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Contact
Faculty of Economics University of Kragujevac,
Liceja Knezevine Srbije 3, 34000 Kragujevac, Serbia;
Tel. +381 34 303 507
www.horizonti.ekfak.kg.ac.rs horizonti@kg.ac.rs

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CONTENTS

Volume 26 Number 2 **May - August 2024**

Economic Horizons, May - August 2024, Volume 26, Number 2, 109 - 110
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EDITORIAL

Upon conducting the double-blind peer review process, the Issue 2 Volume 26 Year 24 of the *Economic Horizons* scientific journal contains four original scientific papers, two review papers, a review of the scientific conference and the Acknowledgement to the reviewers of the manuscripts submitted to the Editorial Board of the Journal in the year 2023.

The coauthors *Marsellisa Nindito, Ilya Afianti, Poppy Sofia Koeswayo* and *Nanny Dewi Tanzil* examine the influence of related-party transactions on financial statement frauds in publicly listed companies in Indonesia. Relying on the theoretical foundation of agency theory and the application of logistic regression in the analysis of a sample including 500 unit data of the companies listed on the Indonesian Stock-Exchange in the period from 2017 to 2019, the coauthors come to a conclusion that related-party transactions and institutional ownership significantly influence the probability that there will be frauds in relation to financial statements in Indonesia. Actually, institutional ownership can mitigate the influence of related-party transactions on the probability that there will be frauds of this kind. The research study provides useful pieces of evidence of the role played by related-party transactions and corporate management in giving shape to the quality of financial statements in emerging economies.

Starting from the attitude that there has been no completely clarified connection between exports and firm performance in the relevant literature, the coauthors *Milan Čupić* and *Stefan Vržina* investigate the connection between exports and the productivity and profitability of enterprises operating in Serbia. Confronting the learning hypothesis with the self-selection hypothesis and applying adequate econometric methods as well, the coauthors point to the fact that the connection between exports and productivity is statistically significant. This finding is robust to changes in the productivity measures and the sample size. The connection between exports and firm profitability is sensitive to changes in profitability measures. Also, the results obtained in the research study are more characteristic of the production sector. The paper highlights several reasons for the bad performances of Serbian exports and offers a few recommendations.

Pursuant to the results obtained in the previous research studies that have shown that intangible assets exert a positive effect on the profitability of a company in different contexts, the coauthors *Vladimir Dženopoljac, Amer Rastić* and *Aleksandra Dženopoljac* examine how intangible assets, measured by the value-added intellectual coefficient (VAIC), influence the margins and return indicators of the most profitable companies in Serbia. Using a data sample for the 72 most profitable companies that meet the VAIC criteria in the period from 2017 to 2020, the coauthors indicate the fact that intangible assets have a positive influence on all the four profitability indicators included, which implies that companies in Serbia should prioritize investment in intangible assets so as to increase their profitability and competitiveness.

The coauthours *Vladislav Radak, Aleksandar Damjanović, Vladimir Ranković* and *Mikica Drenovak* examine the efficiency of the strong Pareto optimum evolutionary algorithm as a technique of the genetic algorithm, for bank portfolio optimization when the expected (average) return and the percentage expected loss are set as the optimization goals. The results suggest that this technique offers well-distributed portfolios along the efficient frontier covering different risk levels. The coauthors also prove that the optimal portfolios obtained from the "average return – expected loss"

* *Correspondence to*: M. Jakšić, Faculty of Economics of Kragujevac University, Liceja Kneževine Srbije 3, 34000 Kragujevac, Republic of Serbia; e-mail: milenaj@kg.ac.rs

optimization are more superior throughout the efficient frontier in the average return – expected loss plain in comparison with those obtained through the "average return – value at risk" optimization. Simultaneously, the optimal portfolios obtained through the "average return – expected loss" optimization shown in the average return – value at risk plain converge towards the portfolios obtained on the basis of the "average return – value at risk" optimization and almost coincide with them for high levels of expected return.

Pursuant to the fact that the trade relations between Bosnia and Herzegovina and Hungary are not at the level that might be expected bearing in mind the size of and distance between these two countries, the coauthors *Marko* Đogo, *Dragan Gligorić* and *Marianne Berecz* apply the gravity model in order to examine the factors that affect both exports and imports. The results of the application of the basic variant of the gravity model (which only takes into consideration the size of the economy and the distance) reveal that these characteristics cannot account for the low trade volume between Bosnia and Herzegovina and Hungary. Bosnia and Herzegovina's international trade is significantly influenced by the fact that it was a member state of the Former Yugoslavia, which is indicative of the importance of historical, cultural and political ties. The results the study has come to, which on their part pertain to Bosnia and Herzegovina's ten most significant trading partners, also refer to the fact that the distance between major cities more strongly impacts exports than imports.

With the aim to investigate the socioeconomic dynamics of entrepreneurial and traditional employment in Hungary as the selected country of the so-called EU periphery, the author *Márton Gosztonyi* applies a series of econometric techniques to a set of data from the year 2022. Simultaneously also examining the manner in which individual self-perceptions and the local socioeconomic environment impact the employment types, the author points to the similarities and differences in that relation in different contexts. The basic conclusion of the research study implies that there are significant deviations in the manner in which entrepreneurs and the traditionally employed perceive local economies, trust in institutions and perceive their respective personal roles within the given economic system.

This Issue of the Journal contains a review of the international scientific conference entitled the *Global Strategic Communication Consortium 2024 Conclave*, which was submitted by *Marko Selaković, Nikolina Ljepava, Shannon A. Bowen, Yicheng Zhu, Elina Erzikova* and *Brett Robertson*. The Conference was organized by the University of South Carolina (USA) and held in Saint Petersburgh (Florida) from 10th to 13th March 2024.

Issue 2 Volume 26 Year 2024 contains the Acknowledgement to the reviewers of the manuscripts submitted to the Editorial Board of the Journal in 2023, of which those having positively been rated in the double-blind peer review process were published as the original scientific and review papers in the Issues 1, 2, and 3, Volume 25 Year 2023 of the Journal.

On behalf of the Editorial Board of the Journal and on my own behalf, I hereby express my gratitude to the authors of the contributions published in Issue 2 of the Journal. Simultaneously, our special gratitude goes to the reviewers whose constructive and critical comments and suggestions given to the authors of the submitted contributions have contributed to raising the level of the quality of the published papers.

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

Editor-in-Chief
Milena Jakšić

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

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AGENCY EFFECTS: RELATED-PARTY TRANSACTIONS, CORPORATE GOVERNANCE, AND FINANCIAL STATEMENT FRAUD IN INDONESIA

Marsellisa Nindito[1*], Ilya Afianti[2], Poppy Sofia Koeswayo[2] and Nanny Dewi Tanzil[2]

[1] *Universitas Negeri Jakarta, Indonesia*
[2] *Universitas Padjadjaran, Indonesia*

This study investigates the impact of related-party transactions on financial statement fraud in the Indonesian publicly listed firms grounded in agency theory. The research study is aimed at examining the need for good corporate governance in order to uphold reporting integrity. This research applies a quantitative approach and a sample of 500-unit data from the companies listed on the Indonesian Stock Exchange in the period from 2017 to 2019 is analyzed using logistic regression models. This study also utilizes moderating regression analysis so as to investigate the moderating roles of institutional ownership and independent commissioners in the research model. The study results have revealed that related-party transactions and institutional ownership significantly affect the likelihood of the financial statement fraud occurrence in Indonesia and that institutional ownership can moderate the impact of related-party transactions on the likelihood of the financial statement fraud occurrence. This study provides the empirical evidence on the role of related-party transactions and corporate governance in shaping the quality of financial statements in emerging economies.

Keywords: financial statement fraud, related-party transactions, institutional ownership, independent commissioners, agency theory

JEL Classification: M40, M41, M42, M48

INTRODUCTION

Recent academic discourse has emphasized the factors and mechanisms contributing to financial statement fraud in light of its increased prevalence. Financial statement fraud (FSF) has posed significant threats to business stakeholders. The ACFE reports (ACFE, 2022) concluded that the estimated average of a $593,000 loss had been caused by fraud in financial statements as the most costly fraud scheme. The size of the economic loss resulting from FSFs makes investors extremely cautious when placing their investments, which may affect capital market development. FSF implies dishonest and unethical

* *Correspondence to:* M. Nindito, Universitas Negeri Jakarta, Kampus A Rawamangun Muka, Jl Rawamangun Muka, Jakarta Timur, Indonesia;
e-mail: marsellisa.nindito@unj.ac.id

acts that may cause the stakeholders' loss of trust and may harm the company's sustainability efforts. When FSF occurs, the company is not the victim but rather an instrument of fraud. Company executives can easily override the company's internal control and conduct FSF. PricewaterhouseCoopers (2020) reported that an increase in fraud cases from 16% in 2016 to 24% in 2018 was due to the increased fraud committed by senior executives.

Several phenomenal FSF cases on a global scale, such as Enron, Adelphia, and Parmalat, have shown bad management practices under the company's executive authority which involves related-party transactions (RPTs) (Gordon, Henry, Louwers & Reed, 2007; Marchini, Mazza & Medioli, 2018). In Indonesia, the cases of RPT-related fraud have been done by Adaro Energy, Sun Prima Nusantara Finance, Hanson International, and the latest case was in 2023, Wijaya Karya, done to manipulate the company's operational performance for the benefit of the company's controlling parties. Those cases of RPT-related FSF have adversely affected stakeholders and snatched investors' confidence in the quality of financial reporting in Indonesia. Furthermore, it is estimated that 68.18% of the companies operating in the manufacturing industry have related-party transactions, which means that 105 out of 154 companies are involved in related-party transactions (Naibaho & Kusuma, 2019). Another prior research also mentioned that 90% of Indonesian-listed companies conduct many forms of RPT (Habib, Muhammadi & Jiang, 2017). Those cases and facts portray the interesting phenomena that urgently call for further investigation so as to understand the magnitude of how RPTs can cause FSF cases in the context of public companies in Indonesia.

As a significant concept within corporate governance, agency theory focuses on the relationship between a company's principals (shareholders) and its agents (managers or executives). According to that theory, modern corporations where ownership and management are separated from each other allow agents not to always act in the best interests of the principals, which results in agency issues. The framework is particularly relevant when examining aspects such as RPT, the role of institutional ownership, and independent commissioners may affect FSFs.

Previous research has indicated the fact that corporate governance effectively reduces managerial opportunism and improves the quality of corporate reporting (Chen, Firth, Gao & Rui, 2006; Nasir & Hashim, 2020). As a part of the Asian Roundtable on Corporate Governance (ARCG), a white paper on corporate governance in Asia was published in 2003 (Nasir & Hashim, 2020), including included a series of standard policies, objectives, and recommendations intended to improve governance controls in order to improve the quality of financial reporting and protect minority shareholders. Furthermore, A. R. H. Pratista (2019) emphasized the importance of good corporate governance in supervising RPT, which became the main priority in the corporate governance reform in Indonesia. Implementing corporate governance will maximize the managerial functions and increase investors' confidence in the company, thus ensuring efficient and effective management (Firmansyah, Pamungkas & Zainuddin, 2021).

Institutional ownership is a critical factor in corporate governance. Frauds, however, are attributed to institutional ownership, prompting companies to focus more on displaying profitable financial performance (Chen *et al*, 2006). Indonesia is an emerging country with concentrated stock ownership, low investor protection, and strong private control. Hence, in regard to the minority and majority interests of the company, the ownership structure has become a critical element of corporate governance in Indonesia from the point of view of agency theory.

Apart from institutional ownership, an independent commissioner is also considered to be the key element of corporate governance that may reduce the possibility of FSF occurrence (Dechow, Sloan & Sweeney, 1996; Nasir, Ali & Ahmed, 2019; Nasir & Hashim, 2020). Indonesia applies a two-tier board system in the company's corporate governance which separates the Board of Directors from the Doard of Commissioners. The Indonesian Financial Services Authority regulation no. IX.1.5 stipulates that independent commissioners are the members of Board of Commissioners that are not shareholders,

do not have any affiliations with the company and its management, and are not involved in any external activities which may create a conflict of interest. Previous research stated that weak corporate governance was characterized by fewer independent directors in the company (Beasley, 1996; Persons, 2005), whilst N. A. B. M. Nasir *et al* (2019) found that companies without fraud had stronger independent commissioners.

Although several previous studies consistently demonstrate the fact that RPTs are more prevalent in companies with weak governance, only few have examined whether RPTs relate to FSFs within the corporate governance framework, specifically when institutional ownership and independent commissioners are considered. Therefore, this study was conducted so as to address this research gap. The relationship between RPT, institutional ownership, and the presence of independent commissioners is crucial to the understanding and prevention of FSFs. The presence of institutional ownership and independent commissioners may provide a more practical setting for testing these competing views of RPT, as their impact may be more significant. This study aims to examine the impact of RPT and corporate governance on FSF in Indonesia as an emerging country. This study also examines how institutional ownership and independent commissioners can moderate the occurrence of the FSF caused by RPT. This study investigates the companies that are publicly listed on the Indonesian Stock Exchange in the period from 2017 to 2021. The study contributes to understanding the red flag of FSF and nuanced insights into agency theory, allowing for the structured examination of the relationships among stakeholders and the RPT characteristics that affect the likelihood of FSF.

The remainder of the paper is structured as follows: Section 2 reviews the relevant literature and develops the hypotheses, Section 3 describes the research design issues, and Section 4 describes the sample selection and the descriptive statistics. Furthermore, Section 5 provides the main test results, and Section 6 concludes the paper.

LITERATURE REVIEW

M. C. Jensen and W. H. Meckling (1976) define agency relations as a cooperation contract between principals and agents in order to carry out the company's activities. The conflicts of interest between the owner of the company and the management are sometimes encountered due to differences in goals between the parties. Company owners are interested in high return on their investment, whereas company management are looking for maximum bonuses for their efforts in managing the company. Management may be under pressure to conduct the company's activities according to the owner's expectations, which may lead to fraud, which is more likely to occur in the companies characterized by weak governance, as management have broad access to control and can override control to commit fraud (Cressey, 1953; Wolfe & Hermanson, 2004).

The ACFE (2022) defined FSF as the intentional misstatement of the company's financial condition, specifically the omission of the financial statement elements intended to deceive users in the form of misstatements, both over- and understatements. Z. Rezaee (2005) states that FSF was characterized by 1) false representation/misleading information, 2) inaccurate information, and 3) the involvement of directors and top management. FSF can also take the form of fictitious revenue, distinctive time differences, the concealment of liabilities and debts, an illicit disclosure, and undisclosed information (Rezaee, 2005; Hogan, Rezaee, Riley & Velury, 2008; Repousis, 2016; Habib & Hasan, 2017).

The Statement of the Financial Accounting Standard (PSAK) Number 7 that regulates RPT in Indonesia stated that RPT was closely related to a person or entity, which includes majority shareholders, an affiliation of majority shareholders, and another affiliated company (Jian, Wong & Jian, 2004). RPT enables the activity of channeling the assets of the company's majority shareholders, for example by supplementing cash compensation for CEOs and directors (Kohlbeck & Mayhew, 2017).

Based upon agency theory, J. Dahya, O. Dimitrov and J. J. McConnell (2008) argued that the conflict of interest between majority and minority shareholders with management may lead to opportunistic earnings manipulation in the form of RPT. The opportunistic motives of management may drive management to use their decision for their personal gain (Benedict, 2021). Managers can manipulate earnings by structuring transactions such as RPT in order to alter the company's financial statement (Hwang, Chiou & Wang, 2013). Furthermore, M. J. Kohlbeck and B. W. Mayhew (2017) stated that RPT problems occurred when management prioritized a profit. Y. L. Cheung, L. Jing, T. Lu, P. R. Rau and A. Stouraitis (2009) noted that controlling shareholders could use RPT as the tunnelling tool to expropriate funds for themselves (Siregar & Utama, 2008; Habib *et al*, 2017). The controlling shareholder may use RPT to exercise earnings management (Cheung *et al*, 2009; Jian & Wong, 2010).

M. J. Kohlbeck and B. W. Mayhew (2010) emphasized the fact that RPT affected the reliability of the financial statement in a way that reduced the effectiveness of contracts, reducing agency conflict. Thus, RPT may contribute to a more significant agency problem through higher equity and monitoring costs. Moreover, M. J. Kohlbeck and B. W. Mayhew (2010) stated that RPT could push a company to engage itself in accounting manipulations because they can be used to conceal the company's bad financial performance (Cheung *et al*, 2009) and as a potential method for achieving earnings targets (Habib *et al*, 2017). RPT is perceived as a high-risk factor that requires auditors to implement additional audit procedures to identify and document fraud risk (Gordon *et al*, 2007). RPTs are complex transactions that can increase the indication of FSF (Lou & Wang, 2009; Henry, Gordon, Reed & Louwers, 2012) and are one of the high-risk factors that may cause FSF in developing countries (Beasley, Carcello, Hermanson & Lapides, 2000). Since RPT must only be disclosed in the footnote, not in the Income Statement, opportunistic behavior can be concealed within a company. C. K. Lau and K. W. Ooi (2016) report that, between 1988 and 2012, public companies in Malaysia committed FSF by not disclosing RPT. Therefore, RPT is considered to be a red flag indicating fraud in financial statements. Therefore, the first hypothesis of this study reads as follows:

H1: RPT positively affects the FSF occurrence.

P. M. Dechow *et al* (1996) found that companies with weak governance have a higher fraud rate. In addition, J. T. Wells (2017) states that management and those in charge of governance are highly responsible for detecting and preventing fraud. Z. Rezaee (2005) points out the fact that good corporate governance must be applied for the company's financial reports to be reliable and credible.

From the point of view of agency theory, the ownership structure can cause the agency conflict type 2 in terms of the conflict between majority shareholders and minority shareholders. Institutional owners have a significant influence in the supervisory function in the company and set high expectations of management's financial performance, simultaneously applying external control of how management should operate so as to improve their performance (Shayan-Nia, Sinnadurai, Mohd-Sanusi & Hermawan, 2017).

M. A. Gulzar, J. Cherian, J. Hwang, Y. Jiang and M. S. Sial (2019) stated that institutional investors had a significant positive effect on profit manipulation. Institutional ownership encourages companies to increase their short-term profits, which may sacrifice their long-term profits. However, institutional owners are rational investors interested in long-term profit orientation (Shayan-Nia *et al*, 2017). The external supervision functions held by institutional owners may affect the opportunity for management to commit themselves to FSF (Lin, Wu, Fang & Wun, 2014; Ramos Montesdeoca, Sánchez Medina & Blázquez Santana, 2019). Therefore, these following hypotheses will be tested, namely:

H2a: Institutional ownership negatively affects the FSF occurrence.

H2b: Institutional ownership lowers the impact of RPT on the FSF occurrence.

The independent commissioners' role is crucial for aligning the interests of management with those

of shareholders, thus reducing agency conflicts. M. S. Beasley *et al* (2000) demonstrate the fact that the lower proportion of independent boards are seen in the companies that experience FSF, which impacts the effectiveness of management supervision in reducing the opportunistic behavior of management because, unlike internal supervisors, independent commissioners are not subject to the control and pressure of the company (Ramos Montesdeoca *et al*, 2019; Rostami & Rezaei, 2022). Consequently, the following hypotheses are proposed:

H3a: Independent commissioners negatively affect the FSF occurrence.

H3b: Independent commissioners lower the impact of RPT on the FSF occurrence.

RESEARCH METHOD AND DATA

FSF is calculated using the F-Score model by P. M. Dechow, W. Ge, C. R. Larson and R. G. Sloan (2011). The F-Score Dechow model is a model for assessing the level of risk or likelihood of fraud in financial statements by applying a methodology similar to M. D. Beneish's (Beneish, 1997, Beneish, 1999). However, the F-Score model is claimed to be a more comprehensive model compared to the Beneish M-Score model since it is formulated based on the examination of all the accounting and auditing enforcement releases issued by the Security Exchange Commission (SEC) between the years 1982 and 2005 (Aghghaleh, Mohamed & Rahmat, 2016). This model is also considered to be better to use in the context of developing countries, such as Indonesia (Aghghaleh *et al*, 2016; Nurcahyono, Hanum, Kristiana & Pamungkas, 2021). The F-Score model is built with the five dimensions: accrual quality, financial performance, non-financial measures, off-balance sheet activities, and market-related variables to detect misstatements in financial statements.

The F Score model is explained as follows:

Predicted Value = -7.893 + 0.790 * RSST + 2.518 * ΔREC + 1.191 * ΔINV + 1.979 * ΔSOFTASSETS + 0.171 * ΔCASHSALES – 0.932 * ΔROA + 1.029 * ISSUE

$$\text{probability} \frac{e^{(\text{predicted value})}}{(1+e^{(\text{predicted value})})}$$

Unconditional probability = 0.0037

$$\text{F Score} = \frac{probability}{unconditional\ probability} \quad (1)$$

If the F-Score value exceeds 1.00, it indicates a higher probability of misstatement than the unconditional expectation.

Below is the formula for each dimension calculation in the model:

$$\text{RSST} = \frac{(\Delta WC + \Delta NCO + \Delta FIN)}{Average\,Total\ Assets}$$

WC = [*Current Assets-Cash and Short-term Investment*]-[*Current Liabilities-Debt in Current Liabilities*]

NCO = [[*Total Assets-Current Assets-Investment and Advances*]-[*Total Liabilities-Current Liabilities-Long-erm Debt*]]

Fin = [*Short-term Investment + Long-term Investment*]-[*Long-term Debt + Debt in Current Liabilities+Preferred Stock*]

ΔREC = *Δ Account Receivables / Average Total Assets*

ΔINV = *Δ Inventory / Average Total Assets*

SOFTASSEST = [*Total Assets-PPE-Cash and Cash Eqivalents*] / *Total Asset*)

ΔCASHSALES = *Percentage change in cash sales* [*Sales - Δ Account Receivables*]

ΔROA = [*Earnings t / Average Total Assets t*]-[*Earnings t-1 / Average Total Assets t-1*]

ISSUE = *1 if securities are issued during the year t* (2)

Furthermore, this research uses abnormal sales RPT to measure the manipulation level of RPT per total net sales. The regression model is used in the calculation of the abnormal sales RPT.

$$Sales\ RPT\ ratio = 0i + \alpha\ 1\ (Size)\ i + \alpha\ 2\ (Lev)\ i + \alpha\ 3\ (growth)\ i + e \quad (3)$$

Abnormal Sales RPT = the value difference between the actual value with the prediction value of the regression model.

Institutional ownership (IO) is calculated by comparing the number of the shares institutional owners have with the total number of the outstanding shares. The independent commissioner (IND) is calculated as the percentage of the independent commissioners on the Board of Commissioners. The company size (SizeComp) and leverage (LEV) are the control variables in this research model, considering various characteristics of the companies included in the research sample. SizeComp is a logarithm natural of the company's total assets and LEV is the percentage of the total debt to the total assets.

The research sample is selected purposively following certain criteria, including the companies listed on the Indonesia Stock Exchange during the period from 2017 to 2021 in the sectors such as information technology, materials, real estate, industrials, communication services, consumer discretionary, and healthcare, the companies with the relevant data on the RPT, IO, IND and the complete data required for this study. Based on these criteria, a total of 100 companies were obtained as the research samples, resulting in 500 data units in the five years for further analysis. The data were obtained from Eikon Reuters, the Indonesian Stock Exchange Database, and the companies' websites.

Logistic regression analysis was used to analyze the data of this research that used the dummy variable measurement for its dependent variable (Ghozali, 2016). T-tests demonstrate how each independent variable affects the dependent variable individually. The t-test was also employed so as to determine how big an influence the independent variable has on the dependent variable individually, which was achieved by comparing the p-value in the Sig column of each independent variable based on the probability values with $\alpha = 0.05$.

RESULTS AND DISCUSSION

FSF is operationalized by using the dummy variables 0 and 1, where 0 indicates that no FSF has been detected, whereas 1 indicates that an FSF has been detected. The results show that 139 out of the 500 companies (27.8%) are classified as "1", and 361 of the 500 companies (72.2%) are classified as "0" (see Table 1). Thus, 139 companies are indicated as the companies committing to FSF. As shown in Table 2, the maximum value of the abnormal RPT is 4.112, which is held by a consumer discretionary company in 2020. Whilst the minimum value of -0.316 belongs to a communication service company in 2021. The maximum IO in the study was 100.00, and the smallest IO was 0.025. Averaging 75.453 points, this study illustrates that the firms are primarily owned by certain institutions and that they are relatively concentrated in ownership. Furthermore, the sample companies have an average IND proportion of 37%, meaning that they have met the minimum requirement of Article 6 POJK 55/2015, requiring at least 30% of IND in public companies.

Table 1 Frequency distribution – FSF

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	361	72.2	72.2	72.2
	1	139	27.8	27.8	100.0
	Total	500	100.0	100.0	

Source: Authors

Table 2 Descriptive statistics

	N	Min	Max	Mean	Std. Deviation
FSF	500	0	1	0.28	0.448
RPT	500	-0.316	4.112	0.000	0.394
IO	500	0.025	100.000	75.453	27.855
IND	500	0.167	0.800	0.396	0.101

SIZE	500	11.324	22.024	17.677	1.728
LEV	500	-27.560	76.353	0.959	4.282
IO*RPT	500	0.000	6.966	0.268	0.752
IND*RPT	500	0.000	6.470	0.242	0.590

Source: Authors

Table 3 shows that all the variables used have met the multicollinearity assumption since the correlation value is < 0.8 for each pair of correlations between variables.

Furthermore, a feasibility test of the logistic regression model was done using the Hosmer and Lemeshow Goodness of Fit, resulting in the statistical value of Chi-Square 14.38, and the Sig value 0.072. The Omnibus test is the test done for the fitness of the logistic regression model. Based on Table 5, the value of *Sig.* is 0.000 < a 0.05 significance level, so it can be concluded that the research model is fit. Moreover, in Table 6, the prediction accuracy 89% is considered as very good because it is in the 81% – 100% range. Moreover, Nagelkerke's R Square is 0.099. Based on these findings, the RPT, INDs, IOs, assets, and LEV explain almost 9.9% of the FSF, the remainder being explained by the other variables.

Table 4 The Hosmer and Lemeshow Test

Step	Chi-square	Df	Sig.
1	14.38	8	0.072

Source: Authors

Table 5 The Omnibus Tests of Model Coefficients

		Chi-square	Df	Sig.
Step 1	Step	86.66	7	0.00
	Block	86.66	7	0.00
	Model	86.66	7	0.00

Source: Authors

Table 3 The correlation matrix

		RPT	SIZE	LEV	IO	IND	IO*RPT	IND*RPT
RPT	Pearson Corr	1	0.005	0.057	-0.223**	-0.086	0.755**	0.535**
	Sig. (2-tailed)		0.919	0.260	0.000	0.090	0.000	0.000
	N	392	392	392	392	392	392	392
IO	Pearson Corr	-0.223**	0.115*	0.019	1	0.105*	-0.326**	-0.104*
	Sig. (2-tailed)	0.000	0.022	0.702		0.038	0.000	0.040
	N	392	392	392	392	392	392	392
IND	Pearson Corr	-0.086	0.106*	-0.011	0.105*	1	-0.076	0.313**
	Sig. (2-tailed)	0.090	0.036	0.825	0.038		0.132	0.000
	N	392	392	392	392	392	392	392
SIZE	Pearson Corr	0.005	1	0.101*	0.115*	0.106*	0.193**	0.335**
	Sig. (2-tailed)	0.919		0.045	0.022	0.036	0.000	0.000
	N	392	392	392	392	392	392	392
LEV	Pearson Corr	0.057	0.101*	1	0.019	-0.011	0.053	0.036
	Sig. (2-tailed)	0.260	0.045		0.702	0.825	0.296	0.474
	N	392	392	392	392	392	392	392
IO*RPT	Pearson Corr	0.755**	0.193**	0.053	-0.326**	-0.076	1	0.668**
	Sig. (2-tailed)	0.000	0.000	0.296	0.000	0.132		0.000
	N	392	392	392	392	392	392	392
IND*RPT	Pearson Corr	0.535**	0.335**	0.036	-0.104*	0.313**	0.668**	1
	Sig. (2-tailed)	0.000	0.000	0.474	0.040	0.000	0.000	
	N	392	392	392	392	392	392	392

Note: ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Source: Authors

Table 6 Classification Table[a]

Observed			Predicted		
			FSF		Percentage Correct
			0	1	
Step 1	FSF	0	350	1	99.7
		1	41	0	0.0
	Overall Percentage				89.3

a. The cut value is 0.500

Source: Authors

Table 7 The Nagelkerke R Square

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	243.489[a]	0.048	0.099

Source: Authors

The statistical value of the Wald test is chi-squared distributed, as is presented in Table 8 below. The RPT significance level is 0.049 < 0.05 and the coefficient 3.593, which means that RPT significantly affects the likelihood of FSF. As a result, H1 is accepted. This result is crucial as it emphasizes the potential risks associated with these transactions in environments with weaker regulatory frameworks. The statistical significance of this finding with the p-value less than 0.05 highlights the robustness of the model and the reliability of the data.

Statistically, IO influences FSF significantly, with the significance level 0.025 < 0.05 and the coefficient -0.16. Therefore, H2a is accepted. The negative relationship between IO and the occurrence of FSF means that more significant institutional ownership reduces the likelihood of FSF significantly. The findings suggest that institutional ownership plays a significant role in mitigating FSF. This result supports the hypothesis and provides the empirical evidence that institutional investors contribute to stronger governance practices. Moreover, the interaction between RPT and IO is statistically significant at 0.024% < 0.05. with the coefficient -3.799. Therefore, H2b is accepted. The interaction between IO and RPT showed a significant moderating effect on the occurrence of FSF. This finding is crucial as it illustrates the fact that IO can buffer the adverse effects of related-party transactions. This interaction was statistically significant with the coefficient -3.799 and the p-value 0.024, indicating a strong moderating role of IO in corporate governance.

Furthermore, IND has a significant level of 0.807 > 0.05, indicating that IND does not influence the occurrence of FSF. Therefore, H3a cannot be accepted. The interaction between RPT and IND shows a significance level of 0.233, suggesting that independent commissioners do not moderate the impact of RPT on the occurrence of FSFs. Thus, H3b is also rejected. This finding challenges the traditional view that independent commissioners are effective in mitigating fraud, suggesting that other factors might influence their effectiveness in the Indonesian context. The lack of significant results for IND in moderating the relationship between RPT and fraud further suggests that merely appointing IND is insufficient without ensuring their active involvement and empowerment in governance processes.

Based on the result shown below, the research model reads as follows:

$$Ln\frac{FSF}{1-FSF} = -5.773 + 3.593RPT - 0.016IO + 0.513IND + 0.312SIZE + 0.25LEV - 3.799IO*RPT - 5773IND*RPT + \varepsilon \quad (4)$$

This study provides a significant theoretical contribution to the agency theory domain, particularly in the context of the relationships explored — RPT, IO, IND, and FSF. The unexpected results regarding the influence of IND challenge the conventional agency theory assumptions, highlighting the nuanced dynamics at play within Indonesian corporate governance. This research result reveals that 27.8% of the sample is likely to commit FSF.

The results obtained in this study demonstrate the fact that RPT significantly affects the occurrence of FSF. Thus, a more significant amount of RPT increases the likelihood of the occurrence of FSF, which confirms the previous research stating that RPT is a high-risk area for causing FSF, as was demonstrated in several cases such as Enron, Satyam, and WorldCom (Hogan

Table 8 The variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	RPT	3.593	1.823	3.885	1	0.049	36.329
	IO	-0.016	0.007	5.042	1	0.025	0.984
	IND	0.513	2.104	0.060	1	0.807	1.671
	SIZE	0.312	0.126	6.097	1	0.014	1.367
	LEV	0.025	0.025	0.964	1	0.326	1.025
	IO*RPT	-3.799	1.681	5.109	1	0.024	0.022
	IND*RPT	-1.699	1.425	1.421	1	0.233	0.183
	Constant	-5.773	2.382	5.870	1	0.015	0.003

[a] The variable(s) entered in step 1: RPT, TA, LEV, IO, IND, IO*RPT, IND*RPT.

Source: Authors

et al, 2008; Lou & Wang, 2009; Lau & Ooi, 2016). RPT is positively correlated with restatement, which works as financial statement red flags (Kohlbeck & Mayhew, 2017). M. Jian and T. J. Wong (2004) point out the fact that capital is the cause of internal markets arising within a group of companies in an emerging market, such as Indonesia, which is characterized by unfavorable external financial market conditions and a high cost of capital. According to agency theory, however, managers may take actions and make decisions in their interest due to the power of delegation, a conflict of interest, and moral hazard, which may result in opportunistic earnings manipulation. Managers can manipulate earnings through structuring transactions such as RPT so as to alter the company's financial statement (Hwang *et al*, 2013), which happens when management place a high priority on the profit, leading the company to engage itself in accounting manipulations (Kohlbeck & Mayhew, 2010). Backing up with a bigger research sample, this study proposes a different perspective from A. Hudayati, T. K. Nisa and Z. M. Sanusi (2022) that states that RPTs negatively affect FSFs in the manufacturing sector in Indonesia. This study results in different findings, accounting for the fact that RPTs positively affect the occurrence of FSFs, which is consistent with A. Habib *et al* (2017) and J. L. Cheung *et al* (2009), who conclude that RPT is useful in achieving earnings targets and hiding companies' poor financial performances. The results of this study support J. L. Cheung *et al* (2009) and M. Jian and T. J. Wong (2010), who also conclude that RPT can be utilized as a tool for tunnelling and earning management. Paying attention to the scale, quantity, as well as category of the total number RPT will help detect financial fraud (Mao, Sun, Zhu & Li, 2022).

