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Original Scientific Paper

IMPACT OF LEARNING ORIENTATION ON COMPANY PERFORMANCE: MEDIATING ROLE OF INNOVATIVENESS

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Abstract. *Ensuring a workforce is up to date on the latest trends in a rapidly changing business environment is one of the main challenges facing modern companies. To achieve long-term profitability and encourage innovation, they tend to constantly improve employees' knowledge and skills. This paper aims to identify the impact of learning orientation on company performance and to test the mediating role of innovativeness in this relationship. The empirical research was conducted on a sample of 79 companies in different industries in the Republic of Serbia. Descriptive statistical analysis, correlation, and regression analysis were applied to the data collected. The research results indicate that learning orientation significantly and positively affects performance and innovativeness in Serbian companies. In addition, the findings show that firm innovativeness partially mediates the relationship between learning orientation and performance, i.e., learning orientation leads to better company performance through increased innovation in all business aspects. The paper contributes to identifying practical implications for managers, pointing out the importance of creating a learning environment and employees´ innovative behaviour as a basis for achieving better business outcomes. Therefore, managers should be responsive in terms of their human resources, providing them with opportunities to acquire new knowledge and skills and develop innovative ideas.*

Key words: *organizational learning, learning orientation, innovativeness, company performance*

JEL Classification: D83, L25, O31

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1. INTRODUCTION

Facing the challenges of growing competition, companies strive to implement activities that will bring the required flexibility and improve performance in all business aspects. The focus is on adapting and responding appropriately to the highly volatile corporate environment. In order to overcome the risk that comes from the outside, employees at all levels need to acquire new knowledge and develop specific skills and abilities. The expanded knowledge base that the company has is expected to improve employee performance and innovative actions in terms of product or service development and management processes. As a result, the overall company performance grows and its competitive market position improves.

Learning orientation is the supporting pillar of the modern paradigm of human resource management and the foundation of sustainable business success. It represents the readiness of the organization to generate learning (Ratten, 2007) and reflects the organization's perspective on the value of learning (Suliyanto & Rahab, 2012). In order to provide a quality workforce, capable of carrying out current and future jobs and developing innovative ideas, employees are encouraged to continuously improve their knowledge and skills. Learning provides a number of long-term benefits to businesses. In addition to enabling greater adaptability to the market (Šlogar, 2022), learning orientation also contributes to the development of innovation, which has a positive impact on company performance (Keskin, 2006). Recent research conducted by Yang et al. (2022) has shown that learning orientation positively affects new venture performance through innovation capability. Therefore, this concept is the key to organizational success (Phorncharoen, 2020; Zlatanović, 2020).

Companies dedicated to learning increase their ability to innovate (Garcia–Morales et al., 2007), and the benefits offered by the development of innovativeness are multiple. While innovation is the backbone of overall social and economic progress from the perspective of the national economy and an effective strategic tool in overcoming the development backwardness of transition economies, innovation's significance at the organizational level is reflected in the long-term enhancement of company performance (Shapiro et al., 2015).

Research of learning orientation, innovativeness, and company performance is motivated by the close interrelationships of these three concepts, established in the studies by Calantone et al. (2002), Keskin (2006), Rahab (2012) and Zayed & Alawad (2017). The research subject in this paper is learning orientation and its impact on company performance in the Republic of Serbia. The paper also deals with innovativeness, i.e. its potential mediating effects in a relationship between the previously mentioned variables. Accordingly, the paper seeks to identify the impact of learning orientation on innovativeness and performance, as well as to examine the mediating role of innovativeness in this relationship. Although there are studies in the current literature that evaluate the link between these three concepts, to the best of the authors' knowledge, no previous research has addressed the mediating function of innovation in the observed relation. In this respect, our study aims to close the indicated research gap. The paper structure includes 5 logically connected parts. The introduction is followed by the literature review and hypotheses development highlighting the main theoretical features of the relationships between learning orientation, innovativeness, and company performance. Then, the research model is developed and the applied methodology is presented. The fourth unit represents the results of empirical research and their discussion. Finally, the main conclusions, theoretical and practical implications, as well as research limitations are identified.

2. Literature Review and Hypotheses Development

Learning orientation is a critical aspect in organizational performance (Phorncharoen, 2020) and a source of competitive advantage (Farell, 2000), which is why it should become a business priority (Suliyanto & Rahab, 2011). It represents a critical component of organizational learning and is defined as "the organization's attitude towards the necessity of learning" (Ratten, 2007). Prediction of the environment and adaptation to market changes are among the most important features of learning-oriented companies (Calantone et al., 2002), which indicates the importance of this concept in achieving the necessary business flexibility. Companies that are more learning–oriented are more likely to interact with third–party knowledge providers (Kumar et al., 2020), making them more prone to innovative activities.

Learning orientation is a construct that implies the managers' "attitude to consider learning as a key organizational resource", understand the need to eliminate old thinking patterns, as well as the need for new learning (Vega Martinez et al., 2020). It is a complex, multidimensional notion that involves "a commitment to learning, shared vision, open–mindedness, and intra–organizational knowledge sharing" (Phorncharoen, 2020). Commitment to learning is "the degree to which an organization values and promotes learning", while a shared vision implies a unique direction and organizational focus on learning (Calantone et al., 2002). Open-mindedness presents a reflection of the company's willingness to abandon the current routine and adopt new knowledge (Li et al., 2010), while intra-organizational knowledge sharing is defined as a synergistic process of cooperation in which people share existing and interactively create new knowledge (Boland & Tenkasi, 1995, as cited in Ro et al., 2021). Garcia–Morales et al. (2007) point out that knowledge sharing and the resulting organizational learning can improve company performance. In addition, knowledge is recognized as one of the key internal factors in creating innovative companies, and innovation itself is the result of knowledge sharing (Zlatanović, 2020).

Although these are related concepts, organizational learning is not synonymous with a learning orientation. Specifically, organizational learning is a broader concept, and learning orientation is one of its dimensions. In this sense, Frank et al. (2012) make a distinction between these two concepts. In their opinion, organizational learning is a complex process that can be split into two basic forms of learning: 1) adaptive, gradual learning, where organizations respond to shifts in circumstances and make adjustments through active learning, and 2) generative learning, as higher-order learning, which changes the "worldview" through re-examination and change of organizational processes. Adaptive and generative learning are two complementary processes (Salim & Sulaiman, 2011). Learning orientation is linked to the second dimension of organizational learning and is considered to be its indirect assessment (Santos–Viande et al., 2005). Thus, in our study, we regarded a learning orientation to be an essential component of organizational learning. Organizational learning and learning orientation, as an integral part of it, are the foundation of innovative activities (Garcia–Moralez et al., 2007), with the potential to achieve superior company performance. Furthermore, in the study conducted by Al–Shami et al. (2022), learning orientation positively correlates with innovation performance.

Learning orientation occupies an important place in contemporary management literature, as it provides numerous positive outputs. Previous studies identify a strong positive effect of learning orientation on business performance (Farrell, 2000). Aziz and

Omar (2013) stated that knowledge sharing and shared vision, as relevant dimensions of learning orientation, are crucial determinants of improving business performance in SMEs. Frank et al. (2012) also show that a significant degree of learning orientation leads to better performance in small and medium enterprises. Besides, learning orientation is positively correlated with business performance in companies that provide accounting services (Martinette et al., 2014). In addition, Vij and Farooq (2014) show that a knowledge-sharing orientation has a positive impact on a company's business performance in the manufacturing and service sectors. Based on the above, the first research hypothesis reads:

H1: Learning orientation has a statistically significant positive effect on company performance.

