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FINANCIAL RESILIENCE TO THE ECONOMIC SHOCK OF COVID-19: AN EMPIRICAL STUDY OF ENTERPRISES IN SERBIA

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Abstract:
This paper examines the financial resilience of medium and large enterprises in Serbia during and after the COVID-19 pandemic. Using economic data from 3,020 firms over six years (2018-2023) obtained from financial statements submitted to the Serbian Business Registers Agency, and following standard data-cleaning procedures, the study employs fixed-effects regression with robust standard errors. The results reveal that firm size and state ownership mediate resilience in ways that challenge established models. Large enterprises increased their operating revenues by 19.4% during the pandemic and by 33.7% in the post-COVID period, compared to medium-sized firms. Profit margins diverged sharply: large private firms improved operating margins, while state-owned firms experienced significant declines despite having larger asset bases. Foreign ownership did not confer significant advantages. These findings indicate that resilience models developed for advanced economies may not fully translate to transitional contexts such as Serbia. The results underscore the need for tailored policy measures to support medium-sized enterprises and for a reassessment of how short-term stabilisation efforts influence long-term efficiency and market structure.

Keywords:
financial resilience; COVID-19; firm size; economic shocks; ownership structure.

JEL Classification:
D22, G3, O5

INTRODUCTION

Economic shocks test a fundamental question in organisational theory: why do some firms differ in their capacity to recover and adapt? The COVID-19 pandemic disrupted lives and businesses worldwide with unprecedented severity. While the global GDP (Gross Domestic Product) declined by 3.5% in 2020 (International Monetary Fund, 2021), firm-level impacts varied substantially depending on size, sector, and institutional environment. As a small, transitional country in Europe with strong ties to the European Union's economy, the

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Republic of Serbia provides insight into how transitional economies respond to global economic shocks. The availability of data, including during the post-pandemic period, presented an opportunity for empirical analysis.

The authors aim to examine what characteristics shaped the financial resilience of Serbian enterprises during the COVID-19 crisis and in the immediate post-crisis period. The purpose is to assess whether resilience models developed in advanced economies can be directly applied to transitional contexts or whether institutional specificities alter expected outcomes.

This paper makes three contributions. First, the findings suggest that size effects in Serbia exceed those documented in developed economies, though direct comparison requires caution due to methodological differences. Second, state-owned firms, despite having resource advantages, lose profitability. Third, the results suggest that crisis interventions can permanently alter market structure when institutions are not market-oriented.

In the Literature Review, the paper presents the theoretical foundations of financial resilience and examines how economic shocks affect enterprise survival. After identifying a gap in the research literature, the Research Hypotheses are presented. Next, the Research Methodology is presented, with the analysed period covering the pre-COVID-19 years (2018-2019) used as the baseline, the pandemic years (2020-2021), and the post-pandemic recovery years (2022-2023). Ultimately, the findings and limitations are discussed, with a conclusion and proposals for future research.

LITERATURE REVIEW

This section first examines the theoretical foundations of financial resilience and shows how economic shocks impact enterprise survival. It then describes the characteristics of the COVID-19 pandemic and the policy response in the Republic of Serbia. The section concludes by identifying the gap in the existing research literature.

Financial Resilience

The literature offers multiple, and sometimes conflicting, definitions of resilience. Early work (Wildavsky, 1988) defined it as adaptive capacity, i.e. the ability to absorb shocks and recover from adversity. Later studies added anticipatory and long-term sustainability aspects (Pradana & Ekowati, 2024; Vogus & Sutcliffe, 2007). In this paper, financial resilience is defined pragmatically as the ability of firms to maintain operations and avoid financial distress during a crisis (Valaskova *et al.*, 2023).

Literature reviews have highlighted conceptual ambiguities in defining the concept of resilience. Van Der Vegt *et al.* (2015) highlighted organisational adaptation mechanisms, while Bhamra *et al.* (2011) focused on manufacturing sector resilience. In a business context, financial resilience refers to a firm's ability to withstand economic downturns and to continue business operations without suffering financial distress (Valaskova *et al.*, 2023). Pradana and Ekowati (2024) proposed a framework of the six stages of the resilience process: "anticipation, coping, adaptation, absorptive, confronting and sustainability", while Zapłata & Matyjaszczyk (2025) proposed a practical framework on how to strengthen organisational resilience.

Theoretical Model of Crisis Resilience

This paper contributes to resilience theory by examining how empirical findings can inform and refine existing theoretical models. By combining the following three perspectives, it offers a theoretical framework for understanding the effects in a transitional economy. First, the resource-based view teaches that firms with superior resources, such as financial reserves, human capital, and organisational capabilities, should demonstrate greater resilience (Barney, 2000). However, in transitional economies, resource advantages may be offset by institutional obligations, particularly for state-owned enterprises that serve dual economic and social functions. Second, the Dynamic Capabilities theory (Teece & Pisano, 1994) focuses on a firm's ability to reconfigure its resources in response to environmental changes. The authors propose that in transitional economies, dynamic capabilities are significantly influenced by underdeveloped institutions and high levels of corruption. Large firms enjoy privileged access to government networks, while smaller firms must rely on operational flexibility. Third, institutional theory (North, 1990) emphasises the role of formal and informal institutions in shaping firm behaviour. In the transitional context of the Republic of Serbia, this study hypothesises that informal institutions, such as political interests, informal networks, and corruption, create specific relationships that can influence outcomes both positively or negatively. The proposed framework yields the following predictions. First, size effects are expected to be stronger in transitional economies due to institutional advantages of larger firms. Second, state ownership is anticipated to produce a "resilience paradox", whereby resource advantages are counterbalanced by social obligations. Third, foreign ownership effects are likely to be attenuated because foreign enterprises are less embedded in local institutional networks.