The research results indicate that IO negatively affects the likelihood of the FSF occurrence. The results confirm the previous studies (Lo, Wong & Firth, 2016; Shayan-Nia *et al*, 2017), also highlighting the role of IO as a mitigating factor. Agency theory posits that, with their more significant stakes, institutional investors act as monitors to align managerial actions with the shareholder's interests. IO represents the majority shareholders with a significant influence on the company's supervisory functions. IO expects management to deliver strong financial results for each investment they make in the company. As a result, they serve as an external control for how management should operate in order to improve the company's performance (Shayan-Nia *et al*, 2017). Additionally, IO are rational investors interested in long-term profit objectives and, with their external supervision functions, they can reduce the opportunity for management to commit to FSF (Shayan-Nia *et al*, 2017; Ramos Montesdeoca *et al*, 2019).

Furthermore, the research results confirmed that IO can lower the effect of RPT on the likelihood of

the FSF occurrence. The nature of RPT is closely associated with management opportunism; therefore, with its external supervision functions, IO can lower the opportunity for management to commit to FSF (Shayan-Nia *et al*, 2017). The ownership structure inversely affects the aggressive behavior on the part of the company's management (Osemene, Adeyele & Adinnu, 2018). Along with that, Lo *et al* (2016) also state that corporate governance is vital in deterring manipulated transfer prices in related-party sales transactions.

M. C. Jensen and W. H. Meckling (1976) stated that monitoring mechanisms could play a substantial role in disciplining RPT and even reduce potential agency costs. Therefore, there is a high incentive for institutional stakeholders to monitor the RPT occurrence and structures (Kohlbeck & Mayhew, 2011). Therefore, together with the RPT disclosure arrangements in Indonesia stipulated in PSAK No. 7 released on February 19, 2010, IO can effectively control management through its monitoring authority by affecting the mandatory disclosure level (Izzaty & Kurniawan, 2018).

However, the study also shows that IND does not affect the likelihood of the FSF occurrence and does not moderate the effect of RPT on the likelihood of the FSF occurrence. Several previous studies led to similar results (Kusumawati, 2007; Sihombing & Rahardjo, 2014). IND could not perform their supervision duty objectively due to the company's policy intervention power held by the concentrated family ownership, which is broadly found in most Indonesian public companies. Indonesia needs stronger regulatory frameworks and effective corporate governance practices to enhance the role of IND in preventing FSF. The recruitment of commissioners is limited to meeting the requirements of the Financial Services Authority. In this regard, the role and functions of the independent Board of Commissioners in supervising the company become less than optimal in practice. As has been found in this study, even though the companies included in the sample have an average of 37% IND in their Boards of Commissioners, it is only to fulfil the regulations of the minimum 30% of IND on the company's Board of Commissioners.

In agency theory, the role of IND is often viewed as a crucial mechanism to align the interests of the company's management with those of the company's shareholders, simultaneously mitigating agency conflicts. The insignificant effect of independent commissioners on FSF prompts the re-evaluation of the presumed effectiveness of IND in mitigating FSF, especially in the presence of RPT, which challenges the traditional agency theory perspective, suggesting that the impact of independent commissioners might be contingent upon contextual factors and the complexity introduced by RPT.

The findings provide insightful implications for various entities, including companies, regulators, and associations, particularly in managing and disclosing RPT and their impact on FSF. Considering the association between RPT and an increased risk of FSF, companies must closely monitor RPT. To ensure proper disclosure of RPT in financial statements, robust internal control systems must be established, and adherence to the PSAK No. 7 should be ensured. In addition to maintaining investor confidence, such transparency can minimize potential agency conflicts. Furthermore, companies should enhance their corporate governance practices so as to minimize the risks associated with RPT, which includes the optimization of the role of independent audit committees and the implementation of stringent review processes for all RPTs.

Regulators should consider enacting more comprehensive regulations on RPT under the PSAK No. 7 in order to ensure their full disclosure and fair dealing in these transactions, which includes thorough audits and potential penalties for noncompliance to deter fraudulent activities and enhance corporate accountability. Only 31.83% of the total companies listed on the IDX sequentially in the period from 2017 to 2021 can be examined due to the absence of RPT and IO data in their financial statements, which fact must be addressed so that all auditors are more skeptical and thorough to ensure audited companies truly disclose their RPT in their financial statements.

IOs are generally equipped with the resources and expertise so as to monitor corporate activities,

including RPT, thus reducing the likelihood of the FSF occurrence. Therefore, regulators should establish a regulatory framework promoting transparency and accountability, such as imposing stricter requirements on the disclosure of companies' relationships and involvement with their institutional investors in order to assess the potential impact of IOs involvement on the company's corporate governance and its financial reporting practices.

Moreover, financial and accounting professional associations should educate their members on the risks associated with RPT and the importance of complying with standards such as the PSAK No. 7. The best practices can be published through workshops, seminars, and publications. As a result of their efforts, these associations can play a crucial role in advocating ethical business practices and financial transparency. Their expert advice and recommendations can influence policymaking.

CONCLUSION

This research study provides important insights into how financial statements are manipulated through RPT inside the Indonesian market, simultaneously underscoring its implications for scholarly work and practical applications. Our findings reveal a significant link between RPT and FSF, thus enriching previous studies by detailing the specific mechanisms through which RPT is employed for earnings manipulation in less developed economies. This study deepens the practical application of agency theory in the emerging markets characterized by weaker regulatory infrastructures. It highlights the critical role of IO in fostering transparency and maintaining the integrity of financial reports. The outcomes suggest that regulators and corporate entities might benefit from strengthening audit practices and enhancing RPT disclosure protocols, which could substantially diminish agency issues while reducing related costs over the long term. The analysis supports the hypothesis that institutional ownership is vital in curtailing the risks linked to RPT, reinforcing the argument for robust corporate governance as an effective barrier against FSF. This support provides the empirical backing to the debate on corporate governance, affirming the importance of institutional investors in deterring fraud.

The limitation of the study reflects in the fact that it solely focuses on the Indonesian publicly listed companies, which may restrict the extent and manner to which the findings are applicable to companies in the other parts of the world or within different economic frameworks. Moreover, the emphasis on the manufacturing sector might limit the breadth of the applicability of said findings across various industrial landscapes. Future research could broaden its scope so as to include firms from various emerging and developed economies and examine how RPT influences FSF under different regulatory and economic conditions. Additionally, covering data from 2017 to 2019, the study may not account for how shifting economic conditions, regulatory changes, or market dynamics could impact the findings during this particular period. Therefore, future studies should consider employing a time-series analysis inclusive of a broader span of years, which would enable researchers to observe how changes in economic conditions, regulatory frameworks, and market dynamics over an extended period may influence the relationship between RPT, IO, IND, and FSF. Lastly, further investigations could explore additional corporate governance elements, such as board diversity, executive remuneration, the CEO duality, and the audit committee effectiveness so as to gain a fuller picture of what influences FSF.

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Marsellisa Nindito is an Assistant Professor of Accounting at the Department of Accounting, Faculty of Economics, Universitas Negeri Jakarta, and a doctoral candidate at the Doctoral Program in Accounting, Universitas Padjadjaran, Indonesia. Her research interests are auditing, fraud, and governance.

Ilya Avianti is a Full Professor in the Faculty of Economics and Business, Universitas Padjadjaran in Indonesia. Her primary research interest is auditing.

Poppy Sofia Koeswayo is an Associate Professor of Financial Accounting and Auditing at the Department of Accounting, Faculty of Economics and Business, Universitas Padjadjaran, Indonesia. Her research interests are auditing, internal auditing, and financial accounting.

Nanny Dewi Tanzil is an Associate Professor of Accounting at the Department of Accounting, Faculty of Economics and Business, Universitas Padjadjaran in Indonesia. Her research interests are accounting and governance.

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FIRM EXPORTS AND PERFORMANCE: EVIDENCE FROM SERBIA

Milan Čupić and Stefan Vržina*

University of Kragujevac, Faculty of Economics, the Republic of Serbia

Despite exports having been the subject of academic attention for decades, associating exports with firm performance is unclear. Previous studies have produced two opposite theories. The learning-by-exporting hypothesis states that exports improve firm performance due to knowledge transfers from foreign markets to exporters, on the one hand, whereas on the other, those advocating the self-selection hypothesis argue that firms with better financial performance are more likely to export. This paper aims to examine the relationship between exports and the performance of firms in Serbia. The results of this research study show that exports are statistically significantly associated with productivity, this finding being robust to changes in the productivity measure and the sample size. Associating exports with firm profitability, however, is sensitive to changes in profitability measures. In addition, the research results are more typical of the manufacturing sector. Several reasons for the poor performance of Serbian exports and several recommendations with respect to that are offered in this paper.

Keywords: international trade, exports, productivity, profitability, Serbia

JEL Classification: F14, F23, M21

INTRODUCTION

The share of exports in the world's GDP has been growing almost constantly for several decades and has been exceeding 25% since 2004 (World Bank, 2023). Firms have increasingly been integrated into global value chains and engaged in different global activities (Baldwin & Yan, 2021). It is, therefore, no surprise that many authors set out to investigate the relationship between exports and firm performance (Sharma & Mishra, 2012). F. Morais and J. Ferreira (2020), however, find that the effects of internationalization on firm performance are less investigated than the internationalization process and the specific factors/variables influencing internationalization. Nevertheless, the relationship between exports and firm performance attracts some research given its relevancy, especially in insufficiently investigated transitioning and developing economies.

Ever since A. Bernard and B. Jensen (1999), there has been an almost unanimous agreement in the literature that exporters outperform nonexporters (Haidar, 2012; Benkovskis, Masso, Tkacevs, Vahter &

* *Correspondence to:* S. Vržina, University of Kragujevac, Faculty of Economics, Liceja Kneževine Srbije 3, Kragujevac, the Republic of Serbia; e-mail: stefan.vrzina@kg.ac.rs

Yashiro, 2020; Segarra-Blasco, Teruel & Cattaruzzo, 2022). Exporters are considered to be more resilient to economic downturns than non-exporters due to their higher productivity and efficiency and their tendency to have access to more diversified markets (World Trade Organization, 2021). Exports are found to be an important factor in the economic development and industrial growth of developing economies (Lee & Dolfriandra, 2020; Bilas & Franc, 2022). For example, X. Diao, M. McMillan and D. Rodrik (2017) argue that South Korea, Taiwan, and China grew through export-oriented industrialization, while J. LiPuma, S. Newbert and J. Doh (2013) point out the fact that the firms seeking to grow through exports contribute more to economic growth than firms in general.

This paper aims to examine the relationship between exports and the performance of firms operating in Serbia. Fixed-effects panel regression analysis is used to examine the relationship between exports and labor productivity and the profitability of large firms in Serbia. The research is based on the Chamber of Commerce and Industry of Serbia's (CCIS) data and covers as many as 500 firms in the period from 2014 to 2018. In general, the results show that exports are associated with the productivity and profitability of Serbian firms. In addition, the relationship between exports and labor productivity is stronger than their relationship with profitability.

The paper focuses on exporters from Serbia because of their respective specificities and the specificities of the Serbian economy. The competitiveness of the Serbian economy is weak mostly due to underdeveloped institutions, the poor infrastructure, and the complexity of the business environment (Tmušić, 2023). The value of Serbian exports is almost constantly growing (Statistical Office of the Republic of Serbia, 2023), but is constrained by a lack of affordable capital to finance and ensure exports, the slow introduction of new and technologically advanced products (Trajković & Stošić Mihajlović, 2021), and insufficient convergence to the European Union's import demand (Nikolić & Nikolić, 2020). Z. Jeremić, M. Milojević and I. Terzić (2015) point out the fact that Serbia is characterized by a small number of competitive net exporters and exports dominated by a small segment of firms, mostly foreign-owned. In addition, the Serbian economy is small, open, import-oriented, and characterized by a strong exchange rate spillover effect (Čupić, 2015).

The paper contributes to the prior literature in two ways. First, it contributes to filling the gap in the literature on exporting by investigating the relationship between exports and firm performance in a small European transitioning and developing economy. There are many studies on this relationship, but relatively few on the samples of firms from developing and transitioning economies (Sharma & Mishra, 2012; Xuefeng & Yasar, 2016; Reggiani & Shevtsova, 2018). The transition of the Serbian economy began at the end of 2000 (European Bank for Reconstruction and Development, 2007), later than in most other European post-communist countries, which, along with the economic isolation during the 1990s, significantly influenced the Serbian business environment (Stančić, Todorović & Čupić, 2012; Čupić, Todorović & Benković, 2023). A. Filip and B. Raffournier (2010) argue that transitioning economies cannot be seen as a homogenous group, because each economy has its own specificities arising from its pre-communist history, cultural influences, and level of economic development.

Second, given the fact that the exports of Serbian firms are mostly labor-intensive (Gligorijević, Ćorović & Manasijević, 2020), labor productivity is used in the paper as a measure of firm performance. Labor intensity makes Serbian exports relatively unattractive in the European Union (EU) market, where demand is greater for goods at a higher level of processing. D. Fu, Y. Wu and Y. Tang (2009) find that the firms operating in export-oriented and labor-intensive industries of the Chinese transitioning economy are more likely to export, more export-intensive, and more persistent exporters. D. Lu (2010) finds that exporters are less productive than non-exporters in labor-intensive sectors, whereas exporters are more productive than non-exporters in the capital-intensive sectors of the Chinese economy. The results of this paper contribute to the literature in that they provide insights into the specificities of the export–performance relationship in an economy dominated by labor-intensive exports.

The remainder of the research study is structured as follows: a review of the literature on the relationship between exports and firm performance is given in the first section, which is followed by the sections in which the research methodology is described, and the study results presented and discussed. The conclusions are presented in the last section of the paper.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

In an integrative assessment of export research, L. Leonidou and C. Katsikeas (2010) stress that international engagement is justifiable on both the national and business grounds. They note that exports can help nations enhance their industrialization, obtain a foreign currency to finance imports and create more job opportunities. They further note that exports can help firms improve their competitiveness, achieve their financial goals, acquire new technology, spread business risks, and achieve sustainable growth. Empirical studies also find that exporting firms are characterized by better performance, most notably productivity and profitability, than non-exporting firms (Fryges & Wagner, 2010; Haidar, 2012; Kuivalainen & Sundqvist, 2018; Benkovskis *et al*, 2020; Segarra-Blasco *et al*, 2022; Vendrell-Herrero, Darko, Gomes & Lehman, 2022).

Exports and firm productivity

J. Wagner (2007) points to the "two alternative but not mutually exclusive hypotheses why exporters can be expected to be more productive than non-exporting firms". These are the learning-by-exporting and self-selection hypotheses. According to the learning-by-exporting hypothesis, knowledge transfers from foreign market participants help exporters improve their performance. J. Wagner (2002) explains that serving a larger market allows a firm to acquire economies of scale in production or reduce domestic variations in demand. In addition, exporters are exposed to more intense competition and must improve faster than the firms selling their products only domestically.

Some studies (Pisu, 2008; Reggiani & Shevtsova, 2018) show that the effects of learning depend on the destination country. The effects of learning are expected to be more pronounced when exports to highly developed economies are concerned because the firm will have the opportunity to learn about the latest technological advances. M. Pisu (2008), however, finds that learning-by-exporting effects also depend on the country of origin, not only on the destination country. A. Segarra-Blasco *et al* (2022) find that firms in leading economies are more sensitive to temporal (the length of time) learning, while spatial (the number of markets) learning has more influence on firms in less advanced economies.

Contrary to the learning-by-exporting hypothesis, where exporters become more productive after a company's entry into the export market, the self-selection hypothesis posits that more productive firms become exporters. J. Haidar (2012) explains that firms face additional costs in connection with selling goods in foreign markets, including "transportation costs, distribution or marketing costs, personnel with skills to manage foreign networks, or production costs in modifying current domestic products for foreign consumption," which provides an entry barrier that less productive firms cannot overcome. F. Bellone, P. Musso, L. Nesta and S. Schiavo (2010) support this hypothesis with the finding that the firms enjoying better financial health are more likely to become exporters, whereas N. Rehman (2017) argues that only highly productive firms can cover the sunk costs of entry into international markets.

The self-selection hypothesis can be questioned for at least two reasons. First, less financially constrained firms are not necessarily self-selecting into exports, i.e. export starters and never-exporting firms need not significantly differ in average liquidity or leverage (see Bellone *et al*, 2010). Second, a highly productive firm can enter the international market using foreign direct investment instead of exports (Oberhofer & Pfaffermayr, 2012). M. Grazzi (2012), nevertheless, points out the fact that, although there is the evidence

supporting both the learning-by-exporting and self-selection hypotheses, "the conjecture that firms are more productive before starting to export has gained consensus, also thanks to some theoretical models that incorporate such a hypothesis". F. Vendrell-Herrero *et al* (2022) connect the learning-by-exporting and self-selection hypotheses, stating that highly productive firms are more likely to export (self-selection) and, upon doing so, achieve greater productivity over time (learning-by-exporting).

Empirical studies on the relationship between the firm's export activity and its productivity usually analyze the total factor productivity (TFP) and/or labor productivity (LP) and find that exporting firms are more productive than non-exporting firms (Breinlich & Criscuolo, 2011; Benkovskis *et al*, 2020; Kiendrebeogo, 2020; Segarra-Blasco *et al*, 2022). Y. Kiendrebeogo (2020), for example, finds that labor productivity and the total factor productivity are 43% and 61% higher for exporting firms than for domestically oriented firms, respectively, mostly due to the learning-by-exporting process. Nevertheless, there are studies finding the statistically insignificant export-productivity relationship (Smeets & Warzynski, 2013; Zhou, 2020). Given the results of the largest number of previous research studies, the first hypothesis reads as follows:

H1: Exports are statistically significantly and positively associated with firm productivity.

Some studies investigate the factors affecting the positive export–productivity relationship. For example, J. Baldwin and W. Gu (2003) find that the positive relationship between export activities and productivity is more pronounced in domestically controlled and younger firms, while T. Mengistae and C. Pattillo (2004) and N. Trofimenko (2008) conclude that productivity is higher in firms exporting outside the continent and to the most developed economies. J. Damijan and Č. Kostevc (2006) reveal that productivity improvements are "a consequence of increased capacity utilization brought about by the opening of an additional market". H. Breinlich and C. Criscuolo (2011) find that higher labour productivity is associated with the higher value of firm-level exports and imports, exporting to and importing from a larger number of countries, exporting and importing more types of services, and higher export and import values per market and per service. K. Benkovskis *et al* (2020) show that the impact of exports on productivity is more pronounced in specific types of exports, such as the exports of knowledge-intensive services.

Exports and firm profitability

There are still relatively few studies on the relationship between firm exports and firm profitability. J. Wagner (2012b) believes that it is more appropriate to examine the relationship between export activities and profitability than productivity, given the fact that profitability rather than productivity is the company's main goal. Exports provide firms with the opportunity to increase sales and reduce costs by using economies of scale, which makes the expected relationship between the firm's exports and profitability positive. In addition, exporting firms are often entitled to some tax benefits; exports are exempt from value-added tax in many countries, and the firms that qualify as predominant exporters usually obtain the refund of value-added tax faster than other firms (Gourdon, Hering, Monjon & Poncet, 2022).

Exports are associated with some risks resulting from exchange rates changes (Nanda & Panda, 2018), trade barriers (Jiang, Liu & Zhang, 2022), cultural differences between the country of origin and the destination country (Escandon-Barbosa & Salas-Paramo, 2022), and a failure in the destination country (Cieslik, Kaciak & Welsh, 2010). To protect against these risks and improve their performance, firms often diversify their exports, i.e. they export to several countries. J. Wagner (2014) finds that "profits tend to be larger in firms with less diversified export sales over goods and in firms with more diversified export sales over destination countries."

The results of the empirical studies examining the export–profitability relationship are less consistent compared to those examining the export–productivity relationship. Some studies (Fryges & Wagner, 2010; Kuivalainen & Sundqvist, 2018; Lessoua, Mutascu & Turcu, 2020; Kao, Wu & Liu, 2023) find a positive

impact of export activities on profitability and conclude that export benefits outweigh export costs. There are also the studies finding no significant impact of export activities on profitability (Grazzi, 2012; Wagner, 2012a; Nanda & Panda, 2018). Finally, A. Vogel and J. Wagner (2010) find a negative impact of service exports on profitability. Given the results of the largest number of the previous research studies, the second hypothesis reads as follows:

H2: Exports are statistically significantly and positively associated with firm profitability.

Y. Temouri, A. Vogel and J. Wagner (2013) show that the impact of export activities on profitability depends on the country of origin. They notice that exporters' profitability is significantly smaller in Germany, significantly greater in France and does not significantly differ from the profitability of non-exporters in the UK. Certain costs significantly influence the impact of export activities on profitability. Some previous studies (Fryges & Wagner, 2010; Vogel & Wagner, 2010; Temouri *et al*, 2013) find that exporting firms have higher labor costs than non-exporting firms. On the other hand, P. Sharma, L. Cheng and T. Leung (2020) find that the impact of exports on the firm profitability significantly depends on the firm's political connections and ownership structure.

RESEARCH METHODOLOGY

The sample

The sample was created using the information provided in the PKS Partner (www.pkspartner.rs), an application developed by the Chamber of Commerce and Industry of Serbia. Only non-financial firms were sampled, while the banking, insurance and similar firms were not included due to their specificities. Additionally, only the firms having been established before 2009 were sampled so as to avoid the potential volatility in the performance of the start-ups and young firms. Following those criteria, a list of the 500 largest firms was identified, according to their operating revenues in 2018. The sample period was from 2014 to 2018 and the initial dataset comprised 2500 observations. However, the final dataset was unbalanced since some observations were removed due to the negative value added, missing data, or outliers. The data had been collected from the annual reports of the sampled firms published from 2014 to 2018. The structure of the firms according to their industry is presented in Table 1. A total of 432 were limited liabilities, while 68 were joint-stock companies in 2018.

Table 1 The industry the sampled firms operate in

Industry	Number of the firms
Agriculture, Forestry, and Fishing	18
Mining	2
Manufacturing	174
Electricity, Gas, Steam and Air Conditioning Supply	3
Water Supply, Wastewater Management, Control of Remediation Pro-cesses and similar activities	3
Construction	40
Wholesale and Retail; Repair of Motor Vehicles and Motorcycles	198
Transportation and Storage	19
Accommodation and Food Services	2
Information and Communication	18
Real Estate	2
Professional, Scientific, Innovation, and Technical Activities	13
Administrative and Support Service Activities	6
Arts, Entertainment, and Recreation	2
Total	500

Source: Authors

The variables

The definitions of the variables used in the research are given in Table 2. The natural logarithm of the net sales per employee (PROD1) and the natural

logarithm of value added per employee (PROD2) were used as the productivity measures. M. Spence and S. Hlatshwayo (2012) define value added as the firm's sales less its purchased inputs, excluding labor and capital. Following this definition and given the specificities of financial reporting in Serbia, value added is calculated as the net sales less the costs of materials, the cost of goods sold, fuel and energy, the costs of production services (rent, advertising, R&D, etc.), and intangible costs (the insurance premium, taxes, representation, etc.). Return on total assets (ROA), return on equity (ROE), and return on sales (ROS) are used as the profitability measures.

Table 2 The definitions of the variables

Variable	Definition
PROD1	The natural logarithm of the ratio of net sales to the number of employ-ees
PROD2	The natural logarithm of the ratio of value added to the number of em-ployees
ROA	The net profit to total assets ratio
ROE	The net profit to total equity ratio
ROS	The net profit to net sales ratio
EXPORT	The export sales to net sales ratio
SIZE	The natural logarithm of total assets
FIXED	The fixed assets to total assets ratio
DEBTR	The total debt to total assets ratio
INFL	The consumer price index in Serbia (data.worldbank.org/country/serbia)

Source: Authors

If a firm generates export revenues in one year, it does not necessarily mean that it actively exports. Z. Fernández and M. Nieto (2005) believe that exports may be a sporadic activity, rather than the result of the firm's decision. Due to the possibly sporadic nature of exporting among Serbian firms, the export activity is measured by the export-to-sales ratio (EXPORT), not by an export dummy. EXPORT includes both the export of goods and the export of services. The following firm-specific control variables are used: the natural logarithm of total assets (SIZE), the share of fixed assets in total assets (FIXED), and the debt ratio (DEBTR). The inflation rate, measured by the consumer price index (INFL), is used as a macroeconomic control variable.

The methods

A panel regression model was used to analyze the relationship between exports and firm performance (PERF), the model reading as follows:

$$PERF_{i,t} = \beta_0 + \beta_1 EXPORT_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 FIXED_{i,t} + \beta_4 DEBTR_{i,t} + \beta_5 INFL_t + \varepsilon_{i,t} \quad (1)$$

where PERF refers to the productivity (PROD1 and PROD2) and profitability (ROA, ROE, and ROS) indicators. The Breusch-Pagan LM test was used to choose between the Ordinary Least Squares (OLS) and Random Effects (RE) regressions and the Hausman test was used to choose between the RE and Fixed Effects (FE) regressions. The multicollinearity problem was checked using Pearson's correlation coefficients and the Variance Inflation Factor (VIF). To mitigate the impact of the outliers, PROD1 and PROD2 were winsorized at the 99th per cent as they may take any value greater than zero. Similarly, ROA, ROE, and ROS were winsorized at the 1st and 99th per cent as they may take any value. Finally, the observations with the DEBTR higher than 100% were excluded as they referred to the overindebted firms.

RESEARCH RESULTS

Descriptive statistics

The results of the descriptive statistics are accounted for in Table 3. The annual averages of PROD1 and PROD2 increased in each of the five years, whereas the annual averages of ROA, ROE, and ROS declined only in 2018. In total, 239 observations have negative ROA, ROE, and ROS due to the net loss. There are 445 observations (17.87%) with the exports equal to zero and 788 (31.65%) with a share of exports in the total revenues less than 1%. The sales were entirely from

the exports in 24 observations (0.96%), whereas the share of the exports in the sales was higher than 90% in 187 observations (7.51%). There are 480 observations (19.28%) with EXPORT greater than 50%, representing predominantly the exporting firms. It is interesting to note that the firms' exports have not changed significantly over the years. The annual averages of EXPORT were 22.59% in 2014, 23.56% in 2015, 23.81% in 2016, 24.02% in 2017, and 23.62% in 2018. On average, the firms had used more debt than equity, and more of their current assets than of their fixed assets.

Correlation analysis

Table 4 shows the Pearson correlation coefficients between the variables used in the study. There is a significant correlation between the labor productivity variables (PROD1 and PROD2) and between the profitability variables (ROA, ROE and ROS) as well. EXPORT appears to be significantly correlated with the labor productivity variables, ROA and ROS. Given the fact that no significant and strong correlation between any two independent variables was found, no multicollinearity problem was expected. It should

Table 3 The descriptive statistics

Variable	Mean	Minimum	Median	Maximum	Standard deviation
Panel A. The firm-specific variables					
PROD1	9.935	-4.415	9.858	13.277	1.227
PROD2	7.847	1.997	7.826	10.151	0.933
ROA	0.062	-0.193	0.052	0.342	0.071
ROE	0.175	-1.004	0.144	0.984	0.206
ROS	0.040	-0.453	0.030	0.294	0.069
EXPORT	0.236	0.000	0.085	1.000	0.307
SIZE	14.781	7.660	14.644	19.811	1.267
FIXED	0.366	0.000	0.353	0.987	0.230
DEBTR	0.545	0.011	0.568	0.992	0.235
Panel B. The macroeconomic variable					
Year	2014	2015	2016	2017	2018
INFL	0.021	0.014	0.011	0.031	0.020

Source: Authors

Table 4 The Pearson correlation coefficients

	PROD1	PROD2	ROA	ROE	ROS	EXPORT	SIZE	FIXED	DEBTR
PROD1									
PROD2	0.566*								
ROA	0.018	0.267*							
ROE	0.146*	0.220*	0.682*						
ROS	-0.036	0.299*	0.728*	0.459*					
EXPORT	-0.156*	0.126*	0.069*	0.024	0.114*				
SIZE	-0.006	0.196*	-0.185*	-0.204*	0.035	0.201*			
FIXED	-0.362*	0.125*	-0.069*	-0.233*	0.119*	0.139*	0.377*		
DEBTR	0.177*	-0.092*	-0.330*	0.183*	-0.358*	-0.103*	-0.125*	-0.238*	
INFL	0.016	0.013	0.017	0.035	0.032	0.002	0.042*	-0.008	-0.001

Note: Statistically significant at the 5% level (*).

Source: Authors

be noted that the strongest such correlation, although still relatively weak ($r = 0.377$, $p < 0.05$), was identified between SIZE and FIXED.

In addition, the presence of multicollinearity was checked using the VIF calculated for each independent variable in each regression model. Each VIF was close to one, thus indicating that no multicollinearity problem should be expected. In fact, the VIF was lower than 1.2 in each case.

Regression analysis

The Breusch-Pagan LM test showed that RE regression was more appropriate than the OLS estimation, whereas the Hausman test showed that FE regression had outperformed the RE regression estimates. The FE estimates are therefore shown in Table 5 and Table 6. Since five labor productivity and profitability variables were employed, the results of the five regression models were reported.

The results of the regression analysis show that the exports are positively and statistically significantly associated with labor productivity, on the one hand, whereas on the other, exports are positively and statistically significantly associated only with ROE, not with the other profitability variables, which means that the export firms fail to create value above the additional costs caused by exports. Given the fact that sales and certain operating expenses were included in measuring productivity, while the net profit was included in measuring profitability, the export-oriented firms may have higher financial and other expenses, which is in line with the debt ratio presented in Table 3, namely the reliance of the sample firms on the use of a debt. The results also show that larger, less capital-intensive, and less indebted firms have demonstrated significantly greater labor productivity and profitability, whereas the impact of inflation is not significant.

The analysis of the exports of the manufacturing industry

According to some previous studies (Baldwin & Gu, 2003; Fryges & Wagner, 2010), the relationship between the exports and productivity and profitability of only the manufacturing firms was further examined. Although the manufacturing industry is of particular

Table 5 The relationship between the exports and productivity and profitability

	PROD1	PROD2	ROA	ROE	ROS
Constant	5.298**	4.361**	10.739*	-25.700	-5.354
	(12.321)	(9.886)	(2.195)	(-1.600)	(-1.174)
EXPORT	0.011**	0.003*	0.018	0.131**	-0.004
	(8.884)	(2.000)	(1.180)	(2.690)	(-0.306)
SIZE	0.333**	0.269**	0.617	3.490**	1.326**
	(11.522)	(9.052)	(1.865)	(3.235)	(4.298)
FIXED	0.012**	-0.007**	-0.094**	-0.239**	-0.063**
	(-9.028)	(-4.987)	(-6.009)	(-4.737)	(-4.350)
DEBTR	-0.002	-0.005**	-0.185**	*-0.062	-0.133**
	(-1.924)	(-5.068)	(-16.354)	(-1.656)	(-12.801)
INFL	0.003	-0.005	-0.023	0.436	-0.060
	(0.234)	(-0.484)	(-0.184)	(1.080)	(-0.526)
F-value	50.416**	27.142**	9.918**	7.711**	9.169**
Adjusted R^2	0.912	0.850	0.653	0.585	0.632
Observations	2.341	2.275	2.348	2.338	2.349

Notes: The t-statistics are given in parentheses; statistically significant at the 5% (*) and 1% (**) levels.

Source: Authors

Table 6 The relationship between the exports and productivity and profitability of the manufacturing firms

	PROD1	PROD2	ROA	ROE	ROS
Constant	7.824** (6.819)	5.738** (5.535)	-6.264 (-0.514)	-46.870 (-1.223)	-19.831 (-1.605)
EXPORT	0.029** (11.361)	0.005* (2.029)	0.079* (2.552)	0.174* (2.072)	0.009 (0.300)
SIZE	0.107 (1.418)	0.163* (2.394)	1.420 (1.761)	4.414 (1.766)	2.380** (2.929)
FIXED	-0.014** (-5.216)	-0.005* (-1.990)	-0.074* (-2.543)	-0.219* (-2.423)	-0.086** (-2.973)
DEBTR	-0.008** (-4.335)	-0.007** (-3.780)	-0.172** (-8.331)	-0.097 (-1.441)	-0.127** (-6.107)
INFL	0.012 (0.494)	-0.016 (-0.748)	-0.075 (-0.299)	0.516 (0.659)	-0.351 (-1.403)
F-value	21.961**	16.205**	7.657**	4.592**	8.399**
Adjusted R^2	0.818	0.770	0.591	0.437	0.618
Observations	819	791	808	801	802

Notes: The t-statistics are given in parentheses; statistically significant at the 5% (*) and 1% (**) levels.

