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EDITORIAL

After conducting the double-blind peer review process, Issue 3 Volume 26 Year 24 of the scientific journal *Economic Horizons* contains five original scientific papers, one review paper and the Overview of the Authors and Titles of all the contributions published in the Journal in 2024.

The coauthors *Sasho Arsov* and *Aleksandar Naumoski* investigate the influence of different factors on the level of foreign direct investment, with a special emphasis on the noneconomic, mainly institutional, determinants. Using a broad sample including 124 countries and the data pertaining to the period from 1996 to 2019, the coauthors apply dynamic panel GMM regression. The results obtained point to the fact that the relative share of foreign direct investment in the GDP positively depends on the development of institutions in the country. In order for them to attract foreign investors, host countries should make considerable progress in the functioning of their respective legal systems, the efficiency of the government and fighting corruption. They should also create a favorable investment climate. The application of the same regression model to the subsample of the European countries has only confirmed the aforementioned findings, indicating that decision-makers must undertake certain steps towards the elimination of the systemic shortcomings instead of subsidizing foreign investors.

Starting from the fact that the fast liberalization process has accelerated the transition of the former socialist economies to the free-market-based economies, the coauthors *Olcay Çolak* and *Ömer Faruk Bölükbaşı* point out the fact that many hidden political tensions between and among some countries have also transformed into conflicts and wars. For the reason of that fact, countries allocate their

scarce resources for the needs of national security rather than their development goals, thus gradually increasing their allocations for the needs of funding defense. Accordingly, the coauthors examine the existence of the dynamic link between defense burden and unemployment during the period from 1996 to 2021 in the nine selected countries – the former Soviet republics that emerged after the collapse of the Soviet Union. The results of the study reveal that defense burden has no influence on unemployment in the short run and that it has a positive effect in the long run.

Investigating the influence of financial technology (Fintech) on the inflation rate, the coauthors *Muhammad Syariful Anam*, *M. Silahul Mu'min* and *Nafis Dwi Kartiko* create a new index for Fintech, which contains in itself several indicators using the main component analysis. The data used in the paper are the data belonging to the panel data set relating to the 10 provinces of the Island of Sumatra, Indonesia, spanning from January 2020 to June 2023. The pooled mean group (PMG) estimation method is employed so as to test the relationship between Fintech and the inflation rate. The results of the research study show that Fintech does exert an influence on reduction in the inflation rate in the long run. Based on that, the coauthors highlight the necessity to intensify the use of Fintech in the creation of an efficient economic environment and the promotion of economic stability.

The coauthors *Srđan Marinković*, *Ognjen Radović* and *Jelena Radojičić* consider the trends and analyze the regularities that appear on the national housing market in Serbia and on its regional markets. The starting assumption implies that, apart from common market driving forces, the newly constructed house market and the existing housing stock market behave as two separate housing markets with imperfectly adjusted prices. The focus of the analysis is on the divergence between the prices of these two segments, with a special interest in the mutual adjustment

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process. The coauthors apply Granger causality tests in order to find whether there is a causal dependence relationship in the price indices on these two market segments. The results of the analysis indicate the prevailing case of causality from the side of the existing housing stock market to the side of the new construction market between the regional markets. The same methodology is also applied in the analysis of the causality between the regional markets themselves, thus confirming the probable influence of the Belgrade new construction market on the markets in the other regions.

Pursuant to the attitude that the anticipation of financial difficulties in companies is important due to the complexity and dynamics of the contemporary business environment, the coauthors *Dragomir Dimitrijević*, *Sunčica Milutinović* and *Predrag Stanković* point to the significance of identifying potential financial difficulties that may result in bankruptcy. The paper researches the key determinants of the occurrence of financial distress that may lead companies to bankruptcy. The goal of the research study is to determine the interdependence between certain determinants of the occurrence of financial distress and the indicators of the probability of the occurrence of financial distress and also to determine the difference in the probability of the occurrence of financial distress prior to and after the onset of the pandemic caused by the COVID-19 virus in the Republic of Serbia. The research results reveal that there is a statistically significant negative correlation between the determinants of profitability, liquidity and solvency and the probability of the occurrence of financial distress. The research study also shows the presence of a statistically significant positive correlation between leverage and the probability of the occurrence of financial distress, as well as between the company growth and the indicator of the Altman Z-score. Apart from the above-mentioned,

there is also a statistically significant difference in the value of the indicator of the Altman Z-score before and after the onset of the pandemic caused by the COVID-19 virus.

Complementing the corporate entrepreneurship concept by the contributions offered by planned organizational change models, the author *Nebojša Janičijević* analyzes the change process through which entrepreneurial endeavors undertaken by individuals and groups within organizations are realized. After the presentation of the corporate entrepreneurship concept, the author synthesized the contributions of the most cited planned organizational change models that define the activities or steps to be undertaken by an internal entrepreneur, as the agent of change, in order to implement the corporate entrepreneurship project. By applying Lewin's model (unfreezing – move – refreezing), the author identifies the following activities: creating the awareness of the necessity of change, creating and communicating a vision, preparing for changes, implementing changes, facilitating changes, the institutionalizing and monitoring of changes. This only adds to the corporate entrepreneurship concept and makes it more realistic in practice.

On behalf of the Editorial Board of the Journal and on my own behalf, I hereby express my gratitude to the authors of the contributions published in Issue 3 of the Journal. Simultaneously, our special gratitude goes to the reviewers, whose constructive and critical comments and suggestions to the authors of the submitted papers have contributed to the level of the quality of the published papers.

The publishing of the journal *Economic Horizons* is financially supported by the Ministry of Science, Technological Development and Innovations of the Republic of Serbia, Decision number: 451-03-41/2024-03/1 as of 4th April 2024.

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Milena Jakšić is a full professor teaching at the Faculty of Economics of the University of Kragujevac. She earned her PhD degree at the Faculty of Economics of the University of Kragujevac in the narrow scientific field of general economics and economic growth. The key areas of her scientific and research interests are the financial system, financial markets, financial instruments and financial institutions.

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THE NEXUS BETWEEN INSTITUTIONAL DEVELOPMENT AND FOREIGN INVESTORS' PREFERENCES - A COMPREHENSIVE GMM STUDY

Sasho Arsov* and Aleksandar Naumoski

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This paper investigates the impact of various factors on the level of foreign direct investments in a country, with a special emphasis on the noneconomic, mostly institutional determinants. Using a broad sample of 124 countries and data for the period from 1996 to 2019, a dynamic panel GMM regression is applied. The regression results indicate that the relative share of FDI in the GDP depends positively on the development of the institutions in the country. To attract foreign investors, host countries should make considerable progress in the functioning of their legal system, the effectiveness of the government and fight against corruption, as well as creating an overall favorable investment climate. The same regression model applied to a subsample of European countries reinforced these findings, sending an important message to policymakers, who need to make decisive steps towards fixing systematic deficiencies rather than subsidizing foreign investors, which is a practice with suspicious cost-effectiveness at the macro level.

Keywords: foreign direct investments, institutions, corruption, rule of law

JEL Classification: F21, O43, P48

INTRODUCTION

The phenomenon of foreign direct investment (FDI) gained increased attention over the last decades of the 20th century as they began to be perceived as a valuable source of investable funds and a shortcut to intensified economic growth. This process was additionally bolstered by the collapse of socialism and

the ensuing process of economic transition, in which billions-of-dollars' worth of state-owned capital assets was offered for sale to private investors. The cross-border movement of capital was subsequently encouraged by some international organizations, such as UNCTAD, the OECD, etc., which extensively emphasized the benefits for the recipient countries. The popularization of FDI attracted the attention of economic science, which found the effects and determinants of FDI compelling grounds for research and examination.

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According to the literature at the time, FDI was expected to bring a host of economic benefits to the recipient countries (De Jager, 2004; Hansen & Rand, 2006). Although some recent studies have failed to unambiguously confirm these postulates, the hunger for investible funds resulted in a worldwide contest aimed at providing better opportunities for foreign investors, be it in the form of relaxed domestic regulations or in the form of bilateral and multilateral agreements aimed at reducing the barriers for capital inflows from abroad (Dašić, 2011; UNCTAD, 2022).

The general purpose of all these measures was to overcome the competitive weaknesses of certain countries in comparison to their peers. Economies differ in many respects, such as natural (geography, resources, climate, access to the sea, etc.), and in their social and economic characteristics as well, predominantly determined by the actions of the past and current generations. Researchers found it important to explore if there were any determinants of FDI that dominated the decision-making process of the foreign investors. This knowledge could provide governments with at least two pieces of information needed to model their policies: the extent to which they should strive in order to make improvements so as to successfully compete with other countries in attracting FDI, and also to determine the areas in which they should concentrate their efforts.

As foreign investors naturally search for ways to increase their economic efficiency and profitability, the most obvious candidates to be considered determinants of FDI are those that could, in one way or another, contribute to the mentioned objective. This favors countries abundant with natural resources, a favorable geographical position, skilled and/or inexpensive labor, large markets, and higher purchasing power (Lucas, 1993). However, foreign investors are interested not only in mere financial profitability but also in the general business conditions in the host country which affect the stability of their ventures and the associated level of risk. This premise has resulted in a myriad of studies using different approaches to explore the numerous determinants of FDI related to the overall business climate and quality of institutions.

The idea of this paper is to shed additional light on the importance of noneconomic factors as determinants of FDI. Therefore, the emphasis is put on corruption, the rule of law, government effectiveness, the infrastructure, human capital, and so forth. The specific goal of the paper is to determine the relative importance of institutional factors in the process of making decisions to invest capital abroad. For this purpose, a comprehensive global sample of 124 countries was created, with a database spanning over a 24-year period, assembled from relevant sources, and the dynamic panel Generalized Method of Moments (GMM) model is applied to answer the main question. In addition, a subsample consisting of 37 European economies was derived so as to investigate the same issue at the European level.

The results of the regression have confirmed that, in addition to the economic factors such as the intensity of economic growth, the availability of the labor force, etc., foreign investments are also induced by the existence of a favorable business environment, which is created by sound government and judiciary institutions, lower corruption, and a generally positive investment climate. In the case of Europe, this is further augmented by the association of the economy with the European Union.

This article contributes to the existing literature in several ways: first, it is the size of the sample, which covers a considerable majority of the world economy, and the time series, which is both very recent and sufficiently long to cover several business cycles; second, the database used, consisting of consistent data from the most reliable sources; and third, the applied econometric technique, which assures confidence in the conclusions as it addresses the problem of possible endogeneity and bidirectional causality among the variables.

The structure of the paper first implies the introduction, only to be followed a review of the literature provided so as to deal with the two issues: the impact of foreign investments on economic development and the importance of various factors as the FDI determinants at the macro-level. The third section elaborates on the research methodology

applied, the regression model and its variables, and the sources and scope of the data used in the study. The fourth section presents and discusses the empirical findings in the two subsections: the one related to the global sample, and the second, containing the application of the same model to a subsample of the European countries. The paper is wrapped up in the conclusion section, which contains the main findings, recommendations, and directions for further research.

LITERATURE REVIEW

During the period from 1983 to 1989, the world FDI flows were growing at an annual compound rate of around 29%, while the annual growth rate of the world income was about 8% (Graham & Krugman, 1993). This dramatic rise in the level of FDI attracted the attention of numerous researchers who strived to answer a variety of questions related to this process.

The first issue that needed scientific elaboration and which would further determine the overall attitude towards FDI was related to their impact on the economy of the recipient country. Using the postulates of exogenous growth theory (Solow, 1956) and the Cobb-Douglas production function, the research was based on the presumption that foreign investment would increase the amount of capital available in the country, enhance the quality and efficiency of the labor force, and boost the overall productivity of the production factors through the introduction of modern technologies. Numerous researchers found these theses sustainable, either through the development of economic models or on the basis of empirical research (Balasubramanyam, Salisy & Sapsford, 1996; de Mello, 1997; Hansen & Rand, 2006; Lee & Huruta, 2020).

However, the stance towards the positive impact of FDI on growth was not unambiguous. K. E. Meyer (2004) emphasized the importance of studying the possible negative effects of FDI, not only to counter the claims of the opponents of globalization but also to develop appropriate policies aimed at attracting FDI if positive impacts prevailed over the negative

ones. In the case of Venezuela, B. J. Aitken and A. Harrison (1999) concluded that the technology spillover effects were only limited to the smaller joint ventures themselves, whereas the productivity of the companies with no foreign participation actually suffered from the competition. The importance of certain preconditions for recipient countries to benefit from FDI was confirmed in many studies, and they included financial development (Hermes & Lensink, 2003; Alfaro, Chanda, Kalemli-Ozcan & Sayek, 2007), technological development and the existence of technological gaps (De Mello, 1997), or the availability of human capital (Borensztein, Gregorio & Lee, 1998; Xu, 2000). V. Bilas and S. Franc (2022) investigated the impact of FDI on economic growth on a sample of the thirteen new European Union member states and concluded that there was a long-term cointegration among FDI, GDP, and exports, but the overall results were ambiguous.

The second popular issue among the academics was to detect the most important determinants of FDI flows, i.e. to identify what made particular countries more attractive as destinations for FDI compared to others. Comprehensive reviews of the relevant literature on this topic are provided by S. Tocar (2018) and J. Paul and M. M. Feliciano-Cestero (2021). FDI determinants are usually classified as economic and noneconomic, but the results of the studies investigating their impact are not unequivocal.

The level of the GDP and economic growth rates are most often cited as the most important economic determinants of FDI. The examples of such studies are the papers by A. Chowdhury and G. Mavrotas (2006) in the case of Chile, Malaysia and Thailand; H. Hansen and J. Rand (2006), for a sample of 31 developing countries; and N. Saini and M. Singhania (2018), who find a positive impact of economic growth on FDI in the case of developed but not in the case of developing countries, and so forth. C. S. Ho and H. A. Rashid (2011) study the ASEAN countries and conclude that the rate of economic growth and the trade openness of the country are the most universal determinants of FDI in the region, with growth having a somewhat unexpected negative sign, whereas openness positively affecting inward

foreign investments. A. Q. Khachoo and M. I. Khan (2012) analyze a sample of 32 developing countries and, in addition to the GDP, find that lower labor costs and the developed infrastructure have a positive impact on FDI, whereas trade openness seems to be insignificant. The importance of lower labor costs is also confirmed by M. Mateev (2009) in the case of the European transition economies. N. Saini and M. Singhania (2018) confirm the importance of trade openness, whereas gross fixed capital formation is a relevant determinant only in the case of developing economies.

Noneconomic determinants also play a significant role in decisions to invest abroad. M. Mateev (2009) and M. Barassi and Y. Zhou (2012) find a significant negative relationship between the level of corruption in a country and the inflow of foreign investments. B. G. Buchanan, Q. V. Le and M. Rishi (2012) explore the impact of institutional quality on FDI inflows and FDI volatility and conclude that institutional quality has a positive impact on FDI levels and a negative impact on FDI volatility. J. Du, Y. Lu and Tao (2012) conclude that property rights protection has a positive impact, whereas efficiency in the enforcement of contracts is found to have a negative impact on FDI. As their study covers only FDI in China, they attribute this surprising outcome to the cultural differences between foreign investors and China as the recipient country. R. Sparks, N. Desai and P. Thirumurthy (2014) conclude that economic factors explain only 22.5% of FDI inflows. The existence of appropriate institutions is important to attract foreign investors, as they need not only markets and natural resources, but also a business-friendly environment to run their businesses. The level of the restrictiveness of a country's policies towards foreign investors is confirmed as a significant factor by F. Mistura and C. Roulet (2019). Applying an augmented gravity model to a sample of 60 countries, they find that the liberalization of policies could significantly increase bilateral FDI flows. The importance of a positive investment climate is also emphasized by K. Sekkat and M. Veganzones-Varoudakis (2007). Their study of the developing countries in South Asia and Africa also stresses the importance of the infrastructure and political and economic stability as factors.

Some papers investigate the validity of previous findings. T. S. Eicher, L. Helfman and A. Lenkoski (2012) question the robustness of the most often cited determinants of FDI. Their findings from a regression based on a comprehensive list of potential factors only confirm the robustness of the size of the domestic market as an FDI determinant. Similarly, B. A. Blonigen and J. Piger (2014) fail to confirm the validity of many variables usually used in studies of FDI determinants and especially point out the fact that the importance of government intervention in attracting FDI is unsupported by the study. The only valid step they recommend is the inclusion of the country in bilateral agreements and regional integrations.

Notwithstanding a plethora of research in this topic, it has been found in this research study that the gap still needs to be filled so as to obtain a complete picture of the factors influencing the international movement of capital. Namely, all of the cited studies are marked by significant shortcomings when general conclusions are to be drawn. Some of them are based on fairly limited samples of countries: H. Hansen and J. Rand (2006) analyze 31 developing countries; M. Mateev (2009) uses eight countries from Central and Southeast Europe; A. Q. Khachoo and M. I. Khan (2012) use a sample of 32 developing countries; the sample of N. Saini and M. Singhania (2018) consists of 20 countries; J. Paul and P. Jadhav (2020) analyze 24 emerging economies, and so on. In addition, the mentioned studies either cover considerably short periods of time or the data refer to the periods of a more distant past, which poses a significant drawback when drawing conclusions in today's dynamic world (for instance, M. Mateev (2009) covers the period from 2001 to 2006; A. Bénassy-Quéré, M. Coupet and T. Mayer (2007) - the pre-2000 period; A. Q. Khachoo and M. I. Khan (2012) cover the period from 1982 to 2008; N. Saini and M. Singhania (2018) cover the period from 2004 to 2013, etc.). B. G. Buchanan *et al* (2012) use a fairly large sample of 164 countries, but a limited period (from 1996 to 2006). Also, many of the studies apply basic econometric techniques based on panel regressions, and the data used are sometimes inconsistent, stemming from various databases or being individually collected by the researchers themselves. In this study, this has been to be a

sufficient justification for comprehensive research in the topic, covering a broad sample of countries and a lengthy timeseries with the most recent data from respectable sources and the use of appropriate econometric methods.

METHODOLOGY AND DATA

The paper basically intends to determine the influence of various factors on the level of FDI inflows, with an emphasis on the institutional determinants. More precisely, the study aims to test the importance of institutional development and governance quality, as well as the levels of the infrastructure development and human capital, as the determinants of the attractiveness of a country as an investment destination. Institutional development and governance quality are represented by the three main variables: the level of corruption, the rule of law, and the effectiveness of the government. The two additional variables (namely the infrastructure and gross fixed capital investments) are added so as to indirectly reflect the general business conditions of a country, and the study is performed at both the global and European levels. As a result of the comprehensive review of the relevant empirical literature, the following research hypotheses regarding the relative importance of the noneconomic variables have been formulated:

- H1: Institutional development quantified by the levels of corruption, government effectiveness, and the rule of law is an important determinant of the attractiveness of a country as a foreign investment destination.
- H2: Institutional factors play an important role in foreign investors' decisions to invest in Europe.
- H3: The other noneconomic factors are significant determinants of foreign investments both in the world and in Europe.

A very broad sample consisting of 124 countries was created for this purpose. The entire available database covers the period from 1996 to 2020, but the last

year was omitted in order to avoid the impact of the COVID-19 crisis, so the final time series contains 24 years of data (from 1996 to 2019). A regression model was set up, in which net FDI inflows into a particular country are used as the dependent variable, in relative terms, as a ratio to GDP. The entire timeseries is divided into three-year periods, so there are a total of eight country-year observations per variable. As the level of FDI in a country could fluctuate thoroughly on an annual basis, three-year averages for all the variables in the regression are used to smooth out such variations.

First, the assumption that the level of FDI in a country (in relative terms) is a function of a set of institutional (I), economic (E) and noneconomic factors (NE) is made:

$$FDI = f(I, E, NE)$$

The factors in the main focus of the study are those depicting the quality of institutions in the country, and they are represented by the following variables:

- the level of corruption ($CORRUP$), which is proxied by the indicator *Control of Corruption* taken from the World Bank Worldwide Governance Indicators Database ($WBWGID$). This aggregate indicator is derived as a perception of the extent to which public power is abused for private benefits, and ranges between -2.5 (the highest level of corruption) and +2.5 (the lowest level of corruption).
- the rule of law (LAW), as a measure of the overall quality of the legislature and the judicial system (the enforcement of contracts, the police, courts, property rights, etc.). The estimate of the rule of law from the $WBWGID$ is used, which ranges between -2.5 (the lowest level of the rule of law implementation) and +2.5 (the highest level of the rule of law implementation).
- government effectiveness ($GOVEFEK$), as an indicator of the overall government performance, measured by the World Bank Government Effectiveness Index. The index spans between -2.5 (the lowest level of effectiveness) and +2.5 (the highest level of effectiveness) and is taken from the $WBWGID$.

The above three variables are at the core of this study. Their impact on FDI is investigated separately as their mutual correlations are very high and would pose a multicollinearity problem if used in the same equation.

The additional variables reflecting the institutional environment in a country are as follows:

- the infrastructure development (INFRA) - this variable is taken as noneconomic because it reflects the quantity and efficiency of the efforts made by governments to provide diverse infrastructural services even when the infrastructure is a result of private investments. The percentage of the total population with access to electricity from the World Bank World Development Indicators Database (WDID) is used as a proxy because all the other corresponding infrastructure indicators are unavailable in sufficiently long data timeseries.
- the total amount of fixed capital investments in the economy (the gross fixed capital formation - GFCF) from the World Bank WDID - although this is an economic variable, it serves as a proxy for the overall business conditions in the country. In the model, the GFCF to the GDP ratio is used.

In addition to the basic independent variables, a set of control economic and noneconomic variables are included in the regression.

The economic variables include:

- the GDP *per capita* (GDP), as a measure of the level of economic development and the purchasing power of the population, used as a log value;
- growth (GROW), which is calculated as a ratio between the log values of the GDP *per capita* for two consecutive years;
- the level of financial development (FINDEV) - countries with more developed financial systems are expected to be more attractive to foreign investors. The usual proxy for this variable in the literature is the ratio of the domestic credit extended to the private sector by banks (as a percentage of the GDP). This variable is used in the log-level form.

- trade openness (TRADE), as a ratio between the sum of exports and imports to the GDP. More open economies are expected to be more attractive as investment destinations due to the lower import and export barriers, also presumably indicating their higher level of competitiveness, on the other hand.
- the unemployment rate (UNEMP), and
- the inflation rate (INFL - the annual GDP deflator).

All of the above economic variables are obtained from the World Bank WDID.

The noneconomic control variables include:

- human capital (HC), represented by the human capital index from the Penn World Tables, based on the average years of schooling from R. J. Barro and J. W. Lee (2013) and an assumed rate of return to education, based on the Mincer equation estimates (Psacharopoulos, 1994);
- accession to and membership in the European Union (EUACC), which is used as a dummy variable, taking the value of 1 for the year when a country was either a candidate country or a member country of the European Union, and 0 otherwise. This variable is only used in the regression model applied to the subsample of the European countries and is expected to reflect the relative importance of the membership of a country in the European Union to foreign investors.

The basic regression model is defined as:

$$FDI_{i,t} = \alpha INST_{i,t} + \beta_1 ECON_{i,t} + \beta_2 NONECON_{i,t} + \gamma_t + \delta_i + \varepsilon_{i,t} \quad (1)$$

where:

- $FDI_{i,t}$ is the relative measure of FDI net inflows to the country i in the period t
- $INST_{i,t}$ is the vector of the institutional variables for the country i in the period t
- $ECON_{i,t}$ is the vector of the control variables of economic nature
- $NONECON_{i,t}$ is the vector of the control variables of noneconomic nature

- γ_t is the year dummy controlling for the time-varying shocks
- δ_i is the dummy variable controlling for the country-specific effects
- $\varepsilon_{i,t}$ is the residual value.

However, there is possible endogeneity among the variables in the model, i.e. the explanatory variables might also be affected by the dependent variable. Namely, one should assume bidirectional causality between the amount of FDI, on the one hand, and economic development and/or economic growth, on the other (confirmed by A. Chowdhury and G. Mavrotas, 2006; H. Hansen and J. Rand, 2006; G. Ruxanda and A. Muraru, 2010). Also, the level of financial development is important for prospective foreign investors; yet, on the other hand, foreign investments usually include investments made by foreign banks and other financial institutions, thus reversibly influencing the amount of FDI. Therefore, the application of the OLS would result in biased results. To overcome this problem, the two-stage dynamic panel GMM econometric tool first described by M. Arellano and S. Bond (1991) is applied as the tool able to resolve simultaneity biases. A dynamic panel is recommended for situations where the number of cross-sections is high, while the number of periods is low. Since the timeseries consists of eight values per country per variable, the dynamic panel GMM model is appropriate.

In said dynamic GMM model, the basic equation of interest transforms into:

$$FDI_{i,t} = (\alpha-1)\delta FDI_{i,t-1} + \beta INST_{i,t} + \gamma CECON_{i,t} + \delta CNONECON_{i,t} + \eta_i + \mu_t + \varepsilon_{i,t} \quad (2)$$

where $FDI_{i,t}$ is the level of FDI in the country i in the period t as a percentage of the GDP; $INST_{i,t}$ is the set of the explanatory (institutional) variables; $CECON_{i,t}$ is the set of the control economic variables; $CNONECON_{i,t}$ is the set of the control noneconomic variables η_i are the unobserved and country-specific fixed effects; μ_t are the time-fixed effects, and $\varepsilon_{i,t}$ is the error term. The instruments should be the variables correlated with the endogenous variables, but not directly with the dependent variable. In order to obtain a dynamically complete model, the second lag of the dependent variable is added when necessary

(Kiviet, 2020). The lagged values of the independent variables are used as instruments, with the lag level corresponding to the need so as to avoid the serial correlation issue. This paper applies the Sargan test to check for endogenous phenomena, whereas the Arellano-Bond tests are used to detect the serial correlation of errors in the first differences.

RESULTS AND DISCUSSION

Descriptive statistics

Prior to presenting the regression results, the descriptive statistics are provided so as to gain an insight into the analyzed sample. Since the gathered data create a panel of 124 countries covering a 24-year period, the presentation of mere averages of the variables would not provide valuable information. Instead, the median values by variable by continent for the first and last years of the data series are presented in order to depict the progress each continent has made with respect to the variables of interest throughout the covered period. The second column in each table represents the number of the countries included in the sample.

The analysis of the descriptive statistics provides us with some interesting insights. With respect to the economic variables, an improvement is evident in almost all the cases. The average GDP *per capita* has increased, and trade openness, financial development, and the share of FDI in the GDP have risen as well, while unemployment has dropped, and inflation seems to have posed no problem (as of 2019).

On the other hand, the trends in the institutional and other noneconomic variables are less encouraging. Although there has been obvious progress with respect to human capital and the infrastructure development, problems with corruption and the application of the rule of law still persist. In two of the continents, the situation with corruption (on average) has worsened (the lower index value), while the situation is similar with the rule of law and government effectiveness indices, although being somewhat differently geographically distributed.

Table 1 The descriptive statistics by continent - the economic variables, the median values

	Year	GDP	GFCF	FDI	TRADE	INFL	FINDEV	UNEMP	
Africa	33	1996	833	19.19	0.94	50.95	8.02	50.95	8.02
		2019	1349	21.90	1.99	57.94	3.00	57.94	3.00
Asia	32	1996	2067	23.89	1.10	68.10	8.11	68.10	8.11
		2019	5309	27.16	2.05	64.86	1.88	64.86	1.88
Australia	3	1996	28581	22.34	1.14	55.12	2.73	55.12	2.73
		2019	40599	23.33	2.81	54.34	3.42	54.34	3.42
Europe	37	1996	7804	20.79	1.38	70.08	7.64	70.08	7.64
		2019	18167	21.58	2.95	101.80	2.20	101.80	2.20
North America	10	1996	4042	18.64	1.57	52.85	9.79	52.85	9.79
		2019	4660	20.46	2.69	70.87	3.43	70.87	3.43
South America	9	1996	4396	18.64	2.55	39.53	11.42	39.53	11.42
		2019	6614	18.98	2.08	46.94	3.06	46.94	3.06

Source: World Bank WDID and World Bank WBWGID

Table 2 The descriptive statistics by continent - the noneconomic variables, the median values

	Year	CORRUP	LAW	GOVEFEK	HC	INFRA	
Africa	33	1996	-0.57	-0.62	-0.58	1.44	15.00
		2019	-0.56	-0.63	-0.53	1.86	48.06
Asia	32	1996	-0.36	-0.18	-0.01	2.21	98.44
		2019	-0.31	0.05	-0.27	2.71	100.00
Australia	3	1996	1.88	1.77	1.71	3.27	100.00
		2019	1.83	1.57	1.73	3.41	100.00
Europe	37	1996	0.42	0.62	0.77	2.93	100.00
		2019	0.57	0.83	0.53	3.43	100.00
North America	10	1996	-0.54	-0.16	-0.62	2.08	81.79
		2019	-0.68	-0.31	-0.71	2.52	98.36
South America	9	1996	-0.40	-0.14	-0.26	2.36	92.87
		2019	-0.34	-0.09	-0.43	2.84	99.76

Source: World Bank WDID and World Bank WBWGID

The global sample - results and discussion

The results of the GMM regression are presented in Tables 3 and 4.

The results of the regression reveal some interesting findings. The variables in the main focus of this study,

those related to the quality of institutions - the rule of law and government effectiveness, show evidence in support of the thesis that foreign investors favor business environments with stronger institutions and more efficient judicial systems. The positive sign of the gross fixed capital formation indicates that the overall investment climate in a country positively

affects foreign investors' decision-making as well (in line with K. Sekkat and M. Veganzones-Varoudakis, (2007)).

The lack of significance for the infrastructure variable could be surprising, but one possible explanation is that the proxy used for this variable (access to electricity for the population) is perhaps a poor representative for the availability of the host of the services embedded in the infrastructure, such as roads, railways, information networks, and so forth.

The negative relationship between inflation and FDI implies the fact that foreign investors globally prefer more stable economic environments. They also prefer to invest in growing economies and in those with higher rates of unemployment, which usually reflects in lower labor costs. Trade openness has a negative sign but is statistically insignificant (in line with A. Q. Khachoo and M. I. Khan, 2012).

