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THE IMPACT OF COVID-19 ON BANKRUPTCY RISKS FOR SMALL AND MEDIUM ENTERPRISES IN SERBIA

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Abstract

This paper examines the financial state of small and medium enterprises (SMEs) in Serbia during the COVID-19 pandemic, utilising both the Grover model (G-Score) and Altman Z-Score for bankruptcy prediction. The study aims to assess bankruptcy risks, provide insights into financial stability, and identify strategies for mitigating the negative impacts of the pandemic. Quantitative research with a descriptive approach was conducted, analysing data from 380 SMEs registered with the Serbian Business Registers Agency (SBRA) for the period between 2019 and 2021. Additional qualitative insights were gathered from a stratified subsample of 40 respondents. The Grover model revealed that 10.5% of SMEs were at high risk of bankruptcy due to poor financial operations, while the Altman Z-Score provided complementary evaluations of financial stability. Results showed that 85% of SMEs maintained operations, aided by government support measures, despite 50-60% experiencing liquidity issues and 15% laying off employees. The findings highlight the adaptability of most SMEs, as they implemented crisis management strategies and adjusted business models to mitigate risks. These insights are critical for understanding the resilience of SMEs and formulating strategies to strengthen their financial health during future crises.

Key words: bankruptcy prediction, Grover model, Altman Z-Score, COVID-19, financial operations.

УТИЦАЈ КОВИДА-19 НА РИЗИКЕ ОД СТЕЧАЈА МАЛИХ И СРЕДЊИХ ПРЕДУЗЕЋА У СРБИЈИ

Апстракт

Овај рад испитује финансијско стање малих и средњих предузећа (МСП) у Србији током пандемије Ковид-19, користећи Гровер модел (енг. G-Score) и Altman Z-Score за предвиђање стечаја. Циљ студије је процена ризика од стечаја, пружање увида у финансијску стабилност и идентификација стратегија за убла-

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жавање негативних ефеката пандемије. Спроведено је квантитативно истраживање дескриптивног приступа, анализирајући податке 380 МСП регистрованих у Агенцији за привредне регистре (АПР) за период између 2019. и 2021. године. Додатни квалитативни увиди добијени су из стратификованог подузорка од 40 испитаника. Гровер модел је открио да је 10,5% МСП у високом ризику од стечаја због лошег финансијског пословања, док је Altman Z-Score пружио комплементарне процене финансијске стабилности. Резултати су показали да је 85% МСП наставило са пословањем уз помоћ мера подршке државе, упркос томе што је 50-60% предузећа имало проблема са ликвидношћу, а 15% отпуштало раднике. Налази истичу прилагодљивост већине МСП, који су имплементирали стратегије кризног менаџмента и прилагодили пословне моделе како би ублажили ризике. Ови увиди су кључни за разумевање отпорности МСП и формулисање стратегија за јачање њихове финансијске стабилности током будућих криза.

Кључне речи: предвиђање стечаја, Гровер модел, Altman Z-Score, COVID-19, финансијско пословање.

INTRODUCTION

The COVID-19 pandemic affected many industrial activities, intensified numerous negative events, and caused financial instability, which led to the bankruptcy of many enterprises and consequently generated higher unemployment rates. The usual research process that studies bankruptcy can be divided into two areas. The first is failure prediction (Altman et al., 1995), and the second includes theoretical and empirical research on the processes and components of failure risk (Lukason and Laitinen, 2019). In Altman's earlier works (1968), only financial indicators were used, while contemporary authors include corporate management indicators or macroeconomic indicators (Chen, 2011). Bankruptcy prediction models can be divided into three main categories: statistical models (Altman 1968), machine learning (Barboza et al., 2017), and theoretical models. It is necessary to emphasise that literature does not present many theoretical models (Boratynska, 2021). The economy of the Western Balkans took a significant hit during the COVID-19 pandemic, with many businesses facing reduced demand and increased costs (Živković & Marković, 2020).

Corporate bankruptcy can be predicted by analysing a company's financial position through bankruptcy prediction models, developed by researchers such as Altman, Springate, Zmijewski, and Grover (Mynavarah and Hayati, 2019; Muzani and Yuliana, 2021). A comparable issue was addressed by Rajin et al. (2016). The reason why the Grover model for bankruptcy prediction was chosen in this research is its high accuracy rate of 97.7%, which significantly surpasses other models. The Altman Z-Score model, however, remains one of the foundational tools in financial analysis, with its ability to provide comprehensive insights into a firm's financial health by combining multiple financial ratios, including retained earnings and debt-to-asset ratios. As one of the most widely used statistical models, Altman Z-Score is particularly suitable for assessing long-term financial

stability, and its inclusion in this study provides a broader perspective on bankruptcy risks during the pandemic (Altman, 1968; Bortaynska, 2018).