One of the results of the learning process that creates new knowledge within the organization is innovativeness (Frank et al., 2012). It is the subject of research in a number of disciplines (Salim & Sulaiman, 2011) and represents the capacity of an organization to develop and/or incorporate new products, procedures, and business models (Nybakk, 2012). Porter (1990) explains innovation as a tool for achieving competitive advantage and points to the need for a broader understanding of this concept, which includes new technologies and new ways of carrying out activities (cited in Zlatanović, 2020). The results of previous research show that new knowledge and skills, acquired through learning, contribute to the ability to innovate, which in turn improves competitiveness and company performance (Salim & Sulaiman, 2011). Chenuos & Maru (2015) recognize lifelong learning as one of the values necessary to achieve organizational innovation.

Suliyanto and Rahab (2012) find that learning orientation has positive effects on company innovativeness. Both learning orientation and innovation are influenced by a variety of factors. Nikolić et al. (2022) have shown that foreign–owned businesses are more innovative and learning–oriented. According to Hurley & Hult (1998), Calantone et al., (2002), and Nybakk (2012), learning orientation is considered a major predictor of innovativeness, which in turn improves company performance. Organizational innovativeness directly depends on the knowledge base that the company has, which is increased by organizational learning (Cohen & Levinthal, 1990, as cited in Garcia–Morales et al., 2007). A recent study of a sample of small and medium–sized enterprises has found a significant positive effect of learning orientation on innovativeness (Phorncharoen, 2020). According to Šlogar (2022), company innovativeness is significantly and positively influenced by learning orientation. As previous research suggests, the higher the degree of learning orientation, the greater the company's innovativeness (Calantone et al., 2002). In a study conducted by Aziz and Omar (2013), knowledge sharing and shared vision have positive significant effects on the ability to innovate. Internally focused learning and market-oriented learning, as dimensions of learning orientation, prove to be statistically significant predictors of product innovation in a study by Dulger et al. (2014), with internally focused learning significantly and positively explaining technological innovation. In addition, Oktavio et al. (2019) find that learning orientation has positive effects on the innovativeness of newly established hotel companies. In addition, the positive effects of learning orientation on hotel innovativeness are proven in the Werlang & Rossetto (2019) study. The above findings are the basis for the formulation of the second research hypothesis:

H2: Learning orientation has a statistically significant positive effect on company innovativeness.

Differences in the level of organizational learning and innovativeness determine the differences in company performance. Corporate performance is a multidimensional

concept that can relate to individual sectors – marketing, manufacturing, and finance (Sohn et al., 2007) or to aggregate indicators such as growth and profit (Babić et al., 2020), which can be measured by objective and subjective indicators (Atalay et al., 2013). They reflect the ability of a business organization to realize its long-term goals (Zayed & Alawad, 2017). Previous research has established a link between learning orientation, innovativeness, and company performance, analyzing both the direct and indirect effects of these variables. Suliyanto and Rahab (2012) explain that learning orientation indirectly improves company performance, through variables that mediate between these two variables. They show that innovativeness has a positive impact on performance. Positive relations of learning orientation, innovativeness, and performance have also been proven in the Malaysian IT (Information, Communication, and Telecommunications) industry (Salim & Sulaiman, 2011). In a sample of Spanish firms, Garcia–Morales et al. (2007) show that organizational learning directly affects performance, but also indirectly, through organizational innovation. In a study conducted by Farell (2000), companies in Australia benefit from a learning orientation in terms of their performance. A positive significant link between learning orientation, innovativeness, and company performance is established in a study conducted by Calantone et al. (2002). In a study conducted by Nybakk (2012), learning orientation does not have a direct effect on the financial performance of companies, but it significantly affects them through innovativeness; therefore, innovativeness has a full mediating effect in a given relationship. According to Dulger et al. (2014), organizational innovativeness is a partial mediator in the relationship between learning orientation and company performance. The relations between learning orientation, innovativeness, and company performance are also the subject of research conducted by Rhee et al. (2010). In a sample of 333 technology-innovative small businesses, they show that learning orientation has a positive effect on innovativeness, and that innovativeness consequently leads to better performance. Based on the above, the third research hypothesis reads:

H3: Innovativeness has a mediating effect in the relationship between learning orientation and company performance.

Figure 1 illustrates the research model.

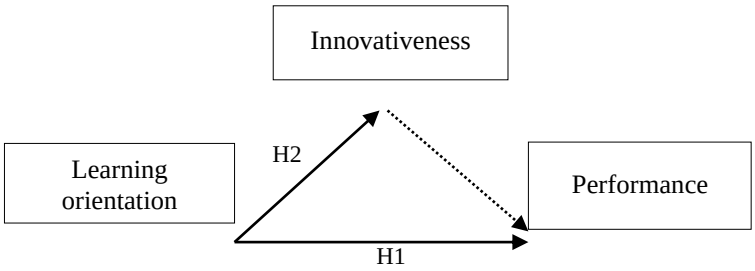

Fig. 1 Research model
Source: Authors

3. METHODOLOGY

Empirical research uses quantitative methodology. Primary data is collected by the survey method, and the questionnaire is designed in four segments. The first subscale consists of 7 items that measure learning orientation (Li et al., 2010; Werlang & Rossetto,

2019; Nikolić et al., 2022), such as *Employee learning is viewed as an investment rather than an expense* and *Learning is seen as essential to a company's survival*. The second part of the questionnaire measures innovativeness through 7 items, formulated based on research conducted by Gunday et al. (2011), Atalay et al. (2013), and Werlang & Rosseto (2019). The examples of items are: *The company supports proactiveness when it comes to producing new goods and/or services* or *The company encourages new approaches to problem-solving*. The company performance is measured by the last 10 items, which are adapted from the research by Vij & Bedi (2016), Psomas et al. (2017), and Payal et al. (2019), for example, *The company has higher profitability compared to the previous period* and *The trend of sales growth in relation to the previous time period is noticeable*. Items that measure performance concern both financial and non-financial performance. The respondents express their agreement with the stated items on a five-point Likert scale.

Data analysis is performed using the techniques of the Statistical package for social sciences (SPSS) 26.0. After the sample structure is analyzed, the following analyses are implemented to determine mediating effects: reliability analysis, descriptive statistics, correlation analysis, and simple and multiple linear regression to determine mediating effects. The questionnaire is distributed to companies in person and electronically. We used the convenience sampling method and the research sample included 79 companies operating on the territory of the Republic of Serbia. From each company, one manager completed the questionnaire. The sample structure is shown in Table 1.

Table 1 Sample structure

Variables		Frequency	%
Activity	Production	39	49.4
	Services	40	50.6
Majority ownership	Domestic	46	58.2
	Foreign	33	41.8
Ownership type	State	5	6.3
	Private	74	93.7
Gender	Men	34	43
	Women	45	57
Age	Less than 25	2	2.5
	26 – 35	27	34.2
	36 – 45	33	41.8
	46 – 55	14	17.7
	Over 55	3	3.8
Position	Employee	2	2.5
	Operations manager	16	20.3
	Middle (tactical) manager	48	60.8
	Top manager	13	16.5
Length of service	Less than 3 years	22	27.8
	3 – 5 years	26	32.9
	Over 5 years	31	39.2
Education	High school	8	10.1
	College	7	8.9
	Bachelor	39	49.4
	Master	23	29.1
	PhD	2	2.5

Source: Authors

The share of production and service companies in the sample is almost equal, with 33 companies being foreign-owned. The majority of businesses belong to the private sector. According to the obtained results, the largest number of respondents work in the position of middle manager (60.8%). The frequency analysis according to the length of service with the current employer shows that the largest number of respondents work in the company for more than 5 years (39.2%), followed by respondents with between 3 and 5 years of service (32.9%). Most of the given sample is university educated.