Financial development and human capital have not proven to be significant, most likely due to the very diverse sample of the countries, as some regions attract investors by providing skilled labor force, and others by offering unskilled but cheap labor force.

The European sample - results and discussion

Another question of interest in this paper is whether the same conclusions would be drawn from the subsample containing only European economies. The special focus on this continent is a result of its specific characteristics: a relatively high GDP *per capita*, a higher degree of political stability, predominantly older democracies, and the dominance of the European Union regulations, higher degrees of urbanization and the infrastructure development, and so on. For this purpose, as many as 37 European countries were extracted from the global sample, and the same model was applied to the subsample, too. As is mentioned above, the dummy variable reflecting the country's accession to or membership status in the European Union is added to this regression.

Table 3 The regression results using the GMM - the global sample

	(1)	(2)	(3)
FDI _{t-1}	-0.037 (0.522)	-0.084 (0.118)	0.007 (0.866)
FDI _{t-2}	-0.022 (0.581)	0.005 (0.902)	0.004 (0.919)
CORRUP	4.797 (0.294)		
LAW		14.945*** (0.004)	
GOVEFEK			5.629* (0.081)
INFRA	-0.074 (0.406)	0.060 (0.426)	-0.032 (0.629)
GFCF	0.730*** (0.000)	0.837*** (0.000)	0.766*** (0.000)
GDP	-8.790 (0.415)	-24.362** (0.042)	-12.388 (0.186)
GROW	49.614*** (0.002)	55.766*** (0.004)	42.387** (0.005)
INFL	-0.273* (0.093)	-0.049 (0.754)	-0.259** (0.049)
TRADE	-0.008 (0.873)	-0.015 (0.781)	0.001 (0.985)
FINDEV	0.526 (0.878)	2.904 (0.450)	-0.166 (0.952)
UNEMP	0.598*** (0.005)	0.550** (0.028)	0.575*** (0.006)
HC	0.785 (0.863)	1.621 (0.728)	1.970 (0.619)
The countries included	124	124	124
Observations	419	419	419
Sargan test (p-value)	0.173	0.155	0.121
AR(1)	0.013	0.045	0.007
AR(2)	0.175	0.196	0.147

P-values in parentheses.

*, **, *** - denote significance at the 10%, 5% and 1% levels, respectively

The Sargan test null hypothesis: the instruments used are not correlated with the residuals.

The AR(2) null hypothesis: the errors in the first difference equation exhibit no second-order serial correlation.

Source: Authors

Table 4 The regression results for the European countries using the GMM model

	(1)	(2)	(3)
FDI _{t-1}	0.068* (0.060)	0.029 (0.212)	0.052 (0.155)
FDI _{t-2}	0.071** (0.010)	0.028 (0.247)	0.073*** (0.003)
CORRUP	10.220*** (0.000)		
LAW		3.725* (0.075)	
GOVEFEK			19.389*** (0.000)
INFRA	0.996 (0.733)	0.432 (0.830)	-2.939* (0.086)
GFCF	0.198** (0.038)	0.009 (0.955)	0.303** (0.015)
GDP	18.942 (0.177)	33.698** (0.012)	-10.279 (0.369)
GROW	66.702*** (0.000)	72.845*** (0.000)	52.768*** (0.000)
INFL	0.085 (0.168)	0.183* (0.013)	0.258*** (0.001)
TRADE	-0.228*** (0.000)	-0.279*** (0.000)	-0.212*** (0.000)
FINDEV	3.988** (0.021)	3.765* (0.059)	1.664 (0.267)
UNEMP	0.596** (0.010)	0.701*** (0.002)	0.522** (0.019)
HC	-4.673 (0.464)	-11.405* (0.089)	4.012 (0.521)
EUACC	16.239** (0.005)	18.314*** (0.001)	13.667** (0.048)
The countries included	37	37	37
Observations	147	147	147
Sargan test (p-value)	0.240	0.239	0.302
AR(1)	0.026	0.045	0.059
AR(2)	0.145	0.200	0.142

P-values in parentheses.

*, **, *** - denote significance at the 10%, 5% and 1% levels, respectively.

The Sargan test null hypothesis: the instruments used are not correlated with the residuals.

The AR(2) null hypothesis: the errors in the first difference equation exhibit no second-order serial correlation.

Source: Authors

The results presented in Table 4 provide similar answers, with even greater confidence in the importance of the institutional determinants. The significance of fighting corruption, improving government effectiveness, and providing an efficient legal system is strongly confirmed in the case of Europe, with gross fixed capital investment complementing the importance of a country's institutional setting to foreign investors. Note that the corruption index ranges between -2.5 (the highest corruption) and +2.5 (the lowest corruption), so the positive sign actually indicates a lower level of corruption (efficient fight against corruption) and a positive impact on attracting FDI (in line with Paul & Jadhav (2020)).

The impact of economic growth and the unemployment rates is as strong as it is in the global sample, while investors in the European countries also prefer to be supported by strong financial sectors. The positive relationship between inflation and FDI can be attributed to the abovementioned impact of economic growth (in line with I. Kersan-Škabić, 2013). Specifically, the economies with higher growth rates are more likely to undergo periods with higher inflation, rather than exhibit deflationary tendencies. A surprising finding is that the higher levels of trade openness are detrimental to foreign investments. A probable explanation is the finding of G. Nicoletti, S. S. Golub, D. Hajkova, D. Mirza and K. Yoo (2003), according to which while tariff barriers have a negative impact on FDI inflows, nontariff barriers have a positive impact (with FDI probably serving as a means to overcome the latter). Finally, the EU candidate countries, as well as its members, are more attractive to foreign investors as they provide, or are about to provide, full access to the large European market of more than 450 million people with significant purchasing power and the accompanying highly developed industrial and service sectors (in line with B. A. Blonigen & J. Piger (2014)).

CONCLUSION

The study confirms most of the expected relations between the analyzed variables and the foreign investment inflows. On the one hand, the corporate

and industrial factors aside, it can be concluded that foreign investors are mostly oriented towards investing in growing economies and countries with abundant labor force available. However, institutional development plays an important role in attracting foreign investors, as FDI is significantly higher in the countries with less corruption, effective governance, and higher confidence in the legal system. This is also supported by the fact that FDI is higher in the countries in which the overall level of capital investments is higher, reflecting the importance of the general investment climate and the business environment, which governments bear ultimate responsibility for. The most important findings originating from the analysis of the European countries are in line with those from the global sample, providing reassurance of the importance of institutional development as a part of the overall attractiveness of a country as an investment destination. In addition, it confirms the importance of the inclusion of the economy in a broader association as a means to overcome the problem of a small market, but also to assure investors of the consistency and harmonization of its system and policies with a set of broadly accepted standards.

The above conclusions support the hypotheses 1 and 2 of this study as they are set above in the paper. The hypothesis 3 is only partly confirmed. Representing the average educational level, human capital lacks statistical significance in the study, but investors are heavily influenced by the status of a country as a member or a candidate member of an important economic and political association.

These findings teach several important lessons to the policymakers in the countries enthusiastically awaiting foreign investors. First, the amount of FDI inflows cannot replace investment made by domestic businesses. The positive sign of the GFCF variable confirms the fact that foreign investments are only complements to, rather than substitutes for domestic investments. Second, the attractiveness of a country is not to be taken as given by its geographical position and natural endowments, but a lot could be done by improving the quality of governance and the overall

political and social systems of the country itself, as well as through its association with a prominent regional community. Therefore, accentuating natural limitations could be the initial but not sufficient excuse for the absence of FDI.

What distinguishes this paper from comparable research in the topic is the comprehensive sample incorporating countries from all over the world, the appropriate econometric technique, and the series of most recent data covering a time span of 25 years. Almost all the data are taken from the same source providing for their consistency. All the other reviewed papers cover shorter time periods, most often biased by particular circumstances (economic transition, economic crises, etc.), so the length of the timeseries should provide protection from such influences.

One probable limitation of the current research reflects in the nature of some of the data used in the study. Apart from their relevance and consistency, some data are based on the estimates and surveys subject to differences in perceptions compared to the accurate data obtained through statistical censuses and accounting information. Also, apart from being a comparative advantage of the study, the breadth of the global sample might also be a source of ambiguity due to the diversity of the economies included in the sample in geographical, political, cultural, and economic terms. Therefore, the results originating from the more consistent European subsample could be considered more convincing.

Undeniably, the study on this topic is far from concluded. Probable directions for future research include, but are not limited to, studies of particular regional groupings of countries, studies concentrating on more consistent samples of economies, the use of potential additional institutional variables, and the inclusion of more exact data as they become available. More ambitious researchers should also consider including micro-level variables at the company or sectoral levels in order to encompass potential interactions between the two groups of determinants.

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THE EXAMINATION OF THE DYNAMIC LINK BETWEEN DEFENSE BURDEN AND UNEMPLOYMENT: THE EVIDENCE FROM THE POST-SOVIET COUNTRIES

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The Eastern Bloc had been dissolved by the end of the Cold War period, and the New World Order was established. The rapid liberalization process accelerated transition to the free market economy. In this transition period, however, numerous political tensions occurring between some countries also transformed into conflicts and wars. Therefore, countries allocate their scarce resources to their national security rather than their development objectives, simultaneously gradually increasing their defense expenditures. Accordingly, the present study aims to examine the existence of the dynamic relationship between defense burden and unemployment for the selected nine post-Soviet countries that emerged after the collapse of the Soviet Union. By incorporating the annual data set of the nine post-Soviet countries over the period between 1996 and 2021, the results revealed that defense burden had no influence on unemployment in the short run, but did have a positive effect in the long run.

Keywords: defense burden, unemployment, post-Soviet countries, panel data

JEL Classification: C33, F51, H56, P20

INTRODUCTION

Together with the unprecedented pace of globalization, the collapse of the Eastern Bloc by the end of the Cold War brought a new political and economic order for

the ex-communist economies. The desire to adopt the free-market economy embracing price mechanisms and institutional reforms such as liberalization of trade and capital accounts led regimes to induce radical and structural changes in those economies. It should be noted that the process of transition to the free-market economy occurred differently in different countries, that being due to their respective economic conditions, geopolitical concerns, and

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institutional capabilities. In this context, the biggest number of the post-Soviet Union countries (except for the Baltic countries, namely Estonia, Latvia, and Lithuania) experienced severe economic, political, and security issues. For political and security reasons, the Commonwealth of Independent States (CIS) were eager to allocate more resources to their military operations instead of investing in developmental aspects aiming to alleviate all forms of poverty.

On the other hand, the economic effects of defense expenditures are among the most profound and intricate topics that have drawn special attention from scholars, both theoretically and empirically. Nevertheless, many of those studies have mainly discussed the effects on economic growth attributed to defense expenditures. Also worthy of noting is the fact that the interconnectedness between the output growth and unemployment is indicated by the famous macroeconomic phenomenon called Okun's Law, which indicates an inverse relationship between the output growth and unemployment, which is why a possible nexus between defense expenditures and unemployment deserves to be paid special attention to since the latter relates to the output growth. In this respect, this paper aims to pursue the dynamic link between unemployment and defense burden, which is measured by the ratio of overall defense expenditures to the gross domestic product (GDP) for the selected post-Soviet countries.

Considering the interaction between defense expenditures and unemployment, there are three mechanisms standing out commonly referred to in the literature so far. The first mechanism is the spillover effect. With the construction of the military infrastructure, rising military spending would lead to productivity gains via a technology spillover to the private sector, which enables companies to demand more labor due to increasing labor productivity. The second mechanism is referred to as the reallocation effect and it induces frictional unemployment due to contraction in the military sector. From this aspect, the reallocation effect sets to the extent that employees in the military sector tend to shift to the private sector due to the decline in military

spending. The third mechanism implies that military expansion may exacerbate the pressure on the general government budget. Governments tend to collect additional taxes in order to alleviate the strain on the general government budget associated with military expansion. Thus, military expansion can create an additional tax burden on employers, which in turn could influence labor demand or supply (Tang, Lai & Lin, 2009; Sanso-Navarro & Vera-Cabello, 2015; Zhong, Chang, Tang & Wolde-Rufael, 2015). Accordingly, the pivotal hypotheses of the paper read as follows:

- H1: There are a long-run dynamic link and the causal nexus between defense burden and unemployment throughout the above-mentioned mechanisms.
- H2: Increases in defense burden tend to accelerate unemployment either in the short- or in the long run.

The fact that this empirical study differs from previous ones in various aspects and that it aims to fill the gap in the empirical literature by employing a relatively novel approach is also worth noting. Initially, this empirical endeavor would be the first to investigate the interplay between defense burden and unemployment for the post-Soviet Union countries never analyzed in empirical analyses to date. The majority of the empirical studies in the field of defense economics have focused on the countries involved in proliferation, namely Greece, Turkey, India, and Pakistan. Moreover, with the developments in cross-sectional and panel data analysis, empirical studies have also focused on some military, political, or economic blocs, such as the NATO, the EU, and the OECD. Moreover, the economic effects of militarization have been discussed empirically in the context of conflicted regions, namely the Middle East and Africa.

Secondly, the present paper differs from the previous in the methodological aspect. To this end, the long-term dynamic link between defense expenditures and unemployment will be estimated using the Cross-Sectional Autoregressive Distributed Lag (CS-ARDL) method introduced by A. Chudik, K. Mohaddes, M.

H. Pesaran and M. Raissi (2016). In the case of the cointegration relationship, the main advantages of this method originate from it capturing the effects of cross-sectional dependence (CD) both in the short- and in the long run even though the series are integrated at different orders. Furthermore, this paper also aims to bring a novel approach in terms of causality analysis, in which context the methodology having recently been introduced by A. Juodis, Y. Karavias and V. Sarafidis (2021) will be used to determine the causal interplay among the variables of interest in this paper. Beside the presence of CD, the methodology allows for the examination of the causal nexus between the variables. There is either homogeneity or heterogeneity in the panel data. Yet, it has the size and power advantages over its counterparts depending on whether the time dimension is bigger or smaller than the cross-sectional dimension. To the best of the authors' knowledge, neither technique has been

implemented so far in identifying the nexus between military spending and unemployment specifically.

Given the aforementioned issues, the rest of the study is organized as follows: in the following section, some figures regarding the trends in unemployment and defense burden over the sampled period in which countries tend to increase their military outlays due to the tensions between them despite the recent outbreak of COVID-19 are presented; in the third section, the theoretical and empirical literature is reviewed, whereas the section four discusses the issues pertaining to the data, model, and empirical strategy to be implemented. Section five is devoted to the results and discussions derived by conducting empirical analysis. Finally, in the section six, some concluding remarks and policy recommendations are reported through the results obtained from the econometric analysis.

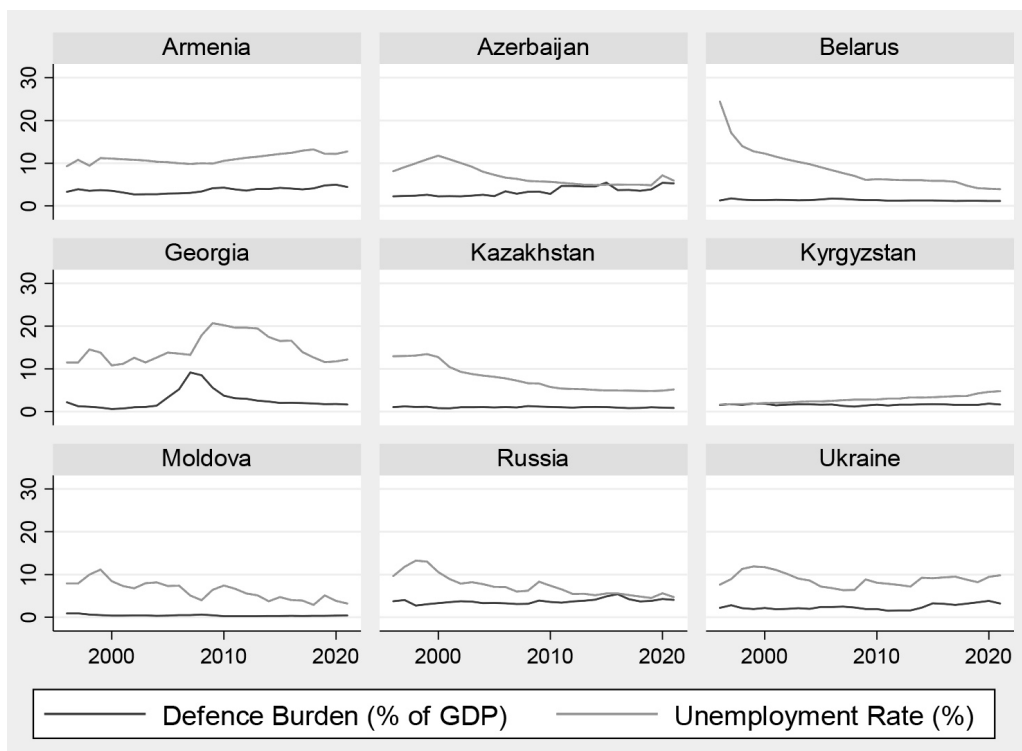


Figure 1 The trends in defense burden and the unemployment rate (in percentage)

Source: Authors

TRENDS AND FACTS

Despite the outbreak of COVID-19 and its ongoing detrimental economic effects in a global context, the increasing tendency in favor of militarization is still continuing. As reported by the Stockholm International Peace Research Institute (SIPRI, 2023), global military expenditures have recorded a historical peak of US \$2240 and have been rising for eight consecutive years. According to SIPRI (2023), governments all around the world allocate 6.2% of their budgets to their military requirements, which also corresponds to \$282 *per capita*. One of the main reasons for the recent rising tendency in military expenditure is the ongoing warfare between Russia and Ukraine. In particular, the neighboring countries and Europe as a whole have adversely been influenced since the outbreak of the war.

Apart from those global trends in militarization, the present study specifically focuses on the selected post-Soviet countries. Accordingly, Figure 1 presents some striking trends in defense burden and the unemployment rates despite the nonexistence of a uniform tendency between these variables.

Due to ongoing operations in the Southern Caucasus, Syria, and Libya, warfare in Ukraine has forced the Russian Federation to expand its military outlays almost twofold. Similar trends are observed in the Russian Federation's neighboring countries. In this respect, Belarus and Ukraine have experienced military expansion in the recent decade. The ongoing dispute over Nagorno-Karabakh since the end of the First Nagorno-Karabakh War induced the breakout of the Second Nagorno-Karabakh War between Armenia and Azerbaijan, both countries continuously increasing their military expenditure during the last two decades. Thus, the share of the defense expenditure in the GDP for both countries is at higher levels. One of the highest records was observed for Georgia, which suffered an invasion by the Russian forces due to the severe territorial issues over Southern Ossetia. To this end, with the outbreak of invasion in 2008, the share of the defense expenditure in the GDP has reached approximately 10%.

On the other hand, unemployment rates exhibit various tendencies for each country. It should be highlighted that the unemployment rates reach high levels mostly in Armenia and Georgia. With the outbreak of the Second Nagorno-Karabakh War in 2020, the unemployment rate tends to increase in Azerbaijan as well. In the earlier transition period, the unemployment rate was the highest in Belarus as compared with the countries included in the study's sample and managed to be alleviated by the earlier periods of the 2000s. Similar tendencies are also observed in Kazakhstan, where defense burden tended to increase between 2000 and 2010, whereas the unemployment rate tended to decline in that same period. It should be noted that the sampled period also coincides with the global financial turmoil that emerged as a subprime mortgage crisis in the USA and severely influenced the real sector worldwide. In this respect, some countries included in the sample are severely influenced by the outbreak of the subprime mortgage crisis. For instance, the unemployment rate in Armenia, Georgia, Moldova, Russia, and Ukraine increased more when compared to the rest of the countries included in the sample.

LITERATURE REVIEW

Differing from the studies examining the nexus between defense expenditures and economic growth, the literature in the field of defense economics also includes the studies that aim to examine the interplay between defense expenditures and unemployment, which are relatively scanty. It should also be noted that the empirical literature has not revealed a clear-cut relationship between defense expenditures and unemployment yet, so that the mechanisms which connect the nexus between the two variables might potentially vary. Nonetheless, the majority of the empirical studies have focused on the advanced economies or regional blocs to address the interconnectedness between defense expenditures and unemployment. In this respect, M. A. Hooker and M. M. Knetter (1994, 1997) examined the effects of curtails in military procurement spending on the unemployment rate for the USA utilizing the

panel data for the USA in each study. Nonetheless, in their earlier studies, the effect of reduction in military procurement spending on unemployment had been analyzed, whereas the latter study aimed to explain the effects of cuts in military procurement spending on employment growth across the states. In their previous study, M. A. Hooker and M. M. Knetter (1994) had concluded that a reduction in military procurement spending not only explained the variations in unemployment across the USA but also swelled up to the overall unemployment level by 0.15%. By conducting standard panel regressions and instrumental variable (IV) analysis, M. A. Hooker and M. M. Knetter (1997) highlighted the fact that variations in employment growth mainly stemmed from a reduction in military procurement spending as well. For the case of France, J. Malizard (2014) aimed to examine the long-term interplay between defense spending and unemployment. It is documented that both defense and nondefense expenditures have adverse long-term effects on unemployment, whereas the effects of the former are more dominant than those of the latter. In a more recent study, C. Michael and R. Stelios (2017) investigated the long-term relationship between defense spending and unemployment for Greece, Italy, Portugal, and Spain over the period from 1960 to 2015. The results of the empirical analyses confirmed the fact that increasing defense spending had reduced unemployment in Portugal and Greece, whereas the result was different in the case of Spain.

Advanced economies aside, numerous studies also focus on developing countries in the context of defense expenditures and the employment/unemployment nexus, to which end P. J. Dunne and D. Watson (2000) added to debate by considering the sectoral approach. In this context, employing the bounds test approach to cointegration, their findings indicate the fact that employment growth in the manufacturing sector of South Africa is negatively influenced by rising military expenditure in the long run. J. Yildirim and S. Sezgin (2003) constructed the constant elasticity of the substitution (CES) type production function in examining the effects of military expenditure on employment in Turkey in the long run by incorporating the annual timeseries data spanning from 1950 to 1997. The results revealed

the fact that military expenditures tended to have detrimental effects on employment either in the short- or in the long run so that the military budget was allocated more on imported cutting-edge arms. In contrast to the results reported by J. Yildirim and S. Sezgin (2003), Jr.-T. Huang and A.-P. Kao (2005) reported the positive long-term interconnectedness between the military outlays and employment for Taiwan. L. Qiong and H. Junhua (2015) estimated the long-term relationship between military expenditure and unemployment for China by performing the Autoregressive Distributed Lag (ARDL) Approach to Cointegration, which was also employed in the studies carried out by J. Yildirim and S. Sezgin (2003) and Jr.-T. Huang and A.-P. Kao (2005). The results demonstrated the fact that rising military expenditure upswung the overall unemployment rate while the nonmilitary components of government expenditure alleviated the overall unemployment rate. In their more recent paper, M. Azam, F. Khan, K. Zaman and A. M. Rasli (2016) focus on the four South Asian Association for Regional Cooperation (SAARC) countries to reveal the presence of the long-term relationship between military expenditure and unemployment by incorporating the annual panel dataset covering the period between 1980 and 2013. Although the results of the Panel Vector Error Correction Mechanism (VECM) test indicated the nonexistence of the short-term relationship, the long-term inverse relationship tended to exist between the military outlays and the overall unemployment rate. In a more recent study, I. A. Raifu and J. A. Afolabi (2023) considered the effect of structural breaks in dealing with the nexus between military spending and unemployment for South Africa by incorporating the quarterly timeseries data spanning from 1994 to 2019. Implementing the linear and nonlinear ARDL cointegration approaches, the authors came to the findings asserting that rising military spending is detrimental to unemployment in the long run.

With the developments in timeseries and panel data analyses, some empirical studies have also addressed the causality nexus between defense expenditures and employment/unemployment. To that end, S. Paul (1996) utilized a large data set of the OECD countries for the period between 1962 and 1988 in order to

investigate the presence of the causality relationship between defense spending and unemployment. The results showed that no significant causal interplay between defense spending and unemployment tended to exist overall. However, defense spending has substantial effects on the unemployment rate for Germany and Australia. For a large panel data set of 46 countries, J.- H. Tang *et al* (2009) find little or no evidence regarding the causality nexus from unemployment to military expenditure. Moreover, the selection of the proxy variables for militarization significantly influences the results, in which context they concluded that, for the non-OECD countries, unidirectional causality existed running from military expenditure to unemployment to the extent that military spending was expressed as a percentage of the GDP. Employing the panel bootstrap causality test, M. Zhong *et al* (2015) report the presence of unidirectional causality running from military spending to unemployment for Canada, Japan and the USA, whereas there it tends to be the opposite form of causality for France and Germany. In addition, the results reveal the existence of bidirectionality in Italy and the UK. Analogous to M. Zhong *et al* (2015), M. Sanso-Navarro and M. Vera-Cabello (2015) employed the panel bootstrap causality test to examine the causality nexus between military expenditure and unemployment for the EU-15 countries. It was documented that there was little evidence regarding the causality nexus between military expenditure and the unemployment rate. Nevertheless, a causal relationship was observed for some countries where personnel expenditure from the military budget was more dominant, or conscription was in force. Since most of the macroeconomic variables and interaction among them potentially exhibit asymmetric relationships, E. Anoruo, U. Akpom and Y. D. Nwoye (2018) investigated the nexus between military spending and unemployment for eight African countries by utilizing the Panel Smooth Transition Regression (PSTR) approach to account for the nonlinear association between the former and the latter. In the last instance, it was accentuated

that military expenditures had a positive effect on unemployment during the low inflation periods, whereas the opposite applied during the high inflation periods. Therefore, it is recommended that military spending should be increased during the period of low inflation periods so as to mitigate the unemployment problem in those countries.

More recently, J. Becker (2021) has examined the effect of unemployment on defense burden disaggregating the latter into personnel expenses and equipment modernization. By employing the panel-corrected standard errors and the Two-Stage Least Squares (2SLS) approaches on the annual panel data set of 34 countries from NATO and the EU over the period from 1991 to 2019, it was determined that defense burden strongly hinged on the developments in the labor markets. Moreover, the results revealed that the countries with high unemployment rates tended to spend less on defense and shift the resources from equipment modernization to personnel expenses. Apart from the aforementioned studies, G. Dudzevičiūtė and A. Šimelytė (2022) discussed the impact of military personnel and some major macroeconomic indicators on defense burden for Greece, Turkey, and the USA, which are the NATO members with the highest military expenditures. By incorporating the annual time series data and conducting the ARDL analysis, the results revealed that defense burden negatively interacted with the output changes in the cases of Turkey and Greece. On the other hand, inflation and the number of military personnel tended to have positive effects on defense burden in all the three countries in the long run.

In accordance with the intricate nature of the nexus between defense spending and unemployment, the current empirical literature exposes a sporadic situation as well. Beneath the veneer of this intricacy in the empirical literature, the next section aims to establish the model and empirical strategy in line with theoretical discussions and pivotal hypotheses of the paper.

DATA, MODEL AND ESTIMATION STRATEGY

Data

The primary objective of the present study is to investigate the long-term dynamic effects of defense burden on unemployment by paying special attention to the post-Soviet countries, most of which are also the members of the Commonwealth of Independent States (CIS)¹. Moreover, the outbreak of the war between Russia and Ukraine, the disputes over the Caucasus region between Russia and Georgia, the conflict between Armenia and Azerbaijan over the issue of Nagorno-Karabakh, and the internal political tensions in Kazakhstan and Kyrgyzstan are the pivotal factors in the selection of the sample countries. On the other hand, three Baltic countries (Estonia, Latvia and Lithuania) were excluded since they are currently the members of the EU and the NATO. Hence, due to the data limitations, the empirical analysis was limited to the nine post-Soviet countries by utilizing the annual balanced panel data set that spanned over the period from 1996 to 2021². Throughout the theoretical discussions and the main hypotheses of this present paper, empirical analysis was carried out incorporating the three variables in accordance with the studies by J.- H. Tang *et al* (2009), J. Malizard (2014), M. Zhong *et al* (2015), M. Sanso-Navarro and M. Vera- Cabello (2015), L. Qiong and H. Junhua (2015), Azam *et al* (2016) and Anoruo *et al* (2018). Apart from the main variables of interest, namely the unemployment rate (the dependent variable) and the defense burden measured by military expenditure as a percentage of the GDP, the GDP *per capita* was also

included as a proxy variable in identifying whether an inverse relationship between the output growth and unemployment is perceived, which is well-known macroeconomic phenomena pioneered by Okun's Law. Except for the data on defense burden, the data on unemployment and the GDP *per capita* were compiled from the World Development Indicators (WDI) Database of the World Bank. The data pertaining to defense burden were gathered from the Military Expenditure Database of the Stockholm International Peace and Research Institute (SIPRI), which generates data on military outlays, arms production and trade in a global context. It should also be noted that all the variables were converted into a natural logarithmic form. The abbreviations, definitions, and sources of data regarding the variables are presented in Table 1.

On the other hand, Table 2 displays the descriptive statistics regarding the variables incorporated in the empirical analysis. Since the difference between the maximum and minimum values is higher for defense burden (LD) and the unemployment rate (LU) is lower, which is the main interest of the variables, the values of the standard deviation are relatively lower indicating a lesser volatility across the countries and the time periods. However, the standard deviation of the GDP *per capita* (LY) is strikingly higher, so that the difference between the maximum and minimum values is significantly higher.

Model and estimation strategy

In order to reveal the dynamic link between defense burden and unemployment, the following baseline specification will be incorporated by including the GDP *per capita* as the output growth proxy:

Table 1 The definitions and sources of the variables

Variables	Unit	Abbreviation	Data Source
Unemployment Rate	As percentage	LU	World Bank
Defense Burden	Military expenditure as a percentage of the GDP	LD	SIPRI
Real GDP <i>per capita</i>	Constant 2015 US \$	LY	World Bank

Note: The capital L denotes the natural logarithm of the corresponding variable.

Source: SIPRI and the World Bank.

Table 2 The descriptive statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
LU	234	0.5818	0.7414	-1.3360	2.2147
LD	234	1.9868	0.5283	0.4842	3.1945
LY	234	24.1888	1.7227	21.7769	28.0299

Note: The descriptive statistics of all the variables are computed in their natural logarithms.