Source: Authors

importance to the Serbian economy, it has been facing the foreign trade deficit issue. Table 6 shows that the FE estimates for the manufacturing firms are almost identical to those found for the entire sample. Nevertheless, it should be noted that the slope coefficients for the relationship between EXPORT and labor productivity are greater than in the initial regression model. In addition, the exports are statistically significantly associated with two of the three profitability variables (ROA and ROE), not only one. The further analysis of the statistical significance of the differences between the regression coefficients for EXPORT shows that the relationship between EXPORT and PROD1 and ROA is statistically significantly greater for the manufacturing firms than for the other firms included in the sample. Such findings imply that the relationship between exports with firm performance is stronger in the manufacturing industry than in the other industries.

Capital-intensive vs. labor-intensive firms

According to some prior studies (Fu *et al*, 2009; Lu, 2010; Edwards, Sanfilippo & Sundaram, 2018), whether the relationship between the exports and firm performance was stronger in capital- or labor-intensive firms was examined. Therefore, the moderating variable CLI (capital- or labor-intensity) was also included, taking the value 1 (if the firm was capital-intensive) and 0 (if the firm was labor-intensive). According to Y. Cui and B. Liu (2018), capital intensity is determined depending on the fixed assets to the number of employees ratio. One-half of the observations with the highest values of this ratio were treated as capital-intensive, whereas the other observations were treated as labor-intensive. The formulated alternative regression model reads as follows:

$$PERF_{i,t} = \beta_0 + \beta_1 EXPORT_{i,t} + \beta_2 (EXPORT_{i,t} \times CLI_{i,t}) + \beta_3 SIZE_{i,t} + \beta_4 FIXED_{i,t} + \beta_5 DEBTR_{i,t} + \beta_6 INFL_t + \varepsilon_{i,t} \quad (2)$$

The FE regression estimates of the model 2 are presented in Table 7. The impact of the moderator CLI is not clear. The CLI moderator appears to significantly be moderating only the relationship between the exports and PROD1, not PROD2; it enhances the relationship with PROD1. On the other hand, CLI does not significantly moderate the relationship between EXPORT and profitability, regardless of the employed profitability measure. The further analysis of the statistical significance of the differences between the regression coefficients for EXPORT

Table 7 The moderating role of capital intensity in the relationship between the exports and labor productivity and profitability

	PROD1	PROD2	ROA	ROE	ROS
Constant	5.529** (12.936)	4.318** (9.747)	10.903* (2.213)	-24.869 (-1.556)	-5.615 (-1.220)
EXPORT	0.008** (6.212)	0.003* (2.223)	0.014 (0.843)	0.117* (2.270)	-0.003 (-0.223)
EXPORT*CLI	0.006** (6.129)	-0.001 (-1.045)	-0.001 (-0.005)	-0.006 (-0.168)	-0.011 (-0.968)
SIZE	0.321** (11.155)	0.272** (9.105)	0.606 (1.820)	3.411** (3.180)	1.339** (4.299)
FIXED	-0.013** (-9.896)	-0.007** (-4.758)	-0.093** (-5.830)	-0.240** (-4.754)	-0.059** (-4.040)
DEBTR	-0.002* (-2.218)	-0.005** (-4.989)	-0.184** (-16.122)	-0.046 (-1.255)	-0.131** (-12.552)
INFL	0.005 (0.449)	-0.006 (-0.521)	-0.018 (-0.142)	0.472 (1.185)	-0.061 (-0.533)
F-value	51.385**	27.091**	9.817**	7.838**	9.087**
Adjusted R^2	0.914	0.850	0.653	0.592	0.632
Observations	2.341	2.275	2.329	2.319	2.329

Notes: The t-statistics are given in parentheses; statistically significant at the 5% (*) and 1% (**) levels.

Source: Authors

shows that the relationship between EXPORT and PROD1 is statistically significantly greater for the capital-intensive than for the labor-intensive firms.

DISCUSSION

The finding that the exports are positively related to firm productivity is consistent with the biggest number of previous studies (Benkovskis *et al*, 2020; Kiendrebeogo, 2020; Segarra-Blasco *et al*, 2022). Additionally, the finding that the exports are weakly related to firm profitability or absolutely unrelated to it is consistent with some previous studies (Grazzi, 2012; Wagner, 2012a). These findings are not surprising given the specificities of the Serbian business environment and exports. According to the findings, H1 and H2 should not be rejected.

J. Vapa-Tankosić, S. Ignjatijević and J. Gardašević (2015) believe that the exports made by Serbian firms are unsatisfactory due to the high transportation costs, the complexity of the export documentation, the poor organization of firms' export offices, poor product design, and inadequate promotion. P. Radojević, D. Marjanović and T. Radovanov (2014) also point to the need to improve the quality and design of products and increase investment in research and development. The performance of Serbian exporters could also be improved through their cooperation within clusters.

The unfavorable export structure may be an additional reason for the unsatisfactory export performance of Serbian firms. Serbian firms mostly produce and export less manufactured products, such as agricultural products (Trpeski, Kozheski & Merdzan, 2024), which causes the transfer of value added to firms in importing countries.

The largest foreign trade partners of Serbian firms are in the countries that are not characterized by the highest living standards, such as Bosnia and Herzegovina, Romania, or Russia (Domazet, Filimonović & Pantić, 2014), which means that Serbian firms need to be price competitive as they sell products in low-wage markets. Given the countries

which Serbian firms export to, it is no surprise that the research results are consistent with the studies (Pisu, 2008; Reggiani & Shevtsova, 2018) pointing out that the more developed the destination country, the more pronounced the effect exports have on firm performance.

The insufficient geographic diversification of exports is yet another problem for Serbian exporters. The majority of the exports are placed in the neighboring Balkan countries, as well as Germany and Italy (Stanojević & Jovancai, 2015). Therefore, the results are consistent with A. Segarra-Blasco *et al* (2022), who argue that the number of foreign markets which firms export to is particularly important for firms in less developed economies.

It is also worth noting that the share of the exports from Serbia to countries outside the European continent is relatively negligible. Therefore, the results are consistent with some previous studies (Mengistae & Pattillo, 2004; Trofimenko, 2008) indicating that exports have a stronger relationship with firm performance if they are directed outside the continent. In the last few years, the Serbian government has developed policies to support firms to export to remote territories outside the continent, such as the United Arab Emirates or China.

The results are consistent with the studies (e.g. Pisu, 2008) pointing out the fact that, not only the level of the economic development of the destination country is important, but the economic development of the country of origin is important as well. Since Serbia is a developing and transitioning economy, the weak relationship between exports and firm performance is not surprising.

The results are also consistent with the findings of J. Baldwin and W. Gu (2003), who say that the relationship between exports and productivity is stronger in domestically controlled and younger firms. The weak relationship between exports and firm performance in Serbia can be explained by the fact that many sampled firms are controlled by foreign owners and well-established (younger firms excluded).

The research results show that capital intensity is not related to the export performance of the firms operating in Serbia. Capital-intensive firms may offer more advanced products and services to foreign customers, thus achieving higher value added and better financial performance. However, due to relatively low labor prices in Serbia, labor-intensive firms may be more competitive than the firms operating in the capital-intensive industries, which cancels out the advantages of capital-intensive firms. For example, average hourly labor costs in Serbia were 5.1 euros in 2012 and 4.9 euros in 2016, while they were 24.5 and 26.0, respectively, in the European Union (Eurostat, 2024).

CONCLUSION

The research on a sample of 500 firms from Serbia in the period from 2014 to 2018 was conducted so as to examine the relationship between exports and firm performance. The results show that there is a statistically significant positive relationship between exports and labor productivity but a relatively weak relationship between exports and some profitability measures. The relationship between exports and firm performance was also found to be stronger in the manufacturing industry than in the other industries. In general, no differences in the relationship between exports and firm performance were found to exist between the capital- and labor-intensive firms.

The research results could be of interest to firm owners and managers, as well as economic policymakers. First, the reasons for such poor export performance can be found in the internal organization, the underdeveloped production capacity, the unsatisfactory design, quality, and marketing of products, as well as insufficient investments in research and development. Owners and managers can improve export performance by addressing these aspects of the firm. For instance, they should invest more in research and development in order to develop and produce high-technology products and obtain greater value added from exporting. A more detailed investigation of foreign markets may enable

firms to better satisfy foreign consumers' demand, thus simultaneously increasing product prices and firm profitability. Firms from developing economies should also consider entering and operating in foreign markets together, thus simultaneously addressing the problem of the insufficient production capacity and high marketing costs of individual firms.

Second, policymakers in developing and transitioning economies should encourage the export of products at a higher processing level of processing, i.e. high technology products. By producing and exporting less processed products, firms lose a significant part of value added, which spills over to foreign firms importing the products. To encourage firms to produce and export more profitable high technology products, the government may undertake several actions. For instance, it can provide guarantees for the bank loans granted to the firms focusing on exporting high technology products and encourage firms to participate in foreign high-tech trade fairs as well.

This research study, however, is not deprived of certain limitations indicating possible directions for future research. The sample includes the firms from only one country in the period of only five years. The results of the research study could have been different if the sample had included firms from more countries and covered a longer period. To avoid extreme values, the sample excludes start-ups and young firms, on the one hand, whereas on the other, this possibly prevented the identification of certain relevant internationalization patterns. Only the data about the total exports were used, which limited a more detailed examination of the influence of the export destination (e.g. inside vs. outside the continent, developed vs. developing countries) and the export structure (e.g. goods vs. services) on the relationship between exports and firm performance. Additionally, the sample includes the branches of multinational companies that export to related legal entities, so there is a risk of inadequate transfer pricing when valuing the exports. Since prior research was mostly conducted in developed countries, future research should be focused on having such research conducted in developing countries as well. Firms from more than one economy should be included and a longer period should be covered.

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Milan Čupić is an associate professor at the Department of Accounting, Auditing and Business Finance, Faculty of Economics, University of Kragujevac. He is the author of more than 40 scientific papers. His areas of scientific interest are foreign exchange risk management, performance management, public financial management and corporate governance.

Stefan Vržina is a teaching assistant at the Department of Accounting, Auditing and Business Finance, Faculty of Economics, University of Kragujevac. He is the author of more than 30 scientific papers. His areas of scientific interest are corporate finance, tax accounting and financial analysis and planning.

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MEAN-EXPECTED SHORTFALL PORTFOLIO OPTIMIZATION USING A GENETIC ALGORITHM

Vladislav Radak[1], Aleksandar Damjanović[1], Vladimir Rankovic[2] and Mikica Drenovak[2*]

[1]*University Union, School of Computing, the Republic of Serbia*
[2]*University of Kragujevac, Faculty of Economics, the Republic of Serbia*

Capital requirements for the market risk exposure of banks is a nonlinear function of the expected shortfall (ES), which is calculated based on a bank's actual portfolio, i.e. the portfolio represented by the bank's current holdings. To tackle portfolio optimization with respect to the ES, a genetic algorithm (GA) is used in this paper. The paper examines the effectiveness of a specific GA technique, namely the Strength Pareto Evolutionary Algorithm 2 (SPEA2) for portfolio optimization when the expected return (the mean) and percentage ES are set as the optimization goals. In addition, the differences between the mean-ES optimal portfolios and the mean-VaR optimal portfolios obtained by using the same optimization algorithm is analyzed in the study. The results document that the SPEA2 method provides well-distributed portfolios along the efficient frontier covering different risk levels. Compared to the mean-VaR optimal portfolios, the mean-ES optimal portfolios document superiority over the entire efficient frontier in the mean-ES plane. Concurrently, the converted mean-ES portfolios seem to converge towards the mean-VaR portfolios in the mean-VaR plane and nearly coincide for the high levels of the expected return.

Keywords: portfolio optimization, expected shortfall, VaR, SPEA2

JEL Classification: C61, C63, G11, G17, G21

INTRODUCTION

To ensure solvency for their clients and counterparties, financial institutions are required to allocate "economic capital". While value-at-risk (VaR) was traditionally used as the industry standard for capital in risk allocation, *The Basel IV Capital Accord* recommends transitioning from VaR to the expected shortfall (ES) as a more appropriate risk measure during stress situations. Both academics and practitioners support this shift, since the expected shortfall has been identified as the minimally coherent and law-invariant risk measure that supersedes VaR. It is worth noting that the implementation of the expected shortfall (ES) under Basel IV represents a significant evolution in the regulatory framework for market risk management. Basel IV builds upon the enhancements introduced in Basel III, specifically

* *Correspondence to:* M. Drenovak, University of Kragujevac, Faculty of Economics, Liceja Kneževine Srbije 3, 34000 Kragujevac, the Republic of Serbia;
e-mail: mikicadrenovak@uni.kg.ac.rs

through the Fundamental Review of the Trading Book (FRTB), which initially integrated the ES to address the limitations of value-at-risk (VaR) in capturing tail risk (BCBS, 2019). The ES is an informative risk measure reflecting potential losses beyond the VaR threshold, thus offering a better understanding of tail risk (Acerbi & Tasche, 2002a). However, the use of the ES under Basel IV is primarily confined to the applications involving internal models for market risk assessment, as standardized approaches still rely on alternative metrics (BCBS, 2016). This constraint ensures that the implementation of the ES is aligned with the sophisticated risk modeling capabilities of financial institutions while addressing the regulatory need for robust risk quantification and capital adequacy.

Rationales for the supremacy of the expected shortfall are numerous. Value-at-risk represents the maximum potential loss that may happen for a specified threshold probability denoted as *p*. Losses beyond VaR appear in extreme situations. That having been said, it is clear that VaR denotes the minimum loss in the case of extreme situations that can be anticipated logically. In stress analysis, however, more pertinent information would be the expected loss in extreme situations (which is quantified by the expected shortfall). In addition, the literature acknowledges that VaR lacks coherence because it has no essential attributes of subadditivity and convexity. Consequently, the sum of VaRs from individual portfolios is not necessarily an upper bound of combined portfolios' VaR. Such behavior contradicts the fundamental financial principle of diversification (Artzner, Delbaen, Eber & Heath, 1999; Acerbi & Tasche, 2002a).

In their paper, C. Acerbi and D. Tasche (2002b) introduce a coherent substitute for value-at-risk. The metrics that they proposed are the *expected shortfall* (ES), simultaneously also referring to it as *conditional value-at-risk* in the financial literature. Since it deals with certain drawbacks of VaR, the ES is a more comprehensive risk measure. To be more precise, the financial literature recognizes that the ES offers a more accurate assessment of tail risk, whereas switching from VaR to the ES enhances risk management capabilities. Nevertheless, both of these two tail risk metrics are closely related to one another. The ES is defined as the conditional expected loss given the fact that it surpasses VaR (the case of continuous distributions). More generally, the ES can be delineated as the weighted mean of VaR and the losses beyond VaR (which is suitable for discrete distributions). Empirical studies indicate that minimizing the ES also yields nearly optimal solutions in VaR (as value-atrisk, by definition, never surpasses the expected shortfall). Therefore, portfolios with the low ES have to exhibit low VaR as well. Furthermore, VaR and the ES will be the equivalent metrics in the scenarios where the return–loss distribution is normal (which is rarely the case in real life). In such a case, the portfolio optimizations based on VaR and the ES will both result in the same optimal portfolio. Conversely, the ES and VaR may lead to disparate optimal portfolios for highly skewed distributions. This paper is an attempt to shed more light on the differences between VaR optimal and ES optimal portfolios. In general, VaR cannot be optimized using standard analytical methods. Some research studies show that VaR can be successfully optimized using GA techniques (e.g. Ranković, Drenovak, Stojanović, Kalinić & Arsovski, 2014).

In empirical research studies, genetic algorithms (GAs) have emerged as the preferred method for solving the financial optimization problems that are too intricate for deterministic techniques. The names of these algorithms originate from their execution, which is inspired by the biological (i.e. genetic) processes in the evolution of organisms. Namely, through the evolutionary crossover, mutation and best-fitted individual selection processes, species in nature evolve and become more and more accommodated to the environment. In the same manner, in genetic algorithms, the solutions with the better values of the given objective functions are selected for the recombination (crossover) and mutation, which would more likely result in better offspring solutions in terms of the objective functions. The multi-objective variants of genetic algorithms (MOGAs) are very suitable for solving multi-objective problems since their ability to find a set of optimal solutions (the Pareto front) in a single run, providing a possibility of applying arbitrary constraints on the

values of decision variables and/or objective functions (Metaxiotis & Liagkouras, 2012).

In this research study, the multi-objective Strength Pareto Evolutionary Algorithm 2 (SPEA2) algorithm is utilized so as to generate the expected (mean) return–ES and the expected (mean) return–VaR efficient frontiers. To the best of the authors' knowledge, this study explores a relatively under-researched area by investigating the differences in the mean–ES and mean–VaR optimal portfolios obtained by using multi-objective evolutionary algorithms.

LITERATURE REVIEW

The optimization methods based on the processes which mimic natural selection have their roots back in the 1930s. Concurrently, the inclusion of numerous practical constraints in the financial portfolio optimization models have increased their complexity and made them difficult to solve by means of conventional optimization techniques. Those pioneering academic research studies gave rise to the three distinct streams. The insights into each of them will be synthetized in this paper.

The first of three streams includes the studies exploring the utilization of GAs in the realm of portfolio optimization. The research study conducted by S. Arnone, A. Loraschi and A. Tettamanzi (1993) investigated the bi-objective optimization problem in the context of the mean return-variance-based risk measures for unconstrained optimization. Having introduced the trade-off coefficient, the authors converted the initial bi-objective problem into a single-objective one. Similar research was carried out by T.-J. Chang, S.-C. Yang and K.-J. Chang (2009) and E. P. Setiawan and D. Rosadi (2020), who proposed the GA-based mean return-risk optimization under the cardinality constraint. The authors considered risk measures such as semi-variance, the mean absolute deviation and variance with skewness. When optimization itself is concerned, the authors followed the procedure for the transformation of the bi-objective problem to the single-objective problem via the trade-off coefficient having been proposed by S. Arnone *et al* (1993). In contrast, V. Ranković *et al* (2014) explored the GA-based portfolio optimization with historical VaR as a risk metric. In their paper, the authors introduced two distinct optimization approaches, namely the single-objective approach, by employing the single-objective GA (SOGA), and the multi-objective approach, by employing the multi-objective GA (MOGA). Both methods provide the mean-VaR efficient frontiers that exhibit favorable risk/reward trade-offs for solution portfolios. However, the authors stress that the MOGA approach outperforms the SOGA counterpart in terms of computational efficiency.

The second stream found in the literature addresses the challenge of portfolio optimization that utilizes the ES as the measure of portfolio risk. The relevance of the ES as a risk measure can be best illustrated by the fact that it transcended traditional financial analysis which it originates from. It has gained traction in diverse fields of science and the academic literature, such as breast cancer therapy (Chan, Mahmoudzadeh & Purdie, 2014), scheduling (Sarin, Sherali & Liao, 2014), and machine learning (Takeda, 2009; Takeda & Kanamori, 2009; Takeda, Fujiwara & Kanamori, 2014; Wang, Dang & Wang, 2015). There are attempts to tackle the problem using the GA to optimize the portfolio regarding the different versions of the ES (Wang *et al*, 2015; Jadhav & Ramanathan, 2019).

C. Acerbi and D. Tasche (2002a) outlined a methodology for the assessment of the ES risk contribution of individual portfolio constituents. S. Ciliberti, I. Kondor and M. Mézard (2007) explored the feasibility of portfolio optimization under the ES as a risk measure. Their paper demonstrates the fact that, if the asset-to-data point ratio (i.e. N/T) exceeds the critical value, empirical return distributions are not defined well. Since the critical value is contingent upon the ES probability threshold, the lower it is, the longer time series is required for effective portfolio optimization. F. Caccioli, J. D. Farmer, N. Foti & D. Rockmore (2015) proposed a novel approach to determining the requisite length of time series for the effective portfolio optimization based on the ES as a risk metric, their approach relying on the construction

of contour maps. The maps are constructed based on the confidence level, the relative estimation error and the number of portfolio constituents. Their findings suggest that the requisite sample size is often unfeasibly large for rational portfolio optimization scenarios. In other words, effective portfolio optimization would require unreasonably long time series of returns, regardless of the chosen confidence level and the number of constituents in the portfolio.

The third and the last stream in the literature delves into the diverse methodologies employed by researchers when utilizing GAs in solving complex portfolio optimizations. One such paper is that by C.-C. Lin and Y.-T. Liu (2008), who conducted a research study focusing on the seminal H. Markowitz (1952) portfolio optimization model that incorporates a constraint on minimum transaction lots. Using SOGA, researchers derived the mean return-variance efficient frontiers. D. W. Corne, J. D. Knowles and M. J. Oates (2000) carried out another important research study and demonstrated the exceptional performance of SPEA in comparison to the other MOGAs. Therefore, SPEA has been established as the generally accepted benchmark in many recent academic research studies on this topic. Building upon this foundation, E. Zitzler, M. Laumanns and L. Thiele (2002) introduced the enhanced version of SPEA known as SPEA2. The improvements include the refined archive truncation method, the addition of the density-estimation technique, and the new fine-grained refined fitness assignment strategy. Thanks to them, SPEA2 dominates its predecessor. The papers by K. P. Anagnostopoulos and G. Mamanis (2011) and V. Radak (2020) will also be addressed. The authors further explored and compared the GA portfolio optimizations based on the mean-variance, mean-ES, and mean-VaR methodologies, which include quantity, cardinality, and class constraints. Their research revealed that the Non-dominated Sorting Genetic Algorithm II (NSGA-II), the Pareto Envelope-based Selection Algorithm (PESA), and SPEA2 exhibited efficient performance regardless of the used risk metric.

MORE ON THE EXPECTED SHORTFALL

Here, A. J. McNeil, R. Frey and P. Embrechts (2015) definition of the ES is presented. For the loss L whose distribution function is F_L and which has its finite expected value $E(|L|)<\infty$, the ES at the confidence level $\alpha\in(0,1)$ is defined as follows:

$$ES_\alpha = \frac{1}{1-\alpha}\int_\alpha^1 q_u\,(F_L)du \tag{1}$$

where $q_u(F_L)=F_\tau(u)$ is the quantile function which depends on the distribution function of the loss L, i.e. F_L. For the given value of VaR_α, ES_α, can be obtained as follows:

$$ES_\alpha = E[X|X \geq VaR_\alpha(X)] \tag{2}$$

The equation (2) makes it clear that the ES essentially represents the expected loss which surpasses VaR, i.e. the anticipated loss in extreme scenarios. As was pointed out by C. Acerbi, C. Nordio and C. Sirtori (2001), the ES can easily substitute VaR as the downside measure, given the fundamental similarities between the two approaches, which is also true for any other left-tail statistics. Nevertheless, the ES still has some drawbacks. One notable limitation pointed out by Y. Yamai and T. Yoshiba (2005) implies its substantial susceptibility to estimation errors. Consequently, it requires very long time series of returns for robust estimation.

To define the ES within the scope of portfolio optimization, the portfolio loss needs to be defined. that the portfolio loss is assumed to be the function $L(x,y)$. It depends on the two vectors: x and y. Vector x denotes the vector of unknown portfolio weights. Vector y is the random vector characterized by the probability density function $p(y)$ which represents uncertainties in the market parameters influencing the loss. Consequently, the probability that $L(x,y)$ falls below a threshold value β is going to be a function $\psi(x,\beta)$. Under this setup, the portfolio's ES for the loss function corresponding to the vector of weights x at the given confidence level $\alpha\in(0,1)$ can be expressed as follows:

$$\phi_\alpha(x) = E[\mathcal{L}(x,y)\,|f(x,y)\ \geq \beta_\alpha(x)]$$
$$= \frac{1}{1-\alpha}\int_{\mathcal{L}(x,y)\geq\beta_\alpha(x)} \mathcal{L}(x,y)p(y)dy \quad (3)$$

The previous notation is inadequate for practical implementation. Therefore, the following reconstruction is recommended, namely:

$$\phi_\alpha(x) = \min_{\beta\in R} F_\alpha(x,\beta) \quad (4)$$

where

$$F_\alpha(x,\beta) = \beta + \frac{1}{1-\alpha}\int_{y\in R^m} [\mathcal{L}(x,y)-\beta]^+ p(y)\phi \quad (5)$$

and $t^+=max\{t,0\}$.

The utilized portfolio optimization models

The variation of H. Markowitz's (1952) multi-objective ES-based optimization model is introduced at this point. The presented model aims to simultaneously maximize the portfolio's expected return (denoted as $\mu_p(x)$ in (Eq. 6.2)) and minimize the portfolio's risk estimated via the expected shortfall (denoted as ES in (Eq. 6.1)).

$$min\ \ ES_\alpha(x) \quad (6.1)$$

$$max \sum_{j=1}^{n} r_j x_j = \mu_p(x) \quad (6.2)$$

$$s.t. \sum_{i=1}^{n} x_j = 1, \quad (6.3)$$

$$0 \leq x_j \leq u_j, \qquad j = 1,\dots,n. \quad (6.4)$$

The equation 6.3 is a budget constraint. It ensures that the sum of weights must be equal to 1, i.e. that the entire investment budget must be invested, nothing more and nothing less. The equation 6.4 represents the short-selling prohibition and the holding constraint (i.e. it puts a limit on the weight of the budget that can be invested in a single asset). Mathematically, it prohibits negative weights and limits the maximum size of each weight. Unless otherwise stated, u_j is equal to 1.

THE STRENGTH PARETO EVOLUTIONARY ALGORITHM 2 (SPEA2)

The Strength Pareto Evolutionary Algorithm 2 (i.e. SPEA2) introduced in the paper by E. Zitzler, M. Laumanns and L. Thiele (2002) is the multi-objective evolutionary algorithm that seeks the exact or approximate Pareto-optimal set of solutions. It is the improved version of the original version of SPEA developed by E. Zitzler and L. Thiele (1999). In contrast to the single-objective counterpart, the multi-objective algorithms such as SPEA2 create the Pareto-optimal solution set in a single run.

The main loop is given as follows:

Step 1. The initialization: Generate the initial population P_0 and create the empty archive $\overline{P_0} = \emptyset$. The set t=0.

Step 2. Fitness assignment: Calculate the fitness values of the individuals P_t and $\overline{P_t}$. The fitness value $F(i)$ of the individual i is defined as follows:

$$F(i) = R(i) + D(i) \quad (7)$$

where $R(i)$ denotes raw fitness and $D(i)$ denotes density. Raw fitness is calculated as follows:

$$R(i) = \sum_{j\in P_t+\overline{P_t}, j\succ i} S(j) \quad (8)$$

where $S(j)$ denotes the strength value of the individual j, and represents the number of solutions in the actual population and the archive that are dominated by the solution j:

$$S(j) = |\{m|m \in P_t + \overline{P_t} \wedge j \succ m\}| \quad (9)$$

$|\cdot|$ describes the cardinality of the set, + means the multi-set union and $\succ$ resembles the Pareto-dominance.

The density value $D(i)$ is defined as the function of the distance to the k-th nearest solution (σ_i^k):

$$D(i) = \frac{1}{\sigma_i^k + 2} \quad (10)$$

where $k = \sqrt{N + \overline{N}}$, N is the population size and $\overline{N}$ is the archive size.

It is important to note that the fitness value is to be minimized.

Step 3. Environmental selection: Copy all the non-dominated individuals in P_t and $\overline{P_t}$ to $\overline{P_{t+1}}$. If the size of $\overline{P_{t+1}}$ exceeds $\overline{N}$, reduce $\overline{P_{t+1}}$ by means of the truncation operator; otherwise, if the size of $\overline{P_{t+1}}$ is less than $\overline{N}$, fill $\overline{P_{t+1}}$ with the dominated individuals in P_t and $\overline{P_t}$.

Step 4. Termination: If $t > T$ or if another stopping criterion is met, set A to the set of the decision vectors represented by the non-dominated individuals in $\overline{P_{t+1}}$. Stop.

Step 5. Mating selection: Perform binary tournament selection with replacement on $\overline{P_{t+1}}$ in order to select the parents. Binary tournament selection implies a random selection of two solutions from a given set, and the solution with a better fitness value is selected for mating. The process is repeated until the mating pool is completed.

Step 6. Variation: Apply the recombination and mutation operators to the mating pool and set $\overline{P_{t+1}}$ to the resulting population. Increment generation counter (t->t+1) and move on to Step 2.

In the case of the SPEA2 algorithm, the fitness value is complex and combines the three values: the number of the solutions dominated by the given solution, the number of the solutions dominating the given solution, and the density value that measures the distance from the other solutions in the solution set. Lower density values are preferred.

DATA SOURCES AND THE MAIN COMPUTATIONAL RESULTS

In this section, the empirical results obtained by conducting optimization experiments on the daily historical returns of the DAX constituents were subjected to analysis. The sample spans from 5th January 2015 to 28th April 2017. A total of seven distinct assets were selected for further investigation due to their favorable distribution in terms of both risk and return (see Figure 1). The reason for a relatively small number of assets lies in the computational times. The selection of the seven German stocks over a two-year period appears to be unconventional to demonstrate the method. This sample size is limited both temporally and cross-sectionally. The reason for that lies in the computational times: the latest run for the tests that include the SPEA2 algorithm took more than four days. An extended set of stocks would exponentially have extended the computational times and would have presented a significant challenge in making investment decisions in the long run. A broader dataset, encompassing a more extensive range of stocks over the entire available historical period or including various asset classes and markets, would have provided a more robust illustration. The selection of the data used for this illustration should be justified and whether their methodology has the computational constraints necessitating such a restricted sample size should be clarified.

Based on the previous results, as many as seven assets were selected for portfolio optimization, namely *Münchner Rückversicherungs-Gesellschaft AG*, *Beiersdorf AG*, *Henkel AG & Co. KGaA*, *Siemens AG*, *Deutsche Börse AG*, *Fresenius SE & Co. KGsA*, and *Infineon Technologies AG*, the review of whose expected returns and risks are accounted for in Table 1. Risk is measured as a 5% 1-day historical ES. When the expected returns are concerned, they were computed as the mean of the daily asset log returns. However, the expected returns are not annualization. Their annualization would create a significant difference in the level between the risk and expected return for the selected asset, which would make optimization more computationally difficult. Instead of that, the daily log returns were scaled to a monthly basis, so that the levels of the expected returns and risks were nearly in the same range.

Table 1 The review of the risk (ES) and expected log return for the selected assets

Number	Asset	ES	Mean log returns
1	Münchener Rück.	2.71%	0.98%
2	Beiersdorf AG	2.87%	1.50%
3	Henkel AG	2.98%	1.73%
4	Siemens AG & Co. KGaA	3.31%	2.16%
5	Deutsche Boerse AG	3.46%	2.24%
6	Fresenius SE	3.55%	2.97%
7	Infineon Technologies AG	4.22%	4.28%

Source: Authors

Multi-objective optimization with SPEA2

The results obtained using the SPEA2 genetic algorithm described in Section 4 of the paper are presented here. The algorithm was executed twice with different settings. In both trials, the population size was set to 500 individuals, while the number of iterations was set to 200. As is illustrated in Figures 2 and 3 (which depict the optimization results), the archive size was designated to 21 in the first trial, whereas in the second, it was adjusted to 250.

As is shown in Figure 2, SPEA2 produces optimal portfolios with a superior return-to-risk ratio compared to the individually analyzed assets. To ensure the presence of the maximum return solution, which is always a single-asset solution, this single-asset solution was added in the initial population. The exact results obtained via the first optimization trial are given in Table 2.

