
4.60	4.99	−0.16	9.69	−1.05	26.76	−1.66	4.17	4.75	−0.24
7.31	4.99	0.93	9.69	−0.49	26.76	−1.45	6.68	4.75	0.81
5.90	4.99	0.37	9.69	−0.78	26.76	−1.56	5.61	4.75	0.36
6.81	4.99	0.73	9.69	−0.59	26.76	−1.49	6.61	4.75	0.78
4.99	4.99	−0.00	9.69	−0.97	26.76	−1.63	4.81	4.75	0.02
5.56	4.99	0.23	9.69	−0.85	26.76	−1.58	5.37	4.75	0.26
5.37	4.99	0.15	9.69	−0.89	26.76	−1.60	4.74	4.75	−0.00
5.36	4.99	0.15	9.69	−0.89	26.76	−1.60	5.36	4.75	0.26
5.03	4.99	0.02	9.69	−0.96	26.76	−1.62	4.13	4.75	−0.26
4.92	4.99	−0.03	9.69	−0.98	26.76	−1.63	4.44	4.75	−0.13
6.96	4.99	0.79	9.69	−0.56	26.76	−1.48	6.62	4.75	0.79
5.73	4.99	0.30	9.69	−0.82	26.76	−1.57	4.72	4.75	−0.01
6.98	4.99	0.80	9.69	−0.56	26.76	−1.48	6.58	4.75	0.77
5.09	4.99	0.04	9.69	−0.95	26.76	−1.62	5.05	4.75	0.13
5.48	4.99	0.20	9.69	−0.87	26.76	−1.59	4.49	4.75	−0.11
4.67	4.99	−0.13	9.69	−1.04	26.76	−1.65	4.63	4.75	−0.05
6.00	4.99	0.41	9.69	−0.76	26.76	−1.55	5.25	4.75	0.21
7.69	4.99	1.08	9.69	−0.41	26.76	−1.43	6.56	4.75	0.77
6.64	4.99	0.66	9.69	−0.63	26.76	−1.50	5.70	4.75	0.40
7.49	4.99	1.00	9.69	−0.45	26.76	−1.44	6.23	4.75	0.62
5.25	4.99	0.11	9.69	−0.92	26.76	−1.61	4.75	4.75	0.00
4.69	4.99	−0.12	9.69	−1.03	26.76	−1.65	4.47	4.75	−0.12
5.27	4.99	0.11	9.69	−0.91	26.76	−1.61	4.00	4.75	−0.31
5.08	4.99	0.04	9.69	−0.95	26.76	−1.62	4.31	4.75	−0.19
7.25	4.99	0.91	9.69	−0.50	26.76	−1.46	6.14	4.75	0.59
7.18	4.99	0.88	9.69	−0.52	26.76	−1.46	6.27	4.75	0.64
6.44	4.99	0.58	9.69	−0.67	26.76	−1.52	5.60	4.75	0.36
6.61	4.99	0.65	9.69	−0.64	26.76	−1.51	6.10	4.75	0.57
6.67	4.99	0.67	9.69	−0.62	26.76	−1.50	6.42	4.75	0.70
4.92	4.99	−0.03	9.69	−0.98	26.76	−1.63	4.64	4.75	−0.04
4.42	4.99	−0.23	9.69	−1.09	26.76	−1.67	3.22	4.75	−0.64
6.52	4.99	0.61	9.69	−0.65	26.76	−1.51	6.33	4.75	0.67
6.69	4.99	0.68	9.69	−0.62	26.76	−1.50	6.36	4.75	0.68
6.56	4.99	0.63	9.69	−0.65	26.76	−1.51	5.19	4.75	0.19
5.95	4.99	0.39	9.69	−0.77	26.76	−1.56	5.67	4.75	0.39
6.79	4.99	0.72	9.69	−0.60	26.76	−1.49	5.79	4.75	0.44
5.79	4.99	0.32	9.69	−0.80	26.76	−1.57	4.65	4.75	−0.04