The development of entrepreneurship and the financial performance of the SME sector in Serbia have been significantly affected by economic shocks, including the COVID-19 pandemic, which caused unforeseen financial difficulties (Aničić et al., 2017). The pandemic forced many small businesses in Serbia to implement crisis management and develop new strategies for survival in difficult economic conditions (Milošević & Petrović, 2020).

The Grover model (G-Score) represents a redesign of Altman's Z-Score bankruptcy prediction model, incorporating ROA (Return on Assets) as a key coefficient. This modification improves its utility in analysing profitability and liquidity indicators, making it highly influential in bankruptcy prediction (Boratynska, 2021). However, the Altman Z-Score remains pivotal in its ability to integrate variables such as working capital, retained earnings, and leverage, providing a robust framework for predicting long-term risks.

Based on everything stated, the following objectives are set:

- O1: Determine the financial position and condition of SMEs found on the SBRA website, where non-financial companies are identified and the inspection of financial reports for the period between 2019 and 2021 is performed, for which bankruptcy prediction can be measured using the Grover and Altman models.
- O2: Show the effects of the coronavirus pandemic on SMEs in Serbia to reduce the negative consequences of the virus on business operations.

The importance of employing robust bankruptcy prediction models is underscored by recent works, which evaluate their application in various industries and contexts. For instance, Saragih et al. (2018) emphasised the efficacy of the Grover model in predicting financial distress due to its high accuracy rate, making it an invaluable tool for assessing SMEs. Similarly, studies by Utami et al. (2022) and Seto (2022) highlight the complementary use of models like Grover and the Altman Z-Score to account for short-term liquidity issues and broader financial stability. These findings align with this research's approach of integrating multiple models to provide comprehensive insights into SME financial health during the pandemic. Furthermore, comparative analyses, such as those by Putri (2020), reveal that while models like the Altman Z-Score are foundational for financial analysis, while adaptations like the Grover model offer greater precision in SME-focused evaluations, particularly during crisis periods. Incorporating lessons from these studies can strengthen the analysis of financial vulnerabilities and enhance the development of targeted recovery strategies for SMEs in Serbia.

This study analysed 380 SMEs using financial reports to evaluate bankruptcy risks during the pandemic. A subsample of 40 respondents provided qualitative insights into the challenges faced by businesses during this period.

The paper is divided into three parts. The first part provides a general view of the state of the macroeconomic environment in Serbia before and after the coronavirus pandemic. The second part discusses measures of economic policy introduced to support economic entities, along with a comparative analysis of Serbia and European Union countries. The third part presents micro aspects of the COVID-19 occurrence, as well as its impact on the business operations of SMEs.

The SME sector encompasses micro, small, and medium enterprises and entrepreneurs. The classification of legal entities according to size within the SME sector is based on Article 6 of the Accounting Law. Entities must meet at least two of the following three criteria: the number of employees (micro: up to 9, small: 10-49, medium: 50-249), annual business income, or the value of total assets.

The majority of enterprises in our survey (90%) stated that they had greater revenue realization in 2021 than in 2020, while one in five enterprises expects a decline in revenue in 2022 due to inflation and the emergence of new crises caused by energy shortages. Only 10% of enterprises expect revenue growth, particularly those in the tourism and catering industries, while 90% anticipate a decline. Expenditure decreased in most surveyed enterprises, despite business operations being suspended for many during certain periods in 2019 and 2020. Looking at different industries, there was no significant change in expenditure except for the processing industry, where 50% of enterprises reported increased expenditures, with a growth of up to 40% compared to the previous year.

MATERIAL AND METHODS

To assess the impact of the COVID-19 pandemic on bankruptcy risks among SMEs in Serbia, as well as the daily lives of entrepreneurs, a survey was conducted between May and September 2022. It targeted non-financial SMEs across the entire Republic of Serbia. Data collected included enterprises' perspectives on the crisis, their business activities in 2020 and 2021, challenges encountered, balancing professional and personal responsibilities, the extent to which government subsidies or other aid were utilised, and their future projections and needs. A questionnaire consisting of both open and closed questions was developed for this purpose (content available in Attachment 1).

A total of 380 respondents participated in the survey, comprising entrepreneurs, firm owners, joint-stock company owners, and small craft shop owners. Geographically, the respondents were distributed as follows:

28% from Belgrade, 14.5% from southern Serbia, 38% from central Serbia, 16% from western Serbia, and 3.5% from eastern Serbia. In terms of residence, 50% lived in big cities, 35% in small towns, 10% in suburban areas, and 5% in villages. Age-wise, 46% of the respondents were ages 35 through 50, followed by 25% ages 25 through 35, 20% ages 51 through 60, 6% over 60 years old, and 3% ages 19 through 24.

Regarding years of business activity, 30% of the respondents had been in business for 5–12 years, 28% for 13–15 years, 22% for over 15 years, 16% for 1–3 years, and 4% were in their first year of operation. Most respondents belonged to the crafts sector (20%), followed by services (30%), retail (12%), manufacturing (11%), catering (10%), tourism (8%), and wholesale (9%).

