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The Relationship Between Fiscal Policy and Economic Growth: The Case of Serbia

Повезаност фискалне политике и економског раста: Пример Србије

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Abstract

Purpose: The main objective of this paper is to examine the potential cointegration relationship and causality between economic growth and fiscal parameters (public expenditures and revenues) in the Republic of Serbia. Additionally, the aim is to analyze the long-term and short-term effects of fiscal parameters on economic growth.

Methodology: Methodologically, the paper applies time series analysis. First, stationarity is tested using the Ng-Perron test, followed by cointegration testing using the Johansen and Bayer-Hanck tests. Finally, VEC (Vector Error Correction) modeling enables the examination of long-term effects and short-term causality.

Findings: The analyzed variables are integrated of order one, $I(1)$. In addition, cointegration between them has been established. The results of the VEC model show that an increase in government expenditures reduces economic growth in the long run, while an increase in government revenues enhances it. The causality test showed that changes in government expenditures cause changes in economic growth in the short run.

Originality/value: To the best of the author's knowledge, this is the first study in Serbia to address such a specifically formulated objective using specific econometric methods..

Practical implications - The results obtained carry practical implications. The negative effect of government expenditures on economic growth indicates low government efficiency, a higher level of corruption, and a lack of institutional quality. In this sense, the recommendations point toward increasing the efficiency of government policies, along with designing an appropriate structure of public spending—focusing on essential services such as education, and healthcare.

Limitations: The key limitations relate to the selection of only aggregated variables. In this paper, consolidated public revenues and expenditures were used as fiscal indicators. In the context of future research, it would be interesting to observe these indicators in a disaggregated manner, in order to enable a more targeted analysis and to test the robustness of the obtained results.

Keywords: government expenditure, government revenue, GDP, cointegration, VEC, case study

JEL classification: C22, H61, O43

Сажетак

Циљ: Основни циљ рада је да се испита потенцијална коинтеграциона релација и каузалност економског раста и фискалних параметара (јавних расхода и прихода) у Републици Србији. Додатно, циљ је испитивање дугорочног и краткорочног ефекта фискалних параметара на економски раст.

Методологија: Методолошки, у раду је примењена анализа временских серија. Најпре, тестирање стационарности применом Ng-Perron теста, затим тестирање коинтеграције применом Johansen и Bayer-Hanck тестова. На крају, VEC моделирање је омогућило испитивање дугорочних ефеката и краткорочне каузалности.

Резултати: Анализиране варијабле су реда интегрисаности један, $I(1)$. Поред тога, установљена је коинтеграција између њих. Резултати VEC модела су показали да раст државних издатака смањује

економски раст у дугом року, док га раст државних прихода увећава. Тест каузалности је показао да промене у државним издацима изазивају промене у економском расту у кратком року.

Оригиналност/вредност – Према сазнању аутора, у питању је прва студија за Србију која тангира овако формулисан циљ применом економетријских метода.

Практична примена - Добијени резултати носе практичне импликације. Негативан ефекат државних издатака на економски раст указује на слабу ефикасност Владе, виши ниво корупције и недостатак у квалитету институција. У том смислу и препоруке иду у правцу раста ефикасности владиних политика, уз дизајнирање одговарајуће структуре државних издатака (у правцу основних услуга попут образовања и здравства).

Ограничења истраживања: Кључна ограничења се односе на одабир само агрегираних варијабли. У раду су као фискални показатељи коришћени консолидовани јавни приходи и расходи. У контексту будућих истраживања занимљиво би било дезагрегирано посматрати ове показатеље ради усмереније анализе и провере робусности добијених резултата.

Кључне речи: државни издаци, државни приходи, БДП, коинтеграција, VEC, студија случаја

ЈЕЛ класификација: C22, H61, O43

Introduction

Governments around the world formulate and implement policies on taxation and public spending. The application of these policies has a strong impact on economic growth, income distribution, and poverty, and is at the center of economic and political debate. After the 1990s, the countries of Central and Eastern Europe went through two transition processes: a political one, involving a shift from totalitarianism to democracy, and an economic one, involving a transition from socialism to a market-based economic system.

The transition process requires fundamental changes in the role of the state - from a situation of pronounced state intervention in the functioning of the economy to one that ensures free competition and private ownership. This change in the role of the state implies a reduction and reorientation of public spending, as well as a comprehensive reform of tax policy and administration. In this context, understanding public finance systems and trends is of great importance - including trends in the overall size of the public sector, as well as specific patterns of taxation and public spending among different groups of countries. In addition, an important goal is to examine the impact of fiscal policy on economic growth and to identify mechanisms for improving the efficiency of fiscal policy.

A large number of authors have demonstrated the importance of fiscal policy and its dominant role over monetary policy in developing countries (among others, Medee & Nenbee, 2011; Munongo, 2012). Furthermore, the complementarity and proper coordination of both policies as a condition for increased economic activity has also been empirically confirmed in certain studies (Falade & Folorunso, 2015). Increasing potential output is a priority for most national economies. Achieving high growth rates requires the effective use of fiscal instruments available to economic policy makers.

Following the transitional recession of the early 1990s, most Central and Eastern European countries began to experience some progress in economic activity. This growth led to a significant reduction in poverty, estimated at around 58 million people (Gray et al., 2007). Public finance reforms have accompanied these economies. A key macroeconomic imbalance - along with its associated risks - in the economy of the Republic of Serbia is

driven by the growing share of public spending and fiscal deficit in the gross domestic product, both at the level of the consolidated general government balance and at the level of more narrowly defined public spending balances. The fiscal imbalance is, among other things, the result of increasing public expenditure and the rapid growth of real wages, which have risen at an unexpectedly high rate, significantly outpacing the growth of gross domestic product.

The main objective of the paper is to examine the potential cointegration between economic growth and fiscal parameters (public revenues and expenditures), as well as the impact that fiscal policy parameters have on economic growth. The paper is based on the research question: Do public revenues and expenditures have a statistically significant impact on economic growth in the short and long run? The contribution of the paper lies in the application of econometric procedures, such as unit root tests, cointegration tests, and causality tests, to examine the validity of the proposed assumptions using the specific case of Serbia. Following the introductory considerations, the paper presents the literature review, methodological framework, and empirical results, in that order. Finally, the concluding section provides recommendations for economic policymakers.

1. Literature Review

Barro (1991) and de La Fuente (1997) examined the effects of fiscal policy on economic growth. They investigated how growth is related to the structure and level of public spending. De La Fuente (1997) showed that if public spending increases, economic growth decreases, while an increase in public investment accelerates economic growth. Previous studies generally confirm the positive impact of investment in education and infrastructure on economic growth. However, in developing countries, investment in infrastructure does not have a positive impact. The influence of governance on public finances has not been confirmed. Earlier studies primarily focused on OECD countries, where public institutions - including those responsible for tax administration and public spending - are more developed, have higher levels of technology, and exhibit greater accountability and transparency compared to developing countries.

Several reasons stand out as key factors explaining why a large public sector (government) hampers economic growth in countries with weaker governance. First, a large public sector increases the likelihood of fiscal deficits due to declining economic activity, particularly where public spending is inflexible due to weaker budgeting systems, reliance on high expenditure commitments, and high public sector employment rates.

Second, the high taxation required to finance large governments may discourage private sector activity, especially if tax administration is weak and unable to ensure a broad tax base. A large public sector can also be accompanied by anti-competitive regulations limiting private sector participation.

Finally, public spending may be misallocated as a result of corruption and weak institutional capacity, which reduces productive resources in the economy. While strong

governments are capable of avoiding these problems through budgetary tightening and efficient tax administration, countries with weaker governance should aim to keep public spending and taxation at moderate levels if they wish to stimulate faster economic growth. The fiscal deficit is also very important for economic growth, and fiscal consolidation plays a role in deficit reduction. Fiscal adjustments that reduce the deficit can be accompanied by economic growth, and adjustments based on spending cuts are likely to be more effective than those based on tax increases.

It is also important to note that economic growth is not the only objective of fiscal policy. Income redistribution and social programs aimed at poverty reduction are also critical concerns. Patterns of public spending influence economic growth in at least two ways. First, the composition of public expenditure can affect overall economic growth, since some categories of spending stimulate while others hinder economic activity. Second, within each category of spending, resources can be allocated in a more or less efficient and effective manner. High levels of government investment in unproductive sectors can have negative effects on growth, whereas investment in productive activities can foster economic growth.

Countries with better governance are more capable of collecting taxes efficiently and spending public funds effectively. A higher share of spending in productive areas may lead to higher growth rates in countries with strong governance, while high spending in unproductive areas does not necessarily have a negative effect on growth. However, in countries with weaker governance, economic activity tends to decline with higher levels of unproductive spending and higher taxation, and investments in productive areas do not necessarily yield positive effects (Gray et al., 2007).

1.1. Effects of Government Expenditures on Economic Growth

One of the most significant debates among economists concerns the role of government intervention in managing short-term fluctuations in economic activity. Classical and Keynesian schools of thought offer differing perspectives on this issue. Unlike classical economists, who believe that market forces naturally ensure long-term equilibrium through labor market adjustments, Keynesians are skeptical of self-regulating mechanisms due to rigidities in the labor market. The Keynesian approach particularly emphasizes the role of fiscal policy during periods of recession.

Fundamentally, fiscal policy can be either expansionary or contractionary, and is applied depending on the goals and level of development of a national economy. For example, expansionary fiscal policy, which includes lowering tax rates and increasing government spending, may initially result in a budget deficit, but in the long term, increased government expenditure can strengthen growth performance. This thesis aligns with Keynesian economic policy, which argues that a budget deficit can have positive long-term effects if the actual output of the economy is below its potential. From a theoretical standpoint, neoclassical economists argue that fiscal policy does not affect the long-term

rate of economic growth, as growth is determined by population growth and the rate of technological progress - both considered exogenous. The explosive development of endogenous growth theory has prompted numerous empirical studies on the determinants of economic growth. Examining the relationship between government spending and economic growth is certainly an important issue in the context of this debate. In endogenous growth models, the production function is not characterized by diminishing returns. Fiscal policy can be used to allocate resources more efficiently by correcting market failures and boosting the productivity of human and physical capital.

Okunlola et al. (2024) results indicate that effective government management can have a beneficial impact on economic growth. The structure of public expenditures also plays a crucial role in analyzing the relationship between government spending and economic activity. Government spending on education and healthcare impacts labor productivity growth. Likewise, infrastructure expenditures (e.g., roads) boost private investment rates, which in turn positively influence the rate of economic growth. Barro (1991) emphasized that education expenditures represent a form of public investment rather than public consumption. Using data from both rich and poor countries, Barro (1991) provided strong empirical evidence that a large public sector hampers economic growth. It is well known that the size of government tends to increase with rising income, a tendency known as Wagner's Law. According to this hypothesis, public spending is income-elastic, and the ratio of government expenditure to economic growth tends to rise with development. The relationship aligns with Wagner's Law only when elasticity is significant - that is, when the coefficient is positive and greater than one.

Since the 1990s, the standard approach to testing Wagner's Law has involved time-series analysis, particularly unit root and cointegration tests. Hansson & Henrekson (1994), using disaggregated data, found that government transfers, consumption, and total output have negative effects, while education spending has positive effects, and government investment shows no impact on productivity growth. Barro (1990) also pointed out that unproductive government spending reduces GDP growth, while the effects of productive spending are ambiguous - depending on government behavior and the share of public spending in aggregate demand. The structure of public spending differs significantly between rich and poor countries. Many programs that are theoretically expected to have positive effects on growth - such as education, infrastructure, research and development, and subsidies - account for less than one-fifth of total public expenditures in the most developed countries (OECD countries). In contrast, in developing countries, the share of such programs exceeds half of total public spending. In other words, over 80% of public spending in highly developed countries often does not contribute positively to economic growth. Liu et al. (2024) have shown that government investments in science and technology have positive spillover effects on the research and development activities of companies and the application of innovative achievements. In this way, more sustainable economic growth is promoted compared to government spending and traditional investments in the long run.

Many studies have tested the impact of government spending on economic growth under the assumption of an inverted U-shaped curve between the two. This idea was popularized by American official Richard Armeý, and the curve is named after him — the Armeý Curve. The curve is based on the law of diminishing returns and emphasizes the role of government in economic functioning. Armeý argued that in the absence of a public sector, an economy produces a very low level of output. At low levels of government spending, governments are unable to provide property rights protection, keeping output low. Conversely, when government spending is too high, individuals lack incentives to invest and produce due to the high level of taxation needed to fund the spending — thus leading to a decline in economic activity. Accordingly, the hypothesis is that at low levels of government spending, increases have a positive impact on economic activity, while at high levels, further increases produce negative effects. The optimal ratio of government expenditure to economic growth (threshold) represents the point at which any increase in government expenditure below the optimal level has positive effects on economic growth, while an increase in government expenditure above the optimal level causes negative effects on growth.

Table 1: The Optimal Ratio of Government Expenditures to Gross Domestic Product (Selected Studies)

Author(s)	Time period	The analyzed economies	Result (<i>threshold</i>)
Karras (1996)	1960-1985	OECD and South America	14-33
Karras (1997)	1950-1990	20 European countries	16
Vedder & Gallaway (1998)	1947-1997	USA	17.45
Chao & Gruber (1998)	1929-1996	Canada	27
Herath (2010)	1959-2003	Sri Lanka	27
Facchini & Melki (2011)	1871-2008	France	30
Iyidogan & Turan (2017)	1998-2015	Turkey	16.5

Note: The result represents the optimal ratio of government expenditure to gross domestic product, expressed as a percentage.

Source: Author.

1.2. Effects of Taxation on Economic Activity

In endogenous and neoclassical growth models, the impact of taxes on economic growth is also examined. As already noted, in neoclassical growth models there are exogenous forces, such as technological progress and population dynamics, which determine the equilibrium output level. Taxes can only have a temporary effect on the income growth rate on the path toward the equilibrium growth trajectory. On the other hand, in endogenous growth models, the tax rate influences parameters such as the rate of return on capital accumulation or the volume of investment in research and development. Thus, the tax rate has a permanent effect on the equilibrium output level. From the perspective of both theories, there is a negative relationship between taxes and economic growth, although this relationship is not fully confirmed empirically (Karagianni et al., 2015).

Indeed, several studies have yielded differing results regarding the relationship between economic growth and taxation. Easterly & Rebelo (1993) and Kneller et al. (1999) showed that the relationship between these variables is moderately positive, and in many cases there is no correlation, neither in the short nor in the long run. On the other hand, Barro (1991) and Engen & Skinner (1992) found a negative relationship between the variables. Leibfritz et al. (1997) examined the effects of tax burdens on GDP growth in OECD countries and concluded that an increase in the tax-to-GDP ratio by 10% leads to a reduction in economic growth by 0.5%, with direct taxation reducing growth slightly more than indirect taxation. One possible reason for the differing empirical results is the choice of inappropriate tax indicators. Many studies have used alternative tax rates, such as disaggregated average tax rates on direct and indirect taxes, as well as the effective marginal tax rate, which has recently become increasingly important in studying the impact of taxes on output dynamics. Engen & Skinner (1996) investigated the individual effects of taxation on labor supply, investment, and productivity. They found that a reduction of the marginal tax rate by 5% and the average tax rate by 2.5% increases economic growth by 0.22%. Yamarik (2000), using data from the United States, showed that the use of disaggregated marginal tax rates generates more consistent growth forecasts in line with growth theories compared to the aggregate average tax rate. Padovano & Galli (2002) empirically confirmed that the average tax rate has no effect on growth, while the marginal tax rate and tax progressivity negatively affect economic growth. Mamatzakis (2005), analyzing the impulse response function in Greece, showed that an increase in the tax burden causes a decline in output. A study conducted by Angelopoulos et al. (2007) showed that the income tax on labor is negatively related to economic growth, while capital and corporate income taxes are generally positively related to growth.

The reduction of income tax rates affects the behavior of individuals and businesses through the income effect and the substitution effect. The positive effect of tax cuts on the economy arises from the fact that lower tax rates increase after-tax income levels, which, through the substitution effect, influence levels of saving and investment. Another positive effect relates to the reduction of tax distortions, which induces efficiency in the composition of economic activity.

A reduction in tax rates increases the marginal return to labor and raises the labor supply through the substitution effect. The value of tax subsidies is reduced, and the composition of economic activity is altered. Additionally, after-tax household income increases at every level of labor supply, which reduces the labor supply through the income effect. Therefore, the net effect on the labor force is ambiguous, as is the effect on saving and other activities.

For example, if the initial income tax rate is around 90 percent, a 10 percent tax cut doubles the after-tax wage. If the tax rate is 20 percent, a 10 percent tax cut increases wages by about 12.5% (Gale & Samwick, 2016). The income effect remains the same, but substitution effects on labor supply and saving are larger when the tax rate is higher, meaning the net gain in labor supply from tax reduction is greater when tax rates are higher.

Since the economic cost increases with the square of the tax rate, efficiency gains from tax rate reductions are also greater when initial tax rates are higher.

Tax reform includes both a reduction in income tax rates and a broadening of the tax base (Gale & Samwick, 2016). By eliminating special treatments for different types of income or consumption, base broadening aims to increase the average effective tax rate on labor supply, saving, and investment. This causes two effects: the average substitution effect will be smaller, and the average income effect will be zero.

Base broadening has an additional effect that is expected to positively impact the economy. The assumption is that it will reduce resource allocation toward sectors and industries that benefit from generous tax treatment. A flatter tax rate and a broader tax base allow resources to shift from sectors with “generous” tax rates to other parts of the economy with higher returns. This reallocation is aimed at enhancing overall economic activity.

2. Data and Methodology

The research includes quarterly time series data for the period from 2005 to 2024, using the case of the Republic of Serbia (80 observations). The variables used in the analysis are consolidated public revenues, consolidated public expenditures, and real gross domestic product. The trivariate model can be specified as follows:

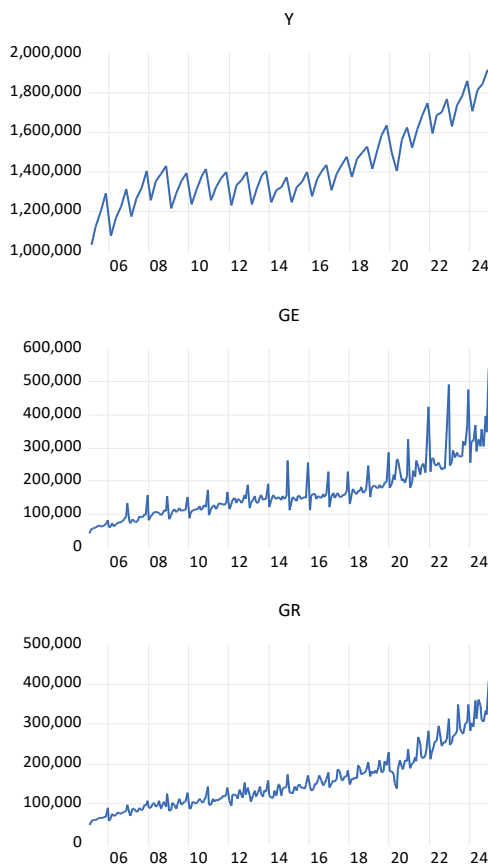
$$\ln Y_t = \alpha_1 - \alpha_2 \ln GE_t + \alpha_3 \ln GR_t + \mu_t \quad (1)$$

The data on real gross domestic product (Y_t) were obtained from the website of the Statistical Office of the Republic of Serbia (SORS), while the data on consolidated public expenditures (GE_t) and consolidated public revenues (GR_t) were sourced from the website of the Ministry of Finance of the Republic of Serbia (MoF). It is assumed that the residual (μ_t) is normally distributed and represents white noise. The variables are expressed in millions of dinars (RSD) and, for statistical reasons, were converted into logarithmic form ($\ln$). In addition, due to the presence of seasonal components, the time series were seasonally adjusted using the X-13 ARIMA model. Figure 1 shows the trend of the variables before logarithmic transformation and seasonal adjustment, while Table 2 presents the descriptive statistics of the variables after the applied corrections.

The trivariate model was selected in order to examine the effects of government expenditures on economic growth, while also avoiding potential bias problems that are possible in bivariate modeling. To test the stationarity of the time series, the traditional Ng-Perron test was applied, with both a constant and a trend. For testing cointegration between economic growth and government expenditures, in the presence of government revenues as an additional variable, the Johansen (1991) cointegration test was used. The basic precondition for applying this test lies in checking the stationarity of the variables, and it includes two essential conditions:

1. The variables must be non-stationary in levels,
2. After conversion to first differences, they must become stationary (i.e., they should be integrated of order one, $I(1)$).

Figure 1: Gross Domestic Product, Consolidated Public Expenditures, and Consolidated Public Revenues in the Republic of Serbia (in millions of dinars)



Source: Author

Table 2: Descriptive Statistics of Variables

Variable	$\ln Y$	$\ln GE$	$\ln GR$
Mean	14.16	11.93	11.87
Median	14.12	11.93	11.85
Std. Deviation	0.12	0.44	0.44
Observations	80	80	80

Source: Author

Trace statistics and maximum eigenvalue statistics are used to determine the cointegration rank. However, conclusions about cointegration can vary depending on the test applied. Bayer & Hanck (2013) proposed a new approach called combined cointegration testing. This test has greater power in detecting cointegration and features a unique aspect of generating a joint test statistic based on the Engle-Granger, Johansen, Peter Boswijk, and Banarjee tests. This approach combines the results of different individual cointegration tests to provide more reliable conclusions. This method will also be applied in this analysis to examine cointegration between economic growth, government expenditures, and government revenues in the case of the Republic of Serbia. Bayer and Hanck (2013) specified the model as follows:

$$EG - JOG = -2[\ln(p_{EG}) + (p_{IOH})]$$

$$EG - JOH - BO - BDM = -2[\ln(p_{EG}) + (p_{IOH}) + (p_{BO}) + (p_{BDM})] \quad (11)$$

Where p_{EG} , p_{IOH} , p_{BO} , p_{BDM} represent the p-values of different individual cointegration tests. If the Fisher statistic for EG-JOH or for EG-JOH-BO-BDM exceeds the critical value, the null hypothesis of no cointegration can be rejected. If the variables are found to be cointegrated, then a Vector Error Correction Model (VECM) can be applied, since the variables share a common stochastic trend in the long run. The VECM provides valuable information about the direction of causality between variables. When this model is used, the variables are transformed into their first differences (i.e., stationary form). The model can be specified as follows:

$$\begin{aligned}
 \begin{bmatrix} \Delta \ln Y_t \\ \Delta \ln GE_t \\ \Delta \ln GR_t \end{bmatrix} &= \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix} + \begin{bmatrix} B_{11,1} & B_{12,1} & B_{13,1} & B_{14,1} & B_{15,1} \\ B_{21,1} & B_{22,1} & B_{23,1} & B_{24,1} & B_{25,1} \\ B_{31,1} & B_{32,1} & B_{33,1} & B_{34,1} & B_{35,1} \end{bmatrix} \times \begin{bmatrix} \Delta \ln Y_{t-1} \\ \Delta \ln GE_{t-1} \\ \Delta \ln GR_{t-1} \end{bmatrix} + \dots \\
 &+ \begin{bmatrix} B_{11,m} & B_{12,m} & B_{13,m} & B_{14,m} & B_{15,m} \\ B_{21,m} & B_{22,m} & B_{23,m} & B_{24,m} & B_{25,m} \\ B_{31,m} & B_{32,m} & B_{33,m} & B_{34,m} & B_{35,m} \end{bmatrix} \times \begin{bmatrix} \Delta \ln Y_{t-1} \\ \Delta \ln GE_{t-1} \\ \Delta \ln GR_{t-1} \end{bmatrix} \\
 &+ \begin{bmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \end{bmatrix} \times \begin{bmatrix} \mu_{1t} \\ ECM_{t-1} \\ \mu_{2t} \end{bmatrix} + \begin{bmatrix} \mu_{3t} \end{bmatrix} \quad (2)
 \end{aligned}$$

Where Δ represents the first difference operator, and ECM_{t-1} is the long-run error correction term. By using the t-statistic associated with the coefficient of the error correction term, it is possible to test for long-run causality. The direction of short-run

causality can be determined using the F-statistic for the lagged first differences of the independent variables.

3. Empirical Results

The results of the applied Ng-Perron unit root test are presented in Table 3. According to the obtained results, the variables related to economic activity, government expenditures, and government revenues are non-stationary at level. However, after converting them into first differences, the variables become stationary at the 5% significance level. These results indicate that the variables are integrated of order one, i.e., $I(1)$.

Table 3: Ng-Perron Unit Root Test

Variables	MZa	MZt	MSB	MPT
$\ln Y_t$	-2.20	-2.39	1.08	16.773
$\ln GE_t$	-2.02	-0.806	0.399	34.106
$\ln GR_t$	-3.175	-1.226	0.386	27.919
$\Delta \ln Y_t$	-16.63 (1)*	-2.87	0.17	1.51
$\Delta \ln GE_t$	-20.099 (0)**	-3.147	0.157	4.671
$\Delta \ln GR_t$	-22.811 (0)**	-3.169	0.139	5.211

Note: () indicates the lag length, while ** denotes 5% level of significance.

Source: Author

In the next step, the results of the Johansen cointegration test are presented. To determine the cointegration rank (r), both the trace statistic and the maximum eigenvalue statistic were used. The results, shown in Table 4, indicate that there is one cointegrating vector. Specifically, the null hypothesis of no cointegration is rejected, which is consistent with the previously obtained results.

Table 4: Johansen Cointegration Test Results

Hypothesis	Trace statistics	Max- Eigen statistics
$\ln Y_t = f(\ln GE_t, \ln GR_t)$		
$R=0$	27.58	20.03
$R=1$	9.55	6.41
$R=2$	3.14	3.14

Note: The trace statistic indicates 1 cointegrating equation at the 10% significance level. The eigenvalue statistic also indicates 1 cointegrating equation at the 10% significance level.

Source: Author.

Table 5 presents the combined cointegration test results, which include the EG-JOH and EG-JOH-BO-BDM tests. As in the case of the Johansen test, it is crucial to determine the appropriate lag length, since the Fisher statistic is highly sensitive to lag selection (Shahbaz et al., 2014). The results show that the Fisher statistic values for both EG-JOH and EG-JOH-BO-BDM are greater than the critical value at the 10% significance level, in the case

where $\ln Y_t$ is the dependent variable. This implies that both tests reject the null hypothesis of no cointegration among the variables.

Table 5: Bayer and Hanck Cointegration Test Results

Estimated models	EG-JOH	EG-JOH-BO-BDM	Cointegration
$\ln Y_t = f(\ln GE_t, \ln GR_t)$	8.97	25.04	Yes
$\ln GE_t = f(\ln Y_t, \ln GR_t)$	5.69	7.17	No
$\ln GR_t = f(\ln Y_t, \ln GE_t)$	4.92	5.72	No

Note: Critical values at the 10% significance level are 8.451 (EG-JOH) and 16.507 (EG-JOH-BO-BDM).

Source: Author.

By applying the VEC model, it is possible to establish a long-term relationship between the variables through long-run elasticity coefficients, as follows:

$$\ln Y = 15.10 - 0.66 * \ln GE + 0.58 * \ln GR \quad (3)$$

$$t\text{-value} \quad (-2.28) \quad (1.66)$$

Based on the cointegration equation, we can conclude that government expenditures reduce, while government revenues increase economic growth in the long run. A one-percent increase in government expenditures decreases economic growth by 0.66%. This result is statistically significant. On the other hand, a one-percent increase in government revenues increases economic growth by 0.58%.

The coefficient associated with the error correction mechanism indicates the speed of adjustment toward the equilibrium state from the short run to the long run. It essentially confirms the existence of a long-run relationship between the variables. In this specific case, the coefficient is statistically significant and negative. The value of the coefficient is -0.15, which implies that economic growth adjusts toward the equilibrium state by 15% each quarter, moving from the short run to the long run. The existence of cointegration among the variables allows for examining the direction of causality between them. In this context, a VECM Granger causality test was applied, which distinguishes between short-term and long-term causality. The results are presented in Table 6. Three causal relationships were identified:

1. Bidirectional causality was found between government expenditures and economic growth, indicating mutual influence over time. The obtained results are in accordance with Kitole et al. (2025).
2. Additionally, changes in government expenditures lead to changes in government revenues, suggesting a unidirectional causal relationship from expenditures to revenues. This result is in contrast with Glavaški et al. (2022). The causality test revealed no causal relationship between economic growth and government revenues, similar to the findings in the study by Gurdal et al. (2021).

Table 6: VECM Granger Causality Analysis

Dependent variable	Type of causality			
	Short- term			Long- term
	$\Delta \ln Y_t$	$\Delta \ln GE_t$	$\Delta \ln GR_t$	ECM_{t-1}
$\Delta \ln Y_t$	-	8.09 [0.00]	0.88 [0.35]	-0.15* [0.00]
$\Delta \ln GE_t$	3.43 [0.06]	-	0.08 [0.77]	-
$\Delta \ln GR_t$	0.71 [0.40]	9.60 [0.00]	-	-

Note: Values in parentheses refer to the p-value.

Source: Author.

Conclusion

The main objective of this paper was to analyze the relationship between economic growth, government revenues, and government expenditures. The research is limited to the economy of the Republic of Serbia, covering the period from 2005 to 2024. In an effort to capture the key aspects of this relationship, the analysis includes gross domestic product, government budget revenues, and expenditures (in logarithmic form). Since the variables are integrated of order one, $I(1)$, the interdependence between government expenditure, revenue, and economic growth indicators is examined using cointegration techniques.

The results of the cointegration tests show that there is a long-term relationship among the analyzed variables. The estimated parameters of the cointegration equation indicate that government expenditures have a negative effect on economic growth, while government revenues have a positive impact on long-run growth. In the short run, the Granger causality test revealed a bidirectional causality between economic growth and government expenditures. This implies that government spending is income-elastic and may tend to grow alongside economic development.

Although Serbia has run a fiscal deficit over an extended period, in 2009 it exceeded the Maastricht criterion for fiscal deficit levels (3% of GDP) for the first time, with a deficit of 3.4% of GDP. The budget deficit of 3.4% in 2010 and 4.2% in 2011 served as a prelude to a culmination of instability in 2012, when the budget deficit reached 5.9% of GDP, seriously threatening the functioning of public finances. However, by the end of 2016, the fiscal deficit had dropped to 0.2% of GDP and remained stable (even turning into a surplus) until the COVID-19 pandemic. After 2020, due to the compounded challenges of the pandemic, energy crisis, and supply chain disruptions, the fiscal deficit began to increase again. Serbia needs to continue strengthening the process of fiscal consolidation to avoid a higher level of public debt. Government expenditure remains extremely high in developing countries and exceeds 45 percent of GDP.

Additionally, the tax system is primarily oriented toward financing public expenditures. It is also used for other purposes, such as ensuring fairness and addressing social and economic challenges. Moreover, it aims to minimize administrative costs for the state and deter tax evasion. Taxes affect household decisions regarding saving, labor supply, and investment in human capital, as well as firms' production choices and job

creation. For such decisions, not only the level of taxation is important, but also how various tax instruments are structured and combined to generate revenue. The effects of tax levels and tax structure on the behavior of economic agents also influence the overall standard of living in the national economy. One of the reasons behind these results may lie in the fact that Serbia, as a transition economy, lacks adequate institutional quality and experiences a relatively high level of corruption. These factors significantly shape the overall performance of the government and may also contribute to rising poverty in Serbia.

Considering the above statements, recommendations for economic policymakers revolve around increasing government efficiency. In addition, particular attention should be given to designing an appropriate structure for public expenditures. In the context of future research, it would be useful to disaggregate government spending and revenue and examine the effects of individual components of public expenditure and income on overall economic activity.

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Complaint behavior of Generation Z in tourism

Жалбено понашање генерације З у туризму

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Abstract:

Purpose: This research aim is to determine the correlation between the ways Generation Z is expressing dissatisfaction in the tourism and the absence of a sense of shame when complaining.

Methodology: The study was conducted in the Republic of Serbia on a sample of 231 Generation Z respondents. Data were analyzed using IBM SPSS Statistics software, and the Pearson correlation test was used to analyze the relationships between variables.

Findings: Results reveal a statistically significant and positive correlation for hypotheses H2, H3, and H4, but non-significant correlation was found for H1, which was therefore rejected. Hypotheses H2, H3, and H4 were accepted.

Originality/value: While consumer complaint behavior has been widely studied, there remains a gap in the literature concerning the complaint behavior of Generation Z tourists. This research contributes by focusing specifically on this generation and their behavioral patterns when dissatisfied.

Practical implications - The research findings are relevant for tourism service providers, as they provide important insights into the behavior of Generation Z consumers. Given these consumers' strong dependence on digital platforms, tourism service providers should pay special attention to communication through online communication channels and train employees to improve the service delivery process. Such measures can reduce the negative impact of complaints and foster long-term loyalty and satisfaction.

Limitations: The study's main limitation is the sample, which consists solely of Generation Z respondents. Additionally, the sample size of 231 respondents is relatively small; expanding it in future research would provide more robust insights into tourist complaint behavior.

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Keywords: tourism, complaint behavior, generation Z, locus of control

JEL classification: M31, Z33, L83

Сажетак:

Циљ: Циљ истраживања је утврђивање повезаности између начина на који Генерација 3 изражава незадовољство у туризму и одсуства осећаја стида приликом подношења жалби.

Методологија: Истраживање је спроведено у Републици Србији на узорку од 231 испитаника Генерације 3. Подаци су анализирани коришћењем IBM SPSS Statistics софтвера, а за анализу корелације коришћен је Пирсонов тест корелације.

Резултати: Резултати показују статистички значајну и позитивну корелацију код хипотеза H2, H3 и H4, али је за H1 пронађена негативна корелација која није значајна, услед чега је H1 одбачена. Хипотезе H2, H3 и H4 су прихваћене.

Оригиналност/вредност - Иако је жалбено понашање потрошача анализирано од стране многих аутора, у литератури и даље недостаје део који се односи на жалбено понашање туриста Генерације 3. Допринос овог истраживања је фокус на Генерацију 3 и њихове обрасце понашања када су незадовољни.

Практична примена - Резултати истраживања су релевантни за пружаоце туристичких услуга, с обзиром да пружају значајне увиде у понашање потрошача Генерације 3. С обзиром на снажну зависност ових потрошача о дигиталним платформама, пружаоци туристичких услуга требало би да обрате посебну пажњу на комуникацију кроз онлине канале комуницирања и обуче запослене како би побољшале процес пружања услуга. Такве мере могу смањити негативан утицај жалби и подстаћи дугорочну лојалност и задовољство.

Ограничења истраживања: Главно ограничење истраживања је узорак, који се састоји искључиво од испитаника Генерације 3. Поред тога, величина узорка од 231 испитаника је релативно мала; његово проширење у будућим истраживањима би пружио значајнији увид у понашање туриста у вези са жалбама.

Кључне речи: туризам, жалбено понашање, генерација 3, локус контроле

ЈЕЛ класификација: M31, Z33, L83

Introduction

Considering the importance of Generation Z in today's business world, it is crucial to analyze their behavior in one of the most popular service sectors, i.e., tourism. It is necessary to analyze how this generation is expressing dissatisfaction through complaints. However, consumers often encounter situations in which their needs are not adequately met. Generation Z, as a digital generation, has a much greater power to influence others due to their online presence (Berry et al., 2014).

When the need is not satisfied, users express their negative attitudes in different ways: some of them opt for public actions as a way to warn or inform the rest of the public about a negative experience, some decide to share their experiences with people in their immediate environment and thus encourage the spread of negative WOM, while some decide to accept the circumstances that have befallen them and refrain from spreading any opinion (Ergün & Kitapci, 2018). Generation Z is considered to pioneer the virtual world, which knows no time or space limitations. Social networks have completely transformed the way communication takes place, the way necessary information is obtained, and even the way experience is shared and with whom it is shared (Huang, Basu & Hsu, 2010).

The subject of research is the behavior of Generation Z in tourism, with a focus on complaints. The research aims to determine the connection between the ways Generation Z is expressing dissatisfaction in tourism and the absence of a sense of shame when submitting complaints. While consumer complaint behavior has been widely analyzed by many authors, there remains a gap in the literature concerning the complaint behavior of Generation Z tourists. This research contributes by focusing specifically on this generation and their behavioral patterns when dissatisfied. The research problem relates to the manner in which the complaining behavior of Generation Z is manifested.

The first part of this paper contains a theoretical basis with a review of the literature that connects tourism as a leading service activity today with Generation Z, and special attention is focused on complaint behavior caused by dissatisfaction. The second part of this paper contains the author's research in which the Pearson correlation test was used in order to determine the existence of a statistically significant and positive correlation between the absence of embarrassment when complaining and different ways of expressing dissatisfaction.