Economic Shocks

The COVID-19 pandemic was unprecedented in the global world. The 2008-2009 Financial Crisis provides the most relevant comparative framework to understand the consequences of economic shocks. However, the pandemic had a profound impact on public health and everyday lives, underscoring the importance of resilience for enterprises globally. The crisis prompted research into how firms can withstand unforeseen circumstances and sustain long-term viability (Valaskova *et al*., 2023). The body of research is growing, showing that outcomes vary across regions and countries. Sattar & Jalal (2024) examined 60 articles with 46.7% reporting negative impacts and 16.7% reporting mixed results.

Firm size has consistently emerged as a key determinant of financial resilience. In the foundational empirical study on SME (Small and Medium-sized Enterprises) vulnerability during COVID-19 (Bartik *et al*., 2020), which analysed the impact of the pandemic on 5,800 SMEs in the U.S.A., it was concluded that such firms typically have little cash on hand and face a high risk of failure in the absence of financial assistance. Eggers (2020) conducted a literature review on 69 papers, summarising that economic shocks have a larger proportional impact on SMEs.

Researchers examining behaviour during various crises consistently identify firm characteristics as crucial resilience factors. Size, liquidity, ownership structure, and operational diversification emerge repeatedly as key determinants of survival capacity (Doern *et al*., 2019; Cowling *et al*., 2020). The relative importance of these factors appears to vary considerably across different types of shocks and institutional contexts. Clampit *et al.* (2022) found that the dynamic capabilities of firms (the ability to adapt competitive strategies in a turbulent setting) strongly correlate with performance for SMEs. Kuckertz *et al.* (2020) demonstrated that startups are responding more quickly to the crisis and are

often able to leverage available resources effectively; however, their potential for innovation and long-term growth is at risk. Savić & Dobrijević (2022) identified agile practices as key to evolving working models to secure business continuity during the COVID-19 pandemic.

COVID-19 Pandemic and Responses

COVID-19, which started in March 2020, provides a unique natural experiment to test resilience theories. The prevalence of government interventions, particularly focused on SMEs, is evident from a systematic literature review by Sakib & Rahman (2024). In the World Bank report (2020), also analysed by Aničić & Paunović (2022) "more than 130 countries have announced some form of support to SMEs such as debt finance (594 instruments), employment support (358 instruments), tax (314 instruments), business costs (136 instruments), other finance (64 instruments), demand (54 instruments), business climate (45 instruments) and business advice (35 instruments)". Evidence from the OECD (Organisation for Economic Co-operation and Development) study showed that these actions contributed to numerous SMEs successfully sustaining their operations (OECD, 2021).

The Republic of Serbia declared a state of emergency on 15 March 2020, and promptly introduced a combination of measures, including border closures and restrictions on movement and businesses. The National Bank of Serbia implemented monetary policy measures, a moratorium on debt payments, and other measures. The Serbian government introduced tax policy measures, direct assistance to companies for employees, economic liquidity measures, and other measures (Martin, 2020). Government intervention and fiscal policies have been significant contributors to moderating the effects of the COVID-19 pandemic worldwide, as well as in Serbia. These interventions likely explain the asset growth observed in this empirical analysis, particularly among large firms that are well-positioned to access government support programs.

Documented Economic Effects

These theoretical frameworks must be assessed in the context of real crisis events. Early studies from Serbian medium-sized firms during the state of emergency reveal a complex relationship between perceived risks and measurable outcomes. Although government measures provided support, their effectiveness varied notably by firm size. The Centre for Advanced Economic Studies (Udovički *et al.*, 2020), in World Bank Group research, estimated that during the lockdown in Serbia, SMEs experienced an average revenue decline of 18-44%, with smaller firms experiencing a sharper decline in revenue. This effect is particularly significant in Serbia, as MSMEs (Micro, Small, and Medium-sized Enterprises, including sole proprietorships) account for two-thirds of formal business sector employment and 59% of gross value added. In analysing the consequences of the COVID-19 crisis and recovery, Lazarević-Moravčević and Kamenkovic (2021) concluded that SMEs were the most vulnerable and that governmental policy measures were effective.

Empirical Research Landscape

Studies conducted during the pandemic primarily aimed to assess its effects and guide policy responses. In the post-pandemic period, empirical research shifted focus toward the immediate macroeconomic consequences. Dyduch (2021) provided insights from Eastern Europe, drawing on a survey panel of 151 SME companies in Poland, and analysed the dynamic capabilities required to maintain operations. A study on how family firms in Europe coped with the COVID-19 crisis (Kraus *et al*., 2020), based on a survey of 27 firms across five countries, empirically showed various strategic responses and concluded that firm size plays a significant role in determining outcomes.

Notable data on the Serbian economy are presented in the World Bank Group study (Udovički *et al.*, 2020), examining the consequences of the pandemic and the recovery of the MSME sector. The study utilised data from the financial statements (as reported by the Serbian Business Registry Agency). Based on a survey of MSMEs, the study concluded that during the lockdown, these firms experienced a revenue shortfall of 18% to 44% relative to their expectations. The data showed that the smaller the size, the more significant the expected decline in revenue was (Udovički *et al*., 2020).

Research by Athira *et al.* (2024) on financial data from firms across 89 countries using the Thomson Reuters "Refinitiv" (London Stock Exchange Group, 2024) database showed the importance of keeping assets and revenue levels during a crisis. The researchers highlighted the importance of a strong liquidity position: firms with higher debt and slower accounts receivable turnover experienced significant value drops, in contrast to firms with strong pre-crisis cash reserves, which received favourable market valuations.