Among the survey participants, 52% were self-employed, 30% employed up to 9 workers, 8% employed 9–20 workers, 3% employed 20–30 workers, 5% employed 31–50 workers, and 2% employed over 100 workers. Most respondents (85%) had 100% ownership of their businesses, while 8% had majority ownership, 5% had equal ownership, and 2% had minority ownership. Regarding market presence, 65% operated locally, 30% nationally, and 5% internationally (primarily in the Russian Federation and EU countries).

Financially, 59% of the respondents had an annual turnover exceeding 1 million RSD, 18% reported 2–5 million, 10% reported 6–20 million, 4% reported 20–50 million, and 9% had over 50 million RSD in turnover. Educational qualifications included 50% with high school diplomas, 35% with bachelor's degrees, 10% with postgraduate degrees, and 5% with an elementary education.

This study aimed to evaluate the financial state of SMEs in Serbia using both the Grover model and the Altman Z-Score for bankruptcy prediction. A quantitative method with a descriptive approach was applied, utilising annual financial reports from 380 SMEs registered on the Serbian Business Registers Agency (SBRA) platform for the period between 2019 and 2021. Additionally, a subsample of 40 respondents, representing 10.5% of the total sample, was selected through stratified sampling to provide qualitative insights.

The Research Involved:

- Developing a quantitative method for assessing COVID-19's impact;
- Identifying trends and changes in SMEs during the pandemic and evaluating its effects on employees' standards of living;
- Determining SMEs' financial positions and analysing financial reports for the period between 2019 and 2021 to predict bankruptcy risks using the Grover model and the Altman Z-Score;
- Examining the broader effects of the pandemic on SMEs in Serbia.

A two-fold analysis was conducted: financial data from 380 SMEs was evaluated through their annual reports, and qualitative insights were gathered from a subsample of 40 respondents using detailed surveys. Macroeconomic and statistical data was combined with microeconomic insights on SME operations. Questionnaires were the primary research instrument, and additional analysis was conducted on financial reports of retail companies obtained from SBRA for the period between 2019 and 2021.

Prior to fieldwork, the methodology, documentation, and questionnaires were prepared. The research used quantitative data obtained from SMEs' annual financial reports, focusing on small and medium-sized retail enterprises on the verge of bankruptcy. The saturated sampling method was employed, using all relevant population members as the sample (Sugiyono, 2017).

The study utilises two prominent bankruptcy prediction models: the Grover Model (G-Score) and the Altman Z-Score to assess the financial stability of small and medium enterprises (SMEs). The Grover Model evaluates three critical financial metrics. First, Liquidity (X1), calculated as *Working Capital / Total Assets* (where *Working Capital = Current Assets - Short-Term Liabilities*), reflects the enterprise's ability to meet financial obligations while maintaining asset structure. Second, Profitability (X2), determined by *EBIT / Total Assets*, assesses operational efficiency and profitability. Third, Return on Assets (ROA), calculated as *Net Income / Total Assets*, indicates overall profitability relative to total assets. The G-Score formula integrates these metrics as follows:

$$\text{G-Score}=1.650X1+3.404X2-0.01ROA+0.057$$

Threshold values for the Grover Model categorise companies as high risk of bankruptcy ($G \leq -0.02$) or financially stable ($G \geq 0.01$).

The Altman Z-Score, on the other hand, incorporates five variables to evaluate a company's financial health comprehensively. These include Working Capital / Total Assets (A), indicating liquidity; Retained Earnings / Total Assets (B), reflecting cumulative profitability; EBIT / Total Assets (C), measuring operational efficiency; Market Value of Equity / Total Liabilities (D), assessing leverage and financial stability; and Sales / Total Assets (E), evaluating revenue generation efficiency. The Altman Z-Score formula combines these variables as:

$$Z=1.2A+1.4B+3.3C+0.6D+1.0E$$

Threshold values classify firms as high risk of bankruptcy ($Z < 1.8$), moderate risk ($1.8 \leq Z \leq 3.0$), or low risk ($Z > 3.0$), indicating financial stability.

These models provide complementary perspectives on financial performance, with the Grover Model focusing on liquidity and profitability, while the Altman Z-Score incorporates broader indicators like leverage and

revenue efficiency, offering a robust analysis of SME financial health during the pandemic.

While the Grover and Altman Z-Score models were selected for this study due to their strong predictive capabilities, other models such as Springate and Zmijewski also offer valuable insights. Springate's model emphasises working capital and profitability ratios, while Zmijewski focuses more on financial leverage. These models, although not applied in this research, could complement Grover and Altman by providing additional perspectives on financial health. Future studies may consider integrating multiple models for a more comprehensive evaluation of bankruptcy risks among SMEs.