1. Literature review

In recent years, tourism has become an increasingly popular service industry and has also contributed to the growth of popularity in related service segments such as hospitality and accommodation facilities. Technology development and its application to planning and organizing trips are the main reasons for the growing popularity of the tourism industry (Jorge-Acain, 2022). The emergence of social media has changed the way tourists access the necessary information. Given that the number of users of tourism services who have time to physically visit a travel agency and thus choose the desired arrangement is decreasing, social networks should be seen as a practical solution.

In their daily life, tourists are burdened with activities that occupy their time, and social networks solve this problem of time limitation by providing the possibility of quick connection with the right information (Dina & Sabou, 2012). Using social platforms, users can easily find the desired information and make decisions about choosing a destination (Alsoud et al., 2023). Social media can be defined as a strategic tool that has a significant role in tourism and hospitality management (Osei, Mensah & Amenumey, 2018). The two main reasons why potential tourists use social networks are: 1) the need to establish social connections; and 2) the need to share and explore interesting information (Narangajavana et al., 2017). The benefits that tourists get from using social media refer to (Alghizzawi, Salloum & Habes, 2018): 1) the presence of the necessary information on the websites of travel companies; 2) benefits that reward satisfied users after the service; 3) a sense of security when purchasing or booking different trips; and 4) the ability to share information about trips or any changes that may occur.

In addition to the advantages that social media has provided to tourists, the most important contribution is evident in the changed way companies that provide services communicate. Today, communication most often takes place in the online world and is direct (Dina & Sabou, 2012). Due to frequent engagement on tourist sites, tourists have

become a key element in the development of the industry (Alghizzawi, Salloum & Habes, 2018). In the process of planning a trip, tourists use social media when they go through each of the three stages (Osei, Mensah & Amenumey, 2018):

- Before the trip (pre-trip) - influence on the most important decisions (help with choosing a destination and accommodation);
- During the trip - discovering information about activities and attractions;
- After the trip (post-trip) - sharing videos, pictures, and leaving reviews.

The experiences that users can share on social media in mutual interaction, whether positive or negative, can influence their further behavior (Marić, Leković & Džever, 2024). Dissatisfaction is most often expressed through negative e-WOM; in this way, tourists can point out potential dangers, inadequate service they experienced, or overall dissatisfaction with the arrangements they had.

In tourism, which is considered an unpredictable environment, tourists are interested in finding out whether a certain service will or will not satisfy their needs. Social media has changed the way people communicate, the way they obtain information, and the way they make decisions about choosing a destination (Huang, Basu & Hsu, 2010). Social media allows users to share experiences, based on which later decisions about destination choice are made. If the experience was positive, there is a high probability that consumers will repeat it (Șchiopu et al., 2023). Although tourists most often use social media for communication, information search, entertainment, relaxation, and expressing opinions, we can classify them into several categories (Akin & Şener, 2024): collaborative projects, blogs and content communities and social networking sites, virtual games, and virtual worlds.

Generation Z is considered responsible for the development of tourism in the digital and online environment. It is believed that this generation will completely transform tourism and hospitality (Robinson & Schänzel, 2019). In addition to the Internet, a major contribution to the development of hospitality and tourism can be attributed to the growing use of smart devices by young users (Gavrilović & Maksimović, 2018). Due to their dependence on technology, Generation Z is also called "i-Gen", "Gen Tech", and "Gen Wii" (Karim, 2019). The main characteristic of Generation Z members is reflected in the fact that this young generation grew up with the Internet and does not know life without it (Williams & Page, 2011). They are also considered the pioneers of social media. Generation Z has a constant need to connect and stay up-to-date, and social media enables them to establish new contacts and develop relationships. They connect on several platforms, look for quick answers and attention, and they can lose interest with a single click (Șchiopu et al., 2023). As consumers, Generation Z can be divided into 4 categories (Yussof et al., 2018): 1) those who are interested in new technologies; 2) those who insist on ease of use; 3) those who want to feel safe; and 4) those who want to temporarily escape from reality. Young members of Generation Z use social media to get positive comments and experiences about destinations, accommodation, travel agencies, and even restaurants. For these reasons, the content on social networks is diverse and rich (Dewi et al., 2021).

Due to its ease of use and non-existent costs, the Internet has become a popular means of accessing important information (Lipowski, 2017). The development of social media significantly facilitated the process of selecting and purchasing tourist services. Potential tourists can search and purchase tourism services wherever they are, at any time, even on their way to work (Wang, Xiang & Fesenmaier, 2014). The most important elements that describe the behavior of Generation Z in tourism include (Baltescu, 2019) the tendency to make decisions at the last moment, intensive search for opportunities, using word-of-mouth (WOM) as a source, and increasing use of low-cost services.

In addition to sharing information, Generation Z tourists have the opportunity to share their opinions and experiences. In the digital world, word-of-mouth communication is present every day, especially after the trip when tourists share their satisfaction in the case of a positive experience or their dissatisfaction in the case of a negative outcome (Chen & Chen, 2010). Sharing their negative experience with others can provide relief (Kusumawati, Suhandi & Purwanegara, 2024).

In the buying process, it is necessary to highlight how different consumers behave in different ways. During this process, they go through the three stages mentioned earlier. The phase in which they express their satisfaction or dissatisfaction after using the product or service is called post-purchase. An unmet need that leads to dissatisfaction with the product or service is the company's main problem after the consumer's interaction. In these situations, the consumer most often chooses one of two options, namely stopping the purchase or spreading negative WOM (Panda, 2014). Considering that Generation Z is addicted to the Internet, they have no problem expressing any form of dissatisfaction on social media (Kusumawati, Suhandi & Purwanegara, 2024).

Every buying process starts with a need that needs to be satisfied. Most often, consumer dissatisfaction is manifested when goal-directed behavior is interrupted before the need is satisfied (Panda, 2014). Consumers who are dissatisfied often want to share it with other users from their environment, but also with the company itself. The opinion of one dissatisfied user has the potential to influence many others today, which was unimaginable in the past (Berry et al., 2014). In the traditional offline environment, complaints were expressed mainly through WOM communication, while with the development of the digital world, they were redirected to digital platforms in the form of discussion forums, service reviews, and blogs, because that way their negative experiences are more effective and visible (Kitapci et al., 2019). Although complaint behavior can often be interpreted as an unpleasant experience, both for the company and the consumer, it represents a significant corrective measure towards future satisfaction (Berry et al., 2014). Analyzing the reactive behavior of consumers after a negative experience with a service or product is presented through the field of research called consumer complaint behavior (CCB-Consumer complaint behavior) (Kitapci et al., 2019). Every customer reacts differently when they are dissatisfied. While some of them will have no problem making their complaint directly, others will turn to the Internet to do so, either through negative reviews or simply by spreading negative WOM (Berry et al., 2014). Complaining behavior of tourists can be divided into three categories (Ergün & Kitapci, 2018): 1) public actions; 2) private actions; and 3) no actions.

When consumers want to publicly share their dissatisfaction with other users and potential tourists, they will opt for public action. Complaining directly to a company whose service has dissatisfied tourists, demanding a refund, or initiating legal action against the company is called public action. The activities that tourists would carry out as part of private actions are related to the spread of negative WOM, sharing a negative experience with close people in their environment, and even boycotting a company and choosing a new one (Irawan & Saptarini, 2023). Behavior characterized as no action implies that the user has experienced dissatisfaction but does not want to exhibit any complaint behavior and, in some cases, chooses to remain loyal to the company (Berry et al., 2014).

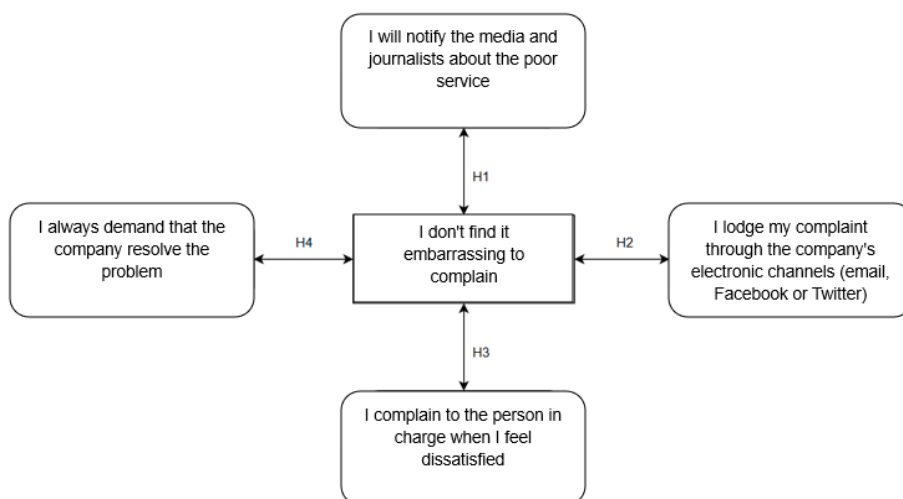
Social media has facilitated the process of complaining and expressing dissatisfaction. Various factors can influence whether a user will engage in complaining behavior. Some of the factors relate to the attitudes, psychology of the individual, but also the locus of control. Most factors are completely out of the company's control. Locus of control is a measure of the degree to which people believe that outcomes depend solely on them and not on external influences from the environment. A distinction needs to be made between the internal and the external locus of control. An internal locus of control is when a person believes they can control the outcome of an event. On the other hand, the external locus of control is when an individual believes that the outcome depends on external influences rather than themselves (Berry et al., 2014).

It is necessary to adapt to the needs of tourists and pay attention to them. The behavior of other users can be influenced by information posted on social media. A positive experience after a trip contributes to the spread of positive images of destinations and an overall higher level of satisfaction in the tourism sector.

2. Methodology

To determine the connection between the ways Generation Z is expressing dissatisfaction in tourism and the absence of a sense of shame when submitting complaints, research was conducted on a convenient sample made up of Generation Z (born from 1995 to 2005). The sample consists of 231 respondents, and the research was conducted from May to July 2025 on the territory of the Republic of Serbia. The sample consisted of 63.2% women and 36.8% men, all born between 1995 and 2005. The majority of respondents have a high school education (34.6%), and were mostly satisfied with the services provided during trips (43.7%). Data were collected using an online questionnaire specifically designed for this research and distributed through social media platforms (Instagram and Facebook). The questionnaire consisted of 30 questions divided into categories. For this research, questions were analyzed within the categories of attention and complaint behavior.

Figure 1: Research framework



Source: The authors' research

For this research, a convenient sample was utilized, focusing on Generation Z. IBM SPSS Statistics software was used to analyze and process the collected data. The Pearson correlation test was conducted to assess the correlation between the observed variables.

3. Results and discussion

The following hypotheses were set based on the literature overview and research objectives:

H₁: There is a statistically significant and positive correlation between the attitude that it is not embarrassing to complain and express dissatisfaction through the media and journalists.

Table 1: Research results (H₁)

Correlations			
		I don't find it embarrassing to complain.	I will notify the media and journalists about the poor service.
I don't find it embarrassing to complain.	Pearson Correlation	1	-0.107
	Sig. (2-tailed)		0.106
	N	231	231
I will notify the media and journalists about the poor service.	Pearson Correlation	-0.107	1
	Sig. (2-tailed)	0.106	
	N	231	231
**. Correlation is significant at the 0.01 level (2-tailed)			

Source: The authors' research

Based on the data obtained from Table 1, it is possible to see that there is no statistically significant or positive correlation between the observed variables, given that the $p > 0.001$, and the coefficient r is negative and equals -0.107 , which indicates that an increase in one variable affects a decrease in another variable. Therefore, hypothesis H_1 has been rejected.

H_2 : There is a statistically significant and positive correlation between the attitude that it is not embarrassing to complain and express dissatisfaction through the company's electronic channels (email, Facebook, or Twitter).

Table 2: Research results (H_2)

Correlations			
		I don't find it embarrassing to complain.	I lodge my complaint through the company's electronic channels (email, Facebook, or Twitter).
I don't find it embarrassing to complain.	Pearson Correlation	1	0.199**
	Sig. (2-tailed)		0.002
	N	231	231
I lodge my complaint through the company's electronic channels (email, Facebook, or Twitter).	Pearson Correlation	0.199**	1
	Sig. (2-tailed)	0.002	
	N	231	231
**. Correlation is significant at the 0.01 level (2-tailed)			

Source: The authors' research

Given that $p = 0.002$, which is lower than the significance limit, i.e., $p < 0.01$, it can be observed that there is a statistically significant correlation between the observed variables. The correlation coefficient is $r = 0.199$ and indicates that there is a weak positive correlation. In other words, if tourists think that it is not embarrassing to complain, there is a high probability that they will submit their complaint to the company through electronic channels. Therefore, hypothesis H_2 has been accepted.

H_3 : There is a statistically significant and positive correlation between the attitude that it is not embarrassing to complain and express dissatisfaction to the person in charge.

Table 3: Research results (H_3)

Correlations			
		I don't find it embarrassing to complain.	I complain to the person in charge when I feel dissatisfied.
I don't find it embarrassing to complain.	Pearson Correlation	1	0.296**
	Sig. (2-tailed)		0.000
	N	231	231
I complain to the person in charge when I feel dissatisfied.	Pearson Correlation	0.296**	1
	Sig. (2-tailed)	0.000	
	N	231	231

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

Source: The authors' research

Looking at the results obtained in Table 3, it is possible to see that there is a statistically significant correlation, given that $p < 0.01$. These results indicate that there is a minimal possibility that the correlation between the tested variables is a coincidence. Also, observing the results of the correlation test, where $r = 0.296$, it is observed that there is a positive correlation of small strength. Therefore, hypothesis H_3 has been accepted.

H_4 : There is a statistically significant and positive correlation between the attitude that it is not embarrassing to complain and the demand that the company solve the problem.

Table 4: Research results (H_4)

Correlations			
		I don't find it embarrassing to complain.	I always demand that the company resolve the problem.
I don't find it embarrassing to complain.	Pearson Correlation	1	0.296**
	Sig. (2-tailed)		0.000
	N	231	231
I always demand that the company resolve the problem.	Pearson Correlation	0.296**	1
	Sig. (2-tailed)	0.000	
	N	231	231

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

Source: The authors' research

Testing the correlation between the variables, the results obtained from Table 4 indicate the presence of a statistically significant and weak positive correlation, given that $p < 0.01$ and $r = 0.296$. The obtained results indicate that changes in one variable have a positive effect on the change in another variable. Therefore, hypothesis H_4 has been accepted.

Similar research was conducted by the authors Mat et al. (2020) with a focus on the millennial generation. These authors proved that there is a correlation between complaining behavior and the users' attitudes towards expressing their negative experiences. Also, a

similar topic was observed by Berry et al. (2014), analyzing how users will express dissatisfaction. The authors have concluded that the way of expressing dissatisfaction (actively, passively, or without activity) largely depends on the internal and external locus of control. If the user exhibits an internal locus of control, according to these authors, it will imply an active manifestation of dissatisfaction through certain channels, while on the other hand, if the user exhibits an external locus of control, their manifestation of dissatisfaction will be passive or even without action.

Conclusion

Analyzing the obtained research results, it is observed that there is a statistically significant correlation with H_2 , H_3 , and H_4 . Given that $p < 0.01$, it is possible to conclude that the possibility that the correlation between the observed variables is a coincidence is extremely small. In case of H_1 , $p = 0.106$, whereby it is concluded that there is no statistically significant correlation between the observed variables. A positive sign is present in the variables in H_2 , H_3 , and H_4 , indicating that an increase in one variable affects the increase in another variable, while in H_1 , this is not the case due to the negative sign in the coefficient r . Based on the obtained results, the authors concluded that hypothesis H_1 (There is a statistically significant and positive correlation between the attitude that it is not embarrassing to complain and express dissatisfaction through the media and journalists) has been rejected. Hypothesis H_2 (There is a statistically significant and positive correlation between the attitude that it is not embarrassing to complain and expressing dissatisfaction through the company's electronic channels (email, Facebook or Twitter)), H_3 (There is a statistically significant and positive correlation between the attitude that it is not embarrassing to complain and expressing dissatisfaction to the person in charge) and H_4 (There is a statistically significant and positive correlation between the attitude that it is not embarrassing to complain and the demand that the company solve the problem) have been accepted.

Digitalization is considered the most significant element of tourism development. The development of technology and digitalization has led to significant changes in the behavior of young tourists of Generation Z, as well as the way in which they express their dissatisfaction. Social media has enabled mass sharing of negative experiences between users and thus become one of the most important sources of information when planning any type of trip. Dissatisfaction with the service has so far been shared through word-of-mouth communication, exclusively between the dissatisfied user and individuals from the user's closest environment. However, the growing popularity of the online world and platforms made it possible for that dissatisfaction to become public and available to every individual looking for additional information about a destination, accommodation, travel agency, and even a restaurant. Public actions have greatly helped and contributed to users in order to prevent them from repeating mistakes or wrong choices.

The limitation of this paper is related to the sample, which consists exclusively of Generation Z. In future research, the same variables can be tested on a sample of tourists belonging to one of the remaining generations. Also, as another limitation, the range of the

sample can be mentioned; the sample of 231 respondents should be enlarged to obtain more relevant information on consumers' complaint-filing behavior. In the future, the goal is to increase the sample size and provide a more detailed explanation of the factors that determine the complaint behavior of Generation Z tourists. In addition to the limitations, this research represents a significant contribution to further research dealing with the complaining behavior of tourists, Generation Z. The complaining behavior of users in tourism is one of the most significant problems for the tourism sector. Companies need to focus on understanding users and responding to their needs. This is the only way to avoid spreading negative experiences through the mass media.

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The Role of Workplace Well-being in Organizational Adaptation to Global Changes based on the Results of Research Conducted among Hungarian Enterprises

Улога благостања на радном месту у организационој адаптацији на глобалне промене на основу резултата истраживања спроведеног међу мађарским предузећима

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Abstract

Purpose: Our study aims to draw attention to the role and significance of the factors influencing workplace well-being and the relationships between them in the process of developing an organizational HR strategy. In our study, we will deal with the concept of workplace well-being, work-life balance, job satisfaction, and the effects of the relationships between dimensions on organizational operational efficiency.

Methodology: In a questionnaire survey conducted among enterprises operating in Hungary, we processed data from 205 respondents using computer-based mathematical and statistical methods.

Findings: The research results confirmed our hypothesis that workplace well-being and its determining factors are closely interconnected and have a significant impact on work motivation and job satisfaction.

Originality/Value: Based on the results, it is recommended to introduce interventions that increase work motivation and employee satisfaction, and to integrate well-being measures more closely into HR strategy.

Practical implications: The results of the article highlight that the complex interrelation of influencing factors of workplace well-being, job satisfaction, and work-life balance should not be treated separately, as it is clear from exploratory results that intervention in one factor has a direct impact on the others. Consequently, non-systematic treatment may lead to a counterproductive HR strategy.

Limitations: The results of our research, which cannot be considered representative, were influenced by the relatively low number of samples, which we are constantly expanding since our present study reports the first partial results of our research project.

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Keywords: adaptation, employee satisfaction, global changes, work and family, workplace well-being
JEL classification: I31

Сажетак

Циљ: наше студије је да скрене пажњу на улогу и значај фактора који утичу на благостање на радном месту и односе између њих у процесу развоја организационе HR стратегије. У нашој студији ћемо се бавити концептом благостања на радном месту, равнотеже између посла и приватног живота, задовољства послом и ефектима односа између димензија на оперативну ефикасност организације.

Методологија: Наше истраживање има за циљ да скрене пажњу на истакнуту улогу коју благостање на радном месту игра у прилагођавању променама у спољашњем окружењу и задржавању радне снаге. У анкетном истраживању спроведеном међу предузећима која послују у Мађарској, обрадили смо податке од 205 испитаника користећи рачунарске математичко-статистичке методе.

Налази: Резултати истраживања потврдили су нашу хипотезу да су благостање на радном месту и његови одлучујући фактори уско повезани и да имају значајан утицај на мотивацију за рад и задовољство послом.

Оригиналност/вредност: На основу резултата, препоручује се увођење интервенција које повећавају мотивацију за рад и задовољство запослених, као и да се мере благостања ближе интегришу у HR стратегију.

Практична примена: Резултати чланка истичу да сложену међусобну повезаност фактора који утичу на благостање на радном месту, задовољство послом и равнотежу између посла и приватног живота не треба третирати одвојено, јер је из истраживачких резултата јасно да интервенција у једном фактору има директан утицај на друге. Сходно томе, несистематски третман може довести до контрапродуктивне HR стратегије.

Ограничења истраживања: На резултате нашег истраживања, који се не могу сматрати репрезентативним, утицао је релативно мали број узорака, који стално проширујемо откако наша садашња студија извештава о првим делимичним резултатима нашег истраживачког пројекта.

Кључне речи: адаптација, задовољство запослених, глобалне промене, посао и породица, благостање на радном месту

JEL класификација: I31

Introduction

The intense changes taking place in the world and the new challenges they pose – including the problems of supply chains, the transition to digital technology, the lack of skilled labor, demographic restructuring or climate catastrophe – result in a continuous need for adaptation and growing economic uncertainty, making it increasingly important for organizations to retain a valuable workforce. Identifying the factors that influence the satisfaction and well-being of an adaptable, properly trained, well-motivated workforce places both work and private life dimensions in the focus of studies.

The most important domains of life are work and family, which often convey conflicting expectations towards the individual. Numerous studies have shown that the factors causing stress in the dimensions of work and personal life can lead to emotional exhaustion, burnout, dissatisfaction with work and life, a decrease in motivation and performance, and the occurrence of work efficiency problems over time (Adame et al. 2016; Bakker et al. 2005; Firth-Cozens 2001).

The main factors that occur at the workplace and generate tension and conflict in the family and other areas of personal life are a lack of satisfaction with work, workplace

stress, workplace burnout, and role conflict experienced in the work environment (Bakker et al. 2007; Ford et al. 2007).

Lack of work-life balance reduces the positive experience of well-being due to high psychological burden and the resulting mental exhaustion (Obrenovic et al. 2020), which can eventually lead to a decrease in performance (Donald et al. 2005; Harter et al. 2003). On the other hand, improving employees' job satisfaction can have a positive impact on overall well-being and life satisfaction, which can also enhance the level of commitment to work and the employer, while at the same time reducing the frequency and intensity of conflicts in private life and family environments (Voydanoff 2002; Eby et al. 2005).

Exploring the connections between workplace well-being and employee satisfaction can provide employers with important information for making decisions and taking measures related to attracting and retaining valuable, talented employees for the organization (Venczel-Szakó 2023).

Based on the above, we raised the following research questions:

Q1: What are the factors that influence well-being at work and job satisfaction, as well as the balance between family and work?

Q2: What specific connections and mutual effects can we identify from the relationships between the examined factors?

Q3: What guidance and suggestions do the identified relationships provide when shaping the human strategy of companies to increase the resilience of employees and organizations to the challenges arising from changes?

Our study aims to draw attention to the role and significance of the factors influencing workplace well-being and the relationships between them in the process of developing an organizational human strategy. The topicality of the research lies in the pressure to respond to tensions and new challenges generated as a result of the events taking place in an external environment burdened with turbulent changes on individuals, families, and organizations (Jarjabka 2001). Accordingly, in our study, we will deal with the concept of workplace well-being, work-life balance, job satisfaction, and the effects of the relationships between dimensions on organizational operational efficiency.

1. Literature review

1.1. Workplace well-being, quality of life at work

Research on workplace stress and employee satisfaction, and the concepts of quality of life and resilience, has provided the basis for studies related to the concept of workplace well-being in recent decades (Cox et al. 2000; Houtman et al. 2007). According to published results, workplace well-being and quality of life at work are strongly related to work

motivation, commitment to the employer, and employee performance, as well as to job and life security, work-life balance, and well-being (Rethinam & Ismail 2008).

Myers and his colleagues contributed to expanding the meaning of the concept by creating a “Wheel of Wellness” model that includes seven different dimensions of an individual’s well-being at work – physical, environmental, professional, intellectual, emotional, social, and spiritual (Myers et al. 2000).

Seligman and Csikszentmihályi identified five pillars of well-being – Positive emotions, Engagement, Relationships Meaning, Accomplishment (PERMA) (Seligman 2011, 2018; Seligman & Csikszentmihályi 2014).

According to Fisher, workplace well-being includes, in addition to cognitive judgments about work, positive feelings that provide a pleasant atmosphere and job satisfaction, as well as negative feelings experienced during work, such as feelings of isolation and alienation (Fisher 2014).

Workplace well-being is thus a complex concept represented by closely related concepts, areas of activity, and influencing factors, which include the environmental conditions at work (workplace safety, health, and ergonomics), the applied social interventions (supporting employees to maintain work-life balance, for example by using flexible working hours, teleworking or parental support programs) and inspiring and supportive management practices based on the recognition of employee performance, empathy, and cooperation. We can also mention here the interventions aimed at developing employee competencies to increase individual and organizational resilience (Bourbeau 2013; White & O’Hare 2014; Raab et al. 2015).

Through the above, the ultimate goal of enhancing workplace well-being, or, in other words, quality of life at work, is for employees to be satisfied, committed, and motivated at their workplace, which is reflected in their performance (Rethinam & Ismail 2008).

Based on the aforementioned factors and the relationships between them, we used Seligman’s PERMA model to assess workplace well-being (Kun et al. 2017).

1.2. Work-life balance

Work-life balance can be defined as the compatibility of work-related and family-related roles and activities (Putra 2022). In practice, this means that meeting work-related expectations does not cause significant difficulties and conflicts in the family and that meeting demands and expectations in private life do not lead to problems and tensions at work, which does not jeopardize taking steps towards the realization of personal career paths (Dennira & Ekowati 2020).

By implementing well-being measures, employers can contribute to reducing tensions arising from conflicts and crisis situations affecting employees, and can also influence work motivation, employee satisfaction, and, through this, performance and the effective achievement of organizational goals (Destilasilika & Perdhana 2023).

Nowadays, in the context of intense changes, crises, and conflicts, it has become increasingly problematic to achieve and maintain a balance between work and private life. Following the measures introduced in response to the pandemic (Dajnoki et al. 2023), due to ongoing technological changes the burden on employees is increasing, which significantly complicates the coordination of work and private life expectations, and the blurring of the boundary between the two spheres is also noticeable (Jarjabka et al. 2024).

The labor shortage, which is increasingly affecting developed countries in Europe, including Hungary, and also has an impact on organizational operational efficiency, has drawn attention to the need to retain valuable employees for employers by applying new types of incentive methods (Jarjabka et al. 2024).

Due to the above, studies on work-life balance, employee satisfaction, and, in connection with these, workplace well-being raise current and relevant questions and problems that need to be addressed both within scientific and policy frameworks (Nagy et al. 2018). When exploring the connections between work and private life, we used the questionnaire of Makra et al. (2012).

1.3. Connections between job satisfaction and workplace well-being

Empirical studies have shown that job satisfaction is associated with increased work motivation and performance, and improved workplace well-being, and through all of these, it can have a positive impact on productivity (Robertson & Taylor 2008).

According to Klein, job satisfaction is determined by various factors, such as individual (personality, attitude, interest, education, intelligence, etc.), social (collegial relationships, cooperation opportunities), as well as cultural (values, habits, views), organizational (organization size, characteristics of human resource management, leadership) and environmental (economic, social, environmental and technological) factors (Klein & Klein 2020).

The starting point for the study by Imola Csóka and Tamás Szőke (2020) focusing on job satisfaction and its determinants was provided by the work-related data for 2015, relevant to Hungary, taken from the International Social Survey Program (ISSP) covering 37 countries. Their results show a strong relationship between job satisfaction and variables related to workplace flexibility, such as the possibility of working from home, flexible working hours, and task organization (Csóka & Szőke 2020). The results of studies conducted in this area show that job satisfaction is closely related to individual performance and work quality, which directly affect the effectiveness of the organization (Sypniewska 2014).

In our research, we used the Mueller and McKloskey satisfaction questionnaire to identify job satisfaction (Lee et al. 2016).

2. Material and method

2.1. Literature research and processing

We examined workplace well-being and other related concepts in the Hungarian and international literature using the so-called rapid evidence assessment method. We searched and collected scientific publications related to the topic in Hungarian and English in electronic databases, such as Google Scholar, Wiley, Sage Journals, Springer, Scopus, Ovid, EBSCO, ERIC, Sociological Abstracts, Web of Science, ResearchGate. During the systematic review, we focused primarily on the concept of workplace well-being, but our search terms also included keywords like satisfaction with life and work, work-family and work-life balance, quality of life at work, as well as Hungarian and English terms with similar meanings to the aforementioned.

The publications collected during the empirical literature review were categorized according to the search terms. Our study aimed to create a relevant database while also performing a thematic mapping of research related to the topic.

2.2. Data collection and processing

During the data collection, we used a complex, online questionnaire compiled from validated questionnaires taken from previous research on the areas of study covered in this article. This methodological innovation allowed us to explore and analyze the correlations between the study dimensions and the multiple factors related to them on a broader scale, which has led to new research results.

The online questionnaire compiled in Google Forms, in addition to general sociodemographic questions, included questions exploring the relationship between work and family, for which we used the validated measurement tool presented in the publication "Hungarian validation of work-family conflict and factors affecting work-family balance" (Makra et al., 2012). Employee satisfaction was assessed using the (also validated) "Satisfaction Questionnaire" by Mueller and McKloskey (Lee et al., 2016) in the complex questionnaire. The third dimension of the study, workplace well-being, was compiled in accordance with the validated measurement tool based on the Hungarian adaptation of Seligman's PERMA Model (Kun et al., 2017).

When studying the development history of workplace well-being systems in Hungary, we focused primarily on large and medium-sized enterprises in terms of the number of employees, assuming that in these cases, we are more likely to find workplace well-being policies and measures integrated at the strategic and operational levels.

After the data collection, a total of 205 evaluable questionnaires were selected and then forwarded for computer statistical processing (SPSS). In addition to basic descriptive statistical calculations, we examined the existence and strength of relationships between different factors using a correlation matrix.

3. Results

The results obtained using basic statistics provide detailed insight into various aspects of workplace well-being, including work and family conflicts, job and life satisfaction, as well as the impact of workplace conditions and relationships on workers' quality of life. (Table 1).

Table 1: The results of the survey on corporate well-being using basic statistics

Variables	N	Mean	Median	Mode	Standard Deviation
Family conflict arising from work (FW)	205	3,75	4,00	5,00	1,20
Work conflict arising from family (WF)	205	4,25	4,60	5,00	0,95
Involvement in the family (IF)	205	3,55	3,65	4,35	1,20
Involvement in work (IW)	205	2,50	2,65	2,35	1,05
Job satisfaction (JS)	205	3,50	3,90	3,90	1,30
Life satisfaction (LS)	205	2,85	3,00	3,35	1,15
Workplace culture and conditions (Sat_WorkCultCond)	205	3,00	3,05	2,40	1,20
Balance of family and work (Sat_SchedulingAndFamilyWorkBalance)	205	3,75	4,05	4,05	1,00
Collegial relations (Sat_CollegialRelation)	205	2,95	3,00	2,50	1,15
External rewards (Sat_ExtrRew)	205	3,20	3,35	3,75	1,15
Professional opportunities (Sat_ProfOpp)	205	2,50	2,50	2,50	1,40
Positive emotions (WorkSat_PositiveEmotions)	205	3,45	3,45	3,15	1,10
Deepening (WorkSat_Deepening)	205	3,25	3,45	3,45	1,15
Positive relations (WorkSat_PositiveRelations)	205	3,60	3,65	3,65	1,10
Meaning (WorkSat_Meaning)	205	3,50	3,35	3,35	1,15
Performance, success (WorkSat_PerformanceSuccess)	205	3,35	3,35	4,00	1,05
Negative aspects of work (WorkSat_WorkNegativeAspects)	205	3,25	3,35	2,50	1,15

Source: based on own data

After transforming the values of the variables obtained from the different factors onto a scale from 1 to 5, the results became comparable. The highest average value is shown by the “Work conflict arising from family” (WF) (4.25), which indicates that a significant proportion of the participants feel that family obligations negatively affect their work. Its low standard deviation (0.95) also confirms that the opinion on this issue is relatively uniform.

From the strong standard deviation (1.40) observed for the “Professional opportunities” (Sat_ProfOpp) indicator we can conclude that the respondents judge their own career opportunities very differently. This significant variation clearly indicates that

the opportunities for professional development are not defined specifically enough, and some may experience significant obstacles in this area.

The relatively high average value of “Balance of family and work” (Sat_SchedulingAndFamilyWorkBalance) (3.75) shows an interesting contrast with the same average value of “Family conflict arising from work” FW: 3.75), which demonstrates the contradictory relationship between work and family, the fragile nature of the balance between them, as a result of which conflict situations can often occur.

Overall, the data suggest that the relationship between family and work is a significant source of conflict for respondents, while their assessment of job satisfaction is mixed. The perception of “Professional opportunities” varies greatly, and “Positive emotions about work” and “Performance” (WorkSat_PositiveEmotions: 3.45; WorkSat_PerformanceSuccess: 3.35) are not outstanding either. All this suggests that the respondents’ work-related engagement and satisfaction are not balanced and that family-work conflicts are particularly determining factors in terms of employee well-being.

The correlation matrix was used to examine the relationships between different factors (Table 2.). The results reveal significant connections between several factors, in particular between “Work conflict arising from family”, “Job Satisfaction”, and “Balance of family and work”. In the following analysis, several factor groups can be identified based on the correlation matrix, which are interrelated but belong to different dimensions. These are as follows.

With regard to “Family conflict arising from work” (FW) and “Work conflict arising from family” (WF), a strong, significant positive relationship can be observed between the variables ($r = 0.590$, $p < 0.01$), which indicates that those who experience conflicts between the two areas of life more intensely may experience that the conflict in one direction is strongly associated with the conflict in the other direction.

Regarding the impact of both types of conflict on “Job and life satisfaction”, it can be stated that they are negatively and significantly correlated with job (JS) and life satisfaction (LS), as well as with dimensions measuring positive experiences at work (e.g. Positive Emotions, Deepening, Positive Relations). This suggests that conflicts significantly reduce the satisfaction and positive psychological state of employees.

This group contains several highly correlated variables. The variables “Job Satisfaction” (JS) and “Life Satisfaction” (LS) show a negative, significant correlation with conflicts. Positive workplace experiences contribute significantly to job satisfaction, while negative experiences resulting from the aforementioned conflicts have the opposite effect.

“Workplace Culture and Conditions” (Sat_WorkCultCond) and “Balance of family and work” (Sat_Scheduling AndFamily WorkBalance) are strongly positively related to other positive dimensions (e.g. JS, LS, Collegial Relations, External Rewards), suggesting that a supportive work environment and appropriate scheduling and balancing of family roles are key to enhancing employee satisfaction.