Table A2. *Cont.*

Factor Variable dm_1							Factor Variable dm_2 at the Resulting Variable R_1		
Observed	**At the Resulting Variable g_1**		**At the Resulting Variable g_2**		**At the Resulting Variable dm_2**		**Observed**	**Expected**	**Chi-Square**
	Expected	**Chi-Square**	**Expected**	**Chi-Square**	**Expected**	**Chi-Square**			
6.06	4.99	0.43	9.69	−0.75	26.76	−1.55	5.39	4.75	0.27
4.85	4.99	−0.05	9.69	−1.00	26.76	−1.64	4.39	4.75	−0.15
5.30	4.99	0.12	9.69	−0.91	26.76	−1.60	4.14	4.75	−0.26
6.83	4.99	0.74	9.69	−0.59	26.76	−1.49	6.21	4.75	0.61
4.96	4.99	−0.01	9.69	−0.98	26.76	−1.63	4.85	4.75	0.04
7.36	4.99	0.95	9.69	−0.48	26.76	−1.45	6.45	4.75	0.72
5.40	4.99	0.16	9.69	−0.89	26.76	−1.60	4.47	4.75	−0.12
5.73	4.99	0.30	9.69	−0.82	26.76	−1.57	4.86	4.75	0.05
5.19	4.99	0.08	9.69	−0.93	26.76	−1.61	4.56	4.75	−0.08
5.26	4.99	0.11	9.69	−0.91	26.76	−1.61	4.10	4.75	−0.27
7.25	4.99	0.91	9.69	−0.50	26.76	−1.46	6.78	4.75	0.86
5.49	4.99	0.20	9.69	−0.87	26.76	−1.59	5.00	4.75	0.11
4.56	4.99	−0.17	9.69	−1.06	26.76	−1.66	5.17	4.75	0.18
7.79	4.99	1.12	9.69	−0.39	26.76	−1.42	5.68	4.75	0.39
6.79	4.99	0.72	9.69	−0.60	26.76	−1.49	6.29	4.75	0.65
5.01	4.99	0.01	9.69	−0.96	26.76	−1.63	4.78	4.75	0.01
5.58	4.99	0.24	9.69	−0.85	26.76	−1.58	5.16	4.75	0.17
5.19	4.99	0.08	9.69	−0.93	26.76	−1.61	5.44	4.75	0.29
4.73	4.99	−0.10	9.69	−1.02	26.76	−1.65	4.44	4.75	−0.13
7.57	4.99	1.03	9.69	−0.44	26.76	−1.43	6.26	4.75	0.64
6.03	4.99	0.42	9.69	−0.75	26.76	−1.55	5.67	4.75	0.39
5.86	4.99	0.35	9.69	−0.79	26.76	−1.56	5.44	4.75	0.29
5.42	4.99	0.17	9.69	−0.88	26.76	−1.60	4.82	4.75	0.03
6.50	4.99	0.61	9.69	−0.66	26.76	−1.51	5.93	4.75	0.50
6.29	4.99	0.52	9.69	−0.70	26.76	−1.53	5.95	4.75	0.51
7.03	4.99	0.82	9.69	−0.55	26.76	−1.47	7.20	4.75	1.03
5.10	4.99	0.04	9.69	−0.95	26.76	−1.62	4.58	4.75	−0.07
5.75	4.99	0.31	9.69	−0.81	26.76	−1.57	5.28	4.75	0.22
5.48	4.99	0.20	9.69	−0.87	26.76	−1.59	4.89	4.75	0.06
7.10	4.99	0.85	9.69	−0.53	26.76	−1.47	6.87	4.75	0.89
4.98	4.99	−0.00	9.69	−0.97	26.76	−1.63	3.90	4.75	−0.36
4.61	4.99	−0.15	9.69	−1.05	26.76	−1.66	4.37	4.75	−0.16
6.62	4.99	0.65	9.69	−0.63	26.76	−1.51	6.14	4.75	0.58
5.33	4.99	0.14	9.69	−0.90	26.76	−1.60	4.67	4.75	−0.03
6.87	4.99	0.76	9.69	−0.58	26.76	−1.49	6.15	4.75	0.59
5.13	4.99	0.06	9.69	−0.94	26.76	−1.62	4.73	4.75	−0.01
5.35	4.99	0.15	9.69	−0.89	26.76	−1.60	4.39	4.75	−0.15