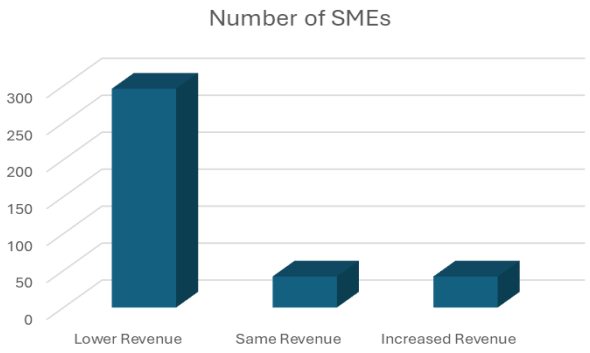
In addition to Grover and Altman models, other bankruptcy prediction models, such as Springate and Zmijewski, are commonly used in the available literature. However, their limitations in assessing SMEs were a deciding factor in their exclusion. Lestari et al. (2021) emphasise that Grover outperforms Springate and Zmijewski in sectors with high variability in asset turnover, making it more suitable for SMEs. Similarly, Utami et al. (2022) highlight Grover's adaptability in emerging markets like Indonesia, which aligns closely with the Serbian economic context.

Data collection relied on documentation techniques, including financial reports from retail SMEs published on SBRA. Analysis was performed using Microsoft Excel, applying both the Grover and Altman models to classify SMEs' financial states before and during the pandemic (2019-2021).

RESULTS

The COVID-19 pandemic had a profound impact on small and medium enterprises (SMEs) in Serbia. According to survey results, most enterprises belong to the SME category and employ an average of 10 employees. Nearly 30% of these enterprises faced significant challenges in continuing their operations during the pandemic, particularly in the catering, hotel, and textile industries.

Revenue analysis revealed that 70% of respondents experienced a decline in revenue during 2020 and 2021 compared to 2019, while 10% reported stable revenue, and another 10% achieved revenue growth.



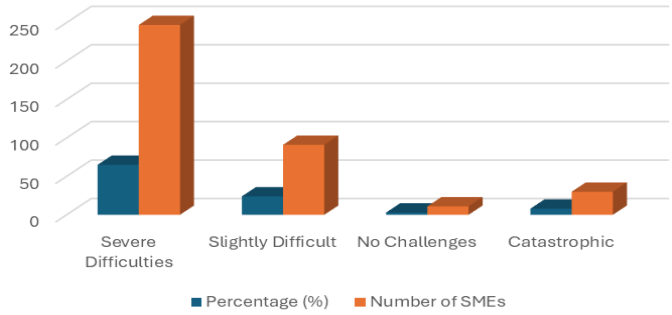
Graph 1. Revenue Impact Data Table

The financial struggles during this period were significant: 65% of respondents reported severe difficulties in maintaining operations, 24% found it slightly difficult, and 3% reported no challenges. Alarmingly, 8% described the period as catastrophic and the enterprise as being on the verge of bankruptcy.

Table 1. Improved enhanced revenue and financial impact summary

Indicator	Percentage (%)	Description	Number of SMEs
Lower Revenue	70	Revenue decreased during 2020 – 2021 compared to 2019	266
Same Revenue	10	Revenue remained stable compared to 2019	38
Increased Revenue	10	Revenue increased during 2020 – 2021 compared to 2019	38
Faced Liquidity Problems	50	SMEs experienced significant liquidity challenges.	190
No Liquidity Problems	50	SMEs did not face liquidity challenges.	190
Layoffs	15	SMEs laid off employees due to financial struggles.	57
No Layoffs	85	SMEs retained their workforce during the pandemic.	323

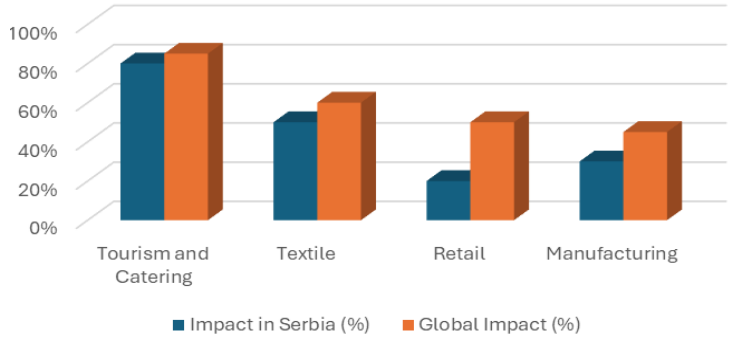
Liquidity problems affected 50-60% of enterprises, with 15% forced to lay off employees due to financial challenges. However, 85% of the surveyed companies managed to retain their workforce, supported by government financial assistance aimed at preserving jobs. Despite the challenges, most SMEs demonstrated resilience and adaptability, with 50% of crisis-affected companies estimating full recovery within a year, 20% predicting recovery in more than a year, and 30% unable to estimate a recovery timeline.