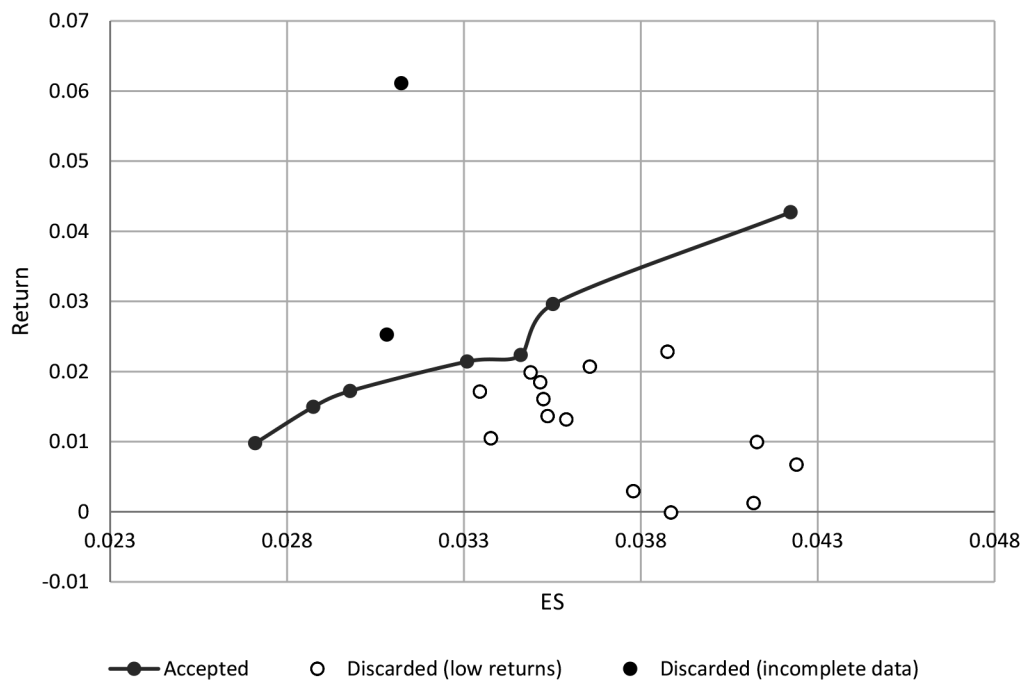

Figure 1 The summary account of risk/return for all the DAX constituents, plotted as the mean daily log return – the ES efficient frontier

Note: The white dots represent the constituents that were discarded due to the relatively low returns compared to the ES, whereas the black dots represent the constituents that were discarded due to the incompleteness of the data.

Source: Authors

Table 2 The optimization results obtained by using SPEA2 with the archive size 21 in the first trial

Number	Mean	ES	Number	Mean	ES
1	2.21%	-2.63%	12	3.31%	-3.14%
2	2.25%	-2.64%	13	3.34%	-3.16%
3	2.40%	-2.70%	14	3.45%	-3.25%
4	2.55%	-2.76%	15	3.56%	-3.32%
5	2.61%	-2.77%	16	3.65%	-3.41%
6	2.78%	-2.84%	17	3.73%	-3.45%
7	2.97%	-2.94%	18	3.82%	-3.53%
8	3.02%	-2.97%	19	3.93%	-3.65%
9	3.07%	-2.99%	20	4.03%	-3.83%
10	3.13%	-3.04%	21	4.26%	-4.20%
11	3.19%	-3.06%			

Source: Authors

The results obtained from the second optimization trial are plotted in Figure 3, which clearly shows that the largest number of the optimal portfolios obtained in the second trial are concentrated around the middle and the maximum expected returns. It should be noted that, in the second optimization trial, optimal portfolios with a lower risk level compared to those obtained in the first optimization trial can be seen. As before, however, it seems that there is a lack of optimal portfolios around the minimum risk (see Figure 3).

Comparison with the mean-VaR optimal portfolios

To analyze the differences between the results obtained in the case when VaR is set as the optimization objective instead of the ES, the experiment was repeated once more, but now with VaR as a risk metric. The results obtained with SPEA2 are depicted in Figure 4.

Figure 4 illustrates the distribution of the optimal portfolios obtained by SPEA2 with the VaR minimizing objective across the efficient frontier, showing simultaneously a superior return-to-risk ratio compared to the seven selected individual assets. If Figure 3 is contrasted with Figure 4, however, it can be seen that there is one notable difference between the optimal portfolios (i.e. the efficient frontier) produced by SPEA2 which minimizes the ES (as is depicted in Figure 3) and those obtained when the same algorithm minimizes VaR (as is depicted in Figure 4). The resultant "efficient" frontier in the case of VaR minimization appears to be flatter and, even after the optimization iterations had doubled, it was still impossible to make any significant improvement. Furthermore, the research results suggest that the optimal portfolios for the lower levels of the targeted expected returns were not distributed well and seemed to be limited by a barrier. These disparities were best seen when the optimal portfolios obtained

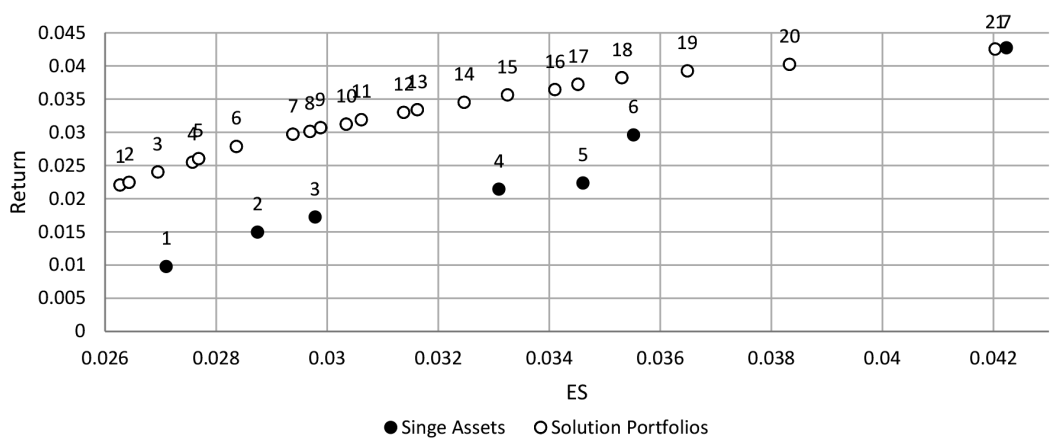

Figure 2 The results of SPEA2 for the archive size 21

Source: Authors

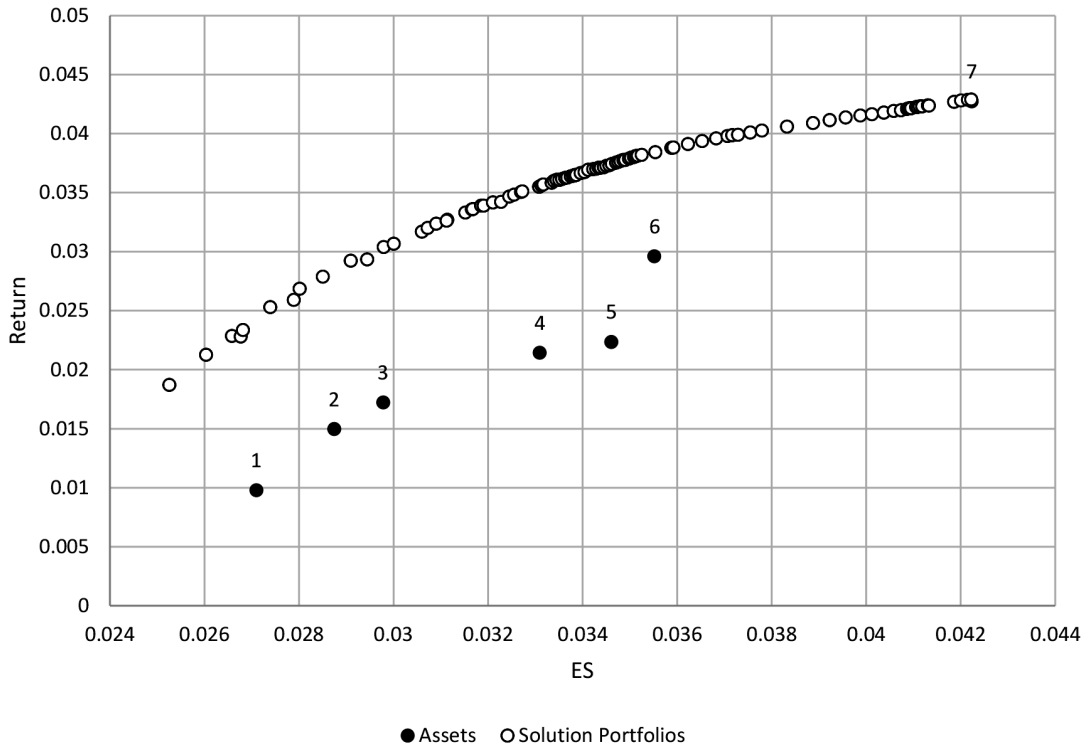

Figure 3 The optimization results obtained using SPEA2 with the archive size 250 in the second trial

Source: Authors

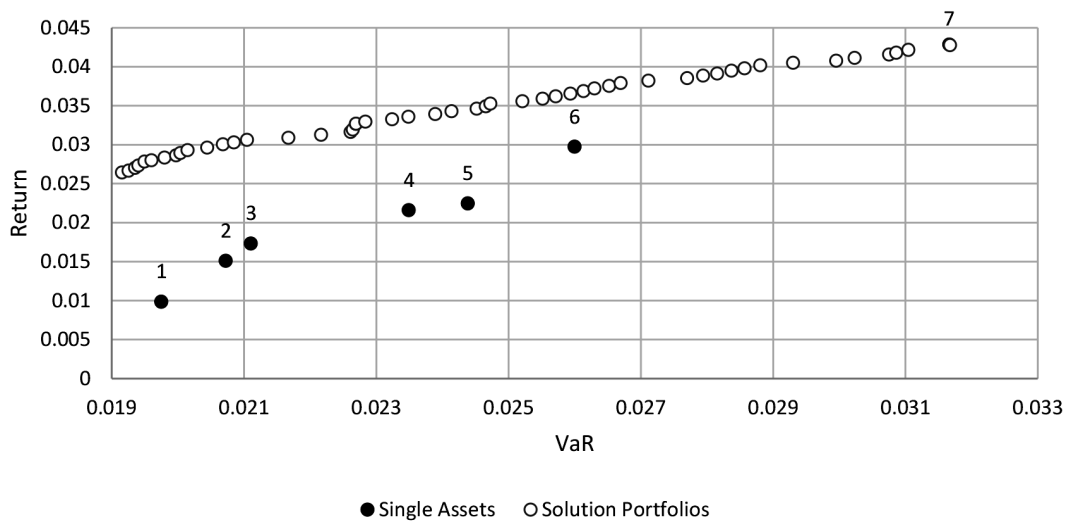

Figure 4 The SPEA2 optimal portfolios based on VaR as a risk objective vs the individual assets

Source: Authors

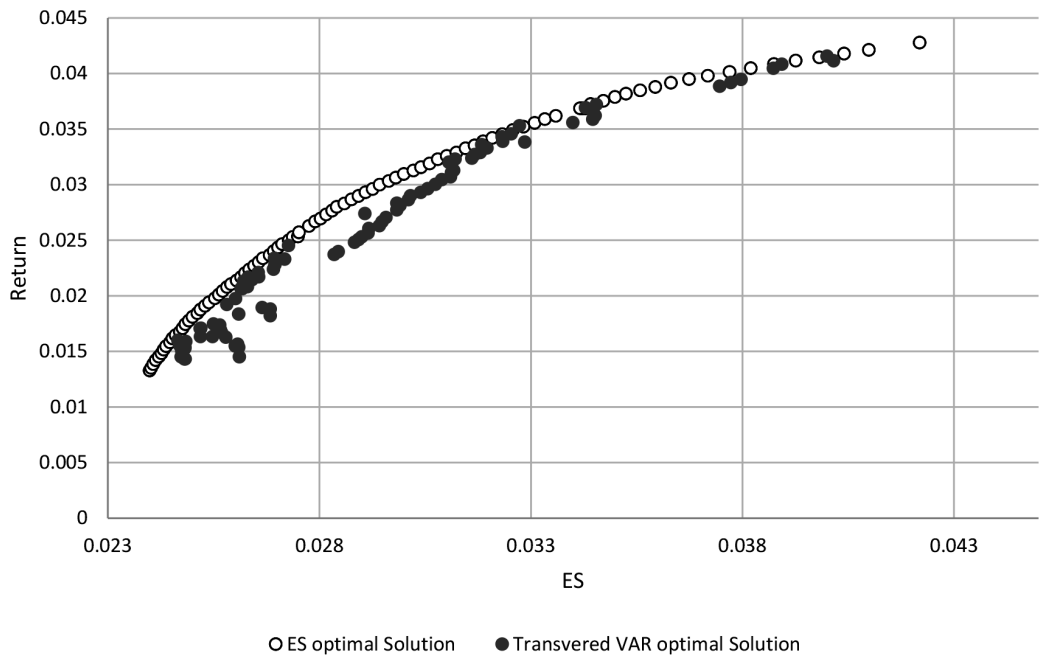

Figure 5 The transformed VaR optimal portfolios vs the ES optimal portfolios

Source: Authors

by mean-VaR optimization were plotted against those obtained by mean-ES optimization in the mean–ES plain. To do so, the ES was computed for the mean-VaR optimal portfolios, and the plotted result is displayed in Figure 5.

According to Figure 5, the mean-VaR optimal portfolios are evidently not distributed well when transformed in the mean-ES plain. The absence of solutions in the ES range of approximately 3.5% to 3.7% is apparent, with the more pronounced clustering of the optimal portfolios with the low expected return (considering the left-hand side of the graph depicted in Figure 5). In addition, the numerous portfolios exhibit nearly identical expected returns, yet display notable discrepancies in the ES values. These results were the motivation to compare the previous two sets of the optimal solutions in the mean-VaR plain as well. To do so, the VaR of the mean-ES optimal portfolios were computed and then those portfolios were plotted against the mean-VaR optimal portfolios in the mean-VaR plain (Figure 6).

As can be seen in Figure 6, the mean-ES optimal portfolios are distributed significantly better along the resulting efficient frontier. In addition, it can be noted that both efficient frontiers now look very similar to each other. The optimal portfolios obtained via ES minimization seem to converge towards the VaR optimal portfolios and nearly coincide for the high levels of the expected return.

In the end, a conclusion can be drawn that, generally speaking, VaR optimization does not provide ES optimal, or near-optimal, solutions. ES optimal solutions may simultaneously generate near-optimal VaR solutions. Consequently, in the case when both the low ES and low VaR are the desirable properties of the managed portfolio, it may be worthwhile to optimize it with respect to the ES.

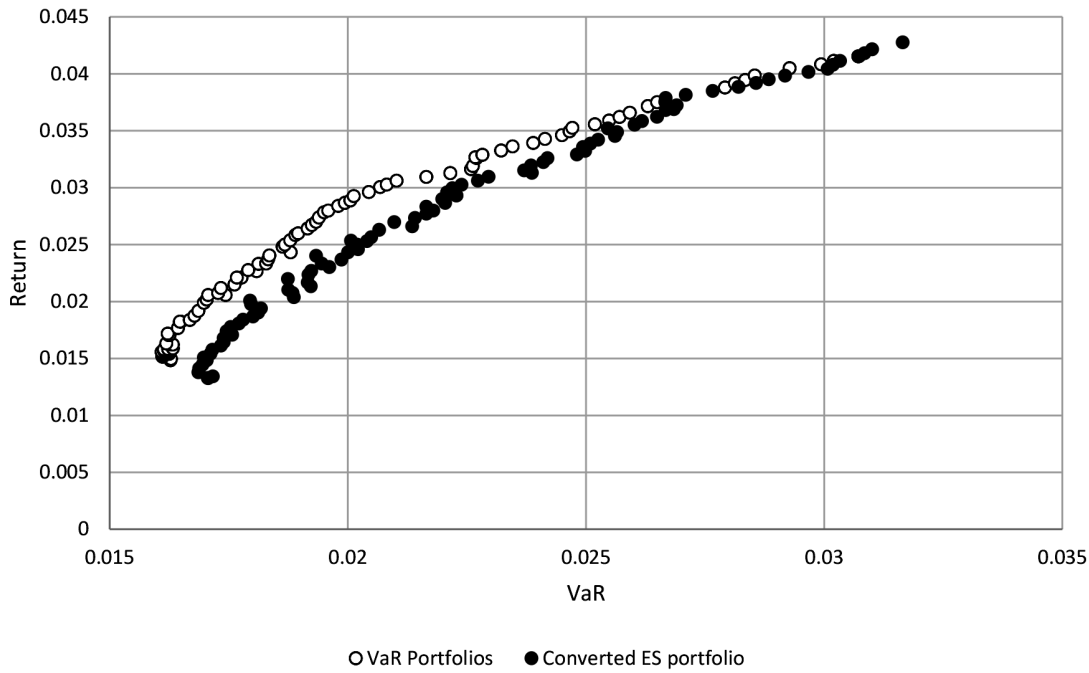

Figure 6 The transformed ES optimal portfolios vs the VaR optimal solutions

Source: Authors

CONCLUSION

This research study explores the applicability of the expected shortfall as a risk measure in the optimal portfolio selection problem. To generate optimal mean-ES portfolios, SPEA2 introduced by E. Zitzler *et al* (2002) was employed. Aiming to obtain computational efficiency, as many as seven most efficient assets from the DAX index were opted for.

In order to establish a benchmark for the results of the research study, SPEA2 was also used to generate the mean-VaR optimal portfolios. The efficient frontier obtained by mean-VaR optimization showed a flatter profile compared to that generated by the ES and produced the well-dispersed optimal solution. Subsequently, the ES for the mean-VaR optimal portfolios was computed and those portfolios were plotted with the mean-ES optimal portfolios. Notable disparities were observed between the two frontiers, particularly at the lower expected return levels. The transformation of the mean-VaR solutions to the mean-ES plain revealed the uneven distribution and absence of certain ES values. Conversely, VaR for the mean-ES optimal portfolios was also estimated and those portfolios were plotted against the mean-VaR optimal portfolios. The resulting efficient frontiers closely resembled each other, with the mean-ES solutions aligning well with the mean-VaR optimal solutions. As a matter of fact, it seems that the mean-ES optimal portfolios converge to the mean-VaR optimal solutions. The findings of this research study demonstrate that the portfolio optimization based on the minimization of VaR and the ES can produce significantly different optimal portfolios for the same opportunity set of assets.

The shortcomings of the no-short-selling constraint are nevertheless acknowledged. Short positions can be strategically employed through direct hedges

in asset-liability management in order to manage various exposure types. Therefore, omitting this constraint limits the applicability of this study and limits its ability to capture the full spectrum of real-world portfolio management practices, potentially reducing the relevance and robustness of the findings.

The limitations of this study are also recognized and avenues for future research in this domain are identified. Firstly, the number of the assets chosen for the optimization algorithms is very small and random. Due to the simple structure of SPEA2, it would be easy to add certain real-world constraints, such as cardinality constraints or short selling. Furthermore, a more in-depth comparison with different multi-objective evolutionary algorithms would be of interest as well.

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Vladislav Radak has over ten years of work experience in quantitative finance and risk management. He has completed his undergraduate and master's studies at the Faculty of Mathematics in Belgrade. In parallel with his work in international consulting companies, he enrolled in doctoral studies at the Technical University in Dortmund. He currently leads the financial forensics team at Deloitte in Dusseldorf, but also teaches at the Faculty of Computing in Belgrade and at higher school in Dusseldorf.

Aleksandar Damjanović is a PhD student at the Department of Statistics, Faculty of Economics, University of Belgrade. He completed his undergraduate and master's studies at the same faculty. He has received several awards and scholarships for his academic achievements. He currently teaches several courses at the Faculty of Computing in Belgrade and works as an auditor in the Oil Industry of Serbia.

Vladimir Ranković is a full professor, specializing in applied computing, at the Faculty of Economics and vice-rector for education and student affairs at the University of Kragujevac. Vladimir Ranković is the director of undergraduate studies in Business Informatics and master's studies in Artificial Intelligence in Business at the Faculty of Economics. He participated in several domestic and international scientific projects and is an author of numerous academic papers.

Mikica Drenovak graduated from the Faculty of Mathematics, and received his master's and PhD degrees from the Faculty of Economics University of Belgrade. He taught at several domestic and international universities. He participated in several domestic and international projects. He has published his research results in several prestigious international academic journals and has been working as a reviewer in the Commission for Accreditation and Quality Control of Serbia for more than 10 years.

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THE EFFECT OF INTANGIBLE ASSETS ON CORPORATE FINANCIAL PERFORMANCE: THE EVIDENCE FROM SERBIA

Vladimir Dženopoljac[1*], Amer Rastić[2] and Aleksandra Dženopoljac[3]

[1]*Zayed University, College of Interdisciplinary Studies, Dubai, UAE*
[2]*Business College of Applied Studies "Prof. Radomir Bojković, Ph.D.", Kruševac, Serbia*
[3]*SP Jain School of Global Management, Dubai, UAE*

The paper examines how intangible assets, measured as the Value Added Intellectual Coefficient (VAIC), impact the margin and return ratios of the most profitable companies in Serbia. Previous research has demonstrated that intangible assets have a positive effect on the company's profitability across various contexts, including the European Union, the United Kingdom, and Serbia as well. This research study aims to determine whether intangible assets have a positive effect on the four ratios, namely the Net Profit Margin (NPM), the Earnings Before Interests, Taxes, Depreciation, and Amortization margin (EBITDAm), Return on Assets (ROA), and Return on Equity (ROE) or not. In the study, a sample consisting of the data collected from the official publication of the Serbian Business Registers Agency (SBRA) covering the period from 2017 to 2020 is used. The sample includes the 72 most profitable firms after excluding those not meeting the VAIC requirements. The findings of the study are indicative of the fact that intangible assets do have a positive impact on all the four ratios (NPM, EBITDAm, ROA, and ROE), which implies that companies in Serbia should prioritize investing in intangible assets so as to enhance their profitability and competitiveness.

Keywords: intangibles, intellectual capital, profitability, performance, VAIC

JEL Classification: O34

INTRODUCTION

The current context of the world economy is intensive in investments that cannot be seen or touched, the investments that are intangible assets according to the accounting rationale. In other words, intangible assets are perceived as a source of value creation in the modern economy (Chen, Cheng & Hwang, 2005; Dženopoljac, Kwiatek, Dženopoljac & Bontis, 2021). Unlike visible and tangible assets which have their physical or financial substance (equipment, buildings, land, plants, raw materials, financial

* *Correspondence to:* V. Dženopoljac, Zayed University, College of Interdisciplinary Studies, Dubai, UAE;
e-mail: vladimir.dzenopoljac@zu.ac.ae

assets, etc.), assets such as available knowledge, information, skills, training, close relationships with customers, good business culture, reputation, information systems, and organizational procedures are not visible. However, intangible assets are the main creator of value in businesses today (Janošević, 2009; Dženopoljac, Muhammed & Janošević, 2019). It is widely emphasized that the high-quality management of human resources and the development of patents affect the realization of a higher market value, investments in employees stimulate profitability, R&D investments positively correspond with the productivity of the firms and the disclosure of the information related to intangible assets causes market value to change (Guthrie, Petty & Johanson, 2001). The importance of firms' portfolio convergence in favor of intangibles is also referred to in the literature (Ciprian, Valentin, Mădălina & Lucia, 2012). *Esselte*, a company operating in the wood industry sector, expressed its concerns in 1979 about the digitization of paper records, also known as the "Paperless Office" concept. The company had been manufacturing paper products for over a hundred years and had also owned a subsidiary that printed Swedish law books. The printing process involved using computer presses, which allowed the company to maintain the database containing all of the Swedish legislation. As a result, *Esselte* launched an electronic search engine specifically designed for Swedish lawyers and attorneys, which was a significant technological advancement at that time (Sullivan & Sullivan, 2000). By converting the old business model into a new B2C model, *Esselte* consolidated intangible assets in digital form and reduced physical assets. The main symptom of the dramatic convergence in favor of intangible assets refers to the pandemic increase of the Market-to-Book Ratio of companies in today's world economy. In this sense in general, it is pointed out in the literature that intangible assets are all but fully recognized in a company's financial position statement, which means that the market value of a company is only partially recorded in the value of the net assets of that company (Janošević, 2009). It is possible to agree upon the fact that, to a certain extent, the explanatory power of the financial position statement has been impaired. However, the income statement has largely preserved its role, which is the reason why most evaluation approaches of firms are calculated according to the income statement. The reason is that information contained in the income statement is very important for the projection of future profits and cash flows a company will achieve (Skinner, 2008). The profit measure in the income statement is still very important. The accounting profit of the company is the generally accepted proof of the company's success (along with the satisfactory finance structure and liquidity) (Novićević & Antić, 2009). Since intangible assets are the key factor for achieving success in today's economy, financial performances mainly derived from the accounting profit are the main barometer for the high-quality management of intangible assets (Xu & Li, 2019). This research investigates the relationship between intangible assets and how they translate to financial performance. This research aims to test the impact of intangible assets on profit measures. The database was created based upon a hundred most profitable companies in Serbia selected by the Serbian Business Registers Agency (SBRA) for 2020. Due to the unusual impact of the COVID-19 pandemic on companies' financial performance, no data belonging to beyond 2020 were taken into consideration in the analysis carried out in this study. Some studies that analyzed the impact of intangible assets on companies' performance during the COVID-19 pandemic identified that the relationship had been negatively moderated by tangible capital (Ognjanović, Dženopoljac & Cavagnetto, 2023). Statistical multivariate regression analysis was used in this research study to test the hypotheses if the intangible assets of these companies impacted their profitability or not. In these hypotheses, intangible assets are proxied by VAIC. Profitability is presented through the margin ratios the Net Profit Margin (NPM), the Earnings Before Interests Taxes Depreciation, and Amortization margin (EBITDAm), and the Return on Assets (ROA) and Return on Equity (ROE) return ratios. The findings of the multivariate regression analysis highlight the importance of intangible assets and their subcomponents. Regarding the role of intangible assets in companies, managers need to involve intangible assets in the business strategy

and pay attention to and allocate resources towards them in order to achieve better financial performance. The terms "intangible assets" i.e. "intangibles" are dominantly used in this paper instead of the term "intellectual capital". Accounting science is more familiar with the term "intangible assets" (Gupta & Raman, 2020). However, authors use all these terms interchangeably in their studies without making a distinction (Pastor, Glova, Lipták, & Kováč, 2017).

LITERATURE REVIEW

Intangible assets

The importance of intangible assets was recorded relatively early by J. Westerman and L. R. Dicksee (Oppong, Pattanayak & Irfan, 2019). W. A. Patton (1922) was the first author to have contextualized the position of goodwill in accounting terms (Serenko & Bontis, 2013). However, intangible assets were more actively emphasized after the popularization of the resource-based view of the firm (RBV), which perceives the company as a collection of the resources available to management. In this sense, depending on their quality, the collection of resources affects the company's competitive advantage (Pike, Fernström & Roos, 2005) and their superior performance (Bhattu-Babajee & Seetanah, 2022). Intangible assets and knowledge as their major element have an impact on the shareholders' wealth and, according to M. Salehi, A. S. Gouji and M. L. Dashtbayaz (2020), they can improve the company's competitive advantage. Furthermore, tacit knowledge sharing represents a major element in the creation of companies' competitive advantage and strategy implementation. For example, it tends to play the key role in mergers and acquisitions during the negotiation phase (Dženopoljac, Abidi, Rauf & Bani, 2022).

The core structure of intangible assets is subject to multidisciplinary interpretation. In the common cross-section of the definitions highlighted by K. E. Sveiby (1997) and R. Petty and J. Guthrie (2000), the intangible asset structure is created by the company's human, structural, and external capital (Sveiby, 1997; Petty & Guthrie, 2000). According to N. Bontis and D. Nikitopoulos (2001), this structure is the closest to being the officially accepted structure in academic literature (Bontis & Nikitopoulos, 2001; Dženopoljac, Yaacoub, Elkanj & Bontis, 2017). Human capital represents the stock of knowledge in an organization that stems from employees (Bontis, Chua Chong Keow & Richardson, 2000). To build human capital in a company, it is crucial to focus on the factors such as employee satisfaction, employer branding, intrinsic motivation, and maintaining a healthy work-life balance (Slavković, Pavlović & Simić, 2018). The intellectual stimulation provided by the company's leaders improves the problem-solving skills in employees and contributes to the overall success of the company (Savović, 2017). Structural capital integrates all the knowledge of the current infrastructure of the company (López & Ramírez-Gómez, 2023). Structural capital refers to databases, algorithms and software, the organizational structure, documentation, and business processes (Bontis *et al*, 2000) and represents the nonhuman reserves of knowledge (Salehi *et al*, 2020). A significant determinant of structural capital in an enterprise is its organizational culture, which is often seen as the key element of the company's internal environment (Todorović, Erić & Stojanović, 2023). Organizational culture plays a significant role in the knowledge-based economy because it facilitates social communication and fosters collaboration among individuals and organizations. Organizational culture is an attribute closely linked to its members' values, beliefs, and assumptions. It is unique to each organization and helps shape each organization's identity (Pietruszka-Orty, 2021). Apart from the company's culture, the job structure and design also affect the engagement of its human capital (Bošković, 2021). As the third component of intangible assets, external capital is represented as relational capital which embodies the value of companies' relationships with their external stakeholders (Dženopoljac *et al*, 2017). According to L. Marinelli, S. Bartoloni, F. Pascucci, G. L. Gregori and M. F. Briamonte (2022), however, relational capital refers to the knowledge inherent in the relationships between an organization and its stakeholders, no matter whether they are

internal or external. This knowledge has a significant impact on the organization's ability to create value and thrive (Marinelli *et al*, 2022). One segment of companies' intangible assets that permeates all the identified elements of intellectual capital is the employer brand, which can be seen as an important intangible asset augmenting all the three components (Dženopoljac, Ognjanović, Dženopoljac & Kraus, 2023a).

The efforts made by management intended to make investments in intangible assets and their efficient usage must be measured. The literature on intellectual capital focused on the measurement issues with intangibles, but this occurred approximately ten years after the concept of intangibles had become a recognized research field (Dženopoljac, Senić, Labben, Arici & Koseoglu, 2023b). The measurement of intangible assets enhances the communication of real value to investors, as well as the implementation of management decisions intended to enhance the company's performance (Marr, Schiuma & Neely, 2004). G. Turner and C. Minonne (2010) pointed out the fact that the accounting profession should develop a tracking and management tool for investments in intangible assets and measure long-term returns on investments. It is important to establish a model that can distinguish companies in which the stock of intangible assets increases from those in which it is reduced (Turner & Minonne, 2010).

The Value Added Intellectual Coefficient (VAIC) that measures the efficiency of intangible assets in companies is the model that deserves to be treated highly significantly in the literature (Pulić, 1998). Indirectly, VAIC also indicates the amount of the stock of intangible assets in the company, given the fact that the companies that have a higher value of intangible assets tend to use them better (they tend to have higher VAIC efficiency coefficients). VAIC represents the methodology that consists of the three main efficiency coefficients, namely Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and Capital Employed Efficiency (CEE). CEE refers to the efficiency of the company's physical assets. The model is inspired by the logic that all of these three elements result in the creation of Value Added (VA) (Dženopoljac, 2014; Dženopoljac *et al*, 2017). According to A. Pulić (1998), VA is determined mathematically as follows (Pulić, 2000; Maji & Hussain, 2021):

$$VA = EBIT + D + A + EC \tag{1}$$

where EBIT is interpreted as Earnings Before Interest and Taxes, D as Depreciation, A as Amortization, and EC as Employee Costs (Maji & Hussain, 2021). A. Pulić (2000) stated that the calculation of the efficiency coefficients including HCE, SCE, and VAIC was covered by the following mathematical patterns (Dženopoljac *et al*, 2017; Maji & Hussain, 2021). HC corresponds with the company's employees' wages and salaries, whereas SC was calculated as the subtraction of HC from VA. According to A. Pulić (2000), the sum of HCE and SCE is expressed as the indicator of Intellectual Capital Efficiency (ICE) (Maji & Hussain, 2021).

$$HCE = \frac{VA}{HC} \tag{2}$$

$$SCE = \frac{SC}{VA} \tag{3}$$

$$SC = VA - HC \tag{4}$$

$$CEE = \frac{VA}{CE} \tag{5}$$

If all these three coefficients are summed, the calculation of *VAIC* reads as follows:

$$VAIC = HCE + SCE + CEE \tag{6}$$

$$ICE = HCE + SCE \tag{7}$$

$$VAIC = ICE + CEE \tag{8}$$

The model has its limitations, too, e.g. the incomplete calculation of structural capital (research and development costs are not involved in the calculation of structural capital). The VAIC model does not involve the relational capital efficiency coefficient, either (Chen *et al*, 2005). VAIC model does not differentiate between assets and costs, nor does it make a difference between inventory and the inventory flow (changes). The VAIC model interprets the isolated contribution of the three types of capital, simultaneously neglecting their combined impact on added value (Marzo, 2022).