4. RESEARCH RESULTS AND DISCUSSION

The reliability analysis of the measurement scale is performed, the results of which are shown in Table 2. Reliability analysis shows that Cronbach's alpha coefficient for all three subscales is higher than the minimum recommended value (0.7), and a conclusion can be drawn about the high internal consistency of items and the reliability of the analyzed variables.

Table 2 Results of reliability analysis

Variables	Cronbach's alpha coefficient
Learning orientation	0.952
Innovativeness	0.955
Performance	0.960

Source: Authors

Descriptive statistics analyzes mean values and standard deviations for all individual items. Respondents show the highest degree of agreement with items *I have access to the information I need to do my job effectively and efficiently* (M=3.72), and *The organization launches new products and/or services* (M=3.71). The largest standard deviation is with items *The company introduces innovations in Human Resource Management area* (SD=1.60) and *The company encourages new approaches to problem–solving* (SD=1.60). The greatest homogeneity of responses is with items *The quality of products/services is better than in the previous period*, which measures the performance of the company (SD=1.27).

Table 3 Correlation matrix

Variables	1	2	3
Learning orientation	1	0.894**	0.796**
Innovativeness	0.894**	1	0.801**
Performance	0.796**	0.801**	1

** Correlation is significant at the level of 0.01.

Source: Authors

Table 3 presents the results of the correlation analysis. The strongest link is between learning orientation and innovativeness (r = 0.894). According to the Pearson coefficient, there is a very strong correlation between all variables. All values shown are significant at 0.01.

For the purposes of hypothesis testing, the mediation regression procedure was applied. To test the mediation effect, according to Baron & Kenny (1986), the following prerequisites must be met: in the first step, it is necessary to confirm the significant direct influence of the independent variable on the dependent one; another simple linear regression examines whether independent, i.e. the predictor variable affects the potential mediator, while in the next step, it is necessary to prove that mediator significantly influences the dependent variable. By confirming these assumptions, the conditions for the final testing of the mediator effect are obtained, and in the final step, the joint influence of the independent variable and the potential mediator on the dependent variable is tested using multiple linear regression. Finally, in order to establish a mediator effect, the potential mediator must be a statistically significant predictor of the dependent variable, while the influence of the independent variable decreases (partial mediator effect) or ceases to be statistically significant (full mediator effect).

Table 4 Simple linear regression

Variables	Dependent variable: Performance			Dependent variable: Innovativeness		
	β	Sig.	R^2	β	Sig.	R^2
Learning orientation	0.796	0.000**	0.629	0.894	0.000**	0.798
Innovativeness	0.801	0.000**	0.642			

** $p < 0.01$

Source: Authors

Table 4 shows the results of a simple linear regression that tests the impact of learning orientation on performance and company innovativeness. The results show that learning orientation has a significant positive impact on company performance ($p<0.01$). The coefficient of determination is 0.629, which means that 62.9% of the performance variability is explained by the observed independent variable. Learning orientation also has a significant positive effect on company innovativeness ($p<0.01$) with the coefficient of the determination being 0.798 and showing that learning orientation determines innovativeness in 79.8% of cases. In the third phase, it was found that innovativeness had a positive significant influence on company performance ($p<0.01$), which met all the requirements for evaluating the mediator effect.

Table 5 Multiple linear regression

Variable	Dependent variable: Performance			
	β	Sig.	R^2	VIF
Learning orientation	0.397	0.008**	0.666	4.960
Innovativeness	0.447	0.003**		

** $p < 0.01$

Source: Authors

Table 5 presents the results of multiple linear regression. In order to check the justification of regression analysis, multicollinearity was checked. As the value of the variance inflation factor (VIF) is less than 5, multicollinearity is not a problem in this regression model. The joint impact of learning orientation and innovativeness on enterprise performance was tested. The results showed that 66.6% of the performance variability is explained by the observed

independent variables. Learning orientation and innovativeness have a significant positive impact on performance, but the inclusion of innovativeness in the regression model significantly reduces the impact of learning orientation. Based on this, it is concluded that there is a partial mediation effect of innovativeness in the relationship between learning orientation and enterprise performance.

Thus, the conducted analysis shows a significant positive impact of learning orientation on company performance, which confirms hypothesis H1. Such a result is consistent with the results obtained by Farell (2000), Frank et al. (2012), and Vij & Farooq (2014). The obtained result is partially compatible with the research of Aziz & Omar (2013), and Marinette (2014) and testifies to the predictive power of learning orientation in predicting company performance. At the same time, the generated result is in contrast with to the research of Oktavio et al. (2019) and Werlang & Rossetto (2019). The research also confirms the H2 hypothesis, according to which learning orientation has a significant positive effect on company innovativeness. The same result is reached by Calantone et al. (2002), Suliyanto & Rahab (2012), Oktavio et al. (2019), Phorncharoen (2020), and Šlogar (2022).This finding implies that learning orientation leads to increased innovation activities such as developing new products or services, management methods, marketing strategies, or innovating human resource management and information systems. The obtained result partially corresponds to the research conducted by Aziz and Omar (2013) and Dulger et al. (2014).

The research also confirms the partial mediating influence of innovativeness on a relationship between learning orientation and company performance, which is partly in line with the findings of Garcia–Morales et al. (2007) and Nybakk (2012). This result shows that innovation mediates the relationship between learning orientation and company performance, i.e. learning orientation affects the performance of the company through innovativeness. In other words, the causal relationship of the observed variables depends on the degree of innovativeness.

5. CONCLUSIONS

This research has shown that learning orientation is a predictor of company performance and innovativeness in the Republic of Serbia. In addition, the research confirms the mediating effect of innovativeness in a relationship between learning orientation and company performance. The paper provides a certain theoretical contribution to the existing literature. First, it clarifies complex connections between learning orientation, innovativeness, and company performance. Examining the mediating role of innovativeness, the paper explains the mechanism by which learning orientation is transformed into performance improvement. The conducted research determines the extent to which company innovativeness changes the strength of the correlation between learning orientation and performance.

The paper also gives some practical implications to company managers. The importance of creating an internal environment that encourages learning is emphasized, as well as the importance of implementing innovative practices, in order to improve the overall company performance. Managers need to take a proactive approach to human resource management and provide opportunities for employees to acquire new knowledge and create innovative ideas. This is particularly important due to the fact that the degree of the company′s innovativeness can be increased through a focus on learning, which will consequently improve company performance.

The conducted research has certain limitations, from which the directions of future research arise. The first limitation refers to the small number of respondents, which is why the analysis should be repeated on a larger sample. As the research is limited to companies operating in the Republic of Serbia, the conclusions cannot be generalized for those operating in a different social, cultural and legal context. Therefore, it would be useful to apply the same research model to a sample of companies in other countries. Future research may also examine the individual effects of the dimensions of learning orientation on enterprise performance, as well as the individual mediating influences of the types of innovativeness in a given relationship.