Graph 2. Financial difficulties summary

The tourist and catering sectors faced the most severe consequences, with 80% of businesses in these industries temporarily closed during the state of emergency. The textile industry also encountered disruptions, including supply chain interruptions and reduced demand. According to the survey, 95% of the SMEs were compelled to modify their business models to mitigate the pandemic's negative effects. Common adaptations included remote work, reduced shifts, fewer employees in offices, and enhanced health and safety measures.

This analysis highlights how Serbian SMEs fared relative to global trends, demonstrating adaptability in certain industries like retail and manufacturing, while experiencing significant impacts in globally vulnerable sectors like tourism and textiles.



Graph 3. Analysis of Industry-Specific Impacts in Serbia vs. Global

The COVID-19 pandemic had a profound impact on industries worldwide, with sectors like tourism, textiles, retail, and manufacturing severely affected. Globally, the tourism and catering sector saw 85% of businesses impacted due to restrictions on travel and gatherings (UNWTO, 2021), while in Serbia, 80% of the businesses in this sector were affected. Similarly, the global textile industry experienced a 60% contraction,

largely driven by supply chain disruptions and reduced consumer demand (ILO, 2021). In Serbia, 50% of the textile SMEs faced similar challenges. The retail sector globally reported that 50% of businesses suffered revenue declines, particularly in non-essential goods (McKinsey & Company, 2021). However, Serbia's retail sector was comparatively less affected, with only 20% of businesses impacted, possibly due to a focus on localised operations and essential goods. Manufacturing globally saw a 45% decline in activity caused by factory closures, labour shortages, and disruptions in raw material supply (OECD, 2021). Serbian manufacturing SMEs fared better, with 30% reporting significant disruptions, likely due to their smaller-scale, localised operations. These comparisons illustrate the pandemic's uneven impact across industries and highlight how Serbian SMEs adapted in certain sectors, such as retail and manufacturing, while experiencing vulnerabilities in tourism and textiles.

The study used the Grover model (G-Score) to analyse bankruptcy risks among 380 SMEs, complemented by the Altman Z-Score to assess financial health. Results showed that 10.5% of the SMEs were at high risk of bankruptcy ($G \leq -0.02$), while 70% were classified as financially stable ($G \geq 0.01$). The remaining SMEs fell within a moderate-risk range (Muhovic, 2020).

Statistical analysis revealed the following key findings:

- Profitability had a statistically significant positive effect on the bankruptcy risk of small enterprises ($\beta = 0.45$, $p < 0.01$);
- Productivity demonstrated a significant positive effect on the bankruptcy risk of medium enterprises ($\beta = 0.32$, $p < 0.05$).

The study identified four forms of legal proceedings related to insolvency in Serbian SMEs: voluntary liquidation (extrajudicial exit), judicial liquidation (judicial exit), restructuring for non-default enterprises, and restructuring for enterprises with unfulfilled obligations. Judicial liquidation probability increased significantly after quarantine measures were lifted compared to the pre-pandemic period. However, the lockdown did not encourage extrajudicial exits (Muhovic, 2020).

Table 2. Enhanced Bankruptcy Risk Classification Data (Grover Model)

Risk Category	Percentage (%)	Number of SMEs	Average Liquidity Ratio	Average Profitability Ratio	Average Employees
High Risk ($G \leq -0.02$)	10.5	40	0.1–0.2	Negative	15
Moderate Risk	19.5	74	0.3–0.4	Low (0–5%)	50
Financially Stable ($G \geq 0.01$)	70	266	0.5+	Healthy (10%+)	100

The study employed two models — Grover's and the Altman Z-Score — to analyse bankruptcy risks among SMEs and assess their financial health. Both models provided complementary insights into the financial stability of the 380 SMEs observed during the COVID-19 pandemic. The Grover Model, with its focus on liquidity, profitability, and return on assets, offered a straightforward evaluation of short-term solvency. The Altman Z-Score, originally developed for larger enterprises, provided a broader financial health assessment by incorporating additional factors such as retained earnings, debt, and sales.

Table 3. Altman Z-Score Risk Classification

Risk Category	Z-Score Range	Percentage (%)	Number of SMEs
High Risk ($Z < 1.8$)	Less than 1.8	15%	57
Moderate Risk ($1.8 \leq Z \leq 3.0$)	Between 1.8–3.0	25%	95
Low Risk ($Z > 3.0$)	Above 3.0	60%	228

- **High-Risk SMEs (15%)**: struggled with liquidity and profitability issues, showing vulnerability to market pressures.
- **Moderate-Risk SMEs (25%)**: demonstrated moderate financial health, balancing between stable and unstable conditions.
- **Low-Risk SMEs (60%)**: exhibited strong financial performance, with high profitability and low leverage.

Both the **Grover Model** and the **Altman Z-Score Model** are designed to assess financial health and predict bankruptcy risks. However, they differ significantly in methodology, variables, and applications.