Intangible assets in the form of isolated reservoirs cannot contribute to financial performance. It is more than simply the sum of its three components (Mondal & Ghosh, 2012). The explanation of the reciprocal contribution of human and structural capital is intuitive and requires empirical evidence (Kai Wah Chu, Hang Chan & Wu, 2011). Some theorists attribute the incomplete coverage of structural capital (Morariu, 2014) and relational capital to the VAIC model. The VAIC model has a limitation where it only considers annual investments made in human capital, which can be confusing as it fails to account for the total value of employees resulting from the company's previous investments. Therefore, human capital is expressed inconsistently over time. The experience curve, which was introduced in the late 1960s, shows that there is a temporal difference in matching labor costs and generating future added value (Marzo, 2022). However, the intention in the VAIC model does not relate to the use of labor costs from an accounting perspective, but rather the intention is to encompass the incremental contribution that employees reflect on added value, which justifies the conclusion that employees' wages are investments because the company expects future benefits from such investments (Marzo, 2022). The VAIC model is also criticized for its inability to be applied to the companies whose profit is negative, which (according to the VAIC logic) have achieved negative value added (VA). In other words, the company spends more on inputs than on the output amount (Kai Wah Chu *et al*, 2011). P. Ståhle, S. Ståhle and S. Aho (2011) mentioned the problematic mathematical construction that relates human capital to its efficiency, which as such suggests that the lower human capital (labor costs), the higher its efficiency. This creates an issue when comparing intangible assets between the companies that have different wage structures as it can undermine the results (Ståhle *et al*, 2011). Despite the mentioned limitations, however, M. Holienka, A. Pilková and M. Kubišová (2016) indicate that this model is the best and most pragmatic solution to studying the impact of intangible assets on the creation of companies' value. The VAIC methodology is based upon available financial information and represents the most suitable system that can be used in empirical research (Holienka *et al*, 2016).

Intangible assets and profitability ratios

In 1959, E. Penrose introduced resource-based theory, which shifted the traditional view of companies as mere administrative entities. Instead, she proposed that companies were composed of various resources managers can utilize to gain a competitive advantage. This competitive advantage is achieved by owning unique and valuable resources that are difficult to replicate and with significant market value (Pike *et al*, 2005). H. Itami (1987) played a significant role in developing intangible assets theory, also known as "invisible assets." In his famous book entitled "Mobilizing Invisible Assets", H. Itami was one of the pioneers to explain that intangible assets such as technology, customer knowledge, and business culture were crucial resources for a company to gain a competitive edge (Kolaković, 2003; Pike *et al*, 2005). Knowledge and information are crucial for creating value in the digital economy, making a company's assets increasingly knowledge-intensive (Ghosh & Mondal, 2009), which means economic value is derived more from intangible assets than from physical ones (Kai Wah Chu *et al*, 2011). Intangible assets are also defined as "something that cannot be touched, yet slowly makes you rich," or as the "knowledge that can be converted into a profit" (Ghosh & Mondal, 2009, p. 370). The contemporary B2C business model implies departure from traditional dependence on physical assets for gaining a competitive edge.

Companies accumulate intangible assets through innovations, employees, and organization, according to G. G. Ciprian *et al*, 2012. Investing heavily in intangible assets may offer several advantages to companies, including scalability, non-depletion by use, and being difficult to imitate (Galbreath & Galvin, 2006). Scalability refers to the ability of intangible assets to be used in multiple places simultaneously, unlike physical, financial, and human assets that cannot be used for alternative simultaneous purposes (Haskel & Westlake, 2018). For instance, an airplane flying from San Francisco to London cannot be used simultaneously for a flight from San Francisco to Tokyo (Lev, 2001). In contrast, intangible assets can be used simultaneously without compromising each other's use. For example, while an airplane

and the crew can only serve one flight at a time, the reservation software application can serve multiple users simultaneously (Lev, 2001).

Intangible assets are assets difficult to replicate in the market. For instance, the iPhone design was not the unique feature of its intangible asset. *Apple* made investments in technology development, customer service (the Apple Store), brand development, market channels, and the innovative Just-in-Time (JIT) concept (Haskel & Westlake, 2018). By combining various forms of intangible and physical assets, favorable financial performance is achieved (Oppong *et al*, 2019). The combined value of these assets exceeds the sum of their values. In other words, the total value of the assets ($a_1 + a_2 + ...a_n$) is less than their combined synergistic value *a*, *i.e.* $a > \sum (a_1 + a_2 + ...a_n)$ (Ghalib, 2004). According to the above-mentioned, intangible assets represent a critically important collection of resources for creating a sustainable competitive advantage for a company (Ionita & Dinu, 2021). Competitive advantage correlates with companies' financial performance such as their revenue, corporate profitability margins, and better market indicators. The studies in which researchers analyze the impact of intangible assets on various financial performances are numerous. In the last 25 years, researchers have invested a considerable effort in elucidating the role of intangible assets in the condition of firms' profitability ratios. The VAIC model and the elementary components of the VAIC coefficient such as ICE and CEE (Radić, 2018; Rastić, Stevanović & Antić, 2021) or HCE, SCE, and CEE (Maditinos, Chatzoudes, Tsairidis & Theriou, 2011; Sardo & Serrasqueiro, 2017) are the most prominent accounting format for intangible assets used in studies (Bhattu-Babajee & Seetanah, 2022). For example, F. Sardo and Z. Serrasqueiro (2017) found a statistically significant positive relationship between HCE and ROA, on the one hand, and between CEE and ROA, on the other, in a longitudinal study conducted on a sample of 2,090 companies from 14 European Union member countries (Sardo & Serrasqueiro, 2017). D. Zéghal and A. Maaloul (2010) studied the impact of VAIC on companies' operating profit margin, ROA, and the market-to-book ratio (M/B ratio). The authors analyzed the high-tech, traditional, and service sectors on a sample of 300 companies in the United Kingdom for the year 2005 and came to the following conclusions: first, they identified a significant impact of the VAIC coefficient on the operating profit margin and ROA in all the three sectors, with but one exception referring to the high-tech sector, where no positive impact of CEE was found, which on its part implies that the high-tech sector was characterized by ROA being highly affected by intangible assets; second, in the case of the M/B ratio, a positive impact of the VAIC coefficient was only identified for the high-tech sector. In other words, investors perceive the companies that cultivate a higher level of intangible assets as more attractive; third, for the traditional and service sectors in the United Kingdom, investors still undervalue investments in intangible assets because no positive impact on M/B was found (Zéghal & Maaloul, 2010).

Using the financial statements of 96 Greek companies, D. Maditinos *et al* (2011) found in their study that HCE, SCE, and CEE had not been sufficiently stimulated to achieve their respective financial performances. More precisely, the findings are indicative of the fact that a significant positive relationship is only seen between HCE and ROE (from 2006 to 2008). No statistically positive impact on the M/B ratio, ROA, and sales growth was found, the conclusion being that the results for the Greek firms could be attributed to the insufficient exploitation of intangible assets and the fact that the Greek economy still created value from the exploitation of physical assets (Maditinos *et al*, 2011). M. Joshi, D. Cahill, J. Sidhu and M. Kansal (2013) tested the impact of intangible assets on ROA in the financial sector composed of 33 Austrian firms and found that HCE and SCE positively corresponded with ROA in banks, insurance companies, and investment funds (Joshi *et al*, 2013).

V. Dženopoljac *et al* (2017) tested the impact of the VAIC components on the three aspects of financial performance: first, profitability ratios (earnings before interest and taxes (EBIT), earnings before interest, taxes, depreciation, and amortization (EBITDA), ROE, ROA, the net profit margin, the EBITDA margin, and the gross profit Margin); second, the efficiency ratio ATO (Asset Turnover), and third, the M/B ratio, only to have come to the following findings: first, EBIT and

EBITDA correspond significantly with increases in SCE and CEE. These two components (SCE and CEE) also affect ROA, whereas ROE is only affected by CEE; second, the efficiency ratio (ATO) is affected by CEE, and third, M/B variability is only determined by the positive impact of HCE (Dženopoljac *et al*, 2017).

H. Pew Tan, D. Plowman and P. Hancock (2007) tested the impact of intangible assets in the firms operating in Singapore's economy. The 450 annual reports of 150 firms used in the study confirmed the four hypotheses for the period from 2000 to 2002. First, the VAIC model coefficients were proven to have positively correlated and to have been in a statistically significant positive relationship with ROE, earnings per share (EPS), and annual stock return (ASR). Second, the increase in HCE and SCE within the company affected future financial performances and the contribution of HCE and SCE was different for the sectors depending on the intensity of intangible assets within them. For example, they concluded that the variability of financial performances was largely explained by the impact of intangible assets in the service sector (Pew Tan *et al*, 2007).

R. Bhattu-Babajee and B. Seetanah (2022) found that VAIC positively impacted the financial performances found in a sample of 152 Mauritian firms. In the long- and short-term intervals, the VAIC coefficient had a positive and significant impact on ROA, ROE, and Tobin's Q. The influence of the VAIC coefficient on financial performance had weaker effects in the short term than in the long term. In other words, the authors noticed that the full effects of investments in intangible assets were time delayed. Reverse causality was also identified by the authors when the impact of financial performances on the VAIC coefficient was concerned, which is extremely important for stimulating employees' motivation because human capital is an integral component of the VAIC model (Bhattu-Babajee & Seetanah, 2022).

S. G. Maji and F. Hussain (2021) found a positive impact of ICE and technical efficiency on the financial performances of the banks in India for the period from 2005 to 2018, this impact, however, not being perceived in the lower performance quantiles that the banks had achieved, which suggests that ICE and technical efficiency represented the watershed of the successful and unsuccessful banks (Maji & Hussain, 2021).

C. Ionita and E. Dinu (2021) found no impact of intangible assets (recognized in the form of patents and R&D) on the sustainable growth rate (SGR) and the firm's value (FV) in Romanian companies. Their database contained a sample of the 78 companies listed on the Bucharest Stock Exchange (BSE) for the period from 2016 to 2019 (Ionita & Dinu, 2021). A. Rastić *et al* (2021), however, found a positive impact of ICE on SGR in the example of 67 Serbian companies for the period from 2015 to 2019 (Rastić *et al*, 2021). B. Komnenić and D. Pokrajčić (2012) identified a positive impact of HCE and CEE on ROE, ROA, and ATO, as well as a positive influence of SCE on ROE. On a sample of 31 multinational companies operating in Serbia, the authors confirmed the fact that the additional stimulation of structural capital was necessary (Komnenić & Pokrajčić, 2012).

In compliance with the findings of the foregoing studies, the following hypotheses were set:

H1: There is a positive impact of intangible assets on the net profit margin (NPM).

- H1a: Firms with a higher ICE coefficient tend to have a higher NPM.
- H1b: Firms with a higher CEE coefficient tend to have a higher NPM.

H2: There is a positive impact of intangible assets on the EBITDA margin (EBITDAm).

- H2a: Firms with a higher ICE coefficient tend to have a higher EBITDAm.
- H2b: Firms with a higher CEE coefficient tend to have higher EBITDAm.

H3: There is a positive impact of intangible assets on return on assets (ROA).

- H3a: Firms with a higher ICE coefficient tend to have higher ROA.
- H3b: Firms with a higher CEE coefficient tend to have higher ROA.

H4: There is a positive impact of intangible assets on return on equity (ROE).

H4a: Firms with a higher ICE coefficient tend to have higher ROE.

H4b: Firms with a higher CEE coefficient tend to have higher ROE.

In compliance with the hypotheses from 1a to 4b, the following figure was created (Figure 1).

RESEARCH METHODOLOGY

Data collection

To test the hypotheses 1a-4b, a sample of the companies based in Serbia was singled out from the official list published by the Serbian Business Registers Agency (SBRA) in November 2021 (SBRA, 2021), which involved the companies that had achieved the highest net profits in 2020. The data published after 2021 were not included in the list due to the significant impact COVID had had on the companies' performance. The data contain the financial statements of these companies for the period from 2017 to 2020. The firms that had not met the VAIC requirements were excluded from the sample (the companies that had had a negative operating profit in the given period). The definitive research sample contained the financial information of the following 72 firms (Table 1).

The definitive sample incorporates the data obtained from various industrial sectors, including the Manufacturing Sector (Pharmacy, Chemicals, Food and Drinks, Tobacco, Weapons, Wood, Packages, Furniture, and Textiles) comprising 46.48%, Transportation, Communications, Electric, Gas, and Mining making up 23.61%, Construction accounting for 13.89%, Trade and Consumer Services participating 9.73%, and Agriculture contributing 6.29%. After the data had been sorted out, a total of 288 observations were made, with four observations per year. A. Rastić, T. Stevanović and M. Staletović (2022) analyzed the same SBRA official list, but only the first ten companies. According to the authors, *Telenor* had the highest HCE and SCE coefficients, only to be followed by *Philip Morris Operations* and *VIP Mobile* (currently known as A1). The authors concluded that those highly profitable companies also had high VAIC coefficients, which suggests that the VAIC coefficients may correspond with the profit measures in Serbian companies. However, further analysis is required to confirm this conclusion (Rastić *et al*, 2022).

Regression models

To test the hypotheses 1a-4b, it is necessary to create regression models. Regression models contain a

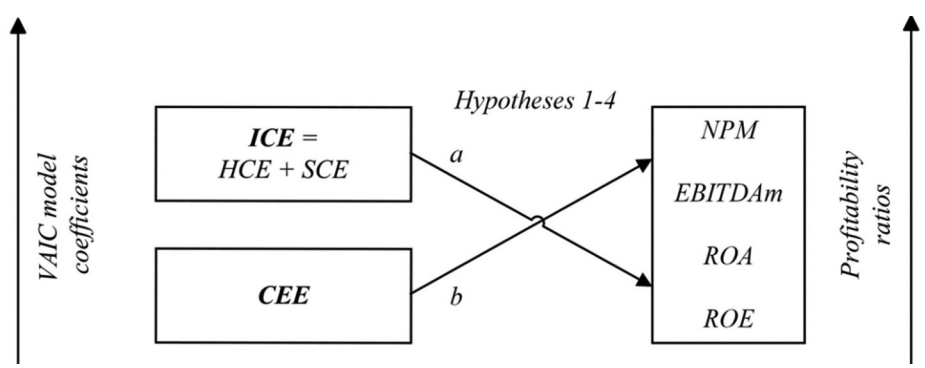

Figure 1 The illustrated view of the hypotheses H1a–H4b

Source: Authors

Table 1 The research sample: the most profitable firms in Serbia in 2020

JP Electric Power Industry of Serbia	Ball Packaging Europe Bel-grade	Gebi
Tigar Tyres Manufacturing Company	Pink International Company	Integral Engineering Branch
Telenor	Koteks Viscofan	My Supernova
Zijin Bor Copper	Lafarge Beočin Cement Facto-ry	Radun Inžinjering
Coca-Cola Hellenic Bottling Company - Serbia	Sinofarm Manufacturing and Trading Company	Galenika Phytopharmacy for Agricultural Chemicals Produc-tion
Telekom Serbia Telecommu-nications Company	Imlek Dairy and Dairy Prod-ucts Industry	Jysk
Philip Morris Operations	MOL Serbia Oil and Gas Trad-ing Company	Euro Road
Hemofarm	DM Invest Construction and Engineering Company	Flash
Delhaize Serbia	Banatski Dvor Underground Gas Storage	Polimark
Vip Mobile	Drenik ND Manufacturing Company	Nicefoods Restaurants
Farmina Pet Foods	Sport Time Trading and Media-tion Company	Teklas Automotive
Serbia Broadband – Serbian Cable Networks	PC Jugoimport-SDPR	Knez Petrol
PUC Belgrade Power Plants	Pharmaswiss	Valjevo Road Company
Tarkett Flooring Manufactur-ing Company	Phuket	Nelt
JP Srbijagas	Sport Vision Trading and Me-diation Company	Agromarket
CRH (Serbia)	Knjaz Miloš Mineral Water and Beverage Production Compa-ny	Mozzart
Grundfos Serbia	Heineken Serbia	Magna Pharmacia
Henkel Serbia	Forma Ideale Furniture Manu-facturing and Trading Compa-ny	RZD International
Tetra Pak Production	Planinka Company for Natural Spas, Tourism, Hospitality, and Production	Messer Technogas Company for Technical and Medical Gases Production and Trading and Ac-companying Equipment
Peštan	Sunoko Sugar Production and Trading Company	Titan Kosjerić Cement Plant
Karin Komerc	Matijević Meat Industry	Contitech Fluid Serbia
Johnson Electric	Strabag	Atlantic Grand
Almex	Phoenix Pharma	PC Post of Serbia
Japan Tobacco International	Inkop Construction Company	Bambi Confectionery Products Manufacturing and Trading Concern

Source: Serbian Business Registers Agency

specific constellation of the relationships between the dependent variable and the independent variables. In the case of the hypotheses 1a-4b, the dependent variables are the net profit margin (NPM), the EBITDA margin (EBITDAm), ROA, and ROE. The independent variables (explanatory variables) in the regression models are ICE and CEE. According to the hypotheses 1a-4b, the regression models are set in the following way:

$$NPM_{i,t} = \beta_0 + \beta_1 ICE_{i,t} + \beta_2 CEE_{i,t} + \varepsilon_{i,t} \quad (9)$$

$$EBITDAm_{i,t} = \beta_0 + \beta_1 ICE_{i,t} + \beta_2 CEE_{i,t} + \varepsilon_{i,t} \quad (10)$$

$$ROA_{i,t} = \beta_0 + \beta_1 ICE_{i,t} + \beta_2 CEE_{i,t} + \varepsilon_{i,t} \quad (11)$$

$$ROE_{i,t} = \beta_0 + \beta_1 ICE_{i,t} + \beta_2 CEE_{i,t} + \varepsilon_{i,t} \quad (12)$$

RESULTS AND DISCUSSION

Descriptive statistics and correlation analysis

The descriptive statistics (Table 2) contain the information about the independent and dependent variables. Based upon 288 observations, the means for the independent variables ICE and CEE are 4.318 and 0.774, respectively. The standard deviations for ICE and CEE are 2.67 and 0.77, respectively. The means for the dependent variables EBITDAm, NPM, ROA, and ROE are 21, 14.96, 15.67, and 32.96, respectively. The standard deviation for EBITDAm is 13.79, while for NPM it is 18.22, 16.73 for ROA, and 34.79 for ROE.

The Kolmogorov-Smirnov test ($p < 0.0005$) indicates the absence of normality in the distribution of the values of the variables (Table 3).

With the absence of normal distribution, it is necessary to implement correlation analysis with Spearman's correlation coefficient (r_s) (Table 4).

After correlation analysis had been conducted, the results showed the presence of weak correlation ($r < 0.5$), moderate correlation ($0.5 \leq r < 0.75$), and strong correlation ($r \geq 0.75$).

A weak positive and statistically significant correlation was identified between the ICE coefficient and RiOE, where $r_s = 0.243$ ($p < 0.05$).

A weak positive correlation between the CEE coefficient with NPM and EBITDAm was also identified.

A weak positive correlation was identified between the ICE coefficient and the dependent variables ROA and NPM, where $r_s = 0.300$ ($p < 0.05$) and $r_s = 0.393$ ($p < 0.05$), respectively.

A moderate positive correlation between the CEE coefficient and ROA was also identified.

Table 2 The descriptive statistics

	N	Mean	Std. Deviation	Min	Max
ICE	288	4.32	2.67	1.04	27.71
CEE	288	0.77	0.77	0.05	5.60
EBITDAm	288	21.01	13.80	0.24	70.95
NPM	288	14.97	18.22	0.12	247.86
ROA	288	15.67	16.73	0.08	123.09
ROE	288	32.96	34.79	0.23	305.89

Source: Authors

Table 3 The normality test results

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistics	df	Sig.	Statistic	df	Sig.
ICE	0.141	288	0.000	0.737	288	0.000
CEE	0.196	288	0.000	0.697	288	0.000
EBITDAm	0.122	288	0.000	0.932	288	0.000
NPM	0.208	288	0.000	0.469	288	0.000
ROA	0.177	288	0.000	0.693	288	0.000
ROE	0.190	288	0.000	0.697	288	0.000

Source: Authors

Table 4 The correlation analysis

			ICE	CEE	EBITDAm	NPM	ROA	ROE
Spearman's rho	ICE	Cor-rela-tion co-effi-cient	1.000	0.041	0.558**	0.393**	0.300**	0.243**
		Sig. (2-tailed)	-	0.492	0.000	0.000	0.000	0.000
		N	288	288	288	288	288	288
	CEE	Cor-rela-tion co-effi-cient	0.041	1.000	0.250**	0.061	0.366**	0.726**
		Sig. (2-tailed)	0.492	-	0.000	0.303	0.000	0.000
		N	288	288	288	288	288	288

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

Source: Authors

A moderate positive correlation was identified between the ICE coefficient and EBITDAm, where $r_s = 0.558$ ($p < 0.05$).

A strong positive correlation between the CEE coefficient and ROE was also identified.

The analysis of the regression models

The multivariate linear regression of the first model (Table 5) indicates that the intangible assets in the model significantly affect the variability of NPM. The determination coefficient (R^2) shows that the coefficients ICE and CEE explain 2.4% of the variability of NPM. Although the explanatory power of the model is only 2.4% (R^2), the model is statistically significant ($p = 0.030$, $p < 0.05$). The standardized beta coefficient for ICE is $\beta = 0.155$ ($p < 0.05$), which confirms the hypothesis H1a. The higher the ICE coefficient, the higher NPM. The results show that the impact of CEE on NPM is negative but not statistically significant, so the hypothesis H1b is not confirmed ($p > 0.05$). According to the partial correlation coefficient (0.154), ICE explains uniquely 2.37% (based on the partial coefficient's squared value) of the NPM variability in the model.

The regression analysis results of the second model indicate that the intangible assets in the model significantly affect the variability of EBITDAm. The determination coefficient (R^2) shows that the ICE and CEE coefficients account for 27.4% of the variability of EBITDAm ($p < 0.05$). The independent variables (ICE, CEE) contribute statistically significantly to the variability of EBITDAm. The beta coefficient for ICE is $\beta = 0.477$ ($p < 0.05$) which explains that the hypothesis H2a is confirmed. The higher the ICE ratio, the higher EBITDAm. The impact of CEE on EBITDAm is positive and statistically significant $\beta = 0.188$ ($p < 0.05$), which explains why the hypothesis H2b is confirmed. Based upon the partial correlation coefficient (0.476), ICE explains uniquely 22.65% (the partial coefficient's squared value) of the variability of EBITDAm in the model. In comparison, the remaining part of the variability of NPM that is attributable to CEE amounts to 3.53% (Table 6).

Table 5 Multivariate linear regression for NPM

	R	R^2	Sig. (model)	Const.	Standardized coefficients Beta	Sig.	Unstandardized coefficients Beta	Correla-tions Part	Collinearity statistics	
									Tolerance	VIF
ICE	0.156	0.024	0.000	10.987	0.155	0.009	1.055	0.154	0.996	1.004
CEE	0.156	0.024	0.000	10.987	-0.032	0.591	-0.742	-0.031	0.996	1.004

Source: Authors

The analysis of the third regression model indicates that the intangible assets in the model significantly affect the variability of ROA. The determination coefficient (R^2) shows that the ICE and CEE coefficients explain 27.8% of the variability of ROA as a dependent variable ($p < 0.05$) (Table 7). The beta coefficient for ICE is $\beta = 0.229$ ($p < 0.05$), which confirms the hypothesis H3a. The higher the ICE coefficient, the higher ROA. The impact of CEE on ROA is positive and statistically significant, $\beta = 0.461$ ($p < 0.05$), which confirms the hypothesis H3b. Based on $Part^2$ (Part = 0.228), ICE explains 5.2% of ROA variability in the model, whereas the remaining part of ROA variability is attributable to CEE ($Part^2$=21.16%).

The analysis of the fourth regression model indicates that the intangible assets in the model significantly affect the variability of ROE. The determination coefficient (R^2) shows that the IiCE and CEE coefficients account for 68.5% of ROE variability ($p < 0.05$) (Table 8). The beta coefficient for ICE is $\beta = 0.131$ ($p < 0.05$), which confirms the hypothesis H4a. The higher the ICE coefficient, the higher ROE. The impact of CEE on ROE is positive and statistically significant, $\beta = 0.809$ ($p < 0.05$), which confirms the hypothesis H4b. ICE explains 1.69% and CEE explains 65.3% of ROE variability, respectively.

It can be concluded that the hypothesis 1 is partly confirmed, whereas the hypothesis 2, hypothesis 3, and hypothesis 4 are fully confirmed.

Table 6 Multivariate linear regression for EBITDAm

	R	R^2	Sig. (model)	Const.	Standardized coefficients Beta	Sig.	Un-standardized coefficients Beta	Correla-tions Part	Collinearity statistics	
									Toler-ance	VIF
ICE	0.523	0.274	0.000	7.767	0.477	0.000	2.464	0.476	0.996	1.004
CEE	0.523	0.274	0.000	7.767	0.188	0.000	3.354	0.188	0.996	1.004

Source: Authors

Table 7 Multivariate linear regression for ROA

	R	R^2	Sig. (model)	Const.	Standardized coefficients Beta	Sig.	Un-standardized coefficients Beta	Correla-tions Part	Collinearity statistics	
									Toler-ance	VIF
ICE	0.527	0.278	0.000	1.770	0.229	0.000	1.433	0.228	0.996	1.004
CEE	0.527	0.278	0.000	1.770	0.461	0.000	9.954	0.460	0.996	1.004

Source: Authors

Table 8 Multivariate linear regression for ROE

	R	R^2	Sig. (model)	Const.	Standardized coefficients Beta	Sig.	Un-standardized coefficients Beta	Correla-tions Part	Collinearity statistics	
									Toler-ance	VIF
ICE	0.828	0.685	0.000	2.550	0.131	0.000	1.701	0.130	0.996	1.004
CEE	0.828	0.685	0.000	2.550	0.809	0.000	36.365	0.808	0.996	1.004

Source: Authors

PRACTICAL IMPLICATIONS OF THE RESEARCH RESULTS

The results obtained from the regression analysis indicate a positive ICE impact on NPM, which is consistent with the previous studies (Xu & Li, 2019) and confirms the fact that resource allocation towards intangible assets is advantageous for Serbian companies. This could also influence investors', analysts', and stakeholders' perceptions. It is very important, however, to implement effective knowledge management in Serbian companies so as to enhance intellectual capital. The EBITDA margin is affected by ICE, which is consistent with the previous results (Zéghal & Maaloul, 2010). Over 22% of the EBITDA margin change was identified to be attributed to the ICE coefficient, which findings suggest that intangible assets improve the operational efficiency of the Serbian companies. The Serbian companies that efficiently use intellectual capital could also benefit from cost reduction or higher revenue generation. The company's ROA variability is also affected by ICE, which is consistent with the previous studies (Komnenić & Pokrajčić, 2012; Joshi *et al*, 2013; Sardo & Serrasqueiro, 2017; Radić, 2018). These results suggest that the Serbian companies efficiently use their intangibles (in the form of skilled workers and effective business culture, innovations, software, etc.) to generate returns from other assets. ICE is also responsible for ROE variability in the observed period, which is in line with the previous findings (Pew Tan *et al*, 2007; Maditinos *et al*, 2011; Dženopoljac *et al*, 2017). It means that intellectual capital significantly contributes to value creation for shareholders relative to the equity invested.

The Serbian companies should prioritize the initiatives that enhance and stimulate intangible assets to maximize financial performance. However, the other studies carried out in Serbia showed slightly different or contradictory effects of intangible assets. For example, when assessing the impact of intellectual capital on performance within the companies in Serbia's real sector, that impact was small or irrelevant (Janošević & Dženopoljac, 2011). Furthermore, a study on the most successful exporters in Serbia revealed no significant impact of intangibles on their performance (Janošević & Dženopoljac, 2012).

CEE's effect on NPM was negative and not statistically significant. CEE's impact on the EBITDA margin is relatively weak compared to the positive impact that ICE has on it, which could mean that there is an overinvestment in fixed assets, but more evidence is needed for such a conclusion to be made. If the Serbian companies' assets converge more towards fixed assets, the high depreciation costs incurred by the company will appear, which creates the impression that CEE does not affect the realization of corporate margins or has a negative effect. The results, however, suggest that the Serbian companies that are more intangible-intensive tend to create higher returns relative to their physical assets. Otherwise, V. Dženopoljac *et al* (2017) stated that the absence of a relationship between CEE and the company's corporate margins could also be attributed to the weaknesses of the VAIC model (Dženopoljac *et al*, 2017). ROA and ROE are relatively more affected by the CEE coefficient than by the ICE coefficient. CEE was found to be the strongest determinant to affect the variability of ROA and ROE.

The obtained results suggest that additional management refocusing is needed in the Serbian companies. The proven causality between ICE and the companies' profitability suggests that managers should make additional efforts to translate the utilization of intangible assets into financial performance. It is necessary to stimulate the activities of human and structural capital exploitation, which could be done through cherishing the organizational culture supportive of the development of talents and skills, creativity, and analytical tools in order to establish knowledge sharing. More investments are needed to foster innovation in terms of new products, processes, and technologies so as to enhance financial performance. The reactivation of decision-making towards intangible assets in the Serbian companies, however, necessitates the integration of intangible assets into a business strategy and the involvement of the intangible assets valuation models such as VAIC or, as M. Cosa, E. Pedro and B. Urban (2023) suggest, the intellectual capital key performance indicators (KPI).

CONCLUSION

The data from the year 2021 onwards were excluded in order to control the COVID-19 impact. The research examines the relationship between the intangible assets and profitability of the companies operating in Serbia officially listed as the most profitable ones in 2020. The study is based on the financial reports (financial position statements and income statements) of the most profitable Serbian companies in the period from 2017 to 2020. The study defines intangible assets as a combination of human and structural capital measured using the VAIC's ICE coefficient. Company profitability is measured using financial ratios, such as NPM, EBITDA margin, ROA, and ROE. The study reveals that the ICE coefficient has a significant influence on the profitability ratios. The research findings suggest the four main conclusions. Firstly, the ICE and CEE of the first model account for 2.4% of NPM variability. Secondly, the ICE and CEE coefficients explain 27.4% of the EBITDA margin variability, with the ICE coefficient alone accounting for more than 22% of the change in the EBITDA margin. Thirdly, the ICE and CEE coefficients explain 27.8% of ROA, with ICE explaining 5.1% of ROA on its own. Fourthly and finally, the ICE and CEE coefficients account for 68.5% of ROE. Based on these findings, the hypothesis 1 is partly confirmed, whereas the hypotheses 2, 3, and 4 are fully confirmed.

It is suggested that managers in the Serbian firms should additionally stimulate investments and the efficient use of intangible assets. Through the evident causality found in the study, the profitability of the Serbian business sector will be improved.

Despite the authors' honest intentions, the research study has some limitations. The authors decided not to use any data published after 2021 in their research due to the unprecedented impact of the COVID-19 pandemic on the companies' performance. As a result, the data sample used in the study is relatively small, only covering a narrow timeframe from 2017 to 2020, with the observations taken from the financial statements of those companies. The study does not involve control variables in the regression analysis. The limitations also correspond with the VAIC model. In spite of the limitations mentioned, the findings of the study still remain valid and reliable.

Future researchers are also suggested to analyze the effect of intangible assets on profitability to strengthen the management's perception according to which investments in intangible assets lead to an increase in the company's profitability. An extended timeseries framework and the adapted versions of the VAIC model are desirable in future research studies.

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Vladimir Dženopoljac is an Associate Professor at the College of Interdisciplinary Studies, Zayed University, Dubai, UAE. He holds an MSc and a PhD in Strategic Management from the University of Kragujevac, Serbia. His research interests are strategic management, intellectual capital, and knowledge management.

Amer Rastić is a lecturer at the Business College of Applied Studies "Radomir Bojković, PhD", Kruševac, Serbia. He holds an MSc and a PhD in economics from the University of Niš, Faculty of Economics. His research interests are related to management and financial accounting.

Aleksandra Dženopoljac is an Academic Manager for Internships and Marketing at SP Jain School of Global Management, Dubai, UAE. She holds a Master's degree in Marketing from the University of Kragujevac, Serbia, and is currently pursuing a Doctor of Science degree at Lappeenranta-Lahti University of Technology, Finland. Her research interests include marketing management and knowledge management.

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TRADE RELATIONS BETWEEN HUNGARY AND BOSNIA AND HERZEGOVINA: THE EVIDENCE FROM THE GRAVITY MODEL

Marko Đogo[1*], Dragan Gligorić[2] and Marianne Berecz[3]

[1]*University of East Sarajevo, Faculty of Economics Pale, Bosnia and Herzegovina*
[2]*University of Banja Luka, Faculty of Economics, Bosnia and Herzegovina*
[3]*Ministry of Foreign Affairs of Hungary, Budapest, Hungary*

With its nominal GDP USD 177.3 billion in 2022, the Hungarian economy is roughly equivalent to the economies of Serbia, Croatia and Slovenia, combined. Yet, these three countries are among the five most important Bosnia and Herzegovina's (B&H) trading partners in exports and imports, while Hungary only ranks eighth among B&H's most significant trading partners. By applying the gravity model, it was found that the basic gravity model (which takes into account only the size of the economy and the distance) is insufficient to explain the volume of trade between Bosnia and Herzegovina and Hungary. Actually, the fact that Bosnia and Herzegovina was once a member state of the Former Yugoslavia still has a significant impact on explaining the international trade of Bosnia and Herzegovina, simultaneously indicating the importance of historical, cultural, and political ties between the countries. The results obtained in this research study pertaining to the ten most significant trading partners of Bosnia and Herzegovina also suggest that the distance between the major cities more strongly influences exports than imports. Taking into consideration the size of the Hungarian economy and the distance, these results suggest that the trade volume between Bosnia and Herzegovina and Hungary is far below the expected level.