Table 2: Correlation matrix of the workplace well-being survey

I D	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Family conflict arising from work (FW)	1															
2	Work conflict arising from family (WF)	0,59 0**	1														
3	Involvement in the family (IF)	0,04 8	0,00 2	1													
4	Involvement in work (IW)	0,02 0	0,09 9	0,0 24	1												
5	Job satisfaction (JS)	0,53 4**	0,37 1**	0,0 89	0,25 1**	1											
6	Life satisfaction (LS)	0,37 4**	0,24 8**	0,1 35	0,23 8**	0,44 0**	1										
7	Workplace culture and conditions (Sat_WorkCultCond)	- 0,33 7**	- 0,26 6**	- 0,0 81	- 0,16 1*	- 0,60 8**	- 0,48 7**	1									
8	Balance of family and work (Sat_Scheduling AndFamilyWorkBalance)	- 0,48 5**	- 0,34 5**	- 0,0 45	- 0,14 3*	- 0,44 4**	- 0,38 0**	- 0,56 9**	1								
9	Collegial relations (Sat_CollegialRelation)	- 0,42 6**	- 0,27 5**	- 0,0 34	- 0,14 4*	- 0,53 6**	- 0,46 1**	- 0,72 8**	- 0,64 7**	1							
10	External rewards (Sat_ExtrRew)	- 0,40 9**	- 0,25 3**	- 0,0 01	- 0,16 8*	- 0,54 3**	- 0,51 1**	- 0,63 2**	- 0,66 7**	- 0,68 1**	1						
11	Professional opportunities (Sat_ProfOpp)	- 0,32 2**	- 0,24 2**	- 0,0 16	- 0,20 0**	- 0,47 3**	- 0,38 9**	- 0,55 1**	- 0,39 7**	- 0,57 5**	- 0,54 2**	1					
12	Positive emotions (WorkSat_PositiveEmotions)	- 0,49 6**	- 0,37 4**	- 0,0 51	- 0,30 6**	- 0,63 6**	- 0,41 6**	- 0,56 1**	- 0,44 7**	- 0,53 2**	- 0,54 4**	- 0,50 2**	1				
13	Deepening (WorkSat_Deepening)	- 0,43 8**	- 0,28 3**	- 0,0 32	- 0,35 9**	- 0,72 1**	- 0,46 7**	- 0,69 0**	- 0,48 7**	- 0,57 2**	- 0,51 4**	- 0,55 3**	- 0,79 7**	1			
14	Positive relations (WorkSat_PositiveRelations)	- 0,34 0**	- 0,27 6**	- 0,0 17	- 0,15 3*	- 0,38 9**	- 0,27 1**	- 0,58 8**	- 0,48 5**	- 0,57 2**	- 0,53 6**	- 0,29 2**	- 0,65 1**	- 0,53 4**	1		
15	Meaning (WorkSat_Meaning)	- 0,37 7**	- 0,29 0**	- 0,0 71	- 0,41 7**	- 0,40 0**	- 0,32 2**	- 0,38 6**	- 0,41 5**	- 0,36 3**	- 0,39 4**	- 0,36 5**	- 0,67 4**	- 0,63 2**	- 0,50 7**	1	
16	Performance, success (WorkSat_PerformanceS)	- 0,34 1**	- 0,38 3**	- 0,0 24	- 0,29 6**	- 0,46 8**	- 0,33 2**	- 0,51 2**	- 0,45 6**	- 0,43 8**	- 0,40 6**	- 0,47 8**	- 0,70 0**	- 0,68 0**	- 0,54 9**	- 0,75 0**	1

uccess)																			
1 Negative																			
7 aspects of																			
work																			
(WorkSat																			
WorkNegative	0,37	0,29	0,0	0,28	0,50	0,33	0,39	0,29	0,30	0,30	0,35	0,53	0,53	0,34	0,43	0,42			
Aspects)	0**	5**	19	7**	4**	2**	1**	1**	9**	1**	9**	6**	7**	1**	2**	8**			

Note: * $p < 0,05$ ** $p < 0,01$ Source: based on own data

In addition to “Collegial Relations” (Sat_CollegialRelation), “External Rewards” (Sat_ExtRw) and “Professional Opportunities” (Sat_ProfOpp), there is an extremely high, significant correlation (in many cases a value above 0.5, up to 0.79) between the variables measuring psychological dimensions, such as “Positive Emotions” (WorkSat_PositiveEmotions), “Deepening” (WorkSat_Deepening), “Positive Relations” (WorkSat_PositiveRelations), “Meaning” (WorkSat_Meaning), “Performance, Success” (WorkSat_PerformanceSuccess).

The aforementioned high coherences indicate that the different dimensions of work experiences form a complex, structured relationship that reflects the overall job satisfaction perceived by employees.

The results of the correlation analysis, therefore, highlight the role of work-family conflicts. As can be seen from the results, these conflicts reduce employee satisfaction and have a negative impact on changes in psychological state and workplace experiences related to work and workplace well-being.

Conclusions and recommendations

Considering the results of the exploratory research, it can be concluded that two-way conflicts related to work and family have a clear negative impact on both job and life satisfaction, as well as on the development of positive workplace experiences.

The correlations of positive workplace experiences, which include supportive workplace culture, the creation of balance, collegial relationships, and the close connection of individual psychological experiences (such as positive emotions, immersion, positive relationships, reason, and performance), indicate the existence of a unified structure characterized by high internal consistency.

During the parallel examination of the different areas of study represented by the three sets of questions, the correlations between the factors related to them produced results that went beyond the individual blocks of study. Based on all this, it is important to emphasize that workplace well-being is a complex, multidimensional construct, which is determined by conflicts, the quality of the work environment, work-family balance, and interpersonal and psychological experiences (Raab et al. 2015).

The results clearly highlight that reducing conflicts and promoting a supportive work environment are key to increasing the overall satisfaction perceived by employees. The

analysis confirms that the different dimensions of workplace well-being are closely related to each other and that improving one factor can have a positive impact on other areas.

Since workplace well-being can significantly contribute to employee satisfaction and thus to increased work performance, it is recommended that the well-being strategy created to reconcile work and family expectations be closely integrated with the HR strategy (Jarjabka 2001). Workplace well-being, job satisfaction, and work-life balance should not be treated separately, as it is clear from exploratory results that intervention in one factor has a direct impact on the others. Consequently, non-systematic treatment may lead to a counterproductive HR strategy. Strategies to motivate employees and increase their satisfaction and well-being are key to creating a supportive and dynamic work environment. These factors play a significant role in increasing employee engagement and productivity.

The results of our research, which cannot be considered representative, were influenced by the relatively low number of samples, which we are constantly expanding since our present study reports the first partial results of the aforementioned research project. Increasing the number of samples may also open up the possibility of applying higher-level statistical methodology and further correlations, which will facilitate the development of implications for various actors (management, higher education actors involved in HR education, corporate HR professionals, consultants, and policymakers).

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Analysis of Income Differences Between Rural and Urban Areas in Serbia

Analiza razlika u prihodima između ruralnih i urbanih oblasti u Srbiji

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Abstract: This study explores income disparities within the rural-urban divide through a multidisciplinary approach, incorporating factors such as education, gender, employment, and household size, with the aim of providing insights for the development of effective policies and promoting inclusive regional development.

Data were collected from the SILC database conducted in Serbia in 2022. A univariate analysis was performed with all control variables, and subsequently a multiple regression analysis. The inclusion of control variables further illuminates the income differences observed between rural and urban areas. Our findings confirm that income levels are higher in urban areas compared to rural ones. The influence of other variables is consistent with the literature.

Future research will adopt a longitudinal approach and include additional socio-economic indicators, which could offer further explanations for income disparities between urban and rural regions.

Keywords: well-being, income disparities, rural areas, EU-SILC.

JEL classification: I31, I32, O18.

Сажетак: Ова студија истражује разлике у приходима унутар рурално-урбаног раздвајања кроз мултидисциплинарни приступ, узимајући у обзир факторе као што су образовање, пол, запосленост и величина домаћинства, с циљем пружања увида за развој ефективних политика и промовисање инклузивног регионалног развоја.

Подаци су прикупљени из SILC базе спроведене у Србији 2022. године. Спроведена је униваријациона анализа свих контролних варијабли, а након тога и вишеструка регресија. Укључивање контролних варијабли додатно осветљава разлике у приходима између руралних и урбаних подручја. Наши налази потврђују да су приходи виши у урбаним него у руралним областима. Утицај других варијабли је у складу са литературом.

Будућа истраживања усмериће се на лонгитудинални приступ и укључивање додатних социо-економских показатеља који би могли додатно објаснити разлике у приходима између урбаних и руралних средина.

Кључне речи: добробит, разлике у приходима, рурална подручја, EU-SILC.

ЈЕЛ класификација: I31, I32, O18.

Introduction

Income disparities between rural and urban areas represent a pressing challenge with profound socio-economic implications. Across various regions, urban areas consistently enjoy higher income levels, reflecting their advantages in access to education, employment opportunities, and essential services. Conversely, rural areas often face limited infrastructure,

restricted economic opportunities, and pronounced skill deficits, exacerbating the income divide. This urban-rural disparity is not only an economic concern but also a societal issue that shapes human capital development, regional cohesion, and long-term national growth trajectories (Perpiña et al., 2023; Zarifa et al., 2019).

The complexity of these disparities is heightened by the unique characteristics of rural areas, which cannot be solely understood through geographical distance or agglomeration effects. Instead, the multifaceted roles of rural regions - anchored in sustainable agri-food systems, territorial capital, and relational proximity - offer alternative pathways for development that transcend traditional frameworks (Mantino, 2022). Moreover, sparsely populated and remote areas, particularly in developed countries, exhibit regional disconnectedness, where urban-centric growth strategies fail to generate equitable spillover effects for surrounding hinterlands (Carson et al., 2022).

From a policy perspective, addressing these disparities requires a nuanced approach. Place-based policies that consider the unique attributes of rural areas are essential for fostering mutual benefits between urban, peri-urban, and rural regions (Perpiña et al., 2023). Similarly, targeted fiscal interventions, such as spatial transfers to poorer regions, can mitigate income inequalities, particularly when calibrated to account for migration and skill-location preferences (Gaubert et al., 2021). Effective governance, including decentralization and local policy innovation, has also proven instrumental in balancing regional development and enhancing rural economic prospects (Díaz-Lanchas & Mulder, 2021).

At the individual level, education emerges as a critical determinant of income disparities. In rural areas, the lower availability and returns on education create significant barriers to socio-economic mobility. Rural residents not only obtain lower levels of formal education but also experience limited access to post-secondary opportunities, often prompting those with higher qualifications to migrate to urban centers for better employment prospects (Zarifa et al., 2019; Mantino, 2022). The resulting skill and income gaps perpetuate cycles of inequality, leaving rural areas at a disadvantage in the knowledge-driven global economy.

This study seeks to contribute to the expanding body of research on income inequalities between rural and urban areas by examining these dynamics through the multidisciplinary lens. Specifically, it draws on various perspectives, including gender, education, employment status, and household size, to offer a comprehensive understanding of the factors underlying these disparities. The findings aim to inform the development of more effective policies and promote inclusive regional development.

The remainder of the paper is structured as follows: Section 1 provides a review of the relevant literature, while Section 2 outlines the data and methodology employed in the study. The results of the analysis are presented in Section 3, followed by the final conclusions.

1. Literature review

Research highlights significant differences in life satisfaction between rural and urban areas within the European Union. Comprehensive insights into well-being disparities, highlighting

diverse indicators across countries and emphasizing the unique challenges and opportunities in rural regions can be found in OECD (2020a, 2020b). Enhancing societal development in a rural-urban context requires addressing disparities in access to resources and opportunities, with the aim of improving general well-being for individuals across both rural and urban areas (Madžar et al. 2024). Rural residents consistently report higher levels of life satisfaction than their urban counterparts, even after controlling for socio-economic factors. This trend is evident across three clusters of EU countries categorized by their level of economic affluence, as measured by GDP. Key drivers of this disparity include lower levels of insecurity, differences in frames of comparison, and enhanced social interaction in rural areas (Sørensen, 2014). Similarly, Shucksmith (2009) has conducted an analysis of urban–rural disparities in perceived welfare and quality of life. This study reveals minimal differences in richer EU countries, while rural areas in poorer nations, particularly EU candidate countries, exhibit significantly lower welfare levels. However, despite these disparities in perceived welfare, subjective well-being remains relatively consistent, suggesting the influence of contextual and cultural factors.

Income inequalities between rural and urban regions have far-reaching socio-economic implications. In Latvia, these disparities have led to increased emigration, reduced tax revenues, and diminished consumer demand, yet the topic remains underexplored in academic literature (Sloka, 2019). A broader analysis of Rodríguez-Pose and Tselios (2009) in Western Europe indicates a robust U-shaped relationship between income per capita and inequality, with 80% of income disparities occurring within regions rather than between them. Northern and urban regions exhibit higher income levels and lower inequality, whereas southern and rural areas lag in economic development. Chivu et al. (2015) showed a growing gap between household income levels and GDP per capita in Romania that reflects significant rural–urban disparities, further challenging the EU's objective of economic and social cohesion.

Labor migration, particularly to Norway following the 2004 EU enlargement, has further exacerbated income inequality. Slettebak (2021) points that this migration has not only increased overall inequality but has also affected income disparities within the native population, particularly in rural municipalities. Unlike refugees, labor migration's impact on inequality is significant among natives, suggesting a distinct mechanism that warrants further investigation.

According to Bernard (2019), several factors contribute to the persistent poverty and deprivation observed in rural areas across Europe. In poorer EU countries, rural regions face lower welfare levels and diminished quality of life, particularly in post-socialist transition contexts and regions with high proportions of agricultural workers. These disparities are closely tied to national economic development and urbanization processes, which exacerbate rural disadvantages. Specifically, rural poverty is driven by three interrelated processes: the concentration of low-resource households, heightened poverty risks for these households, and poverty-enhancing effects that operate independently of household resources. These dynamics underscore the critical role of national economic advancement in addressing rural deprivation. Marković and Marjanović (2025) aim to categorize advanced economies across

Europe based on their poverty levels while also identifying countries that require increased financial and social support to effectively mitigate poverty. The results of Trpeski et al. (2024) show a noticeable deceleration in the growth rates of labor productivity over the past decade in Southern and Eastern European countries. This trend is particularly relevant, as higher labor productivity in urban areas often leads to significant urban-rural income disparities, with urban regions typically benefiting from superior infrastructure, better access to education, and greater economic opportunities—advantages that are less prevalent in rural areas.

Despite lower welfare levels in rural areas, Shucksmith et al. (2009) conclude that subjective well-being remains largely unaffected, suggesting the presence of compensatory social or cultural factors that mitigate the negative impacts of material deprivation. Bukša et al. (2022) highlight the dual impact of foreign direct investment (FDI) on less developed countries, acknowledging its potential to drive economic growth while also recognizing cases where multinational corporations have negatively affected economic stability and sustainable development.

Urban–rural inequalities require targeted policy interventions to address spatial disparities effectively. An analysis of living conditions in Germany, conducted by Schnorr-Baecker (2021), based on NUTS 3 data provides a spatial comparison that highlights significant variations in opportunities and risks for urban and rural areas. Pre-COVID data serve as a baseline for assessing post-pandemic dynamics and identifying areas for policy adjustment. Furthermore, regional disparities in income and quality of life call for a complex approach to rural, urban, and cohesion policies. Addressing these disparities necessitates tailored strategies that consider both the economic and social dimensions of regional inequality.

Regional income distribution patterns reveal a clustering effect, with regions sharing similar economic conditions often grouped both within and across national borders. As elaborated in Rodríguez-Pose and Tselios (2009), northern and urban regions demonstrate higher levels of economic development and lower inequality, while southern and rural regions exhibit the opposite trend. This clustering underscores the interplay between geographical location, economic development, and income inequality, offering insights into the structural factors shaping regional disparities.

Income inequality in Serbia has been a persistent issue. Krstić (2016) observed the Gini coefficient reaching 38.7 in 2013, positioning the country among those with the highest levels of inequality in Southeast Europe. This inequality is evident not only between the employed and unemployed but also among individuals within the workforce. Although tax and benefit policies have contributed to reducing income disparities, their overall impact remains limited compared to EU standards, highlighting the need for systemic reforms. In transition economies, income inequality tends to rise in the initial phases as resources shift from the state to the private sector, leading to wage disparities driven by deregulation and liberalization. However, as transition stabilizes, wages tend to reflect workers' characteristics, such as education and experience, while market competition helps to mitigate further inequalities (Zarkovic-Rakic et al., 2019). A decomposition of income inequality in Slovenia,

Croatia, and Serbia further indicates that wage income constitutes the primary factor contributing to disposable income inequality across all three countries. In Serbia, pensions represent the second-largest contributor (Krstić, 2021). Despite these findings, wage inequality in Serbia remains relatively moderate when compared internationally, as earnings disparities are less pronounced than those observed in overall income distribution (Aleksić, 2023). Furthermore, from 2006 to 2017, Serbia experienced real growth in average consumption by 11.8%, with the lowest-income decile recording an increase of approximately 21%, while the first seven deciles exhibited above-average consumption growth, indicating some degree of economic improvement among lower-income groups (Mladenović, 2019). Veličković and Jovanović (2021) analyze the feasibility of sustainable rural development in Serbia, identifying both available resources and structural constraints. Their study underscores the need for significant investments and reforms to enhance rural development and improve current conditions.

2. Data and Methodology

The studies devoted to research of rural-urban and regional disparities, employ diverse datasets, methodologies, and research goals. For instance, large-scale surveys, such as the EU Statistics on Income and Living Conditions (EU-SILC) employed by Meloni et al. (2024), European Values Study (2008), utilized in Carson et al. (2022) to investigate rural-urban differences in life satisfaction, and the European Quality of Life Survey (2003), applied in Zarifa et al. (2019) to explore income and well-being disparities across urban and rural areas. The European Community Household Panel (ECHP) dataset, covering the years 1995–2000, (Rodríguez-Pose and Tselios, 2009), maps regional income and inequality trends across Western Europe. The analysis in Gaubert, et al. (2021) relies on data from the Federal Statistical Office of Germany to examine urban-rural differences at the NUTS 3 level. Norwegian municipal register data (2005–2016) underpin Mantino, (2022) the analysis of labor migration and income inequality, while regional data from Latvia (Sloka, 2019) and statistical data on household revenues in Romania (Chivu et al. 2015) provide insights into income disparities and their socio-economic consequences.

This study utilizes data from the EU-SILC, conducted in Serbia in 2022. The EU-SILC survey targets all private households and individuals aged 16 and over residing in the Member States at the time of data collection, excluding those in collective households or institutions. It was launched in 2004. Data collection is conducted by National Statistical Institutes using a mix of surveys and register data, incorporating both cross-sectional and longitudinal elements. EU-SILC provides microdata on income, poverty, social exclusion, and living conditions, with topics ranging from household-level income and housing to individual-level demographics, education, labor, health, and income. Income data typically refers to the year preceding the survey and is collected in accordance with international standards. SORS is collecting data in Serbia from 2013.

To classify households as rural or non-rural, the study employs the Degree of Urbanization variable provided by EU-SILC. Consistent with the approaches of Bernard

(2019) and Meloni et al. (2024), a dichotomous rural/non-rural classification was created, enclosing cities, towns and suburbs as non-rural.

Numerous studies (Alexandri et al., 2015; Grzega, 2019; Meloni 2023, 2024; Schnorr-Baecker; 2021; Sloka et al., 2019) demonstrate that individuals living in rural areas tend to have lower income levels compared to their counterparts in urban and non-rural regions across Europe. This disparity reflects structural economic differences, including limited access to high-paying employment opportunities, fewer industries, and reduced economic diversification in rural settings. Additionally, rural areas often face challenges such as weaker infrastructure, lower levels of education and skills among the population, and reduced access to essential services, which further exacerbate income inequalities. These gaps are particularly pronounced in countries with stark regional disparities, where rural regions lag significantly behind urban centers in terms of economic development and living standards. As a result, the rural-urban income divide remains a persistent and multifaceted issue, deeply embedded in Europe's socioeconomic landscape. Therefore, we use logarithm of the average disposable household income per inhabitant as a dependent variable. We choose logarithm over linear form due to normality issues with income distribution.

A set of independent dummy variables are defined in a following way. Rural dummy variable is a crucial variable in our analysis. However, additional control variables that account for key characteristics that influence income levels are gender, education, working status, retirement status and household size.

Table 1: Variable definition

Variable	Definition
Rural	1 if household is located in rural area, 0 otherwise.
Gender	1 if an individual is female, 0 otherwise.
Edu1	1 if an individual has more than lower secondary education, 0 otherwise.
Edu2	1 if an individual has more than post-secondary non-tertiary education, 0 otherwise
Work	1 if person is working, 0 otherwise.
Retirement	1 if person is retired, 0 otherwise.
Hsize	The number of individuals in the household.

Source: Author

To examine income disparities between rural and non-rural areas, we define six distinct models that differ in the inclusion of specified variables and geographic scope. More specifically, we distinguish between models incorporating only the Rural variable and those including the Rural variable alongside other defined variables. Furthermore, the analysis is conducted at two levels: for the entire territory of the Republic of Serbia (RS) and for its NUTS1 regions (RS1 and RS2).

Table 2: Model definitions

Region	RS	RS1	RS2
Rural variable	Model 1	Model 3	Model 5
Rural and control variables	Model 2	Model 4	Model 6

Source: Author

3. Results and discussion

The initial dataset involved 15398 individuals. Following tests for normality and the identification of multivariate outliers, 2751 entries were excluded, resulting in a final sample of 12647 individuals. The distribution of individuals and households regarding the urbanization division is presented in Table 3. The degree of urbanization methodology (Eurostat, 2025) classifies local administrative units (LAUs) into cities, towns and suburbs, and rural areas based on 1 km² population grid cells, ensuring uniformity in classification. This two-step process first categorizes grid cells by population density, contiguity, and size, then classifies LAUs based on where their populations reside: cities ($\geq 50\%$ in urban centers), towns and suburbs ($\geq 50\%$ in urban clusters, $< 50\%$ in urban centers), and rural areas ($> 50\%$ in rural grid cells).

Table 3: Distribution of households and individuals per level of urbanization

Level of urbanization	Households	Individuals
Rural	2004	5677
Non-rural	2750	6970
Total	4754	12647

Source: Author's calculations from EU-SILC database for Serbia, 2022

The initial step in data analysis involved testing for significant differences in income with respect to the predictor variables. We emphasize that this represents a univariate analysis, where each predictor is analyzed independently, excluding all others from the current examination. As it can be seen from Table 4, all predictors have a statistically significant impact on income.

Table 4: Income comparisons per groups

Dichotomous variable	Average of log Income per group		t
	0	1	
Rural	12,7717(0,4771)	12,6002(0,4841)	19,974**
Gender	12,7063(0,4986)	12,6839(0,4858)	2,582*
Edu1	12,5156(0,4863)	12,7563(0,4729)	-24,786**
Edu2	12,6346(0,4747)	12,9928(0,4398)	-33,773**
Working	12,3786(0,4763)	12,7556(0,4660)	-32,852**
Retired	12,6675(0,4970)	12,7542(0,4615)	-9,570**

Notes: Standard errors in parentheses; ** $p < 0,01$; * $p < 0,05$

Source: Author's calculations from EU-SILC database for Serbia, 2022

The findings presented in Table 4 can be summarized as follows: there are statistically significant differences in the average logarithm of income per individual between rural and non-rural areas, with higher income levels observed in non-rural areas. Gender also plays a statistically significant role in income disparities, with male individuals exhibiting higher average income levels. Both education variables indicate that individuals with higher levels of education have significantly higher average incomes. As expected, individuals who are

employed have statistically higher incomes, a trend that is also observed among retired persons.

The correlation between household size and the logarithm of average household income is negative (-0,212) and statistically significant ($p < 0,001$), indicating that an increase in the number of household members is associated with a reduction in average household income.

In Table 5 and Table 6 we summarize findings of models 1-6.

Table 5: Coefficients for models 1 and 2

Coefficient	Model	
	1	2
R Square	0,0306	0,2198
(Constant)	12,7717(0,0058)**	12,4308(0,0164)**
Rural	-0,1715(0,0086)**	-0,0615(0,0081)**
Gender	-	-0,0193(0,0077)*
Edu1		0,1917(0,0095)**
Edu2		0,2543(0,0108)**
Retirement		-0,0203(0,0092)*
Work		0,3711(0,0109)**
Hsize		-0,0485(0,0021)**

Notes: Standard errors in parentheses; ** $p < 0,01$; * $p < 0,05$

Source: Author's calculations from EU-SILC database for Serbia, 2022

To present the findings, we begin with Models 1 and 2, which focus on the entire territory of the Republic of Serbia. The model that includes only the variable Rural explains 3.1% of the variation in income levels. The coefficient for the Rural variable is negative, indicating that rural households have 17% lower income levels compared to non-rural households. The inclusion of control variables in Model 2 significantly improves the explanatory power, with 22% of the variation in the logarithm of household income explained by this model. Moreover, the coefficient for the Rural variable decreases, suggesting that the included control variables contribute to a more extensive understanding of income disparities. The direction of the coefficients aligns with the results from the univariate analysis. Female individuals have 1,9% lower income levels. Individuals with education levels higher than lower secondary education earn 19% more, while those with more than post-secondary non-tertiary education have a 25% higher income. Retired individuals, on average, earn 2% less, whereas employed individuals have 37% higher income. Finally, an increase in household size reduces income by approximately 5%.

A similar is observed when the analysis is restricted to NUTS1 regions. The coefficient associated with the dummy variable Rural decreases upon the inclusion of control variables. The direction of the coefficients remain consistent with the broader model, with the exception that Retirement loses statistical significance in both Model 4 and Model 6, while the Model for RS2 also loses statistical significance for Gender. Interestingly, the coefficients associated with dummy Rural are smaller in the NUTS1 regions, suggesting that the control variables provide a slightly better explanation of variations in income levels at

this regional level. Our findings are consistent with the study by Meloni (2024) for low-income countries and Chivu (2015) and Sloka (2019).

Table 6: Coefficients for models 3-6

Coefficient	Model			
	3	4	5	6
R Square	0,0233	0,2279	0,0159	0,1941
(Constant)	12,8653(0,008)**	12,4574(0,0255)**	12,68(0,008)**	12,3711(0,0211)**
Rural	-0,1572(0,0144)**	-0,0552(0,0133)**	-0,1211(0,0109)**	-0,0217(0,0103)*
Gender	-	-0,0316(0,0119)**	-	-0,0139(0,0099)
Edu1		0,2368(0,0151)**		0,1598(0,012)**
Edu2		0,2186(0,0158)**		0,2832(0,0145)**
Retirement		-0,0215(0,014)		-0,0084(0,0119)
Work		0,3896(0,0176)**		0,3455(0,0137)**
Hsize		-0,0451(0,0036)**		-0,0436(0,0027)**

Notes: Standard errors in parentheses; ** $p < 0,01$; * $p < 0,05$

Source: Author's calculations from EU-SILC database for Serbia, 2022

Conclusion and future work

This study examines income disparities between rural and non-rural areas in the Republic of Serbia. The data used for the analysis were sourced from the SILC database for the year 2022. The analysis contributes to the broader research on income inequality between rural and urban regions. Our findings confirm significant differences in income levels between these areas, with introductory univariate test and a simplified model containing only a single dummy variable indicating statistically lower income in rural areas compared to urban settings. The inclusion of additional control variables, such as gender, education, employment status, and household size, enhanced the explanatory power of the model and provided a more comprehensive understanding of income disparities. The reduction in the coefficient for the Rural variable, accompanied by an increase in the coefficient of determination, suggests that the control variables capture additional dimensions of income inequality between rural and urban areas. These findings underscore the importance of policymakers focusing on increasing support for rural areas or improving the efficiency of existing policies. Targeted interventions could include initiatives to enhance access to education and employment opportunities, investments in infrastructure, and tailored programs to stimulate economic activity in rural regions. By addressing the underlying factors contributing to income disparities, such as lower levels of education attainment, limited employment opportunities, and higher household dependency ratios in rural areas, policymakers can promote more equitable economic development and reduce regional inequalities. Additionally, ensuring that existing support mechanisms are effectively implemented and regularly evaluated for efficiency could further bridge the income gap between rural and urban areas.

Future research could expand on this study by investigating several key areas to enhance the understanding of income disparities between rural and urban regions. A valuable direction would involve the analysis of longitudinal data to examine dynamic changes in income inequality over time and to evaluate the long-term impacts of policies aimed at rural development. Furthermore, future studies could address regional and sectoral heterogeneity by exploring how differences in industrial composition, labor market structures, and access to essential services influence income levels across diverse geographic areas. An important extension would include examining the intersectional dimensions of income disparities, focusing on the roles of gender, age, and other demographic factors in shaping inequalities within rural and urban settings. The integration of geospatial data could further contribute to understanding the influence of physical access to infrastructure, including transportation, healthcare, and educational facilities, on household income. Lastly, comparative research across countries or regions with similar socioeconomic conditions could provide insights into effective policy interventions and best practices for addressing income inequality. The incorporation of qualitative methods, such as interviews or case studies, could complement quantitative analyses by offering a deeper understanding of structural and contextual barriers that may not be evident through statistical models alone.

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Financial development and innovation dynamics

Финансијски развој и динамика иновација

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Abstract

Purpose: The paper explores the relationship between financial development and innovation performance in selected economies of the Western Balkans and Central and Eastern Europe. It aims to determine whether the combination of bank-based and market-based financial development enhances national innovation capacity in transitional contexts.

Methodology: The study is based on panel data analysis covering ten countries over the period 2011–2020. It uses composite indices of financial institutions and financial markets developed by the International Monetary Fund to capture different dimensions of financial development, and the Global Innovation Index to assess innovation. To ensure methodological robustness, the study applies Feasible Generalized Least Squares, addressing heteroskedasticity, serial correlation, and cross-sectional dependence.

Findings: The results reveal that both bank-oriented and market-oriented financial structures have a positive and statistically significant effect on innovation performance. Their combined effect supports the hypothesis that a balanced and integrated financial system fosters innovation in economies undergoing structural transition.

Originality/value: The paper contributes to the literature by examining the dual role of financial systems in innovation development within under-researched transitional economies. It differentiates between institutional and market mechanisms and provides empirical support for their complementarity.

Practical implications: The findings suggest that policy efforts to develop inclusive and diversified financial systems can strengthen national innovation ecosystems. Policymakers are encouraged to adopt reforms that enhance access to financing across both banking and capital market channels.

Limitations: The study is limited by its geographic focus and the use of static models. Future research could include additional countries, dynamic modeling approaches, and qualitative assessments of financial-institutional environments.

Keywords: financial development, innovation, panel analysis, banking sector, capital markets.

JEL classification: G20, O31, C33

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Сажетак

Циљ: Рад испитује однос између финансијског развоја и иновационог учинка у одабраним економијама Западног Балкана и Централне и Источне Европе. Циљ је да се утврди да ли комбинација банкарски и тржишно оријентисаног финансијског развоја подстиче иновациони капацитет у транзиционим економијама.

Методологија: Истраживање се заснива на панел анализи података за десет земаља у периоду од 2011. до 2020. године. Користе се саставни индекси финансијских институција и финансијских тржишта, које је развио Међународни монетарни фонд, као мере финансијског развоја, и Глобални индекс иновација као мера иновационог учинка. За обезбеђивање методолошке поузданости примењена је метода изводљивих генерализованих најмањих квадрата (FGLS), која коригује хетероскедастичност, серијску корелацију и унакрсну зависност.

Резултати: Резултати показују да банкарски и тржишни финансијски системи имају позитиван и статистички значајан утицај на иновациони учинак. Њихов комбиновани ефекат потврђује хипотезу да уравнотежен финансијски систем подстиче иновације у економијама у транзицији.

Оригиналност/вредност: Рад доприноси литератури анализом двоструке улоге финансијског система у развоју иновација у недовољно истраженим транзиционим економијама. Разликује институционалне и тржишне механизме и емпиријски потврђује њихову комплементарност.

Практичне импликације: Резултати указују да реформе које подстичу развој инклузивног и диверсификованог финансијског система могу оснажити националне иновационе екосистеме. Препоручује се унапређење приступа финансирању у оба сегмента, банкарском и тржишном.

Ограничења: Истраживање је ограничено на одређен географски оквир и примену статичког модела. Будућа истраживања могу обухватити шири узорак, динамичке моделе и квалитативне анализе институционалног окружења.

Кључне речи: финансијски развој, иновације, панел анализа, банкарски сектор, тржишта капитала.

ЈЕЛ класификација: G20, O31, C33

Introduction

The interplay between financial development and innovation remains a pivotal area of research in contemporary economics, with significant implications for long-term competitiveness and sustainable growth. As economies across the globe increasingly transition toward knowledge-based and innovation-driven systems, understanding the mechanisms through which financial structures influence innovation becomes essential. This is especially relevant for countries in transition, where institutional frameworks and financial markets are still evolving, and where innovation is viewed as a catalyst for economic modernization and integration.

This study focuses on the Western Balkan Countries (WBC) and Central and Eastern European Countries (CEEC), which have undergone substantial economic, political, and institutional transformations since the early 1990s. Despite their common post-socialist legacy and ongoing efforts to integrate into the European Union, these countries exhibit considerable diversity in terms of financial system development and innovation performance. While some have succeeded in building relatively mature financial infrastructures, others continue to face challenges such as underdeveloped capital markets, limited access to financing, and fragmented innovation systems.

In many cases, financial intermediation in these countries remains dominated by the banking sector, while market-based financing mechanisms, such as equity and bond markets, are often underutilized. This raises an important research and policy question: how do different financial architectures, specifically bank-oriented and market-oriented systems, affect innovation performance in transitional economies? Financial development has been identified as a key driver of innovation in various empirical studies. For instance, Levine (2005) emphasized the role of banks in mobilizing savings and allocating resources toward productive investment, while Le et al. (2019) showed that both financial depth and market sophistication contribute to innovation outcomes. Yet, the extent to which these effects interact and complement each other in post-transition countries remains insufficiently explored.

This paper addresses that gap by empirically examining the relationship between financial development and innovation in a panel of ten countries from the WBC and CEEC regions. It contributes to the literature by distinguishing between bank-based and market-based financial development, and by assessing their individual and combined effects on innovation capacity. The analysis relies on two composite indicators developed by the International Monetary Fund (IMF), the Index of Financial Institutions (IFI) and the Financial Markets Index (FMI), to measure the depth, efficiency, and accessibility of financial systems. Innovation performance is captured using the Global Innovation Index (GII), which offers a multidimensional framework for assessing a country's innovation ecosystem.

By applying robust panel data techniques and focusing on a region that remains underrepresented in the empirical literature, this study seeks to provide evidence-based insights that are relevant for both scholars and policymakers. In particular, it examines whether the coexistence and interaction of different financial structures can foster a more dynamic and sustainable innovation environment in transition economies.

The remainder of the paper is structured as follows. First, the relevant theoretical and empirical literature on the relationship between financial development and innovation is reviewed. This is followed by a description of the research methodology, including the data sources and indicators used for analysis. Next, the key empirical findings are presented and interpreted. Finally, the paper concludes with a discussion of the main implications, offering policy recommendations and suggestions for future research.

1. Literature Review

The nexus between financial development and innovation has become an increasingly important field of study, especially as countries seek to modernize their economies and enhance long-term competitiveness. In the context of global structural changes and the shift toward knowledge-intensive industries, both academic researchers and policymakers have recognized the enabling role of finance in stimulating innovation. At its core, financial development improves the efficiency of capital allocation, reduces transaction and information costs, and facilitates investment in long-term, high-risk projects, characteristics closely associated with innovation activities. As Gomes (2023) notes, the growth process itself is fueled by the generation and propagation of ideas, supported by the dynamic between

basic and applied research, and between radical and incremental innovation, domains often reliant on appropriate financial support structures. Levine (1997; 2005) emphasizes that financial intermediaries and capital markets play a central role in facilitating innovation and economic growth. By efficiently allocating capital, evaluating investment opportunities, and managing risk, the financial system contributes to technological advancement and long-term productivity gains.

The conceptual distinction between bank-based and market-based financial systems plays a central role in analyzing how finance influences innovation outcomes. Banks are typically associated with relationship-based financing, offering long-term loans, credit monitoring, and support for early-stage R&D activities. They are particularly suited to environments where information asymmetry is high and where innovation requires gradual investment and oversight. In contrast, capital markets facilitate access to equity financing, risk diversification, and liquidity, making them more appropriate for scaling up and commercializing innovations. As noted by Kapidani and Luci (2019), bank-based and market-based financial systems influence innovation through distinct mechanisms, reflecting functional differences rather than any inherent superiority. While capital markets offer flexibility and broader participation, banks provide stability and control. However, the stabilizing role of banks may depend on their level of capitalization. Novotna, Stiblarova, and Kocisova (2024) find that the positive relationship between market concentration and banking stability in the Euro Area becomes statistically significant only when banks are sufficiently capitalized. Their findings underscore that prudential regulation, particularly compliance with capital adequacy standards, plays a key role in strengthening systemic resilience, which, in the context of less mature financial systems, may represent an essential condition for sustainable innovation financing.

Empirical evidence increasingly supports the complementary nature of these two financial architectures. Le et al. (2019), in their study on emerging Asian economies, find that financial institutions and markets both positively affect innovation, but through different transmission channels. Similarly, Rey (2022) emphasizes the importance of capital market depth and macroeconomic stability in fostering innovation ecosystems. Levine (2005) shows that banks are instrumental in mitigating credit risk at the early stages of innovation, whereas capital markets drive innovation by supporting high-growth firms and financing scale-intensive industries. These findings underline that the integration of bank-oriented and market-oriented finance could provide a more holistic support system for the entire innovation process, from idea to market implementation. A similar pattern is observed in the Western Balkan countries, where financial development, especially improved credit access and interest rate mechanisms, has a significant impact on economic growth, reinforcing the role of finance as a driver of structural transformation (Bilalli, Beka, & Gara, 2023).