Source: Authors.

$$LU_{it} = f(LD_{it}, LY_{it}) \tag{1}$$

where LU_{it} , LD_{it} , and LY_{it} denote the natural logarithms of unemployment, defense burden, and the GDP *per capita*, respectively, whereas the subscripts i and t denote the cross-sectional unit and the time dimensions, respectively.

In the case of the cross-sectional dependence (CD) with different integrations of the series, the long-term link across the variables will be examined using the CS-ARDL approach, which was introduced by A. Chudik *et al* (2016). It should be noted that the CS-ARDL approach has some superior traits over its counterparts. First, it considers the presence of cross-sectional dependence and slope heterogeneity in panel data. To that end, it facilitates the CD both in the short and in the long run. In addition, this approach captures the long-term effects, which are estimated by controlling the unobservable factors associated with the baseline specification. Second, it is a dynamic approach in which the lagged-dependent variable enters as the weak exogenous regressor under the error-correction mechanism (Sohag, Chukavina & Samargandi, 2021). Accordingly, the CS-ARDL representation of the baseline specification reads as follows:

$$\begin{aligned} \Delta LU_{it} = & \mu_i + \phi_i (LU_{it-1} - \beta_i X_{it-1} - \gamma_{1i} \overline{LU}_{t-1} - \gamma_{2i} \overline{X}_{t-1}) + \\ & \sum_{j=1}^{p-1} \theta_{ij} \Delta LU_{it-j} + \sum_{j=0}^{q-1} \vartheta_{ij} \Delta X_{it-j} + \\ & \sigma_{1i} \Delta \overline{LU}_t + \sigma_{2i} \Delta \overline{X}_t + \varepsilon_{it} \end{aligned} \tag{2}$$

where ΔLU_{it} is the dependent variable, whereas X_{it} represents the vector of the independent variables in which LD and LY are involved. The long-term expected

values of both the dependent and the independent variables are denoted by \overline{LU}_{t-1} and \overline{X}_{t-1} , whereas the short-term value for the dependent variable and the set of the independent variables are denoted by ΔLU_{it-j} and ΔX_{it-j} , respectively. ΔLU_t and ΔX_t represent the expected values in the short run; β_i represents the estimated coefficient of the independent variables, θ_{ij} represents the short-term coefficient of the dependent variable; ϑ_{ij} denotes the short-term coefficients of the independent variables. Finally, σ_{1i} and σ_{2i} denote the coefficients of the expected values and ε_{it} denotes the conventional error term.

The empirical analysis in the present study will be augmented by performing the recently developed panel Granger noncausality approach. A. Juodis *et al* (2021) tailored a new method in testing for Granger noncausality not only in the presence of cross-sectional dependence, but also in the presence of either homogeneity or heterogeneity. Moreover, the test cannot suffer size distortions even if the time dimension (T) is smaller than the cross-sectional dimensions (N). In other words, it has the powerful advantage in the presence of the large N and the small T, and can produce the results that are more efficient when compared to the counterparts, namely to E. L. Dumitrescu and C. Hurlin (2012) (Xiao, Karavias, Juodis, Sarafidis & Ditzen, 2023). By setting linear restriction on the Granger causation parameters, A. Juodis *et al* (2021) assumed the following linear dynamic panel data model:

$$y_{i,t} = z'_{i,t} \theta_i + x'_{i,t} \beta_i + \varepsilon_{i,t} \tag{3}$$

where $z_{i,t} = (1, y_{i,t-1}, \dots, y_{i,t-p})'$, $x_{i,t} = (x_{i,t-1}, \dots, x_{i,t-p})'$, $\theta_i = (\theta_{i,t-1}, \dots, \theta_{i,t-p})'$ and $\beta_i = (\beta_{1i}, \dots, \beta_{pi})'$.

In addition, $i=1, \dots, N$ denotes the cross-sectional unit, $t=1, \dots, T$ denotes the time dimension, whereas $p=1, \dots, P$ denotes the lag length for the heterogeneous autoregressive coefficient. The null hypothesis of $x_{i,t}$ does not Granger-cause of $y_{i,t}$ by the pooled least squares estimator of β , which A. Juodis *et al* (2021) develop in the following form:

$$\hat{\beta} = \left(\sum_{i=1}^N X_i' M_{Z_i} X_i \right)^{-1} \left(\sum_{i=1}^N X_i' M_{Z_i} y_i \right) \tag{4}$$

where $M_{Z_i} = I_T - Z_i (Z_i' Z_i)^{-1} Z_i'$. According to A. Juodis *et al* (2021) the pooled least squares estimator of β suffers a Nickell bias, so A. Juodis *et al* (2021) suggest the half-panel jackknife (HPJ) method pioneered by G. Dhaene and K. Jochmans (2015) to eliminate the bias. Thus, A. Juodis *et al* (2021) derived the following bias-corrected version of the Wald test for Granger noncausality in the following form (Xiao *et al*, 2023):

$$\widehat{W}_{HPJ} = NT \tilde{\beta}' (\hat{J}^{-1} \widehat{V} \hat{J}^{-1})^{-1} \tilde{\beta} \tag{5}$$

where $\hat{J} = \frac{1}{NT} \sum_{i=1}^N X_i' M_{Z_i} X_i$ and $\tilde{\beta}$ is the HPJ estimator that removes the bias associated with the pooled estimator under homogeneity restriction. Accordingly, the discussion on the empirical results will be documented in Section 5 below through the above-mentioned methodological arguments.

EMPIRICAL RESULTS AND DISCUSSION

The first step of this empirical investigation commences with checking the presence of cross-country dependence and slope homogeneity. Since

the countries in the present sample have almost analogous economic and political structures, any shocks (economic, commercial, financial, political, etc.) that arise in one country may potentially influence the rest of the countries in the sample. Thus, it is crucial to check for the presence of cross-country dependency in order to conduct efficient analyses in further steps. Pioneered by M. H. Pesaran (2004), the left-hand segment of Table 3 reports the results of the CD and CD_{LM} tests with respect to each specification. The null hypothesis of cross-sectional independence is firmly rejected by each test since the computed test statistics are significant at the 1% significance level. On the other hand, the homogeneity of slope parameters in a linear model is examined by the homogeneity tests introduced by M. H. Pesaran and T. Yamagata (2008). In this respect, the right-hand segment of Table 3 reports the results of the homogeneity tests, which on their part clearly highlight the rejection of the null hypothesis of slope homogeneity to the extent that the corresponding test statistics exceed the critical values at the 1% significance level.

Before investigating the presence of the long-term interplay across the variables, it is crucial to check for the integration order of the variables so that, in the presence of the unit root, further analyses may produce spurious results. In this respect, various types of panel unit root tests were performed so as to check for the integration order of the considered variables. Depending on the existence of cross-sectional dependence and homogeneity/heterogeneity conditions, those tests are classified as the first-generation and second-generation panel unit root tests. Table 4 reports the results of the panel unit root tests. It should be noted that the underlying

Table 3 CD tests and slope homogeneity

Cross-Sectional Dependency Tests			Homogeneity Tests		
	Test statistics	p-value		Test statistics	p-value
CD Test	21.705	0.000*	$\tilde{\Delta}$ Test	20.691	0.000*
CD_{LM} Test	54.218	0.000*	$\tilde{\Delta}$ adj Test	22.493	0.000*

Note: *denotes the significance level at 1%.

Source: Authors

assumptions and the test statistics of each test might differ as well. The test pioneered by A. Levin, F.-C. Lin and C. J. Chu (hereinafter referred to as the LLC) (2002) is appropriate under the homogeneity of conditions, whereas the tests suggested by G. S. Maddala and S. Wu (1999) and K. S. Im, M. H. Pesaran & Y. Shin (hereinafter referred to as the IPS) (2003) are more appropriate in the case of heterogeneity in panel data. Moreover, the LLC test is based on t-statistics, whereas the IPS and Fisher-type tests (the ADF and PP tests, respectively) are based on the W-statistics and Fisher χ^2 -statistics (Chakraborty, 2023). To this end, the results of the first-generation tests produce consistent results. Except for the series of LD, the series of LU and LY become stationary by the first differencing.

Due to the aforementioned shortcomings associated with the issues of cross-sectional dependence and slope heterogeneity, the first-generation tests might produce spurious inferences, in which context, the stationarity of the variables is also checked by employing the so-called second-generation test pioneered by M. H. Pesaran (2007). Differently from the first-generation tests, the consideration of the cross-sectional dependence and heterogeneity issues is the basic characteristic of the second-generation-type tests. In line with the IPS test, M. H. Pesaran (2007) developed the unit root test suitable in the presence of cross-sectional dependence and heterogeneity. In order to wipe out cross-sectional dependence, M. H. Pesaran (2007) derived the cross-sectional augmented version of the IPS (CIPS) test,

in which the common factor approach was used to eliminate CD. Accordingly, the results of the CIPS test are presented in the last column of Table 4. The results of the CIPS test endorse the results obtained by the implementation of the first-generation unit root tests, in which context, the series of defense burden is integrated at the level, whereas the series of the unemployment rate and the GDP *per capita* become stationary after the first differencing. In other words, I (1). Thus, the mixed order of the integration of the variables in the presence of CD and heterogeneity makes it feasible to apply the CS-ARDL technique to investigate the long-term relationship.

In the case of CD and heterogeneity, on the one hand, and the mix order of integration among the variables, the cointegration relationship is examined employing the CS-ARDL approach. Developed by A. Chudik *et al* (2016), this approach can eliminate the CD bias for different time horizons. Throughout the baseline specification, the CD bias is eliminated in the short run (Model 1), in the long run (Model 2), and jointly (in the short and long run) in Model 3. In other words, Model 1 eliminates the CD bias in the short-term estimators, whereas Model 2 eliminates the CD bias in the long-term estimators. Furthermore, Model 3 eliminates the CD bias in either estimator with respect to each time horizon. The sign of the error-correction term (EC_{t-1}) is negative and statistically significant in each model. Thus, the long-term interplay tends to exist between unemployment, defense burden, and the GDP *per capita*. However, the speed of adjustment to the long-term equilibrium path is 12.4% per year to

Table 4 The panel unit root tests

Variables	LLC	IPS	ADF	PP	CIPS	Outcome
LU	0.6869	0.3220	0.8516	-0.4035	-1.395	
Δ LU	-8.9237*	-8.8599*	8.8645*	31.1553*	-4.746*	I (1)
LD	-3.9234*	-3.2985*	2.8519*	2.0382**	-1.687***	
Δ LD	-7.8566*	-9.1250*	11.2760*	33.8880*	-4.614*	I (0)
LY	0.0259	2.4402	-1.5807	0.2783	-1.365	
Δ LY	-6.6948*	-6.7413*	7.8646*	14.9250*	-3.557*	I (1)

Note: *** denotes the significance level at 1%. The critical values for the CIPS test at 1%, 5% and 10% significance levels are -2.93, -2.76, and -2.66, respectively.

Source: Authors

the extent that is relatively lower with respect to the other models. After the elimination of the CD bias, the speed of adjustment to the long-term equilibrium is 22.8% in Model 2, and 22.6% in Model 3.

The detection of the long-term interplay across the variables leads to checking for potential causality relationships as well. Differently from the standard M. H. Pesaran (1969) causality test, in which the CD and heterogeneity issues are ignored, the A. Juodis *et al* (2021) panel Granger noncausality test was used, the results of the test being accounted for in Table 6 and showing the presence of unidirectional causality from defense burden to unemployment, with respect to which, the null hypothesis reading that LD does not Granger-cause LU is rejected at the 10% significance level. Moreover, there is also unidirectional causality from the GDP *per capita* to unemployment to the extent

validating the presence of Okun's Law. Thus, the null hypothesis reading that LY does not Granger-cause LU is clearly rejected at the 5% significance level. Unidirectional causality is also perceived between the GDP *per capita* and unemployment, in which context, the null hypothesis reading that LY does not Granger-cause LU is rejected at the 5% significance level.

Overall, the results support those documented by P. J. Dunne and D. Watson (2000), J. Yıldırım and S. Sezgin (2003) and L. Qiong and H. Junhua (2015). Furthermore, in the sense that the presence of the causality relationship between defense burden and the unemployment rate, the results of the present study also tend to support the results reported by J.- H. Tang *et al* (2009), M. Zhong *et al* (2015), and Anoruo *et al* (2018). As argued by M. Sanso-Navarra and M. Vera-Cabello (2015), a possible explanation

Table 5 The CS-ARDL model results

	CD in SR (Model 1)	CD in LR (Model 2)	CD in SR & LR (Model 3)
EC_{t-1}	-0.1242 (0.0630)**	-0.2289 (0.0963)**	-0.2263 (0.1133)**
Long-term coefficients			
LD_{t-1}	0.3624 (0.1042)*	0.3986 (0.0733)*	0.4620 (0.0474)*
LY_{t-1}	-0.0430 (0.0611)	-0.5773 (0.1109)*	-0.1195 (0.1135)
Short-term coefficients			
ΔLD	-0.0844 (0.0796)	0.0111 (0.0456)	-0.0253 (0.0698)
ΔLY	-0.5180 (0.2170)**	-0.8051 (0.2700)*	-0.4919 (0.2647)***
Constant	0.3876 (0.1807)**	-0.8992 (0.3797)**	-2.1973 (1.1228)**

Note: *** denotes the significance level at 1%. The standard errors are given in parentheses.

Source: Authors

Table 6 The panel Granger noncausality test results

Direction of causality	HPJ Wald Test	Outcome
LD → LU	3.4108 (0.0648)***	H_0 is rejected
LU → LD	0.4915 (0.4833)	H_0 is not rejected
LY → LU	4.4175 (0.0356)**	H_0 is rejected
LU → LY	2.4955 (0.1142)	H_0 is not rejected
LD → LY	2.0278 (0.1544)	H_0 is not rejected

Note: ** and *** denote the significance levels at 5% and 10%. The corresponding p-values are given in parentheses.

Source: Authors

could be that, rather than being made on capital-intensive, defense expenditures in those countries are inclined more on labor-intensive to the extent that forced conscription or mandatory military service is in force even though the duration of those services depends on respective legislations and the situation those countries are being faced with.³ Thus, except for Russia, which is one of the major arms producers and exporters in the world, the allocation of the budgetary sources could be channelized more to a personnel expenditure rather than the provision of arms products with cutting-edge technologies. Therefore, the anticipated outcome regarding the diffusion of technology to the civilian sector and the associated increase in labor productivity and employment may not be realized.

CONCLUSION

The present study focuses on the long-term dynamic link between defense burden and unemployment for the selected CIS countries where intensive conflicts have broadly been observed in recent years under the shadow of the warfare between Russia and Ukraine. Furthermore, the interplay between defense burden and unemployment were investigated in a novel empirical approach. In this respect, the long-term dynamic link was examined using the CS-ARDL approach that has never been implemented before in the empirical analyses specifically addressing the nexus between defense expenditures and employment/unemployment. The results obtained from all the three versions of the CS-ARDL model have confirmed the existence of the positive dynamic link between defense burden and unemployment, meaning that increasing defense spending tends to accelerate the unemployment rate in those countries. The panel Granger noncausality test by A. Juodis *et al* (2021) has also verified these results.

In line with the results, the characteristics of defense expenditures in those countries could be prone to more labor-intensive rather than capital-intensive, except for Russia, which is one of the leading arms producers and exporters in the global context

and with the potential to invest more in cutting-edge technologies in arms production. Therefore, anticipated productivity gains may not be realized without the diffusion of military technology to the civilian sectors. Since forced conscription is in force in all the countries included in the sample, it is quite plausible that the countries tend to channel their budgetary sources to a personnel expenditure. In order to generate additional employment opportunities associated with productivity rises, governments should allocate defense expenditures in a capital-intensive manner so as to enable the production of cutting-edge technology arms in the country. Moreover, governments should also reinforce cooperation with civil or private sector companies for the provision of defense goods. Beside the diffusion of technology in the country, the provision of those goods would also strain the external dependence of the military sector in general. Thus, the pressure on governments' budgets and the balance of payments would be mitigated as well. Beyond the characteristics of defense expenditures in those countries, governments should channel the budgetary sources to the productive fields that trigger private investments, which are likely crowded out by the defense expenditures of the governments. In line with the results highlighted in the present study, the governments in those countries should gradually constrain defense expenditure in the long run in order to channel the budgetary sources to productive fields.

Despite those major findings and policy implications, this paper has some limitations that are worth mentioning in conducting future studies in this field. The basic limitation of this empirical endeavor hinges on the sample countries. Due to the limitations of the available data for some countries (i.e. for Tajikistan and Uzbekistan), the empirical analysis was limited to those nine post-Soviet countries. Moreover, the three Baltic countries (Estonia, Latvia and Lithuania) were excluded from the sample since they are involved in different economic and political blocs by having integrated with the EU and NATO. Therefore, further empirical analyses could be strengthened by including those countries as well. In addition, the outbreak of the war between the Russian Federation and Ukraine has not only influenced both countries, but their

neighboring countries and European countries as well. In this respect, the majority of the European countries have allocated more budgetary resources to their respective national defense since the outbreak of said war. Thus, future empirical studies could be extended involving those European countries, too. Furthermore, with the availability of proper data for empirical analysis, future studies could be carried out taking into consideration the presence of structural breaks in unveiling the dynamic interplay between militarization and unemployment, together with the other macroeconomic indicators thought to be influenced by changes in defense expenditures.

ENDNOTES

- 1 Currently, the CIS consist of nine states and one associated state, namely Turkmenistan. Due to the data availability issue, Tajikistan and Uzbekistan have not been included in the empirical analyses. Even though Moldova and Ukraine have been ceased the CIS protocol as the founding members, they were included in the empirical analyses instead of Tajikistan and Uzbekistan. For the current discussion on the membership status of the countries, see: https://en.wikipedia.org/wiki/Commonwealth_of_Independent_States.
- 2 Since Estonia, Latvia and Lithuania are the current members of the EU and NATO, they are excluded from the empirical analyses because they are involved in a different political and military bloc.
- 3 To learn where conscription is currently in force with respect to the sex and duration for the countries included in the sample, go to <https://worldpopulationreview.com/country-rankings/countries-with-mandatory-military-service>.

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APPENDIX

A. 1. The list of the post-Soviet Union countries

Azerbaijan	Georgia	Moldova
Armenia	Kazakhstan	Russian Federation
Belarus	Kyrgyzstan	Ukraine

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DOES FINANCIAL TECHNOLOGY REDUCE INFLATION? LESSONS LEARNT FROM SUMATRA

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The purpose of this paper is to investigate the impact of financial technology (Fintech) on the inflation rate. The contribution reflects in the creation of a new index for Fintech, involving several indicators using principal component analysis. The data utilized belong to a panel dataset pertaining to the 10 provinces of the island of Sumatra, Indonesia, spanning from January 2020 to June 2023. The pooled mean group (PMG) estimation method is employed in order to test the relationship between Fintech and the inflation rate. The research findings of the study indicate that Fintech is capable of reducing inflation in the long run. Therefore, this research study implies the necessity to intensify the use of Fintech for the purpose of creating an efficient economic environment and promoting economic stability.

Keywords: financial technology, inflation, Sumatra, pooled mean group

JEL Classification: E31, G23

INTRODUCTION

Digitalization has shaped a new habitus in the economy, altering the structure and patterns of interaction among economic players, including households and businesses. The intensity of digitalization has become more pronounced following the COVID-19 pandemic. The social activity restrictions during the COVID-19 pandemic have necessitated societal adaptation to the interaction

patterns that minimize physical contact. In response to this, various innovation disruptions have emerged based on leveraging information technology to support all societal activities, such as commercial activities, teaching and learning, as well as office-related tasks. Furthermore, the adoption of digital technology is a strategic effort to modify business processes so as to accommodate evolving business and market demands (Adeyinka, 2023).

Financial technology (Fintech) represents the form of disruptive innovation that amalgamates technology and financial services so as to support more modern business models (Chang, Baudier, Zhang, Xu, Zhang & Arami, 2020). Fintech serves as a reflection

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of the digitization progress within the financial services industry based on information technology (Puschmann, 2017). Disruptive innovations such as Fintech have disrupted conventional models in the financial services industry, impacting the industry's structure, intermediary technologies, and marketing models (Beck & Smits, 2018; Al nawayseh, 2020; Alt, Machkour & Abriane, 2020). Furthermore, the presence of Fintech has become an alluring force due to a shift in societal preferences towards online financial services, utilizing the Internet media for digital access. In turn, the incorporation of technology in the financial services industry is becoming a part of the innovation diffusion process aiming to offer transactional convenience to the entire community.

Fintech has the potential to offer various solutions that traditional financial institutions have thus far been unable to provide. Fintech plays an important role in reaching diverse groups of people, particularly the unbanked, by providing them with access to finance. Moreover, the advantages of the Fintech business model highlight cost efficiencies in financial services, the enhanced accessibility and quality of financial services, and the establishment of a more diverse financial landscape (Jagtiani & Lemieux, 2018). Therefore, Fintech can contribute to economic efficiency through reduced transaction costs and the improved allocation of capital and loans.

The cost reduction resulting from the use of Fintech is expected to lead to increased efficiency in the output supply within the economy, thereby exerting downward pressure on inflationary conditions, which assertion is supported by the previous studies examining the impact of Fintech adoption on inflation. The findings of Y. B. Romdhane, S. Kammoun and S. Loukil (2023) consistently demonstrate the fact that Fintech plays a role in reducing inflation in several Asian countries. This study implies that the government should prioritize the enhancing of the digital infrastructure in order to accelerate Fintech development. In the context of Indonesia, R. P. Hariadhy, A. S. Danutirta and M. Lubis (2022) investigated the relationship between the development of Fintech and the monthly inflation rate, their findings indicating that the development of

Fintech correlated negatively with monthly inflation in Indonesia.

Spatially, the regions in Sumatra Island, Indonesia, hold a significant potential for the development of financial technology. This potential can be identified through several indicators. Firstly, based on data obtained from East Ventures (EV), the digital competitiveness index shows that the index increased for all the provinces in Sumatra in 2022 compared to the previous year. Notably, Northern Sumatra and the Riau Islands rank among the top 10 provinces in Indonesia with the highest digital competitiveness and literacy indices. Secondly, according to the latest data obtained from the Financial Services Authority (OJK) spanning from April 2022 to April 2023, the cumulative value of the loans disbursed by Fintech lending indicates that Sumatra's provinces collectively contributed nearly 50% (49.45%) to the total loan disbursement for the non-Java region.

The development of Fintech in Sumatra Island provides a potential intervention to address inflation stability amidst the increasing inflation rate in various regions in Sumatra Island. However, the influence of Fintech on inflation needs to be further identified. Several previous studies have confirmed the role of Fintech in stabilizing inflation rates (Romdhane *et al*, 2023; Mittal, Kathuria, Saini, Dhingra & Yadav, 2023). However, there are other studies that present contrasting findings, suggesting that the presence of Fintech may worsen inflation rates. The study by A. Anggraini and G. Agustin (2022) found that an increase in credit card transactions would support inflation through the intervening variable of money velocity. Furthermore, the findings of B. D. Saraswati, G. Maski, D. Kaluge and R. K. Sakti (2020) also provide the evidence that the development of Fintech will affect the effectiveness of monetary policies in Indonesia, particularly in maintaining long-term inflation stability.

There is a fact that the inflation trends in the provinces of Sumatra continue to rise, which is coupled with the inconsistent results regarding the impact of Fintech on the inflation rate. This study aims to investigate whether Fintech can or cannot play a role in reducing

the inflation rate in Sumatra. To the best of the author's knowledge, no previous studies have been conducted on Fintech and inflation rates, specifically not so for the provinces of Sumatra. Prior studies have only encompassed broader regions, such as Indonesia (Narayan & Sahminan, 2018; Saraswati *et al*, 2020), Asia (Romdhane *et al*, 2023), the MENA zone countries (Kammoun, Loukil & Loukil, 2020), and 30 countries (Mumtaz & Smith, 2020). Therefore, this study seeks to provide additional references and fill the research gap by examining Fintech studies on inflation at the regional level. The data used in this study consist of the panel data obtained from the provinces in Sumatra Island for the period from January 2021 to June 2023. Subsequently, the hypothesis tested in this study is as follows:

H1: Fintech has a significant statistical impact on inflation in Sumatra Island.

The pooled mean group (PMG) method will be used to estimate and test the hypothesis in this study. The remainder of this research is structured into a few more sections. The second section provides a summary of the empirical findings from the existing literature. The third section explains the research methodology and data. The fourth section presents the empirical results and discussions, while the conclusions are presented in the fifth section.

REVIEW OF THE EMPIRICAL LITERATURE

In the digital era, the role of the Internet and information technology has become a primary focus in inflation analysis in a lot of countries. M. N. Çoban (2022) notes an interesting phenomenon that, with the increasing penetration of the Internet, the inflation rates in the ASEAN-5 countries show a declining trend. This observation aligns with the findings of M. H. Yi and C. Choi (2005), who state that increased investment in the Internet infrastructure may help reduce inflation. The underlying rationale is that the rapid development of the Internet has the potential to alter the traditional correlation between money and inflation.

Furthermore, A. F. Priyono (2016) asserts that the Internet should be leveraged not only for communication, but also for research and development and cost efficiency as well. In other words, the utilization of the Internet that enhances cost efficiency is expected to have a deflationary effect on commodity prices. Similarly, K. Charbonneau, A. Evans, S. Sarker and L. Suchanek (2017) also document the deflationary effects of digitization in European countries, although they suggest that such implications should be addressed by policymakers.

The digitization wave and an increased penetration of the Internet particularly in the financial sector have catalyzed the rapid evolution of Fintech. Fintech has transformed the financial industry, particularly in the domains of loan offerings, payments, investments, and various financial services. Through its efficiency and accessibility, Fintech has the potential to influence monetary dynamics and ultimately impact inflation rates. In response to these changes, M. Z. Mumtaz and Z. A. Smith (2020) examined the role of Fintech in the transmission mechanism of the monetary policy and found that the development of Fintech did not alter the velocity of money and the income multiplier. However, mobile and digital technologies, the cryptocurrencies like Litecoin and Ethereum included, emerge as the strong predictors of money demand. Their research also indicates that the monetary policy has a significant effect in post-Fintech implementation, with higher monetary policy rates increasing borrowing costs and broadening the output gap.

Meanwhile, S. W. Narayan and S. Sahminan (2018) explored the influence of Fintech on Indonesia's macroeconomy, specifically so on its potential to curb inflation and strengthen the rupiah against the US dollar. Another research study carried out by Y. B. Romdhane *et al* (2023) sought to clarify the impact of Fintech on Asian economies, with a specific focus on the two pivotal indicators — namely inflation and unemployment — during the period spanning from 2011 to 2017. This investigation reveals a robust and positive correlation between the progress of financial technology and a reduction in both inflation and unemployment, particularly when such technological

advancements are actively embraced. Digital finance essentially emerges as a newfound catalyst in propelling economic development.

Additionally, the study conducted by B. D. Saraswati *et al* (2020) investigated the impact of financial inclusion and Fintech on the efficacy of the monetary policy, specifically through the interest rate channel considering the cost of capital and substitution effects. Their empirical findings reveal that financial inclusion influences the inflation rate, serving as a proxy for the effectiveness of the monetary policy, both in the short run and in the long run. Conversely, Fintech exerts an influence on inflation only in the short run. Similarly, R. Mittal *et al* (2023) explored the interplay between financial inclusion, Fintech, and the effectiveness of the monetary policy in India, only to identify in their study a positive association between financial inclusion, Fintech, and inflation as a proxy for the efficacy of the monetary policy, both in the short run and in the long run. However, the relationship between Fintech and inflation turns to be negative when the cost of the capital effect is integrated in the model.

B. D. Saraswati, G. Maski, D. Kaluge and R. K. Sakti (2022) studied the impact of Fintech on household consumption. Their empirical findings indicate that Fintech has a positive impact on household consumption both in the short run and in the long run. These findings suggest that, while Fintech can drive economic growth, it may also encourage higher consumption, which could potentially lead to an increase in inflation. Additionally, D. S. Puspita, B. D. Saraswati and A. T. Pertiwi (2023) examined the influence of e-money on inflation in Indonesia and found that e-money had a negative effect on the inflation rate, indicating that e-money was capable of controlling inflation. Therefore, a cashless society policy is an appropriate measure to control inflation rates.

The current research confirms the fact that Fintech does play a crucial role in controlling inflation, which indicates that the Fintech revolution, with all its innovations and efficiencies, can influence inflation dynamics differently from traditional factors.

According to the previously reviewed literature, many researchers have delved into the determinants of inflation, such as the money supply level (Long, Hien & Ngoc, 2021; Islam, 2022), interest rates (Mishkin, 1992; Booth & Ciner, 2001), exchange rates (Pham, 2019; Valogo, Duodu, Yusuf & Baidoo, 2023), oil prices (Köse & Ünal, 2021; Zakaria, Khiam & Mahmood, 2021), and government spending (Kandil, 2005; Zhang, 2022). However, despite numerous traditional factors influencing inflation, the role of Fintech in this context seems to have received insufficient attention.

With its specific focus on Sumatra Island, this study aims to fill the gap in the literature by investigating how Fintech influences inflation in the region. Understanding the contribution of Fintech to inflation dynamics is expected to provide new insights for policymakers and relevant stakeholders.

RESEARCH METHOD AND DATA

Data and variables

Over the past seven years, there has been a notable increase in the number of the registered Fintech companies with the Indonesian Fintech Association (AFTECH), as is shown in Figure 1. Concurrently, Figure 2 shows that the inflation rates across nearly all the regions of Sumatra have consistently surpassed the national average, simultaneously having shown a rising trend over the last three years. These trends highlight the significance of examining the economic dynamics and regional stability in Sumatra.

The data analyzed in this research study consist of the secondary time series data covering the monthly period for the 10 provinces of Sumatra Island, namely Bengkulu, Jambi, Bangka Belitung Islands, Riau Islands, Lampung, Aceh, Riau, Western Sumatra, Southern Sumatra, and Northern Sumatra from January 2020 to June 2023. The data were obtained from various government agencies, including Statistics Indonesia, Bank Indonesia, and the Financial Services Authority.