Keywords: traditional trade patterns, regional economic integrations, gravity model, cross-border cooperation

JEL Classification: F10, F13, F14

INTRODUCTION

According to the data obtained from the Foreign Trade Chamber of Bosnia and Herzegovina (B&H) in the year 2022, this country exported to Hungary goods whose worth was USD 205,061,169[1], and imported from Hungary goods whose worth was USD 529,704,800. Hence, the import coverage by export coefficient in Bosnia and Herzegovina's trade with Hungary was only 38.7% in 2022, whereas the coefficient for Bosnia and Herzegovina and all of its other trading partners was 63% in the same year.

* *Correspondence to:* M. Đogo, Faculty of Economics, University of East Sarajevo, Alekse Šantića 3, 71420 East Sarajevo, Bosnia and Herzegovina; e-mail: marko.djogo@ekofis.ues.rs.ba

In a time characterized by the flare-up of trade wars and the spreading sanctions and people starting to talk more often about the process of the deglobalization of the world economy (Goldberg-Reed, 2023; Chase-Dun, Álvarez & Liao, 2023), there were two related questions that the authorities of Bosnia and Herzegovina had imposed upon themselves to answer. The first question was whether trade relations with Hungary had sufficiently been developed given the fact that Hungary is geographically close to Bosnia. If the answer to the first question is negative, the other/second question of how to improve the position of Bosnia and Herzegovina in this exchange arises. Since one paper is not enough to answer both questions, this paper will try to find an explanation for the first question.

This paper does not deal with the structure of exports between the two analyzed countries but only focuses on values. Certainly, however, the intensification of Bosnia and Herzegovina's international trade with Hungary, as well as with the other Western Balkan countries where there is a huge yet untapped export potential (Lazarov & Miteva-Kacarski, 2023) can improve B&H's export structure and make it use its natural resources in a proper way, which is currently not the case (Krajišnik & Krčmar, 2017).

Yet, before starting dealing with the central issue of this research study (i.e. the trade relations between Bosnia and Herzegovina and Hungary) and given the tumultuous times we live in, the wish was to clearly emphasize the fact that the fundamental standpoint of economic science from its very beginnings to date, i.e. the fact that trade enriches all its participants, is still being advocated. Given the fact that, in principle, the Introduction does not cite the literature that supports the premise which the study is based on but introduces the reader to the subject, goal and structure of the study instead, a few most influential papers having shaped our point of view regarding the usefulness of international trade are presented in the relevant literature review.

It is of great importance for the paper itself, however, to point out the results of one of the last IMF's studies (Georgieva & Okonjo-Iweala, 2023), which indicate that, if the deglobalization process continues, its continuation will lead to the formation of trade blocs between geographically (and politically) close countries (as is the case of Hungary and B&H). Moreover, even if deglobalization leads to a drop in the world GDP (which, according to the IMF's forecasts, could be between 0.2 and 7% of the GDP, for some countries even up to 8 to 12% of the GDP), one part of that decline could be compensated for by deeper integrations and trade development within those blocs.

Using precisely the IMF's results, this research study aims to verify the statement that a significant untapped potential for increasing the wellbeing of the citizens of Bosnia and Herzegovina and Hungary lies in the deepening of the economic (in particular trade) relations between the two countries, based on the axiom that more trade means better wellbeing. Accordingly, the following hypothesis is tested in this study:

H1: The trade exchange volume between Bosnia and Herzegovina and Hungary is lower than it is suggested by the basic gravity model based on the size of the economies and the geographic distance.

The method employed to evaluate the proportions of the unused potential in trade between Bosnia and Herzegovina and Hungary is the "classical" gravity model. Although the model lacks a clear theoretical basis (Cieślik, 2009), the same has empirically been proven. According to J. E. Anderson, the gravity model could explain 80–90% of the variation in trade flows in most empirical studies (Anderson, 2010). However, the fact that neither Anderson nor most other authors refer to a simple gravity model, but different variations of this model that include the various additional variables that account for the trade volume between the two countries, should be emphasized as such. Indeed, according to the group of the authors of the EBRD who compiled the Transition Report 2003 (EBRD, 2003) "The gravity model is, therefore, quite flexible, and numerous variables can be added to assess other factors governing trade between countries". Due to the success of the gravity model, there have been attempts to apply it to the fluctuations of some other economic phenomena

(capital flows, the labor force movement, the sectoral structure of the economy, etc.). Nonetheless, although the gravity model is typically successful, there are exceptions throughout the world, i.e. the examples of significantly higher/lower trade between countries that should be consistent with the predictions obtained by applying the gravity model.

This paper is structured into five segments. After the Introduction, the Literature Review presents the research results of the previously published works that dealt with the economic relations of B&H with the other Western Balkans countries by applying the gravity model. Since those papers are scarce (only about 15 had been found for this research study), it was decided that the relevant literature would be expanded so as to include those dealing with the trade relations of the other Southeastern European countries applying the gravity model. In the third part, the research method and data sources used are introduced. The fourth part provides the obtained research results and discussion, whereas the fifth part concludes with the economic interpretation of the obtained results.

LITERATURE REVIEW

The oldest paper in which the gravity model was applied to the trade relations of Bosnia and Herzegovina and the countries of Southeastern Europe or the Western Balkan countries is that written by E. Christie dating back in the year 2002. It is entitled "Potential Trade in Southeast Europe: A Gravity Model Approach" (Christie, 2002). Applying the gravity model, E. Christie concludes that Serbia and Croatia, the two largest economies established after the disintegration of the SFRY, continue to trade significantly less than their potential might allow them to at that moment, whereas North Macedonia is shown to be the regional leader in the trade volume compared to its GDP.

B. Kaminski and M. De La Rosha (2003) confirmed the fact that the trade volume between Serbia and Croatia was still below its potential, whereas the mutual trade volume between the other states having been established after the disintegration of the SFRY had almost reached its potential level. This paper also deduces that the trade volume between the countries established after the disintegration of the SFRY and the Southeast European countries (Romania, Bulgaria and Albania) is still far below its potential.

The beginning of the 2000s was of great importance for the Southeastern European countries since it was then that they, as well as the EU and international multilateral institutions, decided on the further directions of the reform (transition) of these countries, which is noticeable in the IMF's 2003 Working Paper authored by A. Adam, J. McHugh and T. Kosma (2003), who suggested that there were three possible paths before the Southeastern European countries at that moment. First, there was a special free trade zone for this group of countries (SEEFTA). Second, there was the expansion of CEFTA (which had not expanded to Southeastern Europe yet at that moment) onto these countries. Third, they could have opted for the harmonization of the bilateral trade agreements between these countries that were in force at that time (Mamuti, Zubović & Boztepe, 2023). Analyzing CEFTA's and BFTA's experiences in terms of the trade volume and the trade pattern and applying the basic gravity model as the indicator of the "normal" or expected trade level, these authors predicted a considerable increase in the trade volume among these countries and with the EU.

The study carried out by M. Bussière, J. Fidrmuc and B. Schnatz (2005), written for the needs of the European Central Bank, confirms the fact that trade between the Southeastern European countries and the EU was still well below the estimated "normal" level at that time. The paper compares the experiences gained by the countries of Central and Eastern Europe and those of Southeastern Europe and deduces that the first group of the countries have made much greater progress in their integration with the EU.

J. P. Damijan, J. Sousa and O. Lamotte (2006) verified the conclusion of the previous study but also provided an additional insight since it was not only about applying the gravity model to trade between Southeastern

European countries and the EU. According to this paper, Southeastern European countries have reached the top level of mutual cooperation while still being below the average level of trade with the EU and the rest of the world. Another intriguing feature of this paper reflects in that it is the first to document that there was a significant increase in nontariff barriers after the reduction of the customs barriers between the Southeastern European countries and between these countries and the EU.

The work by D. Kernohan (2006) is interesting because this is the first paper in which the gravity model is applied to the trade of the countries established after the disintegration of the SFRY (although without Slovenia) and Albania, Bulgaria, Romania and Turkey, and in which one author explicitly advocates the creation of a customs union between these countries. He sees the customs union as a solution to the problem of the excessive dependence of the countries of the former Social Federal Republic of Yugoslavia (SFRY) on trade with other countries, which emerged after the disintegration of the former Yugoslavia.

J. Herderschee and Z. Qiao (2007) advocated the creation of a customs union of the Southeastern European countries. This paper is interesting since the CEFTA 2006 agreement joined by the countries of the former Yugoslavia had already been signed. However, the paper investigated the influence of bilateral agreements on trade liberalization between the countries of the Western Balkans (plus Ukraine) and the rest of the world (mainly the EU) by applying the gravity model. The study concluded that those agreements had had a significant positive impact on the trade volume.

Lj. Pjerotić (2008) backs the creation of a customs union of the countries established after the disintegration of the former SFRY. This paper is interesting because it is one of the first to suggest that trade between the countries established after the disintegration of Yugoslavia exceeded the natural level by far (it is said to be as much as 300% of potential trade) whereas trading between these countries and Bulgaria, Romania and Albania was still far below the expected level at that particular moment.

O. B. Kucharčuková, J. Babecký and M. Raiser (2012) point to the importance of institutions for increasing the trade volume. In this paper, a group of authors from the Czech Republic applied the gravity model to trade to the three groups of countries, namely to SEE, CIS and CEE, and concluded that if the Southeastern European countries reached the development level of the institutions of the Central European countries, that would lead to an increase in the trade volume with the EU by as much as 150%.

Most of the above-mentioned papers indicate that trade with the countries of the Western Balkans not established after the disintegration of the SFRY is still below the expected level. One such Albanian gravity-model-based research study conducted by A. Pllaha (2012) indicates that Albania's trade with the other countries of the Western Balkans was at only 10% of the real potential at that moment. This research study also considers the influence of the three extra factors (i.e. free trade agreements, ties from the past, and the neighborhood) in addition to the size of the economy and the distance.

A. Gjipali, E. Jorgji and E. Liko (2012) even more explicitly quantified the importance of these factors, concluding that the shared border increased the trade volume twice, the shared language increased it three times, while belonging to the former Yugoslavia increased it even four times.

P. Bjelić, R. Dragutinović-Mitrović and I. Popović-Petrović (2013) used the gravity model to estimate the impact of nontariff barriers both on the intra-regional trade volume of the Southeastern European countries and on the trade volume of these countries with the EU. They concluded that, of all the types of nontariff barriers, technical barriers represented the biggest obstacle to exporting to the EU market (which naturally includes Hungary as well). The authors also deduced that administrative barriers were the biggest obstacle to a further increase in the trade volume of these countries, both intra-regionally and with the EU and third countries.

The oldest paper found which applies the gravity model exclusively to B&H's trade relations with other countries (and does not consider B&H only as one of a

broader group of countries) is that by V. Nastić (2013), who analyzes Bosnia and Herzegovina's exports to 37 countries (including Hungary, too) from 2002 to 2011. By employing the gravity model, the author reaches somewhat surprising conclusions, i.e. the potential for the growth of B&H's exports to the EU countries was already drained in 2011, while the potential for the expansion of exports to the other CEFTA member countries was not exhausted. V. Nastić also points out the fact that the export structure of Bosnia is unfavorable since it only concerns the relatively simple products whose export depends on the price competitiveness, which is supported by the result according to which an increase in the distance (transportation costs) by 1% leads to a drop in the value of exports by as much as 2.121%.

K. Toševska-Trpčevska and D. Tevdovski (2014) believe that administrative barriers are the biggest impediment to a further increase in the volume of international trade in the Southeastern European countries, simultaneously pointing to the importance of the influence of the past trade patterns on the current trade. Specifically, they also find that being a member country of the former Yugoslavia and the shared border are the factors that significantly determine modern trade patterns.

In their paper, S. Kurtović and S. Talović (2015) employ the gravity model to analyze the trade between the CEFTA countries and the EU in the period from 2007 to 2013. Their goal is to determine whether the trade liberalization of these countries contributed to their trade deficit reduction. The obtained results led to the conclusion that trade liberalization between those countries and the EU had led to a reduction in the trade deficit of the first group of countries. Yet, it is noted that this was merely a consequence of the fact that most EU countries went through the 2008 crisis much better than the Western Balkan countries, rather than a consequence of the increase in the national competitiveness of the Balkan countries in the observed period.

In an interesting paper, J. Trivić and Ł. Klimczak (2015) expand the distance between countries from purely geographic to those communicative (the importance of the language) and historical (a shared history) and indicate that the noneconomic factors (such as the common language and belonging to the same religious groups) have greater importance with respect to trade patterns than purely economic factors.

A. Fejzić and E. Čovrk (2016) applied the gravity model to B&H's trade with its 15 biggest trading partners from 2005 to 2014, their goal being to determine how the transportation infrastructure affected Bosnia and Herzegovina's trade with the other countries through transportation costs. The results suggest that an increase in the distance by 1% voids a decrease in trade between Bosnia and Herzegovina and its trading partners by 1.27%. The results they obtained showed how flawed B&H's transportation infrastructure was, i.e. a 1% increase in the quality of B&H's transportation infrastructure would cause an increase in the trade volume between Bosnia and the other countries by as much as 2.83%!

The central question in the paper by R. Dragutinović-Mitrović and P. Bjelić (2015) is whether the Western Balkan countries' accession to the European Union could lead to a shift in trade patterns. They endeavored to answer this question by applying the gravity model to the experiences gained by the Central European countries. Since the trade of the Southeastern European countries with the Central European countries (including Hungary as well) that are the members of the EU is especially considered, it is interesting to deduce that the lower competitiveness on the part of the Southeastern European countries helped achieve the most significant increase in the exports of those countries in the early stages of the EU integration, i.e. when asymmetric trade liberalization was considered in favor of the Southeastern European countries. Also, a more significant increase in trade owing to CEFTA rather than to the SPP indirectly suggests that the very act of these countries entering the EU might not significantly change the existing trade pattern.

The study whose results differ from the results of almost all the other papers and studies in this field is that carried out by E. Pere and E. Ninka (2017), written on nearly 140 pages, which was a part of the

research done by the Vienna Institute for International Economic Studies (WIIW), whose research subject was the trade of the Western Balkan countries with the EU 28 in the period from 2001 to 2015. According to the results obtained in this study, Bosnia and Herzegovina's membership in CEFTA did not have a positive effect on its exports (in contrast to trade liberalization with the EU), and the distance did not play a significant role in its exports, either.

S. Kurtović, B. Halili and N. Maxhuni, (2017) analyzed the impact of trade liberalization on Bosnia and Herzegovina's exports to and imports from the ten most significant trading partners (including Hungary, too) in the period from 2005 to 2014 period. Nonetheless, in contrast to the paper of S. Kurtović and S. Talović (2015), in Kurtović *et al* (2017) they conclude that trade liberalization with more developed countries does not result in a decrease in the B&H's trade deficit (quite contrary to that, it results in its growth). Also, trade liberalization with countries at a similar development level contributes to B&H's trade deficit reduction.

F. Ćejvanović, D. Miličević, and A. Kamerić's (2018) findings are similar to those in the research study presented in this paper in terms of their goal and the applied methodology, except for the fact that it explores Bosnia and Herzegovina's economic relations with another country. In their paper, the gravity model is used to assess whether B&H's trade with Montenegro has reached its full, expected potential in such a way that the full potential is the level suggested by the gravity model. The results indicate that there is additional room for the growth of exports from Bosnia and Herzegovina to Montenegro (the actual exports were USD 149 million in 2013, whereas the expected exports were USD 207 million) and a much greater scope for the growth of imports to Bosnia and Herzegovina from Montenegro (the actual imports to Bosnia and Herzegovina from Montenegro were USD 30 million in 2013, whereas the expected imports were USD 149 million). Regardless of the said, this paper notably does not include the exports and imports of services, whereby Montenegro has undoubtedly exported services to B&H thanks to significant income from tourism, whose value far exceeds the exports of goods.

Using an extended gravity model, Ł. Klimczak and J. Trivić (2018) analyze the impact of the three factors on the volume and patterns of trade, namely the impact of the bilateral trade liberalization agreements that preceded CEFTA, the impact of CEFTA itself, and the impact of the efficiency of institutions in the CEFTA countries. They inferred that the bilateral agreements had a more significant positive effect on the trade volume growth than CEFTA did. They also concluded that the way the institutions worked and operated could play a vital role in boosting the trade volume in the future. It can be interpreted as a fact that reducing administrative barriers to increase the efficiency of institutions in the importing country positively affects the increase in exports to that market from the other CEFTA member countries.

Yet another paper employing the gravity model to assess the impact of trade liberalization on the trade relations between Bosnia and Herzegovina and the EU is that written by H. Omerika and M. Hadžović (2019), who include data on the trade between Bosnia and Herzegovina and the EU in the period from 2005 to 2015 in the gravity model in their study. The results are interesting since it was concluded that the effectiveness of B&H – EU trade liberalization had varied over time. Thus, when movements in the period from 2005 to 2012 are concerned, it was concluded that Bosnia and Herzegovina had not had any particular benefits from the liberalization of trade with the EU (which is in line with the findings of V. Nastić (2013) and S. Kurtović *et al* (2017). It was also concluded, however, that the situation had significantly changed for the better in the period from 2013 to 2015.

The study conducted by the Ministry of Foreign Affairs of the Republic of Poland in cooperation with the OECD on the occasion of the Western Balkan Summit in Poznan 2019 entitled *Unleashing the Transformation Potential for Growth in the Western Balkans* (OECD, 2019) does not employ the gravity model but provides an interesting analysis of the potential for the growth of exports from Bosnia and Herzegovina both in the short term and in the long term instead. Thus, according to the study, the most significant part of the short gains in B&H's exports refers to the

additional exports of the existing B&H products to the other Western Balkans countries. On the other hand, the most extensive part of the long bets in B&H's exports (as much as 75%) is hidden in the inclusion of the companies from Bosnia and Herzegovina in the German–Central European Supply Chain (GCESC), which primarily refers to the companies operating in the automotive industry. Hungarian companies account for a significant part of this chain, so a more powerful inclusion of Bosnia and Herzegovina in this production chain would inevitably imply the strengthening of the trade relations between Bosnia and Herzegovina and Hungary.

H. Jošić and M. Bašić (2021) also agree with the conclusion that CEFTA more significantly stimulated the increase in the trade volume than accession to the EU. Nevertheless, the EU accession greatly impacted trade diversification, at least in Croatia.

The most recent paper to mention, which used the gravity model for the analysis of trade in the CEFTA countries, is that by I. Marković, I. Popović-Petrović and P. Bjelić (2021), who analyze the 100 nontariff impediments that emerged after the 2006 CEFTA establishment. There are concrete examples of how nontariff barriers "succeeded" in replacing the tariffs limiting interregional trade.

It is said in the Introduction of this paper that it rests upon the assumption that trade benefits all its participants, which is the reason why several outstanding works that support and explain that premise in the Literature Review are listed (Romer, 1986; Lucas, 1988; Romer, 1989; Rivera-Batiz & Romer, 1991; Edwards, 1993; Frankel & Romer, 1996; Edwards 1998; Greenaway, Morgan & Wright, 2002; Lee, Ricci & Rigobon, 2004). As can be assumed, most of the foregoing papers came to light at the end of the 1980s and during the 1990s, when the globalization process seemed to be irreversible.

In order not to be accused of bias (Shevchenko, 2023), it should be emphasized herein that, even in the developed globalization era, very prominent authors disagree upon the premise that international trade is always beneficial for participants. Most often, their criticism has gone towards proving the unequal distribution of benefits from mutual trade between participating countries (Chang, 2016) or the unequal distribution of benefits from international trade between different social groups within one country participating in international trade.

RESEARCH METHODS AND DATA

This paper applies the international trade gravity model to the data pertaining to Bosnia and Herzegovina. The determinants of international trade in goods for 2021, i.e. at a one-time point (a cross-sectional study) are analyzed. The ten biggest importers and exporters are considered, and the method of ordinary least squares is used.

There are different sets of the variables used to estimate the gravity model by different researchers. Also, various econometric models are used for the purpose of estimating the gravity model (Ranilović, 2017; Ristanović & Tošović-Stevanović, 2020; Zaninović, 2022). The standard variables used as the dependent variable(s) usually include the GDP of the country for which the model is being estimated, the GDP of the trading partners, and the distance (Zaninović, 2022). Yet, most researchers expand the basic set of the variables by including the population and the artificial variables indicative of sharing the border and the common language (Ristanović & Tošović-Stevanović, 2020), as well as the existence of the historical ties and bilateral and multilateral trade agreements between the countries included in the study (Ranilović, 2017).

The empirical model used in this study generally uses the variables also used by the researchers previously referred to and is represented by the following regression equation:

$$\ln MT_{ij} = \alpha + \beta_1 \ln dist_{ij} + \beta_2 \ln(gdp\_cons_i * gdp\_cons_j) + \beta_3 \ln gdp\_pc\_cons_j + \beta_4 dummy\_ex\_Yu_{ij} + \varepsilon_i$$

where i represents Bosnia and Herzegovina and j denotes the trading partner country. MT stands for international trade, exports, imports or their sum, depending on whether the dependent variable in the model implies exports from Bosnia and Herzegovina

to the country *j*, imports from the country *j* to Bosnia and Herzegovina, or the total trade between them, i.e. the sum of the exports from Bosnia and Herzegovina to the country *j* and the imports from the country *j* to Bosnia and Herzegovina. *Dist* is the distance between the capital of Bosnia and Herzegovina and the trading partner country. Given the fact that the gravity model predicts that a higher GDP of the exporting and importing countries implies more significant international trade between the two countries, the regression used the variable that represents the product of the GDP in the two countries in constant dollars since 2015. A higher GDP *per capita* in the importing country will also mean higher exports from Bosnia and Herzegovina (Cherepovskyi, 2022). Hence the third variable in the model is the indicator that reflects the purchasing power of the foreign market. International exchange is also affected by cultural, linguistic and historical similarities. Therefore, the artificial variable with the value 1 for Serbia, Croatia and Slovenia is introduced. These countries were among the ten most important trading partners of Bosnia and Herzegovina in 2021. All the variables, except for the artificial ones, are used in the econometric analysis in the logarithms. Since it is a log-log model, all the coefficients are interpreted as percentage changes, except for the artificial variable. The specification of the variables is given in Table 1.

Predictably, the longer distance between the capital of Bosnia and Herzegovina and the trading partner country will have a negative impact on international trade due to higher transportation costs (Castanho, Loures, Lousada, Gómez & Cabezas, 2022). Therefore, the expected sign of the coefficient with this variable is negative. If the GDP is high in Bosnia and Herzegovina and in its trading partner countries, greater international exchange is expected. While a higher GDP *per capita* in the country to which Bosnia and Herzegovina exports should result in higher exports due to the greater purchasing power. Therefore, the expected sign for the variables indicating the GDP is positive. Cultural, linguistic and historical similarities mean more significant international trade, and it is anticipated that Bosnia and Herzegovina, as the country belonging to the ten most important trading partners, exports more to the countries with which it used to be a member of the former Yugoslavia, with the other conditions being equal.

Table 1 The specification of the variables used in the model

Variable	Type	Notation	Source
Exports from Bosnia and Herzegovina in 2021	Dependent	Lnx	Foreign Trade Chamber of Bosnia and Herzegovina (2022)
Imports to Bosnia and Herzegovina in 2021	Dependent	Lnm	Foreign Trade Chamber of Bosnia and Herzegovina (2022)
The sum of the exports from and imports to Bosnia and Herzegovina in 2021	Dependent	Lntrade	Foreign Trade Chamber of Bosnia and Herzegovina (2022)
The distance between the capital of Bosnia and Herzegovina and the trading partner country	Independent	Lndist	The *Here WeGo* application is used, where no air distance was considered but the length of the road that takes the least time to arrive from one city to another.
GDP in constant USD in 2021	Independent	gdp_cons	World Bank (2022)
GDP *per capita* in constant USD in 2021	Independent	gdp_pc_cons	World Bank (2022)
The artificial variable indicating cultural, linguistic and historical similarities (the former YU countries)	Control	dummy_ex_Yu	Authors

Source: Authors

RESEARCH RESULTS AND DISCUSSION

As is shown in Table 2, the top ten trading partners comprise almost 76% of the total trade of Bosnia and Herzegovina in 2021. Croatia was the main trading partner, with which USD 3.11[2] billion of the total trade was recorded, only to be followed by Serbia and Germany. It is important to stress that, among the top ten trading partners, the trade surplus is only recorded with Germany and Austria. In 2021, Hungary was the eighth biggest trading partner of Bosnia and Herzegovina, with the total export from Bosnia and Herzegovina USD 156.9 million and the total imports USD 468.8 million, which means that the recorded trade deficit was USD 311.9 million. The share of trade in goods with Hungary was only 2.96% of Bosnia and Herzegovina's total foreign trade.

The descriptive statistics of the other variables used in the econometric analysis are shown in Table 3. Among the top trading partners, China is the major country according to the total GDP and the population, whereas the richest countries measured by the GDP *per capita* are Austria, Germany and Italy. China is the most distant country, while Serbia is the closest, measured by the distance between the two capitals.

Table 4 shows the results of the regression analysis presented in the research methods. The four models are considered, whereby the regression equation related to the exports is evaluated twice – first, using the dependent variables also used to evaluate the total trade model (Model 1) and the import model (Model 2); second, adding the variable indicating the purchasing power of the export market, i.e. the GDP *per capita*, in the importing country at constant prices.

Model 1 shows the estimation of the regression equation related to the total trade represented by the sum of the exports from Bosnia and Herzegovina and imports to one of the ten major trading partner countries. All the variables are significant at the 1% level of statistical significance. The adjusted determination coefficient (Adj. R-squared) shows that 87.2% of the variation is in the dependent variable, i.e. the total trade, explained by the variations in the explanatory variables. The greater the distance between Bosnia and Herzegovina and the trading partner country, the smaller its international trade, because transportation costs represent the limitations to the specialization based on comparative advantages. An increase in the distance between the capital cities by 1% reduces trade by 1.37%. Also,

Table 2 The top ten foreign trading partners of Bosnia and Herzegovina in 2021

No.	Country	The export of goods (in million USD)	The import of goods (in million USD)	Total trade in goods (in million USD)	Share in total trade
1	Croatia	1,043.89	2,001.84	3,111.10	14.72%
2	Serbia	1,046.46	1,865.70	2,912.16	13.78%
3	Germany	1,245.29	1,219.67	2,464.96	11.66%
4	Italy	934.83	1,115.35	2,050.19	9.70%
5	Slovenia	716.87	1,095.29	1,812.18	8.57%
6	Austria	745.45	655.69	1,401.14	6.63%
7	Turkey	209.98	650.28	860.26	4.07%
8	Hungary	156.94	468.87	625.81	2.96%
9	Poland	133.63	319.59	453.20	2.14%
10	China	21.11	336.23	357.33	1.69%
11	Total	6,319.81	9,728.51	16,048.32	75.93%
12	Total (Bosnia and Herzegovina with all the countries)	8,450.47	12,684.89	21,135.36	100.00%

Source: Authors

Table 3 The indicators for Bosnia and Herzegovina's top trading partners in 2021

No.	Country	GDP (in billion USD, constant prices, 2015=100)	GDP *per capita* (in USD, constant prices, 2015=100)	The distance from Bosnia and Herzegovina (in km)	The population (in millions)
1	Croatia	59.13	15,165	425	3.89
2	Serbia	48.61	7,113	300	6.83
3	Germany	3,554.67	42,726	1,494	83.20
4	Italy	1862.3	31,506	849	59.11
5	Slovenia	52.16	24,743	562	2.11
6	Austria	405.14	45,238	790	8.96
7	Turkey	1,131.03	13,341	1,608	84.78
8	Hungary	150.68	15,518	551	9.71
9	Poland	598.3	15,850	1,392	37.75
10	China	15,801.91	11,188	10,717	1,412.36
11	Bosnia and Herzegovina	19.17	5,861		3.27

Source: Authors, based on The World Bank – World Development Indicators (WDI), 2023, and the *Here WeGo* application

Table 4 The assessment of the parameters of the gravity model for Bosnia and Herzegovina

Model variable	(Model 1) ln*trade*	(Model 2) ln*m*	(Model 3) ln*x*	(Model 4) ln*x*
ln*dist*	-1.374***	-1.021***	-2.388***	-1.907***
	[0.223]	[0.154]	[0.476]	[0.322]
ln(gdp_cons_i * gdp_cons_j)	0.741***	0.589***	1.035**	0.807***
	[0.144]	[0.099]	[0.306]	[0.197]
ln*gdp_pc_cons*				0.821**
				[0.244]
ex_yu	1.617***	1.551***	1.560*	1.810***
	[0.325]	[0.225]	[0.693]	[0.426]
Constant	23.742***	22.267***	26.878***	34.498***
	[0.863]	[0.597]	[1.839]	[2.522]
Observations	10	10	10	10
R-squared	0.915	0.941	0.863	0.958
Adj. R-squared	0.872	0.912	0.794	0.924
Prob>F	0.001			
AIC	6.012	-1.384	21.128	11.286
BIC	7.222	-0.174	22.339	12.799

Note: The standard errors are given in brackets; *** p<0.01, ** p<0.05, * p<0.1

Source: Authors

the GDP growth in Bosnia and Herzegovina and its main trading partner countries is a stimulus for international exchange, because the coefficient with the variable that indicates the GDP product of the participating countries is positive.

Model 2 illustrates the regression equation evaluation related to the imports from the partner country to Bosnia and Herzegovina. All the explanatory variables are significant at a 1% level of statistical significance in this model. The adjusted determination coefficient (Adj. R-squared) shows that 91.2% of the variations in the imports can be explained by the variations in the distance, the GDP of the participating countries, and cultural and historical similarities. The greater the distance between Bosnia and Herzegovina and the major trading partner country, the lower the import. An increase in the distance between the capital cities by 1% reduces the imports by 1.02%. Furthermore, the GDP growth in Bosnia and Herzegovina and the importing country increases imports to Bosnia and Herzegovina.

When comparing the coefficients and the variables indicating the geographic distance, it is clear that they are higher in the models 3 and 4, i.e. in those models accounting for the assessment of the export determinants, especially when compared to the import model (Model 2), which means that the greater distance between the capital of Bosnia and Herzegovina and the trading partner country represents more significant export barriers than import barriers. Thus, an increase in the distance by 1% reduces exports from Bosnia and Herzegovina from 1.91% to 2.39%. The determination coefficient related to the exports is higher in Model 4 (being 92.4%) compared to Model 3, where the variations in the independent variables are responsible for 79.4% of the changes in the exports. The lower values of the AIC and BIC information criteria prove that Model 4 is better. What is evident in Model 4 is that an increase in the purchasing power of the foreign market by 1% measured by the GDP *per capita* growth increases exports to a specific country by 0.82%. This variable is significant at a 5% level of statistical significance. On the other hand, it implies that, when trading partner countries are affected by a crisis, a decline in their GDP *per capita* means a considerable drop in exports from Bosnia and Herzegovina.

In order to accept the model as relevant for drawing conclusions, it is necessary that the model specification and whether the OLS assumptions have been met should be checked (Žarković, Krajišnik & Gligorić, 2014). Table 5 shows the results of the model testing, i.e. the testing of the assumptions of the linear regression model. Given the fact that it is a cross-sectional analysis characterized by heteroskedasticity problems (the variability of variances), variance testing was conducted, and the tests showed that the variances were constant in all the models.

The results of the Jarque-Bera test also indicate that the residuals in all the evaluated models are normally distributed, while the Ramsey test shows that the model specification is suitable, i.e. no significant variables are omitted in the evaluated models.

Table 5 The postestimation results for the gravity models

Model	(Model 1)	(Model 2)	(Model 3)	(Model 4)
Heteroskedasticity test – *Breusch-Pagan / Cook-Weisberg (Prob > chi2)*	0.8519	0.829	0.670	0.692
Normality test – *Jarque-Bera (chi2)*	0.678	0.747	0.686	0.817
Model specification test – *Ramsey RESET test (Prob > F)*	0.339	0.308	0.251	0.250

Source: Authors

CONCLUSION

This paper provides several theoretical contributions to applying the trade gravity model to the case of Bosnia and Herzegovina and Hungary. First, the paper shows that the basic gravity model (which only takes into account the size of the economy and the distance) is not sufficient to explain the low level of trade between these two countries. Second, an additional variable indicative of Bosnia and Herzegovina's having been a member state of the former Yugoslavia is introduced as a factor that may affect trade flows. This variable has a significant impact on explaining the international trade of Bosnia and Herzegovina and indicates the importance of the historical, cultural and political ties between the countries. Third, this paper uses data on the distance between the capital cities as a measure of the geographic distance instead of the usual measured distance between the geographic centers of the countries. This measure better reflects the actual transportation and communication costs between the two countries. Fourth, this paper differentiates the effect of the distance on Bosnia and Herzegovina's exports and imports and shows that the distance is more important for exports than for imports, which suggests that Bosnia and Herzegovina faces greater barriers to placing its products on foreign markets.