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UTICAJ ORIJENTACIJE NA UČENJE NA PERFORMANSE KOMPANIJA: MEDIJATORSKA ULOGA INOVATIVNOSTI

Prilagođavanje zaposlenih najnovijim trendovima u dinamičnom poslovnom okruženju jedan je od glavnih izazova sa kojima se susreću savremene kompanije. Da bi obezbedile dugoročnu profitabilnost i podstakle inovacije, one nastoje da konstantno unapređuju znanja i veštine zaposlenih. Cilj istraživanja u radu je identifikovati uticaj orijentacije na učenje na performanse kompanija, kao i medijatorsku ulogu inovativnosti u navedenoj relaciji. Empirijsko istraživanje sprovedeno je na uzorku od 79 kompanija iz različitih delatnosti u Republici Srbiji. Za potrebe analize podataka primenjene su deskriptivna statistika, korelacija, kao i prosta i višestruka regresija. Dobijeni rezultati su pokazali da orijentacija na učenje ima značajan pozitivan uticaj na performanse i inovativnost kompanija u Republici Srbiji. Dodatno, inovativnost ostvaruje parcijalni medijatorski efekat u odnosu orijentacije na učenje i performansi kompanija. Navedeno pokazuje da orijentacija na učenje vodi ka boljim performansama kroz povećane inovacije u svim aspektima poslovanja. Doprinos rada se ogleda u praktičnim implikacijama za menadžere, naglašavajući važnost kreiranja okruženja koje podstiče inovacije i inovativno ponašanje zaposlenih kao osnove za postizanje boljih poslovnih rezultata. Stoga, menadžeri treba proaktivno da pristupe upravljanju ljudskim resursima, pružajući im mogućnosti da steknu nova znanja i veštine i razviju inovativne ideje.

Ključne reči: *organizaciono učenje, orijentacija na učenje, inovativnost, performanse kompanija*

QUESTIONNAIRE

Dear Sir/Madam,

We welcome you to participate in a survey being performed for research interests. This questionnaire is intended to evaluate the links between learning orientation, innovativeness, and corporate performance levels. The information in this survey will be accessible only to the researchers. We also guarantee that the information gathered through surveys will only be used for scientific and research purposes. The respondent's personal name is not necessary because the questionnaire is anonymous, and all information will be kept strictly confidential.

The questionnaire has two main sections: In the first one, you should rate the items linked to learning orientation, innovativeness, and performance for the company you work for. Items are required to be rated on a scale ranging from 1 to 5, respecting the following:

1 – I disagree completely;
2 – I disagree mostly;
3 – I slightly agree;
4 – I mostly agree;
5 – I agree completely.

Learning orientation

Employee learning is viewed as an investment rather than an expense.	1	2	3	4	5
One of the company's main principles is employee learning.	1	2	3	4	5
Learning is seen as essential to a company's survival.	1	2	3	4	5
Management in the organization agrees with the idea that the company's capacity for learning is essential to its competitiveness.	1	2	3	4	5
Staff members agree that learning is an important aspect in developing either products or services.	1	2	3	4	5
The organization has enough resources to undertake learning initiatives.	1	2	3	4	5
I have access to the information I need to do my job effectively and efficiently.	1	2	3	4	5

Innovativeness

The company supports proactiveness when it comes to producing new goods and/or services	1	2	3	4	5
The organization launches new products and/or services.	1	2	3	4	5
The organization employs contemporary management techniques.	1	2	3	4	5
The organization develops new strategies in the marketing field.	1	2	3	4	5
The company introduces innovations in Human Resource Management area.	1	2	3	4	5
The company introduces innovations in information systems.	1	2	3	4	5
The company encourages new approaches to problem–solving.	1	2	3	4	5

Performance

The trend of sales growth in relation to the previous time period is noticeable.	1	2	3	4	5
The company has higher profitability compared to the previous period	1	2	3	4	5
In comparison to the prior time period, the company is more innovative.	1	2	3	4	5
Product/service quality has improved during the prior period.	1	2	3	4	5
The organization is capable of responding promptly and efficiently to technological advances.	1	2	3	4	5
The company is able to adapt swiftly and effectively to market dynamics.	1	2	3	4	5
Consumer satisfaction has increased from the prior period.	1	2	3	4	5
Employee satisfaction has increased from the prior period.	1	2	3	4	5
The organization is capable of retaining critical staff.	1	2	3	4	5
The company is highly reputable in the market.	1	2	3	4	5

Gender:
- Men
- Women

Age:
- Less than 25
- 26 – 35
- 36 – 45
- 46 – 55
- over 55

Education:
- High school
- College
- Bachelor
- Master
- PhD

Position:
- Employee
- Operations manager
- Middle (tactical) manager
- Top manager

Length of service:
- Less than 3 years
- 3 – 5 years
- Over 5 years

Activity:
- Production
- Services

Majority ownership:
- Domestic
- Foreign

Ownership type:
- State
- Private

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Original Scientific Paper

FACTORS THAT AFFECT EMPLOYMENT DECISION OF FUTURE HEALTHCARE PROFESSIONALS IN SERBIA

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Abstract. *Rising trend of international mobility of healthcare workers, ageing population, new diseases and infections bring many challenges to the national healthcare system. Consequently, it is necessary to pay special attention to the development of the healthcare system, as well as the attraction and retention of healthcare professionals. The aim of this paper is to examine and analyze the key factors that influence the decision-making process of future healthcare professionals regarding employment. 444 participants who are studying or have finished one of the accredited study programs in the Republic of Serbia in the field of medicine participated in the empirical research in the period from 2020 to 2022. The research results showed that three key factors that future healthcare professionals value when deciding on employment are: opportunities for career advancement, opportunities for personal growth and development, and a pleasant work environment. The fourth place was taken by an interesting, significant, and challenging job, while salary is in the fifth place. The optimal functioning of the healthcare system depends on the healthcare professionals, so the obtained results are valuable for leaders, managers, and decision makers in healthcare institutions. They are well-informed to adequately prepare employee value proposition not only for the attraction of healthcare workers, but also for their retention in the long run.*

Key words: *healthcare professionals, employment, recruitment, working conditions, career opportunities*

JEL Classification: J24, M50

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1. INTRODUCTION

Healthcare represents one of the most responsible activities of human society, with a dominant social function. The basic right of every human being is to receive adequate health services without distinction based on race, religion, economic and social status, as well as political orientation (World Health Organization, 2020). The imperative for growth and development of each individual and the entire society is health, which is viewed through the concept of physical, mental, and social well-being (Strategija javnog zdravlja u R. Srbiji 2018-2026, 2018). That is why one of the priority goals of every Government is to preserve, improve and protect the health of the population, and to provide quality and affordable health services on the primary, secondary, and tertiary level. Therefore, it is a great responsibility of the Government to create a strategy for the development of the health system, to implement adequate health and social policies, as well as to introduce various measures that will ensure the improvement of health of individuals, families, and the entire society.

The need for professional healthcare will be increasing in the future due to many factors, including: population ageing, new diseases, infections, and many other health and well-being challenges (Cristea et al., 2020). Bearers of the key values of each national healthcare system are healthcare employees and associates (Fernandes et al., 2022). With professional approach and competent work, they direct activities towards treatment, care, prevention of diseases and risky forms of behavior. Knowledge, skills, abilities, attitudes, values, and motivation of healthcare professionals represent the important potential in healthcare and play a significant role in achieving high quality services and general well-being of the population. The key drivers of quality healthcare are: education, employment, good working conditions, training, and retention of competent healthcare employees (Lagarde et al., 2019; Kitsios & Kamariotou, 2021).