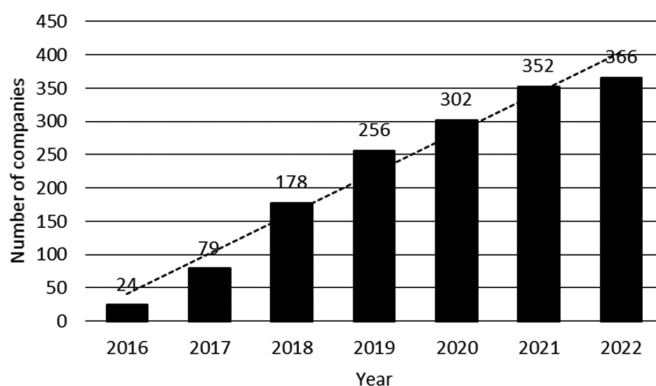


Figure 1 The number of the Fintech companies in Indonesia from 2016 to 2022

Source: Authors, based on AFTECH, 2023

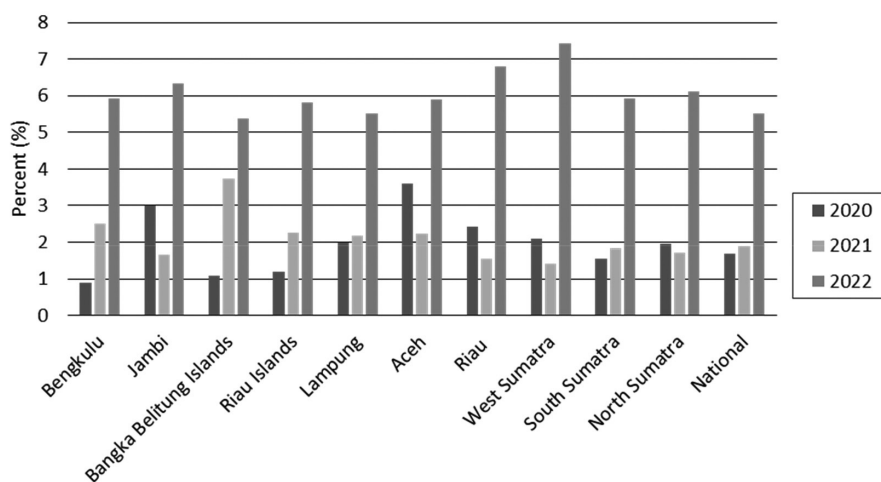


Figure 2 The inflation rate trends of the provinces in Sumatra from 2020 to 2022

Source: Authors

To examine the impact of Fintech on inflation, the consumer price index (CPI) was employed as the dependent variable. Given the limitations of global availability for the Fintech index data, Fintech was proxied in this study by the financial inclusion index formed from the four variables reflecting the activities of the financial technology use. These variables include ATM transaction value, credit card transaction value, the number of electronic money cards, and the cumulative distribution of loans. The indicators of the

Fintech index can be observed in Table 1 in detail. The selection of the Fintech index components was based on data availability and referred to the variables for the index construction by G. Feng, W. Jingyi, W. Fang, K. Tao, Z. Xun and C. Zhiyun (2019). Furthermore, the Fintech index used in this study was constructed using Principal Component Analysis (PCA), the method previously applied in the studies by C.-C. Lee, X. Li, C.-H. Yu and J. Zhao (2021). In this study, PCA was utilized so as to reduce the dimensionality

of the data from the correlated variables through linear transformation, obtaining a single measure. The resulting index can depict the overall variability among the correlated Fintech components (Ahamed & Mallick, 2019; Lee *et al*, 2021).

In an effort to control the external variables that may influence inflation, the four control variables - the exchange rate (ER); the interest rate (IR); money supply (MS); and the gross regional domestic product (GRDP) were introduced in order to avoid simultaneous bias. The current studies have confirmed that inflation is influenced by the exchange rate (Valogo *et al*, 2023), the interest rate (Nchor & Darkwah, 2015), money supply (Long *et al*, 2021), and the GDP (Koulakiotis, Lyroudi & Papasyriopoulos, 2012). Table 1 explains the operationalization of the variables used in this study.

Model specification

This study aims to identify the influence of Fintech on the inflation rate in Sumatra Island region. The model employed in this study adopts a dynamic approach, taking into consideration the factors of inertia or adjustments that occur as the community needs to adapt to developments in financial technology. Consequently, the impact of Fintech cannot directly affect the inflation rate due to the presence of the lag factors. The model utilized in this study reads as follows:

$$\text{Log_INF}_{it} = \beta_0 \text{Log_INF}_{it-1} + \beta_1 \text{FTI}_{it} + \beta_2 \text{Log_ER}_{it} + \beta_3 \text{IR}_{it} + \beta_4 \text{Log_MS}_{it} + \beta_5 \text{Log_GRDP}_{it} + \varepsilon_{it} \quad (1)$$

where INF_{it} represents the inflation rate proxied by the consumer price index, FTI_{it} depicts the Fintech index, ER_{it} , IR_{it} , MS_{it} , and GRDP_{it} serve as the control variables for the exchange rate, the policy interest rate of the Bank Indonesia, money supply, and the gross

Table 1 The operationalization of variables

Variable	Measurement	Definition	Source
Consumer price index (INF)	Index	The consumer price index in a certain region.	Statistics Indonesia
Indicators of Fintech			
Transaction value at ATMs (ATM)	Million Rupiah	The total transaction value on ATM cards includes both cash withdrawal transactions and/or fund transfers.	Bank Indonesia
The value of credit card transactions (CREDIT)	Million Rupiah	The total transaction value on credit cards includes both spending transactions and/or cash withdrawals.	Bank Indonesia
Electronic money (EM)	Unit	The number of the electronic money cards owned both chip- and server-based.	Bank Indonesia
The accumulation of loan disbursement (LEND)	Million Rupiah	The cumulative disbursement of the loans distributed by the Fintech companies (peer-to-peer lending).	Financial Services Authority
Fintech index (FTI)	Index	The Fintech composite index	-
Control Variables			
Exchange rate (ER)	Indonesian Rupiah	The exchange rate of the US dollar against the Indonesian rupiah.	Bank Indonesia
Interest rate (IR)	Percentage	The interest rate policy level of the Bank Indonesia.	Bank Indonesia
Money supply (MS)	Billion Rupiah	The total of broad money M2.	Bank Indonesia
Gross regional domestic product (GRDP)	Billion Rupiah	The total value added of the goods and services produced from all economic activities in an area.	Statistics Indonesia

Source: Authors

regional domestic product, respectively, ε_{it} is the error term, β_1 is the main coefficient to examine the impact of the FTI on inflation, $i=1,\dots,N$ represents the cross-sectional units, and $t=1,\dots,T$ denotes the time periods.

Given the fact that our data consist of the 10 provinces and cover the period of 42 months, and the resulting total of 420 observations with the number of the time series dimensions being greater than the number of the cross-sectional dimensions, the GMM method is not suitable for the analysis made in this study and it may encounter problems related to autocorrelation in the residuals of the first-difference estimation (Roodman, 2009). Therefore, panel ARDL or pooled mean group (PMG) were employed for the analysis carried out herein. The PMG estimator developed by M. H. Pesaran, Y. Shin and R. P. Smith (1999) can examine the relationship among variables both in the short run and in the long run. This method permits for heterogeneity in the short-run coefficients, on the one hand, and homogeneity in the long run, on the other. The PMG estimator also exhibits integrated variables in I(0), I(1), or a combination. The ARDL model used in this study can be shown as follows:

$$\Delta y_{it} = \varphi(y_{i,t-1} - \delta_1 f_{i,t-1} - \delta_2 x_{i,t-1}) + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \lambda'_{ij} \Delta f_{i,t-j} + \sum_{j=0}^{q-1} \lambda''_{ij} \Delta x_{i,t-j} + \omega_{it} \quad (2)$$

where y represents the dependent variable, namely inflation; f is Fintech; x represents the set of the control variables, namely the exchange rate, the interest rate, money supply, and the GRDP; φ shows the error correction term (ECT); δ_1 and δ_2 depict the long-run coefficient of Fintech and the control variables, respectively; λ , λ' , λ'' represent the short-run coefficients of lagged inflation, Fintech, and the control variables, respectively.

Before examining the PMG estimation, various preliminary tests were done. First, the cross-sectional dependence test was employed in order to scrutinize the existence of cross-sectional dependence within the panel data. Second, a unit-root test (i.e. the second-generation panel unit-root test) was done so as to assess the stationarity of the data, after which the presence of the long-term relationship among

the variables was investigated using the Westerlund cointegration test. Ultimately, the causality test was conducted in order to identify the causal relationship among the variables. The diverse statistical tests performed in this study are likely to enhance the robustness of the empirical findings.

Fintech measurement

In this study, the PCA method was applied in order to construct the Fintech index. The PCA is a method employed for extracting information from large datasets and can alleviate multicollinearity within a model (Sun, Khan & Ren, 2023). Utilizing four indicators, this research study compiles the Fintech index with the resulting variables referred to as the FTI. This index can represent advancements in the financial sector as it captures information about each digital financial activity, laying the foundation of Fintech.

Table 2 Principal component analysis for the Fintech index

Components	Eigenvalue	Difference	Proportion	Cumulative
Comp1	3.014	2.352	0.754	0.754
Comp2	0.663	0.444	0.166	0.919
Comp3	0.219	0.114	0.055	0.974
Comp4	0.104		0.026	1.000
Variables	Comp1	Comp2	Comp3	Comp4
Log_ATM	0.533	-0.317	-0.321	0.716
Log_CREDIT	0.499	-0.460	0.683	-0.269
Log_EM	0.541	0.103	-0.567	-0.613
Log_LEND	0.417	0.823	0.330	0.202

Source: Authors

Table 2 accounts for the results of the principal component analysis for the Fintech index (FTI) based on the four financial technology indicators. The findings reveal that the eigenvalue of the first component is 3.014, progressively decreasing to the fourth component, which shows the lowest change at 0.104. Furthermore, the first component explains

approximately 75.4% of the variation in the dependent variables, whereas the second, third, and fourth components contribute around 16.6%, 5.5%, and 2.6%, respectively. Clearly, the first principal component demonstrates the highest level of variation. Therefore, this study intends to utilize Comp1 as the Fintech indicator.

RESULTS AND DISCUSSION

Table 3 shows the descriptive statistics of all the variables used, displaying the figures prior to the logarithmic transformation, thus pointing to the fact that the average monthly inflation rate in the provinces of Sumatra is 0.818%, with the highest inflation reaching 8.55% and the lowest standing at -1.36%. These inflation statistics signal the importance of maintaining stability in Sumatra’s inflation in

order to mitigate higher fluctuations. Furthermore, the Fintech variable used in this research study is constructed using the PCA to obtain the measure that can represent the variation of the Fintech-forming variables. The average Fintech index in the provinces of Sumatra is relatively low, at only 476×10^{-11} , and most provinces in Sumatra have negative Fintech indices throughout the observation period. Northern Sumatra has the highest Fintech index, reaching 3.189, whereas Bengkulu has the lowest Fintech index. Interestingly, the standard deviation values of inflation and the Fintech index are relatively low, indicating that the values of both variables are not broadly dispersed from their means.

The presented correlation matrix is used to identify the potential multicollinearity among the variables of this study. The results given in Table 4 reveal that inflation shows a significant negative correlation with Fintech, characterized by a relatively low correlation

Table 3 The descriptive statistics

	INF	FTI	ER	IR	MS	GRDP
Mean	0.8187143	476×10^{-11}	14683.43	4.184524	7379310	68965.57
Std. dev.	1.5444446	1.000004	520.2556	0.8248445	717274.8	65286.11
Min	-1.36	-2.6476	13662	3.5	6047999	38.77
Max	8.55	3.189422	16367	5.75	8528022	255479.4
Obs	420	420	420	420	420	420

Source: Authors

Table 4 The correlation matrix

Variables	Log_INF	FTI	Log_ER	IR	Log_MS	Log_GRDP
Log_INF	1					
FTI	-0.143*** (0.003)	1				
Log_ER	0.099** (0.043)	0.062 (0.205)	1			
IR	-0.145*** (0.003)	-0.004 (0.939)	0.258*** (0.000)	1		
Log_MS	0.049 (0.315)	0.408*** (0.000)	0.181*** (0.000)	-0.092* (0.060)	1	
Log_GRDP	0.163*** (0.001)	-0.189*** (0.000)	0.007 (0.887)	-0.003 (0.955)	0.037 (0.454)	1

Note: *, **, and *** indicate the significance levels at 10%, 5%, and 1%, respectively.

Source: Authors

coefficient. Furthermore, the interest rate is the only control variable negatively correlated with inflation. In contrast, the other control variables, such as the exchange rates, money supply, and the GRDP, show positive correlations with inflation. The relatively low magnitudes of the correlation coefficients for each variable indicate the absence of multicollinearity among the variables examined in this study (Gujarati & Porter, 2009). The finding underscores the reliability of the estimation results in this study.

The provinces in Sumatra are expected to have the potential to influence each other mutually due to regional cooperation among the provinces. Additionally, the efforts to stabilize inflation made by the Regional Inflation Control Team (TPID) in Sumatra may foster trade cooperation among the regions throughout Sumatra. Thus, testing for cross-sectional dependence (CSD) is essential to ascertain whether there is mutual influence among the regions in Sumatra. Neglecting this test may lead to unreliable estimations. The CSD test performed in this study employs the Breusch-Pagan Lagrange Multiplier (LM) test, which provides accurate estimations when $T > N$ (Breusch & Pagan, 1980). Therefore, the LM test is relevant for this study as the number of the time dimensions (42) is greater than the number of the cross-sectional dimensions (10). The CSD test results in Table 5 confirm that the null hypothesis reading that there are no CSD in the data should be rejected, showing that the p -value is significant, which on its part confirms the presence of CSD in this study. Then, it indicates that a shock in one region can probably influence another in this study. As a result, the presence of CSD required that second-generation tests, including the unit root test, the cointegration test, and long-term estimation should be employed.

Since the empirical study has confirmed the presence of cross-dependence among the variables, the first-generation panel unit root test, such as the Levin, Lin, and Chu (LLC) unit root test, is irrelevant to adopt as it is unable to produce unbiased estimation in the presence of cross-sectional dependence (Levin, Lin & Chu, 2002). Consequently, the study employs the

second-generation unit root test, namely the cross-sectionally augmented Im, Pesaran, and Shin (CIPS) approach, which takes into account the issue of cross-sectional dependence (Pesaran, 2007). The CIPS test examines the null hypothesis of nonstationary against the alternative hypothesis.

The results of the unit root test performed in this study are reported in Table 6. For the $I(0)$ order, the null hypothesis of nonstationary, inflation, Fintech, the exchange rate, the interest rate, and money supply is not accepted at the 1% significance level, whereas only the GDP fails to reject the null hypothesis. Furthermore, all the variables applied in this study reject the null hypothesis at the $I(1)$ order, thus indicating that all the variables are stationary. Therefore, the variables used in this study are stationary of mixed order at the level and the first difference, while no variable has proven to be stationary at the second difference, which on its part indicates that the variables unveil the cointegration relationship in the long run.

Subsequently, whether the variables employed show a long-term relationship or not was examined. The cointegration test developed by J. Westerlund (2007) was done in this study. The test is based on whether the Error Correction Term (ECT) equals zero for the panel Error Correction Model (ECM) or not. This cointegration test approach is considered to be more reliable compared to the traditional cointegration methods as it is more flexible and more adequate to accommodate specific short-term unit dynamics, trends, and slope parameters, as well as the presence of cross-sectional dependence (Persyn & Westerlund, 2008). The results of the cointegration test are presented in Table 7. These results indicate that the p -values for the error correction terms for the mean groups (G_t and G_a) and the panel (P_t and P_a) are significant. Therefore, the null hypothesis of no cointegration is rejected as such, suggesting that all the variables used in this study have a long-term relationship.

Table 5 The cross-sectional dependency test

Chi2	747.335
Prob.	0.000***

Note: *** indicates the significance level of 1%.

Source: Authors

Table 6 The stationarity test

Variables	Log_INF	FTI	Log_ER	IR	Log_MS	Log_GRDP
Level	-5.922***	-3.916***	2.610***	2.610***	2.610***	-2.159
First Difference	-6.190***	-6.053***	2.610***	2.610***	2.610***	-6.051***

Note: *** indicates the significance level of 1%.

Source: Authors

Table 7 The cointegration test

Statistics	Value	Z-value	P-value
G_t	-3.752	-3.670	0.000***
G_a	-21.649	-2.560	0.005***
P_t	-20.193	-11.739	0.000***
P_a	-49.005	-14.303	0.000***

Note: *** indicates the significance level of 1%.

Source: Authors

This study applies the panel ARDL or PMG approach to investigate the impact of Fintech on inflation both in the short run and in the long run. The Akaike Information Criterion (AIC) was utilized for the optimal lag selection, resulting in the selection of (3, 4, 4, 4, 4, 4) for the PMG. Table 8 displays the PMG estimation results for the panel of the provinces of Sumatra Island. The short-term estimation results show that the coefficient for lagged inflation (-1) is positive and significantly different from zero at the 5% and 10% levels, thus indicating the fact that the inflation of the previous period significantly contributes to an increase in the inflation of the current period. However, the positive coefficient estimate for Fintech is not statistically significant, which implies

Table 8 PMG estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long-term equation				
FTI	-1.172	0.155	-7.558	0.000***
IR	-0.260	0.061	-4.271	0.000***
Log_ER	-21.699	4.654	-4.663	0.000***
Log_MS	4.607	1.557	2.958	0.004***
Log_GRDP	3.276	1.460	2.245	0.026**
Short-term equation				
ECT (-1)	-0.509	0.218	-2.330	0.021**
D(Log_INF(-1))	-0.361	0.163	-2.218	0.028**
D(Log_INF(-2))	-0.106	0.149	-0.710	0.479
D(FTI)	0.296	0.273	1.085	0.280
D(FTI(-1))	0.258	0.370	0.697	0.487
D(FTI(-2))	0.017	0.299	0.055	0.956
D(FTI(-3))	-0.055	0.202	-0.274	0.784
D(IR)	0.923	0.331	2.786	0.006***
D(IR(-1))	-0.042	0.343	-0.124	0.902
D(IR(-2))	-1.998	0.527	-3.789	0.000***
D(IR(-3))	1.078	0.347	3.107	0.002***
D(Log_ER)	16.337	8.053	2.029	0.044**
D(Log_ER(-1))	7.726	9.266	0.834	0.406
D(Log_ER(-2))	11.429	5.845	1.955	0.052*
D(Log_ER(-3))	3.966	3.374	1.176	0.241
D(Log_MS)	-1.452	3.023	-0.480	0.632
D(Log_MS(-1))	12.428	4.875	2.549	0.012**
D(Log_MS(-2))	4.977	3.195	1.558	0.121
D(Log_MS(-3))	11.139	2.422	4.600	0.000***
D(Log_GRDP)	8.226	3.135	2.624	0.009***
D(Log_GRDP(-1))	-0.649	1.000	-0.649	0.517
D(Log_GRDP(-2))	0.294	2.040	0.144	0.885
D(Log_GRDP(-3))	-3.687	2.383	-1.547	0.124
C	-91.729	39.024	-2.351	0.019
S.D. dependent var	0.727	Mean dependent var		0.016
Akaike info criterion	1.373	S.E. of regression		0.425
Schwarz criterion	3.730	Sum squared resid		31.562
Hannan-Quinn criteria	2.304	Log likelihood		-43.321

Note: *, **, and *** indicate the significance levels of 10%, 5%, and 1%, respectively. The model selection method: AIC. The selected model: ARDL (3, 4, 4, 4, 4, 4).

Source: Authors

that digital financial transaction activities reflected in Fintech do not have a significant impact on the occurrence of inflation in the short run, a plausible explanation for this finding being that, in the short run, the imperfect information about and incomplete utilization of Fintech advancements by society may limit the impact on consumer consumption patterns and ultimately do not alter the inflation rate (Saraswati *et al*, 2020). Interestingly, most of the control variables have a significant positive impact on the inflation in the provinces of Sumatra in the short run. Furthermore, it is observed that the coefficient of the ECT is negative and significant at the 5% and 10% levels, indicating the presence of a long-term equilibrium. The ECT coefficient of -0.509 suggests that any deviation from the long-term equilibrium corrects itself at a speed of 0.509.

The results of the long-term estimation indicate a significant negative impact of Fintech on inflation in the provinces of Sumatra Island during the observation period, with the coefficient of -1.172, which is implicative of the fact that a 1-unit increase in the Fintech index will reduce inflation by 1.172 percent, assuming that other variable influences should remain constant, which suggests that intensifying Fintech activities enhances efficiency in financial transactions and can suppress transaction costs. These findings align with the study by Y. B. Romdhane *et al* (2023), who concluded that the active use of Fintech in two-way transactions, both in sales and in purchases, had a reducing effect on inflation. Furthermore, Fintech activities such as loan distribution can support optimal economic growth through cost efficiency and the provision of more effective services, thereby alleviating the demand-side inflationary pressures. In turn, the ease of access provided by Fintech to various economic actors may lead to efficiency, stimulate a higher output, and increase income (Mumtaz & Smith, 2020; Zhang, Tan, Hu, Wang & Wan, 2020; Abbasi, Alam, Du & Huynh, 2021).

The digitization aspect plays a crucial role in driving Fintech adoption. Digitization holds a significant position in the financial industry as it can reduce costs, improve access to and the quality of financial

services, and create a more diverse financial landscape (Lee & Shin, 2018). Provincial governments in Sumatra must develop the digital infrastructure, including ATMs and other payment systems, to support noncash transaction activities. Additionally, the readiness of the community to adopt Fintech also presents challenges. Therefore, the development of Fintech needs to be balanced by providing financial literacy education and making consumer protection efforts, fostering trust among the public in using Fintech as an innovative financial service. Intensive education can ensure a more direct Fintech use and mitigate potential risks (Suryono, Budi & Purwandari, 2021).

Subsequently, the Dumitrescu-Hurlin panel causality test was done in this study in order to examine the causal relationships among the variables, the test being based on the null hypothesis that no homogeneous causality is present across the cross-sections. Two lags were selected for the causality test using the AIC approach. In Table 9, the results of the panel causality test indicate bidirectional causality between inflation and Fintech, and between inflation and money supply as well, with the p -values lesser than alpha. Unidirectional causality is perceived to exist between the interest rates and inflation, and between inflation and the exchange rates as well. The panel causality results underscore the need for policymakers to consider how innovations in financial technology and adjustments in monetary supply can impact inflation. In the meantime, the identification of unidirectional causality from the interest rates to inflation and from inflation to the exchange rates provides target insights for the monetary policy and the exchange rate management. These findings are essential for crafting effective economic policies, enhancing stability, and guiding strategic decisions in both financial and real sectors.

CONCLUSION

This study investigates the influence of financial technology on the inflation rate. The results indicate that Fintech can potentially reduce inflation in the

Table 9 The pairwise Dumitrescu-Hurlin panel causality test

Null Hypothesis	W-Stat.	Zbar-Stat.	P-value.	Conclusion
FTI → Log_INF	6.280	5.835	0.000***	Rejected
Log_INF → FTI	4.575	3.443	0.001***	Rejected
IR → Log_INF	4.955	3.975	0.000***	Rejected
Log_INF → IR	3.024	1.266	0.206	Accepted
Log_ER → Log_INF	1.776	-0.484	0.628	Accepted
Log_INF → Log_ER	4.703	3.622	0.000***	Rejected
Log_GRDP → Log_INF	1.547	-0.805	0.421	Accepted
Log_INF → Log_GRDP	2.970	1.191	0.234	Accepted
Log_MS → Log_INF	3.640	2.131	0.033**	Rejected
Log_INF → Log_MS	3.812	2.372	0.018**	Rejected
IR → FTI	4.783	3.734	0.000***	Rejected
FTI → IR	3.228	1.553	0.120	Accepted
Log_ER → FTI	0.702	-1.991	0.046**	Rejected
FTI → Log_ER	3.593	2.065	0.039**	Rejected
Log_GRDP → FTI	4.262	3.003	0.003***	Rejected
FTI → Log_GRDP	5.723	5.053	0.000***	Rejected
Log_MS → FTI	5.824	5.195	0.000***	Rejected
FTI → Log_MS	4.701	3.620	0.000***	Rejected
Log_ER → IR	1.740	-0.535	0.593	Accepted
IR → Log_ER	8.344	8.731	0.000***	Rejected
Log_GRDP → IR	3.967	2.590	0.009***	Rejected
IR → Log_GRDP	2.657	0.752	0.452	Accepted
Log_MS → IR	1.902	-0.307	0.759	Accepted
IR → Log_MS	0.516	-2.252	0.024**	Rejected
Log_GRDP → Log_ER	3.905	2.503	0.012**	Rejected
Log_ER → Log_GRDP	6.199	5.721	0.000***	Rejected
Log_MS → Log_ER	1.634	-0.684	0.494	Accepted
Log_ER → Log_MS	0.428	-2.376	0.018**	Rejected
Log_MS → Log_GRDP	7.062	6.933	0.000***	Rejected
Log_GRDP → Log_MS	3.602	2.077	0.039**	Rejected

Note: ** and *** indicate the significance levels of 5% and 1%, respectively.

Source: Authors

long run. This study suggests that a more intensive use of Fintech can create an efficient economic environment and support economic stability. Not only does Fintech help reach the unbanked, but it also offers cost-efficient financial services, improves the quality and reach of financial services, and creates a more diverse financial landscape. This finding is consistent with the previous studies demonstrating the role of Fintech in stabilizing inflation rates in

various countries. This study suggests the necessity of enhancing the digital infrastructure to expedite the development of Fintech, particularly in Indonesia.

The findings of the study offer valuable insights into the potential of financial technology (Fintech) to reduce inflation, particularly in Sumatra Island, Indonesia. The results reinforce the notion that Fintech can enhance economic stability by improving transaction efficiency and loan distribution as a component of economic digitalization. This study suggests that Fintech can effectively control inflation, particularly in the areas experiencing rapid Fintech growth, such as Sumatra. The findings imply that the central bank should integrate Fintech development in the monetary policy framework and consider it an essential factor in inflation analysis and policy decision-making. Furthermore, the central bank must collaborate closely with the other regulators so as to guarantee that Fintech’s progress stays within the robust regulatory framework, promoting innovation and simultaneously mitigating related risks. Local governments in Sumatra play a crucial role in supporting the implementation of Fintech. They must ensure the availability of an adequate digital infrastructure and promote Fintech adoption among businesses and communities. These measures include improving access to the high-speed Internet, supporting digital education and training, and promoting financial inclusion through Fintech.

This study has several limitations that should be considered in future research. Specifically, the geographical focus on Sumatra restricts the generalizability of the findings, suggesting that further research should be done in order to explore the impact of Fintech on inflation in the other regions of Indonesia or even in other countries. Secondly, since this study relies on the secondary data, incorporating primary data (such as surveys or interviews) may be beneficial to gain a more comprehensive understanding of how Fintech influences economic agents’ daily economic decisions. Another limitation is the study’s timeframe, i.e. its spanning from January 2020 to June 2023. This period was chosen due to the availability of consistent and relevant data. Expanding the timeframe in future research could

provide a more robust analysis of the trends and the long-term effects of Fintech. Finally, future research should delve into the long-term effects of Fintech on broader economic aspects, such as employment growth and the development of small and medium-sized enterprises (SMEs).

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THE HOUSING MARKET IN SERBIA – SEGMENTATION, ARBITRAGE AND OVERVALUATION

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The paper discusses market trends and analyzes the regularities that appear on the Serbian national housing market and regional submarkets. It is assumed that, apart from the common market driving forces, the market for newly constructed houses and the market for the existing housing stock behave like two separate segments of the housing market with the imperfect adjustment of prices. The prime focus of the analysis is on the divergence between the prices in those two segments, with a special interest in the process of mutual adjustments. Granger causality tests are employed in order to reveal whether there is a causal relationship between the price indices in those two segments and it has been found that there is a causality relation between the existing housing market and the newly constructed house market prevailing among the regional submarkets. The same methodology is applied to test if there is any such causality between the regional markets. The results have confirmed a likely influence of the Belgrade new construction market on the other regional markets. The findings will help understand the process of price adjustments between the two market segments and will lead to policy recommendations.

Keywords: regional housing markets, Granger causality, market efficiency, urban development

JEL Classification: R31, R21, G51, C32

INTRODUCTION

Durability, heterogeneity and spatial fixity are the distinctive features of the housing stock as a capital good (Smith, Rosen & Fallis, 1988). Although a number of goods have some of those features, houses have all of them together and they have them to the extent that exceeds those features in the case of all

other tradable goods. Durability is a consequence of the long physical and economic life of the housing structure. For market considerations, this means that the existing number of houses will significantly outnumber newly constructed houses at any point in time. This feature limits the overall importance of the current level of the construction activity in the total housing supply. House heterogeneity is an issue that must be overcome in order to quote the prices potentially comparable both in the spatial dimension and in the time dimension. For example, the studies of the price determinants of individual houses operate

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with dozens of house characteristics that may explain cross-sectional price variability (Ke, Yang, Shi, Mougharbel, Guo, & Zheng, 2023; Cai, Smit & Helbich, 2024; Soltani, Zali, Aghajani, Hashemzadeh, Rahimi & Heydari, 2024). The last feature generates the spatial rigidity of housing (service) supply and explains the spatial fragmentation of the housing market. Together with the forces that direct the spatial distribution of housing demand, this will be responsible for a rather persistent spatial price variability.

A house can serve multiple purposes. It can be a durable consumption good, an investment and a speculative asset. To the extent that those purposes are possible to delineate, it is possible to recognize the three components of total housing demand, namely consumption, investment and speculative demand. Only a fraction of houses are bought by their owners to live in (owner-occupied). Those houses are said to serve consumption purposes. If a person buys a house so as to rent it (rented), then it belongs to the investment asset, hence representing investment demand. If someone buys a house in order to sell it at a higher price in a short period, then it becomes a speculative asset and represents speculative demand. The last two motives are not easily delineated, since the expected price increase may be considered as a valuable income stream even in investment-motivated purchases, the same as speculative purchases do not exclude the renting income. The motives pertaining to the income stream (rent or a capital gain) dominating the decision to buy a house differ. The consumption part of demand is the least price-sensitive; investment demand will largely depend on the current and perspective price-rent relationships, whereas speculative demand is purely price-sensitive.