This paper has several policy and managerial implications for Bosnia and Herzegovina and Hungary. First, the research results obtained in this study show that the basic gravity model is not sufficient to explain the low level of trade between these two countries and that the fact that Bosnia and Herzegovina had once been a member country of the former Yugoslavia has a significant positive effect on its trade flows, which on its part suggests that historical, cultural and political ties play an important role in shaping trade patterns and preferences. Therefore, both countries should take into account these factors when designing and implementing their trade policies. Second, the results of this study also show that the distance has a negative effect on Bosnia and Herzegovina's exports, not its imports, which is implicative of the fact that Bosnia and Herzegovina faces greater barriers to accessing foreign markets than importing from them, for which very reason it should seek to reduce these barriers by improving its export competitiveness, diversifying its export products and destinations, and negotiating preferential trade agreements with strategic partners. Third, the results of this research indicate that there is still room for increasing trade flows between Bosnia and Herzegovina and Hungary by reducing trade frictions. Improving the transportation infrastructure, harmonizing the standards and regulations, facilitating the customs procedures and promoting cross-border cooperation are just a few potential measures that may help enhance trade facilitation between the two countries and lower the transportation and communication costs between the two countries, simultaneously increasing their mutual trust and confidence. Finally, the analysis carried out in this study is not deprived of certain limitations and caveats that should be taken into account, e.g. the data on the distance between the capital cities as a proxy for the geographic distance which may not capture the variation in transportation costs across regions within each country. Tariffs are also assumed to be exogenous and not to affect trade flows directly, which may not be realistic in some cases. Moreover, the linear specification of the gravity model is used, which may not account for possible nonlinearities or interactions among the explanatory variables. Furthermore, ordinary least squares are applied as the research study's estimation method, which may suffer from endogeneity issues. Therefore, future research should address these limitations using alternative data sources and models.

Analyzing the trade between Bosnia and Herzegovina and its most important trading partners, the gravity model applied in this study has once again proved to be useful. Nonetheless, the details are particularly attention-grabbing. The obtained results for Bosnia and Herzegovina's ten most significant trading partners suggest that the distance between the major cities more strongly influences the exports than the imports. The imports depend more on Bosnia and Herzegovina's and its trading partners' GDPs. Thus, while the 1% increase in the distance between Bosnia and Herzegovina and its trading partners causes a 1.37% decrease in the trade volume, the decrease in the exports is much more pronounced (1.91% to 2.39%) compared to the drop in the imports (1.02%).

As was expected, the movement of the Bosnian GDP has no significance for its exports, whereas the 1% drop in the GDP of the trading partner leads to the 0.82% drop in the Bosnian exports to that trading parting country.

Considering the size of the Hungarian economy and the distance, the research results suggest that the trade volume between Bosnia and Herzegovina and this country is far below the expected level. Hence, the "B&H once having been a member country of the former Yugoslavia" variable had to be included in the analysis in order to help the explained level of Bosnia and Herzegovina's international trade to be as much as 87.2%, at the 5% statistical significance level.

This study has the limitations that should be taken into consideration and addressed in future research, which could use panel data to account for the time effects and unobserved heterogeneity across countries. Second, this study used the basic gravity model that only considers the economic size of and the distance between two countries as the explanatory variables. Future research could extend the model by including the other variables that may affect trade flows, such as trade policies, cultural similarities, institutional quality, transportation costs and so forth. Third, this study has only focused on the bilateral trade flows between Bosnia and Herzegovina and Hungary, which may not reflect the multilateral trade relations among the countries in the region. Future research could use the multilateral gravity model that incorporates the effects of third countries on bilateral trade flows.

ENDNOTES

1 The Central Bank of Bosnia and Herzegovina's average exchange rate for the US Dollar (USD) against Bosnia and Herzegovina's Convertible Mark (BAM) was 1.833 convertible marks for 1 American dollar on 31st December 2022. Available at: https://www.cbbh.ba/CurrencyExchange/

2 The Central Bank of Bosnia and Herzegovina's average exchange rate for the US Dollar (USD) against Bosnia and Herzegovina's Convertible Mark (BAM) on 31st December 2021 was BAM 1.725 for USD 1. Available at: https://www.cbbh.ba/CurrencyExchange/

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Marko Đogo obtained his PhD at the Faculty of Economics in East Sarajevo. Since 2007, he has been employed at the Faculty of Economics in East Sarajevo, where he held various posts, from a teaching fellow to associate professor. He is the author of four books and about forty scientific papers.

Dragan Gligorić is an Associate Professor and Vice-dean for Scientific Research at the Faculty of Economics, University of Banja Luka. He is also Editor-in-chief of the Acta Economica and a member of the supervisory board of NLB Bank Banja Luka. His areas of interest are exchange rates, foreign direct investments, innovation and internationalization, Economics integration, Health Economics, and Applied econometrics.

Her Excellency Marianne Berecz is a retired Ambassador who has worked in the Hungarian Foreign Service for 40 years both in bilateral and multilateral positions; amongst them as Hungary's Permanent Representative to the OSCE. She served as Deputy High Representative in Bosnia and Herzegovina and Head of the Banja Luka Regional Office of the OHR from December 2016 to October 2022.

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THE COMPARATIVE DYNAMICS OF ENTREPRENEURSHIP AND TRADITIONAL EMPLOYMENT IN THE SEMI-PERIPHERY OF THE EU

Márton Gosztonyi

Asia-Europe Institute - Universiti Malaya, Malaysia

This study explores the socioeconomic dynamics between entrepreneurship and traditional employment within the framework of the semi-periphery of the European Union, specifically focusing on Hungary. A mix of the ridge, LASSO, elastic net, and polynomial regression techniques are used so as to analyze a representative 2022 dataset, examining how individual self-perceptions and local socioeconomic environments influence employment types. The analysis made in this study reveals that, while entrepreneurship and traditional employment often exist on a continuum, they are influenced by the distinct socioeconomic and perceptual factors that contribute to a fluid employment landscape. The key findings indicate significant variations in how entrepreneurs and traditional employees perceive local economies, trust in institutions, and view their personal roles within the economic system. The study reveals critical details in the interplay between personal aspirations and a broader socioeconomic context, suggesting a complex, intertwined relationship that challenges traditional dichotomies between employment types.

Keywords: entrepreneurship, traditional employment, regularized regression techniques, European union, semi-peripheral dynamics

JEL Classification: J01, L26 C4, B50

INTRODUCTION

The comparative analysis of entrepreneurship and traditional employment has emerged as a crucial area of academic inquiry, especially within the evolving frameworks of modern economies (Mahieu, Melillo & Thompson, 2022; Xu, 2023). Despite this growing interest, there remains a notable dearth of comprehensive studies examining the interplay between these two primary employment modes in the context of flexible capitalism (Narotzky, 2015). Addressing this gap, this research adopts a systemic approach in order to explore the nuanced roles of entrepreneurship and traditional employment in Hungary, an EU member state characterized by its semi-peripheral economy.[1] By focusing on both contextual and individual factors and

* *Correspondence to:* M. Gosztonyi, Asia-Europe Institute - Universiti Malaya, Kuala Lumpur, Federal Territory of Kuala Lumpur, Malaysia; e-mail: gosztonyi.marton@um.edu.my

incorporating perception theory, this research study offers a multifaceted understanding of how the socioeconomic status, local economic perceptions, trust in institutions, and individual self-conceptions interact so as to influence employment choices.

The impetus for this study stems from the recognition of the dynamic and fluid nature of employment landscapes in semi-peripheral economies. With its unique economic position in the EU, Hungary provides an ideal context for examining these dynamics. A lack of the comparative studies that integrate both entrepreneurial and traditional employment perspectives in such economies highlights a significant research gap this study aims to fill. Additionally, understanding the individual perceptions and socioeconomic factors that drive employment choices is critical for developing the policies and programs that support both entrepreneurial ventures and traditional employment.

This study makes several key contributions to the literature. By integrating the ridge, LASSO, elastic net, and polynomial regression techniques, this research study provides a robust analytical framework so as to understand the complex interplay between socioeconomic factors and individual perceptions. Shifting the focus from purely contextual analyses in order to include the individual-level factors and perceptions, a deeper insight into the drivers of employment choices is enabled in this study. Focusing on Hungary, the unique challenges and opportunities within the semi-peripheral EU economies are highlighted, simultaneously contributing to a more comprehensive understanding of the employment dynamics in place in these regions. By incorporating perception theory, the manner how the individual self-conceptions and perceptions of the local economy and social institutions influence employment types is examined, providing a thorough view of the psychological underpinnings of employment decisions at the same time.

Several gaps in the existing literature are addressed in this research study. There is a scarcity of studies comparing entrepreneurship and traditional employment within the same analytical framework, particularly in the context of flexible capitalism. Previous research has often overlooked the role of individual perceptions in influencing employment choices, whereas this gap has been filled in this research study by incorporating perception theory into the analysis made in it. While much of the literature focuses on either the core or the peripheral economies, this study sheds light on the semi-peripheral context, simultaneously offering the insights that are relevant for a broader range of economic settings. By addressing these gaps, this research not only contributes to the theoretical understanding of employment dynamics but also provides practical implications for policymakers and practitioners, aiming to foster both entrepreneurship and traditional employment in semi-peripheral economies.

LITERATURE REVIEW

The conversation distinguishing entrepreneurs from traditional employees has become more pronounced against the backdrop of shifting economic landscapes. Historically, the studies exploring the socioeconomic characteristics of entrepreneurship and employment have primarily focused on these roles separately. In the early 1990s, there was a notable increase in academic interest in the socioeconomic aspects of entrepreneurship. D. L. Birch (1990) posited that nascent small firms underpinned job creation and economic evolution, a perspective deeply rooted in J. A. Schumpeter's conceptualization of entrepreneurs as harbingers of innovation fostering economic progress. Later reinterpretation emerged, defining entrepreneurs as the innovators who harnessed resources so as to pinpoint and leverage opportunities, thus driving economic and social advancement (Shane & Venkataraman, 2000). Researchers further delineated entrepreneurs as agile, risk-resilient individuals with adept execution capabilities (Sarasvathy, 2001; Baker & Nelson, 2005; Aleksić-Mirić, Aničić & Petrović, 2023). Additionally, research has supported these economic perspectives by highlighting the role of entrepreneurship in driving innovation-led economic development, intertwined

with socio-relational factors (Acs & Audretsch, 2003; Alshibani, Kristoffersen & Volery, 2024).

Simultaneously, the perspective on the socioeconomic aspects of traditional employment has also evolved. Traditionally, based on organizational theory, employees were viewed as the contractual members of organizations, exchanging tasks for a compensation (Coase, 1937). This perspective developed so as to recognize the intricate relationships between employees, employers, and broader organizational structures (Blau, 1986), encompassing both transactional and sociopsychological interactions (Rousseau, 1995). In the era of digital transformation, employees have emerged as the essential repositories of knowledge and catalysts for change, pivotal for organizational adaptability and sustaining a competitive edge (Asensio & Ferreira, 2024). Their fundamental role in shaping organizational culture and the strategic direction has become more apparent (Đorđević, Milanović & Stanković, 2021; Park, Feng & Jeong, 2024).

Unsurprisingly, the entrepreneur-employee dichotomy is intricately influenced by the factors such as the gender (Audretsch, Keilbach & Lehmann, 2006), age (Zahra, Rawhouser, Bhawe, Neubaum & Hayton, 2008), education, ethnicity (Light & Dana, 2013), and spatial income dynamics (Hyytinen & Ruuskanen, 2007), underscoring their substantial explanatory significance. Recent research in the socioeconomic field underscores the complex dynamics between entrepreneurship and traditional employment, offering detailed insights into their respective opportunities and challenges. Importantly, the distinction between the "employee" and the "entrepreneur" has gradually blurred, with their definitions increasingly overlapping (Hurst & Pugsley, 2011; Piketty, 2014; Kenney & Zysman, 2016). This convergence highlights the need for a comprehensive exploration of both areas, considering the evolving nature of work and socioeconomic structures – the discourse that this current research study of ours aims to enhance.

Recent research emphasizes the critical role of individual behavior in distinguishing entrepreneurs from employees, highlighting the importance of integrating perception theory into the comparative study contained herein. In entrepreneurship research, constructivist perception theory is prominent, suggesting that perceptions are shaped by a blend of past experiences and intersubjective interpretations of sensory data (Gregory, 1980), which stands in contrast to the ecological perspective that suggests perceptions are formed from an objective understanding of the environment (Gibson, 1986). Currently, research in entrepreneurial and employees' perceptions tends to adopt the constructivist approach influenced by both environmental and individual factors. In the 1990s, the research studies based on this theory investigated how entrepreneurs perceived their roles in economic outcomes, such as job creation and innovation promotion. Additional research, such as that done by D. G. Blanchflower and A. J. Oswald (1998), examined the wellbeing and financial satisfaction of both entrepreneurs and employees, often associating economic perceptions with trust in social institutions.

Early research recognized trust as essential for business success and, over time, has evolved so as to emphasize the complexity of trust in entrepreneurship (Mayer & Antoine Habersetzer, 2015), including its interplay with social capital and networks. More recent studies have focused on the role of trust in fostering innovation within entrepreneurial ecosystems (Nahapiet & Ghoshal, 1998; McEvily, Perrone & Zaheer, 2003). Simultaneously, the importance of trust in employee contexts has become increasingly apparent. Initial works, such as those by D. M. Rousseau (1995), highlighted the critical nature of trust in employee–employer relationships. Later studies have delved into the psychological contracts that underpinned that trust, examining its effects on organizational loyalty and productivity (Dirks & Ferrin, 2002; Chandna, 2022; Park *et al*, 2024). Current research shifts the focus to the influence of leadership on building organizational trust and its subsequent effects on employees' efficiency and wellbeing (Asensio & Ferreira, 2024).

However, researchers have extended perception theory to the self-perceptions of entrepreneurs and employees as well, simultaneously illuminating

distinct self-views held by each group. Classical studies indicate that entrepreneurs often perceive themselves as more efficient and autonomous than employees due to the inherent demands of entrepreneurial roles requiring self-reliance and innovation (Anderson, Dunkelberg & Condon, 1990). J. H. Dyer, H. B. Gregersen, and C. Christensen (2008) highlighted the fact that entrepreneurs often saw themselves as self-directed visionaries, the trait that drives them to initiate and lead businesses, the consistency observed across various sectors (Kenny & West, 2010). On the other hand, employees typically view themselves as the essential parts of the organizational framework, which contributes to their sense of security (Proudfoot & Kay, 2018; Bošković, 2021). However, this structured setting can sometimes inhibit the personal development and creativity of employees (Çekmecelioğlu & Günsel, 2011; Đorđević *et al*, 2021).

In summary, perception theory delves into both the socioeconomic landscape, including trust in institutions, and individuals' self-perceptions. While the interplay of the economic perception and trust in shaping entrepreneurial and employment paths is an evolving discourse warranting further exploration, substantial insights have been gathered on the self-perceptions that distinguish entrepreneurs from employees. However, comprehensive analysis remains crucial to unravel the intertwining dynamics of the economic perception, trust, and individual self-views within both domains, thereby enriching the understanding of the intricate backdrop that shapes these sectors.

In this paper, a systemic approach complemented by a specific focus, centering on a semi-peripheral European Union member state is utilized. The growing interest in the complex economic and social dynamics of semi-peripheral nations arises from their unique position bridging the central and the peripheral economies, presenting distinct opportunities and challenges. This study is dedicated to conducting an investigation into the entrepreneurial and employment dynamics in place in these regions and illuminates the simultaneous processes of economic divergence and economic convergence (Mayer *et al*, 2015), potentially predicting critical long-term economic trajectories, especially in the fields such as technology and innovation which are essential for maintaining competitiveness. Furthermore, the diverse socio-cultural complexities of these regions provide a fertile basis for the future research that could extend to either the core or the peripheral countries. The need for a systemic perspective is driven by the complex nature of entrepreneurial and employee ecosystems, which are nonlinear, third-order systems far from equilibrium. These systems are characterized by multiphase linkages, autopoiesis, and the hierarchy of control parameters (Nicolis, 2012), necessitating the adoption of a system-based analytical framework. Ultimately, exploring the trajectories of entrepreneurs and employees is crucial due to their significant influence on a nation's economic health and social cohesion. This research study has the goal to enrich this discourse by merging contextual and individual-level systematic analyses.

This study shifts the focus from analyzing the macro-context to the individual, micro-context elements, simultaneously integrating insights from socioeconomic environments (Sarasvathy, 2001; Baker & Nelson, 2005) with individual perceptions (Sarason, Dean & Dillard, 2006). This approach enables the examination of how broader economic and social frameworks interact with personal perceptions and behaviors, enhancing the understanding of their influence on entrepreneurial and employment dynamics. Distinctively, entrepreneurs and employees are compared across various socioeconomic dimensions: the gender (Audretsch *et al*, 2006), education (Zahra *et al*, 2008), generational shifts (Light & Dana 2013), and the factors such as foreign work experience and income (Hyytinen & Ruuskanen 2007). Drawing from the literature, the perceptions of both entrepreneurs and employees of their own views on the local economy and social institutions (Nahapiet & Ghoshal, 1998; McEvily *et al*, 2003), and self-perception (Proudfoot & Kay, 2018) are gauged. Then, the systemic relationship between the contextual and perceptual variables is assessed. This research study is guided by the following hypotheses:

H1: In the semi-peripheral European Union member states, there is a significant differentiation in the socioeconomic status between entrepreneurs and employees, characterized by disparities in the gender distribution, educational attainment, age demographics, working hours, international experience, and income levels. Specifically, it is hypothesized that:

- H1.1: Male entrepreneurs account for a higher proportion of entrepreneurs compared to employee demographics.
- H1.2: Entrepreneurs exhibit a broader age range, with the tendency towards younger age groups when compared to the employees who are characterized by a more uniform age distribution.
- H1.3: Entrepreneurs are on average characterized by a different educational background than employees, potentially exhibiting either a higher or lower educational attainment.
- H1.4: Entrepreneurs have fewer work years than employees.
- H1.5: Entrepreneurs are more likely to have substantial foreign experience when compared to employees, indicating a possible global perspective in their business approach.
- H1.6: Entrepreneurs demonstrate a significantly higher income variance compared to employees, which is indicative of the varied financial outcomes associated with entrepreneurial ventures.

H2: In semi-peripheral European Union member states, the level of trust in local economic dynamics and social institutions diverges significantly between entrepreneurs and employees. This divergence is hypothesized to manifest in the following ways:

- H2.1: Entrepreneurs exhibit a heightened sense of optimism regarding the local economy compared to employees, potentially driven by entrepreneurial resilience or differing economic incentives and opportunities.
- H2.2: Entrepreneurs are more receptive to foreign social institutions compared to the local, which is a trend hypothesized to be less prominent among employees, which may reflect a more global or outward-looking perspective nurtured through international business interactions or aspirations.

H3: In semi-peripheral European Union member states, entrepreneurs and employees exhibit discernible disparities in self-perceptions across various dimensions of their personal and professional life. This hypothesis postulates that:

- H3.1: Entrepreneurs consistently rate their leadership skills more highly compared to employees.
- H3.2: Entrepreneurs perceive themselves as more successful at the local level in comparison to employees.
- H3.3: Entrepreneurs report a more favorable work–life balance compared to employees, indicating a potentially more flexible and adaptive working style that caters to individual preferences and lifestyle choices.
- H3.4: However, entrepreneurs demonstrate a lesser inclination towards adherence to government initiatives, which is possibly indicative of a more independent, critical, or skeptical outlook on governmental policies and interventions compared to employees.

H4: In semi-peripheral European Union member states, the differentiation between entrepreneurs and employees is more profoundly influenced by socioeconomic determinants than individual perceptions and attitudes.

The foregoing hypotheses seek to identify similarities and differences between employees and entrepreneurs. This combined exploration highlights the increasingly blurred boundaries between these two primary types of employment in flexible capitalism (Sarason *et al*, 2006; Hurst & Pugsley, 2011;

Piketty, 2014; Kenney & Zysman, 2016). This approach provides valuable insights into the evolving nature of work and economic structures, underscoring the dynamic interplay between different labor forms.

DATA AND METHODOLOGY

In this paper, the data were obtained from a structured questionnaire administered to a representative sample of entrepreneurs and employees in Hungary, a semi-peripheral European Union member state, in 2022. This dataset, representative across the age, gender, settlement type, education, and income, comprised 1,297 respondents and 35 pertinent variables. While the variables had significant missing data (59.63%), no variable exceeded the critical 5% threshold (Little & Su, 1987), permitting data imputation and subsequent dimensionality reduction. The Classification and Regression Trees (CART) method for data imputation, a machine learning algorithm that fills missing values by leveraging patterns in the existing data (Wray & Byers, 2020), was used in this research, during which process, 1000 substitution models were being employed in order to optimize the imputation and reduce variance, capitalizing on CART's recursive partitioning capabilities. The chosen methodology enhanced the accuracy and reliability of the data analysis by systematically addressing data gaps.

In this analysis, exploratory factor analysis (EFA) was carried out as the dimensionality reduction method intended to discern latent constructs within the extensive variable set of this research study, effectively identifying the underlying factors that accounted for observed correlations (Pruzek, 2005). The EFA was applied to delineate the trust and self-perception categories into two of the four analytical models. For both, the Kaiser-Meyer-Olkin (KMO) index confirmed satisfactory sampling adequacy ranging between 0.80 and 0.90. Bartlett's test of sphericity, complemented by Chi-square (χ^2) analysis, yielded small p-values, thus suggesting meaningful correlations between the variables and supporting further factor analysis (Braeken & Van Assen, 2017). Factor determination in this study was guided by the minimal residual method and the varimax rotation, with a significance threshold 0.3 for the variable loadings. Although some items indicated their multifactorial characteristics, both models captured about 70% of the total variance (Peterson, 2000). The model's appropriateness was validated by the RMSR values and the Tucker-Lewis Index (TLI), suggesting a robust model fit (Peterson, 2000). The factor scores demonstrated reliable consistency, underscoring the validity of the EFA models.

In the refined EFA models, the trust dimension is divided into two factors: the attitudes towards local institutions (Trust Local Institutions) and the attitudes towards foreign companies (Trust Foreign Companies). Meanwhile, the self-perception dimension includes five distinct factors: openness and proactivity, life satisfaction and stability, regional aspiration and entrepreneurial spirit, leadership preference, and engagement with government initiatives. These factors collectively cover a broad spectrum of self-perceptions, ranging from openness and creativity to leadership aspirations and perspectives on government initiatives, providing a comprehensive view of the various psychological traits influencing behavior in this study.

After the data cleaning and imputation, and dimensionality reduction, the mini-max algorithm was used to normalize the data (Cai & Zhou, 2012). The primary variable of interest, namely "The entrepreneur or the employee", is binary by nature. As many as 21 variables with their respective descriptive statistics detailed in the Appendix, Table A1, were subjected to analysis. This structured approach ensured that the data were optimally prepared for the subsequent analytical phases of the research itself.

Regularized regression techniques, namely ridge, LASSO, and elastic net regressions, alongside polynomial regression, were used in order to manage the complexities associated with the high-dimensional data. Those computations were executed in the R environment (the version 4.2.2), utilizing the RStudio (the version 2023.06.1 +524). For the model development and validation, the *glmnet* and *caTools* packages (R Core Team, 2022) were used. This

approach facilitated robust analysis and enhanced the predictive accuracy of the models.

The used regression methods are noted for mitigating multicollinearity and overfitting, enhancing the prediction accuracy (Zou & Hastie, 2005; Friedman, Hastie & Tibshirani, 2010; James, Witten, Hastie & Tibshirani, 2013). The ridge regression introduced by A. E. Hoerl and R. W. Kennard (1970) is an L2-regularized approach, reducing the model complexity and addressing multicollinearity. The corresponding equation is delineated below, and reads as follows:

$$\hat{\beta}^{\text{ridge}} = \arg\min_{\beta}\left\{\sum_{i=1}^{n}(y_i - x_i'\beta)^2 + \lambda\sum_{j=1}^{p}\beta_j^2\right\} \quad (1)$$

The LASSO regression proposed by R. Tibshirani (1996) uses L1 regularization, promoting coefficient sparsity and aiding feature selection with the equation as follows:

$$\hat{\beta}^{\text{lasso}} = \arg\min_{\beta}\left\{\sum_{i=1}^{n}(y_i - x_i'\beta)^2 + \lambda\sum_{j=1}^{p}\left|\beta_j\right|\right\} \quad (2)$$

The elastic net conceived by H. Zou and T. Hastie (2005) combines ridge and LASSO penalties, drawing from the strengths of both. The equation is formulated as follows:

$$\hat{\beta}^{\text{elastic}} = \arg\min_{\beta}\left\{\sum_{i=1}^{n}(y_i - x_i'\beta)^2 + \lambda\left(\alpha\sum_{j=1}^{p}\left|\beta_j\right| + (1-\alpha)\sum_{j=1}^{p}\beta_j^2\right)\right\} \quad (3)$$

Additionally, polynomial regression extends multiple linear regression, incorporating variable powers as distinct variables (Montgomery, Peck & Vining, 2012; James *et al*, 2013), and reads as follows:

$$Y = \beta_0 + \beta_1 X + \beta_2 X^2 + \cdots + \beta_p X^p + \varepsilon \quad (4)$$

Polynomial regression enhances the general linear model by incorporating polynomial terms, allowing it to capture nonlinear relationships and the model complex, curvilinear relationships in real-world data (Montgomery *et al*, 2012; James *et al*, 2013). While providing stability and improved generalization particularly in the presence of the Gaussian noise, on the one hand, on the other ridge regression does not offer complete feature selection (Hoerl & Kennard, 1970). Differently from the former regression, the LASSO regression is highly effective in feature selection, yielding sparse models and often achieving a superior predictive accuracy in certain high-dimensional scenarios (Tibshirani, 1996). However, it may sometimes be inconsistent in its selection of variables. The elastic net combines the advantages of both ridge and LASSO regressions, particularly beneficial for dealing with correlated predictors (Zou & Hastie, 2005). While it addresses the issue of excluding correlated variables which is found to be common with LASSO, its computational demands and the risk of overfitting if parameters are not properly adjusted remain significant challenges (Friedman *et al*, 2010).

In this study, using regularized and polynomial regressions was crucial for reducing the risk of overfitting. The robustness of the models was enhanced through their cross-validation, which ensured the reliable evaluation of prediction performance. To determine the most effective regression model, the hyperparameters were meticulously tuned and the performance metrics such as the Root Mean Squared Error (RMSE), Adjusted R-squared, the Akaike Information Criterion (AIC), and the Bayesian Information Criterion (BIC) were evaluated (Cavanaugh & Neath, 2019). This rigorous approach ensured the optimal model fit and interpretability. In the final evaluation of the model, the coefficient analysis was focused on. In the context of regularized regression, this analysis emphasizes the significance of the coefficient magnitudes over the traditional p-values, aligning with the contemporary analytical practices (Emmert-Streib & Dehmer, 2019). This methodological approach underscores the authors' commitment to precision and accuracy in interpreting complex data relationships.

RESULTS

Prior to delving into the models, understanding "The entrepreneur or the employee" variable is crucial (Table 1). The descriptive statistics reveal that both

Table 1 The past and current statuses: The employee or the entrepreneur (N=1297)

Value	Frequency	Percentage
The respondent was an entrepreneur and is an entrepreneur now.	434	33.46%
The respondent was an employee and is an employee now.	196	15.11%
The respondent was an employee and is an entrepreneur now.	655	50.50%
The respondent was an entrepreneur and is an employee now.	12	0.93%

Source: Author

categories exhibit fluidity. While consistency can be observed between the respondents' last workplace(s) and their current status as being either an entrepreneur or an employee, the transitions between the categories are also prevalent.

The sample included in this research study, 48.57% of the respondents maintained their previous either "the entrepreneur" or "the employee" status, with a higher retention rate among the entrepreneurs (33.46%) compared to the employees (15.11%). Notably, there is a pronounced trend on the employees' part to transition to entrepreneurship (50.50%), with the mere 0.93% moving in the opposite direction. These findings underscore the fluidity between the categories, cautioning against viewing "the entrepreneur" and "the employee" as fixed classifications, but rather as the dynamic roles influenced by inter-category mobility.

Identifying the optimal models

Three models were constructed to investigate "The entrepreneur or the employee" variable, culminating in the fourth model assessing system-level correlations. These models encompassed 1) the socioeconomic context, 2) the economic climate and trust perceptions, 3) self-perception, and 4) the holistic system evaluation, the primary task being to identify which of the regressions (ridge, LASSO, elastic net, or polynomial) best suited the data belonging to each category.

The data for each model were partitioned into the training (80%) and testing (20%) subsets. Fluctuating lambda values were analyzed, cross-validating to pinpoint the optimal lambda that minimized the average cross-validation error. Employing these lambda values, the final models were established, and the set predictions were tested.

The model efficacy was evaluated based on the RMSE calculated from the square root of the mean squared deviations between the predicted and actual values, and the R-squared values, which indicate the proportion of the variance in the dependent variable explained by the model. Additionally, the AIC and the BIC were used to assess the model fit. The optimal regression model was subsequently identified, as is detailed in Table 2.

For the model focusing on the socioeconomic status variables, all the four regression techniques (ridge, LASSO, elastic net, and polynomial) produced similar RMSE values (0.3653 and - 0.3695), with the LASSO model having slightly outperformed the others in terms of the predictive accuracy. Notably, while the R-square values were modest across all the models, the LASSO model demonstrated superior performance with the lowest AIC (227.727) and BIC (256.212) scores. Despite the less favorable performance of the polynomial model, LASSO was selected for its optimal results with this set of variables.

In the second model that examined the economic climate and trust perceptions, ridge regression proved to be the most effective, having achieved the lowest RMSE (0.3647), the highest R-squared (0.0176), and the most favorable AIC (223.429) and BIC (241.232) scores.

The third model continued the trend of the former, with LASSO regression having outperformed its counterparts again by finding the optimal balance between the model fit and complexity.

Table 2 The evaluation metrics for the various regression models

	Model	RMSE	R-squared	AIC	BIC
The socioeconomic context	Ridge	0.3653	0.0145	230.262	258.748
	LASSO	0.3635	0.0240	227.727	256.212
	Elastic Net	0.3636	0.0238	227.772	256.257
	Polynomial	0.3695	-0.0081	788.781	843.166
The economic climate and trust perceptions	Ridge	0.3647	0.0176	223.429	241.232
	LASSO	0.3649	0.0164	223.748	241.552
	Elastic Net	0.3649	0.0167	223.663	241.466
	Polynomial	0.3651	0.0153	854.791	889.399
Self-perception	Ridge	0.3430	0.1311	191.509	209.312
	LASSO	0.3425	0.1335	190.777	208.580
	Elastic Net	0.3426	0.1331	190.937	208.741
	Polynomial	0.3432	0.1301	663.224	697.832
The holistic system evaluation	Ridge	0.3339	0.1768	203.469	267.561
	LASSO	0.3321	0.1852	200.775	264.867
	Elastic Net	0.3325	0.1835	201.339	265.431
	Polynomial	0.3342	0.1753	619.234	718.116

Source: Author

The comprehensive fourth model also preferred LASSO regression, which showed the lowest RMSE (0.3321), the highest R-squared (0.1852), and the best AIC (200.775) and BIC (264.867) values.

To sum up, while the four regression models showed comparable performances, the polynomial model consistently lagged behind its regularized counterparts. Each model set revealed the subtle distinctions that helped pinpoint the most suitable regression technique for the respective datasets.

Distinguishing dynamics: "the employee vs the entrepreneur" analysis

The subsequent research phase delved more deeply into the foregoing four models, building upon the previously determined optimal ones. Figure 1 depicts the coefficient trajectory across the various regularization parameters for each model, illustrating the anticipated enhancements in prediction reliability via the interaction of the variables. Evidently, the

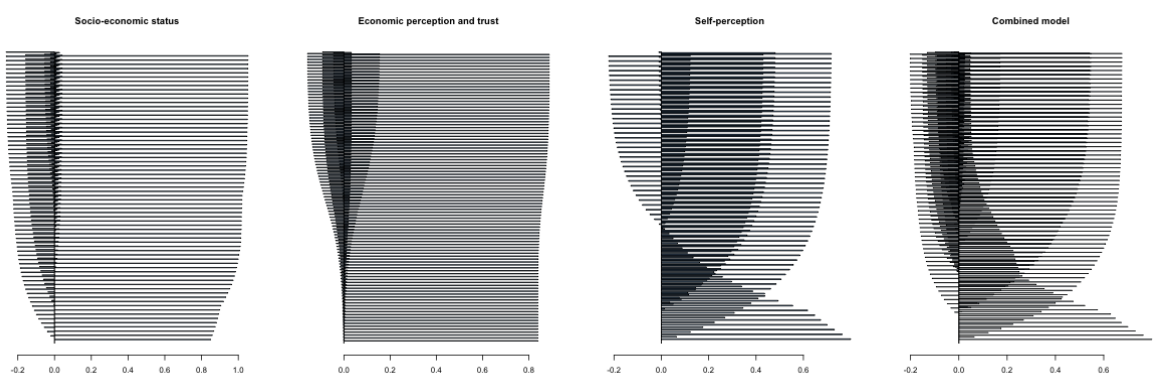

Figure 1 The coefficient variation of the regularization parameters across the entrepreneurs and the employees[2]

Source: Author

regression coefficient matrices for the distinct λ-values present discernible patterns across the models.