Empirical research from Slovakia demonstrates methodological approaches that might inform Serbian analysis. A study by Valaskova *et al.* (2023) utilised the ORBIS (Bureau van Dijk, 2023) global database of financial data by Moody's. Researchers compared 30,130 Slovak enterprises from the pre-COVID years (2018-2019) with those from the pandemic years (2020-2021). That provided valuable insights into the effects of the crisis and the responses to it. This study observed statistically significant differences in the analysed periods (pre-COVID and during COVID). The results showed that the COVID-19 pandemic had a strong negative impact on Slovak companies, particularly by increasing their debt levels.

Another empirical study utilised data from 131 enterprises listed on the Vietnamese stock exchange from Q1 2016 to Q3 2021 to investigate the impact of COVID-19 and resilience strategies. The research indicates that profitability declined during the pandemic due to lower revenues and disruptions to the supply chain. The size and revenue of firms had a significant positive effect on resistance and Return on Assets performance (Huy BUI *et al*., 2022).

The Gap in the Research Literature

The current research literature reveals a notable gap in understanding the longer-term consequences of the COVID-19 economic shock and how different enterprises perform during and, especially, following the pandemic. Most empirical studies to date have relied on surveys, as shown in the systematic review by Sattar & Jalal (2024). An exploratory study conducted by Adžić & Al-Mansour (2021) on 40 Serbian enterprises identified the strongest factors contributing to the pandemic's impact, but also concluded that more data is needed. Survey methodologies provide valuable insights, but they also introduce potential subjective biases.

The availability of financial results from years before, during, and after the pandemic enabled observations over a multi-year horizon. The analysis focused on using key enterprise-level factors, including firm size, revenue, and profitability, which were available in the dataset. The chosen analytical parameters: firm size, revenue, profitability, and ownership reflect established predictors of resilience identified in prior crisis literature (Cowling *et al.*, 2020; Doern *et al.*, 2019).

Transition economies have a specific institutional context, as discussed in Corruption Impact on East European Emerging Markets Development (Dobromirov, 2021). That study highlights the limitations of conventional indicators in emerging markets, suggesting that widely used indices, such as the CPI, may obscure rather than illuminate the institutional realities that influence firm resilience.

Despite the growing literature, analyses using quantitative financial data remain sparse, particularly in transitional economies like Serbia. This research aims to fill the empirical gap by providing econometric evidence on how firm-specific factors, such as size and ownership, influence financial results. By leveraging Serbia's unique position as a transition economy with a substantial foreign investment presence, this analysis contributes to a broader understanding of how institutional and ownership factors mediate crisis resilience in emerging market contexts.

RESEARCH HYPOTHESES

The authors hypothesised that all enterprises would be adversely affected by the crisis, but that larger firms would display greater financial resilience. They further expected that firms with (partly) foreign ownership would fare better during the crisis due to owners' support and better governance, and also that state-owned firms would show better results, primarily due to stronger policy and financial intervention by the government.

The following hypotheses are formulated:

H1: Large enterprises demonstrated greater financial resilience to the COVID-19 crisis compared to medium-sized enterprises.

H2: Operating and net profit margins of enterprises were significantly affected during the COVID-19 period.

H3: Ownership structure influenced enterprise performance during the COVID-19 crisis.

Data and Research Methodology

In this section, the study presents the available data on Serbian enterprises, accompanied by statistical analysis. Then, appropriate Econometric Methodology is defined, and Statistical Results are presented.

Data on 3,313 enterprises were collected from financial statements as reported to the Serbian Business Agency covering the pre-COVID years (2018-2019), the COVID-19 years (2020-2021), and the post-COVID years (2022-2023). Financial reporting is standardised in the Republic of Serbia (Spasić & Denčić-Mihajlov, 2014). The enterprises included in the sample span a range of sizes and sectors, including manufacturing, services, and trade, capturing the heterogeneity of the Serbian economy.

Size categorisation uses rules from the Serbian Law on Accounting (Official Gazette of the Republic of Serbia, 2019), as presented herein:

Table 1. Enterprise Size Categorisation

Size	Employees	Revenue EUR	Assets EUR
Micro	≤ 10	≤ 700,000	≤ 350,000
Small	> 10 ≤ 50	> 700,000 ≤ 8,000,000	> 350,000 ≤ 4,000,000
Medium	> 50 ≤ 250	> 8,000,000 ≤ 40,000,000	> 4,000,000 ≤ 20,000,000
Large	> 250	> 40,000,000	> 20,000,000

Note: The exchange rate (EUR/RSD = 117.50) was averaged during the observed period, as fluctuations were relatively low (The National Bank of Serbia).Two out of three criteria are needed for the categorisation.
Source: Serbian Law on accounting, Article 7.

Initial data analysis revealed that some firms changed their size group or ownership category during the observed periods, which impacted the ability to track changes over periods. As statistical annex data (assets, employees) were available only from 2021, size classification was determined based on the data that were available. Firms' characteristics for the entire analysis period are fixed to simplify calculation and minimise the influence of potential changes in ownership or size classification.

An initial review of the dataset exposed the need to remove outliers. Micro and small-sized firms (n = 48), firms undergoing bankruptcy or liquidation (n = 34), socialistic enterprises (n = 2), and one additional significant outlier ("MERCATA") were excluded. Additionally, firms with extreme operating or net margins exceeding 100% (n = 213, all medium-sized) were removed, as such non-market-driven outcomes would have skewed the analysis.