The aim of this paper is to examine and analyze the key factors that influence decision-making process regarding employment of future healthcare professionals in Serbia.

The paper is organized as follows: The first chapter is focused on the key reasons for the migration of healthcare professionals, while the second chapter is devoted to the key motivational factors. The third chapter describes the research design, while the fourth one deals with the results of research findings and discussion.

2. THE KEY REASONS FOR MIGRATION OF HEALTHCARE PROFESSIONALS

In today's unstable conditions which are characterized by constant challenges - globalization, economic crisis, decline in economic growth, global pandemics (COVID-19, SARS, bird flu, anthrax...) and migrant crises, healthcare systems (especially in developing countries) are faced with numerous challenges. Among the key challenges are how to strengthen already fragile healthcare systems, which policy and practice of motivating and retaining human resources to apply, and how to slow down the rate of migration. Concerning fact according to the World Health Organization (2006) is that 57 countries are faced with critical health workplace shortage. Furthermore, low birth rate, ageing population, and high migration rate affect labor availability (Arandarenko, 2021). The trend of migration of medical professionals (especially nurses and technicians) from developing to developed countries has started since 2000 (Brush, 2008). The most frequent factors that impact the migration of healthcare workers are: poorly equipped

working environment, lack of resources and tools for effective working, low salary, poor working conditions, limited educational and career opportunities (Wiskow et al., 2010). Economic, social, professional, personal, as well as political factors of migration dominate among healthcare workers (Dywili et al., 2013; Willis-Shattuck et al., 2008). Here is primarily referred to individual needs and desires for ensuring a better quality of life (higher salaries), personal safety, healthy environment, as well as better opportunities for training and professional career development (Kingma, 2007).

Migrations are present among all healthcare workers. For example, while medical doctors are more likely to migrate because they expect benefits to their growth and development, medical students also migrate abroad due to the opportunity to accumulate diverse and valuable skills (World Bank, 2020). In countries with limited employment opportunities, the departure of young people is often not seen as a problem, but as a solution to high unemployment rates (Santric-Milicevic et al., 2015). The European Training Education report states that „the Serbia's biggest export 'product' is labour" (Arandarenko, 2021, p. 5). The main reasons for leaving Serbia are better opportunities and conditions for employment, working, and living (Djurić & Tiodorović, 2018). The study of World Bank (2020) showed that the main reasons for migration of doctors and medical technicians from Serbia to other countries are the inability to find work and low salaries. This trend of migration is especially present among young people who have just finished formal education. Research conducted among 719 nursing graduates from 2012/2013 academic year in Serbia showed that almost 70% indicated the intention to work abroad hoping for higher salaries, better working conditions, and higher quality of life (Santric-Milicevic et al., 2015).

International mobility and uncontrolled migration flow of healthcare workers can threaten the national healthcare system and have consequences for the management of human resources and the processes of planning, recruitment, development, and retention. The lack of healthcare professionals additionally increases the level of workload and stress of those employees who remain, which can directly affect the decline in performance and the reduction of quality of provided healthcare service. Research conducted in 2007 in Clinical Center Nis in Serbia in which 770 healthcare workers participated showed that more than two thirds of them are overloaded with work (Nikić et al., 2008). The growing healthcare needs of the population, at the national and global level, require healthcare systems with a stable and strong infrastructure, and sustainable human resources (Kingma, 2008). That is why it is necessary to pay special attention to the definition of the national strategy for development of the healthcare system and retention of healthcare professionals. Retention of healthcare professionals is the key to successful functioning of healthcare institutions, and it leads to savings in costs needed for recruitment, hiring, socialization and orientation of new workers.

3. The Key Motivational Factors for Healthcare Workers

The number of authors examined what motivates people to become healthcare professionals in low and middle-income countries (Uganda, Sierra Leone, Cambodia, Zimbabwe). The results showed that the most impactful are intrinsic motivational factors such as: „personal calling" (helping people in community, serving people, saving the lives of people), desire for status of professionals (feeling of pride when wearing uniforms) and high respect of community (Witter et al., 2018). Similar results

are obtained in a study in rural areas in Vietnam where the key motivational factors for being healthcare workers were: respect from community, good interpersonal relations, and collaboration (Thi Hoai Thu et al., 2015). Furthermore, results from research conducted in Northwest Ethiopia showed that among main motivational factors for healthcare professionals are: leadership, support, participation in decision making, opportunities for professional development, appropriate work schedule, necessary equipment, and good communication channels (Weldegebriel et al., 2016). Healthcare professionals are mostly motivated with factors such as autonomy, supportive supervision, respect, good interpersonal relationships, and clear growth opportunities (Veenstra et al., 2022).

Similar results are obtained in semi-structured interviews with doctors in Spain – they are driven by intrinsic motivational factors such as helping others, providing quality service, dedication, and help (Berdud et al., 2016). The study of Kjellström et al. (2017) in five primary healthcare centers in Sweden showed that work motivation for healthcare professionals is achieved due to clear goals, lateral collaboration, and systematic improvement of work quality. In Czech Republic are introduced special measures for recruitment and retention of healthcare workers: higher salary grades, benefits in public-health facilities, continuous programmes for professional development and growth, flexible working hours, and part-time contracts for people with children (Wiskow et al., 2010). The results of research conducted in 22 public hospital clinics in Warsaw, Poland, showed that the main factors of job satisfaction among medical doctors are quality of work, status, respect, and autonomy (Chmielewska et al., 2020). Furthermore, research regarding healthcare workers in countries of the European Union with the highest salaries showed that in most cases intrinsic motivators influenced the decision to go to work abroad. For example, in Germany, nurses are leaving the country due to dissatisfaction with working conditions, low salaries, and inadequate professional recognition. On the other hand, doctors emigrate because of the high level of workload and stress, inadequate working conditions, and structured training after completing postgraduate studies (Ognyanova et al., 2014).

In Serbia there is a declining trend in the number of healthcare professionals under 35 years who will replace retired healthcare workers. Those young professionals are more mobile and willing to frequently change employers searching for better working conditions (Milićević et al., 2018). Research showed that for healthcare workers in Serbia salary was not the most impactful factor for leaving the job (Council on Linkages between Academia and Public Health Practice, 2016). Based on data from the report of the Institute of Public Health of Serbia from 2019, the satisfaction of employees in 324 health institutions has increased compared to previous years. In 2019, the percentage of satisfied employees was 46.8%, while the percentage of dissatisfied decreased to 19.7% (Horozović & Jaćović Knežević, 2020). For years, healthcare professionals give the highest satisfaction ratings to professional factors such as: quality cooperation with colleagues, support from superiors, the ability to express one's own opinion and ideas, the relationship between patients and employees, available time for organization, and implementation of work. However, the factors that cause the greatest dissatisfaction among healthcare workers are: salaries, insufficient human resources and inadequate distribution of work among existing workers, lack of or exploited medical equipment, inadequate policy and practice of the reward system, disorganized work, and overload with administrative tasks. Other researchers stated that the intention of healthcare workers to leave their current job is increased when they feel tension, stress, and pressure (Tripković et al., 2021). Results from research conducted in Vojvodina among 719

healthcare professionals showed that they are mostly satisfied with secure jobs, support from supervisors, independence at work, good work relationships, personal qualities of supervisors, and positive working atmosphere (Grujičić et al., 2018). Babić et al. (2014) showed that in the private and public sector, motivation among healthcare workers was positively related to relationship and support of colleagues. What is worrying is that almost one third of doctors and nurses employed in the public health sector plan to find a job in the private health sector or to move abroad for better career opportunities, professional development, recognition, better working conditions, modern equipment, work-life balance, and greater transparency (World Bank, 2020). The situation is even more dramatic among younger health professionals. In 2014, about 80% of first-year and fifth-year medical students in Serbia planned and intended to work abroad (World Bank, 2020).