In this paper, the current stance on the local housing market is investigated. In spite of the ardent public debate, the Serbian housing market has not attracted much attention from the academic community so far (to the best of the authors' knowledge, there are rare exceptions such as Đorđević & Petronijević, 2015; Radivojević, 2019; Martin, 2023; Marinković, Džunić & Marjanović, 2024). In the past years, Serbia has been

witnessing a steady increase in housing prices. The speeding up of new construction (Jakopin & Gračanac, 2023) appears to be unable to keep up with booming demand. At the same time, the upward trend in prices has not been equally steep across the regions, nor has it been equally strong in the segment of newly constructed houses, in comparison to rising prices on the market for the existing housing stock. The main focus of the paper is on the reasons lying behind the divergent processes prone to being attributed to the ineffectiveness of the market consolidation forces. If the forces are weak, the prices will adjust slowly and even incompletely, indicating the importance of the structural reasons for the housing market inefficiency, which is why the paper employs Granger linear causality tests between the pairs of the indices of the quality-adjusted housing prices testing the null hypothesis reading that there is no causality at all. The methodology can reveal the direction of the influences, as well as adjustment lags. It is a well-established methodology broadly used in studying the co-movement of the stock market indices or the causality between different macroeconomic or macro-financial variables (Gradojević & Dobardžić, 2013; Marinković & Radović, 2014; Radojičić & Radović, 2023; Ekşi, Zeren & Gürsoy, 2024).

In the next section, the basic identities that economic science uses to explain the determinants of housing demand and supply is reviewed, after which how the demand and supply forces mutually interact and how those interactions help to set the prices that would clear the market is analyzed. The analyses are based on contributions from market microstructure theory. Here, it is assumed that the housing market is a market with incompletely integrated segments of newly constructed and the existing houses. In the fourth part, data analysis is carried out and newly built houses are found to potentially systematically differ in prices from the existing housing stock in the medium term, which is attributed to the imperfect adjustment process that produces the incomplete alignment of the housing prices in the two market segments. The conclusions are presented in the final section.

THE HOUSING MARKET EQUILIBRIUM

The stock-flow model that belongs to the specific class of the economic models used to formalize markets for the goods that are constantly produced (flow) and consumed in many years (stock) is the basic framework for the macroeconomic analysis of the housing market. The stock-flow model differentiates between the stock of goods (capital goods or durable consumption goods), which is rigid in the short run, and the flow of new production, which reacts more quickly to changes in economic conditions.

The two-equation stock-flow model of the housing market (Poterba, 1984; DiPasquale & Wheaton, 1994; Meen, 2002) depicts the housing demand and housing supply functions, which are both presumably determined by the housing price, so that demand ultimately equals supply, and the housing market comes to a settled equilibrium with the clearing housing price. In J. Poterba (1984), demand for housing services is the decreasing function of the rental price, the same as the supply of housing services is considered to be the increasing function of the rental price. A number of housing units are entered in the model, with the assumption that the stock of the housing units (new construction not playing a role in the short run) produces a flow supply of services. The supply of housing services will depend on the number of the existing housing units and the rental price. The market clearing rental price equates demand to supply for housing services. The costs of housing services are proportionate to the real price of houses (P), including depreciation (at the rate δ), repair and maintenance costs (κ), mortgage interest payments and the opportunity costs of the housing equity (i). The costs also include tax liabilities, namely the income tax at the rate θ and the property tax at the rate μ . If the rates may differ (they are not constant across individuals), it is assumed to be marginal values. The above sum is reduced by the nominal capital gain (π_H) so as to generate the marginal value of the costs of the housing service provided.

It is assumed that, at any point in time, homeownership demands financing a house purchase with the money borrowed from the loan market at the mortgage rate

(i) and the equity supposed to earn some return, on assumption that the same opportunity cost rate i applies. The treatment of capital gains is model-specific, but it is worth knowing that gains may be either added to the homeowner marginal value of housing services or subtracted from the costs. The capital gain is the ratio of the housing price rate of change (ΔP) to the old housing price (P) and, expressed in real terms as it is given below, it is the difference between the house price inflation rate and general inflation. Both house price inflation and general (consumer price) inflation are precious concepts in the housing market analyses. The relevance of inflation for the housing market is based on substitution between housing and composite consumption goods. An equilibrium condition of the residential housing market is represented by the following equation:

$$\Delta P = vP - R \quad (1)$$

where:

$$v = \delta + \kappa + (1 - \theta)(i + \mu) - \pi \quad (2)$$

R is the marginal rental value of the services generated by the existing housing stock (H) and vP is the concept similar to the costs of the housing services provided by the homeowner. The variable v should not be confused with the rate of the costs of the housing services provided, since it substitutes the housing price inflation (π_H) for the overall inflation (π), thus excluding the real capital gain (π_Q). The latter variable uses the housing price inflation or the nominal capital gain. According to economic theory, housing services will be provided until the marginal cost of services exceeds the marginal value of services.

Therefore, the above equation (1) means that, whenever the costs of housing services (the real capital gain not included) exceed the marginal value of housing services, investors must be compensated for by the rise in the housing prices. Market efficiency also requires the following arbitrage relationship to hold (rearranged from G. Meen (2002), p. 6):

$$P = R / [\delta + \kappa + (1 - \theta)(i + \mu) - \pi_Q] \quad (3)$$

where R is the real imputed rental price of housing

services. The rationale for the above-mentioned equation (3) implies that the housing price is the renting income rate (the price of the housing service expressed as the ratio of the housing price) discounted by the sum of the rates of all the costs related to house ownership (cost-of-carry). The arbitrage relationship assumes that the streams of both income and costs continue in time, i.e. they are represented as infinite series.

The next set of equations explains the way new construction relates to the existing housing stock market conditions. The total housing supply (H_s) is a sum of the latest change in the number of houses and the existing housing stock. Change in the number of houses (ΔH_s) is the difference between newly constructed houses, i.e. residential construction investment (I), and the depreciation of the existing housing stock (δH). Residential construction investment is defined as a price-dependent variable, i.e. as the increasing function of the housing price ($I = f(P); f' > 0$):

$$H_s = I + (1 - \delta)H \quad (4)$$

$$\Delta H_s = I - \delta H = f(P) - \delta H \quad (5)$$

The model by J. Poterba (1984) has many virtues because it makes it possible to cover the services that houses provide as consumption, investment and even speculative assets. Firstly, the value of housing services is a concept that can easily incorporate not only the rental income, but also any convenience enjoyable by the homeowner that occupies the home. Therefore, the model is suitable for consumption purposes. Secondly, the model explicitly incorporates the rental price and the capital gain, which makes it suitable for studying investment and speculative motives.

Although this model is a seminal piece of work in the economic modeling of the housing market, some authors afterwards improved it by more specifically defining both the determinants of investments in new housing construction and the determinants of housing demand. For example, D. DiPasquale and W. C. Wheaton (1994) extended the set of the variables that should be used in projecting housing demand to include the vector of exogenous variables, such

as various demographic features and the household income and wealth.

More contemporary contributions (DiPasquale & Wheaton, 1994; Meen, 2002) underline the fact that new construction will not depend so much on the sale price as they will depend on the mark up in the building industry, or the difference between the selling price and the cost of construction per unit (land, labor, a material, technology, the financial cost etc.). Some authors (Glaeser & Gyourko, 2018) use the ratio of the housing price to the minimum profitable construction cost, which is akin to Tobin's q , the standard ratio of the market value to the firm replacement cost. Such an approach has some virtues, because housing construction projects take several years to complete, so the costs relevant for price determination are contemporaneous rather than historical (real) costs. Moreover, minimum profitable construction costs will strongly depend on the location and the investor's efficiency, so that, in this case as well, the marginal value of costs is what matters for housing market considerations.

When the depreciation rate (δ) is concerned, it should be noted that the rate is neither purely an accounting variable¹, nor is it an engineering matter. There are many developments of social nature that may influence the rate. For instance, a change in the disposable income, the average family size, housing standards and habits, and huge urban interventions may make one part of the existing housing stock unattractive, abandoned, or consequently demolished. The demolition rate also changes significantly overtime. For example, in the US in the first four decades of the 20th century, the annual ratio of demolitions was below 0.2 percent (Blank & Winnick, 1953), while contemporary standards in the US rule demolitions after barely fifty years of exploitation. The Serbian average was 0.06 percent in 2021, whereas newly built houses represented slightly less than one percent of the existing housing stock (RZS, 2022).

Although the presented model explicitly underlines the distinguishing between the market for the existing houses and the market for new construction (Poterba, 1984), it does not differentiate between the

prices of newly constructed houses and the prices of the existing housing stock. It is obvious that the price relevant in the former case (eq. 1-3) is the price on the secondary market, whereas in the latter (eq. 5), it has to be the price on the primary market, if prices on the primary and secondary markets are allowed to differ.

THE HOUSING MARKET MICROSTRUCTURE

A house is an asset that has too many individual features constraining any effort to decrease the uncertainty of quality. No asset can be standardized to the extent that such standardization would enable exchangeability between different items, which is the reason why houses are always traded through a brokerage mechanism. Real estate agencies act as brokers. Agencies actively search to match sellers and buyers and coordinate exchange between sellers and buyers in the brokered market. There is no dealer active on the market that can help align demand and supply by accepting a risk associated with changing inventory (Harris, 2003). On residential housing markets, virtually not a single transaction passes through a dealer's temporary inventory. Rather infrequent trade² prevents dealers from establishing their role in housing markets.

"Sellers of individual homes are typically less concerned with short-term price volatility, and hence with immediacy, than with making sure that the widest possible set of ultimate buyers can be informed of the house's availability. Potential market makers, moreover, face not only all the ordinary costs of maintaining a continuous presence in a thin market, but the additional moral hazard that arise from the owner's possibly adverse private information about the value of the property. The result is a market in which intermediaries, to the extent that they are involved at all, provide brokerage or search services, not immediacy." (Grossman & Miller, 1988, 620).

Not only market-makers³, but professional traders⁴ as well, seldom appear on the housing market to exploit intertemporal price changes, which contributes to the

inefficiency of the housing market, which R. Shiller (2014) traces to the high costs of trading. It is costly for traders to trade in and out of the housing market in order to profit from predictable price changes (a high brokerage commission for sellers and high search costs for buyers). It is difficult to profit from overpriced homes because forward markets and short-sale opportunities are nonexistent, carrying costs are high because the rental income is low relative to maintenance costs, and there are many local drivers of demand that are difficult to predict. If excess returns are expected to be positive because of anticipated appreciation, there is nothing to preclude a buy-and-hold strategy, which is why the housing market exhibits serially correlated price changes that may govern profitable trading patterns (Case & Shiller, 1989). Nevertheless, some developments in the financial sphere bring some optimism that the housing market can attain the level of efficiency comparable to that in most financial markets. The appearance of the real estate investment funds that try to profit from buying and selling individual homes may be a game changer in housing markets.

The housing market segmentation

Primary market transactions include newly built houses, while secondary market transactions include trade in the existing housing stock. While the primary market is limited by the construction activity, the secondary market is theoretically limitless, capable of growing to the sizes that are multiple times the size of the primary market⁵. The idea of the primary market segmentation from the secondary market is explicitly employed in D. Mauer and L. Senbet (1992) for the case of the IPO markets. The authors found the price differential reflecting the primary risk premium that captures both limited investors' access to the primary market and the risk associated with the imperfect substitutability of the asset in the secondary market. Similarly, A. Gordon and M. Peterson (2020) found arbitrage trading establishing the connectedness of the prices in the primary and secondary markets for exchange traded funds. For housing markets, the idea of separation between the two market segments has been used so far merely to

derive a single housing market price, with no special interest in the price determination specificities of the two market segments. An interesting issue is which market segment leads, and which follows in said price determination. Based on the previous discussions, it is known that construction costs are integrated in the housing price. According to the stock flow model, it appears as true that costs are included in the price equation only on the primary market, since it is only there that such costs are contemporaneous, whereas on the secondary market, it is the owner/seller who may have some records, or remember historical costs, but those historical costs will not directly influence the selling price, if only.

When the numbers of the current housing units (the secondary market) relative to newly built houses (the primary market) are concerned, the former dominate the latter to a great extent as a rule. As already mentioned, the ratio of new houses to the existing housing stock is very low. For example, the number of the newly constructed houses in 24 Serbian cities for during the period from 2011 to 2021 averaged 0.55 percent of the existing housing stock, ranging from 0.02 to 2.67 percent. The period of the most intensive residential construction activity in Novi Sad was reported in the year 2021 (RZS, 2022). Since residential construction is largely concentrated in urban areas, the national average that also includes rural areas is even lower. However, while the entire stock of new houses enters the market, only a fraction of old houses appears on the market. Researchers (Olsen, 1969; Poterba, 1984) sometimes overcome this issue by choosing to operate using the housing service concept instead of the concept of the housing units supplied on the market, in which way any house, either occupied by the owner or by tenants, provides housing services, irrespective of the fact that it may be offered on the market or not so. However, the amount of the said fraction of the existing housing stock offered on the market greatly reflects on short-term price developments as the most volatile part of the total supply. Essentially, the existing housing stock represents a scope of latent supply, being a reserve pool that can feed up supply if triggered by the price. This part of supply is more speculative by nature.

High prices would bring it up, while depressed prices would make this part of the total supply nearly vanish, in which way both the construction activity and the existing housing stock supply on the market will demonstrate a strong dependence on the price.

Tax considerations aside, the primary and secondary housing markets can be considered almost perfect substitutes in terms of demand determinants. Therefore, despite differences in the reasons shaping a decision to build for sale relative to a decision to sell the houses that have already been bought, the housing market must behave like a segmented market that tends to consolidate itself. Housing markets are partly segmented in that the primary market is only accessible to certain buyers who make a subset of the buyer universe contrary to which the secondary market is accessible to all market participants. Namely, bearing in mind the fact that, in the case of Serbia, a large portion of newly built houses are sold before completion (in the so-called 'grey' phase or even in the planning and design phases of the project), the primary market buyers have to be compensated for the risk taking that arises from intertemporal price changes and the other nontrivial reasons that may endanger the project accomplishment, with respect to revealing information to the public financing investors for the period prior to houses starting producing any services at all. For such reasons, the primary market prices may differ from the secondary market prices fixed for the very same house.

Segmented market consolidation

In addition to many other influences, market segmentation may isolate cross-segment price impacts (Chen & Duffie, 2021). According to the market microstructure contributions, there are three mechanisms that consolidate a segmented market (Harris, 2003). Firstly, within each market segment, traders adjust their prices so as to reflect information from all the segments. Secondly, some traders route their trade to market segments where they expect the best prices. Finally, arbitrageurs trade whenever prices in one segment are inconsistent with prices in another.

On the residential housing market, the first consolidation mechanism works efficiently if there are no significant impediments to the flow of information. Real estate agencies collect information from the primary market sellers (investors) and the secondary market sellers and make it public free of charge. Perspective buyers can easily access such information, albeit not without exposing themselves to costs, because housing heterogeneity makes search rather costly (primarily time consuming). In addition to agencies, investors alone invest in direct sale through Internet platforms and sale offices. The second mechanism works a little differently than in the general consolidation case, since it is only buyers who are free to choose between the segments. Finally, the housing market also opens some space for arbitrage to work.

It is obvious that the inability to sell short (Glaeser & Nathanson, 2015) and the limited ability to buy forward limit arbitrageurs' potential to exploit certain inefficiencies on housing markets. There are authors (Caplin & Leahy, 2011) who assign serially correlated housing prices (persistent price trends) to certain housing market specifics. Namely, during the periods of excess supply, buyers extract a surplus from sellers, their ability to do so yet being limited by the sellers' option to wait because unlike other goods, holding inventory in the housing stock is not that costly. Contrary to many other physical goods and similarly to financial assets, houses produce services with the value that may exceed regular carrying costs. The sellers who decide to sell must be at least as well-off as the sellers who postpone it, which links the prices across such periods. During excess demand periods, sellers extract a surplus from buyers, but their ability to do so is limited by buyers' option to search for houses elsewhere, which links the prices across spatial markets, in which sense sellers are responsible for intertemporal arbitrage since they are tied to locations, while buyers are responsible for cross-market arbitrage since they are free to search across markets. Therefore, even on the house market, there are some arbitrage forces that act to align prices spatially and over time. Are there any such forces available for arbitrage between pools of newly built and the existing houses at all?

For example, if the secondary market is relatively expensive, an actor selling his or her home in order to buy a new one on the primary market actually performs arbitrage. Such arbitrage exposes an arbitrageur to the costs⁶ of movement (only for occupied houses), which will only be profitable if the price differences are big enough to compensate for such costs of movement. In the industry's jargon, such transactions are called 'related', and it is believed that a large share of the total turnover originates from such transactions. Naturally, only part of related transactions are motivated by exploiting the price differentials arising from market inefficiencies⁷. Furthermore, if the secondary market is relatively cheap, investors may use proceeds from sale to invest on the secondary market. Unfortunately, those are the only ways for arbitrage-like transactions to be made on the residential housing market in order to exploit persistent unjustified differences in housing prices in those two segments. For arbitrage to work perfectly, everyone must be allowed to take any position at any time, without any funds needed and without exposing themselves to any risk (Shleifer & Vishny, 1997). In the real world, such a strategy is all but easy to implement. Arbitrageurs are exposed to risk and do not have unlimited access to resources. No short sale is possible. So, in this case, arbitrage has no potential to fully align the prices of those two market segments.

If two assets are not perfect substitutes, the price equalization process will still work, the market segments eventually attaining their separate equilibriums with two instead of one price that will differ to the extent to which the market values the difference between them. As has already been mentioned above, houses are extremely heterogenic durable capital goods. Those differences are less prominent among newly built houses, since such houses must comply with the same contemporary building standard and the regulation as well, which is why the US Census Bureau first proposed the index of the 'prices of new homes sold', also called the 'Constant Quality Index' (Shiller, 2014). Are there, however, any systematic price-relevant differences between the pool of newly built houses and the pool of the existing housing stock? For the sake of simplicity, some economic models (Poterba, 1984)

explicitly assumed that new construction was the same with respect to the construction quality as the existing housing stock. How does it yet look in real life? The biggest source of differences between newly built and old houses lies in the location. The location is not a tradable source of value since the already built location cannot be easily converted and used for new projects. Probably, the best locations are already taken by the existing housing stock, so that new projects have to be placed either in areas on the outskirts of cities, which are less attractive and often lack in the infrastructure, or in the city downtown, where the scarcity of usable land for building may limit the size and architecture of such new projects. The second difference relates to the building standards and quality. In the time spans of several decades, change in the housing standards and living habits has related to the clearly noticeable various definitions of comfort. An example of these developments is the newly established energy efficiency and thermal comfort regulations. It appears that the pool of newly constructed houses may systematically differ from the existing housing stock in terms of price-relevant features in some periods of time probably more than in others.

SERBIA'S HOUSING MARKET

In this section, market trends are discussed and the regularities in force on the Serbian national housing market and regional submarkets are analyzed. It is assumed that, apart from common market driving forces, the newly constructed house market and the existing housing stock market behave like two separated segments of the housing market with the imperfect adjustment of prices. The prime focus of the analysis is on the divergence between the prices on these two segments, with special interest in the process of mutual adjustments. Therefore, Granger causality tests are done in order to reveal whether there is any causal relationship between the price trends on these two segments or not. The results are indicative of the segment that may lead in response to a price-relevant shock and the one following it, if any such exists. Moreover, the same methodology is

applied to test if there is any such causality between the regional markets or not.

Dataset – the house price indices

The data on the housing price can be collated from various sources. Official statistics publish data on the average price based on the reported transaction prices for each individual sale. The second source of data implies collecting data from the real estate agencies which assemble data on brokered units. Irrespective of the extent to which an agency may dominate the market, its data will only refer to a fraction of the total market volume. Houses are priced based on the seller's offer that is subject to bargaining and are quite often contracted at prices lower than the offered ones. It is actually the ask/offer quotation that cannot be taken as the market price for granted. On the other hand, the reported transaction price may also be biased, since there is practice to report a lower price in selling contracts in order to decrease the capital gain and consequently personal income tax, or to decrease stamp duties or value-added tax, in which way a portion of the total price is payable in cash and not reported in contracts. This tax-evasion-motivated misreporting is more likely to occur in secondary markets. Moreover, sales made on the primary market are to a great extent arranged without the intermediation of real estate agencies, so they are free of some levies. Therefore, the data on the price for newly built houses are not completely comparable to those on the existing housing stock and are slightly more reliable for analytical purposes. The price reporting practices that do not take into account the enormous heterogeneity of housing units suffer from a critical flaw. Namely, homogeneous houses are fictitious, so are the average prices.

“What we call ‘housing’ is a disparate bundle of commodities: copper pipes, hardwood parquet flooring, brick siding, permission to send children to a neighborhood public elementary school, and exposure to certain levels of crime and noise. What most clearly binds these unlike goods together might seem to be the monthly mortgage payment that buys them all” (King, 1976, 1077).

Each housing unit is a different combination of intrinsic characteristics and location attributes, hence the heterogeneity (Gobillon & Goffette-Nagot, 2018). However, thanks to improvements in the scientific methodology (Jensen, De Vries, Coolen, Lamain & Boelhouwer, 2008; Hill & Trojanek, 2022), common price trends can now be extracted from the large baskets of commodities that differ in many price-relevant features. This methodology is based on hedonic price regressions (HPR). HPR-based price indices hold constant all the price determinants that make individual houses differ in their respective prices, only reporting change in common valuation determinants. Therefore, such indices are much better measures of the housing price inflation than any index produced with unfiltered transaction data, or the indices based on the ask/offer prices collected from real estate agencies. RGZ (Republički geodetski zavod – *Republic Geodetic Authority*) reports HPR price indices separately for the primary and secondary housing markets for the period from 2017 to date. Thus, any difference in the two indices represents different market conditions on these two market segments. Table (1) accounts for the base indexed for the Republic of Serbia and the regions.

Concerning the housing prices of the existing housing stock, Vojvodina is the fastest growing submarket, only to be followed by Belgrade Region, Southern and Eastern Serbia, and Šumadija and Western Serbia. In the region of Vojvodina and Belgrade Region, housing prices have more than doubled in the last seven years. Speaking of the prices for newly constructed houses, the two northern regions are clearly separated from the southern regions, which have reported an increase

in the price of less than 50 percent, whereas the northern regions have reported an approximately 70 percent increase. The figures shown in the last right-hand column present the ratios between the prices on the two market segments for the national market and for each regional market separately, which can be interpreted as the gaps in the prices on the two segments that have accumulated during the seven-year period. Providing that there was equilibrium between the secondary and primary market prices at the start of 2017, the national market for the existing housing stock (the secondary market segment) was overpriced relative to the new house market (the primary market segment) by more than 20 percent based on the RGZ (2024) housing price index, at the end of 2023. Again, the region of Vojvodina reports the highest rate of relative overvaluation, Šumadija and Western Serbia account for a modest rate, while the other two regions lie on the average. Yet, the assumption of equilibrium is doubtful since there is no reason whatsoever to believe that the market forces that are supposed to align the secondary market prices to the primary market prices worked at all back in 2017. Thus, the real extent of the overvaluation of the secondary market is possibly even higher.

Descriptive statistics

In this section, the summary statistics pertaining to the data series of the quarterly growth rates of the housing prices for each region are presented (Table 2), separately for the newly constructed houses (the primary market prices) and the existing housing stock (the secondary market prices). The dataset relates to

Table 1 The residential housing hedonic price indices, 2023QIV (2017Q1=100)

National and regional markets	New construction (1)	Existing stock (2)	Relative growth in % (2/1)
Republic of Serbia	163.01	198.13	21.54
Belgrade Region	169.42	205.03	21.02
Vojvodina	171.80	223.61	30.16
Southern and Eastern Serbia	145.67	179.63	23.32
Šumadija and Western Serbia	148.98	162.96	9.39

Source: The authors' calculation based on the RGZ (2024) dataset.

Table 2 The summary statistics of the data set (levels data; T=27)

	Mean	Max	Min	St. dev	Skewness	Kurtosis
RS						
New construction	1.83	2.94	0.89	0.50	0.72	3.09
Existing stock	2.57	4.47	0.79	0.98	0.15	2.40
BEL						
New construction	1.97	3.05	0.77	0.55	0.19	3.06
Existing stock	2.70	4.51	0.77	1.01	-0.06	2.25
VOJ						
New construction	2.03	2.94	0.80	0.55	-0.46	2.32
Existing stock	3.03	4.81	0.33	1.14	-0.78	3.29
SES						
New construction	1.40	4.49	0.49	1.11	1.46	4.16
Existing stock	2.20	4.79	0.71	1.25	0.67	2.43
ŠWS						
New construction	1.49	2.68	0.53	0.64	0.41	2.26
Existing stock	1.83	3.93	0.44	1.01	0.63	2.51

Source: The authors' calculation based on the RGZ (2024) dataset.

the Republic of Serbia (RS), Belgrade Region (BEL), Vojvodina (VOJ), Southern and Eastern Serbia (SES) and Šumadija and Western Serbia (ŠWS).

Unit root tests

The presence of the unit root in time series can compromise the statistical inference based on various statistical methods for time series analyses. It is also the case with causality tests. For the reason of that fact, the possibility that the series contains unit roots must be rejected as such. The ADF test proposed by D. Dickey and W. Fuller (1979) and the PP test proposed by P. Phillips and P. Perron (1988) were applied in the analysis in order to test for the presence of the unit root (non-stationarity) as a statistical property crucial for further modelling. These procedures test the null hypothesis that each individual time series has its own unit root. All the variables expressed as the levels (the quarterly growth rates) proved non-stationary (the test results not enclosed), so the procedure was repeated with the first differences. In the table below (Table 3), the computed τ -statistics and the p -values assigned to them (as given in parenthesis) are reported. The numbers with the asterisks indicate the cases of stationarity. According to the results, there is confidence greater than 95 percent that no series of the first differences contains the unit root.

Table 3 The unit root tests

		ADFT ¹⁾	PP τ ²⁾
	First difference		
RS	New construction	-2.250090* (0.0262)	-2.333880* (0.0217)
	Existing stock	-4.396232** (0.0001)	-1.813142 (0.0670)
BEL	New construction	-2.570621* (0.0124)	-2.570621* (0.0124)
	Existing stock	-3.124905** (0.0033)	-2.248598* (0.0263)
VOJ	New construction	-2.964311** (0.0047)	-2.948069** (0.0049)
	Existing stock	-2.412031* (0.0181)	-2.412031* (0.0181)
SES	New construction	-2.313167* (0.0231)	-3.8616** (0.0073)
	Existing stock	-2.4711* (0.0158)	-2.4922* (0.0150)
ŠWS	New construction	-3.167289** (0.0028)	-3.177429** (0.0027)
	Existing stock	-2.464125* (0.0160)	-2.528307* (0.0138)

Notes: ¹⁾Augmented Dickey–Fuller estimation with the constant, lag length automatic, based on SIC, MacKinnon (1996) one-sided p -values; ²⁾Phillips–Perron estimation with the constant, Bandwidth Newey–West using the Bartlett kernel filter; *The null hypothesis is rejected at the 5% significance level; **The null hypothesis is rejected at the 1% significance level.

Source: Authors

Granger causality

The statistical procedure proposed by C. Granger (1969) intends to test the statistical causality between a pair of the stationary variables re-sampled as time series. The procedure rather tests time precedence than causality in common sense. According to the test, if the past values of an explanatory variable predict the current (lagged) value of the dependent variable better than the past values of the dependent variable itself, the assumed explanatory variable can be said to Granger-cause the assumed dependent variable. The Granger test tests the null hypothesis (H_0) saying there is no causal relationship. If H_0 is rejected with statistical significance, it can be concluded that there is causality in the tested direction. Then, the test is repeated in the opposite order so as to see if there is any clue showing that causality does exist between the two variables in the opposite direction. Therefore, there are two null hypotheses to test for the pair of the variables. The test results are crucially sensitive to the chosen time lag, so the researcher has to repeat the procedure as many times as needed in order to find the most appropriate (the best fitted) lag length. In the table below (Table 4), the best fitted lag lengths, the computed F -values and the p -values assigned to them (as given in parenthesis) are reported. The

numbers with the asterisks indicate the cases of Granger causality.

The Granger linear causality tests (Table 4) confirmed the statistically robust case of unidirectional causality from the secondary market prices to the primary market housing prices for the national market and for the majority of the submarkets. With the exception of Belgrade Region, there is no evidence of the bidirectional causal relationship between those two housing segments in the other regions. Based on the causality tests, the secondary market, rather than the primary market, seems to lead in response to the prices. The primary market follows the trend of setups and reversals of the secondary market, with the lags of up to four quarters. The one-year lag (the four quarterly periods) fits best for all the regions except Vojvodina, where the one quarter lag is the best fitted lag length. For Vojvodina, the results are less conclusive (10 percent significance). The Belgrade Region case appears to stand out from other cases. Although bidirectional causality is confirmed, the causality from the primary market housing prices to the secondary market housing prices is more convincing in this particular case, which exception deserves special attention. Belgrade Region was the location of choice for almost 40 percent of all the

Table 4 The Granger causality test results – the prices for newly constructed houses (y)

Existing housing stock prices (x)	Lag	H_0 : x does not cause y	lag	H_0 : y does not cause x
First difference				
Republic of Serbia	4	8.6734*** (0.0031)	4	1.4740 (0.2585)
Belgrade Region	4	3.3096* (0.0645)	4	8.4806*** (0.0031)
Vojvodina	1	3.1687* (0.0662)	1	0.9689 (0.3975)
Southern and Eastern Serbia	4	10.1730*** (0.0016)	4	1.2365 (0.3167)
Šumadija and Western Serbia	4	6.8626*** (0.0077)	4	1.9368 (0.1765)

Notes: *The null hypothesis is rejected at the 10% significance level; **The null hypothesis is rejected at the 5% significance level; ***The null hypothesis is rejected at the 1% significance level.