Table A2. *Cont.*

Factor Variable dm_1							Factor Variable dm_2 at the Resulting Variable R_1		
Observed	**At the Resulting Variable g_1**		**At the Resulting Variable g_2**		**At the Resulting Variable dm_2**		**Observed**	**Expected**	**Chi-Square**
	Expected	**Chi-Square**	**Expected**	**Chi-Square**	**Expected**	**Chi-Square**			
4.54	4.99	−0.18	9.69	−1.06	26.76	−1.66	3.81	4.75	−0.40
6.60	4.99	0.64	9.69	−0.64	26.76	−1.51	6.09	4.75	0.56
7.73	4.99	1.10	9.69	−0.40	26.76	−1.42	6.62	4.75	0.79
6.58	4.99	0.64	9.69	−0.64	26.76	−1.51	5.32	4.75	0.24
6.83	4.99	0.74	9.69	−0.59	26.76	−1.49	6.11	4.75	0.57
5.19	4.99	0.08	9.69	−0.93	26.76	−1.61	4.63	4.75	−0.05
4.70	4.99	−0.12	9.69	−1.03	26.76	−1.65	4.60	4.75	−0.06
5.72	4.99	0.29	9.69	−0.82	26.76	−1.57	4.52	4.75	−0.09
5.22	4.99	0.09	9.69	−0.92	26.76	−1.61	4.30	4.75	−0.19
7.58	4.99	1.04	9.69	−0.44	26.76	−1.43	6.21	4.75	0.62
6.83	4.99	0.74	9.69	−0.59	26.76	−1.49	5.98	4.75	0.52
7.02	4.99	0.82	9.69	−0.55	26.76	−1.47	6.17	4.75	0.60
6.28	4.99	0.52	9.69	−0.70	26.76	−1.53	5.96	4.75	0.51
6.71	4.99	0.69	9.69	−0.62	26.76	−1.50	6.72	4.75	0.83
4.79	4.99	−0.08	9.69	−1.01	26.76	−1.64	4.36	4.75	−0.16
5.15	4.99	0.07	9.69	−0.94	26.76	−1.61	3.80	4.75	−0.40
6.72	4.99	0.69	9.69	−0.61	26.76	−1.50	6.48	4.75	0.73
6.40	4.99	0.57	9.69	−0.68	26.76	−1.52	6.42	4.75	0.71
6.90	4.99	0.77	9.69	−0.58	26.76	−1.48	5.45	4.75	0.30
5.04	4.99	0.02	9.69	−0.96	26.76	−1.62	4.63	4.75	−0.05
7.03	4.99	0.82	9.69	−0.55	26.76	−1.47	5.98	4.75	0.52
5.98	4.99	0.40	9.69	−0.76	26.76	−1.55	5.12	4.75	0.16
5.87	4.99	0.35	9.69	−0.79	26.76	−1.56	5.43	4.75	0.29
4.82	4.99	−0.07	9.69	−1.00	26.76	−1.64	4.38	4.75	−0.15
5.79	4.99	0.32	9.69	−0.80	26.76	−1.57	3.82	4.75	−0.39
6.85	4.99	0.75	9.69	−0.59	26.76	−1.49	6.33	4.75	0.67
5.23	4.99	0.10	9.69	−0.92	26.76	−1.61	4.95	4.75	0.09
6.71	4.99	0.69	9.69	−0.62	26.76	−1.50	6.39	4.75	0.69
4.79	4.99	−0.08	9.69	−1.01	26.76	−1.64	4.34	4.75	−0.17
5.59	4.99	0.24	9.69	−0.85	26.76	−1.58	5.16	4.75	0.17
5.95	4.99	0.39	9.69	−0.77	26.76	−1.56	5.63	4.75	0.37
5.53	4.99	0.22	9.69	−0.86	26.76	−1.59	4.47	4.75	−0.12
7.68	4.99	1.08	9.69	−0.41	26.76	−1.43	6.79	4.75	0.86
5.79	4.99	0.32	9.69	−0.80	26.76	−1.57	5.21	4.75	0.19
4.56	4.99	−0.17	9.69	−1.06	26.76	−1.66	5.17	4.75	0.18
7.66	4.99	1.07	9.69	−0.42	26.76	−1.43	6.57	4.75	0.77
6.88	4.99	0.76	9.69	−0.58	26.76	−1.49	6.41	4.75	0.70

Table A2. *Cont.*

Factor Variable dm_1							Factor Variable dm_2 at the Resulting Variable R_1		
Observed	At the Resulting Variable g_1		At the Resulting Variable g_2		At the Resulting Variable dm_2		Observed	Expected	Chi-Square
	Expected	Chi-Square	Expected	Chi-Square	Expected	Chi-Square			
5.03	4.99	0.02	9.69	−0.96	26.76	−1.62	5.54	4.75	0.33
5.47	4.99	0.19	9.69	−0.87	26.76	−1.59	5.12	4.75	0.16
5.04	4.99	0.02	9.69	−0.96	26.76	−1.62	5.38	4.75	0.27
4.99	4.99	0.00	9.69	−0.97	26.76	−1.63	4.32	4.75	−0.18
7.49	4.99	1.00	9.69	−0.45	26.76	−1.44	6.48	4.75	0.73
6.11	4.99	0.45	9.69	−0.74	26.76	−1.54	5.48	4.75	0.31
6.16	4.99	0.47	9.69	−0.73	26.76	−1.54	5.73	4.75	0.42
5.63	4.99	0.26	9.69	−0.84	26.76	−1.58	4.73	4.75	−0.01
6.30	4.99	0.53	9.69	−0.70	26.76	−1.53	5.52	4.75	0.33
5.69	4.99	0.28	9.69	−0.82	26.76	−1.57	5.78	4.75	0.44
6.91	4.99	0.77	9.69	−0.57	26.76	−1.48	6.74	4.75	0.84

Source: Calculated and compiled by the authors.

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