Nonetheless, the effectiveness of each model appears to be context-specific and influenced by the maturity of institutions, legal frameworks, and financial infrastructure. Kapidani and Luci (2019) argue that the combination of these financial channels does not always yield linear results, particularly in transitional economies where governance structures may still be fragile. In some contexts, the dominance of one system over the other has led to resource misallocation or underutilization of innovation potential. Therefore, a

balanced financial structure, where both banks and capital markets are developed and function synergistically, may offer the most robust foundation for supporting national innovation capacity.

In the specific context of the WBC and CEEC, the question of how financial development shapes innovation becomes even more pressing. These countries have undergone deep transformations over the past three decades, transitioning from centrally planned to market-oriented systems. However, the development of financial systems in these regions has not always kept pace with innovation needs. According to Uvalić and Cvijanović (2018), many countries in the region continue to suffer from insufficient integration of financial and innovation policies, resulting in fragmented systems and limited entrepreneurial support. Capital markets remain underdeveloped, while banking sectors, though dominant, are often characterized by high foreign ownership and risk aversion. This structural weakness has been confirmed for the Serbian context as well, where institutional inefficiencies and regulatory bottlenecks continue to hinder capital market development (Petrović, Orlandić, & Marković, 2024).

Several studies point to the need for strengthening both financial pillars in the region. Vangjel and Mamo (2022) stress that a well-structured financial sector is essential for promoting entrepreneurship and technology transfer in the Western Balkans. Popović and Erić (2018) highlight that attracting foreign direct investment and implementing targeted financial reforms can improve the innovation environment. Despotović et al. (2014) link the effectiveness of innovation policy to financial support mechanisms, particularly in terms of competitiveness and SME development. Ziberi and Alili (2021) further emphasize that the structure and maturity of financial markets influence the extent to which financial development translates into innovation output.

Despite the growing body of literature that acknowledges the roles of banks and markets in fostering innovation, a crucial analytical gap remains, particularly for transitional economies. While prior studies have often isolated the effects of either bank-based or market-based financial development, few have examined their combined and potentially complementary influence on innovation outcomes. This omission is especially significant in the context of WBC and CEEC, where both financial segments are still in the process of institutional consolidation and may function in interdependent ways.

The reviewed theoretical perspectives and empirical findings suggest that a synergistic interaction between banking and market finance could provide a more comprehensive support system for innovation, encompassing both early-stage development and large-scale implementation. In light of these insights, and in response to the institutional and financial realities of the studied regions, this paper formulates and tests the following hypothesis:

H₁: The interaction between bank-oriented and market-oriented financial development has a statistically significant and positive effect on innovation performance.

This hypothesis reflects the theoretical proposition that a balanced and integrated financial structure, where institutions and markets complement rather than substitute one

another, can enhance innovation outcomes more effectively than either channel alone. By empirically testing this assumption, the study aims to extend existing knowledge and offer policy-relevant findings that resonate with the specific challenges and opportunities present in transitional economies.

2. Methodology of empirical research

The study includes Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Hungary, North Macedonia, Poland, Serbia, and Romania as sample countries. These nations have been selected based on their shared historical trajectory from socialist to market-oriented economies. This transition provides a compelling context for examining the interplay between financial development and innovation capabilities. Each country in the sample presents a unique blend of historical, economic, and social dynamics but shares a significant pathway of economic reforms and integration into European and global markets. This commonality is crucial for analyzing how similar starting conditions influence diverse developmental paths in financial structures and innovative capacities across the CEEC and WBC. These nations offer a spectrum of financial systems, predominantly dominated by banking sectors, along with varied levels of innovation output and infrastructure. The dominance of the banking sector in these countries is largely attributed to historical factors, such as the absence of well-functioning, transparent, and efficient capital markets, which has positioned banks as pivotal mediums for financial intermediation. As these nations have progressed through their economic transitions, many have initiated efforts to establish stock market systems and promote stock exchange participation. Despite these developments, their financial systems remain predominantly bank-centric, characterized by significant foreign bank ownership.

Additionally, another trend worth noting in both groups of countries is the presence of relatively modest innovative potential and the concentration of technological infrastructure. Despite collaborative efforts to enhance innovative infrastructure, several systemic challenges persist, including strong state intervention, limited competitive dynamics, lack of private initiatives, and suboptimal conditions for fostering innovation.

The dataset used in this study covers the period from 2011 to 2020, allowing for a longitudinal assessment of financial development and innovation dynamics in the selected countries.

In the study, two indices of financial development are used to capture distinct aspects of financial systems within the sample countries: the Index of Financial Institutions (IFI) and the Financial Markets Index (FMI), representing banking-oriented and market-oriented financial development, respectively. Both indices are components of the broader Financial Development Index (FDI) constructed by the International Monetary Fund (IMF), and the data for IFI and FMI were obtained from the IMF Financial Development Database (IMF, n.d.; Svirydenka, 2016). This bifurcated approach allows for a detailed analysis of how both institutional and market mechanisms contribute to financial development. The IFI focuses on the depth, efficiency, and accessibility of banks and other financial institutions, measuring factors such as the size and liquidity of banks, the diversity of financial services available,

and the efficiency with which these institutions operate. The FMI, on the other hand, evaluates the development of financial markets, including stock exchanges and bond markets, providing insights into market size, liquidity, and the diversity of financial instruments available. The holistic nature of indices allows for a nuanced evaluation of financial systems, emphasizing the multifaceted nature of financial development (Svirydenka, 2016).

Furthermore, to capture the innovation landscape, the study utilizes the GII, a leading measure for evaluating the innovation capabilities and achievements of countries. Developed by the World Intellectual Property Organization (WIPO), the data used in this study were extracted from the WIPO Global Innovation Index database (WIPO, n.d.). The GII provides a comprehensive view of innovation, taking into account various factors that contribute to a country's innovation performance, including technological advancements, creative outputs, business sophistication, and infrastructural development. It is recognized as a significant reference for national innovation assessments, offering insights that extend beyond conventional innovation measures (Bilic et al., 2018).

By integrating these indices into our analytical framework, the study aims to explore the relationship between financial development and innovation capacity. The inclusion of both the FDI and GII in our methodology supports a broader understanding of how well-developed financial systems can facilitate or hinder the innovation environment in transitioning economies. This approach is intended to provide a deeper insight into the mechanisms through which financial and innovation ecosystems interact, potentially influencing overall economic growth and development.

Table 1 presents a comprehensive statistical analysis of the variables - GII, IFI, and FMI. The analysis includes both descriptive statistics and correlation measures, enabling us to draw substantive conclusions regarding the dataset's characteristics. For the GII, the arithmetic mean and median are closely aligned, suggesting a symmetric distribution. This proximity indicates that the innovation performance across the sampled countries does not exhibit extreme variation, with most countries clustering around the central tendency. The standard deviation is moderate, which confirms the spread around the mean is not excessively wide, suggesting relative consistency in innovation performance across nations. The IFI data show a mild right skew, as evidenced by a significant result from the Jarque-Bera test, confirming a deviation from normality. This skew indicates that while most countries have moderately developed financial institutions, a few outliers possess highly developed financial institutions, which tilt the distribution rightward. Conversely, the FMI is characterized by a significant right skew, with a distribution that deviates markedly from normality, confirmed by a robust Jarque-Bera test result. This indicates the presence of extreme values at the higher end of financial market development, suggesting that some countries have exceptionally developed financial markets compared to other countries.

The correlation analysis reveals a moderate positive correlation of 0.3733 between GII and IFI. This correlation suggests a positive association where countries with more developed financial institutions tend to exhibit better innovation performance, albeit the relationship is not particularly strong. In contrast, a much stronger correlation of 0.7914

between GII and FMI indicates a robust positive relationship, suggesting that better-developed financial markets are closely associated with higher levels of innovation.

Finally, the correlation between IFI and FMI stands at 0.2919, indicating a weak positive relationship. This finding suggests that the development of financial institutions and markets may occur somewhat independently within different national contexts. The relatively low correlation further implies that the inclusion of both IFI and FMI in regression models would not result in significant multicollinearity, facilitating accurate and independent evaluations of each variable's impact on innovation performance.

Table 1: Descriptive statistics and Correlation matrix of the variables

<i>Variables</i>	<i>GII</i>	<i>IFI</i>	<i>FMI</i>
Mean	38.40664	0.508619	0.164498
Median	38.06000	0.493166	0.062972
Minimum	23.10000	0.357028	0.000636
Maximum	51.30000	0.688055	0.591462
St. Dev.	6.003439	0.092257	0.168915
Skewness	0.127018	0.603725	0.594831
Kurtosis	2.618913	2.427583	1.844188
Jarque-Bera	0.961407	8.183990	12.60966
Probability	0.618348	0.016706	0.001827
Obs.	110	110	110
<i>Correlation</i>			
Variables			
GII	1		
IFI	0,3733	1	
FMI	0,7914	0,2919	1

Source: Authors' calculations

Overall, these statistical insights highlight the nuanced relationships between financial development and innovation across countries, providing a solid foundation for further analysis.

Panel datasets often manifest cross-sectional dependence, which is influenced by the nature of the dependency across sections as well as the level of inter-sectional correlations (De Hoyos & Sarafidis, 2006). This phenomenon introduces complexities when assessing the stationarity of data (Shariff & Hamzah, 2015). Therefore, it is crucial to address cross-sectional dependence to select the proper tests for analyzing the order of data integration and for evaluating the robustness of the resulting model. To this end, the analysis of cross-sectional dependence will utilize the Breusch–Pagan LM test and the Pesaran-scaled LM test, acknowledging that standard LM tests may be biased in certain panel settings (Baltagi, Feng, & Kao, 2012).

Given the high degree of interactivity in the functioning of the economies of the countries under study, the effects of spatial spillover, which is one of the causes of cross-sectional dependence, are becoming increasingly apparent. Consequently, it is assumed that the panel data will exhibit cross-sectional dependence, necessitating the use of second-

generation unit root tests to assess the nature of the series' stationarity. Pesaran (2007) introduced a unit root test known as the IPS test with cross-section adjustment. In this study, the CIPS test will be applied, which utilizes an extended version of the Dickey-Fuller statistic adjusted for cross-sectional dependence.

This study will employ a static panel model due to the limited number of observations available. This approach is particularly relevant given the characteristics of the data derived from GII. Until 2009, the GII utilized a scoring system ranging from 1 to 5 to assess the innovation performance of countries. However, the scoring system was later expanded to a range from 0 to 100, enabling a more detailed and nuanced assessment of innovation capabilities. Such adjustments in scoring methodologies are common as organizations strive to improve the precision and relevance of their indices over time.

To analyze the static panel model, the study will initially explore three common approaches: pooled ordinary least squares (OLS), fixed effects, and random effects models. Among these, the pooled OLS method is often critiqued for its inability to account for unobserved heterogeneity, as it neglects variations between countries and assumes uniformity across all observations (Asteriou & Hall, 2021). Recognizing this limitation, the study will evaluate the fixed and random effects models to account for entity-specific characteristics.

The Hausman test will determine whether the fixed or random effects model is more appropriate. If the null hypothesis of no correlation is rejected, the fixed effects model will be used; otherwise, the random effects model will be preferred (Kennedy, 2008). Additionally, diagnostic tests, including the Wald test (heteroscedasticity), Wooldridge test (serial correlation), and Pesaran CD test (cross-sectional dependence), will be conducted. If violations of classical regression assumptions are detected, the study will apply Feasible Generalized Least Squares (FGLS) for robustness. FGLS will be utilized to correct for heteroscedasticity and autocorrelation, ensuring efficient and unbiased parameter estimation. Unlike fixed or random effects models, which address specific structural features of panel data, FGLS adapts to correct for issues such as non-constant variance and correlated errors across time or entities (Baltagi, 2008). This flexibility makes it particularly well-suited for analyzing the nuanced interplay between financial development and innovation, as these relationships are likely influenced by complex, non-uniform dynamics across countries.

The strength of FGLS lies in its ability to estimate the variance-covariance matrix of error terms feasibly and incorporate these adjustments into the model. For example, if the Wald test identifies heteroscedasticity, FGLS will transform the model to stabilize the variance across observations. Similarly, if the Wooldridge test detects serial correlation, FGLS will account for the correlation patterns within entities over time. Furthermore, if cross-sectional dependence is detected through the Pesaran CD test, FGLS will adjust for correlations among countries, enhancing the reliability of parameter estimates (Asteriou & Hall, 2021; Vangjel & Mamo, 2022).

By adopting this methodological framework, the study aims to provide robust insights into the role of financial development in driving innovation. FGLS will not only address diagnostic challenges but also facilitate a nuanced understanding of the economic contexts

of WBC and CEEC. This approach ensures that the findings are statistically reliable, policy-relevant, and theoretically informed.

3. Results and Discussion

In line with the findings from the Breusch–Pagan LM and Pesaran-scaled LM tests, as presented in Table 2, there is compelling evidence of cross-sectional dependence. This evidence suggests that the economies of the countries under study are intricately integrated, which enhances the likelihood of spatial spillover effects. As a result, when a disturbance occurs in one country, it is likely to have repercussions in others. Consequently, these results provide a strong justification for the use of second-generation unit root tests, which are designed to specifically address cross-sectional dependencies.

Table 2: Cross-sectional dependence test results

Dependent variable	<i>Breusch–Pagan LM</i>		<i>Pesaran-scaled LM</i>	
	Statistic	Probability	Statistic	Probability
GII	154.2209	0.0000	11.51289	0.0000

Source: Authors' calculations

Table 3 presents the outcomes of the CIPS test, demonstrating that while all variables exhibit non-stationarity when analyzed at their levels, they achieve stationarity upon first differencing. This transformation indicates that the variables, although initially non-stationary, stabilize and exhibit consistent statistical properties over time when first differences are considered.

Table 3: Unit root test results

<i>Variables</i>	<i>GII</i>	<i>IFI</i>	<i>FMI</i>
CIPS (level)	-2.148	-2.009	-2.166
CIPS (first difference)	-3.247*	-2.305*	-2.936*

*Note: * symbolizes the rejection of the null hypothesis of unit root*

Source: Authors' calculations

In assessing the impact of financial development on the innovativeness of countries using panel data, fixed and random effects methods were employed, and the Hausman test was applied to identify the more efficient and consistent method. Table 4 displays the results of the random effects method, suggesting that the Hausman test fails to reject the null hypothesis, leading to the conclusion that the estimation of random effects is more appropriate. However, before interpreting the results, it is necessary to conduct additional diagnostic tests. Tests, including group-wise heteroscedasticity, serial correlation, and examining cross-sectional independence, aim to examine the reliability of the model outcomes. Conducting diagnostic tests is crucial for ensuring the robustness and credibility of the findings derived from the random effects estimation methods.

Table 4: Results of random effects methods

<i>Dependent variable GII</i>	<i>Coefficients</i>	<i>p-value</i>
IFI	6.154424	0.465
FMI	25.92045	0.000
R-sq within	0.0883	
R-sq between	0.7324	
R-sq overall	0.6456	
Hausman test	0.38	0.8280

Source: Authors' calculations

The results of the diagnostic tests are presented in Table 5, which shows the outcomes of the Pesaran CD test, the Wald test for heteroscedasticity, and the Wooldridge test for detecting serial correlation. Specifically, the Wald test yields a test statistic of approximately 77.400 and a p-value of 0.0000, strongly indicating the presence of group-wise heteroscedasticity in the data. This suggests that the error variances are not constant across different groups within the panel. Additionally, the Wooldridge test for autocorrelation presents a test statistic of $F(1, 9) = 32.006$ with a p-value of 0.0003, confirming the presence of autocorrelation in the panel data. This result implies that there are serial correlations in the error terms across different time periods. Furthermore, the Pesaran CD test shows strong evidence of cross-sectional dependence with a test statistic of 10.740 and a p-value of 0.0000.

Because of these issues, the standard errors of the estimated coefficients may be incorrect, impacting the statistical significance of the coefficient IFI in Table 4. In this context, the lack of statistical significance for one of the coefficients could be attributed to these econometric problems. The inflated or deflated standard errors may lead to incorrect conclusions about the significance of the coefficient. Additionally, broader systemic disruptions may have compounded these econometric challenges. For instance, Pavlović (2024) demonstrates that the COVID-19 pandemic had a depreciating effect on human capital in Serbian banks, leading to short-term instability and long-term erosion of performance. Such context-specific volatility in banking efficiency could partially explain the inconsistent statistical behavior of the IFI variable.

Table 5: Diagnostic test results

<i>Test</i>	<i>Statistics</i>	<i>p-value</i>	<i>Indication</i>
Pesaran CD	10.740	<0.0001	Presence of cross-sectional dependence
Wald test	7.74e+04	0.0000	Presence of group heteroscedasticity
Wooldridge test	$F(1, 9) = 32.006$	0.0003	Presence of autocorrelation

Source: Authors' calculations

The outcomes of the diagnostic tests conducted on the panel data have significant implications for the reliability of the random effects method initially employed. Given these results, it is evident that the random effects model's results are compromised and unreliable. The presence of group heteroscedasticity, autocorrelation, and cross-sectional dependence in the panel data undermines the assumptions underpinning the random effects method,

potentially leading to biased and inefficient estimates. Consequently, the assessment of the interaction effects of bank-oriented and market-oriented financial development on countries' innovation was conducted using FGLS. FGLS adjusts for heteroscedasticity and autocorrelation within the panel data, thereby providing more robust and reliable estimates. Moreover, it accounts for the cross-sectional dependence identified in the data, ensuring that the interconnections among the different units in the panel are appropriately considered in the analysis.

Table 6 presents the results of the FGLS regression, which accounts for heteroscedasticity and cross-sectional dependence, using a common AR(1) autocorrelation coefficient among the panels. The analysis, based on 110 observations, yields statistically significant results, as evidenced by a Wald chi2 statistic of 942.64 with a corresponding p-value of 0.0000. The robust significance level underscores the reliability of the model in capturing the dynamics of the studied relationship. The coefficient for IFI is 10.79964 with a p-value of 0.0000, indicating a highly significant positive relationship between IFI and GII. Practically, the result suggests that improvements in the depth, efficiency, and accessibility of banking sector services are associated with a substantial increase in a country's innovation capacity. Specifically, an increase of one unit in IFI is associated with an approximate increase of 10.80 in GII, holding other factors constant. The 95% confidence interval for this coefficient ranges from 7.29208 to 14.3072, reinforcing the precision of the estimate. A more pronounced effect is observed with the FMI. The estimated coefficient of 26.51352 and a p-value of zero indicate a highly significant relationship with GII. The coefficient implies that for every one-unit increase in FMI, there is an associated increase of approximately 26.51 in GII. The results suggest that the depth, efficiency, and accessibility of capital markets, as captured by FMI, play a crucial role in fostering the innovation ecosystem of economies. In conclusion, the results of the FGLS regression analysis provide compelling evidence of a positive and statistically significant relationship between the structures of the financial system (both banking and capital markets) and the innovation capacity of countries. The coefficient magnitudes for both IFI and FMI emphasize the critical role these financial indices play in shaping the innovation landscape.

Table 6: FGLS Results

Variables (Dependent Variable: GII)	Coefficients	p-value	95% Confidence Interval
IFI	10.79964	0.0000	7.29208 14.3072
FMI	26.51352	0.0000	24.8065 28.22055
Wald chi2	942.64	0.0000	
<i>Notes: Coefficients: Generalized Least Squares; Panels: Heteroskedastic with Cross-Sectional Correlation; Correlation: Common AR(1) Coefficient for All Panels</i>			

Source: Authors' calculations

Given the corrective nature of the FGLS approach, the need for additional corrective and diagnostic testing post-estimation is significantly reduced. In traditional regression frameworks, such tests are imperative to confirm the absence of issues like heteroskedasticity or autocorrelation, which could invalidate the results. However, with FGLS, these problems are preemptively addressed during the estimation process. Consequently, the focus shifts

from diagnosing and resolving these issues to ensuring the robustness of the model specification and the accuracy of data input from the outset. Therefore, corrective and diagnostic tests are not required for testing the model as FGLS is employed as a solution (Olive, 2017).

The hypothesis that the interaction between banking-oriented and market-oriented financial development has a statistically significant and positive effect on innovation performance has been confirmed. The results suggest that both banking-oriented and market-oriented financial development play a crucial role in enhancing the innovation performance of WBC and CEEC, as measured through GII. The findings indicate a synergistic effect, where both parts of the financial system complement each other. While banks provide necessary funds and support for initial research and development, capital markets facilitate the growth and scaling of innovative ideas by offering broader financing avenues and liquidity options. These factors collectively create a favorable environment for innovation. The observed positive effects of the IFI and FMI on the GII demonstrate how these dual aspects of financial development interact to support innovative activities. Previous studies align with these findings, illustrating how the convergence of financial sectors enhances innovation. Mullineux (2007) argues that the integration of banking and capital markets improves corporate governance, reduces market frictions, and creates a more conducive environment for innovation. A well-integrated financial system, combining banking functions and market mechanisms, facilitates more efficient capital allocation and risk management, which are essential for sustaining innovation. This supports the observed synergistic effect in WBC and CEEC, where both sectors significantly contribute to innovation-driven growth. Moreover, Laureti, Costantiello, and Leogrande (2020) emphasize that financial accessibility plays a pivotal role in fostering innovation, particularly in European nations with advanced financial institutions. Their findings illustrate how the integration of banking- and market-oriented development enhances access to diverse funding sources, enabling firms to invest in innovative activities. Similarly, Janković (2019) highlights that in Serbia, Croatia, and Slovenia, banking institutions remain dominant financial intermediaries, while capital markets are still underdeveloped. The study emphasizes that strengthening both financial institutions and market mechanisms is crucial for long-term economic development. This underscores the critical role of a coherent financial system in driving innovation and aligns with the observed positive impacts of IFI and FMI in this study. Although the results emphasize the importance of banking sector and capital market development in fostering innovation, they must be contextualized within a broader spectrum of research. Specifically, Le et al. (2019) found no significant impact of the interaction between these sectors on innovation. Similarly, Kapidani and Luci (2019) suggest that combined analysis of banking and non-banking institutions (including stock markets) can be ineffective in channeling capital flows toward innovative practices. In line with this diversity, Tee et al. (2014) provide evidence from East Asian countries, emphasizing the differing roles of financial systems in fostering innovation. Their study demonstrates that banking sector development significantly enhances innovation, particularly in supporting patent applications and other inventive activities. In contrast, the stock market's role appears less influential in the same context, suggesting that the banking sector often serves as the primary driver of innovation funding, especially in economies where stock markets are still

emerging. These findings reinforce the importance of context when analyzing the financial-innovation nexus, as the relative contributions of banking and market-oriented systems may vary depending on economic and institutional development. In the established model, the GII's comprehensive assessment of innovation performance might explain the differing outcomes compared to studies using patent applications as the primary metric. While patent counts are a direct measure of innovation output, the GII captures a broader innovation ecosystem, including institutional quality, human capital, infrastructure, market sophistication, and knowledge outputs. This holistic approach reveals the impacts of financial development that may not be immediately apparent when focusing solely on patents. Grabowski and Maciejczyk-Bujnowicz (2016), in their study of the Polish economy, demonstrate that financial development fosters innovation when both banking and market mechanisms are effectively utilized. Their findings support the notion that a coordinated financial system lowers barriers to funding and increases financial inclusivity, which are critical for fostering innovation. Similarly, Melnyk, Melnychenko and Reznikova (2019) reinforce this argument by showing how an integrated financial system reduces transaction costs and allows a more streamlined capital flow, underscoring the importance of leveraging both banking and market mechanisms to create a stable, accessible environment for innovation. The investigation into the interaction between banking-oriented financial development and capital markets reveals an essential, previously underexplored avenue in understanding how financial systems influence innovation. Empirical evidence highlights a significant, positive relationship between IFI and FMI with overall innovation, as these elements of financial development interact to stimulate economic growth and foster innovative outputs. This synergistic effect suggests that financial systems encompassing both banking and capital market mechanisms are better positioned to support comprehensive innovation outcomes. For WBC and CEEC, where financial structures are still evolving to achieve an optimal balance, these findings are particularly relevant. A strategic approach that equally emphasizes the growth of the banking sector and the development of capital markets could lead to broader innovation benefits, as opposed to strategies that prioritize one aspect of the financial system. By recognizing the value of a dual-focused financial approach, policymakers can effectively harness the strengths of both banking and market-oriented institutions. This dual development facilitates greater capital accessibility and liquidity for innovative firms, providing resources necessary for early-stage research and development, as well as growth-phase expansion supported by capital market liquidity. Furthermore, the approach of balancing banking sector and capital market growth counters traditional models that might prioritize banking over market development or vice versa. Metrics such as patent applications often overlook broader dimensions of the innovation ecosystem. The GII, by capturing a range of innovation activities—including institutional quality, human capital, infrastructure, market sophistication, and technology outputs—offers a more holistic view of the innovation landscape, particularly in dynamic financial contexts. Ultimately, understanding that various aspects of financial development impact different types of innovation outcomes allow policymakers to tailor their strategies more precisely. By aligning financial development policies with specific national goals for innovation and economic growth, countries can stimulate innovation across sectors, making the most of their unique financial and economic conditions. For WBC and CEEC, where the need for a balanced,

integrated approach to financial development is prominent, adopting policies that advance both banking and capital market functions offers a pathway to cultivating a sustainable and diversified innovation landscape.

Conclusion

The study has provided valuable insights into the critical interplay between financial development and innovation within the specific contexts of WBC and CEEC. Using a robust empirical framework based on panel data analysis, the findings underscore the importance of both banking-oriented and market-oriented financial development in fostering national innovation capabilities, as measured by GII. The results reveal that both IFI and FMI contribute significantly to innovation. These findings confirm the central hypothesis of this study (H_1), which proposed that the interaction between bank-oriented and market-oriented financial development has a statistically significant and positive effect on innovation performance. Specifically, the analysis highlights the complementary nature of these two components: while banking institutions are instrumental in supporting early-stage research and development activities, financial markets play a pivotal role in scaling and commercializing innovative ideas. This dual mechanism not only bolsters national innovation ecosystems but also enhances economic dynamism and competitiveness. The use of FGLS method to address issues such as heteroscedasticity, serial correlation, and cross-sectional dependence has ensured that the conclusions drawn are both statistically robust and reliable. By correcting these econometric challenges, the study has provided a nuanced and comprehensive understanding of how financial systems interact with innovation, particularly in transition countries.

These findings carry significant policy implications. For countries in WBC and CEEC, where financial infrastructure is still maturing, a balanced and coordinated approach to financial development is essential. Policymakers should aim to (1) strengthen access to long-term financing for SMEs and startups, particularly by expanding credit guarantee schemes; (2) foster financial literacy and investor confidence to deepen capital markets through education and regulatory reform; and (3) promote public-private co-financing mechanisms, including innovation vouchers and state-matching grants, to reduce risk and encourage private investment in innovation. Collaboration between banking and capital market institutions, through blended finance models or innovation-focused credit lines, can significantly improve capital allocation and innovation diffusion.

Beyond economics, the broader societal relevance of this study lies in its contribution to innovation policy, higher education, and entrepreneurial development. Encouraging an inclusive and dynamic financial ecosystem supports not only R&D investment but also the broader culture of innovation, which is essential for human capital development, institutional modernization, and technological resilience.

The study also reaffirms the importance of adopting comprehensive innovation metrics. Unlike traditional proxies such as patent counts, the GII captures a more holistic innovation landscape, including institutional quality, infrastructure, and market sophistication, offering more actionable insights for decision-makers across sectors.

While the findings are compelling, this study acknowledges several limitations. First, expanding the scope to include additional regions could reveal comparative effects of financial architectures on innovation. Second, applying dynamic panel models might uncover lagged or time-sensitive relationships. Third, incorporating qualitative insights from case studies or stakeholder interviews could offer deeper contextual understanding of how financial mechanisms operate on the ground.

In conclusion, this study contributes to the growing body of literature on the finance-innovation nexus by providing empirical evidence of the significant and synergistic roles played by banking-oriented and market-oriented financial development. For WBC and CEEC, leveraging this dual approach offers a strategic pathway to achieving sustainable innovation and long-term economic growth. By fostering inclusive, diversified, and well-integrated financial systems, these countries can position themselves as dynamic innovation-driven economies in the increasingly competitive global landscape.

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Panel Analysis of Wholesale Profitability in the Republic of Serbia

Панел анализа профитабилности трговине на велико у Републици Србији

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Abstract

Purpose: The aim of this paper is to analyze the profitability of wholesale companies in the Republic of Serbia and to investigate the factors that influence it.

Methodology: Profitability is measured by return on assets (ROA), while the impact of independent factors such as quick ratio, leverage, inventory turnover period, assets turnover ratio, growth, and company size is analyzed through panel regression. The sample includes 18 wholesale companies from the Republic of Serbia, whose financial statements were observed during the period from 2007 to 2023.

Findings: During this period, companies included in the sample showed a trend of profitability growth. The average return on assets was 6.69%, which means that wholesale companies, on average, generated 6.69 EUR of net profit for every 100 EUR invested in assets. The results of the panel regression analysis show that leverage and inventory turnover period have a significant negative impact on profitability. On the other hand, asset turnover ratio, growth, and company size have a positive and significant impact on profitability.

Originality/value: This paper contributes to the theoretical and practical research of the factors of profitability, especially from the perspective of wholesale companies in the Republic of Serbia.

Practical implications – The results of this research are both theoretically and practically significant for the

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process of making reliable decisions in managing profitability and can be useful for various stakeholders such as owners and/or managers of wholesale companies, regulatory bodies, and others.

Limitations: The limitation of this research is that it is focused only on the wholesale sector in the Republic of Serbia, and future research could include other countries to investigate economic specificities and their impact on profitability.

Keywords: Panel Regression Analysis, Wholesale, Profitability, Return on Assets

JEL classification: L81, C23, M42

Сажетак

Циљ: Циљ овог рада је анализа профитабилности veleпродајних предузећа у Републици Србији и истраживање фактора који утичу на њу.

Методологија: Профитабилност је мерена повратом на имовину (ROA), док је утицај независних фактора као што су quick ratio (коефицијент ликвидности), задуженост, период обрта залиха, обрт на имовини, раст и величина предузећа анализиран применом панел регресије. Узорком је обухваћено 18 veleпродајних предузећа из Републике Србије, чији су финансијски извештаји посматрани у периоду од 2007. до 2023. године.

Резултати: У том периоду, предузећа која су била обухваћена узорком имала су тренд раста профитабилности. Просечна вредност поврата на имовину износила је 6,69%, што значи да су veleпродајна предузећа, у просеку, остварила 6,69 ЕУР нето профита на сваких 100 ЕУР уложених средстава. Резултати спроведене панел регресионе анализе показали су да задуженост и период обрта залиха имају значајан негативан утицај на профитабилност. С друге стране, обрт имовине, раст и величина предузећа имају позитиван и значајан утицај на профитабилност.

Оригиналност/вредност - Овај рад доприноси теоријском и практичном истраживању фактора профитабилности, посебно из угла veleпродајних предузећа у Републици Србији.

Практична примена - Резултати овог истраживања су теоријски и практично значајни за процес доношења позданих одлука у управљању профитабилношћу и могу бити од користи различитим заинтересованим странама, као што су власници и/или менаџмент veleпродајних предузећа, регулаторна тела и други.

Ограничења истраживања: Ограничење овог истраживања је то што се односи само на сектор трговине на велико у Републици Србији, те би будућа истраживања могла обухватити и друге земље како би се испитале економске специфичности и њихов утицај на профитабилност.

Кључне речи: Панел регресиона анализа, трговина на велико, профитабилност, поврат на имовину
ЈЕЛ класификација: L81, C23, M42

Introduction

Although the traditional forms of wholesale in many countries today compete with other organizational forms that take over some of its functions, wholesaling remains one of the key actors in marketing channels (Quinn & Sparks, 2007; Dawson, 2007; Musso, 2010). Wholesale companies resell partial or complete products made by manufacturers to third parties or another business, such as retailers, institutional, commercial or industrial customers (Tamilia & Charlebois, 2009). Thus, they interact with other intermediaries in the channels (Dawson, 2007). In comparison to retailers, wholesalers pay less attention to promotion, atmosphere and location as they rather deal with organizations as customers than with final consumers; their transactions and trade area coverage are usually larger than retailers'; and governments treat wholesalers and retailers differently in terms of legal regulations and taxes (Rudež, Gajić & Vujičić, 2019).

Wholesalers buy and sell goods acting as middlemen or merchants. As middlemen (agents or brokers), they act on a fee or contract basis, while as merchants they act in their own name and on their own account and are usually specialized for particular products (European Commission, 2003). As they purchase goods in bulk quantities, they play a crucial role in the processes of products collection, sorting, modification, processing,

packaging/repackaging, etc. In order to carry out these activities and maintain their market competitiveness, wholesale companies have to continuously improve their efficiency by investing in warehousing, inventory management, transportation facilities, new technologies, personnel trainings, etc. (Shyshkin, Onyshchenko, & Cherniak 2020; Krittanathip, Cha-um, Suwandee, Rakkarn, & Ratanamaneichat, 2013; Bohusova, Svoboda, & Veverkova, 2022; Rudež et al., 2019).

Wholesalers play a vital role in food, beverages and tobacco supply chains. In the structure of the total EU food supply chain turnover, which was valued at 3.8 trillion EUR in 2021, the food and drink wholesale turnover amounted to 1,039 billion EUR, while the turnover of agriculture was 498 billion EUR, food and drink industry 1,196 billion EUR and food and drink retail companies and stores 1,132 billion EUR (FoodDrinkEurope, 2024). As intermediaries, food, beverages and tobacco wholesalers are not only responsible for the availability of these products, but also for the promotion of sustainability and for addressing the global food security issues (Jones, Comfort, & Hillier, 2017; Rosa, Abdala, & Cezarino, 2019; Mc Carthy et al., 2018). Their competitive advantages stem from their higher accessibility to markets and networks, delivery infrastructure, information technologies, etc. (Dubovitski, Klimentova, & Rogov, 2022; Roy, Hall, & Ballantine, 2019). Due to the world's rising geopolitical turbulences, global food, beverages and tobacco supply chains face disruptions and shifting trade patterns (Euromonitor International, 2023). With the growing retailers' financial power in this segment, many of them independently carry out wholesale activities and vice versa, many wholesalers are actively involved in organizing their own retail activities (Hallier, 2014).

The subject of this paper is the analysis of 18 companies in the wholesale sector in the Republic of Serbia for the period of 2007-2023. More precisely, the subject of analysis is the Group 46.3 "Wholesale of food, beverages and tobacco", according to classification of activities in the Republic of Serbia. It includes "Wholesale of fruit and vegetables; Wholesale of meat and meat products; Wholesale of dairy products, eggs and edible oils and fats; Wholesale of beverages; Wholesale of tobacco products; Wholesale of sugar and chocolate and sugar confectionery; Wholesale of coffee, tea, cocoa and spices; Wholesale of other food, including fish, crustaceans and molluscs; non-specialized wholesale of food, beverages and tobacco" (Paragraf, 2025). *The aim of this paper* is to determine the impact of the independent variables: quick ratio (acid test), leverage, inventory turnover period, asset turnover ratio, growth and companies' size on profitability measured through return on assets (ROA) in the wholesale sector in the Republic of Serbia.

The paper proceeds as follows. Section 1 represents a review of the relevant literature. Section 2 lays out the data and methodology of the research. Section 3 explains the obtained results and discussion. At the end of the paper, conclusions and recommendations for further research are provided.

1. Literature Review

Companies' profitability is one of the most important indicators of their financial success, and of crucial importance for their reputation and survival on the market (Zeeshan et al., 2016). The goal of any business is the ability to cover costs and to additionally realize a financial surplus, i.e. profit (Chiladze, 2018). Many studies explore the impact of different determinants on the profitability of companies in various sectors, especially through its widely used indicator - the return on assets (ROA) (Čupić, & Vržina, 2024; Kuster, Álvarez, Lezcano, & Álvarez-Vaz, 2023; Tica, Vuković, Peštović, & Medved, 2023; Đaković, Milenković, & Andrašić, 2023; Peštović, Medved, Rađo, Jakšić, & Saković, 2022; Vojinović, Milutinović, Sertić, & Leković, 2022; Vojinović, Milutinović, & Leković, 2020).

Panel data analysis of 1,801 small and medium-sized enterprises and 321 large companies in the wholesale and retail sector in the Republic of Serbia in the period 2010-2014 was conducted (Mijić, Nuševa, & Jakšić, 2018). The results pointed out that profitability of small and medium-sized enterprises in this country is positively influenced by leverage, quick ratio, sales growth and previous profitability, but negatively by company's size and fixed assets ratio.