4. RESEARCH DESIGN

The healthcare institutions as employers need to be prepared for attraction and retention of future healthcare professionals. Management of any healthcare institution has a responsibility to devote their time and effort to measuring and managing employees, with the key goal to improve human capital efficiency (Veselinović et al., 2022). Having in mind previously mentioned facts regarding healthcare professionals, the key research questions (RQ) are:

RQ1: Which factors affect decision-making process of future healthcare professionals regarding employment?

RQ2: Are there differences regarding gender, volunteering and working experience of future healthcare professionals?

In order to answer the imposed research questions in this paper desk-top and survey research were conducted. Desk-top research was based on relevant literature review on this topic, as well as on contemporary trends regarding employment and healthcare professionals. Survey research was conducted using a questionnaire which consisted of six questions. The first five questions were of demographic nature and related to age, gender, education, employment status, previous experience in volunteer activities and professional practices. The sixth question was formulated in the form of a five-point Likert scale named „Factors influencing the choice of employer". The scale consisted of 11 factors for which respondents answered from 1 (not at all important) to 5 (extremely important) depending on the influence that these factors have on the decision of employment. Those factors were selected regarding: *economic value* (salary, benefits - paid parking, gym, private health insurance), *professional value* (career advancement opportunities, opportunities for personal development, an interesting, significant and challenging job, working with modern technologies), *working conditions* (pleasant working environment, easily accessible company location, working time flexibility), and *reputation value* (company reputation - comments on social and professional networks, corporate social responsibility).

Given the fact that respondents are students belonging to the most networked generation that predominantly uses mobile phones, tablets and computers, the questionnaire was conducted online. In the period from June 2020 to May 2022, a total of 444 respondents, who are studying or have finished one of the accredited study programs in the Republic of Serbia in the field of medicine, filled the questionnaire.

The collected responses were analyzed using Statistical Package for Social Sciences - SPSS 21.0. (Armonk, NY: IBM Corporation). Normality of data distribution was tested by Kolmogorov-Smirnov test and by reviewing histograms, asymmetry (skewness), flatness (kurtosis), normal probability curve (Normal Q-Q plot) and rectangular diagrams (boxplot). As the assumptions about the normality of data distribution for statistical analyses within the measurement scale were met, parametric statistical techniques were applied. A t-test of different groups was used to examine the differences between the two groups within the measurement scales, while Anova (analysis of variance) was used to examine the differences between the three groups. In all tests comparing differences between groups, Leven's test for assessing the homogeneity of variance was applied. In all cases, the homogeneity of variance was satisfied ($p > 0.05$).

5. Research Results and Discussion

Students of vocational and academic medical studies in Serbia born between 1995 and 2005 participated in the research. The largest number of respondents was born in 2000 (27.3%), followed by those born in 1999 (23%). Regarding gender structure, female respondents were dominant (68.9%), while 31.1% of respondents were male. The largest number of respondents (91%) attended vocational or academic bachelor studies. A small number completed master studies (2.9%), while 5.9% of respondents were attending master's studies. Out of the total number of respondents, the largest number was unemployed (67.6%), but there was a certain number of respondents who worked for less than a year (11.9%), then from 1 to 3 years (11.7%) and over 3 years (8.8%). Regarding volunteer activities, it is interesting to highlight the fact that 63.3% of respondents volunteered, while 36.7% did not participate in those activities.

The Cronbach's Alpha coefficient for the statements given in the Likert scale „Factors influencing the choice of employer" was 0.84 which indicates a high degree of reliability of the scale and justifies its application.

Table 1 shows descriptive statistics based on the values of arithmetic mean (M) and standard deviation (SD) for each of the offered factors that influence participants when choosing an employer.

Table 1 Descriptive statistical analysis for the scale „Factors influencing the choice of employer"

Factors		M	SD
Economic value	Salary amount	4.29	0.815
	Benefits (paid parking, gym, private health insurance)	3.80	1.074
Professional value	Career advancement opportunities	4.68	0.689
	Opportunities for personal development (continuous improvement and acquisition of new knowledge and skills)	4.58	0.721
	An interesting, significant, and challenging job	4.44	0.778
	Working with modern technology	3.71	1.071
Working conditions	Pleasant working environment	4.54	0.725
	Easily accessible company location	3.71	1.044
	Working time flexibility	4.10	1.004
Reputation value	Company reputation (comments on social and professional networks)	3.45	1.133
	Corporate social responsibility	4.03	1.011

Source: Authors' Calculation

The key factors that have the highest values of the arithmetic mean and the lowest values of the standard deviation are: career advancement opportunities (M=4.68; SD=0.69); opportunities for personal development (continuous improvement and acquisition of new knowledge and skills) (M=4.58; SD=0.72); and pleasant working environment (M=4.54; SD=0.73). Furthermore, the arithmetic means greater than four were given to the factors related to: an interesting, significant, and challenging job (M=4.44; SD=0.78); salary amount (M=4.29; SD=0.82); working time flexibility (M=4.10; SD=1.00); and corporate social responsibility (M=4.03; SD=1.01).

Those results are not surprising having in mind the study of Bratton et al. (2010) which stated that financial incentives are important but not enough for motivating the healthcare professionals. Other research results also showed that opportunities for career development and personal growth are the most important motivational factors among healthcare workers (Weldegebriel et al., 2016; Chmielewska et al., 2020; Veenstra et al., 2022). A comprehensive national study conducted in Serbia in 2008 also found that non-financial aspects of job satisfaction (professional autonomy, opportunity to develop skills, collegiality, and support) are more important to medical professionals (doctors and nurses) than salary (Kuburović, et al., 2016).

In the following tables (from table 2 to table 5) research results are presented in numbers and percentages, for further and easier discussion and analysis.

Table 2 presents results regarding factors of economic value (salary and benefits - paid parking, gym, private health insurance).

Table 2 Reponses regarding the importance of economic value among future healthcare professionals

Factors	Option	Number	%
Salary Amount	Not at all important	5	1.1
	Low importance	4	0.9
	Neutral	59	13.3
	Very important	164	36.9
	Extremely important	209	47.1
	Missing response	3	0.7
Benefits (paid parking, gym, private health insurance)	Not at all important	15	3.4
	Low importance	37	8.3
	Neutral	108	24.3
	Very important	146	32.9
	Extremely important	137	30.9
	Missing response	1	0.2

Source: Authors' Calculation

Results showed that 84% of respondents answered that salary amount is very and extremely important factor when choosing an employer, while 63.8% answered that benefits such as paid parking, gym, private health insurance are very and extremely important. Furthermore, 24.3% of respondents are neutral regarding benefits, while 13.3% are neutral regarding salary amount.

Table 3 presents results regarding development value (career advancement opportunities, opportunities for personal development, an interesting, significant, and challenging job, working with modern technology) for future healthcare professionals.