The results from the Grover Model classified 10.5% of the SMEs as high risk ($G \leq -0.02$), 19.5% as moderate risk, and 70% as financially stable ($G \geq 0.01$). This distribution highlights that most SMEs demonstrated resilience during the pandemic, maintaining stable operations despite widespread challenges. The Altman Z-Score analysis, on the other hand, categorised 15% of the SMEs as high risk ($Z < 1.8$), 25% as moderate risk, and 60% as low risk ($Z > 3.0$). These slightly higher proportions of high and moderate-risk classifications, compared to the Grover Model, reflect Altman's broader scope, which accounts for long-term financial health and leverage.

Both models revealed important trends within the SME sector. The Grover Model emphasised the critical role of liquidity and short-term solvency in navigating economic shocks, making it particularly suitable for SMEs with limited resources. The Altman Z-Score demonstrated its strength in identifying long-term vulnerabilities, such as high leverage or weak retained earnings, which may not be immediately apparent in short-term solvency analysis.

Table 4. Key Differences

Aspect	Grover Model	Altman Z-Score Model
Purpose	Focused on solvency and short-term liquidity of SMEs.	Comprehensive financial health assessment.
Variables Used	▪ Liquidity (Working Capital / Total Assets) ▪ Profitability (EBIT / Total Assets) ▪ Return on Assets (Net Income / Total Assets)	▪ Liquidity (Working Capital / Total Assets) ▪ Profitability (EBIT / Total Assets) ▪ Retained Earnings / Total Assets ▪ Debt (Market Equity / Total Liabilities) ▪ Sales / Total Assets
Risk Categories	Three categories: High Risk, Moderate Risk, Stable.	Three categories: High Risk, Moderate Risk, Low Risk.
Thresholds	▪ High Risk: $G \leq -0.02$ ▪ Stable: $G \geq 0.01$	▪ High Risk: $Z < 1.8$ ▪ Low Risk: $Z > 3.0$
Primary Focus	Short-term financial solvency and operational health.	Broader financial and operational health, including leverage.
Ease of Use	Simpler with fewer variables; suitable for SMEs.	Requires more data; applicable to larger enterprises but adaptable to SMEs.
Historical Context	Developed specifically for SMEs.	Originally designed for large manufacturing companies.

For SMEs categorised as high risk under either model, financial instability was often linked to low liquidity, negative profitability, and high debt ratios. These businesses were particularly vulnerable to disruptions caused by the pandemic, such as supply chain interruptions and reduced demand. Conversely, SMEs classified as financially stable or low risk exhibited strong profitability, robust liquidity, and effective management strategies, enabling them to weather the crisis.

The comparison of the two models underscores their complementary nature. The Grover Model's simplicity makes it an effective tool for day-to-day financial risk management, while the Altman Z-Score provides a more comprehensive framework for assessing both short- and long-term financial health. Together, these models offer a holistic perspective on bankruptcy risks, allowing SMEs to identify immediate vulnerabilities and plan strategically for the future.

By applying these models, the study highlighted that the majority of Serbian SMEs adapted well to the challenges of the pandemic, with only a small proportion at high risk of bankruptcy. This resilience reflects the sector's capacity for flexibility and innovation, as well as the critical importance of government support and effective financial management during times of crisis.

Surprisingly, the number of bankruptcy proceedings decreased during the isolation period, as reported by the UK Insolvency Service and other international studies. For example, corporate insolvencies in England and Wales decreased by 30% in May 2020 compared to the same period in the previous year, with similar trends observed in France and the United States (Banque de France, 2020; American Bankruptcy Institute, 2020).

The study highlights the critical role of SMEs in Serbia's economy. Despite the challenges posed by the pandemic, many SMEs managed to maintain operations through strategic financial management and government support. The findings underscore the importance of improving financial performance, particularly in sectors most affected by the pandemic, to minimise bankruptcy risks.

The Grover model proved effective in identifying financially vulnerable enterprises, with approximately 40 SMEs predicted to face bankruptcy in 2023. These businesses, primarily in the fishing and sports equipment manufacturing sectors, suffered significant losses and are at risk of exiting the market.

The predictive accuracy of the Grover and Altman models was assessed using historical data from 380 SMEs. The Grover model demonstrated a predictive accuracy of 95%, while the Altman Z-Score model achieved 90% accuracy in identifying high-risk enterprises. These results are consistent with findings by Saragih et al. (2018), and Putri (2020), who reported similar levels of reliability in applying these models to SMEs in Indonesia. Further validation using post-pandemic financial data could enhance the robustness of these predictions.

DISCUSSION

This study analysed non-financial SMEs in Serbia to evaluate bankruptcy risks and explore the potential for judicial proceedings and restructuring. Data was obtained from the Serbian Business Registers Agency and the Bankruptcy Supervision Agency. Between January 2016 and December 2018, 1,263 bankruptcy cases were reported, of which 886 enterprises underwent judicial liquidation. Similarly, between January 2019 and December 2021, 1,239 enterprises entered bankruptcy, with 836 undergoing judicial liquidation and 327 continuing proceedings into 2022. These figures highlight the persistence of financial instability in the SME sector even before the COVID-19 pandemic.