The study of Tousek, Hinke, Malinska & Prokop (2021) based on their research of trading companies in the Czech Republic pointed out that "wholesale is on average a less profitable and more leveraged sector than retail" (p. 165). They also concluded that leverage has a negative impact on profitability in both sectors. Analysis results of linear regression showed that profitability of joint stock companies in Montenegro through return on assets (ROA) is negatively affected by leverage (Filipovic & Demirovic, 2016).

Panel regression model of 189 companies in the food sector in the Republic of Serbia from 2011-2021 identified a positive correlation between profitability and liquidity and sales growth rate (Tomašević, Momčilović, Milenković, & Milić, 2024). Leverage, size, and materiality of assets are in negative correlation with profitability. The authors concluded that there is no significant correlation between liquidity and profitability.

As liquidity ratios represent a measure of company's ability to meet its obligations to creditors at any moment, they have a significant impact on the profitability of companies measured by the rate of return on assets (ROA) (Saleem & Rehman, 2011). The quick ratio, as one of the indicators of the company's liquidity, shows its ability to meet short-term liabilities (Svitlik & Poutník, 2016). The results of the regression analysis of 158 manufacturing companies in Indonesia in the period 2012-2016 confirm the positive influence of the quick ratio on their profitability and ROA, that is, the availability of liquidity will encourage companies to reduce debt and equity costs and risks by using internal instead of external financing in their daily operations (Pandeiro, Sumanti, & Aseng, 2022). A regression analysis of the trade sector in Jordan in the period 2008-2015 revealed a significant influence of the quick ratio as a liquidity indicator on the profitability of trading companies in this country (Al-Qadi & Khanji, 2018).

Based on the empirical research through linear regression of pharmaceutical companies, which were listed on the Indonesia Stock Exchange from 2015-2019, Rajagukguk & Siagian (2021) stated that liquidity and total assets turnover have a negative

effect on companies' profitability. Companies use total asset turnover ratio as a measure of the efficiency of their business operations (Patin, Rahman, & Mustafa, 2020).

One of the most important company's financial goals is to determine and maintain the optimal level of inventory (stocks of raw materials, production in process and finished products) in order to minimize asset values losses and boost profitability (Kumaraswamy, 2016). In his analysis of data from 2015-2017 gathered from the U.S. Security and Exchange Commission website, Hamad (2024) found that a shorter inventory turnover period increases return on assets (ROA) as it lowers a company's inventory costs. So, inventory turnover period negatively impacts profitability.

Results of the research of 50 large and medium-sized manufacturers in the Republic of Serbia from 2018-2021 indicate that independent variables such as inventory ratio and sales growth positively influence profitability (Nuševa, Dakić, Peštović, & Hladika, 2024). Another study of Serbian manufacturing companies listed on the Belgrade stock exchange from 2017-2020 showed that there is significantly positive correlation between ROA and the following variables: size, current ratio, and growth (Rado & Peštović, 2022). On the other hand, there is a significantly negative correlation between ROA and leverage.

2. Data and Methodology

The purpose of this paper is to demystify the impact of selected financial indicators on corporate profitability, measured through the return on assets (ROA). Each of the selected financial indicators in this study provides insight into different aspects of company's financial health and operational efficiency. Together, these indicators can help assess a company's ability to generate revenue based on its assets.

The research covers companies from the wholesale sector, observed over the period from 2007 to 2023. The analysis was conducted using the Gretl software, and the data were sourced from the Scoring database (Scoring, 2025).

The initial model was defined as a panel regression with ROA as the dependent variable, while the independent variables included the Quick Ratio (Acid Test), Debt Ratio, Inventory Turnover Period, Asset Turnover Ratio, Growth, and Size.

Table 1 presents an overview of all variables included in the model, along with an explanation of their meaning, calculation methods, and the expected impact of the independent variables on the dependent variable (ROA).

Table 1. Variables included in the model

Variable	Explanation	Calculation	Expected impact on the dependent variable
Dependent Variable			
Return on Assets (ROA)	ROA measures how efficiently a company utilizes its total assets to generate net income.	Net income / Total assets	/
Independent Variables			
Quick Ratio (Acid test)	A company's ability to meet its short-term obligations using its most liquid assets.	(Current assets – Inventory) / Current liabilities	Positive
Debt Ratio	The proportion of debt in total assets, indicating the extent to which a company is financed through borrowing.	Total debt / Total assets	Negative
Inventory Turnover Period	The average number of days required for inventory turnover.	(Average Inventory / Annual cost of goods sold) *365	Negative
Asset Turnover Ratio	Indicates how many times total assets are turned over during a year.	Sales revenue / Total assets	Positive
Growth	Revenue growth between two consecutive accounting periods.	(Sales revenue _t – Sales revenue _{t-1}) / Sales revenue _{t-1}	Positive
Size	The size of a company expressed as the natural logarithm of total assets.	Total assets	Positive

Source: the authors'

Considering the subject and objective of the research, and relying on the expected impact of the independent variables on the dependent variable, ROA, we formulated the following research hypotheses:

- H₁: Quick Ratio (Acid test) positively affects the profitability of wholesale companies, measured by ROA.
- H₂: Debt Ratio negatively affects the profitability of wholesale companies, measured by ROA.
- H₃: Inventory Turnover Period negatively affects the profitability of wholesale companies, measured by ROA.
- H₄: Asset Turnover Ratio positively affects the profitability of wholesale companies, measured by ROA.
- H₅: Business growth positively affects the profitability of wholesale companies, measured by ROA.
- H₆: Company size positively affects the profitability of wholesale companies, measured by ROA.

In this study, a panel regression model was initially applied, as it allows for a deeper

analysis compared to cross-sectional or time series analyses. Panel data combines variations between companies (cross-sectional variation) and changes over time (time variation), enabling more precise estimates of the effects of independent variables on ROA. Standard cross-sectional analyses do not provide insight into how changes in independent variables impact the dependent variable over time.

During standard tests for verifying the assumptions of panel regression methods, heteroskedasticity and autocorrelation issues were identified in the dataset. As a result, the initial panel regression model (along with other corrections detailed in the *Results and Discussion* section) was replaced by an OLS model with robust standard errors (White-Huber HC1 correction).

The application of the White-Huber correction for standard errors ensures reliable estimates in cases where heteroskedasticity issues are present. Standard OLS estimates assume constant variance of residuals, which is often not the case in practice. By using the White-Huber correction, standard errors become resistant to changes in error variance, ensuring a more accurate assessment of the statistical significance of the model.

3. Results and discussion

The first step in the analysis presented in this study was the calculation of basic descriptive statistics shown in Table 2. The importance of this step is justified by the fact that descriptive statistics provide the foundation for further analysis, offering insight into the characteristics of the variables included in the study, as well as potential modelling possibilities.

Table 2. Descriptive Statistical Analysis

Variable	Mean	Median	S.D.	Min	Max
ROA	0.06697	0.05125	0.073115	-0.1584	0.4392
Quick Ratio	3.0071	1.55	4.5911	0.43	50.35
Debt Ratio	0.50122	0.5257	0.26879	0	1
Inventory Turnover Period	48.306	32.885	54.448	0	458.03
Asset Turnover Ratio	2.9903	2.285	2.4334	0.39	19.47
Growth	6.175	1.0714	110.72	0	2416.7
Size	11.755	11.594	1.662	8.0074	17.058

Source: the authors'

Based on the results presented in Table 2, the following observations can be made:

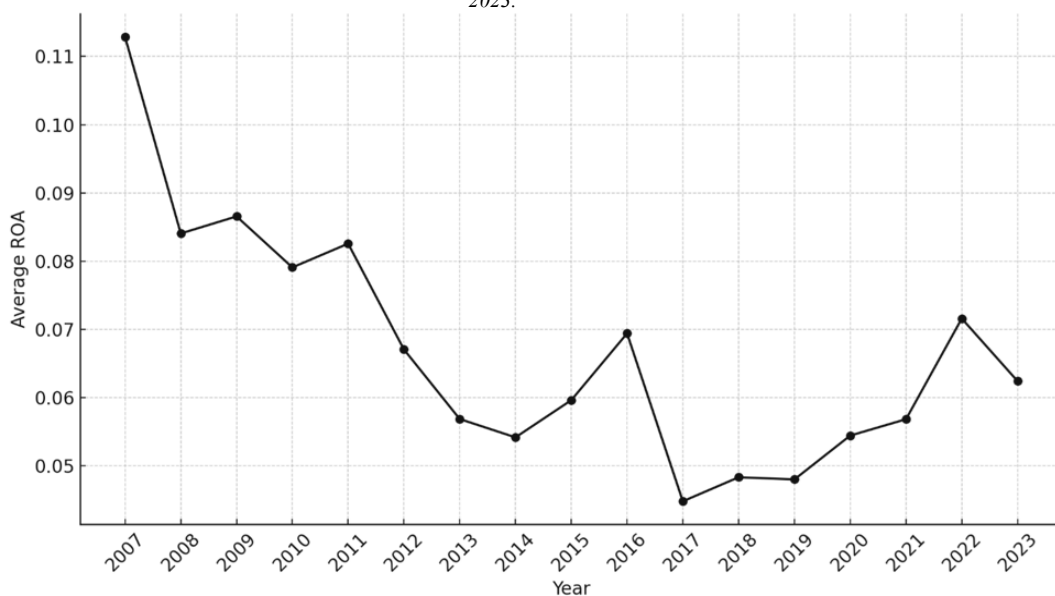
- A high standard deviation relative to the mean value of ROA indicates significant differences in company profitability, while a negative minimum value suggests the presence of companies that experienced losses.
- A high standard deviation and a large gap between the maximum and minimum values of the Quick Ratio indicate substantial differences in liquidity among the

observed companies. However, the average Quick Ratio value suggests that, on average, companies do not face liquidity issues.

- The arithmetic mean (0.50122) and median (0.5257) of the Debt Ratio indicate that the companies in the sample maintain an optimal level of indebtedness, as their assets are financed nearly 50:50 from equity and external sources.
- The extremely high maximum value (458.03) and the large standard deviation (54.448) of the Inventory Turnover Period indicate that some companies hold inventory significantly longer than others.
- Although the average value of the Asset Turnover Ratio is relatively high, its wide variability (large S.D.) suggests notable differences among companies in the efficiency of asset utilization.
- A high standard deviation relative to the mean value of Growth indicates a very wide distribution, with potential outliers significantly increasing the maximum value.
- The distribution of company size appears relatively consistent, with values concentrated around the mean.

By analyzing ROA trends over time, key periods of change can be identified, helping to understand the causes of these changes, which is valuable for planning future strategies. Figure 1 presents the trend of the average value of the dependent variable (ROA) over the observed period from 2007 to 2023.

Figure 1. Trend of the average ROA value in the period from 2007 to 2023.



Source: the authors'

As we can see in the chart, during the observed period, there are periods of ROA growth, indicating favorable economic conditions or periods of successful internal management strategies and improved operational efficiency. On the other hand, there are periods of ROA decline, which may result from an economically challenging environment and/or poor asset management. In any case, visible variability in asset utilization efficiency indicates that company profitability is sensitive to both external economic factors and changes in internal company policies. A deeper and more detailed analysis would require considering additional variables, as well as correlating the trends displayed with specific events within each individual company.

The next step in the research was to check for the presence of multicollinearity among the data. Therefore, a correlation matrix (Table 3) was calculated, and a Variance Inflation Factor (VIF) analysis was performed (Table 4).

Table 3. Correlation Matrix

	ROA	Quick Ratio	Debt Ratio	Inventory Turnover Period	Asset Turnover Ratio	Growth	Size
ROA	1						
Quick Ratio	0.1485	1					
Debt Ratio	-0.3668	-0.5544	1				
Inventory Turnover Period	-0.1111	-0.015	-0.0414	1			
Asset Turnover Ratio	0.0775	0.0136	0.0035	-0.3546	1		
Growth	0.0343	-0.0194	0.0693	-0.0288	0.0166	1	
Size	0.1222	-0.05	-0.1132	0.268	-0.4874	-0.0044	1

Source: the authors'

As seen in Table 3, the highest correlation in the dataset is between the Quick Ratio and Debt Ratio (-0.5544). This correlation is logical, as a higher Quick Ratio may indicate lower debt relative to liquid assets. Other correlations do not exceed the threshold of 0.5 and are well below the 0.8 threshold, which is typically considered the point of serious concern regarding the presence of multicollinearity among the data.

Table 4. Variance Inflation Factor (VIF) Analysis

Variable	VIF
Quick Ratio	1.477
Debt Ratio	1.506
Inventory Turnover Ratio	1.162
Asset Turnover Ratio	4.423
Growth	1.006
Size	1.379

Source: the authors'

The VIF analysis presented in Table 4 confirms that, although there is a moderately high correlation between the Quick Ratio and Debt Ratio (Table 3), it does not cause a statistically significant multicollinearity problem in the model. Therefore, we conclude that there is no presence of multicollinearity. All VIF values are significantly lower than the usual thresholds that indicate multicollinearity in the dataset. The common threshold is a VIF value of 10, and in stricter approaches, it is 5. In both cases, the VIF values shown in Table 4 are much lower, which means the predictors are independent of each other.

In the next step, we tested for the presence of heteroskedasticity in the data (Table 5).

Table 5. Heteroskedasticity Tests

Test	Test Statistics	<i>p</i> – value
White test	93.62	0.0000000028
Breusch-Pagan test	34.04	0.0000066

Source: the authors'

Both tests presented in Table 5 indicated significant variance inequality of the residuals between different companies, thus confirming the presence of heteroskedasticity in the data.

The Durbin-Watson test for autocorrelation, with a statistic of $DW = 0.847$, below 2, indicated the presence of positive autocorrelation. This means there is dependence between residuals at different time periods. This was also confirmed by the Wooldridge test.

The presence of heteroskedasticity and autocorrelation in the data can lead to incorrect conclusions about the significance of variables and cause unreliable coefficient estimates. Keeping this in mind, the authors implemented appropriate corrective measures to address the issues:

- 10 companies with extreme values (outliers) were eliminated from the initial sample of 28 wholesale companies, reducing the sample size to 18 companies and decreasing heteroskedasticity in the data.
- A logarithmic transformation of the "Debt Ratio" and "Size" variables was performed to correct standard errors for heteroskedasticity and autocorrelation.
- An OLS model with robust standard errors (White-Huber HC1 correction) was applied to fully address the heteroskedasticity problem.

After these corrections, the final model is presented in Table 6.

Table 6. OLS Model with Robust Standard Errors (White-Huber HCl Correction)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Const	-0.326079	0.064896	-5.024676	0.000001
Quick Ratio	0.001639	0.001423	1.151272	0.250540
Debt Ratio (log)	-0.079665	0.024522	-3.248710	0.001291
Inventory Turnover Period	-0.000118	0.000059	-2.003919	0.045981
Asset Turnover Ratio	0.005341	0.001105	4.831876	0.000002
Growth	0.000029	0.000002	12.479781	0.000000
Size (log)	0.166140	0.024357	6.821076	0.000000

Source: the authors

Based on Table 6, we can conclude that all independent variables, except for Quick Ratio, are statistically significant at the 5% level. The logarithmically transformed variable Debt Ratio (-0.079665; $p = 0.001$) shows a negative impact on ROA, meaning that a higher level of debt negatively affects profitability. The same conclusion applies to the Inventory Turnover Period (-0.000118; $p = 0.046$), indicating that a longer average time needed to sell inventory reduces profitability. The Asset Turnover Ratio (0.005341; $p < 0.001$) has a positive impact on the dependent variable ROA, meaning that a higher asset turnover (fewer days tied up in assets) positively contributes to profitability. Company growth (0.000029; $p < 0.001$) also has a positive effect on ROA, as larger companies (0.166140; $p < 0.001$) tend to achieve higher ROA.

Based on these results, we can conclude that hypotheses H_2 , H_3 , H_4 , H_5 , and H_6 are confirmed, while hypothesis H_1 is rejected.

The model is statistically significant (F-statistic: 193.9696 with p -value < 0.0001) and explains about 31.8% of the variation in ROA ($R^2 = 0.318$). Autocorrelation is still present (DW = 0.755241559), but it does not undermine the validity of the model since the standard errors have been adjusted.

The presented OLS model with robust standard errors has proven to be the most suitable choice in this case. The methodological correctness is evident, as it addresses the problems of heteroskedasticity and autocorrelation (ensuring consistency of estimates despite the presence of positive autocorrelation), is easy to interpret, and has no limitations regarding the correlation between individual effects and independent variables. The Hausman test did not provide valid results, so we could not provide valid evidence that either the Fixed-effect (FE) or Random-effect (RE) model would be a better fit.

Conclusion

The wholesaling industry of food, beverages and tobacco in Serbia increased by 0.8 % CAGR in the period 2019-2024, recording an estimated revenue of 4.3 billion EUR, 29,938 employees and 4,202 businesses in 2024 (IBIS World, 2024). It is of a great importance for

the country's economy as a significant part of Serbia's total wholesale trade turnover is realized by these products. The wholesale trade turnover by commodity groups in Serbia in 2023 total was 3,820,155 mil. RSD (approximately 3,820 mil EUR), while the wholesale trade turnover by food products (including non-alcoholic and alcoholic beverages) was 638,385 mil. RSD (approximately 5,410 mil EUR) and the wholesale trade turnover by tobacco products was 253,361 mil. RSD (approximately 2,147 mil EUR) (Statistical Office of the Republic of Serbia, 2024).

This analysis has highlighted the significance of certain financial indicators in predicting the profitability of companies in the wholesale sector. Through a series of diagnostic tests and corrective measures, the validity of the model was ensured despite initial issues with heteroscedasticity and autocorrelation.

We conclude that companies with higher levels of debt and longer inventory turnover periods achieve lower profitability. To improve profitability, companies should reduce their debt levels and shorten the inventory turnover period. On the other hand, companies with fewer days of asset turnover, companies that experience sales growth, and larger companies achieve better profitability. These findings can be useful for managers and investors in making strategic decisions regarding financing and operational efficiency.

Future research could consider applying dynamic panel models (Arellano-Bond GMM) to further eliminate autocorrelation, as well as incorporating other factors that may affect ROA, such as macroeconomic indicators and sector-specific factors, along with comparative analysis with companies from other countries.

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International financial reporting standards as the basis of financial reporting for listed companies

Међународни стандарди финансијског извештавања као основа финансијског извештавања котираних компанија

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Abstract

Purpose: The research explores the specificities and differences in the application of International Financial Reporting Standards (IFRS) as the basis for financial reporting by listed companies worldwide. The primary issue addressed is the inconsistency in IFRS application across countries, despite its global significance for the transparency and comparability of financial statements.

Methodology: Methodologically, the research relies on the analysis of 168 jurisdictions whose profiles are available on the IFRS Foundation's website. Data on the extent of IFRS application in domestic and foreign listed companies were analysed, including whether the adoption of the standards is mandatory or optional.

Findings: The results indicate the dominance of jurisdictions where IFRS application is mandatory for listed companies, while specificities in the permissibility and scope of application are observed in other cases.

Originality/value: This study identifies the reasons behind the differences in the level of IFRS implementation across various jurisdictions, with a focus on listed companies, and provide insights into the future directions of IFRS implementation.

Practical implications: These findings are relevant for analysts, investors, and regulators in assessing the effects of global harmonisation of financial reporting.

Limitations: Although the analysis was conducted on all jurisdictions whose profiles are presented on the IFRS Foundation's website, which do not represent all jurisdictions in the world, the study did not consider changes in the scope and various variations of IFRS application in these jurisdictions over time.

Keywords: IFRS, listed companies, jurisdictions, IFRS Foundation

JEL classification: M41

Сажетак

Циљ: Профитабилност је један од најважнијих показатеља перформанси предузећа и истовремено веома значајан индикатор у односу на остале кључне пословне показатеље. Циљ овог истраживања је да испита утицаје кључних показатеља на ниво профитабилности одабраних предузећа.

Методологија У истраживању су коришћени модели фиксних и случајних ефеката, као и модел генерализованих најмањих квадрата, за анализу панел података 78 предузећа из различитих сектора

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привреде, која су листирана на берзама бивше Југославије. Емпиријска анализа обухвата период од 2006. до 2022. године и укључује показатеље структуре капитала, ликвидности, активности, величине и старости предузећа.

Резултати: Главни налази указују на статистички значајан утицај показатеља структуре капитала и активности, док су показатељи старости и величине такође показали значајне ефекте.

Оригиналност/вредност: Добијени резултати доприносе обogaћивању постојеће литературе и унапређују знање финансијских менаџера у региону, омогућавајући боље разумевање утицаја специфичних показатеља на перформансе предузећа.

Практична примена - Резултати се могу користити од стране финансијских менаџера приликом креирања финансијског микса предузећа.

Ограничења истраживања: Главна ограничења односе се на коришћење искључиво микроекономских показатеља, уместо макроекономских, као и на анализу ограничену на подручје бивше Југославије.

Кључне речи: IFRS, котиране компаније, јурисдикције, IFRS Фондација

ЈЕЛ класификација: M41

Introduction

Financial statements are indispensable, given their importance to numerous users. For these users, globalisation and international comparability of financial reporting standards are crucial. Global standards enhance comparability between companies across countries and within individual nations. With the rapid progress in converging financial reporting standards in relatively short period (Carmona & Trombetta, 2008), comparability of financial statements has significantly improved. It should be considered that financial reporting is a dynamic and essential process that enables organizations to communicate their financial performance and position to a diverse set of stakeholders. This includes preparation of financial statements, compliance with regulatory standards, auditing and effective communication through various channels (Mladenović et al., 2023).

Despite efforts to harmonise financial reporting globally, eliminating all discrepancies remains challenging. A global consensus on reporting standards is crucial to minimise differences between countries. The likelihood of IFRS adoption increases when trading partners and neighbouring countries already use them (Ramanna & Sletten, 2009). However, factors like political systems, tax regimes, legal frameworks, traditions, and culture persist as key drivers of differences in national financial reporting standards. One of the aspects from which differences in the financial reporting systems of various countries can be observed is the financial reporting of listed companies, i.e., companies whose securities are traded on public capital markets (stock exchanges). Consequently, the subject of this study is the specificities and differences in the application of IFRS as the basis for financial reporting by listed companies in countries around the world.

The aim of the research conducted in this study is to identify and analyse the reasons behind the specificities and differences among various countries worldwide regarding the level of application of full IFRS as the basis for financial reporting by domestic and foreign companies whose equity or debt securities are traded on public capital markets. This paper contributes to a better understanding of IFRS, highlighting its role in financial reporting for listed companies worldwide. It offers valuable insights into the global application of IFRS and supports analysts by providing data on its adoption across different jurisdictions. The

practical relevance extends to foreign investors, who may base their decisions on whether companies apply IFRS. In cases where IFRS is not used or permitted, unfamiliarity with local GAAP can deter investment due to the extra effort needed for analysis. By presenting and analysing summary data on the financial reporting practices of listed companies globally, conclusions were drawn about the extent to which countries around the world have implemented IFRS in a particularly significant area of application – listed companies, which are typically large entities whose operations should be transparent, considering they are public interest entities. Based on the research findings, conclusions were made about future directions for the implementation of IFRS in listed companies and the potential for improving their application in this context.

The study is empirically oriented, analysing profiles of 168 jurisdictions from the IFRS Foundation's website. The findings highlight the significance of IFRS for listed companies and provide insights for financial analysts assessing IFRS applicability across countries, particularly for domestic and foreign listed companies. Moreover, the results can aid current and future foreign investors in making informed decisions based on IFRS adoption and application in listed entities worldwide.

In addition to the introduction and conclusion, the study consists of four parts. The first part presents a review of the literature related to the global significance of IFRS. The second part focuses on the importance of IFRS for listed companies. The third part outlines the research methodology. The fourth part presents the results of the conducted empirical research, based on the analysis of jurisdiction profiles regarding the application of IFRS in listed companies.

1. Global Significance of International Financial Reporting Standards

Before IFRS, only International Accounting Standards (IAS), developed by the International Accounting Standards Committee (IASC), were in use. After IFRS was introduced, both sets of standards became applicable. Obradović (2016) notes that the IASC was founded by accounting organisations from nine countries: Australia, France, the Netherlands, Japan, Canada, Mexico, (West) Germany, the USA, and the UK (with Ireland). During its more than 25 years of operation, the IASC issued the Framework for the Preparation and Presentation of Financial Statements and developed 41 standards, later revised or replaced, leaving 34 in effect when it transitioned to the International Accounting Standards Board (IASB). The IASB issues IFRS, which can be understood narrowly as the standards it publishes or broadly as the entire body of international standards, including IAS. In a narrow sense, IFRS refers to a series of documents, i.e., standards published by the IASB, while in a broader sense, IFRS represents the “entire authoritative literature on international standards,” encompassing 1) IAS, 2) Interpretations issued by the IFRS Interpretations Committee, and 3) Interpretations published by the Standing Interpretations Committee (SIC), the predecessor to the IFRS Interpretations Committee (Obradović, 2016). IFRS, as products of several decades of work by the IASC and its successor, the

IASB, form the basis for the global convergence of financial reporting standards (Obradović, 2016). Ian Mackintosh, former Vice-Chairman of the IASB, stated in November 2014 that “the last 10 years have been complicated, but absolutely successful for IFRS” (Mackintosh, 2014). Since the beginning of the 21st century, after IFRS received support from the International Organization of Securities Commissions (IOSCO), their position has been significantly strengthened (Garbutt, 2010). Judge et al. (2010) note that the acceptance of IFRS most depends on the willingness of a country’s institutions to impose them on companies.

The arguments most commonly cited in favor of adopting IFRS are primarily economic and focused on improving the functioning of financial markets. However, considering the unequal levels of economic development among countries, the expected economic benefits of adopting IFRS are not equally significant motivations for their adoption across all countries (Koning et al., 2018), as some countries already had a sufficiently high level of economic development before adopting IFRS. Dimitrou (2020) notes that there are numerous differences among countries concerning social, economic, and legal conditions, which significantly influence foreign investors’ decisions to invest in companies. However, the same author also points out that IFRS help bridge the gap, reducing the differences in financial reporting stemming from the social, economic, and legal disparities among countries.

The earnings and book value figures provide a summary of the available financial information on a company. The information content of financial statement figures often determines the degree to which investors consider these figures in making investment decisions. Thus, accounting standards are capable of influencing the value relevance of financial statements. Most of the pioneer studies on changes in accounting standards address the US financial reporting environment (Imhanzenobe, 2022).

The increasingly widespread adoption of IFRS conveys a sense of positive reception toward this set of financial reporting standards by many countries. For a long time, the U.S. Securities and Exchange Commission (SEC) required all foreign companies listed on U.S. stock exchanges to reconcile their net income and equity with U.S. Generally Accepted Accounting Principles (GAAP) (Obradović, 2016). The decision to allow foreign entities listed on U.S. exchanges to apply IFRS initially seemed to accelerate the possibility of IFRS becoming the default standard for domestic U.S. companies (Chua & Taylor, 2008). However, this prediction has not materialised, as U.S. companies continue to use U.S. GAAP. It is likely that U.S. GAAP and IFRS will coexist globally for an extended period, with some foreign-listed companies in the U.S. applying IFRS and companies elsewhere using U.S. GAAP. Despite the potential for competition between these standards, Jamal and Sunder (2007) expressed doubts about its likelihood. Some argue that the SEC’s decision to let foreign companies choose between U.S. GAAP and IFRS may have slowed the convergence process (Street & Linthicum, 2007). However, Chua and Taylor (2008) maintained that the push for a single global standard issued by the IASB would continue, a perspective supported by progress in IFRS and U.S. GAAP convergence. Tolkach (2023) highlights that adopting IFRS in the U.S. could enhance global consistency, ease cross-country comparisons, and better meet investors’ needs.

The convergence of IFRS and U.S. GAAP is crucial in the context of financial reporting globalization. Three main economic reasons justify this convergence: transparency, quality, and comparability. Transparency improves when IFRS is adopted, as it reduces information asymmetry between company management and external users of financial statements (Brown, 2013; Song & Trimble, 2022). Some argue that demand for high-quality financial reporting arises from the need for robust accounting of company transactions rather than solely from using financial statements for investment assessments (Watts & Zimmerman, 1986). When analysing the marginal value-relevance of adopting IFRS for firms already reporting according to NGAAP, it was observed that shareholders' equity reported under IFRS shows greater value-relevance compared to the balance sheet prepared under NGAAP, as a higher representation of fair values contributes to increased value-relevance. Additionally, normalized net operating income reported under IFRS demonstrates greater value-relevance compared to the corresponding NGAAP figure, especially for firms with intensive intangible assets (Gjerde et al., 2008). Regarding quality, research shows that the quality of financial reporting depends more on how standards are implemented than on the standards themselves (Chua & Taylor, 2008). Lastly, while it's surprising, there is little evidence that results under different financial reporting standards are non-comparable (DeFranco et al., 2011). These reasons play a key role in the global convergence of IFRS and other standards, supporting the globalization of financial reporting standards. Li et al. (2024) proved that the implementation of IFRS not only leads to improved company performance but also to better forecasting of future earnings and cash flows, which significantly affects the competitiveness of enterprises.

The idea that a unified set of financial reporting standards could provide significant assistance to current and potential foreign investors in assessing the suitability of companies for potential investment is highly significant. It is essential for investors, particularly foreign ones, to have a global set of financial reporting standards to aid in their decision-making regarding investments in companies. According to Brown (2013), external financial statements, while relevant to some extent for decision-making, are not particularly timely sources of information. This is because they reflect past transactions and events, meaning they are inherently backward-looking.

It is worth noting that major audit firms, particularly the “Big Four” audit firms (KPMG, Ernst & Young, PricewaterhouseCoopers, and Deloitte) can play a significant role in the global adoption of IFRS. Tran et al. (2019) state that these firms possess the expertise and experience needed to support and advise companies on adopting IFRS, thereby increasing awareness of the global importance of IFRS.

The globalisation of financial reporting standards is crucial for corporate financing, especially in international borrowing. Globally accepted standards reduce borrowing costs for companies with foreign lenders. For nationally operating companies, changes in financial reporting can impose costs if national authorities set specific debt contracting conventions. However, such changes can also benefit some companies (Kim et al., 2010). Kim et al. (2007) show that non-U.S. borrowers who voluntarily adopt IFRS experience

lower borrowing costs, underlining the global significance of IFRS in reducing borrowing costs, even for national companies.

Leuz and Wysocki (2008) suggest that voluntary IFRS adoption mainly improves capital market efficiency, analysts' forecasts, and similar outcomes. Barth et al. (2008) found that the financial statements of firms using IFRS are more relevant than those not applying it. Eroglu (2021) explains that mandatory IFRS adoption in the EU aims to harmonise financial reporting, save time and resources, and support the global expansion of listed companies.

Another important aspect of the global significance of IFRS is the comparability of financial statements. It is entirely expected that comparability of financial statements significantly increases with the global acceptance of IFRS. Numerous studies, as reviewed by Yip and Young (2012), demonstrate the positive impact of IFRS adoption on the comparability of financial statements. Similarly, Becker et al. (2021) note that IFRS adoption improves the comparability of financial statements and increases the predictability of stock prices for companies transitioning from national GAAP to IFRS, affirming its superiority as a financial reporting standard. From today's perspective, this assertion can be confirmed, as IFRS has significantly contributed to the global comparability of company financial statements.

An additional aspect of IFRS's global significance is its impact on the level of corruption in countries. Corruption is a critical factor for investors, who are hesitant to invest in companies from countries with high corruption levels. El-Helaly et al. (2020) conclude that there is a negative (inverse) correlation between the level of corruption and the speed and extent of IFRS adoption in a country.

IFRS for Small and Medium-sized Entities (SMEs) is a document introduced by the IASB for entities that prepare general-purpose financial statements but are not publicly accountable (Obradović, 2016). Sellami and Gafsi (2018) note that in the context of globalisation, where markets are increasingly integrated and economic activities more complex and competitive, it has become essential for SMEs worldwide to keep pace with innovations, including the adoption of IFRS.

From the above discussion, it is evident that there are numerous aspects from which the significance of IFRS on a global level can be assessed. These include its importance for international investors, increased business transparency, relevance for stock price prediction, capital market functioning, international comparability of financial statements, and more. Therefore, the process of IFRS adoption by national regulators in various countries and the alignment of national financial reporting standards with IFRS is crucial for facilitating the movement of capital, goods, and services between countries.

2. The Importance of IFRS for Listed Companies

IFRS represent the foundation of high-quality financial reporting, transparency, and comparability of financial statements for companies across different countries. When it comes to the transparency of corporate operations, it can be said that transparency is most pronounced and most demanded in the case of companies whose securities are traded on stock exchanges, i.e., listed companies. The mandatory adoption of IFRS for listed companies leads to significant changes compared to previous accounting regulations, particularly regarding the relationships between balance sheet items and income statement items (González et al., 2014). This is due to the fact that listed companies, considering the public trading of their securities, are subject to scrutiny by numerous stakeholders. Therefore, it is of utmost importance that the information they disclose, particularly information contained in financial statements, is relevant and faithfully represented.

Caramanis (2005) analysed 178 listed companies and found that the international comparability of their financial statements significantly improved after adopting IFRS. Tran et al. (2019) argue that IFRS adoption enhances transparency, reliability, and investor confidence, boosting foreign capital inflow. In a study investigating the adoption of IFRS in Italian companies, it was concluded that the implementation of IFRS positively affects performance, with a significant impact on net income and equity, and a more pronounced effect on equity (Cordazzo, 2013). Nurunnabi et al. (2020) found that IFRS implementation in Saudi Arabia resulted in increased transparency, comparability, and cross-border investment opportunities. Similarly, Jung et al. (2020) observed a significant improvement in the international comparability of financial statements following IFRS adoption. Lopez and Viana (2008) studied 44 listed Portuguese companies and found positive effects on equity and net results after transitioning from Portuguese GAAP to IFRS. Chalho et al. (2007) examined 26 Spanish companies and found that IFRS adoption increased total liabilities and decreased equity. Kalra and Vardia (2016) studied six Indian companies that voluntarily adopted IFRS by 2014 and concluded that IFRS improved financial reporting quality and comparability, though it had no significant effect on key financial ratios.

Nguyen et al. (2020), in their study analysing a sample of listed companies from Vietnam, stated that they identified two variables that influence the transition from Vietnam's national standards to IFRS. The variables in question are the support of administrators and the qualifications of accountants. Therefore, the adoption of IFRS is facilitated by the quality support of administrators (management) and qualified accountants within companies. One of the positive aspects of adopting IFRS can also be found in the research conducted by Kainth and Wahlstrøm (2021), which relates to predicting the occurrence of financial difficulties and bankruptcy in listed companies, an issue of significant importance for management. These authors, by analysing a sample of Norwegian listed companies, concluded that the occurrence of financial difficulties and bankruptcy in companies can be better predicted in those using IFRS as the basis for financial reporting, compared to those using Norwegian GAAP.

Lantto and Sahlstrom (2007) studied 125 Finnish companies and found that IFRS adoption altered financial indicators by increasing profitability ratios and leverage, while reducing the P/E ratio and quick ratio. Profitability increased due to higher earnings and reduced goodwill impairment under IFRS 3, while leverage rose due to increased debt and reduced equity. Hung and Subramanyam (2007) found that IFRS adoption resulted in higher total asset values, equity, and net income variability in German companies from 1998 to 2002. Odoemelam et al. (2019) concluded that IFRS adoption positively impacted the market value of listed companies. Glaum and Street (2003) found significant non-compliance with IFRS in German companies, with IFRS-compliant companies showing lower compliance than those using US GAAP. Callao and Jarne (2010) studied 1,408 non-financial EU companies and found significant IFRS impact, especially in France and the UK. Blanchette et al. (2011) analysed Canadian companies and identified differences in financial ratios post-IFRS adoption, but they were not statistically significant.

Georgakopoulou et al. (2008) investigated a sample of 39 companies from the industrial sector in Greece that adopted IFRS in 2005. Their findings indicate differences in four out of the ten financial ratios considered. Similarly, Pazarskis et al. (2011) examined the impact of IFRS adoption by Greek listed companies in the information technology sector using twelve financial ratios. Their results revealed a statistically significant difference in the profit margin ratio, which increased after IFRS adoption, as reflected in the ratio of EBIT (Earnings Before Interest and Taxes) to revenue. Additionally, the debt-to-equity ratio decreased following IFRS adoption compared to the pre-adoption period. Dumontier and Raffournier (1998) explored the relationship between disclosure levels and corporate characteristics using a sample of 133 companies listed on the Swiss stock exchange. Univariate analyses demonstrated a positive influence of company size, international operations, listing status (quality of traded securities), auditor type, and ownership dispersion on voluntary compliance with IFRS. In contrast, leverage, profitability, and the ratio of non-current assets to total assets were insignificant in explaining compliance levels. They concluded that political costs and pressures from external markets play a critical role in the decision of Swiss-listed companies to adopt IFRS.