Diagnostic checks showed that the panel data were of sufficient quality, so no additional winsorising or trimming was required. The final analytical sample comprises 3,020 firms, with 16,145 firm-year observations. The resulting panel structure enables a comprehensive analysis of the COVID-19 shock's impact and the subsequent recovery. Data distribution tables and various significant statistics are presented in Appendix 1. The numbers of observations and degrees of freedom is presented as notes to the statistical result tables in Appendix 2.

Foreign ownership is included in the analysis as a binary indicator (domestically owned vs. partly or fully foreign-owned). Foreign investors in transitional economies often operate through large firms, and the number of foreign-owned firms in Serbia is relatively small (22.9% of the sample). Disaggregation by firm size would create insufficient subsamples for robust statistics.

ECONOMETRIC METHODOLOGY

The empirical analysis employed fixed-effects panel regression models to control for unobserved heterogeneity across firms while capturing temporal variation in key variables. This method allows us to isolate the effect of time-variant explanatory variables while accounting for time-invariant firm-specific characteristics.

The performance of an enterprise for a period is evaluated through three primary economic indicators, used as dependent variables in this study: logOperatingRevenue (natural logarithm of annual Revenue from operations reported by the firm), logTotalRevenue (natural logarithm of Total Revenue -- operating + finance + other), and OperatingMargin (the ratio of Operating Result profit/loss to Operating Revenue, measuring the efficiency of core business operations). Natural logarithms are used to normalise distributions and enable the interpretation of coefficients as percentages, where a coefficient β on a log-transformed variable approximates a percentage change of $(e\hat{}\beta - 1) \times 100$.

To evaluate the hypotheses, in line with the conclusions from the literature review, the enterprise size and ownership structure are utilised. Given the available data the following independent variables were used: Firm Size (Medium, or Large), Ownership Structure (Private, Cooperative, Mixed, or Governmental), Foreign Ownership (binary indicator of partial or full foreign ownership), COVID period (distinguishing three periods: pre-COVID 2018–2019 used as the baseline, COVID 2020-2021, and post-COVID 2022–2023).

Model Specification

The baseline regression model is specified as follows:

$$Y_{it} = \beta 1\ COVID_t + \beta 2\ (COVID_t \times Size_i) + \beta 3\ (COVID_t \times Ownership_i) + \\ + \beta 4\ (COVID_t \times Foreign_i) + \lambda_t + \mu_i + \varepsilon_{it} \quad (1)$$

In Equation 1, the result "Y_{it}" represents the dependent variable (as defined above) for firm "i" in year "t". The COVID period (Pre, Covid, Post) is denoted by the "$COVID_t$" dummy to capture systematic differences across the three periods. Independent variables are "Size$_i$", "$Ownership_i$", and "$Foreign_i$" as explained herein. The interaction term ($COVID_t \times Size_i$) captures the relationship between firm size and the observed period. Time-invariant main effects (Size, Ownership, Foreign) are absorbed by the firm fixed effects μ_i. For log-dependent variables, β approximates the percentage change ($e\hat{}\beta$–1). For level variables (RSD million), coefficients indicate absolute changes. The time fixed effects are captured in "λ_t", and "μ_i" represents firm fixed effects. The "ε_{it}" is the error term.

From the total of 3,020 enterprises, the baseline group consists of medium-sized firms (83%, n = 2,416) and privately owned firms (85.9%, n = 2,593) during the pre-COVID period. The selected fixed-effects model controls for time-invariant enterprise-specific factors. That allows the model to analyse how within-firm changes over time correlate with COVID-period indicators and ownership or size interactions. The chosen approach is appropriate, considering that 77% of firms (n = 2,335) have observations across all six years.

The fixed-effects approach identifies associations rather than causal effects. In fixed effects models, R^2 statistics reflect only within-firm variation, as the firm fixed effects absorb between-firm variation. Consequently, adjusted R^2 values can be negative when the time-varying predictors explain slight within-firm variation relative to the degrees of freedom lost.

Data analysis

A script in the R programming language was used for data analysis and statistical modelling, relying on the popular "plm", "lmtest", and "sandwich" R library packages. The script is included in Appendix 3 of this paper. The model formula utilises coefficients from plm (formula, pdata.frame(), model = "within"), which are adjusted for robust regression results with heteroskedasticity- and autocorrelation-consistent (HAC) standard errors. Intra-individual correlation was adjusted using the Arellano (1987) method (within the firm over time). The "Arellano estimator" addresses serial correlation in panel residuals, while the standard "HC1" corrections adjust for heteroskedasticity, which is common in firm-level data where the variance scales with firm size. All models employed fixed-effects panel regression with robust standard errors grouped at the firm level.

Statistical Results

This section is organised around the three hypotheses formulated earlier. First, analysis of the impact of firm size on revenue dynamics (H1). Second, the changes in profitability (H2). Third, the role of ownership structure, with a special focus on state-owned and foreign-owned firms (H3). The presentation begins with a summary of the main model results, followed by a more detailed discussion of the coefficients and robustness checks.

The results of coefficient diagnostics for all executed models are summarised in Table 2. After analysing the panel data, the study focuses on three dependent variables: logOperatingRevenue, OperatingMargin_pct and logTotalRevenue. TotalRevenue has fewer observations, so logTotalRevenue was only used to evaluate the effects of finance and other revenues, indicating a possible increase in subventions from 2021 (when data was available from the Statistical Annexe). Complete result tables are given in Appendix 2.