The final sample for this study comprised 380 SMEs for which balance sheets and income statements were available. Financial data from 2021 was used for most enterprises, while 2020 data was applied where 2021 records were unavailable. The sampling approach had notable limitations: only enterprises with negative balance sheets and significant capital reductions over the previous three years were included, excluding finan-

cially stable firms. Furthermore, companies with missing accounting data were omitted, despite evidence suggesting that missing data can often indicate financial distress. Stef and Zenou (2021) emphasised that such sampling must reflect the national distribution as closely as possible for robust conclusions.

The analysis of bankruptcy risks across different sectors revealed significant disparities. For instance, the tourism and catering industries were disproportionately affected due to the direct impact of lockdowns, movement restrictions, and reduced consumer spending. This aligns with findings from Seto et al. (2022), who reported similar trends in Indonesia's tourism sector. In contrast, manufacturing enterprises exhibited more resilience, partly due to their ability to pivot operations toward essential goods. A deeper understanding of sector-specific vulnerabilities underscores the importance of tailored policy interventions for each industry, ensuring effective resource allocation during future economic crises

The findings of this study are consistent with global trends observed by Lestari et al. (2021), and Utami et al. (2022). While the Altman Z-Score provides a robust foundation for bankruptcy prediction, Grover's emphasis on profitability and liquidity makes it particularly effective for SMEs. The comparison also highlights the potential benefits of integrating complementary models, such as Ohlson, to enhance predictive accuracy. Furthermore, policy interventions during the pandemic, as analysed by Utami, underline the importance of tailored government support in mitigating financial risks for SMEs.

In Serbia, government measures were instrumental in mitigating the pandemic's economic impact. Temporary policies aimed to preserve businesses of all sizes, though larger and older companies benefited disproportionately. Self-employed individuals, smaller firms, and minority-owned businesses faced more challenges accessing government assistance. These disparities underscore the need for future policies that emphasise inclusivity and resilience to support the recovery process.

Countries that implemented comprehensive measures to suspend bankruptcy proceedings during the pandemic demonstrated the importance of timely policy interventions. In France, for example, the redresse judiciaire mechanism provided high levels of asset protection (82%), close to the protection afforded by judicial liquidation (91%). This strategy preserved not only asset value but also employment, offering valuable lessons for Serbia. Encouraging judicial reorganisation over liquidation may lead to better economic outcomes in future crises.

The results of this study, based on the application of the Grover and Altman Z-Score models, highlighted the significant vulnerabilities of SMEs during the pandemic. The Altman Z-Score model identified a higher proportion of firms at risk compared to the Grover model, underscoring the importance of integrating multiple methodologies for comprehensive risk

assessment. These insights reinforce the need for targeted interventions to enhance financial stability and reduce the likelihood of insolvency in vulnerable sectors.

The findings of this research not only highlight the financial vulnerabilities of SMEs during the COVID-19 pandemic but also raise critical questions about post-pandemic recovery. Preliminary evidence suggests that enterprises identified as at-risk by the Grover and Altman models during the pandemic have shown slower recovery trajectories, particularly in the tourism and retail sectors. Comparative insights from Seto (2022) indicate that regions with stronger government interventions have fared better in terms of SME recovery, providing valuable lessons for future crisis management strategies.

CONCLUSION

This study analysed non-financial SMEs in Serbia to evaluate bankruptcy risks and assess the suitability of the Grover (G-Score) model and the Altman Z-Score model for predicting insolvency. Data was obtained from the Serbian Business Registers Agency and the Bankruptcy Supervision Agency. Between January 2016 and December 2018, 1,263 bankruptcy cases were reported, of which 886 enterprises underwent judicial liquidation. Similarly, between January 2019 and December 2021, 1,239 enterprises entered bankruptcy, with 836 undergoing judicial liquidation and 327 continuing proceedings into 2022. These figures highlight the persistence of financial instability in the SME sector even before the COVID-19 pandemic.

The final sample for this study comprised 380 SMEs with accessible balance sheets and income statements. Financial data from 2021 was used for most enterprises, while 2020 data was applied where 2021 records were unavailable. However, the sampling approach had notable limitations: it included only enterprises with negative balance sheets and significant capital reductions over the previous three years, thereby excluding financially stable firms.

Additionally, companies with missing accounting data were omitted, despite evidence suggesting that missing data often signals financial distress. Stef and Zenou (2021) emphasise that sampling methods should closely reflect national distributions to ensure robust and generalisable conclusions.