The use of IFRS has also been linked to reduced delays in audit report issuance. Ologun et al. (2020) analysed Nigerian listed companies and concluded that IFRS adoption reduced audit report delays. This implies that financial statements and audit reports prepared under IFRS are more timely compared to those based on national standards. The study on IFRS adoption in China showed that audit fees increased after the implementation of IFRS, but the changes varied depending on prior IFRS experience. Audit firms with experience charged higher premiums, while clients with previous IFRS experience paid lower fees (Lin & Yen, 2016).

Numerous developed and developing countries have embraced IFRS (Demir et al., 2013). A significant milestone for IFRS adoption in European countries was the decision of the European Parliament and the EU Council of Ministers to mandate IFRS for all companies preparing consolidated financial statements and listed on regulated capital markets within the EU (Obradović, 2016). Specifically, in 2002, the European Council and

the EU Council of Ministers approved a regulation requiring all publicly traded companies in the EU to adhere to IFRS for consolidated financial statements from 2005 onwards. This marked a pivotal step toward achieving the goal of internationally comparable financial reporting (Demir & Bahadır, 2014).

Given the numerous variations in financial reporting practices among listed companies and the wide-ranging implications of IFRS adoption on company performance worldwide, the significance of IFRS adoption is perceived differently by various companies and national financial reporting regulators. Consequently, the scope of IFRS application varies across listed entities in different countries. It is therefore essential to examine the differences in the extent of IFRS adoption as the foundation for financial reporting among listed companies across countries, as well as the unique characteristics of IFRS implementation in listed companies globally.

3. Research Methodology

As previously mentioned, the research conducted in this study is empirically oriented, given that publicly available data on jurisdiction profiles, published on the IFRS Foundation's website in the form of completed questionnaires, was used to examine the adoption of IFRS as the basis for financial reporting by listed companies. The IFRS Foundation states on its website that it uses information from various sources to ensure the accuracy of jurisdiction profiles. Each jurisdiction's webpage includes a summary table that shows the extent of IFRS adoption within the jurisdiction, while more detailed information can be found in the questionnaire itself. This information pertains to: 1) relevant authorities, 2) details of survey participants, 3) public commitment to global financial reporting standards and IFRS, 4) scope of IFRS application, 5) IFRS adoption, 6) whether the jurisdiction has eliminated options or made specific modifications, 7) the process of IFRS translation, and 8) IFRS adoption for small and medium-sized entities. This approach aims to achieve the research objective, i.e., identifying and analysing the reasons behind the specificities and differences between various countries (jurisdiction profiles) in terms of the level of full IFRS adoption as the basis for financial reporting by domestic and foreign companies whose equity or debt securities are traded on public markets.

By analysing 168 jurisdiction profiles, each containing a section titled "EXTENT OF IFRS APPLICATION" (segments of the profiles focusing on IFRS application in listed entities), it is possible to draw conclusions about the scope and specificities of IFRS application in listed companies. The first part of this section pertains to domestic listed companies preparing consolidated financial statements. The second part concerns questions related to other financial statements of domestic listed companies, excluding consolidated financial statements. The third group of questions focuses on foreign listed companies.

The first question in the section on domestic listed companies addresses whether IFRS is a mandatory or permitted basis for preparing consolidated financial statements. The second question specifies whether IFRS is required or merely allowed in these entities. The third question examines the entities applying IFRS (whether required or permitted),

focusing on whether this applies to all or only specific entities. If the answer is that IFRS applies only to specific entities, the questionnaire identifies the types of entities to which it applies. The first question in the second part of the analysed section concerns whether IFRS is required or allowed for other financial statements (excluding consolidated ones) of companies whose securities are traded on capital markets. The second question pertains to whether IFRS is required or allowed when preparing individual financial statements, while the third question relates to the application of IFRS in companies that are not listed. The fourth question explores plans for IFRS adoption in the future (mainly if the jurisdiction neither requires nor allows IFRS application). The first two questions in the third part address the mandatory/permissive application of IFRS for foreign listed companies. The third question examines whether IFRS applies to all or only specific foreign listed companies. If IFRS applies only to certain entities, the questionnaire specifies the types of foreign listed entities to which it applies.

4. Research Results

Based on the data presented on the IFRS Foundation's website, the distribution of jurisdictions by world regions can be summarised as shown in Table 1.

Table 1: Overview of Analysed Jurisdictions

Region	Number of Jurisdictions	% by Region
Europe	44	26%
Africa	39	23%
Middle East	13	8%
Asia, Australia and Oceania	35	21%
North and South America	37	22%
Total	168	100%

Source: IFRS Foundation: Who Uses IFRS Accounting Standards, <https://www.ifrs.org/use-around-the-world/use-of-ifrs-standards-by-jurisdiction/>, retrieved February, 2024

It can be unequivocally concluded that the participation of available jurisdiction profiles in the observed regions is approximately equal, except in the case of the Middle East, where there is an absolute minimal number of available jurisdiction profiles, accounting for 8% of the total number of observed jurisdictions. European countries are the most represented in the analysis, with 26% of the total number of available jurisdiction profiles. Then, with a slightly smaller share, Africa ranks second (23%), followed by North and South America combined in third place (22%), while Asia, Australia, and Oceania are in fourth place in terms of participation in the total number of observed jurisdictions. Jurisdictions can be divided into those that require the application of IFRS for all or most domestic publicly accountable entities, those that allow or require IFRS for at least some (but not all or most) domestic publicly accountable entities, and those that neither require nor allow the application of IFRS for any domestic publicly accountable entity. Publicly accountable entities are characterized by limited liability of a large number of owners, as well as the separation of ownership and management (Đukić & Pavlović, 2014). The review of jurisdictions according to this classification is presented in Table 2.

Table 2: Review of jurisdiction colours worldwide according to the IFRS application mandatory criteria

Region	Number of Jurisdictions	Required application	% of jurisdictions where application is required	Required or allowed application	Neither required nor allowed application
Europe	44	43	98%	1	0
Africa	39	37	95%	1	1
Middle East	13	12	92%	1	0
Asia, Australia and Oceania	35	28	80%	2	5
North and South America	37	26	70%	9	2
Total	168	147	87.5%	13	8
% of 168 jurisdictions	100%	87.5%	/	7.7%	4.8%

Source: IFRS Foundation: *Who Uses IFRS Accounting Standards*, <https://www.ifrs.org/use-around-the-world/use-of-ifrs-standards-by-jurisdiction/>, retrieved February, 2024

Based on Table 2, it can be concluded that the majority of jurisdictions require the application of IFRS, meaning there is no choice involved, as the regulatory bodies of these countries have mandated the use of IFRS for all or most domestic publicly accountable entities. In other words, 87.5% of the jurisdictions require the application of IFRS for all or most domestic publicly accountable entities, 7.7% have jurisdictions where some entities are obligated, while others have the option to apply IFRS, and 4.8% of jurisdictions neither require nor allow the application of IFRS for domestic publicly accountable entities. Although a high percentage of jurisdictions (87.5%) formally require the application of IFRS, this does not guarantee global consistency and transparency of financial statements. The seemingly high compliance rate often conceals issues related to implementation and adaptation to local regulations, which may lead to partial and inconsistent application of the standards. Furthermore, the lack of adequate oversight and technical capacity in less developed countries hampers the proper implementation of IFRS, making formal harmonisation more symbolic than substantive. Such differences in interpretation and enforcement undermine the fundamental goal of global standardisation of financial reporting and hinder data comparability and transparency.

Unlike the previous analysis, which relates to the general application of IFRS in companies belonging to certain regions, an analysis can also be performed by exclusively focusing on listed companies in 168 jurisdictions. The summary results of the analysis of the mandatory application of IFRS in listed entities across all 168 observed jurisdictions are provided in Table 3.

Table 3: Obligation of applying IFRS in listed entities

Variants	Number of Jurisdictions	% of jurisdictions
Required application	135	80.35%
Allowed application	11	6.55%
Required for some entities, allowed for others	2	11.90%
Neither required nor allowed	6	3.57%
No financial market	14	8.33%
Total	168	100%

Source: IFRS Foundation: *Who Uses IFRS Accounting Standards*, <https://www.ifrs.org/use-around-the-world/use-of-ifrs-standards-by-jurisdiction/>, retrieved February, 2024

An analysis of jurisdiction profiles reveals that IFRS is predominantly mandated by government authorities in 135 jurisdictions (80.35%). In contrast, IFRS is permitted in 11 jurisdictions (6.55%) and neither required nor permitted in 6 jurisdictions (3.57%). Specific nuances exist within these mandates. For example, in the European Union, IFRS adopted by the EU is mandatory for the consolidated financial statements of domestic companies listed on regulated markets, while unregulated markets may allow or require IFRS for various financial statements. In Sweden, IFRS is mandatory for entities on regulated markets but optional for unregulated ones. Similarly, Nicaragua allows entities to choose between IFRS and U.S. GAAP, with one being obligatory. Yemen, despite lacking a stock exchange, mandates IFRS for companies selling shares to the public. These examples highlight variations in IFRS adoption across jurisdictions. Differences between jurisdictions that apply IFRS and those that do not are often the result of economic and regulatory challenges as well as local accounting traditions. In less developed economies, the complexity and cost demands of IFRS implementation represent a significant problem, often leading to the assessment that the benefits do not justify the resources invested.

However, the question arises whether these reasons are truly justified or whether they conceal resistance to modernising accounting practices and globally harmonising reporting. In addition to economic barriers, some countries retain local standards due to the belief that they better reflect the specific characteristics of the domestic economy, while in some cases political resistance emerges, as the adoption of IFRS is perceived as a threat to sovereignty in financial reporting. Furthermore, non-application of IFRS may discourage foreign investors due to the lack of transparency and international comparability of financial statements, causing domestic companies to lose access to global capital markets. In an attempt to find a compromise, some countries develop hybrid solutions that combine local standards with certain elements of IFRS. However, such practices can further complicate the comparison of financial statements and undermine transparency, thereby failing to achieve the fundamental goal of harmonisation.

The next aspect essential to consider regarding the application of IFRS in listed companies is the extent of compliance with the IFRS requirements, i.e., whether the previously analysed mandates for IFRS application apply to all or only certain domestic listed entities. The results of the analysis of entities subject to the IFRS mandatory application requirements are presented in Table 4.

Table 4: Entities to which IFRS mandatory application requirements apply

Variants	Number of Jurisdictions	% of jurisdictions
Requirements for mandatory application of IFRS apply to all domestic listed entities	137	81.55%
Requirements for mandatory application of IFRS apply to certain domestic listed entities	12	7.14%
Data not available	19	11.31%
Total	168	100%

Source: IFRS Foundation: *Who Uses IFRS Accounting Standards*, <https://www.ifrs.org/use-around-the-world/use-of-ifrs-standards-by-jurisdiction/>, retrieved February, 2024

In Table 4, the data are presented in aggregate form, without distinguishing whether IFRS application is mandatory or permitted, as discussed in the previous analysis. This section of the analysis examines jurisdictions based on whether the mandatory IFRS application requirements apply to all or only certain domestic listed entities.

Table 4 shows that 137 out of 168 jurisdictions (81.55%) mandate IFRS for all domestic listed entities, while 12 jurisdictions (7.14%) apply this requirement only to certain listed entities. Data for 19 jurisdictions (11.31%) are unavailable, often due to the absence of financial markets or domestic listed entities, or the prohibition of IFRS application. In some cases, specific entities, such as banks or insurance companies, do not apply IFRS even when it is required for others, as seen in Argentina, El Salvador, and Russia. Conversely, in countries like Albania and Canada, public-interest entities, such as banks and insurers, are required to use IFRS. Bolivia limits IFRS to subsidiaries of foreign entities, with others following Bolivian GAAP. Additionally, some countries, including France, Germany, and Ireland, mandate IFRS for domestic listed entities except those in unregulated financial markets. Although the results indicate a high rate of formal IFRS adoption among listed companies, the question arises as to whether this adoption truly achieves the fundamental objectives of the standards, such as transparency and comparability of financial statements. In practice, it often happens that, despite the mandatory application of IFRS, financial statements do not provide sufficiently reliable information to users, particularly in jurisdictions with weaker regulatory frameworks or limited supervisory capacities. In such cases, the application of IFRS may be more formal than substantive, where companies technically meet the standard requirements but face challenges such as inadequate accountant training, lack of professional oversight, and discrepancies in standard interpretation. This formalistic approach leads to a paradox in which nominally compliant reports are not genuinely transparent and comparable, thereby calling into question the fundamental goal of global harmonisation of financial reporting.

The next important aspect to consider in IFRS application is the extent of its use for the preparation of individual financial statements of listed companies. A summary of the research results from this perspective is presented in Table 5.

Table 5: Application of IFRS for the Preparation of Individual (Separate) Financial Statements of Listed Companies

Variants	Number of Jurisdictions	% of jurisdictions
Required application	96	57.14%
Allowed application	23	13.69%
Required for some entities, allowed for others	5	2.98%
Allowed for some entities, forbidden for others	1	0.60%
Neither required nor allowed	33	19.64%
Not defined	10	5.95%
Total	168	100%

Source: IFRS Foundation: *Who Uses IFRS Accounting Standards*, <https://www.ifrs.org/use-around-the-world/use-of-ifrs-standards-by-jurisdiction/>, retrieved February, 2024

Based on Table 5, most jurisdictions require mandatory IFRS application for individual financial statements of listed companies. Specifically, 96 of 168 jurisdictions (57.14%) mandate IFRS use, while 23 jurisdictions (13.69%) permit but do not require it. In 33 jurisdictions (19.64%), IFRS application is neither mandated nor allowed. Some cases are more specific: in five jurisdictions, Australia, Hong Kong, Latvia, Lithuania, and Slovakia, IFRS is mandatory for banks, insurers, and financial institutions but permitted for other listed entities. IFRS may also be mandatory for entities on regulated or primary markets but optional for those on unregulated or secondary markets. The European Union represents a unique case: IFRS for individual financial statements is allowed in some member states but prohibited in others, depending on national laws. Lastly, 10 jurisdictions (5.95%) fall into an undefined category, including those without financial markets (e.g., Afghanistan, Angola, Belize, Brunei, Gambia, Honduras, Lesotho, Macau, Madagascar) or where individual financial statements are not mandatory (e.g., the UAE). The application of IFRS significantly varies between developed and less developed markets, with economically stronger countries generally being more successful in the consistent and high-quality implementation of the standards. Developed economies possess skilled personnel, financial resources, and a regulatory framework that enables the proper and complete application of IFRS, whereas countries with lower levels of development often face serious obstacles, such as a lack of trained accountants, financial constraints, and weak institutional support. In such conditions, although the standards are formally adopted, their actual application may be superficial and inadequate, thereby losing the substantive benefits of alignment with international accounting standards. In addition to economic limitations, the problem also lies in the regulatory flexibility that varies between countries. While developed countries often have stricter regulatory frameworks that ensure consistent application of IFRS, more flexible approaches in less developed countries allow companies to adjust or even bypass certain provisions. This leads to the formal acceptance of IFRS without any real impact on the quality of financial reporting and complicates the international comparability of financial statements.

Based on the questions in the jurisdiction profiles, it is possible to assess the extent of IFRS application in entities that are not listed, meaning their securities are not traded on public markets. The results of this analysis are provided in Table 6.

The last analysed section of the jurisdiction profiles is the one concerning the application of IFRS for foreign listed entities. The results of the analysis regarding the mandatory application of IFRS for foreign listed entities are provided in Table 6.

Table 6: Mandatory application of IFRS for foreign listed entities

Variants	Number of Jurisdictions	% of jurisdictions
Required application	116	69.05%
Allowed application	25	14.88%
Required for some entities, allowed for others	2	1.19%
Neither required nor allowed	4	2.38%
No financial market	14	8.33%
No foreign companies	7	4.17%
Total	168	100%

Source: IFRS Foundation: *Who Uses IFRS Accounting Standards*, <https://www.ifrs.org/use-around-the-world/use-of-ifrs-standards-by-jurisdiction/>, retrieved February, 2024

Based on the data in Table 6, it is clear that the majority of jurisdictions require IFRS application for foreign listed companies. Specifically, 116 out of 168 jurisdictions (69.05%) mandate IFRS, while 25 jurisdictions (14.88%) permit but do not require it. Four jurisdictions (2.38%), China, Indonesia, Montserrat, and Vietnam, do not allow IFRS for foreign listed companies. Fourteen jurisdictions lack a financial market, and thus, no foreign listed companies can apply IFRS. In the European Union, some member states require IFRS, while others permit it. In Singapore, foreign listed companies in the primary financial market must use IFRS, while those in the secondary market may use IFRS, GAAP, or SFRS. Additionally, seven jurisdictions (Iran, Kuwait, Myanmar, Oman, Qatar, Saudi Arabia, and Syria), accounting for 4.17% of the total, have no foreign listed entities despite having a financial market. The last segment of the analysis of jurisdiction profiles also pertains to foreign listed entities, specifically the application of mandatory IFRS requirements for these entities. It has been determined whether the mandatory IFRS application requirements apply to all or only specific types of foreign listed entities. If the requirements apply only to certain types of foreign listed entities, this has been specified. The results of the analysis of the application of mandatory IFRS requirements for foreign listed entities are presented in Table 7.

Table 7: Foreign entities to which the requirements for the mandatory application of IFRS apply

Variants	Number of Jurisdictions	% of jurisdictions
The requirements for the mandatory application of IFRS apply to all foreign listed entities	141	83.93%
The requirements for the mandatory application of IFRS apply to certain foreign listed entities	4	2.38%
Data not available	23	13.69%
Total	168	100%

Source: IFRS Foundation: *Who Uses IFRS Accounting Standards*, <https://www.ifrs.org/use-around-the-world/use-of-ifrs-standards-by-jurisdiction/>, retrieved February, 2024

From Table 7, it can be concluded that the majority of jurisdictions require IFRS application for all entities within the jurisdiction. Specifically, 141 jurisdictions (83.93%) mandate IFRS for all entities. In four jurisdictions (2.38%), IFRS is mandatory only for certain foreign listed entities. In 23 jurisdictions (13.69%), the data is not available because these jurisdictions either lack a financial market or prohibit the application of IFRS. Examples of jurisdictions where IFRS is mandatory for specific entities include Argentina, where all entities except banks and insurance companies must use IFRS; Bolivia, where foreign subsidiaries listed on the stock exchange must apply IFRS; Canada, where all foreign listed companies must use IFRS unless they are listed on a U.S. stock exchange (in which case they may use U.S. GAAP), or if their home jurisdiction's accounting standards are approved by Canadian regulators; and Japan, where IFRS is only allowed for foreign entities whose securities are traded on the secondary financial market.

Conclusion

This paper's research covered 168 jurisdiction profiles from the IFRS Foundation's website, focusing on the application of IFRS in listed companies. The findings highlighted significant variations in IFRS application for domestic and foreign listed companies, with some entities applying IFRS voluntarily, while others are required to do so. Overall, IFRS application is predominantly mandated by regulators, with a smaller proportion of jurisdictions allowing or prohibiting their use. The study also examined the mandatory application of IFRS in preparing financial statements for domestic listed and unlisted entities, showing that IFRS is mostly required in both cases. However, the use of IFRS for individual financial statements of listed entities is less widespread than for consolidated financial statements (57.14% vs. 80.35%). Also, foreign listed entities are more likely to be required to use IFRS when their securities are traded on domestic financial markets.

The results of this paper offer several contributions and implications. Firstly, they enhance the understanding of IFRS, particularly its role in financial reporting for listed companies. The findings provide valuable theoretical insights into the application of IFRS in listed companies globally. Moreover, the research can assist financial, business, and economic analysts by offering data on the extent of IFRS obligation and prevalence across different jurisdictions, which can be useful in their own research. The practical implications extend to current and potential foreign investors, who may base their investment decisions on the prevalence of IFRS in the countries where companies operate. If a company does not apply IFRS or operates in a jurisdiction that prohibits IFRS, investors may choose to avoid investing in that company due to unfamiliarity with the national GAAP, which may require additional time and resources to analyse.

The research in this paper has certain limitations. Although the analysis was conducted on all jurisdictions whose profiles are presented on the IFRS Foundation's website, which do not represent all jurisdictions in the world, the study did not consider changes in the scope and various variations of IFRS application in these jurisdictions over time. Given the statement that the analysed jurisdiction profiles are those available on the IFRS Foundation website, another limitation of the research concerns the number of

analysed jurisdictions. This is because the total number of jurisdictions in the world was not analysed.

Future research on the global application of IFRS could focus on jurisdictions that do not apply IFRS and investigate the reasons behind this. Additionally, future studies should consider the dynamics of IFRS adoption, analysing changes in the extent of its implementation over time to identify countries' attitudes towards IFRS. Research could also expand to include entire jurisdiction profiles, rather than just the segment related to IFRS in listed entities. Furthermore, future studies should incorporate additional jurisdictions as data become available or if new jurisdiction profiles are added to the IFRS Foundation website.

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Determinants of financial performance: the case of companies from the former Yugoslavia region

Детерминанте финансијских перформанси: случај компанија држава бивше Југославије

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Abstract

Purpose: Profitability is one of the most critical performance indicators of a company and at the same time a very important indicator of importance to the rest of the key business indicators. The aim of this study is to examine the effects of key indicators on the level of profitability of selected companies.

Methodology: The study uses fixed and random effects models as well as a generalized least squares model to analyze panel data of 78 companies from various sectors of the economy, listed on the stock exchanges of former Yugoslavia. The empirical analysis covers the period from 2006 to 2022 and includes indicators of capital structure, liquidity, activity, size, and age of companies.

Findings: The main results indicate a statistically significant effect of indicators of capital structure and activity, while indicators of age and size also displayed significant effects.

Originality/value: The results help enrich the existing literature and refine the knowledge of financial managers in the region for a better understanding of the effects of specific indicators on company performance.

Practical implications – The results can be used by financial managers when constructing the financial mix of the company.

Limitations: The main limitations are the use of only microeconomic indicators in relation to the use of macroeconomic indicators, as well as the analysis of only the ex-Yu region.

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Keywords: Profitability, capital structure, panel data, Yugoslavian region

JEL classification: C23, G32

Сажетак

Циљ: Профитабилност је један од најважнијих показатеља перформанси предузећа и истовремено веома значајан индикатор у односу на остале кључне пословне показатеље. Циљ овог истраживања је да испита утицаје кључних показатеља на ниво профитабилности одабраних предузећа.

Методологија У истраживању су коришћени модели фиксних и случајних ефеката, као и модел генерализованих најмањих квадрата, за анализу панел података 78 предузећа из различитих сектора привреде, која су листирана на берзама бивше Југославије. Емпијска анализа обухвата период од 2006. до 2022. године и укључује показатеље структуре капитала, ликвидности, активности, величине и старости предузећа.

Резултати: Главни налази указују на статистички значајан утицај показатеља структуре капитала и активности, док су показатељи старости и величине такође показали значајне ефекте.

Оригиналност/вредност: Добијени резултати доприносе обогаћивању постојеће литературе и унапређују знање финансијских менаџера у региону, омогућавајући боље разумевање утицаја специфичних показатеља на перформансе предузећа.

Практична примена - Резултати се могу користити од стране финансијских менаџера приликом креирања финансијског микса предузећа.

Ограничења истраживања: Главна ограничења односе се на коришћење искључиво микроекономских показатеља, уместо макроекономских, као и на анализу ограничену на подручје бивше Југославије.

Кључне речи: Профитабилност, структура капитала, панел подаци, Југословенски регион

ЈЕЛ класификација: C23, G32

Introduction

Financial indicators of a company's profitability represent very important information for its stakeholders. Increased profitability represents the starting point of successful performance of companies and entails the improvement of other business indicators depending on the efficiency of management and the financial policy of companies when distributing the achieved results. Given the evident effect of company's profitability on the improvement of other business segments, it is important to understand the effects of those indicators on the future profitability of companies, which is the goal of this study. Profitability refers to a company's capacity to create profit. Each economic entity aims to generate profit by adding value. Optimizing capital structure, company governance, and equity ownership can significantly improve performance (Georgakopoulos et. al., 2022). According to Blinch et al. (2011), a high rate of return allows for internal company capital to cover most funding demands. High profitability indicates favorable corporate prospects, which attract investors and lead to a growth in firm value. Increased earnings imply a company's successful performance (Husna & Satria, 2019). Profitability ratios assess how well a company's management generates profits from sales, total assets, and, most crucially, investors' investments. Profitability ratios are important for those who prioritize a company's long-term survival (Batchimeg, 2017). Investors value the return on their capital, and a successful company may provide significant long-term profits. Financial profitability benefits employees, improves product quality, and promotes environmentally sustainable manufacturing, more profits lead to more investment, job creation, and income growth overall (Mirza & Javed, 2013). A company's sustainability depends on its profitability.

Companies with low or fluctuating profitability raise concerns about their long-term viability. Profitability usually must be assessed with other criteria. The company's performance is impacted by internal and external variables, including incentives and restraints, as well as industry-specific conditions (Klapalová, 2015). Profitability indicators are closely monitored by managers, shareholders, investors, creditors, rivals, business partners, and other stakeholders to evaluate the company's performance and potential for growth (Wieczorek-Kosmala, Błach, & Gorzeń-Mitka, 2021). The profitability combined with other business indicators determines a company's creditworthiness assessment by banks and impacts banks' willingness to extend credit to a company, that is important for realization of future business plans and investments. Therefore, higher current profitability fosters future company's growth and profitability (Živković et al., 2023).

Most studies on the topic of company's performance relied on the structure-conduct-performance paradigm from industrial organization economics. This study followed a similar approach to research traditions that emphasize micro-level factors as predictors of company's profitability, which is a key dimension of performance. The managerial/entrepreneurial research tradition focuses on the company as the unit of analysis, whereas the economic research tradition focuses on the industry as the unit of analysis and explains profitability primarily through indirect structural factors (Pattitoni et al., 2014). Rizqia et al. (2013) suggested that a company's capacity to raise earnings while maintaining stability is a favorable indicator of its worth to investors. Company's increasing earnings indicate strong performance and attract investors to invest their funds.

This study consists of three main parts. The first part includes the theoretical aspect of the study, in which a review of the existing literature in the field of determinants of performance companies, analysis of the main findings in the field as well as setting of the main hypotheses of this research were carried out. The second part includes the methodology of the study, where an overview of the main variables used, an overview of data analysis methods, as well as the execution of the main model of the study are performed. The third and final part includes presenting the main results of the study and conducting an analysis of the results with previous findings from this area.

1. Theoretical background

An extensive literature supports research related to company performance indicators, and this section of the study will review the findings of studies related to this topic. A study by Stierwald (2010) pointed to the significance of firm-level characteristics and, to a smaller extent, the influence of sector characteristics. Vătavu (2014), in his study investigating companies listed on the Bucharest Stock Exchange, indicated the presence of a significant effect of determinants such as capital structure, tangibility of assets, company size, and liquidity level. A higher level of asset tangibility, debt, and liquidity indicated a negative effect on companies' returns, while an increase in company size indicated a positive effect, which confirmed similar findings (Onaolapo & Kajola, 2010). Contrary to the previous finding, a study conducted by Ebaid (2009) indicated a very weak, even non-existent relationship and effect of capital structure on the profitability of Egyptian non-financial

companies. A study by Batchimeg, (2017), researching Mongolian companies, found a presence of a negative influence of determinants such as short-term debt and cost to revenue, while earnings-per-share, return to costs, and growth in sales ratio presented a positive influence.

The study on listed firms in the United Kingdom discovered that while companies with more physical assets utilize a lot more debt in their capital structure, profitability dramatically lowers leverage. Leverage was positively impacted by firm size and non-debt tax shield in a statistically insignificant way. Although not by much, using more unique items lowers the amount of external debt. Age, growth, and capital spending had no discernible effects (Rahman, Hossain & Sen, 2024). A study by Mirza & Javed (2013) confirmed the existence of a negative relationship between profitability and both short-term and long-term debt. The same study confirmed a positive effect of size on the performance of companies listed on the Pakistani stock exchange. The study by Choi, Sauka & Lee (2024) revealed that in periods of economic stability, the capital structure decisions of a corporation are more impacted by internal variables such as profitability. Nonetheless, it was shown that external macroeconomic market circumstances often have a bigger influence on these choices during times of economic downturn.

Researching a particular sector of industry, the study by Pjanić, Đaković & Kalaš (2023) found a negative influence of profitability on the capital structure of Serbian agricultural companies. The study by Ehiedu, & Priscilla (2022), investigating the Nigerian gas industry, showed that liquidity and leverage had a positive and significant influence on the profitability of companies. The influence of leverage was also confirmed by Thi Bui & Nguyen (2021) that investigated oil and gas companies from Vietnam. The US automotive industry study by Dsouza, Kayani & Nasserredine (2024) found that while sales growth, firm size, and the tangibility ratio had no discernible effects on any of the debt variables that represented capital structure, a company's profitability had a negative and significant impact on both the total debt ratio and short-term debt. The study by Tica, Đorđević & Saković (2023), covering the period of the pandemic and researching Bosnian companies from the manufacturing sector, revealed a negative but statistically significant influence of capital and asset structure on profitability. Dencic-Mihajlov, K. (2014), in her study investigating companies from the Serbian capital market, revealed a positive influence of both company size and liquidity on the profitability of companies. Researching the capital market of Croatia, Pervan, Pervan & Todoric (2012) found positive effects of age, size, and liquidity on the profitability of companies. Researching the hospitality sector in India, Soni, Arora, & Le (2022) revealed positive effects of indicators like liquidity, age, and net asset turnover on the profitability of companies, while size and solvency demonstrated negative effects. The results of the study by Agiomirgianakis, Voulgaris & Papadogonas (2006) showed the impact of the size, age, exports, capital structure, and profitability of the company on the growth and development of the company itself. The findings also indicated a significant relationship between age, size, exports, debt dependence, and profitability of Greek manufacturing companies.

The findings of these studies, as well as the nature of this study, point to the creation of the following hypotheses:

***Hypothesis 1:** Short-term debt has a significant negative effect on companies' performance.*

***Hypothesis 2:** Long-term debt has a significant negative effect on companies' performance.*

***Hypothesis 3:** Company size has a significant positive effect on a company's performance.*

***Hypothesis 4:** Company age has a significant positive effect on company's performance.*

***Hypothesis 5:** Liquidity has a significant positive effect on company's performance*

***Hypothesis 6:** Tangibility has a significant positive effect on company's performance.*

The study by Submitter et al. (2020) on Indonesian stock exchange businesses found a favorable correlation between firm value and factors such as growth, profitability, liquidity, tangible assets, audit committee, board size, and firm size. These findings demonstrated the importance of profitability in determining the total worth of the organization. A similar study, also researching Indonesian companies found a positive influence of profitability on company value overall (Indriyani, 2017). These studies are presented to illustrate the multitude of relationships affected by the profitability of one company. The studies (Markonah, Salim & Franciska, 2020; Igbinovia, & Ogbeide, 2019) also confirmed the presence of a positive influence of profitability on the overall value of the company, whereas the findings by Šepa, et al. (2024) showed a negative effect. Another study related to Indonesian listed companies found that macroeconomic factors had a more significant effect on company's profitability than microeconomic factors. The level of inflation and the level of capital market development in the country showed a negative effect on company profits, while size showed a positive effect, which is similar to previous findings in this area (Prasetyantoko & Rachmadi, 2008). Another study investigating companies listed on the Indonesian stock exchange indicated a relationship between liquidity and profitability where variables such as the size and the so-called market power of the company showed a significant positive effect. On the other hand, efficiency indicators did not show a statistically significant relationship (Lim & Rokhim, 2021). Regarding the influence of profitability on the efficiency of companies, the study by Alarussi (2021) indicated a positive influence on the profitability on the efficiency of Malaysian companies.

The study conducted by Machmud et al. (2024) showed the interrelation of profitability ratios and activity ratios in affecting the performance of companies. In particular asset turnover showed a positive influence on company's performance. The study by Youssef, Salloum & Al Sayah (2022), investigating UK small and medium size companies, indicated the significant effect of activity ratios on profitability. The study by Prahendratno (2023) revealed a positive influence of both asset turnover, inventory turnover, and receivables turnover, pointing to an increase in the efficiency of companies

listed on the Indonesian stock exchange. Similar findings were revealed by Dencic-Mihajlov, K. (2014) investigating the Serbian capital market. The findings of these studies, as well as the nature of this study, point to the creation of the following hypotheses:

Hypothesis 7: *Inventory turnover has a significant positive effect on companies' performance.*

Hypothesis 8: *Receivable turnover has a significant positive effect on companies' performance.*

3. Data and Methodology

The subject of this study is the analysis of the effects of selected microeconomic indicators on the profitability of companies listed on the stock exchanges of selected countries belonging to the former Yugoslavia. The study includes 78 companies and the analysis is based on panel data. Empirical research includes 964 observations and covers the period of analysis from 2006 to 2022. The dependent variable includes the indicator of return on assets, while the independent variables include indicators of the capital structure, i.e. short-term debt in relation to assets and long-term debt in relation to assets, company size, age of the company, tangibility of assets as well as activity indicators, i.e. inventory turnover and receivables turnover. The main goal of the study is to understand the direction of action of independent variables on the profitability of companies operating in several industry sectors using only company-specific variables. The authors determined that the use of a fixed effects model (FEM), random effects model (REM), or generalized least square (GLS) model would be most adequate to use to generate regression results, depending on the results of the diagnostic tests. The primary source of information was the financial reports of the companies obtained from the websites of the stock exchanges of the selected countries.

The table below shows the distribution of variables as well as calculation methods:

Table 1: Overview of used variables

Variables	Calculation	Source
Dependent		
ROA	Net profit/Total assets	Machmud, et al. (2024), Prahendratno (2023), Pervan, Pervan & Todoric (2012), Soni, Arora, & Le (2022)
Independent		
STD	Short-term debt/Total assets	Batchimeg (2017), Mirza & Javed (2013), Nunes & Serrasqueiro (2017)
LTD	Long-term debt/Total assets	Mirza & Javed (2013), Nunes & Serrasqueiro (2017)
LIQ	Current assets/Current liabilities	Vätavu (2014), Ehiedu & Priscilla (2022)

TAN	Tangible assets/Total assets	Vätavu (2014), Alathamneh et al. (2025), İltaş & Demirgüneş (2020)
SIZE	Logarithm of total assets	Vätavu (2014), Onaolapo & Kajola (2010)
AGE	Logarithm of age of companies	Soni, Arora & Le (2022)
INV	Cost of sold goods/Inventory	Machmud et al. (2024), Prahendratno (2023)
REC	Income from sales/Receivables	Youssef, Salloum & Al Sayah (2022), Prahendratno (2023)

Source: author's

As mentioned earlier, the sample consists of companies operating in several industry sectors. The table below shows a breakdown of the combined sectors as well as the percentage of participation of each sector in the total sample. This division was made for a better understanding of the interpretation of the main results of the study.

Table 2: Overview of industry sectors

Industry sector	Share
Manufacturing	29%
Transportation	16%
Pharmaceutical	10%
Construction	9%
Energy and oil	14%
Information and communication	13%
Retail	3%
Hospitality	6%

Source: author's

The panel data analysis uses various diagnostic tests to establish the validity of the selected data. The tests used are unit root tests such as Levin, Lin & Chu, Pesaran & Shin, Augmented Dickey-Fuller, and Phillips-Perron test. The variance inflation factor (VIF) test was used in conjunction with the correlation matrix to test the data for the presence of multicollinearity, while tests such as the Breusch-Pagan, Pesaran, and Hausman tests were performed to identify the presence of heteroscedasticity, cross-sectional dependence, and model adequacy. The most important part of the interpretation of the main sites is the use of the fixed, random effects model and the generalized least squares model. Based on the review of the variables used, the following model will be evaluated in this study:

$$ROA_{it} = \alpha + \beta_1 STD_{it} + \beta_2 LTD_{it} + \beta_3 LIQ_{it} + \beta_4 TAN_{it} + \beta_5 AGE_{it} + \beta_6 SIZE_{it} + \beta_7 INV_{it} + \beta_8 REC_{it} + u_{it} \quad (1)$$

where the abbreviations are as follows: i - company (i = 1,2,3..., n); t - year (t = 1,2,3); ROA – return on assets; STD –short-term debt; LTD – long-term debt; LIQ –

current liquidity; TAN – tangibility of assets; AGE – age of company; SIZE – size of company; INV – inventory turnover; REC – receivables turnover; u – error term.