Table 2. Summary of All Models

Dependent Variable	Observation	Firms	R_square	Adj_R_sq.	F_statistic
logOperatingRevenue *	16,145	3,020	0.0669	-0.1488	78.32
OperatingRevenue_mil	16,145	3,020	0.0855	-0.1258	102.22
logTotalRevenue *	9,098	2,835	0.4867	0.2522	492.30
TotalRevenue_mil	9,098	2,836	0.2075	-0.1534	136.40
Assets_mil	9,317	2,838	0.0827	-0.3214	48.58
OperatingMargin_pct *	16,145	3,020	0.0664	-0.1494	77.69
NetMargin_pct	16,145	3,020	0.1121	-0.0931	137.99

* — Selected models are highlighted in bold.
Note: For a log-transformed variables' coefficient to a percentage change: $\Delta\%=(e\beta-1)\times100$.
The low R^2 values are expected in fixed effects models focused on within-variation.
Baseline: medium-sized, privately-owned, domestic firms in the pre-COVID period
Source: Authors' calculations

Summary of Key Findings

This summary presents the empirical results and model diagnostics for each of the hypotheses: revenue effects (H1), profitability impacts (H2), and ownership interactions (H3), all measured relative to the pre-COVID baseline for medium-sized, privately owned firms. This section highlights whether the hypotheses are supported by the data or are only partially confirmed.

For H1, large enterprises demonstrated superior performance, with operating revenues increasing 19.4% during COVID ($p < 0.001$) and 33.8% post-COVID ($p < 0.001$) compared to the baseline of medium-sized firms. The effects on margins were unexpected, as they diverge sharply by ownership. State-owned enterprises experienced operating margin declines of 15.6 percentage points (pp) during the COVID period and 33.1 pp post-COVID (both $p < 0.001$), relative to the pre-COVID baseline. At the same time, large firms increased their margins by 4.14 pp during COVID and by 6.81% post-COVID.

Three consistent patterns emerge from the regression results: (i) large firms increased revenues relative to medium-sized firms; (ii) profitability diverged sharply across ownership types; and (iii) these differences widened in the post-COVID period.

H1: Large enterprises demonstrated greater financial resilience.

Large enterprises showed statistically significant positive effects in revenue, as logOperatingRevenue increased by 0.177 during the pandemic ($p < 0.001$) and 0.291 post-pandemic ($p < 0.001$), translating to approximately 19.4% (e^0.177 - 1) and 33.7% (e^0.291 - 1) higher revenues relative to medium-sized firms.

H2: Profit margins were significantly affected during COVID.

Operating margins showed significant divergence across firm sizes. Large firms experienced margin improvements of 4.14 percentage points (pp) during COVID ($p < 0.001$) and 6.81 pp post-COVID ($p < 0.001$) relative to medium-sized firms. This contradicts the expected general margin compression, as discussed in the examined literature. Aggregate operating margins changed marginally (+0.6 pp), but the effect was not statistically significant ($p = 0.126$), indicating substantial heterogeneity across firm types.

H3: Ownership structure influenced performance.

The data showed limited evidence of ownership effects on revenue. However, profitability for state-owned and mixed-ownership firms showed a severe deterioration. State and mixed-owned firms suffered severe margin compression, with government firms losing 15.59 pp during COVID ($p < 0.001$) and 33.09 pp post-COVID ($p < 0.001$). No statistically significant association was found between foreign ownership and operating revenue performance during the COVID period.

DISCUSSION

In the discussion section, the findings are interpreted within the broader context of the institutional theory of firm resilience, helping to explain why outcomes in Serbia diverge from patterns documented in developed economies. This structure integrates the empirical results with theoretical insights and concludes by outlining policy implications and directions for future research.

The Serbian case reveals three notable patterns that reflect its transitional institutional context.

Large enterprises exhibited significantly higher operating revenues during the COVID period, consistent with institutional advantages; however, unobserved time-varying firm factors may also contribute.

Developed market studies document 25-40% declines among SMEs (Bartik *et al.*, 2020). As this study excludes micro and small-sized enterprises, direct comparison with SME studies cannot be made. However, the magnitude of large firm advantages (19-34%) indicates pronounced size effects in Serbia's transitional economy. Large firms have concentrated market power, privileged access to state support programs, informal credit networks, and regulatory forbearance unavailable to SMEs.

State-owned firms experienced significant profit declines despite holding larger asset bases and benefiting from formal institutional support. This erosion of margins reveals an implicit policy choice to use state-owned firms as economic stabilisers, creating a future problem for the governmental sector.

Economic theory predicts a "return to the mean" as economic shock subsides and recovery progresses. Instead, the findings revealed widening gaps: the operating revenue advantage of large firms increased from 19.4% to 33.8%, while the margins of state-owned firms continued to deteriorate. This change supports the view that, following the COVID-19 pandemic, a new normal is emerging. In Serbia, the authors expect a rise in market concentration, with the market dominated by large private firms that maintain close relationships with the government and policymakers.

As shown in the key findings, hypothesis H1 is supported as large enterprises exhibited superior performance compared to medium-sized firms. Both operating and total revenue showed statistically significant increases during the COVID-19 pandemic and the subsequent post-pandemic period. LogOperatingRevenue for large enterprises showed positive effects during the pandemic (estimate = 0.177, $p < 0.001$; +19.4% operating revenues) and even more so in the post-pandemic period (estimate = 0.291, $p < 0.001$). This indicates economically meaningful size advantages beyond statistical significance.