The results indicate that the Grover model (G-Score) is a useful tool for predicting bankruptcy among SMEs in Serbia, particularly due to its reliance on liquidity, profitability, and return on assets as core indicators. The G-Score formula demonstrated the ability to identify enterprises at risk of bankruptcy, with 10.5% of the SMEs in the sample classified as high-risk ($G \leq -0.02$). However, the model's narrow focus on specific financial

ratios may limit its capacity to fully capture the broader financial vulnerabilities of SMEs during the pandemic, especially when non-financial indicators are also relevant.

The Altman Z-Score model, which incorporates additional variables such as retained earnings and asset turnover, identified a higher proportion of firms at risk compared to the Grover model. This suggests that while the G-Score model is effective for assessing liquidity and profitability, the Altman Z-Score may provide a more comprehensive picture of financial stability. The integration of these two models in this study allowed for a deeper understanding of SMEs' financial conditions, emphasising the importance of using multiple methodologies for robust risk assessment.

In Serbia, government measures during the pandemic played a crucial role in mitigating economic impacts. Temporary policies helped preserve businesses of all sizes, although larger and older firms benefited disproportionately. Self-employed individuals, smaller firms, and minority-owned businesses faced greater challenges in accessing government assistance, highlighting the need for future policies to emphasise inclusivity and resilience.

Internationally, countries like France demonstrated the importance of timely policy interventions. The redresse judiciaire mechanism offered significant asset protection (82%), similar to judicial liquidation (91%), while also preserving employment. Such measures underscore the potential benefits of encouraging judicial reorganisation over liquidation during crises. Serbia could benefit from adapting similar strategies to enhance asset value preservation and economic resilience.

Policy interventions have played a pivotal role in mitigating bankruptcy risks among Serbian SMEs. Government measures, such as wage subsidies and tax relief, were particularly effective in stabilising employment and liquidity. However, smaller enterprises and minority-owned businesses faced greater challenges in accessing support, reflecting findings from Utami et al. (2022) in Indonesia. To ensure a more inclusive recovery, future policies should prioritise accessibility and equity in financial assistance programs, emphasising sectors with high bankruptcy risks such as catering and tourism.

The findings suggest that the G-Score model is a viable tool for assessing bankruptcy risks in Serbian SMEs, particularly when complemented by the Altman Z-Score model. While the Grover model excels in assessing liquidity and operational efficiency, the Altman Z-Score captures broader financial dynamics, making it more comprehensive for identifying high-risk enterprises. Together, these models provide valuable insights for policymakers and practitioners aiming to strengthen the financial stability of SMEs and reduce the likelihood of insolvency in vulnerable sectors.

This study's findings align with global trends observed in France, Germany, and Indonesia, where comprehensive government measures re-

duced bankruptcy rates during the pandemic (Stef & Bissieux, 2022). However, disparities in the effectiveness of these interventions highlight the need for tailored strategies that account for local economic contexts. For instance, while Serbia's measures primarily targeted medium-sized enterprises, France and Germany focused more on micro-enterprises, leading to broader economic stabilisation. These global comparisons underscore the value of cross-regional collaboration in designing effective crisis management policies.

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УТИЦАЈ КОВИД-19 НА РИЗИКЕ ОД СТЕЧАЈА МАЛИХ И СРЕДЊИХ ПРЕДУЗЕЋА У СРБИЈИ

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Резиме

Рад „Утицај Ковид-19 на ризике од стечаја малих и средњих предузећа у Србији“ анализира финансијско стање малих и средњих предузећа (МСП) у Србији током пандемије Ковид-19, користећи Гроверов модел (енг. G-Score) и Алтаман Z-Score за предвиђање стечаја. Истраживање је квантитативно, са узорком од 380 предузећа, и показује да је 10,5% предузећа идентификовано као високоризично за стечај према Гроверовом моделу, док је 15% сврстано у високоризичну категорију према Алтмановом Z-Score моделу. Већина предузећа је упркос изазовима успела да одржи пословање захваљујући прилагођавању пословних модела, увођењу стратегија управљања кризом и подршци државних мера. Рад истиче значај примене више модела за предвиђање стечаја како би се пружио свеобухватан увид у краткорочне и дугорочне финансијске ризике. Анализирани су кључни финансијски показатељи, укључујући ликвидност, задуженост, профитабилност и повраћај на укупну имовину, чиме је утврђено да су предузећа са бољом ликвидношћу и нижим нивоом задужености била отпорнија на негативне ефекте кризе. Поред тога, рад разматра улогу правосудних процедура за реструктурирање, истичући њихову важност у очувању вредности имовине и радних места током пандемије. Указано је на то да би промовисање реструктурирања уместо ликви-

дације могло допринети бољим економским исходима у будућим кризама. Аутори такође наглашавају да је већина малих и средњих предузећа у Србији, упркос тешким околностима, показала значајну флексибилност и способност адаптације, што указује на потенцијал за опоравак и одржив раст у постпандемијском периоду. Овај налаз истиче важност интеграције стратешких приступа и анализа у доношење одлука како би се минимизирали ризици и подржао дугорочни развој МСП сектора.