Source: Authors

houses built in the group of the 24 major Serbian cities in the year 2021, in which very same year Belgrade Region held one-half of the whole national housing market in the number of sale transactions and even 63 percent of the total turnover, which is by far the most active submarket and simultaneously the submarket with the strongest influence of the new construction prices on the overall housing price level. This is why it may be assumed that the Belgrade submarket may have some influence over the other markets.

The above procedure (Table 4) assumes that the adjustment forces may work for cross-segment price alignments and that the forces are only in place within the submarket spatial boundaries. In addition to that, some other tests were done to check if there are such processes between different submarkets. Namely, house services fixed in location (trailers being the exception) can only be utilized by the movement of people, which *per se* is largely (but not entirely) motivated by search for income (job or business), the chain of the housing substitutes for buyers is limited by the travel time or distance from the site of the locational preference (Blank & Winnick, 1953). Those limitations create boundaries around the housing submarkets and bring upon the spatial delineation of the housing markets. However, this is completely true if houses are treated as solely serving the purpose of consumption, i.e. only if a house is bought to be lived in. If a house is treated as an investment vehicle, then its location may deviate from the investor's locational preference but is still

closely related to the job and income prospects of the submarket of the house location (Marinković *et al*, 2024). Bearing in mind the investment purpose of houses, all houses can be considered close substitutes, and the spatial boundaries will stay loose. The most plausible assumption is that the Belgrade Region price trends influence the price trends in the other regions (submarkets). Separate tests were performed for the new construction (Table 5) and the existing housing stock (Table 6) price trends. As in the previous case, reverse causality was also checked for, although this direction of causality is obviously less likely to be found.

The results obtained upon completion of the testing (Table 5) confirm the fact that the changes in the prices for the new construction in Belgrade Region precede the same direction changes in the prices in the other regions, which is indicative of the fact that the Belgrade prices may have a certain influence on the prices on the other submarkets, the influence being the strongest (the most conclusive) in Vojvodina, only gradually weakening in the two southern regions. The same applies if the best fitted lags are compared. The fastest transition of the prices to new levels is found to have occurred in Vojvodina, whereas the other regions need more time to react.

The next tests (Table 6) take the prices of the existing housing stocks for the purpose of analysis. The clear causality cases that appeared among the Belgrade submarket and other regional submarkets when the

Table 5 The Granger causality test results – The Belgrade newly constructed housing prices (*y*)

Newly constructed housing prices (<i>x</i>)	Lag	$H_0: x$ does not cause <i>y</i>	lag	$H_0: y$ does not cause <i>x</i>
First difference				
Vojvodina	1	0.3297 (0.7231)	1	8.2075*** (0.0027)
Southern and Eastern Serbia	2	1.1919 (0.3253)	2	4.4446** (0.0280)
Šumadija and Western Serbia	4	1.3385 (0.2901)	4	2.7910* (0.0912)

Notes: *The null hypothesis is rejected at the 10% significance level; **The null hypothesis is rejected at the 5% significance level; ***The null hypothesis is rejected at the 1% significance level.

Source: Authors

Table 6 The Granger causality test results – the Belgrade existing housing stock prices (*y*)

Existing housing stock prices (<i>x</i>)	Lag	H_0 : <i>x</i> does not cause <i>y</i>	lag	H_0 : <i>y</i> does not cause <i>x</i>
First difference				
Vojvodina	2	3.7925** (0.0422)	2	5.6926** (0.0121)
Southern and Eastern Serbia	4	2.0795 (0.1556)	4	0.6865 (0.5185)
Šumadija and Western Serbia	3	1.3802 (0.2783)	3	3.3065* (0.0612)

Notes: *The null hypothesis is rejected at the 10% significance level; **The null hypothesis is rejected at the 5% significance level; ***The null hypothesis is rejected at the 1% significance level.

Source: Authors

prices for the newly constructed houses were being considered are not visible here to a great extent. Only Vojvodina and to a lesser extent Šumadija and Western Serbia proved to be responsive to the Belgrade prices. These are Belgrade Region's bordering submarkets, so it is more likely that buyer-led cross-market arbitrage achieved the spatial alignment of the price movements. In the market segment of newly constructed houses, investors' pricing decisions are more important in determining the price and the investor's community is more spatially maneuverable. They have greater freedom to opt for the locations to build in than buyers when choosing the location to live in. The difference in the causality established as such through testing the existing housing market and the newly built housing market may be explained by the assumption that a large share of national investment in and speculative demand for houses are both directed towards the newly constructed houses in Belgrade Region as the major national submarket, which is probably the reason why buyer-led arbitrage will work better in the new construction market segment.

Based on the findings, some explanations can be summarized and the following sequence of the impacts between the market segments is suggested. Since the majority of new houses are sold in the early construction phase and, bearing in mind the comparably modest level of the residential construction activity, unsaturated demand ends

on the secondary market pushing prices up. Excess demand heats the secondary market, first with the tendency to spill over to the primary market and the prices of newly constructed houses. This sequence will generate co-movement in prices in the two segments, with the new construction housing prices lagging behind the existing housing stock prices. This explanation must be considered with some caution. Namely, the observed regularity can be at least to some extent explained by the fact that it is one of a more technical nature. The fact that a large share of newly constructed houses are sold at pre-agreed prices based on pre-contracts, i.e. in the early construction phases, but such sales are reported upon completion based on final contracts with lags of up to the total length of the production time, some of the reported new construction prices will reflect previous market conditions.

Is cooling possible on the Serbian housing market or not? If the answer is *yes*, where would it start? If the slowing down of demand is assumed, then the primary market will face slowing sales, with the potential for prices and/or the output to fall. For the given structure of the construction industry, the output fall is a more likely scenario. If there is a decrease in the price to some extent, then there will be a spillover onto the secondary market. If this happens, however, the falling trend is not believed to potentially continue any longer and a significant downward correction of the prices is needed. The

high price elasticity of new construction is likely to hold on any further downward adjustment of the housing prices. If the fact that the current level of the housing prices endangers housing affordability in terms of a desirable policy is accepted as such, the findings recommend the measures that will stimulate residential construction and prevent shocks from the housing demand side. The first aim could be addressed by applying numerous measures. For example, urban development theory (Caldera & Johansson, 2011) indicates the beneficial influences of the measures that tackle the physical limitation on development land, the restrictive regulation on the land use, the provision of the infrastructure and other public services complementary to housing, as well as the degree of competition in the residential construction industry. Those measures affect housing supply responsiveness to prices in more densely populated areas, especially in large cities. It is exactly inelastic supply that is considered to be primarily responsible for housing bubbles (Glaeser, Gyourko & Saiz, 2008). The second aim prescribes inflation control and activity to promote financial alternatives for inflation hedges i.e. the financial investment vehicles that may offer return comparable to real estate investments.

CONCLUSION

The paper investigates the dynamics of the prices on the Serbian residential housing market. The data confirm the fact that, in the medium term, newly built houses may systematically differ in quality-adjusted prices from the existing housing stock. The cross-segment adjustment process was imperfect producing not only the slow but also incomplete alignment of the prices in those two housing market segments and is likely responsible for the steady divergence of the secondary market housing prices from the primary market housing prices. The trend that has continued during the last seven years has led to the overvaluation of the existing housing stock relative to the newly constructed houses on the national market of over 20 percent, with notable differences among the regions. The paper employs

the Granger linear causality tests between the pairs of the quality-adjusted housing price indices testing the null hypothesis implying the presence of no causality at all. The Granger tests confirmed the statistically robust case of the unidirectional causality from the secondary market housing prices to the primary market housing prices for the national market and all the submarkets, except for Belgrade Region, which shows bidirectional causality with the even more conclusive reverse causality case. Thus, it seems that the secondary market, rather than the primary market, leads in response to prices. In the majority of the regional submarkets, the primary market follows the secondary market regarding the trend of setups and reversals with the lags of up to four quarters. Concerning new construction, the Granger causality tests performed so as to test whether there is any causality in the co-movements of the regional submarkets or not have confirmed the assumed direction of causality from Belgrade Region to the other regional markets. The results of the tests of the co-movement of the markets for the existing housing stocks are of a mixed nature. In terms of the desirable policy, the findings recommend the activity that will stimulate residential construction and prevent shocks coming from housing demand.

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ENDNOTES

- 1 In Serbia's accounting regulation, it is currently 2.5% annually.
- 2 The average time to sell a house in the City of Niš with *qzida* agency is 51 days after the house has first appeared on the market.
- 3 To some extent, investors may play a certain role in smoothing intertemporal price changes, which is the market-maker's role. By holding inventory when prices are low in expectation of future rising prices or selling in advance ongoing projects when prices are considered as high, investors exert an influence on smoothing price developments.
- 4 'Early bird' buyers are a specific type of speculators on housing markets, although they are not professional traders. They buy in advance and share risk with the main investor. The position of such buyers-investors is rather complex, but certainly includes speculation on intertemporal price movements. Some of them engage themselves in repeated transactions of buying and selling in a sequence, targeting early bird discounts on new houses. The similar role is played by subcontractors if they are paid in housing units.
- 5 It is estimated that, in Serbia, a half of the total market turnover is realized in the newly constructed house segment.
- 6 Such costs have a more direct influence on owner-occupied houses, although even in the cases of rented houses, movement costs may be of relevance since the costs may affect the tenant's readiness to pay the renting price and hence the readiness of the house buyers to pay the price for the house intended for rent.
- 7 The sale of a house followed by the purchase of another house, or vice versa, immediately or at short notice, if aimed to exploit unjustifiable price differentials between those houses, is actually an arbitrage-like trade. Such trades may 'relate' the houses of a different market segment or the houses of the same segment.

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DETERMINANTS OF THE OCCURRENCE OF FINANCIAL DISTRESS IN MEDIUM-SIZED AND BIG PUBLIC JOINT-STOCK COMPANIES

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Forecasting financial distress in companies is very significant bearing in mind the complexity and dynamics of the modern business environment. Accordingly, the subject matter of this research study is the determinants of the occurrence of the financial distress that may lead a company to bankruptcy. The study is aimed at determining the interdependence (correlation) between certain determinants of the occurrence of financial distress and the indicators of the probability of the occurrence of financial distress and considering the difference in the probability of the occurrence of financial distress before and after the onset of the COVID-19 pandemic in the Republic of Serbia. The research was conducted on a sample of 73 publicly traded companies, of which 22 belong to the group of big companies, and 51 to the group of medium-sized companies over the 2018-2022 period. The results have shown that there is a statistically significant negative correlation between the determinants of profitability, liquidity and solvency and the probability of financial distress. In addition, it was shown that there is a statistically significant positive correlation between leverage and the probability of financial distress, as well as between company growth and the Altman Z-score indicator. It is concluded that there is a statistically significant difference in the value of the Altman Z-score indicator before and after the onset of the pandemic caused by the COVID-19 virus.

Keywords: financial distress, bankruptcy, Altman Z-score, COVID-19

JEL Classification: M41, G32, G33

INTRODUCTION

Whatever a company's size and the activity it engages itself in, every company tries to predict its business

and the conditions of the business activity from different aspects. What companies are particularly interested in is how successful they will be in eliminating the risks that threaten their business in the future. In other words, companies are very interested in predicting and managing the factors that could lead to business failure and, eventually, bankruptcy. Decisions to discontinue operations are based on

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expected returns and the company's ability to cover its variable costs. It should be noted that a company can be in financial distress for many years, but it must never fail to pay its current obligations. If it is not able to pay its obligations upon maturity dates, then major financial problems may arise for the company (Altman & Hotchkiss, 1993). There are numerous reasons for the occurrence of business failure, of which A. S. Dewing (1926) states the four: excessive competition, unprofitable expansion, the cessation of demand for the company's products or services, and the excessive payment of capital expenditures. A slightly different understanding of the process of developing financial distress in companies implies that companies in financial distress go through the four stages of business deterioration before declaring bankruptcy, namely through incubation, a lack of cash, financial insolvency and complete insolvency (Newton, 1975).

It is very important to consider the statistical data on the number of active bankruptcy proceedings in the Republic of Serbia in the period from 2018 to 2022, because that period is covered in the paper. Namely, the data obtained from the Bankruptcy Trustee Licensing Agency indicate a large number of bankruptcy proceedings and a decrease in their number in the period from 2018 to 2022 as well (the number of bankruptcy proceedings was observed at the end of the business year). According to the website of the Bankruptcy Supervision Agency, there were 2,101 active bankruptcy proceedings at the end of 2018. In 2019, this number was 2,057; in 2020, there were 1,916 active bankruptcy proceedings; in 2021, there were 1,760, whereas at the end of 2022, there were 1,719 active bankruptcy proceedings.

The subject matter of the research study presented in the paper implies the key determinants of the occurrence of the financial distress that may lead a company to bankruptcy and the research covers all the medium-sized and big public joint-stock companies in the territory of the Republic of Serbia. The fact that it is a very complex issue to consider the factors that lead companies to an unfavorable financial position must not be forgotten, because there is a very large

number of the factors that lead to financial distress, so it is almost impossible to include them all. However, it is possible to see the key determinants based upon which the occurrence of financial distress can be predicted.

In many studies conducted in the Republic of Serbia and its neighboring countries, the Altman Z-score was used in order to predict the occurrence of the financial distress of companies in various industries (Ivaniš & Popović, 2013; Milašinović, Knežević & Mitrović, 2019; Knežević Špiler, Milašinović, Mitrović, Milojević & Travica, 2021; Kozarević & Pirić, 2022; Milić, Tekić, Novaković, Zekić, Popov & Mihajlov, 2022). Yet, there is a significantly smaller number of papers dealing with the analysis of the determinants of the occurrence of financial distress in public joint-stock companies in the Republic of Serbia, as well as those dealing with the comparison of the probability of the occurrence of financial distress in these companies before and after the onset of the pandemic caused by the COVID-19 virus. The COVID-19 pandemic is known to have affected not only people's health, but also the operations of companies and the functioning of countries' economies, so it is very important to take into consideration the changes caused by the pandemic when speaking about the likelihood of financial distress for the observed companies. The aforementioned facts represent a certain research gap that the authors will try to eliminate with this research. Therefore, the paper is aimed at determining the interdependence (correlation) between certain determinants of the occurrence of financial distress and the indicators of the probability of the occurrence of financial distress and the difference in the probability of the occurrence of financial distress before and after the onset of the pandemic caused by the COVID-19 virus in the Republic of Serbia.

Based on the defined subject matter and the goal of the research study, the following research hypotheses were set in the paper:

H1: There is a statistically significant negative correlation between the probability of financial distress and profitability.

- H2: There is a statistically significant negative correlation between the probability of financial distress and liquidity.
- H3: There is a statistically significant negative correlation between the probability of financial distress and solvency.
- H4: There is a statistically significant positive correlation between leverage and the probability of financial distress.
- H5: There is a statistically significant negative correlation between the Altman Z-score and company growth.
- H6: There is a statistically significant difference in the value of the Altman Z-score before and after the onset of the COVID-19 pandemic.

The research study carried out in the paper includes all big and medium-sized public joint-stock companies in the territory of the Republic of Serbia, i.e. 22 big and 51 medium-sized public joint-stock companies in the period from 2018 to 2022 (the size having been determined based on the criteria outlined in the Accounting Law). In addition to the quantitative methods (descriptive statistics, correlation statistical analysis, and the Wilcoxon signed rank test), the qualitative methods of induction, deduction, analysis, synthesis and abstraction were also used.

Except for the Introduction and Conclusion, the paper is structured into three more parts. The first part presents a literature review. The second part gives an overview of the methodology used in the work. The third part contains the results of the empirical research and the discussion of the results.

LITERATURE REVIEW

The term “financial distress” is general and vague to some extent. Generally speaking, the term refers to the inability to pay obligations (for example a debt) when they are due (Gilson, Kose & Lang, 1990). Operational definitions of financial distress focus on two main events: bond default and bankruptcy, both being

known to the public and the dates they occurred on being known with some precision (Beaver, Correia & McNichols, 2011). The continued development of conceptually richer and more accurate forecasting models is of importance to regulators, practitioners and academics (Shumway, 2001). Recently, with the development of informational technology, machine learning and artificial intelligence, a new field of digital data analysis has begun to emerge and develop rapidly, which has contributed to the accelerated development of the methods that can predict the financial distress of companies (Sun & Li, 2008).

The following is an overview of the individual determinants on the basis of which the research hypotheses were set in this paper, based on previously conducted research. As can be seen from the formulated hypotheses, each determinant simultaneously has a certain interdependence with the indicators that indicate the possibility of financial distress.

Profitability

Profitability can be defined as the ultimate measure of the economic success achieved by a company in relation to invested capital (Andriani, Nurnajamuddin & Rosyadah, 2021). Profitability is the primary goal of all companies and without profitability no company can survive for a long period of time (Khan & Raj, 2020). The ROA (Return on Assets) ratio is most often used to measure profitability (Ohlson, 1980; Lo, 1986; and Gombola, Haskins, Ketz, & Williams, 1987). However, it is also suitable to use the ROE (Return on Equity) ratio that measures the financial success achieved from the owner’s point of view, which B. Kollár and Z. Sojková (2015) used in their research on financial distress. Return on assets represents the quotient of the net result and the total company’s assets, whereas return on equity represents the quotient of the net result and the company’s equity (Račić, Barjaktarović & Zeremski, 2011).

J. Y. Campbell, J. Hilscher and J. Szilagyi (2008) studied the determinants of corporate failure and the pricing of stocks in financial distress using statistical models and came to the conclusion that lower

profitability would lead to higher levels of financial problems that increase the chance that the company would find itself bankrupt. In the research conducted by C. K. Thim, Y. V. Choong and C. S. Nee (2011), the authors also came to the conclusion that there was a statistically significant negative correlation between profitability (measured through ROA) and the probability of financial distress (measured by the Altman Z-score). A study by E. Masdupi, A. Tasman and A. Davista (2018) which was carried out on a sample of Indonesian listed companies also shows that there is a negative correlation between profitability and the probability of financial distress. R. A. Dwiantari and L. G. S. Artini (2021) say in their paper that there is a negative correlation between the profitability indicators and the possibility of financial distress.

Liquidity

Liquid assets are generally considered to be a measure against crises as they allow companies to save funds by not having to sell assets in unfavorable situations in order for them to pay off their debt (Shleifer & Vishny, 1992). In this paper, liquidity is measured using three ratio numbers, namely the current, quick and liquid ratios. The *current ratio* (CR) represents the quotient of the current assets and short-term liabilities, while the *quick ratio* (QR) is obtained from the ratio of the current assets less the value of inventories (the so-called relatively liquid assets) and the amount of short-term liabilities, and the *liquid ratio* (LR) is represented by the quotient of the amount of cash and short-term liabilities (Saleem & Rehman, 2011).

Liquid funds can be said to allow companies to avoid higher costs of the other sources of funds for financing their activities and investment (Mikkelsen & Partch, 2003). A. W. Butler, G. Grullon and J. P. Weston (2005) found that the fees charged by investment banks were lower for the companies with more liquid capital. The study showed that the costs of financial distress were inversely related to the holding of the liquid assets. The results of the research conducted by O. S. Desiyanti, W. Soedarmono, K. Chandra and K. Kusnadi (2019) clearly point to the fact that there

is a statistically significant negative correlation between the liquidity ratios and the probability of financial distress. In the results of their paper, C. K. Thim *et al* (2011) state that they have also discovered a statistically significant negative correlation between liquidity and the probability of the occurrence of financial distress in the listed companies. In the research study conducted by N. Kim-Soon, A. A. E. Mohammed and F. K. M. Agob (2013) on a sample of listed companies, the authors found that there was a statistically significant negative correlation between the liquidity indicators and the possibility of financial distress.

Solvency

Given the fact that liquidity represents a company's ability to meet its obligations as they fall due, solvency is often referred to as "long-term liquidity". Namely, the ratio analysis of solvency basically implies an overview of the solvency which represents the long-term vitality of the company (Wild, Subramanyam & Halsey, 2007). The solvency ratio represents the quotient of own and borrowed capital (Obradović, 2021).

The solvency ratio can be used to measure the severity of financial distresses (James, 1996). M. Harris and A. Raviv (1990) suggest that leverage is inversely related to the solvency ratio and argue that an increase in debt will cause a higher probability of default. In their research done in the listed companies, C. K. Thim *et al* (2011) point out the fact that there is a statistically significant negative correlation between the ratio of the solvency indicators and the probability of financial distress in the companies. In the research study that included companies from the USA, K. Amoa-Gyarteng (2021) also states that a statistically significant negative correlation was identified between the ratio of the solvency indicators and the probability of the occurrence of financial distress. In their study, L. C. Megasanti and H. E. Riwayati (2023) state that they came to the conclusion that there was a negative correlation between the ratio of the solvency indicators and the probability of the occurrence of financial distress.

Leverage

Leverage shows the impact of a debt on investment rates and investment opportunities in companies where the level of the company's debt will indirectly affect investors' interest and confidence in the companies (Rohmadini, Saifi & Darmawan, 2018). A company's high or low debt will affect the size of the risk of financial distress that may occur in the company. The debt-to-equity ratio (DER) is a ratio used to assess a company's leverage. According to Dirman's interpretation, this ratio is obtained by comparing all debts, including the current debt, with the total capital, i.e. total liabilities, which is equal in amount to the total assets (Dirman, 2020).

If a company does not have sufficient revenue, it is very likely that the company will easily find itself in a situation where financial distress will occur (Gobenvy, 2014). In their research, among other things, A. Rohmadini *et al* (2018) came to the results that leverage affected financial problems in a sense that there was a positive correlation between leverage and the probability of financial problems. In their study including manufacturing companies, S. M. K. Rahman, M. K. Islam and M. M. Hossain (2021) also indicated the presence of a positive correlation between leverage and the probability of financial distress. Investigating the interdependence of leverage and the probability of the occurrence of financial distress, A. Dirman (2020) came to the conclusion that there was no negative correlation between leverage and the probability of the occurrence of financial distress, i.e. there was a positive correlation between leverage and the possibility of the occurrence of financial distress in the company.

Company growth

Where company growth is concerned, different types of growth, such as market growth, financial growth, growth in terms of the size or profitability, and other types can be discussed. In this paper, company growth is exclusively discussed as growth from the aspect of profitability. According to the statement, growth will be quantified by considering change in

the operating profit in the current year compared to the previous year, which C. K. Thim *et al* (2011) used in their paper.

O. Yosha (1995) suggested that companies with potentially valuable future growth projects would not raise a debt by issuing securities (the debt) because of the high costs of disclosing sensitive information. Also, J. K. MacKie-Mason (1990) explains that the companies that work intensively on research and development should avoid issuing debt securities. Therefore, there should be a negative relationship between growth and financing by debt, which means that high-growth companies will face a lower Altman Z-score indicator (a negative correlation between growth and the Altman Z-score) because they employ less financing by debt. Thus, the current borrowing alleviates the immediate situation, but worsens the company's future position, which is the reason why the fifth research hypothesis posits that the companies experiencing certain growth have a higher likelihood of facing financial distress in the future, as indicated by lower Altman Z-score values. Assuming that companies are unique in terms of future, as well as current financial problems, there is a good chance that companies with highly expected growth opportunities will maintain a low-risk debt capacity to avoid financing future investments through equity offerings or missed investments (Morri & Cristanziani, 2009). C. K. Thim *et al* (2011) point out the fact that company growth has a statistically significant negative correlation with the Altman Z-score indicators.

The COVID-19 pandemic

The companies that have experienced the financial distress caused by the COVID-19 pandemic require the corrective steps that are adapted to the conditions of the crisis caused by the pandemic, as well as those that will allow those companies to continue to operate and improve their business, in order to improve their performance in the future (Marginingsih, 2022). Restrictions on community activities due to the COVID-19 pandemic restrictions have caused economic losses at the national level (Hadiwardoyo, 2020).

According to the results of a survey conducted on a sample of 27 companies from Indonesia (Rahmah & Novianty, 2021), it was concluded that there were statistically significant differences in the Z-score value between the period before and during the COVID-19 pandemic. A similar research study conducted on the listed companies in China generated similar results, namely that the COVID-19 pandemic had a significant impact on the business of the analyzed companies (Rababah, Al-Haddad, Sial, Chunmei & Cherian, 2020). Based on the research study on companies in Nigeria conducted by H. O. Aifuwa, A. Saidu and S. A. Aifuwa (2020), it can be concluded that the linear regression results of this study revealed the fact that the COVID-19 pandemic was detrimental to the financial and nonfinancial performance of private companies in Nigeria. The results of the research study conducted by R. Marginingsih (2022) indicate an increased probability of financial distress (a decrease in the Z-score indicators) in the period after the onset of the pandemic. N. Fitria, H. Putri, K. Shabirin and O. T. Doumbouya (2022) present the results of their research study, in which they found that there was a certain difference in the Altman Z-score indicators before and during the COVID-19 pandemic.

RESEARCH METHODOLOGY

The criteria for classifying companies by size were based on the standards outlined in the Accounting Law of the Republic of Serbia, as presented in Table 1. It is important to note that a company must meet

two out of the three specified conditions so as to be classified into a particular group.

Therefore, the joint-stock companies listed on the Belgrade Stock Exchange, i.e. those whose shares can be traded on the stock exchange, are included. The period covered by the research study spans from 2018 to 2022, (namely, five-year period), in which all the companies' performances are observed at the end of the year, bearing in mind the fact that the subject matter of the analysis is the financial statements of the companies published at the end of the business years. All financial reports were downloaded from the website of the Business Registers Agency, and the data presented in them were processed in the SPSS statistical program for social sciences. For the companies included, consolidated financial statements were used, as it is more appropriate to review the financial statements of the entire group rather than only of the parent company. The consolidated financial statements provide a better basis for analysis.

The qualitative methods of analysis, synthesis, induction, deduction, and abstraction are used in the paper. In terms of quantifying the probability of the occurrence of financial distress in the companies, the most famous and potentially the most acknowledged model known as the Altman Z-score is used. This model is based on the calculation of certain ratio indicators (from X_1 to X_5), based on which the Z-indicators are calculated to sublimate the effect of all the five mentioned variables (except for the Z'' indicator that sublimate the effect of the four

Table 1 The criteria for classifying companies by size

The size	The average number of employees	Business revenues	Total assets
Micro	≤ 10 employees	≤ 700.000 euros	≤ 350.000 euros
Small	> 10 and ≤ 50 employees	> 700.000 and ≤ 8.000.000 euros	> 350.000 and ≤ 4.000.000 euros
Medium-sized	> 50 and ≤ 250 employees	> 8.000.000 and ≤ 40.000.000 euros	> 4.000.000 and ≤ 20.000.000 euros
Big	> 250 employees	> 40.000.000 euros	> 20.000.000 euros

Source: Authors. Calculation is based on the Accounting Law of the Republic of Serbia

variables). So, based on the results of the Z-indicators, the examiner draws a conclusion about the probability of bankruptcy in companies. The model is represented by the following formula (Altman, 1968):

$$Z = 1,2 X_1 + 1,4 X_2 + 3,3 X_3 + 0,6 X_4 + 0,999 X_5 \quad (1)$$

where Z is the Altman Z-score, and the other elements marked with an X are calculated as follows:

X_1 = The net current assets / Total assets

X_2 = The net current assets / Total assets

X_3 = EBIT (Earnings before interest and taxes) / Total assets

X_4 = The market value of equity / The book value of the total liabilities (hereinafter, this calculated variable is marked as "X4.1")

X_5 = Sales revenue / Total assets

For the company whose Z-score value is lower than 1.80, there is a high probability of bankruptcy. If the Z-score value is greater than 3.00, the probability of bankruptcy is very low. The range between 1.80 and 3.00 represents the so-called "zone of ignorance" or "uncertainty zone," where it is difficult to determine the probability of bankruptcy.

Since the Z-score was only applicable to public companies, not to private ones (because of the X_4 indicator), Altman developed a new model with new weights, which can be applied to the companies whose shares are not traded (Altman, Iwanicz-Drozowska, Laitinen & Suvas, 2017):

$$Z' = 0,717 X_1 + 0,847 X_2 + 3,107 X_3 + 0,420 X_4 + 0,998 X_5 \quad (2)$$

where X_4 represents the ratio of the book value of own capital and the book value of total liabilities (hereinafter, this calculated variable is marked as "X4.2").

If the value of Z' is lower than 1.23, there is a high probability of bankruptcy, whereas in a situation where the value of Z' is greater than 2.90, there is a very low probability of bankruptcy. When the Z'-score value is between 1.23 and 2.90, the probability of

bankruptcy cannot be determined with certainty (the so-called "uncertainty zone").

In order for there to be no influence of the activity on the bankruptcy prediction model, a four-variable model was developed, in which the X_5 variable was excluded (Altman & Hotchkiss, 1993), namely:

$$Z'' = 3,25 + 6,56 X_1 + 3,26 X_2 + 6,72 X_3 + 1,05 X_4 \quad (3)$$

where the X_4 variable is determined as in the Z' model (hereinafter, this calculated variable is marked as "X4.2"), and for the companies with the negative value of Z'', the probability of financial distress is very high.

The ROA and ROE indicators were calculated in order to assess profitability, whereas the current, quick and liquid ratios were calculated so as to assess liquidity, and the X_4 Altman Z-score indicator was taken as the solvency indicator. On the other hand, leverage was calculated as the ratio of the total liabilities to the total assets, whereas company growth was measured as the chain index of change in the operating profit in the current year compared to the previous year.

All the analyzed data were statistically processed in the SPSS program. At the same time, descriptive statistical analysis was first used, whereas correlational statistical analysis was used to examine the interdependence between the individual determinants and the probability of the occurrence of financial distress (the Altman Z-score). For the purpose of analyzing the differences in the Altman Z-score values before and after the onset of the COVID-19 pandemic, the Wilcoxon signed rank test was used, preceded by the Shapiro-Wilk test which was used to test the normality of the distribution.