Table 3 Reponses regarding importance of professional value among future healthcare professionals

Factors	Option	Number	%
Career advancement opportunities	Not at all important	4	0.9
	Low importance	5	1.1
	Neutral	18	4.1
	Very important	73	16.4
	Extremely important	343	77.3
	Missing response	1	0.2
Opportunities for personal development	Not at all important	3	0.7
	Low importance	3	0.7
	Neutral	34	7.7
	Very important	95	21.4
	Extremely important	308	69.4
	Missing response	1	0.2
An interesting, significant and challenging job	Not at all important	3	0.7
	Low importance	6	1.4
	Neutral	43	9.7
	Very important	130	29.3
	Extremely important	260	58.6
	Missing response	2	0.5
Working with modern technology	Not at all important	19	4.3
	Low importance	31	7.0
	Neutral	127	28.6
	Very important	145	32.7
	Extremely important	120	27.0
	Missing response	2	0.5

Source: Authors' Calculation

More than 90% of respondents answered that for them it is very and extremely important to have career advancement opportunities (93.7%) and opportunities for personal development (90.8%). For 87.9% of respondents an interesting, significant, and challenging job is very and extremely important, while 59.7% highly valued working with modern technologies. Other studies have also found that elements such as engaging work, the chance of career advancement, the desire to be respected, recognized, and appreciated by coworkers and the employer are among the crucial factors that motivate healthcare workers (Gupta et al., 2021). Additionally, some other research findings also showed that career development is a key determinant of motivation and happiness of healthcare professionals (Muthuri et al., 2020). Clear career plans are among the most important motivating factors for healthcare professionals. By acquiring new knowledge and skills, they can perform work in the best way possible, which consequently leads to the increase in their self-esteem and overall satisfaction (Afolabi et al., 2018). For that reason, some institutions implemented career ladders – clear path of professional advancement when healthcare professionals demonstrate new skills, and increase their job responsibilities (Vilendrer et al., 2022). Working environment, available medical devices, tools, equipment, and resources influence the overall quality of healthcare system. If those elements are not satisfactory, that may lead to stress, burnout and high level of absenteeism and turnover among healthcare professionals (Wiskow et al., 2010).

Table 4 presents results regarding working conditions (pleasant working environment, possibility to work from home, easily accessible company location, working time flexibility) for future healthcare professionals.

Table 4 Reponses regarding importance of working conditions for future healthcare professionals

Factors	Option	Number	%
Pleasant working environment	Not at all important	2	0.5
	Low importance	5	1.1
	Neutral	34	7.7
	Very important	111	25.0
	Extremely important	290	65.3
	Missing response	2	0.5
Easily accessible company location	Not at all important	9	2.0
	Low importance	48	10.8
	Neutral	127	28.6
	Very important	139	31.3
	Extremely important	120	27.0
	Missing response	1	0.2
Working time flexibility	Not at all important	7	1.6
	Low importance	29	6.5
	Neutral	74	16.7
	Very important	136	30.6
	Extremely important	196	44.1
	Missing response	2	0.5

Source: Authors' Calculation

The largest number of respondents answered that for them it is very and extremely important to have pleasant working environment (90.3%), working time flexibility (74.7%), and easily accessible company location (58.3%). Those results are not surprising having in mind contemporary trends of modern workplace in which employees want to have unique experience as if they are the clients of the organization (Mićić et al., 2022). They want to feel happy, satisfied and supported at work. Many changes in lifestyles, work demands, as well as the larger number of women entering the labor market and increased need for elderly care fostered employees to appreciate the employers which give them the opportunity for flexible working time and work-life balance (Mladenović & Krstić, 2021). Having in mind the growing problem of available parking spaces, it is not surprising why easily accessible company location is also important for respondents. That is the main reason why almost one third of respondents consider location as an important factor.

Table 5 presents results regarding reputation value (company reputation - comments on social and professional networks, corporate social responsibility) for future healthcare professionals.

Table 5 Reponses regarding reputational value of employers for future healthcare professionals

Factors	Option	Number	%
Company reputation - comments on social and professional networks	Not at all important	30	6.8
	Low importance	54	12.2
	Neutral	129	29.1
	Very important	145	32.7
	Extremely important	85	19.1
	Missing response	1	0.2
Corporate social responsibility	Not at all important	11	2.5
	Low importance	19	4.3
	Neutral	96	21.6
	Very important	136	30.6
	Extremely important	182	41.0
	Missing response	0	0.0

Source: Author's Calculation

Regarding company reputation – comments on social and professional networks, 41.8% of respondents answered that for them this factor is very and extremely important, 29.1% had a neutral attitude, and 6.8% answered that this factor is not at all important, while 12.2% answered that it has low importance. On the other hand, corporate social responsibility is for 71.6% of respondents of very and extremely high importance, while 21.6% had a neutral attitude. Employers e.g. healthcare institutions need to be oriented toward corporate social responsibility, because young generations put a special emphasis on this perspective. Furthermore, healthcare institutions should focus their attention on the process of employer branding with the aim to attract, hire and retain healthcare professionals. Important part of employer brand is their reputation in social and professional networks (Lukić Nikolić & Lazarević, 2022).

T-test and Anova were used in further analysis in order to determine whether there are statistically significant differences between different characteristics of respondents regarding their gender (male and female respondents), volunteering activities (participated in volunteering and not participated) and length of working experience (work for less than a year, from 1 to 3 years and over 3 years).

The results of the t-test did not show statistically significant differences between male and female respondents $t(434) = -1.279$; $p = 0.202$; $p < 0.01$.

Furthermore, the results of the t-test did not show statistically significant differences between respondents who volunteered / performed internships and those who did not $t(435) = -0.484$; $p = 0.628$; $p < 0.01$.

Additionally, the results of Anova test did not show statistical differences regarding working experience of respondents $F(df=4, n=432) = 1.726$, $p = 0.143$.

The obtained results from statistical tests showed that gender, volunteering activities, and length of working experience do not affect the answers of respondents. Consequently, employers e.g. healthcare institutions can prepare universal value proposition for future healthcare professionals in order to attract and retain them in the long run. Human resource management policies and practices in healthcare institutions should be modified and adjusted according to these research findings.

6. CONCLUSION

The key aim of the paper was to examine which factors are the most important for future healthcare professionals when making the decision about employment. The results of conducted research in this paper showed that the main factors that future healthcare professionals value when deciding on employment are: opportunities for career advancement, personal growth and development, a pleasant work environment, an interesting and challenging job, as well as salary.

The key scientific contribution of this paper is in explaining and analyzing the factors that influence the decision making of healthcare professionals regarding employment. Obtained results are valuable for scientific community in order to understand the specifics of behavior and attitudes of healthcare professionals. Furthermore, obtained results can be useful to extend and refine the theory of motivation and stress management. Increased international mobility and uncontrolled migration flow of healthcare workers may increase the level of workload and stress of those employees who stayed in Republic of Serbia. Consequently, there is need to modify and adjust human resources activities and practices in order to provide high quality of healthcare services. Scientific contribution also lies in the fact that the need for professional healthcare will be increasing in the future due to population aging, new infections and diseases. Retention of healthcare professionals is the key to successful functioning of healthcare institutions.

Regarding the applied contribution of the paper, there are several important facts for the healthcare system and human resource policies and practices. Human resource management in healthcare faces numerous challenges in the processes of planning, recruiting, hiring, developing, retaining and releasing medical workers from healthcare institutions. Therefore, it is important that managers, human resource experts and leaders of health institutions carefully analyze and determine the key motivational factors of healthcare workers. Salary is not the primary motivational factor for future healthcare workers, as is often assumed and stated. Future healthcare workers are more oriented toward the development of their career, opportunities for advancement, training, acquiring new knowledge, and working in a pleasant work environment. With these research findings, healthcare systems are well-informed to adequately prepare strategy and employee value proposition not only for the attraction of healthcare workers, but also for their retention in the long run. Clear career plans, continuous education, training, and development of employees, as well as building a pleasant work environment must be at the top of the list of priorities in healthcare institutions.