The data support Hypothesis H1 and align with recent empirical evidence from transitional economies. The magnitude of the observed effects exceeds those found in Slovakia (Valaskova *et al.*, 2023), where large firms showed more modest advantages. This difference likely reflects Serbia's unique institutional context as a transitional economy. Large firms often have more established relationships with state institutions, which facilitates access to support programs. Findings align with the theoretical relationship between size and performance during a crisis. Resource-based advantages (Barney & Clark, 2007) and financial flexibility theory (DeAngelo *et al.*, 2006) suggest that larger firms' diversified revenue streams and access to credit create buffers that are unavailable to smaller competitors. This theory is supported by the results of this study, particularly through the analysis of the logarithm of Total Revenue, which indirectly indicates the importance of support programs and monetary measures. A World Bank Group study (Udovički *et al.*, 2020) found that the government's assistance programs in the Republic of Serbia have been less effective in supporting the government's stated short-term goals of liquidity and employee retention. Still, in the medium term, the packages have been critical to medium-term sustainability and survival.

Increased revenues might also be a consequence of accounting treatments for government subsidies (Spasić & Denčić-Mihajlov, 2014), which might be booked as operating revenue. Additionally, enterprises may use "creative accounting" to present a more favourable picture to investors and public stakeholders.

The literature consensus reveals that during economic shocks, margins are significantly impaired; however, the profit margin analysis reveals stark heterogeneity. Hypothesis H2 is supported; however, while private firms maintained and large private firms improved margins, government and mixed-ownership enterprises experienced significant margin deterioration. The operating margins of state-owned firms declined by 15.6 percentage points (pp) during the COVID period and by 33.1 pp post-COVID (both $p < 0.001$). The state-owned firms held assets 6.2 times larger than those of private firms (Table 4).

This pattern suggests that while revenue support programs may have prevented bankruptcy, they failed to preserve profitability for state-connected enterprises.

There was a significant level of governmental intervention in the economy, accompanied by strong monetary measures by the central bank. The observed margin compression seems to be a result of governmental policy instructing state-owned (and mixed ownership) firms to maintain employment and suppress price increases. Such informal price controls helped moderate economic shock on the population, but contributed to larger inflation after the pandemic. The observed paradoxical effect contradicts both developed and emerging market patterns. Studies from Vietnam (Huy BUI *et al.*, 2022) and an 89-country analysis by Athira *et al.* (2024) consistently show margin compression across all ownership types.

The characteristics of the Serbian market may have enabled the private sector to preserve margins. Serbia is a transitional economy with significant state ownership and limited competition in most sectors, allowing for pricing power. Even during the lockdown, the demand for essential goods and services remained strong. The government provided direct monetary support to the general population, while the lockdowns limited people's opportunities to spend on non-essential goods and services. The observed post-pandemic inflation in Serbia supports this interpretation, indicating that firms' ability to pass costs to consumers. Lastly, the firms might have effectively reduced their cost structure, helped by government support programs for the workforce.

The literature shows that ownership structure can be a significant factor in enterprise performance during an economic shock. The results show that hypothesis H3 is partly supported. As discussed, state-owned enterprises have experienced a substantial compression of their margins. In the logOperating Revenue model, government ownership effects were positive but statistically insignificant (COVID: $\beta = 0.0069$, $p = 0.774$; Post: $\beta = 0.0352$, $p = 0.316$). Mixed ownership firms show similar statistics. The results suggest that these enterprises have benefited from targeted public support or access to resources unavailable to private competitors. This outcome likely reflects a policy that supported state-owned enterprises, enabling them to avoid price increases and survive margin compression.

Other ownership types (Foreign, Cooperative, and Mixed) exhibited limited (non-statistically significant) impacts on performance indicators. Foreign ownership showed some correlation (COVID: $\beta = -0.027$, $p = 0.208$; Post: $\beta = -0.021$, $p = 0.514$) with domestic firms, although the patterns were inconsistent. The analysis of total revenues (though not shown in the main results) suggests limited access to domestic support programs that benefited local firms. The muted effects of foreign ownership contrast with evidence from developed markets (Desai *et al.*, 2004) but are consistent with institutional theory: in crisis contexts, local network embeddedness may outweigh typical advantages of foreign firms, such as access to capital and managerial expertise.

The findings of this study underscore the central role of institutional arrangements in shaping resilience outcomes in transitional economies. The divergence from both developed and emerging markets highlights the specificities of transitional economies. In Serbia, weak formal institutions and entrenched informal networks appear to have amplified size advantages while eroding the profitability of state-connected firms. These patterns show that resilience models derived from advanced economies cannot be directly transferred to transitional settings without explicit consideration of institutional constraints and incentives. This paradox can be explained through institutional theory: formal and informal obligations placed upon state-owned firms – maintaining employment, moderating prices, and serving political objectives – effectively transformed resource advantages into liabilities.

Limitations

Several limitations in this paper deserve consideration.

First, the analysis excluded small and micro enterprises due to the limited number of observations available in the dataset. This exclusion limits comparability with studies that include the full spectrum of firms.

Second, as is common in transitional economies, the reliability of firm-level accounting data is uneven. Extreme outliers and inconsistent reports were excluded, which reduces noise; however, this may introduce a degree of survivor bias. Even so, the magnitude and coherence of the observed patterns suggest real economic changes and support the validity of the main conclusions.

Finally, data required to determine enterprise size, assets, and ownership were only available as of 2021. For this reason, enterprise classifications were held constant across the study period. Although this approach may obscure within-firm changes over time, it provided clearer tracking of aggregate trends across the observed periods.

CONCLUSION

This study confirms that the features of transitional economies fundamentally alter the dynamics of resilience. Three hypotheses were tested.

Hypothesis 1, which posited that large enterprises would demonstrate greater resilience than medium-sized enterprises, is strongly supported. Large firms not only outperformed during the pandemic (with revenues approximately 19.4% higher than those of medium-sized firms) but also further increased their revenue advantage in the recovery period (33.7% post-COVID).