4. Results and Discussion

In the first part of this section, the authors with the help of table no. 3 below show the key indicators of the descriptive statistics of the variables used in the study. The results indicate the largest size of the standard deviation indicator in the case of the stock exchange, liquidity, and company size indicators. The quotient of the standard deviation points to a larger distribution of indicator values around the mean value as well as the largest difference between the minimum and maximum values of the indicator. Precisely for those indicators, there is also a greater difference between the mean value and the median of the data. A high amount of the mean value of the liquidity indicator shows a relatively high level of liquidity of the selected companies together with higher levels of turnover coefficients, i.e. activities. A higher mean value of the inventory indicator points to a relatively fast turnover of the company's inventory, which can mainly be attributed to the more dominant share of companies from the manufacturing sector in the total sample.

Table 3: Descriptive statistics

Variables	Obs.	Mean	Median	Maximum	Minimum	Std. Dev.
ROA	964	0,032735	0,026877	2,694951	-0,599500	0,113598
STD	964	0,272803	0,206611	1,332369	0,000182	0,232132
LTD	964	0,118245	0,049905	4,035068	0,000000	0,198790
LIQ	964	6,976801	1,604155	3773,103	0,016566	121,5855
AGE	964	3,596590	3,806662	5,062595	0,000000	0,805958
SIZE	964	13,04007	14,19749	23,83842	3,852419	6,242738
TAN	964	0,543428	0,529541	9,702686	0,000000	0,488302
INV	964	35,23976	1,151722	4253,335	0,000000	247,7966
REC	964	8,296562	4,633843	237,8338	0,000000	18,20295

Source: author's calculation

Criteria that must be met for obtaining a valid regression model are the absence of multicollinearity of independent variables as well as the presence of stationarity of the data used. The table below shows the results of the Variance inflation factor (VIF) test, which indicates the absence of multicollinearity in the data because the average value of the coefficient does not exceed a value of 10.

Table 4: VIF test

Variable	Coef. Variance	Uncentered VIF	Centered VIF
STD	0,0002	2,7617	1,1591
LTD	0,0003	1,7007	1,2559

LIQ	0,0000	1,0095	1,0061
AGE	0,0000	21,8550	1,0440
SIZE	0,0000	6,7340	1,2545
TAN	0,0000	2,7768	1,2398
REC	0,0000	1,2338	1,0214
INV	0,0000	1,0321	1,0116
Average			1,1241

Source: author's calculation

Unit root tests to establish the stationarity of the data is also required to perform a valid model. In this study, tests like Levin, Lin & Chu, Pesaran and Shin, Augmented Dickey-Fuller, and Phillips-Perron were conducted. The results indicated the stationarity of all dependent and independent variables at the level. This conclusion serves as the basis for subsequent diagnostic tests. As mentioned earlier, the analysis covers the period from 2006 to 2022 and a panel data set of 77 companies. In order to conduct the empirical part of the research, fixed (FEM) and random effects (REM) models were used, as well as the generalized least squares (GLS) model. Before obtaining the results, it was necessary to conduct adequate diagnostic tests in order to establish the adequacy of the data used. The diagnostic tests employed include the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity, the Pesaran test of cross-sectional dependence, and the Hausman test for selection between fixed and random effects models. The first test that was performed was the Hausman test, while the following tests were performed to select between the generalized least squares (GLS) model or the selected more adequate static model. The results indicated a greater adequacy of the random effects model (REM) in the case of static models, while the results of the heteroskedasticity test indicated the heteroskedasticity in the data. The results of the Pesaran CD test indicated the cross-sectional data dependence, which, together with the data heteroscedasticity, supported the selection of the generalized least squares (GLS) model for the interpretation of results due to its higher precision of regression results in the presence of data heteroskedasticity and cross-sectional data dependence compared to the fixed and random effects model.

Table 5: Diagnostic tests

Test	Test statistics	P-value
Hausman test	6,62	0,5783
Breusch-Pagan / Cook-Weisberg test	332,29	0,0000
Pesaran CD test	2,20	0,0278

Source: author's calculation

Table no. 6 below shows the results of all three types of models used. It was previously established that the most adequate interpretation of the results is shown by the use of the generalized least squares (GLS) model. The results indicated a statistically significant effect of capital structure indicators, i.e. both short-term debt and long-term debt. Also, the activity indicator of inventory turnover revealed a statistically significant

effect together with the variables of company size, age, and tangibility. The liquidity indicator did not show any statistically significant impact.

Table 6: Regression analysis

Variables	FE Model		RE Model		GLS Model	
	Coefficient	Prob,	Coefficient	Prob,	Coefficient	Prob,
STD	-0,0338*	0,0701	-0,0351**	0,0369	-0,0429***	0,0000
LTD	0,2492***	0,0000	0,2359***	0,0000	0,0331***	0,0022
LIQ	0,00001	0,5817	0,00001	0,6057	-0,000007	0,407
AGE	0,0185	0,1129	0,0198***	0,0036	0,0085***	0,0000
SIZE	0,0008	0,8144	-0,00008	0,9396	-0,0007***	0,0024
TAN	0,0967***	0,0000	0,0956***	0,0000	0,0093**	0,0503
INV	-0,000009	0,4784	-0,00001	0,3016	-0,00002***	0,0002
REC	0,00004	0,8146	0,00008	0,6115	0,00006	0,1727
C	-0,1172**	0,0430	-0,1065***	0,0003	0,0084	0,3259
R-squared	0,5776		0,4186		0,2848	
Prob(F-statistic)	0,0000		0,0000		0,0000	

Source: author's calculation

Observing first the effect of capital structure indicators on profitability, it is noticeable that the level of short-term debt showed a negative effect, while the level of long-term debt showed a positive effect with a significance of 1%. The results show that a 1% increase in short-term debt causes a 0.04% decrease in return on assets (ROA), while a 1% increase in long-term debt contributes to a 0.03% increase in return on assets (ROA). These results are in direct contrast to the findings of a previous study conducted by Abor, J. (2005), which showed a positive effect of short-term debt, while long-term debt showed a negative effect on company performance in Ghana. The findings of this study point to the conclusion that the increased level of short-term lending in the example of the selected companies contributes to the decrease in profitability, which can be attributed to the nature of short-term lending in the change of interest costs when refinancing them. Although looking absolutely at short-term and long-term debt, long-term debt represents a more expensive alternative, the positive effect of long-term borrowing in the example of this research can also be attributed to its nature of constancy and absence of frequent changes in interest costs. The study by Đaković, Kalaš & Indić (2024) found that profitability negatively affected the short-term debt of companies listed on the Belgrade stock exchange which alongside the findings of this study, further points to the existence of mutual influence of these two indicators. These findings point to the conclusion to accept hypothesis no. 1 and reject hypothesis no. 2 regarding short-term and long-term debt.

The age of companies is indicative of a positive effect at the significance level of 1%. The results suggest that for a 1% increase in age, companies achieve a 0.008% increase in profitability, indicating that the older companies are, the more they typically increase their profit levels, similar to the findings of Pervan, Pervan & Todoric (2012). The reason

for this conclusion can be attributed to the management's success in improving the efficiency of business cost control over time. The indicator of company size showed a negative effect on the level of profitability of companies similar to the findings of Vuković, et al. (2020), where an increase in company size by 1% causes a decrease in profit by 0.0007%. A statistically significant effect was observed, however it was not very large in terms of change in companies' profitability. It can be concluded that as the company becomes bigger, there may be a slight drop in the level of profitability. This study did not reveal any presence of a significant effect of liquidity on the profitability of companies, similar to the findings of Murthy, Vrramakrishna & Naik (2022), but contrary to (Ehiedu, 2014; Doğan, 2013). The findings of this study lead to the rejection of hypothesis no. 3, hypothesis no. 5, and the acceptance of hypothesis no. 4.

The indicator of the tangibility of assets showed a statistically significant positive effect, contradictory to the findings of (Burja C. 2011; Shah & Khan, 2007) but similar to Bhutta, & Hasan (2013), where the growth of tangibility of assets, i.e. the level of fixed assets in the company's assets by 1% causes an increase in the level of profitability by 0.009%. This effect, similar to the influence of the size of the company, does not cause an excessive change in the level of profitability, but the effect is significant at the level of 5%. The activity indicator that showed a statistically significant impact is the inventory turnover ratio, which indicated a negative effect on the level of profitability, contradictory to the findings from Prahendratno (2023) but similar to Goddard, Tavakoli & Wilson (2005). An increase in the turnover ratio by 1% causes a drop in profitability by 0.00002%. The significant effect of this indicator can be additionally explained by the majority participation of companies from the manufacturing sector in the sample. These findings lead to accepting hypothesis no. 6 but rejecting hypothesis no. 7 and hypothesis no. 8.

Conclusion

In this study, the focus is on examining the effect of certain firm-specific factors on the profitability of selected companies. Profitability is the primary focus of financial management, and understanding the interaction of performance indicators with other internal indicators is of great importance in creating adequate financial policies. The research covered the period from 2006 to 2022 and included companies from various industrial sectors, listed on the stock exchanges of the countries of the former Yugoslavia. The study was conducted with the aim of better understanding the factors that have a significant effect on profitability, as well as creating a basis for financial policymakers when making decisions that are important for the company's performance.

The theoretical and empirical part of the research represented the main division of this study, where the first part covered the main findings of similar research, on the basis of which the main hypotheses tested in the empirical part were derived. The main findings indicated a significant effect of the capital structure indicator, i.e. short-term debt and long-term debt as well as indicators of tangibility of assets, company age, company size, and inventory turnover indicators. Indicators of short-term debt, tangibility of assets, company size, and inventory turnover showed a negative effect, while indicators of long-term debt and age of companies showed a positive effect. The main limitations of this study are the

summary presentation of the results in relation to the separate division by country and industry sector and the individual presentation of the results. This type of research is proposed as a continuation of this study. It is also suggested to include certain macroeconomic factors in the analysis in order to understand the interaction of profitability with both firm-specific and external factors.

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Production-economic indicators of plum growing in the Republic of Serbia

Производно-економски показатељи узгоја шљиве у Републици Србији

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Abstract

Purpose: The aim of this paper is to analyze the trend of plum production in the Republic of Serbia in the period from 2014 to 2023, with a special focus on the dynamics of planted areas, total yield and yield per unit area. These parameters show the development of fruit growing and its economic importance for agriculture.

Methodology: the approach includes the analysis of official statistics and the application of comparative analysis to identify production trends in the plum sector, both at the national and global levels.

Findings: The research results indicate that the Republic of Serbia, with an average annual plum production of 441,420 tons, is positioned as the third largest producer globally, with a share of 3.86% in total world production. Within the structure of Serbian fruit production, plum occupies a dominant position - it is represented on 37.44% of the total area under fruit (behind apple as the leading fruit species in terms of production volume), while its share in total fruit production is 29.23%.

Originality/value: This paper contributes to a better understanding of plum production dynamics and its position in international competition, the identification of key factors influencing production outcomes, as well as proposals for measures to improve fruit production in Serbia.

Practical implications: It is relevant for experts, decision-makers, and producers in planning and developing the sector. From an economic perspective, it provides indicators for assessing the success and potential of plum production as a basis for long-term strategies.

Limitations: A limitation of this research is that it is based primarily on available official statistical data, without a more in-depth analysis of local specificities and individual production practices.

Keywords: Plum, production, yield, economic indicators, the measures to improve plum production.

JEL classification: Q100, Q110

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Сажетак

Циљ: Циљ овог рада је анализа кретања производње шљиве у Републици Србији у периоду од 2014. до 2023. године, са посебним освртом на динамику површина под засадима, укупан принос и принос по јединици површине. Ови параметри показују развој воћарства и његов економски значај за пољопривреду.

Методологија обухвата анализу званичних статистичких извора и примену компаративне анализе ради идентификације производних трендова у сектору шљиве, како на националном, тако и на глобалном нивоу.

Резултати: Резултати истраживања указују на то да се Република Србија, са просечном годишњом производњом шљиве од 441.420 тона, позиционира као трећи највећи произвођач на глобалном нивоу, са учешћем од 3,86% у укупној светској производњи. У оквиру структуре воћарства Србије, шљива заузима доминантну позицију – заступљена је на 37,44% укупних површина под воћем (иза јабуке као водеће воћне врсте по обиму производње), док њено учешће у укупној производњи воћа износи 29,23%.

Оригиналност/вредност: Овај рад доприноси бољем разумевању динамике производње шљива и њеног положаја у међународној конкуренцији, идентификацији кључних фактора који утичу на резултате производње, као и предлозима мера за унапређење воћарске производње у Србији.

Практична примена: Релевантан је за стручњаке, доносиоце одлука и произвођаче у планирању и развоју сектора. У економском смислу, пружа показатеље за оцену успешности и потенцијала производње шљива, као основу за дугорочне стратегије.

Ограничења истраживања: Ограничење овог истраживања огледа се у томе што је засновано првенствено на доступним званичним статистичким подацима, без дубље разраде локалних специфичности и индивидуалних произвођачких пракси.

Кључне речи: Шљива, производња, принос, економски индикатори, мере за унапређење производње шљиве

ЈЕЛ класификација: Q100, Q110

Introduction

The importance of the agricultural sector in the Republic of Serbia is commonly measured by indicators such as the sector's share in GDP, employment in agriculture, the gross value of agricultural production, and the value of agricultural exports. According to these indicators, agriculture represents a significant part of Serbia's economy, directly contributing about 6.5% to the GDP (Ševkušić et al, 2024). However, agriculture becomes far more significant when related activities are included. Compared to other countries in the Western Balkans, these indicators provide a clear insight into the relative importance of this sector and its role in the national economy (Dimitrijević et al, 2023). Fruit farming is a very important part of agriculture, with plum production holding a prominent place as one of the major branches. Fruit growing is an important branch of agriculture in the Republic of Serbia. Areas planted with orchards account for 5.2% of the total agricultural land in Serbia (Sredojević et al, 2024).

The subject of this paper is a detailed analysis of the production and economic indicators of plum cultivation in the Republic of Serbia during the period from 2014 to 2023. The aim is to identify key trends and factors affecting the productivity and economic sustainability of plum production through systematic collection and processing of relevant statistical data, as well as critical analysis of the literature. Furthermore, the paper seeks to evaluate the position and significance of this fruit crop within the national agricultural sector, with particular emphasis on its export potential and opportunities for improving

competitiveness in both domestic and international markets. The analysis of production and economic indicators enables a better understanding of trends in production, challenges, and sector potential, which is of crucial importance for making informed decisions in agricultural policy and planning. In a time of intense global competition, improving productivity and competitiveness in plum production contributes to sustainable development and increased economic stability for domestic producers. This paper provides a foundation for creating strategies that will support the development of this important agro-economic sector.

The structure of the paper is as follows: Section 1 provides a review of the relevant literature. Section 2 presents the data and research methodology. Section 3 discusses the results and provides an analysis. Finally, the paper concludes with key findings and offers recommendations for future research.

1. Literature Review

Plums represent a botanically diverse group of stone fruits, comprising up to 40 different species originating from Europe, Asia, and the Americas. The most commercially important species are the hexaploid European plum (*Prunus domestica*) and the diploid Japanese plums (*Prunus salicina* and *Prunus simonii*), all belonging to the genus *Prunus* within the family *Rosaceae* (Antanyiene et al, 2025). Plums have been cultivated worldwide for over 2,500 years (Duralija, 2002), and more than 6,000 cultivars are currently known (Milošević et al., 2021). The European plum (*Prunus domestica* L.), as the most significant species, was historically confined to Europe and Western Asia, but today it is grown globally due to its adaptability to various soil types and climatic conditions (Dimitrijević et al., 2022; Grujić & Nedeljković, 2023; Gazdić et al., 2024).

Stone fruits make up more than two thirds of fruit plantations in Serbia, and plums are the most dominant one (Milić et al, 2018). As the most important fruit species in Serbia (Matković, 2015; Subić et al, 2021), plums have a significant economic impact. Additionally, there is a long tradition and favorable agro-ecological conditions for the production of the plum in Serbia, making it an important national fruit (Keserović et al, 2017). When it comes to growing conditions, plums are well-suited to temperate-continental climate, and very adaptable to different climatic conditions. Plums can be grown at altitudes ranging from 200 m to 1,250 m, as well as on soils of different types (Tomić et al, 2006). However, it thrives best on terrains at an altitude of 200 m to 750 m and on deep, permeable soils, of easier mechanical composition, rich in phosphorus, potassium and humus, with a pH value in the range from 6.0 to 7.5.

Plum fruits have a refreshing, diuretic, energetic and anti-infective effect (Maglakelidze et al, 2017). They are rich in carbohydrates, organic acids, various minerals, vitamins and phenolic compounds (Molnar et al, 2016). Provitamin A and vitamins B and C are more significant vitamins found in plums (Blagojević and Božić, 2012). According to the authors Maglakelidze et al, 2017, plum has a higher vitamin content than pear, cherry, strawberry, raspberry, and apple, but lower energy value than grapes and cherries.

In villages, plums are used fresh and in the form of various products (dried plums, plum juice, compote, jam, brandy, etc.). In terms of nutritional value, the dried plum is the most important plum product (Mihailović, 2006; Kandić et al, 2007; Zlatanović 2017; Milatović et al, 2018; Nedeljković et al, 2024). About 65% of plums are used to manufacture plum brandy, 21% of plums are processed, 8% are used fresh, and only 2% are used for making plum jam (Lukač-Bulatović et al, 2017; Glišić et al., 2018). In Serbia, the most important plum varieties are Stanley, "Čačak beauty" and "Čačanska rodna", which represent about 65% of the production (Milošević et al, 2017). Many factors affect the economics of plum production, including key factors such as variety, microclimate parameters, agro-technical measures, production costs, and market prices, that should be optimized (Prodanović et al, 2017).

Although Serbian agricultural producers face strong competition, they have the ability to enter foreign markets, where higher-quality and more competitive products are needed. It is necessary to strengthen the sector's competitiveness through resource conservation, revitalization of cooperatives, and support for small farms (Aničić et al, 2025). The cost of establishing an orchard depends on numerous factors, including the area, type of plantation, cultivation system, variety, rootstock, and investment dynamics. The cultivation value of the orchard represents its initial value and serves as the basis for depreciation, which varies depending on the type of fruit crop and cultivation system. Estimating the value based on the total establishment costs is of great importance, especially in market-oriented operations (Lukač-Bulatović et al, 2024).

2. Data and Methodology

The research in the paper refers to the period 2014-2023. The databases of the Statistical Office of the Republic of Serbia (SORS) and the Food and Agriculture Organization of the United Nation (FAO) were used as data sources. Plum production in the world is shown through average production values in tons and average yield values expressed in t/ha, at the level of world production and for the top ten largest plum producers in the world. The evaluation of the statistical indicators of plum production in Serbia is given through the analysis of the areas under plum plantations expressed in ha, through the total production expressed in t and through the yield in t/ha. Standard indicators of descriptive statistics (average, standard deviation and coefficient of variation) were used.

The literature review included scientific and professional research papers that addressed the same or similar topics, with tables and graphs interpreting the data.

The main objective of the research in this paper is to examine the position of Serbia in global plum production. Additionally, tracking plum production throughout the Republic of Serbia and by region serves to emphasize how important it is to preserve this production for Serbian agriculture. In accordance with yield variations over the years, measures for its improvement are provided at the end of the paper.

3. Results and discussion

Plum production in the world

The average world production of plums for the period 2014-2023 was 11,914,111 tons (FAO). China dominates world production with 55.39% participation. Romania ranked second, with an average production of 621,562 t and a share of 5.22%. The Republic of Serbia ranks third with an average production of 460,025 tons, which is 3.86% of the total world production of plums. Chile, USA, Turkey, Iran, Italy, Ukraine, France, etc. follow in order of participation (Table 1).

Table 1: Average production/yield and share of leading plum producers worldwide in the period 2014–2023

Production (t)		Participation in production (%)	Yield (t/ha)
World (total)	11,914,111	100.00	
China	6,599,066	55.39	3.42
Romania	621,562	5.22	9.36
Serbia	460,025	3.86	5.82
Chile	370,764	3.11	22.06
USA	331,873	2.79	14.65
Turkey	306,533	2.57	13.82
Iran	305,981	2.57	16.86
Italy	194,710	1.63	15.71
Ukraine	181,886	1.53	10.13
France	178,600	1.50	11.61
Other countries	2,363,111	19.84	

Source: Authors' calculations based on the FAO database, 2024

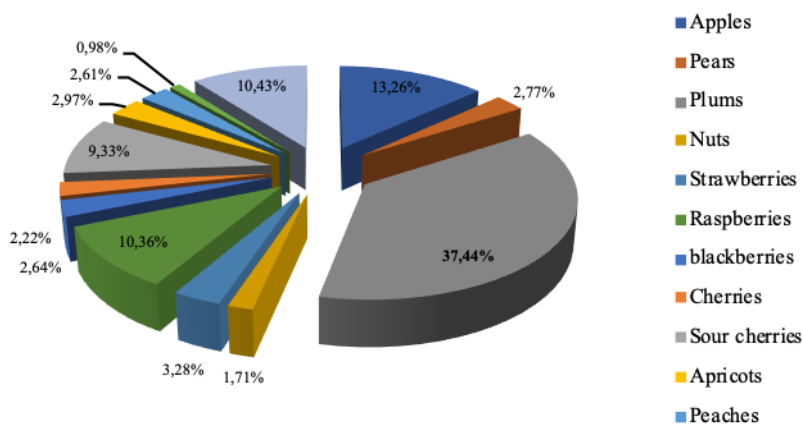
The highest yield is achieved by Chile with 22.06 t/ha, and the lowest by China with 3.42 t/ha. Serbia achieves an average yield of 5.82 t/ha (Table 1). Yield differences reflect the differences in production and application of agrotechnical measures. Several factors determine yield (certified and high-quality planting material, use of the necessary means of protection, application of adequate irrigation in terms of the type of system and adequate watering norms in combination with feeding, application of modern technologies in the process of growing plums). Within the European Union, agriculture is a long-term strategic priority, which is evidenced by consistent financial support and its priority placement in common policies. Analyzing agricultural performance in EU member states is crucial due to existing regional disparities and varying levels of sectoral development. One of the key objectives of the Common Agricultural Policy is to reduce these inequalities and to stimulate the overall growth of agricultural productivity across the Union (Rađenović et al, 2022).

Plum production in the Republic of Serbia

Serbian plums and their products, especially plum brandy (šljivovica), have long symbolized Serbia internationally, recognized for their high quality (Simonović, 2006).

According to the data of the Statistical Office of the Republic of Serbia, the average values for the examined ten-year period (2014–2023) show that the plum occupies the first place in terms of the area on which it is grown, which is 37.44%. It is followed by apples (13.26%), grapes (10.43%), raspberries (10.36%), cherries (9.33%), etc. (Figure 1). According to the total yield in t achieved in production, apples and plums are ranked first and second, respectively, while according to the average yield, with 6.1 t/ha, plums are at the seventh place, behind apples, pears, peaches, grapes, cherries and quinces (SORS).

Figure 1: Average prevalence in the Republic of Serbia in the period 2014–2023. yr (unit in %)



Source: Authors' calculation based on The Statistical Office of the Republic of Serbia, 2024

According to the Statistical Office of the Republic of Serbia, the average area of plum plantations in Serbia was 73,200 ha for the 2014–2023 period covered by this paper. The smallest area of 72,024 ha was recorded in 2017, while the largest area of 75,626 ha was recorded in 2014 (Table 2).

According to the base index calculated using 2014 as the base year, the area under plum plantations decreased when compared to the base year, but from 2020 the situation changes slightly and we see a slight increase in the area under plum plantations.

The largest areas under plum plantations are located in the region of Šumadija and Western Serbia, where plums are traditionally grown very successfully. This region's plum production areas account for 69.0% of areas under plum in Serbia as a whole. The region of Southern and Eastern Serbia participates with 23.5% with its production areas, the Belgrade region with 4.6% and the Vojvodina region with only 2.9%. The coefficient of variation ranges from 1.33% to 6.33%, so it can be concluded that the variability of the areas under plum plantations is very weak.

Table 2: Annual changes in areas devoted to plums in Serbia by region in the period 2014–2023 (unit in ha)

Years of research	SERBIA NORTH		SERBIA SOUTH		Republic of Serbia (TOTAL)	Base index (2014=100)
	Belgrade region	Region of Vojvodina	Region of Šumadija and Western Serbia	Region of Southern and Eastern Serbia		
2014	3,582	2,432	51,719	17,893	75,626	100.0
2015	3,367	2,316	50,973	17,516	74,172	98.1
2016	3,194	2,207	50,593	17,325	73,319	96.9
2017	3,182	2,181	49,773	16,888	72,024	95.2
2018	3,229	2,192	49,863	16,940	72,224	95.5
2019	3,313	2,168	49,908	16,927	72,316	95.6
2020	3,483	2,080	50,401	17,046	73,010	96.5
2021	3,372	2,046	50,188	16,963	72,569	96.0
2022	3,354	1,974	50,043	16,952	72,323	95.6
2023	3,366	1,985	51,596	17,471	74,418	98.4
Arithmetic mean	3,344	2,158	50,506	17,192	73,200	
Standard deviation	118.66	136.62	672.31	323.95	1124.65	
Coefficient of variation (%)	3.55	6.33	1.33	1.88	1.54	
Participation structure (%)	4.6	2.9	69.0	23.5	100.0	

Source: The Statistical Office of the Republic of Serbia, Statistical yearbooks, 2014–2023

Plum production in this period varied according to the volume of production. The largest production was achieved in 2020 (582,547 t), and the smallest in 2017 (330,582 t). The largest production takes place in the Region of Šumadija and Western Serbia, with a participation in the total production of 63.7%, while the smallest production is realized in the Belgrade Region with a participation of 5.7%. The region of Vojvodina has a smaller area under plum plantations compared to the Belgrade Region, but on that smaller area, greater production is achieved (Table 3). Plum production varies on an annual basis. The coefficient of variation ranges from 14.07% to 27.14%, so it can be concluded that the variability of plum production is relatively weak.

Table 3: Statistical indicators of plum production in Serbia by region in the period 2014–2023 (unit in tons)

Years of research	SERBIA NORTH		SERBIA SOUTH		Republic of Serbia (TOTAL)	Base index (2014=100)
	Belgrade region	Region of Vojvodina	Region of Šumadija and Western Serbia	Region of Southern and Eastern Serbia		
2014	28,781	37,992	249,027	105,729	421,529	100.0

2015	23,724	23,053	218,623	89,490	354,890	84.2
2016	30,161	33,776	278,464	129,041	471,442	111.8
2017	22,945	30,352	198,047	79,238	330,582	78.4
2018	25,829	32,816	267,665	103,890	430,199	102.1
2019	27,695	32,865	363,380	134,991	558,930	132.6
2020	28,254	28,619	388,894	136,780	582,547	138.2
2021	20,644	20,219	275,532	96,383	412,778	97.9
2022	25,195	18,644	329,683	115,071	488,593	115.9
2023	18,553	14,083	244,617	85,461	362,713	86.0
Arithmetic mean	25,178	27,242	281,393	107,607	441,420	
Standard deviation	3,543.74	7,392.34	58,419.44	19,704.99	80,100.73	
Coefficient of variation (%)	14.07	27.14	20.76	18.31	18.15	
Participation structure (%)	5.7	6.2	63.7	24.4	100.0	

Source: The Statistical Office of the Republic of Serbia, Statistical yearbooks, 2014–2023

Average yield of plums at the level of Serbia for the period 2014–2023 is 6.1 t/ha (Table 4), which is significantly below the maximum reproductive potential. In well-managed local plum plantations, yields range between 20 and 30 t/ha (Mišić, 2006).

Table 4: Statistical indicators of plum yields in Serbia by region in the period 2014–2023 (unit in t/ha)

Years of research	SERBIA NORTH		SERBIA SOUTH		Republic of Serbia (TOTAL)	Base index (2014=100)
	Belgrade region	Region of Vojvodina	Region of Šumadija and Western Serbia	Region of Southern and Eastern Serbia		
2014	8.0	15.6	4.8	5.9	5.6	100.0
2015	7.0	10.0	4.3	5.1	4.8	85.7
2016	9.4	15.3	5.5	7.4	6.4	114.3
2017	7.2	13.9	4.0	4.7	4.6	82.1
2018	8.0	15.0	5.4	6.1	6.0	107.1
2019	8.4	15.2	7.3	8.0	7.7	137.5
2020	8.1	13.8	7.7	8.0	8.0	142.9
2021	6.1	9.9	5.5	5.7	5.7	101.8
2022	7.5	9.4	6.6	6.8	6.8	121.4
2023	5.5	7.1	4.7	4.9	4.9	87.5
Arithmetic mean	7.5	12.5	5.6	6.3	6.1	
Standard deviation	1.08	2.94	1.19	1.17	1.12	
Coefficient of variation (%)	14.31	23.48	21.25	18.73	18.50	

Source: The Statistical Office of the Republic of Serbia, Statistical yearbooks, 2014–2023

The highest percentage values in the yield are shown in the territory of the Vojvodina Region (12.5 t/ha), followed by the Belgrade Region (7.5), Region of Southern and Eastern Serbia (6.3%), and Region of Šumadija and Western Serbia (5.6 t/ha). The coefficient of variation ranges from 14.31% to 23.48%, so it can be concluded that the variability of the plum yield is relatively weak.

Risks and threats in plum production and measures to improve production

In the production of plums there are certain risks or threats related to the following:

- dependence of production on the occurrence of droughts or frosts as extreme climatic conditions;
- fight against viruses due to the use of non-certified planting material;
- unstable and underdeveloped market;
- fierce export competition;
- mistrust of agricultural producers in accepting new production technologies and innovations, etc.

Accordingly, some of the measures to improve plum production in the Republic of Serbia should be:

- revitalization of old and planting of new plum plantations with certified planting material, high-yielding varieties that can achieve high and high-quality yields for the domestic and foreign markets;
- regionalization of fruit production, which would identify areas suitable for plum cultivation (Prodanović et al., 2017);
- improvement of plum cultivation technology, with the application of modern and innovative technologies;
- intensive involvement in the protection of plums from diseases and pests;
- association of plum producers and formation of purchase stations;
- stimulating agricultural producers with various agricultural policy measures through loans, incentives, etc.
- to the greatest extent possible implementation of scientific achievements, etc.

Conclusion

This paper made an analysis of plum production trends in the Republic of Serbia for the period 2014-2023. All relevant indicators and statistical data for the Republic of Serbia indicate a slight variation in production. Variations that occur in certain years can be linked to changing climatic conditions and unstable markets, both domestic and foreign. Based on research, the plum is the top-ranked fruit in Republic of Serbia by area 73,200 ha. The region of Šumadija and Western Serbia (69.0%) has the largest share of plum areas followed by the region of Southern and Eastern Serbia (23.5%), the Belgrade region (4.6%)

and finally the Vojvodina region (2.9%). The area variation coefficient ranges from 1.33% to 6.33%.

The average production of plums is 441,420 t, with a share of 63.7% in the region of Šumadija and Western Serbia, and the smallest share of 5.7% in the Belgrade region. The coefficient of variation ranges from 14.07% to 27.14%.

The average yield per unit area (6.1 t/ha) shows annual fluctuations and a downward trend, with a coefficient of variation by region ranging from 14.31% to 23.48%. The lowest yield per unit area was achieved in the region of Šumadija and Western Serbia (5.6 t/ha), while the highest yield was achieved in the region of Vojvodina (12.5 t/ha).

In order to encourage the production of plums in Serbia, it is necessary to revitalize the existing (old) plantations and raise new perennial plantations, which requires significant investments. Production needs to be improved on old plantations by implementing agrotechnical measures with more intensive application of modern, contemporary and innovative technologies, use of certified planting material, adaptation of production to market requirements (domestic and foreign), preparation of plum products, association of plum producers, product promotion, etc.

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Прегледни чланак
Review article

Low Code/No Code Software Development: Definition, Drivers, and Inhibitors

Low-Code/No-Code развој софтвера: дефиниција, покретачи и инхибитори

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Abstract

Purpose: Low Code and No Code refer to software development by end users with little or no IT background. The goal of the manuscript is to define this concept, as well as identify the drivers on one hand, and the limitations, challenges, and inhibitors on the other.

Methodology: In order to answer the previously posed research questions, a systematic literature review was conducted. The systematic review of the literature included three main steps: planning the review, conducting the review, and writing the report.

Findings: The paper presents various definitions of the LowCode/NoCode concept, as well as one general definition. It then lists the key drivers that lead to the increasing use of this concept in organizations. After that, the limitations, challenges, and inhibitors of Low Code/No Code software development are presented.

Originality/value: The paper provides a clear and systematic review of the LowCode/NoCode concepts in relation to three dimensions (definition, drivers, and limitations/challenges/inhibitors).

Practical implications - The results presented in the paper can be useful for both IT departments and business units as a starting point for establishing and managing LowCode/NoCode practices within an organization.

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Limitations: The systematic literature review included papers published in two citation databases and in English. Future research directions would focus on the empirical validation of specific drivers and limitations, challenges, and inhibitors from both business and IT users' perspectives.

Keywords: Low Code, No Code, Development, Citizen Development

JEL classification: M10, Z00

Сажетак

Циљ: Low Code and No Code представљају приступ развоју софтвера од стране крајњих корисника који нису ИТ стручњаци. Циљ рада је да дефинише овај концепт, као и да идентификује покретаче с једне стране и ограничења, изазове и препреке с друге.

Методологија Како би се одговорило на претходно постављена истраживачка питања, спроведен је систематски преглед литературе. Систематски преглед литературе обухвата три главна корака: планирање прегледа, спровођење прегледа и писање извештаја.

Резултати: Рад представља различите дефиниције концепта Low Code/No Code, као и једну општу дефиницију. Затим се наводе кључни покретачи који доводе до све веће употребе овог концепта у организацијама. Након тога, представљена су ограничења, изазови и препреке Low Code/No Code софтверског развоја.

Оригиналност/вредност – Рад пружа јасан и систематичан преглед концепата Low Code/No Code у односу на три димензије: дефиниција, покретачи и ограничења/изазови/препреке.

Практична примена – Резултати представљени у раду могу бити корисни како за ИТ одељења, тако и за пословне јединице као полазна тачка за успостављање и управљање Low Code/No Code праксама у оквиру организације.

Ограничења истраживања: Систематски преглед литературе обухватио је само радове објављене у две цитатне базе података и на енглеском језику. Будући правци истраживања били би усмерени на емпиријску валидацију одређених покретача и ограничења, изазова и препрека из перспективе како пословних, тако и ИТ корисника.

Кључне речи: Low Code, No Code, развој софтвера, развој софтвера од стране крајњих корисника.

ЈЕЛ класификација: M10, Z00

Introduction

The digital transformation of organizations is an inevitable process that has affected almost every organization, regardless of the activity it performs (Modupe, 2023; Popović, 2020; Ubiparipović et al., 2023). Consequently, organizations are in need of more software solutions that automate business processes (Binzer et al., 2024; Elshan et al., 2024; Prinz et al., 2024). It appears, however, that the number of required IT developers does not match the number of available ones (Biedova et al., 2024; Guthardt et al., 2024; Käss et al., 2023a, 2023b). In response, large software companies are increasingly promoting software development tools that end users without adequate IT skills can use (Sahay et al., 2020). Literature and practice refer to these platforms as Low Code/No Code (LCNC) platforms, and software as *Low Code/No Code development* (LCNCD). This concept is becoming increasingly popular in both academia and within the software industry (Pinho et al., 2023), as well as in non-IT organizations (Guthardt et al., 2024). The term low code/no code has become a new jargon in the software community (Rafiq et al., 2022) and is gaining importance and attracting the attention of many organizations (Luo et al., 2021; Overeem & Jansen, 2021). Although Low Code/No Code tools are capable of accelerating the digital

transformation (Martinez et al., 2024), according to Kass et al. (2022) research in this area has just begun, and further research is needed.

In spite of the lack of a formal and clear definition of Low Code/No Code (LCNC) (Luo et al., 2021; Pinho et al., 2023), it is true that this type of software development has emerged as a relatively new, increasingly important, rapidly improving area of software development by end-user developers, with no manual coding necessary, making it easier to create business applications, and bypassing traditional IT bottlenecks (Beranic et al., 2020; Biedova et al., 2024; De Silva et al., 2024; Luo et al., 2021; Pinho et al., 2023; Rokis & Kirikova, 2022). This concept emerged in the early 2000s when drag-and-drop tools for web page development became available (Biedova et al., 2024). Furthermore, it is impossible to ignore the concepts that preceded and contributed to LCNC development. In their literature review, Schenkenfelder and colleagues (2024) report that end user development (EUD) was introduced in the 1980s, while consulting firms coined the term Low Code development in 2014. The same authors state that LC platforms or services are usually cloud-based and focused on business processes, user interfaces, databases, web and mobile applications, and industrial applications. Di Ruscio et al. (2022) compare model driven engineering with low code development and point out that both approaches have similar goals, but with some differences, since not all model driven engineering techniques are aimed at reducing the amount of code, nor are all low-code approaches driven by models. According to the same authors, over the past few decades, several trends have been distinguished that attempted to reduce manual code writing, including 4GL and CASE tools in the 1980s, Rapid Application Development in the 1990s, End User Development a decade later, and Model Driven Development in the last two decades. There is also Shadow IT (Đorđević Milutinović et al., 2023; Raković, 2020; Raković et al., 2019; Rakovic et al., 2020a, 2020b; Raković et al., 2020), which refers to IT activities that happen outside of the IT department's radar where end users create their software.