EMPIRICAL RESEARCH RESULTS

First, the results of the descriptive statistics are presented in Table 2, where the results of the mean, minimum, maximum, standard deviations and medians for individual indicators, as well as the sublimated indicators of the Altman Z-score, are

Table 2 The descriptive statistics of the used ratio indicators and the Z-score

Year		ROA	ROE	CR	QR	LR	Solvency	Leverage	Growth	Z-score
2018	Mean	0.023	0.072	1.925	1.264	0.330	1.963	0.503	-0.058	2.754
	Median	0.016	0.034	1.317	0.893	0.066	0.582	0.459	-0.150	2.096
	Std. deviation	0.072	0.135	1.724	1.320	0.633	4.520	0.345	3.137	3.086
	Minimum	-0.328	-0.288	0.066	0.041	0.000	0.010	0.041	-15.014	-1.400
	Maximum	0.223	0.716	9.371	6.825	3.164	33.935	1.704	14.273	22.068
2019	Mean	0.027	0.105	1.980	1.288	0.403	2.149	0.478	1.193	2.881
	Median	0.017	0.025	1.405	0.859	0.108	0.596	0.426	0.180	2.190
	Std. deviation	0.173	0.436	1.948	1.396	0.785	4.931	0.316	4.124	3.250
	Minimum	-1.032	-0.241	0.058	-1.011	0.000	0.006	0.042	-4.685	-1.648
	Maximum	0.897	3.690	12.326	6.093	3.975	36.754	1.500	22.551	23.565
2020	Mean	0.006	-0.165	2.027	1.343	0.459	2.074	0.482	-3.995	2.679
	Median	0.013	0.027	1.587	0.962	0.136	0.580	0.411	0.040	2.097
	Std. deviation	0.103	1.430	1.650	1.311	0.708	4.787	0.341	35.373	3.143
	Minimum	-0.384	-11.784	0.052	0.033	0.000	0.004	0.055	-296.146	-2.077
	Maximum	0.281	0.440	7.884	6.237	2.874	35.622	1.701	31.432	22.793
2021	Mean	0.007	-0.018	1.876	1.237	0.413	1.908	0.495	0.899	2.596
	Median	0.014	0.030	1.521	0.895	0.127	0.599	0.426	-0.009	2.174
	Std. deviation	0.092	0.438	1.450	1.224	0.776	4.384	0.361	7.305	2.865
	Minimum	-0.471	-3.570	0.049	0.032	0.001	0.011	0.055	-14.860	-1.939
	Maximum	0.190	0.319	7.139	6.489	5.528	32.681	1.697	38.541	20.710
2022	Mean	0.014	0.003	1.891	1.211	0.359	2.511	0.523	-0.113	3.077
	Median	0.014	0.025	1.443	0.888	0.097	0.665	0.443	-0.009	2.081
	Std. deviation	0.082	0.220	1.471	1.187	0.640	7.142	0.512	1.546	4.350
	Minimum	-0.254	-1.449	0.035	0.025	0.000	0.015	0.048	-5.698	-2.117
	Maximum	0.316	0.351	7.376	5.755	3.937	55.367	3.663	4.121	33.587

Source: Authors

accounted for. Certain factors that influence the values of the Altman Z-score that were determined by the hypotheses are also given.

The data necessary to conduct the research study and calculate the indicators were collated from the financial reports of the analyzed companies from the Business Registers Agency's website and processed using the SPSS statistical program for social sciences. The confidence levels $\alpha = 0.05$ and $\alpha = 0.01$ were used to determine statistical significance.

Table 2 shows the results of the descriptive statistics of the individual determinants and the Altman Z-score, since the Z-score for the selected sample (the listed joint-stock companies) is the most suitable measure of the occurrence of financial distress.

According to the data shown in Table 2, it can be clearly concluded that, in all observed years, the result of the Altman Z-score (used for the listed companies) is in the so-called "uncertainty zone" for the companies from the observed sample, since the values of the mean and the median of the Altman Z-score are in all observed years between the lower and upper limits, i.e. between 1.80 and 3.00. In 2022, however, the mean was 3.077, which means that the observed companies mostly had a low probability of financial distress, which speaks in favor of the hypothesis H6, since it is a year in which the pandemic had a weak effect. The minimum values of the Altman Z-score refer to the company *Politika*, which means that this company is extremely exposed to financial distress and there is a high probability of opening bankruptcy proceedings.

In order to test the hypothesis H1 it is necessary to analyze the results of the correlation analysis presented in Table 3. At the same time, Spearman's correlation coefficient was used because it was established through the box-plot diagram that it was not a normal distribution. In such a situation, Spearman's correlation coefficient is a more suitable measure for determining interdependence between variables. The fact that the Altman Z-score values are interpreted inversely, i.e. the higher values of the Z-score indicate a lower probability of the occurrence of financial distress, whereas the lower values of the Z-indicator indicate a greater probability of the occurrence of financial distress, should not be forgotten and the interpretation of the results should be done according to that fact.

Considering the results accounted for in Table 3, it can be said that, until 2020, there was a statistically significant strong positive correlation (Spearman's correlation coefficient is over 0.6 and Sig.=0.000 < α = 0.01) between ROA and the Altman Z-score, which is more relevant than Z' and Z''. Then, in 2020 and 2021, there was a statistically significant moderate positive correlation (Spearman's correlation coefficient

was between 0.4 and 0.6, and Sig.=0.000 < α = 0.01) between the profitability ratios (ROA and ROE) and the Altman Z-score. Finally, in 2022, there was a statistically significant weak positive correlation (Spearman's correlation coefficient was between 0 and 0.4, and Sig.=0.000 < α = 0.01).

The hypothesis H2, as well as the hypothesis H1, will be tested performing correlation analysis. The results of the correlation analysis between the liquidity indicators are presented in Table 4. At the same time, the number of the observation units remains unchanged (n=73).

Based on the data presented in Table 4, it is clear that there is a statistically significant strong positive correlation, or interdependence, between liquidity and the Altman Z-score in the public joint-stock companies included in the sample, which indicates a statistically significant strong negative correlation between liquidity and the probability of bankruptcy. It should be noted that the positive correlation between liquidity and the Altman Z-score signifies a negative correlation between liquidity and the likelihood of financial distress, due to the inverse interpretation of the Altman Z-score values (the

Table 3 The results of Spearman's correlation between the profitability indicators and the Altman Z-score

Year	Ratio		Z	Z'	Z''	Year	Ratio		Z	Z'	Z''	
2018	ROA	Spearman's coef. cor.	0.602**	0.567**	0.544**	2019	ROA	Spearman's coef. cor.	0.619**	0.542**	0.558**	
		Sig. (2-tailed)	0.000	0.000	0.000			Sig. (2-tailed)	0.000	0.000	0.000	
		n	73	73	73			n	73	73	73	
	ROE	Spearman's coef. cor.	0.506**	0.458**	0.327**		ROE	Spearman's coef. cor.	0.578**	0.473**	0.433**	
		Sig. (2-tailed)	0.000	0.000	0.000			Sig. (2-tailed)	0.000	0.000	0.000	
		n	73	73	73			n	73	73	73	
2020	ROA	Spearman's coef. cor.	0.482**	0.457**	0.404**	2021	ROA	Spearman's coef. cor.	0.557**	0.452**	0.334**	
		Sig. (2-tailed)	0.000	0.000	0.000			Sig. (2-tailed)	0.000	0.000	0.004	
		n	73	73	73			n	73	73	73	
	ROE	Spearman's coef. cor.	0.451**	0.383**	0.279*		ROE	Spearman's coef. cor.	0.493**	0.342**	0.232*	
		Sig. (2-tailed)	0.000	0.001	0.017			Sig. (2-tailed)	0.000	0.003	0.048	
		n	73	73	73			n	73	73	73	
2022	ROA	Spearman's coef. cor.	0.379**	0.412**	0.267**			Spearman's coef. cor.	0.379**	0.412**	0.267**	
		Sig. (2-tailed)	0.001	0.000	0.022			Sig. (2-tailed)	0.001	0.000	0.022	
		n	73	73	73			n	73	73	73	
	ROE	Spearman's coef. cor.	0.316**	0.321**	0.179			ROE	Spearman's coef. cor.	0.316**	0.321**	0.179
		Sig. (2-tailed)	0.006	0.006	0.129				Sig. (2-tailed)	0.006	0.006	0.129
		n	73	73	73				n	73	73	73

**Correlation is significant at the level of Sig.=0.01 (2-tailed) *Correlation is significant at the level of Sig.=0.05 (2-tailed)

Table 4 The results of Spearman’s correlation between the liquidity indicators and the Altman Z-score

Year	Ratio		Z	Z'	Z''	Year	Ratio		Z	Z'	Z''
2018	CR	Spearman’s coef. cor. Sig. (2-tailed)	0.695** 0.000	0.670** 0.000	0.909** 0.000	2019	CR	Spearman’s coef. cor. Sig. (2-tailed)	0.669** 0.000	0.609** 0.000	0.808** 0.000
	QR	Spearman’s coef. cor. Sig. (2-tailed)	0.742** 0.000	0.734** 0.000	0.833** 0.000		QR	Spearman’s coef. cor. Sig. (2-tailed)	0.710** 0.000	0.700** 0.000	0.758** 0.000
	LR	Spearman’s coef. cor. Sig. (2-tailed)	0.629** 0.000	0.689** 0.000	0.724** 0.000		LR	Spearman’s coef. cor. Sig. (2-tailed)	0.594** 0.000	0.626** 0.000	0.598** 0.000
2020	CR	Spearman’s coef. cor. Sig. (2-tailed)	0.663** 0.000	0.688** 0.000	0.875** 0.000	2021	CR	Spearman’s coef. cor. Sig. (2-tailed)	0.537** 0.000	0.725** 0.000	0.831** 0.000
	QR	Spearman’s coef. cor. Sig. (2-tailed)	0.659** 0.000	0.706** 0.001	0.816** 0.000		QR	Spearman’s coef. cor. Sig. (2-tailed)	0.643** 0.000	0.768** 0.000	0.786** 0.000
	LR	Spearman’s coef. cor. Sig. (2-tailed)	0.683** 0.000	0.779** 0.000	0.770** 0.000		LR	Spearman’s coef. cor. Sig. (2-tailed)	0.574** 0.000	0.653** 0.000	0.611** 0.000
2022	CR	Spearman’s coef. cor. Sig. (2-tailed)	0.640** 0.001	0.700** 0.000	0.933** 0.000						
	QR	Spearman’s coef. cor. Sig. (2-tailed)	0.635** 0.000	0.712** 0.000	0.865** 0.000						
	LR	Spearman’s coef. cor. Sig. (2-tailed)	0.671** 0.000	0.744** 0.000	0.713** 0.000						

**Correlation is significant at the level of Sig.=0.01 (2-tailed)

Source: Authors

lower values indicate a higher probability of financial distress and vice versa). Only in 2021 was there a moderate correlation, however, the value of the coefficient itself being extremely close to the limit of 0.6, which also indicates an almost strong correlation between liquidity and the Altman Z-score indicator. All the obtained values are statistically significant at the 99% level (Sig.=0.000 or 0.001 < α = 0.01). On the other hand, if the correlation between liquidity and the Z' and Z'' indicators is observed, the values of Spearman’s correlation coefficient can be seen, which indicates an extremely strong positive correlation (correlation coefficient > 0.8), statistically significant at the level of reliability of 99% (Sig.=0.000 or 0.001 < α = 0.01).

To test the hypothesis H3 that refers to the interdependence of solvency and the possibility of financial distress in the companies, correlational statistical analysis was also carried out in the SPSS statistical program for social sciences. As in the testing of the previous hypotheses, the sample simultaneously remains unchanged, i.e. n=73. It should be known that the positive correlation of solvency and the Altman Z-score indicates negative

correlation between solvency and the probability of financial distress due to the inverse interpretation of the value of the Altman Z-score (the smaller values indicate a greater probability of financial distress and vice versa).

In Table 5, the X₄ Altman model indicator is used as the solvency indicator, because the formula for calculating X₄ is identical to the formula for calculating the solvency ratio. At the same time, X4.1 is used when calculating the Z-score (for the listed joint-stock companies), while X4.2 is adapted for calculating the indicators Z' and Z'' (for the companies that are not listed). With the risk of error (p-value) of 1% (Sig.=0.000 < α = 0.01) and the confidence level of 99%, it can be argued that there is a moderate positive correlation between the indicator X4.1 and the indicator Z, which tends towards strong correlations (in each observed year, the value is closer to 0.6 than to 0.4), while there is a strong positive correlation between the indicator X4.2 and the indicators Z' and Z'' (Sig. < α = 0.01). If observation is carried out in the opposite way, it is clearly seen that the indicator X4.1 is mostly weakly correlated with the indicators Z' and Z'' (especially with Z'), and also that the indicator X4.2 is moderately

and, in terms of its value, almost weakly correlated with the indicator Z, which additionally justifies the claim that X4.1 is suitable for calculating the Z indicator, and X4.2 for calculating the indicators Z' and Z''.

In order to test the hypothesis H4, the results of the correlation analysis between leverage and the Altman Z-score indicators are shown in Table 6. The hypothesis was tested on all 73 public joint-stock companies included in the sample. As before, simultaneously bear in mind the fact that the positive correlation of this determinant with the Z-indicators indicates a negative correlation with a probability of

the occurrence of financial distress, i.e. a negative correlation with the Z-indicators implies a positive correlation with a probability of the occurrence of bankruptcy and financial distress in the observed companies.

Based on the data shown in Table 6, it can be claimed at the confidence level of 99% (Sig. < α = 0.01) that there is a statistically significant negative (inverse) correlation between leverage, which indicates the degree of indebtedness, and the Altman Z-score. For the most part, this interdependence is of a moderate character (moderate negative correlation), throughout the observation period. However, it is

Table 5 The results of Spearman's correlation between the solvency indicators and the Altman Z-score

Year	Ratio		Z	Z'	Z''	Year	Ratio		Z	Z'	Z''
2018	X4.1	Spearman's coef. cor.	0.546**	0.314**	0.659**	2019	X4.1	Spearman's coef. cor.	0.565**	0.401**	0.645**
		Sig. (2-tailed)	0.000	0.007	0.000			Sig. (2-tailed)	0.000	0.000	0.000
2018	X4.2	Spearman's coef. cor.	0.422**	0.593**	0.878**	2019	X4.2	Spearman's coef. cor.	0.432**	0.601**	0.844**
		Sig. (2-tailed)	0.000	0.000	0.000			Sig. (2-tailed)	0.000	0.000	0.000
2020	X4.1	Spearman's coef. cor.	0.564**	0.389**	0.632**	2021	X4.1	Spearman's coef. cor.	0.546**	0.406**	0.647**
		Sig. (2-tailed)	0.000	0.001	0.000			Sig. (2-tailed)	0.000	0.000	0.000
2020	X4.2	Spearman's coef. cor.	0.438**	0.683**	0.895**	2021	X4.2	Spearman's coef. cor.	0.404**	0.664**	0.910**
		Sig. (2-tailed)	0.000	0.000	0.000			Sig. (2-tailed)	0.000	0.000	0.000
2022	X4.1	Spearman's coef. cor.	0.586**	0.399**	0.636**						
		Sig. (2-tailed)	0.000	0.000	0.022						
2022	X4.2	Spearman's coef. cor.	0.452**	0.611**	0.896**						
		Sig. (2-tailed)	0.000	0.000	0.000						

** Correlation is significant at the level of Sig.=0.01 (2-tailed)

Source: Authors

Table 6 The results of Spearman's correlation between the leverage and the Altman Z-score

Year	Ratio		Z	Z'	Z''
2018	Lever.	Spearman's coef. cor.	-0.416**	-0.590**	-0.873**
		Sig. (2-tailed)	0.000	0.007	0.000
2019	Lever.	Spearman's coef. cor.	-0.422**	-0.595**	-0.838**
		Sig. (2-tailed)	0.000	0.000	0.000
2020	Lever.	Spearman's coef. cor.	-0.427**	-0.678**	-0.889**
		Sig. (2-tailed)	0.000	0.001	0.000
2021	Lever.	Spearman's coef. cor.	-0.395**	-0.662**	-0.903**
		Sig. (2-tailed)	0.001	0.000	0.000
2022	Lever.	Spearman's coef. cor.	-0.427**	-0.590**	-0.884**
		Sig. (2-tailed)	0.000	0.000	0.022

** Correlation is significant at the level of Sig.=0.01

Source: Authors

interesting that the correlation with Z'-score is in the domain of a moderate, even strong negative (a strong negative correlation was seen in 2020 and 2021), while the negative correlation of leverage and the Z'-indicator in each observed year is extremely strong (the correlation coefficient < -0.8). In other words, the simpler the model for predicting the occurrence of financial distress in companies, the stronger the negative correlation between leverage and the Altman model. In any case, it is clear that there is a statistically significant negative correlation between leverage and the Altman Z-score indicator, which further means that there is a positive correlation between leverage and a probability of financial distress.

In order to test the hypothesis H5 Table 7 presents the results of the correlation analysis between the growth index and the Altman Z-score indicators. This hypothesis required certain corrections in terms of excluding some observation units from the sample, so not all the companies that had initially been included in the sample were tested because the existence of the outliers, i.e. the observation units with pronounced extreme values, was observed.

Considering the results of the correlation analysis shown in Table 7, it can be seen that, in most years of the observation period, there is a weak correlation

between the growth indicators and the Altman Z-score indicators. Namely, in 2018, 2019 and 2022, the confidence level of 95% (Sig. < α = 0.05) was noticed, based upon which fact it can be claimed that there was a statistically significant weak positive correlation (the correlation coefficient > 0; < 0.4) between growth and the Altman Z-score of the observed companies. On the other hand, with the confidence level of 99% (Sig. < α = 0.01), it can be claimed that, in 2020 and 2021, there was a statistically significant moderate positive correlation between the growth index and the Altman Z-score indicator, which further means that there is a statistically significant negative interdependence between the growth of the company and a probability of financial distress. What can also clearly be seen in the table is the fact that, for the purposes of testing H5, the number of the observation units (n) was reduced, since the existence of the extreme values (outliers) that could hinder the research to some extent was noticed, and the obtained results are unreliable. Therefore, the companies that had the extreme values (either positive or negative) of the growth index were excluded from the research study.

Tables 8 and 9 show the results of testing the last hypothesis H6, which refers to the differences in the value of the Altman Z-score indicators before

Table 7 The results of Spearman's correlation between the growth index and the Altman Z-score

Year	Ratio	Z	Z'	Z''	
2018	Growth	Spearman's coef. cor.	0.311*	0.181	0.117
		Sig. (2-tailed)	0.020	0.181	0.391
		n	56	56	56
2019	Growth	Spearman's coef. cor.	0.335*	0.295*	0.406**
		Sig. (2-tailed)	0.015	0.034	0.003
		n	52	52	52
2020	Growth	Spearman's coef. cor.	0.384**	0.246	-0.011
		Sig. (2-tailed)	0.004	0.067	0.937
		n	56	56	56
2021	Growth	Spearman's coef. cor.	0.410**	0.182	0.165
		Sig. (2-tailed)	0.001	0.167	0.213
		n	59	59	59
2022	Growth	Spearman's coef. cor.	0.251*	-0.165	-0.206
		Sig. (2-tailed)	0.044	0.190	0.100
		n	65	65	65

** Correlation is significant at the level of Sig.=0.01 (2-tailed) * Correlation is significant at the level of Sig.=0.05 (2-tailed)

and after the onset of the pandemic caused by the COVID-19 virus, where one year before the onset of the pandemic (2019) and one year after the onset of the pandemic (2020) are observed. At the same time, the three companies that represented the extreme values were eliminated from the sample. For the purpose of testing this hypothesis, only the Z-score values (not the Z' and Z'' values) were used as the most reliable measure since all the companies are listed on the Belgrade Stock Exchange. Given the fact that the subject matter of the observation in 2019 and 2020 are the same companies and that the change in the value of one variable (the Z-score) is observed before and after the onset of the COVID-19 virus pandemic, the dependent samples with repeated measurements are concerned. In order to determine whether the t-test of paired samples (parametric) or the Wilcoxon signed rank test (nonparametric) will be applied, it is necessary to test the normality of the differences in the values of the variable before and after the onset of the pandemic, which was done through the Shapiro-Wilk test, the results of which are presented in Table 8. In the same way, I. Rahmah and I. Novianty (2021) tested the hypothesis of differences in the value of the Altman Z-score indicators before and after the onset of the pandemic caused by the COVID-19 virus (in 2019 and 2020).

Table 8 The results of the Shapiro-Wilk test

	Shapiro-Wilk		
	Statistic	n	Sig.
Z(2019) – Z(2020)	0.939	70	0.002

Source: Authors

The results of the Shapiro-Wilk test of the normality of the distribution of the differences of the observed variables at the confidence level of 99% (Sig.=0.002 < $\alpha=0.01$) indicate that the difference of the observed variables does not follow normal distribution. Therefore, the further course of research is aimed at conducting the Wilcoxon signed rank test. Thanks to the box-plot diagram, the presence of the three real

outliers (the extreme values) was observed, so it was decided to eliminate them from the sample due to extremely high values, simultaneously ensuring the representativeness of the sample itself.

Table 9 The results of the Wilcoxon signed rank test

	Asymp. Sig. (2-tailed)	n	Median
Z (2019)	/	70	2.200
Z (2020)	/	70	2.053
Z (2019) – Z (2020)	0.019	/	/

Source: Authors

By conducting the Wilcoxon signed rank test at the confidence level of 95% (Sig.=0.019 < $\alpha=0.05$), it can be concluded that there is a statistically significant difference between the median values of the Altman Z-score before and after the pandemic of the COVID-19 virus in the set of the observed listed joint-stock companies (both medium-sized and big) on the Belgrade Stock Exchange, in which context the fact that the median value of the Altman Z-score decreased in 2020 compared to 2019 (from 2.200 to 2.053) should be emphasized, which on its part means that there was an increase in the probability of financial distress in the observed companies.

CONCLUSION

The research study conducted in this paper included 51 medium-sized and 22 big public joint-stock companies listed on the Belgrade Stock Exchange as a part of the Prime Listing or Open Market in the period from 2018 to 2022 and based on the financial reports publicly available on the website of the Business Registers Agency, whose data were then processed in the SPSS statistical program for social sciences. As has already been said at the beginning of the paper, the research study was aimed at observing the connections between certain factors representing the determinants of the occurrence of financial problems

in companies and the Altman Z-score indicator, which predicts a probability of the occurrence of financial problems in companies.

Based on all the obtained results presented in this paper, conclusions can be drawn about the set hypotheses. *The first hypothesis* was confirmed, since the research results showed a statistically significant positive correlation between profitability and the value of the Altman Z-score, which means that there is a statistically significant negative correlation between profitability and a probability of financial distress, since the lower levels of the Z-indicators mean a higher probability of financial distresses and vice versa. Thus, the findings of the research study are in agreement with the results of earlier research (Campbell *et al.*, 2005; Thim *et al.*, 2011; Masdupi *et al.*, 2018; Dwiantari & Artini, 2021), i.e. the research in the interdependence of profitability and the probability of the occurrence of financial distress done in this paper was confirmed by previous relevant research.

The second hypothesis was confirmed because, there was a statistically significant strong positive correlation between the liquidity indicator and the Z-score throughout the observation period (five years), which leads to the conclusion that there is a statistically significant negative correlation between liquidity and a probability of the occurrence of financial distress, bearing in mind the fact that the higher values of the Z-score indicate a lower probability of financial distress and vice versa. Therefore, it can be said that the results of the research study presented in this paper are in agreement with the conclusions of previous research (Mikkelson & Partch, 2003; Butler *et al.*, 2005; Desiyanti *et al.*, 2019; Thim *et al.*, 2011; Kim-Soon *et al.*, 2013).

The third hypothesis was confirmed, since there is a positive correlation between the solvency indicator and the Altman Z-score, which leads to the conclusion that there is a negative correlation between solvency and a probability of the occurrence of financial distress (the lower Z-indicator indicates a higher probability of the occurrence of financial distress and vice versa). Therefore, the results presented in the

research study carried out in this paper coincide with the results of previous research (Harris & Raviv, 1990; Thim *et al.*, 2011; Megasanti & Riwayati, 2023; Amoa-Gyarteng, 2021).

The fourth research hypothesis was confirmed according to the presented research results. Such findings are related to the correlation between leverage and the probability of the occurrence of financial distress are in accordance with the results of previous research (Harris & Raviv, 1990; Thim *et al.*, 2011; Amoa-Gyarteng, 2021; Megasanti & Riwayati, 2023), which is due to the fact that, in the cases of the increased indebtedness of the company, there may be a temporary decrease in the probability of financial distress due to a new inflow of funds into the company. However, the source of those funds, i.e. the fact that it is the debt that needs to be repaid in the future, interest included, should not be forgotten. In the initial stages of borrowing, shortly after having borrowed funds, a company may positively perform, as expected, since it has received an inflow of a large amount of money at one point, and its debt repayment is made periodically. Therefore, the obtained results are completely justified, since, if the company borrows, that may have long-term consequences in terms of the inability of the company to repay the debt (mainly bank loans), which leads it to bankruptcy.

Based on the presented results, it is concluded that the *fifth hypothesis* was not confirmed because there was a positive correlation between the growth index and the Altman Z-score indicator with different reliability levels in the observation period. These results contradict the conclusions of previous research (MacKie-Mason, 1990; Yosha, 1995; Morri & Cristanziani, 2009; Thim *et al.*, 2011). The reason for such findings lies in the fact that the companies that have an evident growth in the operating profit, i.e. developing companies, have a smaller chance of facing financial distress in the future (the positive correlation of growth in the operating profit and the Altman Z-score), because they have accumulated profits from performing their activities. On the other hand, if a company (i.e. its operating profit) decreases, certain financial distress may arise in the future, because the company does not have an accumulated

profit from performing its regular activities. In fact, that profit has been decreasing from year to year, and the company will not be able to meet its financial obligations timely, which may lead to financial distress and bankruptcy. Companies and their management should always think in a way that is oriented towards the future. It is necessary to anticipate that certain sudden circumstances may occur (as was the case with the COVID-19 pandemic) and create an adequate response to those circumstances, which is the accumulation of the profit from regular business in this case, accompanied by the assessment of the optimal level of that accumulation, which leads to more stable company operations.

The sixth hypothesis was confirmed, according to the presented research results, since it was concluded that there was a statistically significant difference in the Altman Z-score indicators before and after the onset of the pandemic caused by the COVID-19 virus, for which reason the results can be said to be consistent with previous research (Rababah *et al*, 2020; H. O. Aifuwa *et al*, 2020; Rahmah & Novianty, 2021; Marginingsih, 2022; Fitria *et al*, 2022).

The results presented in the paper have certain theoretical and practical implications, i.e. they make certain theoretical and practical contributions. The theoretical contribution of the paper reflects in the expansion of the theoretical knowledge of the importance of looking at the future of companies through the prism of the possibility of financial distress. Namely, the theoretical aspects of the paper point to the determinants that can be extremely important for predicting the occurrence of financial distress, as well as the possibility of quantifying them and bringing them into relationship with the Altman Z-score indicators. The theoretical implications can help to gain new knowledge in the field of forensic accounting and auditing, since the Altman Z-score is broadly accepted in these accounting disciplines. On the other hand, the practical implications of the paper reflect in the paper's contribution to company management, especially the management of the public joint-stock companies whose shares are traded on the securities markets, bearing in mind the fact that medium-sized and big public joint-stock companies

are included in the observed sample. Accounting and financial managers can benefit from the results of this study in order to adequately and timely review all financial distress determinants and make right decisions, so that the company does not end up facing financial distress or even bankruptcy. They can try to timely prevent financial distress and influence these determinants, which will have a positive effect on the company's operations. Also, the results can be useful to the current and potential investors and the company's creditors in terms of making decisions on investing in a particular company by taking into consideration the analyzed determinants. Current investors will withdraw their funds from the companies that, based on the analysis of the described determinants, are perceived as having a high probability of financial distress, whereas future investors will avoid investing in such companies. For financial and business analysts, the findings obtained in this paper can be extremely useful in terms of the determinants that should be considered when analyzing the success and adequacy of certain companies' operations. Since many stakeholders rely on the conclusions reached by financial analysts, it is necessary that these analyses should be of exceptional quality. Therefore, the results presented in this paper can help them choose the determinants to be considered when predicting the future of the company. By analyzing the probability of financial distress with their business partners, customers and suppliers can also make decisions on the beginning, continuation or termination of cooperation with them. If there is a high probability of financial distress in a company, its customers will not want to purchase its goods, and suppliers will not want to deliver the requested goods to that company due to the possibility of uncollectible claims. Since companies may decide to illegally avoid paying taxes (tax evasion) in the conditions of financial distress, the results of this research study are also useful for tax authorities because they can timely identify such moves made by such companies and prevent them through the analysis of the presented variables.

However, the research presented in this paper has certain limitations. Namely, the analysis was conducted on a sample of 73 public joint-stock companies over a five-year period. Also, the growth

determinant was measured as change in the operating profit in the current year compared to the previous year. It is possible that the results of the research study would be different if, instead of the growth of the company measured in this way, that growth was observed as change in the number of employees in the current year compared to the previous year, or as change in the profit (the net result), or change in the business assets (total assets), or in turn as change in the market share in the current year compared to the previous year.

Future research in this topic may include a broader sample, whereby the sample would include all public joint-stock companies listed on the Belgrade Stock Exchange in the Prime Listing and Open Market (including micro- and small enterprises) and the inclusion of the companies operating in foreign, neighboring countries in the sample may also be considered. The observation period could be longer, since the period of five years was used in the paper. When speaking about the determinants, it is possible to include additional determinants of the occurrence of financial distress, especially when the company growth indicator is concerned, whereby this indicator could be calculated in one of the alternative ways mentioned in the previous paragraph. On the other hand, further steps in the research in this issue may concern the application of more complex statistical methods, such as multiple regression analysis, because it is important to investigate the influence of each individual determinant on the indicators of the probability of the occurrence of financial distress, i.e. the Altman Z-score indicator. Thus, it is possible to reveal the strength of the influence of individual determinants and single out those with the strongest influence on the occurrence of financial distress.