Hypothesis 2, which posited that profitability would be significantly affected, is also supported. However, the direction of change diverged: private firms maintained or improved margins, while state-owned and mixed-ownership firms, despite having resource advantages (six times larger assets than private firms), experienced substantial losses (-15.6 percentage points during COVID, -33.1 pp post-COVID). The baseline private firms maintained or improved margins.

Hypothesis 3, which posited that ownership structure influences outcomes, is only partially supported. While state ownership clearly impaired resilience, foreign ownership did not confer the expected advantages. That contradicts evidence from developed markets (Desai *et al*., 2004).

The findings show that existing resilience frameworks should be adapted to account for the institutional specificities of transitional economies. Traditional resilience models assume that greater resources enhance adaptive capacity; however, the findings indicate that institutional obligations to maintaining employment and price stability impair profitability and resilience. Unlike developed markets, where post-crisis competition restores market structure, weak competitive forces and institutional advantages can lock in gains made during the crisis period.

There is a clear need for support programs that account for the disadvantages of small and medium-sized enterprises (SMEs), possibly through simplified application procedures or dedicated funding specifically for SMEs. Policymakers should consider how short-term stabilisation policies may affect long-term efficiency and market structure, particularly in economies with high state ownership. Overall, the Serbian case shows the need for context-sensitive resilience models that reflect the institutional realities of transitional economies.

Future research should address several limitations. Dynamic classifications of firm size and ownership would enable a more nuanced understanding of how changes in characteristics impact resilience. Sector-level analysis could reveal whether industry structure moderated outcomes. Comparative studies across transitional economies would further clarify whether the Serbian case reflects broader regional patterns or unique institutional features. By integrating these perspectives, future work can refine resilience theory to account for institutional asymmetries and provide more tailored guidance for policymakers.

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APPENDIX 1 – DISTRIBUTION TABLES

Table 3. Size Enterprise Size Distribution

Size group	Before	After
Micro	42	/
Small	6	/
Medium	2,766	2,519
Large	503	501
Total	3,312	3,020

Note: Distribution before and after filtering for size, liquidation and margin outliers.
Source: Authors' calculations

Table 4. Assets by Size and Year

Year	Medium-Size	Large-Size
2021	1,280.8 (637.7) n=2,199	18,413.0 (5,223.3) n=464
2022	1,350.8 (679.4) n=2,181	20,569.0 (5,865.7) n=464
2023	1,468.0 (740.8) n=2,162	22,182.9 (6,864.7) n=496

Note: Values shown as Mean (Median) in RSD million; n=observations.
Distribution after filtering for size, liquidation and margin outliers.
Data for 2018-2020 unavailable due to lack of Statistical Annexe; other tables use all years.
Source: Authors' calculations

Table 5. Assets by Ownership

Year	Mean Assets	Median Assets	Observations
Mixed	19,373.0	1,467.2	250
Governmental	18,584.1	961.1	666
Private	2,287.2	894.8	6,770
Cooperative	2,266.4	1,452.1	280

Note: Values shown in RSD million.
Distribution after filtering for size, liquidation and margin outliers.
Data for 2018-2020 unavailable due to lack of Statistical Annexe; other tables use all years.
Source: Authors' calculations

Table 6. Enterprises' Ownership Distribution

Ownership	Number	Percentage
Private	2,593	85.9%
Government	234	7.7%
Cooperative	97	3.2%
Mixed	96	3.2%
Total	3,022	100.0%

Note: Distribution after filtering for liquidation, Socialistic (n=2) and margin outliers.
Source: Authors' calculations

Table 7. Panel Foreign Distribution

Ownership	Number	Percentage
Domestic	2,330	77.1%
Foreign	692	22.9%
Total	3.022	100.0%

Note: Foreign ownership status is considered if any of the shareholders are foreign.
Distribution after filtering for liquidation and margin outliers.
Source: Authors' calculations

Table 8. Enterprises' Balance Check Data

Years observed	Number of firms	Percentage
1	171	5,7%
2	98	3,2%
3	115	3,8%
4	90	3,0%
5	213	7,0%
6	2,335	77,3%
Total	3,022	100,0%

Note: Distribution after filtering for liquidation and margin outliers.
A perfectly balanced panel would have all firms with all six observations.
Source: Authors' calculations

APPENDIX 2 – RESULTS TABLES

All reported coefficients represent differential effects relative to the baseline: medium-sized, privately-owned, domestic firms in the pre-COVID period (2018-2019).

Negative adjusted R2 values in fixed effects models typically indicate that the time-varying predictors explain little within-firm variation relative to the degrees of freedom consumed (Allison, 2009). This effect is expected, given that firm characteristics such as size and ownership are time-invariant in the specification. Nevertheless, the significant F-statistics (all $p < 0.001$) confirm that COVID period effects are statistically meaningful, even if they account for a small fraction of total variation.

Table 9. Dependent Variable: logOperatingRevenue

Variable	**Estimate**	**Std. Error**	t value	p-value	
Covid	-0.0107	0.0120	-0.8979	0.369	
Post	0.1459	0.0162	8.9845	< 2e-16	***
Covid:Large	0.1771	0.0191	9.2648	< 2e-16	***
Post:Large	0.2908	0.0275	10.5678	< 2e-16	***
Covid:Foreign	-0.0270	0.0215	-1.2584	0.208	
Post:Foreign	-0.0209	0.0321	-0.6520	0.514	
Covid:Cooperative	0.0813	0.0457	1.7814	0.075	.
Post:Cooperative	0.0643	0.0699	0.9193	0.358	
Covid:Mixed	-0.0914	0.0501	-1.8253	0.068	.
Post:Mixed	-0.1785	0.0762	-2.3418	0.019	*
Covid:Government	0.0069	0.0240	0.2866	0.774	
Post:Government	0.0352	0.0351	1.0021	0.316	

Note: Significance codes: *** p<0.001, ** p<0.01, * p<0.05, . p<0.1

Number of observations: 16,145; Number of firms: 3,020.