To drive their digital transformation initiatives, organizations are increasingly considering the use of LCNC platforms as a solution to the challenge of finding qualified IT professionals. LCNC is crucial for accelerating business software development (De Silva et al., 2024), as they enable end users to create their own custom applications (Pańkowska, 2024) for automating and redesigning specific business processes (Biedova et al., 2024). Elshan et al. (Binzer et al., 2024; Elshan et al., 2024) state that the terms Low Code and No Code are often used as synonyms, but they are not the same, since No Code tools allow tools to be developed without coding.

Citizen Development (CD) is a term closely related to low code/no code development. In fact, the proliferation of citizen development has actually been enabled by low-code/no-code tools. The literature often refers to end users who develop their own applications as Citizen Developers (CD) (Biedova et al., 2024; Overeem & Jansen, 2021). CDs represent developers who have domain knowledge but limited programming skills (Mottu & Sunyé, 2024).

By enabling organizations to develop business applications with minimal training, LCDP tools democratize software development (Binzer et al., 2024; Guthardt et al., 2024). Although LCNC tools are designed for end users, certain IT skills are required to use them, i.e., IT knowledge (Rokis & Kirikova, 2023) is necessary to use these tools to their full potential. As a new, young workforce emerges that is technologically savvy and so to speak digitally native, these qualifications become less relevant (Elshan et al., 2024).

In response to the pressure of accelerated software development within budget constraints, an increasing number of organizations are embracing low code software development. According to Viljoen et al. (2023), a recent trend in software development is to become more abstract, simple, and accessible. Yet, there is a lack of empirical research and a deeper understanding of drivers and inhibitors affecting LCNC development (Käss et al., 2023b).

It is evident that this concept is becoming more popular due to the growing number of LCNC tools available on the market, and by the large IT players offering LCNC solutions, like Google, Microsoft, Amazon, Medix, Outsystems, etc. (Di Ruscio et al., 2022; Di Ruscio et al., 2022; Luo et al., 2021). Although it is difficult to compare LCNC platforms from different manufacturers, according to Phalake et al. (2024) the most popular Low Code Development Platforms (LCDP) available in the market are Mendix, Outsystem, Appians, Salesforce, Quickbase, Microsoft Power Apps and PEGA. When it comes to the Gartner Magic Quadrant for Enterprise LC Application Platforms, there are five organizations – OutSystems, Mendix, Microsoft Power Apps, Salesforce and ServiceNow – with strong capabilities in LCNC development (De Silva et al., 2024). Based on a survey of IT professionals, De Silva et al. (2024) found that Microsoft Power apps was the most commonly used LCNC platform, thanks to its impressive features such as speed, simplicity, mobile compatibility, and cost-effectiveness. In fact, Microsoft was among the first to take LCDP trends seriously and released the Power Apps platform in November 2016 (Di Ruscio et al., 2022). In January 2020, Google acquired LCDP APP Sheet and made its flagship low-code solution, while in June 2020, Amazon launched Honeycode LCDP for web and mobile application development (Di Ruscio et al., 2022). Interestingly, LC development has grown dramatically in recent years, so that it was used by less than 25% of organizations in 2020, increased to 36% the next year, and is expected to reach 70% in 2025 (Kass et al., 2022). One example of this software is Robotic Process Automation (RPA) software (Horvat et al., 2024).

Accordingly, and considering the relative novelty of the LCNC concept, three research questions were posed: RQ1: How is LCNC development defined; RQ2: What are the drivers of LCNC development, and RQ3: What are the inhibitors/challenges/limitations of LCNC development.

1. Methodology

A systematic literature review was performed to answer the previously posed research questions. This systematic literature review was conducted based on the methodology set forth by Xiao and Watson (2019) and Kitchenham and colleagues (Kitchenham, 2004;

Kitchenham et al., 2013). According to the aforementioned authors (Xiao & Watson, 2019), a successful review involves three major stages: planning the review, conducting the review, and reporting the review.

The first step, Planning the Review, establishes the objectives of the research, the citation bases that will be searched, the search keywords, as well as the criteria for inclusion and exclusion of papers. The research goals set based on the research questions are as follows:

- RG1: Identify the definitions of LCNC development;
- RG2: Identify the most important drivers of LCNC development; and
- RG3: Identify the most significant inhibitors/challenges/limitations of LCNC development.

For citation databases, Scopus and Web of Knowledge were chosen as the two largest databases. When searching the mentioned databases, the keywords used were “Low code” or “No code” development. The inclusion criterion must provide information to some extent on at least one of the research questions if the paper is to be included in the analysis. Among the exclusion criteria are the following: the paper is shorter than four pages, it is merely a research announcement, and it does not contribute to any of the set research goals.

Conducting the Review is the second phase of a systematic literature review. Initially, the Web of Knowledge and Scopus databases were searched using “Low code” or “No code” development keywords, followed by analysis of titles, abstracts, and keywords. A further analysis was conducted on those papers that, based on the analyzed parts, could contribute to the answer to at least one research question. Whenever the researchers were uncertain whether a paper was appropriate based on its title, abstract, or keywords, they selected it for analysis. In Table 1, the number of hits found during the primary search is shown along with the number of papers that were included in the next phase based on the initial analysis.

Table 1: Quantity of results after databases were searched by keywords

Citation database	Number of hits based on the keywords “Low code” or “No code” development	Number of papers included in second phase
Web of Knowledge	62	17
Scopus	295	43

Source: Authors' research in December 2024

In the next phase, duplicates were removed, and a unique list was created. A total of 35 papers remained after duplicates were removed, which were then downloaded in their entirety and analyzed further. Each paper was analyzed to determine if it could contribute to at least one research question. Among 35 papers, 24 can contribute to answering at least one of the three research questions. In Table 2, a list of papers with marks of usefulness is given according to the research questions. According to Figure 1, the selected papers are shown by the year of publication, indicating that the topic is very current, since the papers have been published in the last five years.

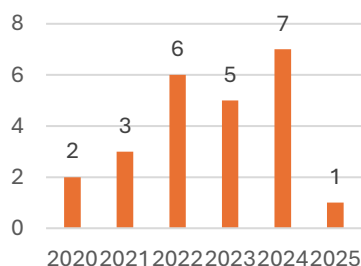
Table 2: Papers included in further analysis

Author(s)	Year	Title of the manuscript	A paper useful for a research purpose		
			Definition	Drivers	Inhibitors
Ajimati et al.	2025	Adoption of low-code and no-code development: A systematic literature review and future research agenda	✓	✓	✓
Binzer et al.	2024	Establishing a Low-Code/No-Code-Enabled Citizen Development Strategy	✓	✓	✓
De Silva et al.	2024	Role of Quality Assurance in Low-Code/No-Code Projects	✓	✓	✓
Elshan et al.	2024	Unveiling Challenges and Opportunities in Low Code Development Platforms: A StackOverflow Analysis		✓	✓
Martinez et al.	2024	Developing a novel application to digitalize and optimize construction operations using low-code technology		✓	✓
Mottu & Sunyé	2024	Emerging New Roles for Low-Code Software Development Platforms	✓	✓	✓
Pańkowska	2024	Low Code Development Cycle Investigation		✓	✓
Phalake et al.	2024	Optimization for achieving sustainability in low code development platform		✓	
Käss et al.	2023a	A Multiple Mini Case Study on the Adoption of Low Code Development Platforms in Work Systems		✓	✓
Käss et al.	2023b	Practitioners' Perceptions on the Adoption of Low Code Development Platforms		✓	✓
Martins et al.	2023	Combining low-code development with ChatGPT to novel no-code approaches: A focus-group study	✓		✓
Pinho et al.	2023	What about the usability in low-code platforms? A systematic literature review	✓		✓
Rokis & Kirikova	2023	Challenges of Low-Code/No-Code Software Development: A Literature Review	✓	✓	✓
Di Ruscio et al.	2022	Low-code development and model-driven engineering: Two sides of the same coin?		✓	✓
Gomes & Brito	2022	Low-Code Development Platforms: A Descriptive Study	✓	✓	✓
Kass et al.	2022	Drivers and Inhibitors of Low Code Development Platform Adoption		✓	✓
Rafiq et al.	2022	Understanding Low-Code or No-Code Adoption in Software Startups: Preliminary Results from a Comparative Case Study		✓	
Rokis & Kirikova	2022	Challenges of Low-Code/No-Code Software Development: A Literature Review	✓	✓	✓
Hintsch et al.	2021	Low-code development platform usage: Towards bringing		✓	✓

		citizen development and enterprise IT into harmony			
Luo et al.	2021	Characteristics and Challenges of Low-Code Development	✓	✓	✓
Overeem & Jansen	2021	Proposing a Framework for Impact Analysis for Low-Code Development Platforms	✓	✓	
Beranic et al.	2020	Adoption and Usability of Low-Code/ No-Code Development Tools	✓	✓	✓
Sahay et al.	2020	Supporting the understanding and comparison of low-code development platforms	✓	✓	✓

Source: Authors' research

Figure1: Number of papers by years



Source: Authors' research

2. Results

2.1. Defining LCNC development

Even though the term “Low Code/No Code” development has become a buzzword in recent years, there is no a definition that is accurate or uniquely accepted. There is no doubt that Low Code/No code definition will include software development by citizen developers with minimal need for coding, while No code will enable the same but without any coding necessary. It might be helpful to see how SAP (n.d.), one of the most successful companies in the production of business software, views this or rather these two concepts:

“Low-code is a method of designing and developing applications using intuitive graphical tools and embedded functionalities that reduce traditional – or pro-code –writing requirements. Pro-code writing is still part of the development process, but low-code development offers an augmented and simplified experience to help users start creating quickly.”

“No-code is a method that benefits from a similar user experience as low-code, but goes the extra mile by allowing non-technical business users to develop applications without having to write even a single line of code.”

Table 3 shows the definitions of Low code and/or No code platforms that were identified in the selected papers.

Table 3: Definitions of LCNC concept

Definitions	Source
“Low-code platforms are a type of software development tool which is used for software design and development. It is based on using a graphical user interface (GUI) and pre-built elements and components, such as user interfaces, business objects, data objects (e.g., tables), and other components.”	Martins et al., 2023
“LCNC development platforms are built on graphical user interface models that allow users to ‘drag and drop’ building blocks or visual diagrams in developing and deploying business applications.”	Ajimati et al., 2025
“Low-code/no-code platforms are powerful tools that enable “citizen developers”—employees with little or no IT background—to quickly create digital solutions.”	Binzer et al., 2024
“The low-code/no-code development approach is an important concept addressing current challenges in the software development.”	Beranic et al., 2020
“LCD to be an approach for software development that uses tools that minimise (or eliminate) the number of lines of code written. In addition, we consider they can be enterprise solutions, conversational assistants, and visual programming tools.”	Pinho et al., 2023
“A low-code development platform (LCDP) is designed for domain experts without IT skills, who want to build applications”	Mottu & Sunyé, 2024
“Low-code here means creating software with radically small amounts of code, or even without hand-coding.”	Luo et al., 2021
“Low-code software development is a development approach that enhances rapid, flexible, and iterative software development by enabling quick business requirements translation through visual programming with a graphical interface, visual abstraction, and minimal hand-coding; and involving practitioners with various backgrounds and software development experience.”	Rokis & Kirikova, 2023
“The surgency of terms like “low-code” or “no-code” are usually used when referring to platforms, applications, or products with a high-level programming abstraction, that are intended for end-user development (sometimes also called Citizen development) through Model-Driven Engineering (MDE) principles and that aim to serve as a tool for resolving prevailing challenges or for meeting new requirements.”	Gomes & Brito, 2022
“LCDPs enable citizen developers to develop increasingly complex software without formal software development training.”	Overeem & Jansen, 2021
“LC development employs a user-friendly visual interface, featuring drag-and-drop functionality and pre-built modules, offering developers a powerful tool for creating applications with a high degree of customization and flexibility.”	De Silva et al., 2024
“LCDPs allow end-users with no particular programming background (called citizen developers in the LCDP jargon) to contribute to software development processes, without sacrificing the productivity of professional developers.”	Sahay et al., 2020

Source: Authors' research

Based on the existing definitions, it can be concluded that the term Low Code/No code means platforms, applications, development and software products with a high level of abstraction. Platforms are tools tailored to end users, domain experts, often called citizen

developers, with no or limited IT software development background. No Code represents platforms, applications, and development without any hand coding, while Low Code works with less hand coding.

2.2. LCNC drivers

Table 4 shows the drivers of LCNC development. Luo et al. (2021) note that some developers find LCD platforms easier to learn and use than programming languages, while others say that the steep learning curve makes LCD platforms a bit difficult. Furthermore, some developers consider LC development to be more affordable while others consider it to be expensive. Additionally, some developers consider LC a user-friendly tool, while others believe it requires programming expertise. While advocates for LC development assert that it creates high-quality, secure, scalable, perfectly adaptable and sustainable applications, opposition contends that LC development creates hard-to-adjust, maintain, adapt, and correct applications. Hence, the perspective of the observer and probably the tools they use are crucial factors. Therefore, certain drivers can be inhibitors at the same time (Luo et al., 2021).

The drivers of LCNC development are numerous. It is often emphasized by LCNC manufacturers how easy and quick their tools make it to develop applications. According to Ajimati et al. (2025), technology such as LCNC platforms enables companies to automate their business processes and foster a culture of innovation and collaboration between their workforces. According to the same authors, adopting LCNC and CD practices raises awareness of digital literacy in the workplace, which in turn encourages employees to acquire new skills. This will allow employees to be more autonomous and less dependent on others (Ajimati et al., 2025).

As widely known, software development involves a number of phases, including analysis, design, coding, and testing. The development of each one requires an amount of time, which can be reduced by using LC development (Phalake et al., 2024). Pańkowska (2024) also argues that LC development can serve as a prototype for further professional development.

Through LCNC development, citizen developers are empowered to become creative, engaged, and flexible (Pańkowska, 2024) as well as to acquire new skills independently, which in turn influences the attraction of talent (Biedova et al., 2024). LCNC development can also greatly reduce the use of spreadsheet applications (Biedova et al., 2024) and other forms of Shadow IT, while simultaneously bridging the gap between business and IT professionals (Ajimati et al., 2025).

Table 4: Drivers of LCNC development

Drivers	Source
Acceleration of the development cycle (time based efficiency)	Ajimati et al., 2025; Beranic et al., 2020; Biedova et al., 2024; De Silva et al., 2024; Elshan et al., 2024; Gomes & Brito, 2022; Hintsch et al., 2021; Luo et al., 2021; Martinez et al., 2024; Mottu & Sunyé, 2024; Overeem & Jansen, 2021; Phalake et al., 2024; Rafiq et al., 2022; Rokis & Kirikova, 2022, 2023
Expected efficiency improvements, decreased costs	Ajimati et al., 2025; Biedova et al., 2024; Kass et al., 2022; Käss et al., 2023a; Luo et al., 2021; Rokis & Kirikova, 2022, 2023
Easy to develop application (Reduction of required knowledge for application development, Newbie friendly)	Ajimati et al., 2025; Biedova et al., 2024; Di Ruscio et al., 2022; Gomes & Brito, 2022; Kass et al., 2022; Käss et al., 2023b; Luo et al., 2021; Sahay et al., 2020
Higher quality of software products	Gomes & Brito, 2022; Luo et al., 2021; Rokis & Kirikova, 2022
Reduced dependency of IT development and application development delays	Biedova et al., 2024; Binzer et al., 2024; Kass et al., 2022; Käss et al., 2023b
Replacement/reduction/mitigation of shadow IT development	Käss et al., 2023a, 2023b; Rokis & Kirikova, 2023
Easy to learn, intuitive and simple user interface	Beranic et al., 2020; Luo et al., 2021
Increased responsiveness to business and market demands	Rokis & Kirikova, 2023
Easier maintenance/customization	Biedova et al., 2024; Gomes & Brito, 2022; Rokis & Kirikova, 2023
Encouraging closer collaboration between IT and business teams	Rokis & Kirikova, 2023
Promoting digital innovations, idea development	Ajimati et al., 2025; Rokis & Kirikova, 2023
Better user experience	Luo et al., 2021
Facilitated collection of user requests	Biedova et al., 2024
Development of employees' digital skills	Ajimati et al., 2025; Biedova et al., 2024

Source: Authors

2.3. LCNC limitations, challenges and inhibitors

LCNC development faces numerous challenges or inhibitors (Rokis & Kirikova, 2022). Ajimati et al. (2025) found lack of cultural solidarity, limited organizational-wide awareness and low understanding of benefits/challenges of LCNC development. According to the same authors, the development of LCNCs is often done without awareness of cyberattacks and network security, as well as without considering data protection, quality control, and maintenance (Ajimati et al., 2025). It is common for applications to be developed without considering possible negative impacts due to rapid implementation and a lack of experience

with security practices (Hintsch et al., 2021). This happens primarily because there are no rules, standards, guidelines or directives for citizen developers (Ajimati et al., 2025).

Although LCNCs are easy to use, there is still a learning curve involved (Biedova et al., 2024). Even though software companies claim that virtually any user, without a background in software development, can build an application, the reality is that citizen development still requires some level of technical literacy and a basic understanding of data modeling in order to deliver a functional digital solution (Martinez et al., 2024).

Fragmentation of platforms and vendor lock-in, that is dependency on LCNC tools manufacturers, are frequent challenges for LCNC (Ajimati et al., 2025). Furthermore, it is very difficult to identify key performance indicators and assess return on investment (Ajimati et al., 2025). Citizen developers often duplicate features and data from other applications or official IT systems (Hintsch et al., 2021). They also skip testing and documenting their software, which later negatively affects both the quality and the understanding of the software and its maintenance. It is almost impossible to build quality software without following a specific methodology, and according to Hintsch (Hintsch et al., 2021), developing a common methodology for the lifecycle of citizen development applications remains a challenge. Thus, the development of LCNC faces a number of limitations, challenges, and inhibitors. Based on the literature review, Table 5 shows the most significant ones (Hintsch et al., 2021).

Table 5: Limitations, challenges and inhibitors of LCNC development

Limitations, challenges and inhibitors	Source
Vendor lock-in/Third-party lock in (Dependence on platform vendors for software updates/security)	Ajimati et al., 2025; Biedova et al., 2024; Binzer et al., 2024; Di Ruscio et al., 2022; Kaess, 2022; Kass et al., 2022; Käss et al., 2023a, 2023b; Luo et al., 2021; Rokis & Kirikova, 2022, 2023; Sahay et al., 2020
Increased security, compliance and privacy risk (Data security breaches/cyberattacks, Shadow IT/non-compliance issues)/Security and data privacy concerns	Ajimati et al., 2025; Biedova et al., 2024; Hintsch et al., 2021; Kaess, 2022
Integration/Interoperability / Difficult to integrate to other systems	Elshan et al., 2024; Kass et al., 2022; Rokis & Kirikova, 2022; Sahay et al., 2020
Low scalability (Limited options for large scale computations/cloud resources)	Ajimati et al., 2025; Käss et al., 2023b; Rokis & Kirikova, 2022, 2023; Sahay et al., 2020
Selection of the platform	Rokis & Kirikova, 2022
Performance/Performance evaluation problem (Limited and inconsistent performance metrics)/Weaker performance	Ajimati et al., 2025; Beranic et al., 2020; Hintsch et al., 2021; Rokis & Kirikova, 2022, 2023
Lack of documentation	Biedova et al., 2024; Hintsch et al., 2021; Kass et al., 2022; Käss et al., 2023b; Martins et al., 2023
Limited testing and analysis support/ Citizen developers are not trained to test	De Silva et al., 2024; Hintsch et al., 2021; Rokis & Kirikova, 2022, 2023

Lack of flexibility and customization	De Silva et al., 2024; Kass et al., 2022; Käss et al., 2023b; Luo et al., 2021; Mottu & Sunyé, 2024; Rokis & Kirikova, 2022
Development knowledge gap (Lack of appropriate software skills)	Ajimati et al., 2025
No real ease of use/ A certain level of technical literacy and basic knowledge of data modeling is required / Need of basic programming knowledge	Gomes & Brito, 2022; Luo et al., 2021; Martinez et al., 2024
Lack of customization	Gomes & Brito, 2022
Duplication of features and data / Fear of island application landscape	Ajimati et al., 2025; Biedova et al., 2024; Hintsch et al., 2021; Käss et al., 2023b
Limited functionality of LCDPs / Limited freedom and creativity	Kass et al., 2022; Martins et al., 2023
Difficult estimation of total costs	Käss et al., 2023b
Lack of LCNC developers	Biedova et al., 2024; Käss et al., 2023b
Problem of IT Governance (Lack of rules/standards/guideline/directives - Knowledge integration/maintenance problems)	Ajimati et al., 2025; Kass et al., 2022; Käss et al., 2023b; Pańkowska, 2024; Sahay et al., 2020
Who is responsible for problems with LCD applications	Hintsch et al., 2021
Difficulty of maintenance and debugging	Elshan et al., 2024; Luo et al., 2021
Citizen developers engage in development, resulting in a loss of productivity	Biedova et al., 2024
Role conflicts and collaboration (Loss of control/reduced influence of IT professionals on business professionals)	Ajimati et al., 2025; Biedova et al., 2024
Lack of application development planning / Lack of strategic thinking about architecture	Ajimati et al., 2025; Biedova et al., 2024; Rokis & Kirikova, 2023
No access to source code	Rokis & Kirikova, 2022, 2023
Requirement Specification	Rokis & Kirikova, 2022
High prices	Luo et al., 2021
Insufficient transparency, platform capabilities are not understood by users	Pinho et al., 2023

Source: Authors' research

Conclusion and limitations

Digital workplace (Raković et al., 2022) cannot be imagined without tools that facilitate process transformation within organizations. As a result of their agility and ease of use, LCNC platforms (Martins et al., 2023) have become increasingly popular in both business and academia (Hagel et al., 2024). LCNC development is particularly interesting in domains that need to automate business processes, but practitioners have very different and conflicting

views on the advantages and disadvantages of this type of software development (Luo et al., 2021).

Although LCNC has been studied, Kass et al. (2022) call for further empirical research in order to fill the empirical gap. Furthermore, LCNC tool manufacturers promise significant improvements, but there is little evidence in the literature (Varajão et al., 2023). Varajão et al. (2023) wonder if this is just propaganda from LCNC development tool providers, because their advertisements seem too good to be true, and believe that it is important to distinguish between what is advertising and what is feasible.

According to Binzer et al. (2024), introducing and using LCNC tools requires a holistic strategy, since installing these platforms will not ensure success. Without a strategic approach, they can result in inefficiency, unachieved goals, and missed investments. There are many organizations without a strategy, and it is important to balance the autonomy of Central Development with centralized governance, which ensures that tools are adopted, integrated, and managed throughout the organization (Binzer et al., 2024). In some cases, low code/no code tool creators can mitigate certain challenges by improving documentation and instructions (Rokis & Kirikova, 2022).

Organizations should be very careful when choosing and adopting LCNC platforms. Most often, however, citizen developers make the decision to adopt LCNC on their own without consulting IT department (Biedova et al., 2024). As a result, citizen developers often make these decisions in a hurry, frustrated by the urgent need for certain applications to operate (Biedova et al., 2024).

Ajimati et al. (2025) advocate observing and managing LCNC development holistically, and evaluating contracts and platforms carefully to avoid vendor dependency and costs of switching to other platforms. The organization's current systems should also be considered when choosing platforms. Therefore, Microsoft Power is a good choice for organizations that have already implemented other Microsoft applications, but not for those that use other ecosystems (Binzer et al., 2024). In addition to the LCNC platform itself, it is important to consider whether citizen developers are developing scalable and durable LCNC applications (Viljoen et al., 2023). Naturally, citizen developers need to be supported by carefully chosen LCNC platforms and trained on how to use them (Biedova et al., 2024).

It is clear that the use of artificial intelligence will facilitate the easier and faster development of LCNC applications by citizen developers (Hagel et al., 2024; Martins et al., 2023). Furthermore, McHugh et al. (2024) emphasize the need to establish citizen development/LCNC programs in secondary schools in order to train as many users as possible for this method of software development.

LCNC application development is often found at the intersection of Shadow IT and End User Development. Shadow IT refers to the creation of applications without the knowledge of the IT department, so LCNC application development that is not approved by the IT department can also be considered as Shadow IT. On the other hand, End User Development refers to application development by users who do not have adequate IT

knowledge, so if users who engage in LCNC application development lack the necessary IT skills, they can be considered End User Developers.

Despite addressing the topics of definition, drivers, and inhibitors of LCNC development in detail, the paper has some limitations. A limitation of the study was that only two (albeit the largest) citation databases were investigated, along with the fact that the reviewed papers were published in English. Furthermore, the research results have not been practically confirmed. As a result, the following directions can be considered for future research: an analysis of papers published in journals and symposia indexed in other citation databases, and conducting case studies and surveying business and IT users.

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Ljubojević, T.K. (2000b).
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Strakić, F., & Mirković, D. (2006). The role of the user in the software development life cycle. *Management Information Systems*, 4(2), 60-72.

➔ Journal article, two authors, paginated by volume

Ljubojević, K., & Dimitrijević, M. (2007). Choosing your CRM strategy. *Strategic Management*, 15, 333-349.

➔ **Journal article, three to six authors, paginated by issue**

Jovanov, N., Boškov, T., & Strakić, F. (2007). Data warehouse architecture. *Management Information Systems*, 5(2), 41-49.

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➔ **Journal article, more than six authors, paginated by issue**

Ljubojević, K., Dimitrijević, M., Mirković, D., Tanasijević, V., Perić, O., Jovanov, N., et al. (2005). Putting the user at the center of software testing activity. *Management Information Systems*, 3(1), 99-106.

➔ **Journal article, more than six authors, paginated by volume**

Strakić, F., Mirković, D., Boškov, T., Ljubojević, K., Tanasijević, V., Dimitrijević, M., et al. (2003). Metadata in data warehouse. *Strategic Management*, 11, 122-132.

➔ **Magazine article**

Strakić, F. (2005, October 15). Remembering users with cookies. *IT Review*, 130, 20-21.

➔ **Newsletter article with author**

Dimitrijević, M. (2009, September). MySQL server, writing library files. *Computing News*, 57, 10-12.

➔ **Newsletter article without author**

VBScript with active server pages. (2009, September). *Computing News*, 57, 21-22.

B. Books, Brochures, Book Chapters, Encyclopedia Entries, And Book Reviews

Basic format for books

Author, A. A. (Year of publication). *Title of work: Capital letter also for subtitle*. Location: Publisher.

Note: "Location" always refers to the town/city, but you should also include the state/country if the town/city could be mistaken for one in another country.

➔ **Book, one author**

Ljubojević, K. (2005). *Prototyping the interface design*. Subotica: Faculty of Economics.

➔ **Book, one author, new edition**

Dimitrijević, M. (2007). *Customer relationship management* (6th ed.). Subotica: Faculty of Economics.

➔ **Book, two authors**

Ljubojević, K., Dimitrijević, M. (2007). *The enterprise knowledge portal and its architecture*. Subotica: Faculty of Economics.

➔ **Book, three to six authors**

Ljubojević, K., Dimitrijević, M., Mirković, D., Tanasijević, V., & Perić, O. (2006). *Importance of software testing*. Subotica: Faculty of Economics.

➔ **Book, more than six authors**

Mirković, D., Tanasijević, V., Perić, O., Jovanov, N., Boškov, T., Strakić, F., et al. (2007). *Supply chain management*. Subotica: Faculty of Economics.

➔ **Book, no author or editor**

Web user interface (10th ed.). (2003). Subotica: Faculty of Economics.

➔ **Group, corporate, or government author**

Statistical office of the Republic of Serbia. (1978). *Statistical abstract of the Republic of Serbia*. Belgrade: Ministry of community and social services.

➔ **Edited book**

Dimitrijević, M., & Tanasijević, V. (Eds.). (2004). *Data warehouse architecture*. Subotica: Faculty of Economics.

➔ **Chapter in an edited book**

Boškov, T., & Strakić, F. (2008). Bridging the gap: Complex adaptive knowledge management. In T. Boškov & V. Tanasijević (Eds.), *The enterprise knowledge portal and its architecture* (pp. 55-89). Subotica: Faculty of Economics.

➔ **Encyclopedia entry**

Mirković, D. (2006). History and the world of mathematicians. In *The new mathematics encyclopedia* (Vol. 56, pp. 23-45). Subotica: Faculty of Economics.

C. Unpublished Works

➔ **Paper presented at a meeting or a conference**

Ljubojević, K., Tanasijević, V., Dimitrijević, M. (2003). *Designing a web form without tables*. Paper presented at the annual meeting of the Serbian computer alliance, Beograd.

➔ Paper or manuscript

Boškov, T., Strakić, F., Ljubojević, K., Dimitrijević, M., & Perić, O. (2007. May). *First steps in visual basic for applications*. Unpublished paper, Faculty of Economics Subotica, Subotica.

➔ Doctoral dissertation

Strakić, F. (2000). *Managing network services: Managing DNS servers*. Unpublished doctoral dissertation, Faculty of Economics Subotica, Subotica.

➔ Master's thesis

Dimitrijević, M. (2003). *Structural modeling: Class and object diagrams*. Unpublished master's thesis, Faculty of Economics Subotica, Subotica.

D. Electronic Media

The same guidelines apply for online articles as for printed articles. All the information that the online host makes available must be listed, including an issue number in parentheses:

Author, A. A., & Author, B. B. (Publication date). Title of article. *Title of Online Periodical, volume number*(issue number if available). Retrieved from <http://www.anyaddress.com/full/url/>

➔ Article in an internet-only journal

Tanasijević, V. (2003, March). Putting the user at the center of software testing activity. *Strategic Management*, 8(4). Retrieved October 7, 2004, from www.ef.uns.ac.rs/sm2003

➔ Document from an organization

Faculty of Economics. (2008, March 5). *A new approach to CRM*. Retrieved July 25, 2008, from <http://www.ef.uns.ac.rs/papers/acrm.html>

➔ Article from an online periodical with DOI assigned

Jovanov, N., & Boškov, T. A PHP project test-driven end to end. *Management Information Systems*, 2(2), 45-54. doi: 10.1108/06070565717821898.

➔ Article from an online periodical without DOI assigned

Online journal articles without a DOI require a URL.

Author, A. A., & Author, B. B. (Publication date). Title of article. *Title of Journal, volume number*. Retrieved from <http://www.anyaddress.com/full/url/>

Jovanov, N., & Boškov, T. A PHP project test-driven end to end. *Management Information Systems*, 2(2), 45-54. Retrieved from <http://www.ef.uns.ac.rs/mis/TestDriven.html>.

2. Reference Quotations in the Text

➤ Quotations

If a work is directly quoted from, then the author, year of publication and the page reference (preceded by “p.”) must be included. The quotation is introduced with an introductory phrase including the author’s last name followed by publication date in parentheses.

According to Mirković (2001), “The use of data warehouses may be limited, especially if they contain confidential data” (p. 201).

Mirković (2001), found that “the use of data warehouses may be limited” (p. 201). What unexpected impact does this have on the range of availability?

If the author is not named in the introductory phrase, the author's last name, publication year, and the page number in parentheses must be placed at the end of the quotation, e.g.

He stated, “The use of data warehouses may be limited,” but he did not fully explain the possible impact (Mirković, 2001, p. 201).

➤ Summary or paraphrase

According to Mirković (1991), limitations on the use of databases can be external and software-based, or temporary and even discretion-based (p.201).

Limitations on the use of databases can be external and software-based, or temporary and even discretion-based (Mirković, 1991, p. 201).

➤ One author

Boškov (2005) compared the access range...

In an early study of access range (Boškov, 2005), it was found...

➤ When there are **two authors**, both names are always cited:

Another study (Mirković & Boškov, 2006) concluded that...

➤ If there are **three to five authors**, all authors must be cited the first time. For subsequent references, the first author’s name will cited, followed by “et al.”.

(Jovanov, Boškov, Perić, Boškov, & Strakić, 2004).

In subsequent citations, only the first author’s name is used, followed by “et al.” in the introductory phrase or in parentheses:

According to Jovanov et al. (2004), further occurrences of the phenomenon tend to receive a much wider media coverage.

Further occurrences of the phenomenon tend to receive a much wider media coverage (Jovanov et al., 2004).

In “et al.”, “et” is not followed by a full stop.

➤ Six or more authors

The first author's last name followed by "et al." is used in the introductory phrase or in parentheses:

Yossarian et al. (2004) argued that...

... not relevant (Yossarian et al., 2001).

➤ Unknown author

If the work does not have an author, the source is cited by its title in the introductory phrase, or the first 1-2 words are placed in the parentheses. Book and report titles must be italicized or underlined, while titles of articles and chapters are placed in quotation marks:

A similar survey was conducted on a number of organizations employing database managers ("Limiting database access", 2005).

If work (such as a newspaper editorial) has no author, the first few words of the title are cited, followed by the year:

("The Objectives of Access Delegation," 2007)

Note: In the rare cases when the word "Anonymous" is used for the author, it is treated as the author's name (Anonymous, 2008). The name Anonymous must then be used as the author in the reference list.

➤ Organization as an Author

If the author is an organization or a government agency, the organization must be mentioned in the introductory phrase or in the parenthetical citation the first time the source is cited:

According to the Statistical Office of the Republic of Serbia (1978), ...

Also, the full name of corporate authors must be listed in the first reference, with an abbreviation in brackets. The abbreviated name will then be used for subsequent references:

The overview is limited to towns with 10,000 inhabitants and up (Statistical Office of the Republic of Serbia [SORS], 1978).

The list does not include schools that were listed as closed down in the previous statistical overview (SORS, 1978).

➤ When citing **more than one reference from the same author**:

(Bezjak, 1999, 2002)

➤ When several **used works by the same author were published in the same year**, they must be cited adding a, b, c, and so on, to the publication date:

(Griffith, 2002a, 2002b, 2004)

➤ **Two or more works in the same parentheses**

When two or more works are cited parenthetically, they must be cited in the same order as they appear in the reference list, separated by a semicolon.

(Bezjak, 1999; Griffith, 2004)

➡ **Two or more works by the same author in the same year**

If two or more sources used in the submission were published by the same author in the same year, the entries in the reference list must be ordered using lower-case letters (a, b, c...) with the year. Lower-case letters will also be used with the year in the in-text citation as well:

Survey results published in Theissen (2004a) show that...

➡ **To credit an author for discovering a work**, when you have not read the original:

Bergson's research (as cited in Mirković & Boškov, 2006)...

Here, Mirković & Boškov (2006) will appear in the reference list, while Bergson will not.

➡ **When citing more than one author**, the authors must be listed alphabetically:

(Britten, 2001; Sturlasson, 2002; Wasserwandt, 1997)

➡ **When there is no publication date**:

(Hessenberg, n.d.)

➡ **Page numbers must always be given for quotations**:

(Mirković & Boškov, 2006, p.12)

Mirković & Boškov (2006, p. 12) propose the approach by which "the initial viewpoint...

➡ **Referring to a specific part of a work**:

(Theissen, 2004a, chap. 3)

(Keaton, 1997, pp. 85-94)

➡ **Personal communications, including interviews, letters, memos, e-mails, and telephone conversations**, are cited as below. (These are *not* included in the reference list.)

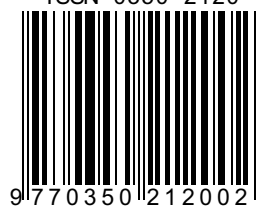
(K. Ljubojević, personal communication, May 5, 2008).

3. Footnotes and Endnotes

A few footnotes may be necessary when elaborating on an issue raised in the text, adding something that is in indirect connection, or providing supplementary technical information. Footnotes and endnotes are numbered with superscript Arabic numerals at the end of the sentence, like this.¹ Endnotes begin on a separate page, after the end of the text. However, journal **does not recommend the use of footnotes or endnotes**.



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