In the socioeconomic status model, the LASSO technique identified eight predictors: the gender, education, work experience (years), income-subjective, income-objective, the settlement type, foreign experience, and the XYZ generation affiliation. The gender coefficient starts at a zero and rises to the optimal 0.040 (Figure 1 and Table 3), denoting the correlation between the gender and entrepreneurial tendencies. Contrarily, the education coefficient steadily drops to -0.157, suggesting that entrepreneurs are generally at lower educational levels than their employees, which aligns with the generational affiliation coefficient, where the negative correlation (-0.2635) reflects the fact that the younger generations (the Y and Z generations) prevail among entrepreneurs, possibly explaining the lower education level. Concurrently, the work experience (years) coefficient, i.e. predictor shows to be negative (-0.0546). The settlement type coefficient 0.0170 points to urban predominance among the entrepreneurs. As far as the foreign experience predictor indicating overseas work/study or daily foreign language usage is concerned, its positive value (0.0274) denotes a stronger presence among the entrepreneurs. Pertinently, while the income-subjective predictor holds a positive value (0.0087) suggesting that the entrepreneurs feel they earn more, the income-objective predictor is negative (-0.0212), implying their actual earnings are lesser compared to those earned by their employees.

In brief, this research study indicates a predominantly male representation among the entrepreneurs, although the effect size is relatively small. The entrepreneurs generally exhibit lower education levels, they are younger, and they have fewer years of work experience compared to the employees. Having foreign experience slightly increases the likelihood of entrepreneurial activity. Urban environments appear to be more conducive to entrepreneurship than to traditional employment. Interestingly, while the entrepreneurs tend to perceive their income more positively, the actual income levels suggest that the employees typically earn more, which discrepancy highlights a significant contrast in their income-subjective versus income-objective assessments between the two groups.

Table 3 The optimal coefficient values for the LASSO regression model analyzing the socioeconomic model across the entrepreneurs and the employees

Model variables	Coefficient (optimal λ)
Sex	0.0408
Education	-0.1572
The XYZ generation	-0.2635
Work experience (years)	-0.0546
The settlement type	0.0170
Foreign experience	0.0274
Income-subjective	0.0087
Income-objective	-0.0212

Source: Author

In the second research model herein, which was most effectively captured by ridge regression, the economic perceptions and institutional trust among the entrepreneurs and the employees was examined, the analysis incorporating the key seven variables: the first variable measures satisfaction with the local economic situation (economic situation – satisfied); the second and third variables assess the entrepreneurs' perceptions; the fourth variable reflects the positive views (the good perception of the entrepreneurs); the fifth contrasts with the belief that successful entrepreneurs engage themselves in corrupt practices (corrupt if successful – the entrepreneurs), and the sixth and seventh evaluate trust in local institutions (trust local institutions) and in international institutions (trust foreign institutions), respectively. This model was so designed as to clarify how those factors varied between the entrepreneurs and the employees, and how such differences might influence their respective career trajectories and achievements.

According to Figure 1, it can be noted that increasing regularization leads to satisfaction with the local economy emerging as a stronger predictor, simultaneously indicating the fact that the entrepreneurs tend to be more satisfied than

the employees (-0.0452), as is detailed in Table 4. Additionally, the entrepreneurs generally have a more positive view of their peers compared to the employees (0.0322), and a smaller proportion of the entrepreneurs believe that successful entrepreneurship requires their being engaged in corrupt practices (-0.0924). Regarding the trust indicators, there is a noticeable entrepreneurial lean in confidence towards local institutions (0.1543), whereas trust in international entities shows a negative correlation with entrepreneurial tendencies (-0.1580). These results indicate the fact that trust in local institutions may foster entrepreneurial activity, whereas trust in foreign institutions might act as a deterrent to it.

Table 4 The optimal coefficient values for the ridge regression model analyzing the predictions of the local economy and the trust perceptions across the entrepreneurs and the employees

Model variables	Coefficient (optimal λ)
Economic situation – satisfied	-0.0452
The good perception of the entrepreneurs	0.0322
Corrupt if successful – the entrepreneurs	-0.0924
Trust local institutions	0.1543
Trust foreign institutions	-0.1580

Source: Author

The research study's findings provide compelling insights. The entrepreneurs demonstrate stronger trust in local institutions compared to those foreign, a sentiment that is reversed among the employees. Consistent with the expectations, the entrepreneurs are less likely to view their successful peers as corrupt and hold a more favorable opinion about entrepreneurship than the employees do. However, entrepreneurs tend to be more pessimistic about the economic situation compared to their salaried counterparts, thus revealing a nuanced understanding of the economic conditions.

The third research model in this paper examines the self-perception of the employees and the entrepreneurs. Figure 1 and Table 5 reveal the fact that the entrepreneur rate proves to be higher in openness, productivity (0.1223), and satisfaction with the work-life balance (0.4296) than that pertaining to the employees. The entrepreneurs demonstrate a markedly stronger tendency towards entrepreneurship (0.7177), and a higher aspiration to take the leadership role (0.4806). Conversely, the employees show a more pronounced alignment with government initiatives (-0.0107), simultaneously indicating the differing priorities and motivations between the two groups.

Table 5 The optimal coefficient values for the LASSO regression model analyzing the predictions of self-perception across the entrepreneurs and the employees

Model variables	Coefficient (optimal λ)
Openness and proactivity	0.1223
Life satisfaction and stability	0.4296
Regional aspiration	0.7177
Leadership preference	0.4806
Engagement with the government	-0.0107

Source: Author

To briefly conclude, the entrepreneurs predominantly resonate with regional aspirations and self-identify strongly as entrepreneurs, also tending to report higher levels of life satisfaction and stability and show preference for leadership roles. Conversely, alignment with government initiatives is slightly more typical of the employees, highlighting the distinct motivational and value frameworks between the two groups.

The fourth research model integrates the prior three models into one comprehensive framework and employs LASSO regression for the analysis. Figure 1 and Table 6 account for the results obtained. Notably, Table 6 gives a unique matrix representation, highlighting the absence of negligible values in

the LASSO analysis. This clarity underscores how the integrated variables elucidate the distinctions between the entrepreneurs and the employees within the nuanced relational system.

Table 6 The optimal coefficient values for the LASSO regression model analyzing the complex model across the entrepreneurs and the employees

Model variables	Coefficient (optimal λ)
Sex	...
Education	-0.0572
Work experience (years)	...
Income-subjective	-0.1162
Income-objective	-0.0227
The settlement type	...
Foreign experience	...
The XYZ generation	-0.1673
Openness and proactivity	0.0860
Life satisfaction and stability	0.4484
Regional aspiration	0.6467
Leadership preference	0.4480
Engagement with government initiatives	...
Trust local institutions	...
Trust foreign institutions	-0.0880
Economic situation – satisfied	...
The good perception of the entrepreneurs	-0.0208
Corrupt if successful – the entrepreneurs	-0.0133

Source: Author

In the complex research model herein, Figure 1 proves to be more significant than the Table 5 that merely lists the optimal lambda values. Figure 1 provides a detailed illustration of the hierarchy of the variable importance as determined by LASSO regression, beginning with the exclusion of the variables with the minor coefficients, such as the gender, work experience, the settlement type, and foreign experience. Then, the model progressively eliminates a significant number of the socioeconomic status variables, only to be followed by the variables related to the economic perception and trust, the additional socioeconomic variables such as the education and income variables, the generational affiliation variable and, ultimately, the self-perception variable.

The results obtained in this study highlight a nuanced distinction between the entrepreneurs and the employees. Initially, the social determinants are prominent. As the analysis progresses, however, the economic perceptions and especially the individual self-perceptions are becoming the crucial differentiators. Although these variables are interconnected and constitute a complex system, there is a noticeable transition from the impact of the social determinants to the influences of the economic and individual perceptions in distinguishing between the two groups. This evolution underscores the multifaceted nature of the factors that differentiate the entrepreneurs from the employees.

DISCUSSION

This study aims to explore the distinctions and overlaps between entrepreneurship and traditional employment in Hungary as a semi-peripheral European Union country. Utilizing advanced regression techniques on the set of data from the year 2022, the hypotheses were evaluated through rigorous analytical methods, yielding nuanced insights into the distinctions and overlaps between these employment roles. This approach integrates insights from socio-economic environments (Sarasvathy, 2001; Baker & Nelson, 2005) with individual perceptions (Sarason *et al*, 2006), examining how broader economic and social frameworks interact with personal perceptions and behaviors.

The first hypothesis (H_1) and its sub-hypotheses ($H_{1.1}$-$H_{1.6}$) focused on the socioeconomic status. $H_{1.1}$ predicted a higher proportion of the male entrepreneurs compared to the employees, which was confirmed by analysis carried out in this study, aligning with the existing literature on the gender disparities in entrepreneurship (Audretsch *et al*, 2006). The findings underscore the persistent gender

gap in entrepreneurial participation, possibly due to the sociocultural norms and structural barriers that favor male entrepreneurship. $H_{1.2}$ anticipated that the entrepreneurs would be younger than the employees, which the study's findings also confirmed, and which is supportive of the notion that younger individuals are more inclined towards risk-taking and innovation, probably being driven by a greater propensity to embrace uncertainty and a longer time horizon to recover from potential failures (Light & Dana, 2013). $H_{1.3}$ suggested that the entrepreneurs would have lower educational attainments than the employees, the hypothesis that was supported by the data used in the study. This result implies that formal education may be less critical for entrepreneurial success compared to traditional employment, possibly because entrepreneurial skills and success are often derived from practical experience and specific, nonacademic competencies (Zahra *et al*, 2008). $H_{1.4}$ proposed that the entrepreneurs had fewer years of work experience than the employees, which was confirmed by the findings of this research study, and which is supportive of the idea that entrepreneurship often attracts individuals seeking new opportunities early in their careers, leveraging their fresh perspectives and innovative ideas unencumbered by a prolonged exposure to traditional employment environments (Hyytinen & Ruuskanen, 2007). According to $H_{1.5}$, the entrepreneurs were expected to have more substantial foreign experience, which was supported by the analysis made in this study, which suggests that international exposure contributes to entrepreneurial aspirations and activities, potentially by broadening the individual's perspectives, increasing their awareness of diverse markets, and enhancing their ability to identify and exploit cross-border opportunities. $H_{1.6}$ posited that the entrepreneurs would have higher income than the employees. This hypothesis, however, was rejected. Despite the fact that the entrepreneurs perceived their income more positively, the actual income levels were higher for the employees. This discrepancy highlights the critical contrast between the income-subjective and income-objective assessments, suggesting that the entrepreneurs might derive their positive income perceptions from the nonmonetary benefits such as autonomy, satisfaction, and the potential for future growth.

The second hypothesis (H_2) and its sub-hypotheses ($H_{2.1}$-$H_{2.2}$) addressed economic perceptions and trust in institutions. $H_{2.1}$ hypothesized that the entrepreneurs would have a more optimistic view of the local economy compared to the employees, contrary to which hypothesis the study's results revealed that the employees had shown greater satisfaction with the local economic situation. This unexpected outcome suggests that the entrepreneurs might have adopted a more critical perspective due to their direct engagement with the market dynamics and a potential exposure to higher risks and uncertainties (Nahapiet & Ghoshal, 1998; McEvily *et al*, 2003). $H_{2.2}$ suggested that the entrepreneurs would trust foreign institutions more than the local ones, but the findings of the research study rejected that, indicating that entrepreneurs had demonstrated greater trust in local institutions. This result underscores the importance of local institutional support for entrepreneurial activities, reflecting the entrepreneurs' reliance on the local socioeconomic infrastructure for their ventures. Conversely, the employees exhibited greater trust in foreign institutions, perhaps due to the perceived stability and predictability associated with established international entities.

The third hypothesis (H_3) and its sub-hypotheses ($H_{3.1}$-$H_{3.4}$) focused on self-perception. $H_{3.1}$ proposed that the entrepreneurs would rate their leadership skills higher than the employees, which was confirmed by the analysis performed herein. The entrepreneurs consistently rated their leadership abilities more highly, simultaneously highlighting their views of themselves as being proactive and capable leaders. $H_{3.2}$ hypothesized that the entrepreneurs would perceive themselves as more successful at the local level in comparison with the employees. This hypothesis was supported, with the entrepreneurs expressing stronger perceptions of their local success. This finding may be attributed to the entrepreneurs' direct involvement in creating and sustaining their ventures, which fosters a strong sense of accomplishment and a local impact. $H_{3.3}$ predicted that the entrepreneurs would report a more favorable work-life balance than the employees. The research data supported this hypothesis, suggesting that the entrepreneurs may enjoy greater flexibility and adaptability in their work styles, which allows

them to better balance their respective professional and personal commitments. $H_{3.4}$ proposed that the entrepreneurs would show less alignment with government initiatives compared to the employees. This hypothesis was confirmed, reflecting a more independent or critical stance towards governmental policies among the entrepreneurs. This result aligns with the entrepreneurial ethos of autonomy and skepticism towards the regulatory constraints that might impede their innovative efforts.

The fourth hypothesis (H_4) posited that the socioeconomic factors would be more influential than the individual perceptions in differentiating the entrepreneurs from the employees. This hypothesis was rejected after the analysis had been made, simultaneously demonstrating that self-perceptions played a more significant role. This finding emphasizes the importance of the personal identity and mindset in shaping employment choices, suggesting that individual attitudes and self-concepts are crucial in distinguishing entrepreneurial paths.

In summary, this research study reveals a complex interplay between the socioeconomic factors and the individual perceptions in shaping employment choices. The results indicate that, while the socioeconomic factors such as the gender, age, education, and foreign experience distinguish entrepreneurs from employees, their respective self-perceptions related to leadership, success, and the work-life balance are more critical determinants. These findings underscore the significance of the personal identity and mindset in employment choices, highlighting the need to incorporate psychological factors in the economic models of employment behavior (Sarason *et al*, 2006).

This research study contributes to both the theoretical and practical understanding of employment dynamics. The fluidity of the employment categories and the significant role of self-perception in differentiating the employment types extend the current theoretical frameworks. The study's findings align with the established literature (Hurst & Pugsley, 2011; Piketty, 2014; Kenney & Zysman, 2016), suggesting that the "employees" and "entrepreneurs" categories are not fixed but fluid. Practically, these insights can inform policymakers and program developers in a way to allow them to aim their efforts towards providing support to both entrepreneurs and traditional employees. Recognizing the importance of local institutional trust for entrepreneurs, policymakers can enhance support systems to foster entrepreneurial activities. Additionally, addressing the discrepancy between income-subjective and income-objective perceptions can help tailor financial support and advisory services for entrepreneurs.

The approach utilized in this research study that shifts the focus from the macro- to the individual micro-context elements allows for a nuanced examination of how broader socioeconomic frameworks interact with personal perceptions and behaviors, enhancing the understanding of their influence on entrepreneurial and employment dynamics (Sarasvathy, 2001; Baker & Nelson, 2005; Sarason *et al*, 2006). By comparing entrepreneurs and employees across various socioeconomic dimensions, valuable insights into the evolving nature of the work and economic structures are provided, underscoring the dynamic interplay between different labor forms in flexible capitalism (Hurst & Pugsley, 2011; Piketty, 2014; Kenney & Zysman, 2016).

CONCLUSION

This research provides the intricate examination of the distinctions between entrepreneurs and traditional employees in the semi-peripheral context of the European Union. The findings substantially contribute to both theoretical and practical discourses on employment dynamics, yielding several pivotal insights.

In theoretical terms, the study underscores the fluidity and permeability of the employment categories, thereby challenging the traditional dichotomy between entrepreneurship and conventional employment. The results obtained in this study suggest that these categories are not rigid but rather exist on a continuum, with a significant overlap influenced by the socioeconomic and psychological factors, which fact underscores the need for contemporary economic models to incorporate the

psychological dimensions such as self-perception and the individual identity in understanding employment behaviors.

From a practical point of view, the insights gained in this research study hold profound implications for policymaking and program development. The nuanced understanding of how local institutional trust supports entrepreneurial activities can inform the design of targeted support systems to foster entrepreneurial ecosystems. Furthermore, addressing the observed discrepancy between the income-subjective perceptions and the actual income levels among the entrepreneurs can lead to more tailored financial advisory services, enhancing both entrepreneurs' satisfaction and their financial stability.

The findings which the study came to provide robust empirical support for the study's hypotheses. While the socioeconomic factors such as the gender, age, education, and foreign experience serve as the significant differentiators between the entrepreneurs and the employees, their self-perceptions regarding leadership, success, and the work-life balance emerge as more critical determinants, which highlights the paramount importance of the individual's mindset and identity in shaping employment choices, suggesting that the interventions aimed at fostering entrepreneurship should also address these psychological dimensions.

In spite of the significant contributions of this research study, it is not without limitations, either. The focus on a semi-peripheral EU country inherently limits the generalizability of the findings. To enhance external validity, future research should encompass a broader spectrum of countries, including both the core and peripheral nations as well. Additionally, the cross-sectional design of the study constrains the ability to infer causality. Longitudinal studies would provide a more robust framework for understanding the temporal dynamics and causal relationships in employment transitions.

Future research directions should explore the longitudinal impacts of the identified factors on employment transitions. Investigating the influence of government policies on these dynamics across diverse economic contexts would also yield valuable insights. Expanding the analytical framework to include the core and peripheral EU countries would offer a more comprehensive understanding of employment dynamics across different economic landscapes.

In conclusion, this research study elucidates the complex interplay between the socioeconomic factors and individual perceptions in shaping employment choices. These findings have significant implications for enhancing support for both entrepreneurs and traditional employees, ultimately contributing to a more adaptive and resilient economic landscape. The applied comparative system analysis of the two primary pillars of flexible capitalism – entrepreneurs and traditional employees – highlights both their distinctions and convergences. Recognizing the interplay of socioeconomic dynamics and perceptual processes is essential for promoting the agility and adaptability necessary in today's rapidly evolving economic environment. These insights are crucial for policymakers, educators, and business leaders, helping them in the development of more effective training programs, entrepreneurial initiatives, and the employment policies attuned to the complex realities of the modern workforce.

ENDNOTES

1 A semi-peripheral economy within the European Union represents an intermediate economic status between the core and peripheral countries, blending the characteristics of both developed and developing nations. These economies exhibit moderate technological and industrial development and mixed income levels and engage themselves in the complex economic relations that involve both exploiting and being exploited. Wallerstein's world-systems theory provides a framework for understanding these dynamics, categorizing countries not only economically but also politically and socially (Wallerstein, 2011). The research conducted by C. Chase-Dunn and P. Grimes (1995) specifically highlights the manifestation of these relationships in the integrated context of the EU.

2 Unlike the traditional horizontal representation, the figure uses vertical representation.

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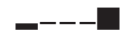
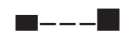
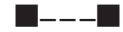
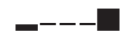
Márton Gosztonyi, Ph.D., is a Senior Lecturer at the University of Malaya with over 15 years of experience in Cultural Computation, educational pedagogy, and entrepreneurship research. His expertise includes network analysis, data visualization, and machine learning.

APPENDIX

Table A1 The descriptive statistics of the variables

Models	Variable	Missing	Compl. Rate	Mean	SD	Histogram
The entrepreneur or the employee	The entrepreneur or the employee	0	1	0.8396	0.3670	
	The entrepreneur or the employee – the last paid job	0	1	0.6561	0.4751	
The socio-economic status	Age	0	1	0.2958	0.1534	
	Sex	0	1	0.5242	0.4996	
	Education	0	1	0.7702	0.2621	
	Work experience (years)	0	1	0.2722	0.2040	
	Income-subjective	0	1	0.7954	0.2213	
	Income-objective	0	1	0.5477	0.2423	
	The settlement type	0	1	0.6931	0.3771	
	Foreign experience	0	1	0.7956	0.4033	
	The XYZ generation	0	1	0.4884	0.3267	
Local economic perception and trust	Trust local institutions	0	1	0.5577	0.1843	
	Trust foreign institutions	0	1	0.5416	0.2030	
	Corrupt if successful – the entrepreneurs	0	1	0.4962	0.2892	
	The good perception of the entrepreneurs	0	1	0.5003	0.1821	
	The economic situation – satisfied	0	1	0.4471	0.2900	
Self-perception	Openness and proactivity	0	1	0.7766	0.1082	
	Life satisfaction and stability	0	1	0.5490	0.1525	
	Regional aspiration	0	1	0.6222	0.1704	
	The leadership preference	0	1	0.6054	0.1300	
	Engagement with government initiatives	0	1	0.5770	0.1573	

Source: Author

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Conference review

REDEFINING STRATEGIC COMMUNICATION AND ITS FUTURE ROLE: THE GLOBAL STRATEGIC COMMUNICATION CONSORTIUM 2024 CONCLAVE – A REVIEW

March 10-13, 2024, St. Petersburg, Florida, USA

Marko Selaković[1*], Nikolina Ljepava[2], Shannon A. Bowen[3], Yicheng Zhu[4], Elina Erzikova[5], Brett Robertson[3]

[1]*SP Jain School of Global Management, Dubai, UAE*
[2]*American University in the Emirates, Dubai, UAE*
[3]*University of South Carolina, USA*
[4]*Beijing Normal University, China*
[5]*Central Michigan University, USA*

INTRODUCTION

The Global Strategic Communication Consortium 2024 Conclave with the main topic "Ethics and Futurism" was held in St. Petersburg, Florida (USA), between March 10th and 13th, 2024. Organized by the University of South Carolina, the conclave brought together more than 30 top-level academics having been invited from all the continents along with high-level professionals to discuss the future directions of strategic communication and possible developments within the discipline.

* *Correspondence to:* M. Selaković, SP Jain School of Global Management, Dubai International Academic City, 502345 Dubai, UAE; e-mail: marko.selakovic@spjain.org

With the mission to move strategic communication forward by focusing research and collaborations on future challenges, technological innovations, crises, and ethics in the field, the Global Strategic Communication Consortium ambitiously aimed to redefine strategic communication and its ethical framework in the post-truth era, which is immensely important. In the nowadays BANI (brittle, anxious, non-linear, and incomprehensible) world (de Godoy & Ribas Filho, 2021), ethics is taking an even more vital role than it has ever assumed before. In the future, ethics must undoubtedly take the central role in society's response to geopolitical issues such as conflicts, wars, supply-chain challenges, food shortages, health problems, crises, and rapid technological changes (Li, Deng, Gao, & Chen, 2019;

Robert Kentish-Barnes, Boyer, Laurent, Azoulay & Reignier, 2020; Frowe, 2022). Such an ethical response is critical to the strategic communication management discipline, even civilization itself, given the fact that, strongly associated with ethics, institutional legitimacy is becoming a topic of growing importance (Lischka, 2019; Lovari & Bowen, 2020). As S. A. Bowen and R. L. Heath (2020) argued, strategic intelligence had to be ethical and based on research, because a mutually beneficial paradigm was simply no longer applicable in such a complex world. With significant ethical concerns about the communications on the governmental, business, and organizational sides, especially contextualized within the framework of the propulsive growth and omnipresent use of artificial intelligence and other advanced technologies, embedding ethics in strategic communication ranging from overall strategies to crisis responses is becoming a crucial element for the future world (Cheng & Jiang, 2021; Dorosh, Astramowicz-Leyk & Turchyn, 2022; Selaković & Ljepava, 2023).

THE FUTURE ROLE OF STRATEGIC COMMUNICATION: KEY CONSIDERATIONS

In the opening keynote, C. Botan (George Mason University) provided insights into the role of strategy in the future, strongly reflecting on the need to redefine the strategy framework in the new contexts and circumstances of the future. B. Berger (University of Alabama) suggested the need for building "practical wisdom" within the strategic communication leaders of the future, only to be followed by S. A. Bowen (the University of South Carolina) and E. Erzikova (Central Michigan University), who offered a new definition of strategic communication in the future context, according to whose research study strategic communication increases organizational effectiveness by enhancing competitive advantage and the normative ethical responsibility, driving values, the vision, the mission, and operations in an identifiable and planned manner. The definition of strategic communication provides a new context different from the previously discussed definition given by A. Zerfass, D. Verčič, H. Nothhaft and K. P. Werder (2018), which puts strategic communication in the context of organizational success. According to S. A. Bowen and E. Erzikova, strategic communication can be defined differently as an "interdisciplinary management function responsible for communication between organizations and stakeholders, facilitating a social role and duty."

GLOBAL VALUES OF STRATEGIC COMMUNICATION

In their effort to assess the global values of strategic communication, a group of researchers from the University of Cagliari, namely A. Lovari, M. Porcu, and M. Pitzalis, offered additional insights into the hybridization of strategic communication (Hoffjann, 2021), referring this phenomenon to the public sector. Furthermore, A. Adi (Quadriga University) and T. Stoeckle (Bournemouth University) additionally supported the new definition of strategic communication by emphasizing the need for a new approach in public relations with social values. According to her considerations, determining the role of public relations in addressing complex societal challenges also involves the need to reconsider how social value and the social impact are defined and measured. K. Place (Quinnipiac University) highlighted the importance of ethical listening from the female point of view, identifying the fact that male narratives still influenced perceptions surrounding chief communications officers and how they had to listen. Moreover, Y. Ibuki (Kyoto Sangyo University) suggested that metacognition and organizational learning were the key values behind the success having been made by Japanese public relations generalists.

Y. Zhu (Beijing Normal University) and D. Lan (the Beijing University of Post and Telecommunications) assessed controversies by examining the use of the "like" button as the reactive communication behavior of closed publics within the CAPS problem-solving framework (Kim, Miller & Chon, 2016). C. A. Yue (the

University of Connecticut), L. Lemon (the University of Alabama), and J. Huang (the University of Minnesota) explored new methodological perspectives in the future navigation of strategic communication. According to their research, the methodological focus will expand to the three perspectives – quantitative, qualitative, and computational – with the growing presence of computational methodological approaches. K. Alharbi (Al Imam Mohammad ibn Saud Islamic University) and the researchers from the University of South Carolina, namely S. A. Bowen and C. Piacentine, discussed strategies to mitigate the spread of misinformation during natural disasters in the future, encompassing significant ethical elements within the findings of their study.

FUTURE APPROACHES TO STRATEGIC COMMUNICATION

Artificial intelligence (AI) and its anticipated future role in strategic communication were the pivotal issues discussed at the conclave. M. Selaković (SP Jain School of Global Management) and N. Ljepava (American University in the Emirates) elaborated on the future role of artificial intelligence in the preparation of crisis communication strategies. Despite the anticipated advancements of AI, M. Selaković and N. Ljepava concluded that professionals in the strategic communication domain would remain the decisive factor in selecting the strategies and tactics involved in organizational and institutional crisis communication. In a similar fashion, A. Cheng (North Carolina State University) discussed leveraging AI for crisis communication, simultaneously highlighting its applications, associated challenges, and anticipated future trends, only to ultimately conclude that AI offered an immense potential in crisis communication by providing real-time insights, boosting public engagement, and optimizing emergency response. M.-G. Chon (Auburn University) elaborated on the ethical aspects of the use of AI in strategic communication from the point of view of professional associations' codes of ethics and emphasized the pressing question pertaining to the adequacy of the guidelines available to public relations practitioners for the responsible use of AI.

In the context of post-pandemic workplaces and workforces, R. Men (the University of Florida) emphasized the profound implications of the changes in the realm of internal communication. In addition to global changes, new generations of the workforce are emerging, bringing novel and different expectations with them. Understanding priorities of generations to come, their expectations, and values may enable organizations to align their internal communication with their employees' expectations. P. M. Buzzanell (the University of South Florida) gave speech on strategic transformative resilience, pointing out the intersection of strategic communication and communicative resilience. In the research study carried out by P. M. Buzzanell together with K. Kee (Texas Tech University) and B. Robertson (the University of South Carolina), a new theoretical framework was offered through the Communication Theory of Resilience (CTR), simultaneously highlighting five key resilience processes. A team of researchers from Texas Tech University, namely M. Hassan, O. Okunloye, and K. Kee, supported by E. Deelman (the University of South California), analyzed strategies for virtual collaboration during the pandemic and identified that all was aimed at leveraging communication in order to keep the workplace virtually coordinated. In addition, A. Adi and T. Stoeckle elaborated on the social impact in the context of the future of public relations and communications as disciplines.

THE CONCLUSIONS AND KEY DIRECTIONS FOR THE FUTURE DEVELOPMENT OF STRATEGIC COMMUNICATION

Based on the discussions made and research presentations given during the Global Strategic Communication Consortium 2024 Conclave, the following points can be highlighted as critically relevant for the future development of strategic communication as a scientific discipline:

1. Both the term "strategy" and the term "strategic communication" will assume new meanings in the future context. Thus, the new definition of strategic communication proposed at the Conclave will be discussed and explicated in S. A. Bowen and E. Erzikova's Introductory Chapter (still in press), as well as in numerous other Consortium members' introductory chapters, in the forthcoming book entitled "The Handbook of Innovations in Strategic Communication" (Elgar). At the same time, the new context of strategic communication dictates the need to redefine its global values, for which reason a new definition of strategic communication should incorporate both ethical responsibility and social role facilitation.

2. Future workplaces in the post-pandemic world are bringing new challenges and expectations with them. The strategic communication leaders of the future will need to be capable of overcoming challenges, understand the specifics of the post-truth world, and build practical skills and wisdom. In this context, it is important to focus on nurturing resilience and understanding the need for generations to come to excel in both internal and external strategic communication.

3. New methodologies and new value elements will need to be included in future research in strategic communication. Technological development and change in expectations enable various improvements and changes in the future strategic communication research paradigm.

4. The propulsive growth of artificial intelligence is offering a novel perspective and a myriad of opportunities in strategic communication, especially if used ethically. Thus, practitioners and researchers should be aware of the key principles and aspects of the ethical use of AI in strategic communication. Professional associations should play a vital role in ensuring ethical AI application in the future.

It is important to highlight the presence and contribution of the following strategic communication practitioners, namely M. B. West, S. Smith, and Maj. Gen. M. K. Eder, who had generously supported the organization of the Global Strategic Communication Consortium 2024 Conclave and offered their insights into future strategic communication roles and issues.

The next Global Strategic Communication Consortium Conclave will be held in Cagliari, Sardinia, Italy, from May 10th to 13th, 2025.

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Marko Selaković is manager, researcher and scholarly academic who is occupying various senior roles at S P Jain School of Global Management (currently Deputy Director and Assistant Professor). He is a strategic management and communications professional with more than 20 years of high-level experience in Europe and the Gulf countries. His research interests include strategic, crisis, investor, and internal communications.

Nikolina Ljepava is Department Chair of Marketing and Management at American University in the Emirates College of Business Administration. She is a practice-oriented academic with extensive industry experience in areas of marketing research, marketing communications, e-business, and evaluation and assessment from America, Europe and Asia. Nikolina is also dedicated to community development and engagement especially in the area of youth Internet safety education.

Shannon A. Bowen is Professor at the University of South Carolina School of Journalism and Mass Communications. She is founder and Executive Director of Global Strategic Communication Consortium. Bowen is an elected member of the Board of Trustees of the Arthur W. Page Society and sits on the Board of Directors of the International Public Relations Research Conference. She teaches and researches ethics across corporations, pharmaceutical firms, governmental entities, and the public relations industry.

Yicheng Zhu is an Assistant Professor at the School of Journalism and Communication at Beijing Normal University, China P.R. His research interests include international public relations, public diplomacy, and computational communication research.

Elina Erzikova is Professor of Public Relations at Central Michigan University and Conference Director of Global Strategic Communication Consortium 2024 Conclave. She is a Fellow of the Plank Center for Leadership in Public Relations at the University of Alabama. Her primary areas of research interest include relationships between the media & power and public relations leadership.

Brett Robertson is an Assistant Professor at the University of South Carolina School of Journalism and Mass Communications and Conference Secretary of Global Strategic Communication Consortium 2024 Conclave. Much of his recent focus has been on disaster preparedness and prevention communication – and the barriers that vulnerable and marginalized populations face during natural disasters. His work explores how emerging technologies can mediate these barriers.

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The Editorial Board of the *Economic Horizons* scientific journal thanks the reviewers for their critical, objective and argumented valuation of the manuscripts submitted to the Editorial Board in 2023.

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