R-squared: 0.0669, Adjusted R-squared: -0.1488.

F-statistic: 78.32 on 12 and 13.113 DF, p-value: < 2.22e-16

Numerator Degrees of Freedom (DF) = number of time-varying coefficients in the model, Denominator DF = Total observations - Number of firms - Number of coefficients)

Large firms had 19.4% higher Operating Revenues during COVID period, and 33.7% higher in post-COVID period, compared to the medium-size baseline.

Source: Authors' calculations

Table 10. Dependent Variable: logTotalRevenue

Variable	**Estimate**	**Std. Error**	t value	p-value	
Covid	6.0017	0.2246	26.7269	< 2.2e-16	***
Post	6.4903	0.2200	29.5038	< 2.2e-16	***
Covid:Large	-0.1092	0.2516	-0.4340	0.664	
Post:Large	0.8352	0.2486	3.3594	0.001	***
Covid:Foreign	-1.1885	0.2530	-4.6974	2.69e-06	***
Post:Foreign	-0.0769	0.2487	-0.3092	0.757	
Covid:Cooperative	1.2621	0.8238	1.5321	0.126	
Post:Cooperative	0.9694	0.7760	1.2492	0.212	
Covid:Mixed	-0.5997	0.7389	-0.8116	0.417	
Post:Mixed	-0.8405	0.7949	-1.0574	0.290	
Covid:Government	0.8774	0.7681	1.1422	0.253	
Post:Government	0.5066	0.7749	0.6538	0.513	

Note: Significance codes: *** p<0.001, ** p<0.01, * p<0.05, . p<0.1
Number of observations: 9,077; Number of firms: 2,835.
R-squared: 0.4867, Adjusted R-squared: 0.2522.
F-statistic: 492.30 on 12 and 6.230 DF, p-value: < 2.22e-16.
Source: Authors' calculations

Table 11. Dependent Variable: OperatingMargin_pct (percentage points)

Variable	**Estimate**	**Std. Error**	t value	p-value	
Covid	0.602	0.393	1.532	0.126	
Post	0.646	0.625	1.035	0.301	
Covid:Large	4.142	0.745	5.560	2.76e-08	***
Post:Large	6.807	1.314	5.180	2.25e-07	***
Covid:Foreign	1.287	0.746	1.725	0.085	.
Post:Foreign	0.929	1.317	0.705	0.481	
Covid:Cooperative	-0.215	1.352	-0.159	0.874	
Post:Cooperative	-3.760	2.861	-1.314	0.189	
Covid:Mixed	-12.911	2.375	-5.437	5.53e-08	***
Post:Mixed	-23.395	4.483	-5.219	1.83e-07	***
Covid:Government	-15.587	1.236	-12.609	< 2.2e-16	***
Post:Government	-33.094	2.115	-15.651	< 2.2e-16	***

Note: Significance codes: *** p<0.001, ** p<0.01, * p<0.05, . p<0.1
Number of observations: 16,145; Number of firms: 3,020.
Values in percentage points.
R-squared: 0.0664, Adjusted R-squared: -0.1494.
F-statistic: 77.69 on 12 and 13,113 DF, p-value: < 2.22e-16.
Source: Authors' calculations

APPENDIX 3 – PROGRAM -- "R" CODE

The program code and execution are available in the GitHub repository:
https://github.com/...

FINANSIJSKA OTPORNOST NA EKONOMSKI ŠOK COVID 19: EMPIRIJSKA STUDIJA PREDUZEĆA U REPUBLICI SRBIJI

Rezime:

Ovaj rad ispituje finansijsku otpornost srednjih i velikih preduzeća u Srbiji tokom i nakon pandemije COVID-19. Koristeći ekonomske podatke iz 3.020 firmi tokom šest godina (2018–2023), iz finansijskih izveštaja dostavljenih Agenciji za privredne registre Republike Srbije, nakon standardnog čišćenja podataka, studija primenjuje regresiju sa fiksnim efektima i robusnim standardnim greškama. Rezultati pokazuju da veličina firme i državno vlasništvo utiče na otpornost i oporavak preduzeća na načine koji dovode u pitanje ustaljene modele.

Velika preduzeća su povećala svoje operativne prihode za 19,4% tokom pandemije i za 33,7% u post-COVID periodu, u poređenju sa srednjim firmama. Marže profita su se značajno razlikovale: velike privatne firme su poboljšale operativne marže, dok su državne firme doživele značajan pad uprkos posedovanju veće imovine. Strano vlasništvo istovremeno nije davalo značajnu prednost. Ovi nalazi ukazuju na to da modeli otpornosti iz razvijenih ekonomija možda nisu u potpunosti primenjivi na tranzicione ekonomije, kao što je Srbija.

Rezultati ističu potrebu za prilagođenim merama ekonomske politike za podršku srednjim preduzećima i za ponovnu procenu kako kratkoročni napori za stabilizaciju utiču na dugoročnu efikasnost i strukturu tržišta.

Ključne reči:

finansijska otpornost;
COVID-19;
veličina firme;
ekonomski šokovi;
struktura vlasništva.

JEL klasifikacija:

D22, G3, O5