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Review paper

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THE ROLE OF PLANNED ORGANIZATIONAL CHANGE IN CORPORATE ENTREPRENEURSHIP

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In this paper, the corporate entrepreneurship concept is complemented by the contributions from planned organizational change models. Resulting from entrepreneurial endeavors undertaken by both individuals and groups within established organizations, corporate entrepreneurship leads to innovation or the regeneration of the existing and the creation of new businesses within the existing companies. However, there is little research in the change process through which entrepreneurial endeavors are realized. This paper seeks to close this gap by synthesizing the contributions of the most cited planned organizational change models, resulting in the activities or steps that, as the change agent, the internal entrepreneur should undertake in order to implement a corporate entrepreneurship project. Based on Lewin's model (unfreezing – move – refreezing), these activities include creating the awareness of the necessity of change, creating and communicating a vision, preparing for changes, implementing changes, facilitating changes, the institutionalizing and monitoring of changes. Thereby, the corporate entrepreneurship concept is complemented and made more realistic in practice.

Keywords: corporate entrepreneurship, planned organizational change, internal entrepreneur, organizational change process

JEL Classification: I26, M10

INTRODUCTION

Broadly defined as entrepreneurship within an established business, corporate entrepreneurship is increasingly being viewed as a tool that allows businesses to rejuvenate and revitalize and create new value through innovation, business development, and renewal (Heinonen & Toivonen,

2008). Corporate entrepreneurship includes a continuous creative process, whose main objective implies the implementation of innovations in the organization as a function of successful business and solving problems faced by consumers and society (Kuratko, Hornsby & Covin, 2014; Crnogaj & Širec, 2014). In S. A. Zahra and J. G. Covin (1996), corporate entrepreneurship is a formal or informal activity aimed at creating new businesses in established firms through product and process innovations and market developments. Understood in this way, corporate entrepreneurship must include the organizational

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change process, since it is only through organizational change that innovations can be introduced to the existing organization that will renew, rejuvenate, and develop the business model (D'Angelo, Cavallo, Ghezzi & Di Lorenzo, 2024). For this reason, planned organizational change could be a very useful concept in building a corporate entrepreneurship model.

Planned organizational change is a set of deliberate activities undertaken by the company's management so as to move the organization from its present state to a desired future state (Stouten, Rousseau & Cremer, 2018). Planned organizational change is very complex and involve many activities and participants, and they occur in constantly changing conditions. For that reason, their success is highly questionable. According to some studies, only one-third of the planned organizational change projects are successful (Jarrel, 2017). There is no reason not to assume that the same applies to entrepreneurial projects within the framework corporate entrepreneurship. Despite the obvious need for the ability to efficiently manage planned organizational change in order to successfully implement corporate entrepreneurship projects, this topic has been largely neglected in the field of corporate entrepreneurship so far. All the authors in the field of corporate entrepreneurship emphasize the fact that this effort leads to changes, but no one has seriously addressed the problem of implementing these changes yet. Thus, a serious gap has emerged in the field of corporate entrepreneurship, which this paper attempts to close. Integrating the planned organizational change concept in the field of corporate entrepreneurship would provide very useful contributions to the development of the theory and practice of corporate entrepreneurship. On the other hand, the application of planned organizational change in corporate entrepreneurship could certainly enrich and enhance the knowledge of how these changes should be implemented. This paper aims precisely to highlight the possibilities of using the knowledge offered by the planned organizational change concept in explaining the corporate entrepreneurship process.

The subject matter of the paper implies change management during corporate entrepreneurship. The

primary research question is: How should corporate entrepreneurs implement changes, i.e. what activities, methods, and techniques should they undertake in order to effectively implement the changes that bolster the implementation of their entrepreneurial ventures? The paper is aimed at presenting the planned organizational change implementation process during the implementation of entrepreneurial ventures within companies. The main hypothesis of the paper reads as follows:

H1: A successful corporate entrepreneurship ventures implementation within companies requires the application of the model of planned organizational change.

This hypothesis will be proven through the integration of corporate entrepreneurship models and planned organizational change management models, which will be performed analyzing the relevant theoretical concepts of both corporate entrepreneurship and planned organizational change.

The paper is structured as follows: first, corporate entrepreneurship is defined; then, the basic dimensions, components, and processes included in it are explained; this is followed by a synthesis of the different planned organizational change models that are found in the literature is carried out so as to identify the activities, steps, or phases of such planned organizational change. Finally, the integration of the planned organizational change models in corporate entrepreneurship is performed by describing the activities and phases of planned organizational change during the corporate entrepreneurship process.

CORPORATE ENTREPRENEURSHIP

Corporate entrepreneurship refers to entrepreneurship within actively operating companies. So, it is entrepreneurial behavior that is dealt with. Namely, it is not an independent individual's behavior, but rather the behavior of a member of an organization, which significantly changes the problem. One of the broadly accepted definitions of corporate entrepreneurship

suggests that it is the process of discovering and developing new opportunities to create value through innovation, regardless of any resources or the entrepreneur's position (Antoncic & Hisrich, 2001). Some authors define corporate entrepreneurship as a process by which individuals within the organization seek opportunities in and beyond the organization, making efforts to use them regardless of the resources currently available to them (Lumpkin, 2007). These definitions emphasize the willingness of an individual to embrace new opportunities and take responsibility for affecting creative change. Corporate entrepreneurship involves behavioral intentions different from routine practice and describes the employee's entrepreneurial behavior within a stable organization (Antoncic & Hisrich, 2001).

Although the corporate entrepreneurship concept has been studied by many researchers, no consensus on its causes and processes has been reached yet, for which reason corporate entrepreneurship still remains a black box (Glinyanova, Bouncken, Tiberius & Cuenca Ballester, 2021). Additionally, researchers have used different terms to describe entrepreneurial activities within organizations, such as corporate entrepreneurship (Kuratko et al, 2014), intrapreneurship (Antoncic & Hisrich, 2001), and corporate venturing (Miles & Covin, 2002). Thus far, research on corporate entrepreneurship has mainly dealt with defining the phenomenon (Sharma & Chrisman, 2007), the impact on performance (Zahra & Covin, 1995), the factors that encourage corporate entrepreneurship and the characteristics of the organization that nurtures it (Burger & Blažková, 2020), the role of managers as facilitators (Burgess, 2013; Cingula, 2013), the measurement of corporate entrepreneurship (Kuratko et al, 2014), and the influence of the other variables that have an indirect or mediatory impact on corporate entrepreneurship (Lumpkin & Dess, 2001).

An important issue in corporate entrepreneurship is its effect on corporate performance. Entrepreneurship is generally considered to have a positive effect on company performance (Mokaya, 2012). Entrepreneurial activity leads to gaining and retention of competitive advantage, regardless of

the industry and size of the organization (Bhardwaj, Sushil & Momaya, 2011). "Entrepreneurial actions help to sustain competitive advantage for firms facing rapid changes in the industry and market structures, customers' needs, technology, and societal values" (Bhardwaj *et al*, 2011, p. 188). It also increases profitability, long-term survival, growth, and financial stability (Hitt, Ireland, Camp & Sexton, 2001). Yet, even though entrepreneurship is considered to be a driving force in value creation, there are not enough empirical studies on international and national markets regarding the entrepreneurship - performance connection (Kahkha, Kahrazeh & Armesh, 2014).

Many definitions of corporate entrepreneurship explain it as a part of the process of the radical change that revitalizes the company (Glinyanova *et al*, 2021). D. F. Kuratko, R. D. Ireland, J. G. Covin and J. S. Hornsby (2005) defined corporate entrepreneurship as the process whereby, in association with an established company, an individual or a group of individuals create a new business or instigate renewal or innovation within the current business. According to said definition, strategic renewal (which is concerned with organizational renewal involving major strategic and/or structural changes), innovation (which is concerned with introducing something new to the marketplace), and corporate venturing (the corporate entrepreneurial efforts that lead to the creation of new business organizations within the corporate organization) are all important and legitimate parts of the corporate entrepreneurial process. R. D. Ireland, J. G. Covin, and D. F. Kuratko (2009) claim that corporate entrepreneurship supports the strategic renewal of a company and, therefore, the creation of new businesses, simultaneously improving the existing ones. These definitions of corporate entrepreneurship involve the transformation of stagnant businesses to dynamic activities, a way to re-create economic capabilities, the activation or reinvigoration of the existing organization through risk taking, innovation, and active competition behaviors (Zahra & Covin, 1995) or the rejuvenation and revitalization of the existing companies (Maes, 2004). According to G. G. Dess, R. D. Ireland, S. A. Zahra, S. W. Floyd, J. J. Janney and P. J. Lane (2003), there are four types of corporate entrepreneurship,

namely sustainable regeneration, the rejuvenation of the organization, strategic recovery, and strategic turnaround. Those four categories include the largest number of the forms of corporate entrepreneurship in organizations. Therefore, the essence of corporate entrepreneurship lies in the introduction of innovations through changes in the established business and the established organization (Heinze & Weber, 2016), which means that an integral part of the corporate entrepreneurship process is not only the creation of innovations but also their implementation through planned organizational change. Bearing this in mind, surprisingly little attention has been paid to this part of the corporate entrepreneurship process so far. Despite great ideas and innovations, it is impossible to undertake the entire entrepreneurial endeavor within a company if the organization does not have the capacity to implement these innovations through planned organizational change.

The major activities related to corporate entrepreneurship include opportunity perception, idea generation, designing a new product or another recombination of resources, internal coalition building, persuading management, resource acquisition, planning and organizing (Burger & Blažková, 2020). The key behavioral aspects of corporate entrepreneurship are personal initiative, active information search, thinking outside the box voicing, championing, taking charge, finding a way, and some degree of risk taking (Lumpkin, 2007). D. F. Kuratko et al (2005) outlined the following essential activities: endorsing, refining, and navigating entrepreneurial opportunities through organizational bureaucracies and individual networks, and identifying, acquiring and deploying the resources needed to pursue these opportunities. S. Shane and S. Venkataraman (2000) described the entrepreneurial activity as the discovery, evaluation, and exploitation of opportunities. O. Belousova, B. Gailly and O. Basso (2009) introduced yet another activity as a separate category: legitimation/enrolment, which includes the process of spreading the idea, translating it for organizational members, and joining them to the project network. The activities of corporate entrepreneurship identified so far are not sufficient to describe everything that needs to be done in

order to realize an entrepreneurial endeavor within an established organization. So far, authors have mainly focused on creating innovations, not on their implementation. In order to undertake an entrepreneurial endeavor within a company, it is necessary to implement the planned organizational change that include numerous activities which have not been explicitly mentioned in corporate entrepreneurship theories and models yet. Therefore, it is necessary that the activities included in the planned organizational change models should first be identified, then applied in the context of undertaking an entrepreneurial endeavor within a company.

PLANNED ORGANIZATIONAL CHANGE

Operating in the circumstances of globalization, technological development, political changes, and unforeseen disruptive events such as pandemics and war, modern companies are forced to undergo frequent organizational change. However, organizational change is expensive, risky, and relates to many negative consequences for the organization and its members. Therefore, company management strive to implement these changes quickly and efficiently by approaching them in a planned and deliberate manner, for the reason of which fact many models of planned organizational change have been developed in the literature aiming to assist management in leading the change.

Planned organizational change represents a special type of changes in organizations that occur as a result of the conscious, planned efforts made by the organization's management. They are different from spontaneous organizational change that happens in every organization at every moment, regardless of the will and intentions of the management themselves. Planned organizational change may encompass very different changes in terms of the cause, content, and type of changes themselves (Janićijević, 2008). According to the cause, changes can be organizational adaptation, i.e. changes caused by the external factors that impose the need for the organization to adapt, on the one hand, and organizational development,

namely changes caused by internal factors, on the other (Maes & Hootegeem, 2019). From the point of view of content, planned organizational change includes changes in the formal, hard components of the organization (its structures and systems), on the one hand, and the informal, soft components of the organization (its leadership, culture, human resources), on the other. Finally, the criterion of the type of change implies that planned organizational change can include continual changes (incremental, partial, evolutive) and discontinuous changes (radical, comprehensive, revolutionary) (Vrcelj, 2023). Planned organizational change is always led by an individual or team acting as the change agent: someone who operationally plans, leads, and controls the change process (Janićijević, 2008).

The key issue in the field of planned organizational change is certainly the change process, or the activities that management need to perform in order to successfully implement changes. The planned organizational change models that have been developed in the literature differ precisely in the steps, or groups of activities that should be undertaken in a specific order to successfully implement planned organizational change. The literature identifies many planned organizational change models (Siddiqui, 2017; Teczke, Bospayeva & Bugubayeva, 2017; Stouten et al, 2018; Rosenbaum, More & Steane, 2018; Maes & Hootegeem, 2019; Vrcelj, 2023). According to one of the best reviews of planned organizational change models (Stouten et al, 2018), the most cited models in the Web of Science and the most googled models are: 1. the Six-Step Model by M. Beer, R. A. Eisenstat and B. Spector (1996), 2. J. P. Kotter's (1996) Eight-Step Model, 3. A. Judson's (1991) Five-Stage Model, 4. the Ten Commandments Model by R. M. Kanter, B. A. Stein and T. D. Jick (1992), 5. Appreciative Inquiry (Cooperrider & Srivastva, 1987), and 6. the ADKAR Model (Hiatt, 2006), only to add to the aforementioned models D. A. Nadler's (1997) Twelve-Action-Step Model and the Ten-Key Model by J. Pendlebury, B. Grouard and F. Meston, (1998).

Even a cursory review of these planned organizational change models implies that they are similar and largely overlapping, which is because they are all

based on the same model, namely Lewin's "unfreezing – move – refreezing" model. K. Lewin's seminal work (1952) laid the foundations for all the subsequent thoughts of what the planned organizational change process should look like. The relative similarity of all the mentioned planned organizational change models enables their synthesis, and it has been concluded in this paper that all the activities that management should undertake in order to implement planned organizational change may be grouped into seven large groups representing the phases or steps in the planned organizational change process, namely 1. the creation of the awareness of the necessity of changes; 2. the vision creation and communication; 3. preparing for changes; 4. change implementation; 5. change facilitation; 6. change institutionalization; 7. monitoring changes. These groups of activities are chronologically arranged although their overlapping is possible. All the identified groups of activities can be grouped into the three basic phases of Lewin's change process. The creation of the awareness of the necessity of changes, the vision creation and communication, and preparing for changes belong to the unfreezing phase in Lewin's model. In Lewin's move phase, two groups of activities are performed: change implementation and change facilitation. Finally, Lewin's refreezing phase includes two groups of activities: change institutionalization and monitoring changes.

The first step in planned organizational change pertains to the creation of the awareness within the organization of the fact that changes are necessary, which breaks the inertia within the organization and creates conditions for change to actually begin. A good number of the authors of these planned organizational change models have included some of the activities that belong to this group in their respective models. J. P. Kotter (1996) explicitly emphasizes the importance of the need to create and spread awareness in the organization that changes are not only necessary but also urgent. A similar thing happens in the ADKAR model (Hiatt, 2006). The essence of the step is breaking away from the past (Kanter et al, 1992), which indicates the fact that, above all, these activities should lead to change in the organizational members' consciousness, i.e. in their mental schemes. According

to the planned organizational change models, this initial activity of change occurs through the analysis of organizational problems and/or perceiving the chances and opportunities that require change (Stouten et al, 2018).

The second step in the unfreezing phase is the vision creation and communication. Once the fact that changes are necessary has been understood as such in the first step, the second step follows, requiring that the future which to aspire towards should be shaped, which is also a goal of changes. In almost all the models mentioned, there are certain activities that belong to this group. Thus, D. L. Cooperrider and S. Srivastva (1987), M. Beer et al (1990), J. P. Kotter (1996), J. Pendlebury et al (1998), J. M. Hiatt (2006), as well as J. Stouten et al (2018) explicitly state that, in this step, it is not only necessary to shape a clear and compelling vision, but it is also essential that the vision should be communicated throughout the organization. This second part, which relates to the vision spreading, is critical since no change will successfully be made if the vision remains in the leader's head or top managers' heads.

The third step in the unfreezing phase pertains to preparing for change and consists of the four basic tasks that need to be performed by the change agent. The first task involves planning changes and establishing the structure necessary to implement them, thereby removing obstacles to change (Judson, 1991; Kanter et al, 1992; Kotter, 1996). Then, it is necessary to secure political support for changes not only from the leaders but also from all those who have the power in the organization. The largest number of

the planned organizational change models contain the activities that handle power because power is both an active and a passive element of changes (Kanter et al, 1992; Kotter, 1996; Nadler, 1997; Pendlebury et al, 1998; Stouten et al, 2018). Power is an active element of change because the change agent must have the power to implement changes. On the other hand, it is also a passive element because those who have the power in the organization can either facilitate or block changes. The next task in preparing for change is motivating for change to ensure sufficient energy for its implementation (Pendlebury et al, 1998; Hiatt, 2006; Stouten et al, 2018). Finally, it is not enough to just motivate the organization's members for change, but it is also necessary to ensure that they have enough knowledge of and abilities to carry out changes (Hiatt, 2006; Stouten et al, 2018).

The second, move phase of the change process according to Lewin is the process in which changes are executed. It encompasses two groups of activities according to the cited models of planned organizational change. The first is the implementation of changes and includes the direct activities that operationalize changes. All the selected planned organizational change models contain some form of this activity. They consist of change operational planning and their implementation to follow. Along with these, J. P. Kotter (1996) adds achieving quick initial successes and the further strengthening of changes based on those successes. The second group of the activities in the move phase imply that, during the implementation, change facilitation is also performed, which includes change communication,

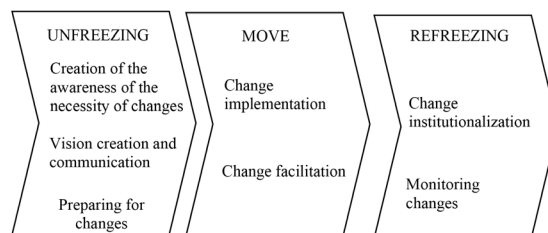


Figure 1 The planned organizational change process

Source: The author's synthesis based on the chosen planned organizational change models.

following and reinforcing the change process (Kanter et al, 1992; Nadler, 1997; Stouten et al, 2018).

In the third phase of the change process called the refreezing phase, the organization stabilizes after the changes have been implemented through the two groups of activities. Change institutionalization implies their incorporation in the organization's culture to ensure change sustainability. These activities are included in all the mentioned planned organizational change models. Moreover, at the very end of the process, it is necessary to perform the monitoring and control of the implemented changes, which further reinforces them (Beer et al, 1990; Judson, 1991; Kanter et al, 1992; Nadler 1997).

INTEGRATING PLANNED ORGANIZATIONAL CHANGE IN CORPORATE ENTREPRENEURSHIP

Corporate entrepreneurship involves initiating and implementing an entrepreneurial endeavor within the existing organization that innovates products, processes, the market approach, and organization. For this reason, planned organizational change must be an integral part of the corporate entrepreneurship process. Understanding corporate entrepreneurship is not complete if, apart from the sources and effects of innovations, it does not include the process through which they are realized through an entrepreneurial endeavor within the organization (Güven, 2020). The knowledge of organizational change the researchers have gained is believed to potentially be very useful at both the theoretical and the practical levels in the corporate entrepreneurship field. The activities, steps, and phases of planned organizational change should be viewed as a part of the corporate entrepreneurship process. These activities and steps should serve as practical guidance for internal entrepreneurs on how to implement their entrepreneurial ideas in practice. No matter if they may be individuals or groups, internal entrepreneurs must be seen as the agents of change who should carry out the entrepreneurial innovation process, as well as any change, as efficiently as possible. To be able to do so, it is useful

for them to be familiar with the basic activities of planned organizational change identified in the appropriate models.

The previous synthesis of the activities, steps, and phases of the planned organizational change process is a useful basis for expanding the theory and practice of corporate entrepreneurship. In doing so, the specificity of changes being implemented in corporate entrepreneurship must be taken into account and the activities of planned organizational change must adapt to it.

The vision creation and communication are commonly the second activity or step in the planned organizational change process (Phillips & Klein, 2023). However, the entrepreneurial innovation realization process starts precisely from creating a vision; so, in the case of implementing changes in corporate entrepreneurship, it is actually the first activity. An internal entrepreneur creates a vision through his business innovation which he devises and proposes. It is very important that this vision is clear and understandable to everyone in the organization. Therefore, it should be formulated in the way and using the language that can be understood by all or the largest number of the people in the company. The vision must be desirable and attractive, as well as realistic, so that it is perceived as feasible. As an agent of change, an internal entrepreneur must somehow formalize his vision, most likely through a formal proposal of the entrepreneurial project that will be offered to the company's management. Also, communicating the vision places a task before the internal entrepreneur to devote himself to active communication with all the members of the organization, not just with its management. Communicating the vision must be performed not only through the vertical channel, but also through the horizontal channel. In addition, the rule "the more, the better" applies, which means that it is necessary to provide as much information about the vision as possible, in as many ways and in as many places as possible. All the available communication channels should be used. In communicating the vision, the internal entrepreneur should use the principle of repetition, i.e. to repeat the same information several

times. In communicating the vision, the internal entrepreneur should use metaphors, analogies, and the like.

Creating the awareness of the necessity for change can be a very challenging activity for the internal entrepreneur as an agent of change (Janićijević, 2008; McFee, 2023). When changes are introduced in an organization suffering a crisis, it is quite easy to create the awareness of the necessity of change, in which case, the emerging signs of a crisis such as, for example, a decrease in performance, a loss of resources, or strikes make the employees and managers of the company quickly become aware of the need for change. However, corporate entrepreneurship involves changes that are most often not caused by a crisis, a decrease in performance, or problems in the functioning of the organization. These changes are driven by the entrepreneurial initiative and ideas on how to improve the business and performance of the otherwise successful organization, which makes it a more difficult task for the internal entrepreneur as an agent of change. It can be accomplished by merging this change implementation activity with the previous one and continuing from it, or by communicating the necessity of bringing the vision to reality. Since one cannot rely on the threat of a crisis and the company's downfall, the internal entrepreneur must strengthen the awareness of the necessity for changes in the company using the arguments of the advantages that the bringing of their vision to reality will bring. Therefore, after creating the vision and while communicating it to employees and managers, it is necessary to emphasize the necessity of seizing the opportunities that the realization of the vision provides and the threats if this vision is not realized. Hence, the vision communication process must aim not only to acquaint employees and managers with the entrepreneurial innovation, but also to acquaint them with the reasons why its realization is necessary and what opportunities the company misses if it is not realized.

An internal entrepreneur should prepare himself for change by securing political support for the internal entrepreneur's visions and innovations (Kotter, 1996; Phillips & Klein, 2023). It is essential

to gain the support of the leader, as well as of all the other powerful groups within the organization. If this fails, the entrepreneurial project will not be implemented. Securing the acceptance of the entrepreneurial project by the top management and powerful groups within the organization should transform the entrepreneurial idea into an officially approved entrepreneurial project and the internal entrepreneur into an agent of change with sufficient power to implement the changes that would enable the implementation of the accepted project. This activity involves political activities through exerting the power and influence of the internal entrepreneur and requires the internal entrepreneur to have certain political abilities and skills. As an agent of change, the internal entrepreneur must have the ability to exert influence in all three directions: downwards – towards the subordinates at the lower hierarchical levels, horizontally – towards the colleagues at the same hierarchical level, and upwards – towards the managers at higher hierarchical levels. Only in this way can the internal entrepreneur ensure that his entrepreneurial endeavor will be accepted throughout the organization. In addition to support and acceptance, internal entrepreneurs need to also ensure their employees' and managers' motivation to participate in the implementation of the entrepreneurial innovation (Güven, 2020). Motivating employees and managers to accept changes can be conducted in two ways: by developing dissatisfaction with the current state of the company (the stick) and by developing positive expectations from the changes (the carrot). The internal entrepreneur should focus on the latter motivation method since, unless the company is in crisis, it is not realistic to achieve motivation by using the first method. As in the previous two activities, in order to motivate colleagues to accept changes and engage themselves in them, the internal entrepreneur must communicate intensively throughout the organization. The final task in this group of activities is building the employees' and managers' knowledge and abilities needed to implement the innovations (Phillips & Klein, 2023), which is a very difficult task for the internal entrepreneur since they do not have formal authority over the human resources development

process. Therefore, the internal entrepreneur can influence other managers and employees in the company only by setting an example of their own.

When change implementation, i.e. the realization of an entrepreneurial endeavor, is concerned, the internal entrepreneur as an agent of change must undertake activities for change operational implementation (McFee, 2023). The internal entrepreneur must perform the role of the project leader and carry out all the activities this role entails. The operationalization of an innovation project requires operational planning and preparation, as well as execution, during which the internal entrepreneur monitors, directs, and controls the activities of all the project team members (Pendlebury et al, 1998). If the changes implied by the implementation of entrepreneurial innovation are comprehensive and radical, it is very likely that their implementation will require the forming and operating of multiple project teams. In this case, the internal entrepreneur could perform activities related to the coordination of the work of several project teams, as well as monitoring and controlling their work. The extent to which the internal entrepreneur is engaged as the agent of change in this phase depends on the breadth and depth of the changes that the undertaking of their endeavor requires. The challenge for the internal entrepreneur could be the authority required to effectively lead and coordinate the work of operational teams for implementing changes. Therefore, it is necessary to ensure the full support of the top management of the organization in the previous phase.

Change facilitation implies that, during the implementation of changes, it is essential for the agent of change to act as the change facilitator (Güven, 2020). This role entails three basic tasks. First, the internal entrepreneur must monitor the implementation of changes and have information about the project status at all times. Second, in the role of the change agent, the internal entrepreneur must remove difficulties and empower participants in the implementation of his entrepreneurial endeavor. In other words, the internal entrepreneur must solve the problems that arise during the implementation of changes. Third, the internal entrepreneur must

communicate changes during their implementation. The internal entrepreneur must communicate the flow of changes, the achieved effects of changes, as well as the expectations regarding the timeline and the final outcome. Communication is directed both to the company's top management as the main sponsor of the project and all the company's employees and managers. In collaboration with top management, the internal entrepreneur should also ensure the dissemination of information about the entrepreneurial endeavor to the interested external public.

The institutionalization of changes triggers the process of their consolidation or refreezing (Janićijević, 2008). For changes implemented through entrepreneurial innovation to be sustainable, they must be aligned with the company's organizational culture. As a set of assumptions, values, norms, and attitudes shared by the organization's members, culture significantly shapes their thinking and behavior (Janićijević, 2013). If the implementation of entrepreneurial innovation introduces novelties in the company's operations that require its employees and managers to work in a way that is inconsistent with their existing values and norms, they will enter a state of cognitive dissonance, which is a very uncomfortable and frustrating state from which employees and managers try to escape by returning to their usual way of working, which is in line with their attitudes and values. If this happens, the changes introduced will be abandoned, i.e. they will be only formal and not substantial. To prevent this, the internal entrepreneur as the agent of change must check whether entrepreneurial innovation conflicts with prevailing cultural values, and if so, he must proceed to change the organizational culture so as to align it with the new business model. This is how the institutionalization of changes is conducted, i.e. how they integrate in the culture of the organization. This task presents a significant challenge for the internal entrepreneur since the process of changing culture is very complex, long, and demanding (Janićijević, 2013). It requires engaging a significant amount of power and an active role of leaders. The internal entrepreneur per se does not have the capacity to change organizational culture to include in it the novelties brought by the entrepreneurial

project. Therefore, to perform this activity, the internal entrepreneur must secure the support and even participation of the organization's leader.

Monitoring changes is the last activity in the entrepreneurial endeavor implementation process. In order to monitor the implementation of the project, the internal entrepreneur should analyze the changes made and control their effects. The internal entrepreneur needs to ensure that the experiences of the implementation of the project are incorporated in organizational knowledge for the future. Also, based on the experiences gained, the internal entrepreneur should update the project or even start a new cycle of changes if monitoring shows that it is necessary.

CONCLUSION

Corporate entrepreneurship involves innovative, proactive, and transformational changes in the company that are the result of the entrepreneurship of individuals and groups within the company itself. As internal entrepreneurs, individuals and groups within the organization create innovations that change the way the company delivers value to consumers. The ultimate effect of corporate entrepreneurship is the creation of new businesses within the existing company and/or the revitalization and regeneration of its existing businesses.

Bearing in mind the fact that corporate entrepreneurship is actually carried out through innovative changes to the existing businesses or the creation of new businesses within a company, it is necessary to include in the corporate entrepreneurship concept the knowledge that researchers in planned organizational change have come to so far. According to the planned organizational change models, it is necessary to include the steps or activities that the internal entrepreneur needs to undertake in order to be able to realize their entrepreneurial initiative in the corporate entrepreneurship concept.

Identifying the activities or steps that internal entrepreneurs should undertake in order to successfully implement changes and realize their

entrepreneurial endeavors is the most important result of the research presented in this paper. These activities or steps or phases of planned organizational change must be an integral part of the corporate entrepreneurship process in order for it to be based on realistic foundations and able to achieve its effects. As the integral components of corporate entrepreneurship, the groups of activities, steps or phases of the change process are: 1. the vision creation and communication, 2. the creation of the awareness of the need for change, 3. preparing for changes, 4. change implementation, 5. change facilitation, 6. change institutionalization, and 7. monitoring changes. By identifying the aforementioned change management activities that must be undertaken in the corporate entrepreneurship project implementation process, the fundamental hypothesis in this research study has been proven.

The key theoretical contribution of this paper reflects in proving the need to expand corporate entrepreneurship theory by including research in organizational change as a legitimate element of the entrepreneurial process within the existing organizations, which is a very promising direction of research that can contribute not only to the development of the corporate entrepreneurship concept, but to the development of the theory of organizational change as well. The key applicative contribution of this paper consists of providing guidance to company management and internal entrepreneurs on how to effectively lead the organizational change process during the implementation of entrepreneurial projects. In addition to these contributions, the paper raises some questions relevant to future research. First and foremost, future studies should deepen the understanding of the methods and techniques for the implementation of the identified activities in the change management process. It is also necessary to investigate the impact of relevant organizational variables on the change management process during corporate entrepreneurship, such as organizational culture and leadership.

The presented research study has its key limitations. The research done is theoretical by nature and lacks

empirical confirmation. Next, the research study has not made a difference between internal and corporate entrepreneurship which, according to some authors, does exist. Finally, only one classification of the planned organizational change models was used, albeit a very credible one. Had a different classification been used, the results might have been different.

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