The conducted research is accompanied by certain limitations. One of the limitations of research is the sample which encompasses students who are just getting their education and preparing for work in healthcare. They still do not have (enough) working experience, so their answers are based on their expectations and perceptions. Furthermore, this research has not examined some specific working environment, so the questions were of a general nature and did not include leadership style, organizational culture, and the quality of interpersonal relations. Therefore, a recommendation for future research on this topic is to include and analyze a wider range of factors that may impact the employment decision of healthcare professionals. One of the propositions is to conduct longitudinal study and to examine whether preferences and attitudes of healthcare professionals are changed during their career.

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FAKTORI KOJI UTIČU NA ODLUKU O ZAPOŠLJAVANJU MEDICINSKIH STRUČNJAKA U SRBIJI

Trend rastuće mobilnosti medicinskih stručnjaka, starenje populacije, pojava novih bolesti i infekcija donose brojne izazove pred nacionalne zdravstvene sisteme. Iz tog razloga je potrebno posvetiti posebnu pažnju razvoju zdravstvenog sistema i privlačenju i zadržavanju medicinskih stručnjaka. Cilj ovog rada je da ispita i analizira ključne faktore koji utiču na odluku budućih medicinskih stručnjaka o zapošljavanju. U periodu od 2020. do 2022. godine sprovedeno je empirijsko istraživanje u kojem su učestvovala 444 ispitanika koja studiraju ili su završila neki od akreditovanih medicinskih programa u Republici Srbiji. Rezultati istraživanja su pokazali da su tri ključna faktora koja utiču na njihovu odluku o zapošljavanju: mogućnosti za razvoj karijere, mogućnosti i prilike za lični razvoj i prijatno radno okruženje. Na četvrtom mestu se nalazi interesantan, značajan i izazovan posao, dok je na petom mestu visina zarade. Optimalno funkcionisanje zdravstvenog sistema zavisi od sposobnosti zdravstvenih radnika, tako da dobijeni rezultati mogu biti od koristi liderima, menadžerima i donosiocima odluka u zdravstvenim ustanovama. Oni imaju vredne i značajne informacije pomoću kojih mogu da definišu predlog vrednosti kojim će ne samo privući, već i dugoročno zadržati medicinske stručnjake.

Ključne reči: *medicinski stručnjaci, zaposlenost, radni uslovi, karijerne mogućnosti*

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SOCIAL INFLATION IN MTPL INSURANCE

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Abstract. *The insurance industry is facing the negative effects of inflation in the post-pandemic period. In addition to economic inflation, the insurance industry also faces the phenomenon of social inflation, i.e. abnormal growth of claims caused by various social factors. In this paper, we examine whether insurance companies in the Balkans face social inflation. We analyze the growth rate of motor third-party liability insurance claims in 11 countries of the region for the period 2011-2020, including a more detailed analysis of the insurance market in the Republic of North Macedonia. The results show that there is no systematic existence of social inflation, but occasional abnormal shifts are noticeable for certain countries in the region, especially EU countries, i.e. certain companies in the Republic of North Macedonia. In addition, we find that social inflation occurs in countries with a higher rule of law index, indicating that low institutional development and low trust in institutions potentially prevent the development of social inflation. The paper contributes to the current literature by analyzing the problem in an international context and in a new region, as well as producing recommendations for policy makers.*

Key words: *Social inflation, Balkans, Motor third-party liability insurance*

JEL Classification: G22, G41

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1. INTRODUCTION

The acceleration of inflation in the post-pandemic period remains in the focus of central banks and policy makers due to the harmful effects of inflation on various economic sectors around the world. Inflationary pressures also significantly affected the insurance sector through a reduction in the ability of policyholders to purchase insurance policies, growth in administrative and sales costs, growth in the amount of claims paid out, disruption of returns from invested assets, etc. (Swiss Re, 2010). In addition to economic inflation, the insurance sector can also be affected by the phenomenon of social inflation. Social inflation is defined as all the influences through which the amount of claims of insurance companies grows faster than the general economic inflation. If this phenomenon exists in certain economies, it can significantly increase existing insurance prices, cause reduced supply and demand for insurance, as well as reduced capacity by increasing the number of exclusions in insurance contracts (Heim, 2022).

Social inflation is an old phenomenon that occurs periodically, but recent literature emphasizes the existence of this problem, especially during and after the Covid-19 crisis, focusing mainly on developed countries. (Dunsavage, 2019; 2020a; 2020b; 2021; Geneva Association, 2020; Heim, 2022; Oh, 2021). However, social inflation can be a potential problem for insurance companies in less developed countries, i.e. the countries of the Balkans and the Republic of North Macedonia. The insurance markets in the region are relatively underdeveloped with the dominant participation of the mandatory motor third-party liability insurance (MTPL). Their institutional development is significantly lower than developed countries, while the low development of road infrastructure can contribute to a higher frequency of traffic accidents and higher mortality resulting in an abnormal growth of claims. Therefore, the question arises: does social inflation exist in the region and in the Republic of North Macedonia?

The purpose of this paper is to find out whether the insurance companies in the Republic of North Macedonia and in the countries of the Balkans face the problem of social inflation and abnormal growth in the amount of claims. Social inflation occurs most often in liability insurance, where there are opportunities for abnormal claims, especially in relation to non-material claims. The insurance structure in the Balkan countries is dominated by motor third-party liability insurance. Therefore, the analysis of MTPL claims in the selected region is appropriate to detect the problem of social inflation. First, we analyze the aggregate level and annual growth rate of claims per premium unit in motor liability insurance for a selected set of 11 Balkan countries by providing data from XPRIMM for the period 2011-2020. Due to the potential problems in the analysis with aggregate claims, we focus on North Macedonia and analyze the level and pace of growth of claims per individual company, providing data from the Insurance Supervision Agency of the Republic of North Macedonia for the period 2018-2021.

This paper makes a contribution in two domains. First of all, the paper analyzes the problem of social inflation in the Balkan region for the first time. Research so far has concentrated on developed countries, such as the United States, neglecting the potential for social inflation to develop in underdeveloped countries, especially in countries where motor liability insurance has a dominant share. In addition, the paper analyzes the problem covering several countries that differ in terms of economic, institutional and social development. That makes it possible to analyze the potential factors of social inflation that make certain insurance markets fertile ground for the development of social inflation.

Finally, the paper also provides recommendations for policy makers in the insurance domain.

The paper is organized in the following order. First, a definition of the phenomenon of social inflation and a review of the literature related to it is presented. In the following section, we explain the data collected, the sample, and the methods of analysis. In the penultimate section, we present the results of the analysis and potential explanations and discussions. Finally, the last part is reserved for concluding observations and recommendations.

2. Literature Review

The term social inflation is related to the ways in which insurance company costs, i.e. claims, rise faster than economic inflation, including changes in social preferences about who is best placed to absorb risk (Geneva Association, 2020). Alternatively, social inflation has a more specific meaning, that is, it describes the rise in liability risks and costs associated with litigation (Heim, 2022). Similarly, Oh (2021) defines social inflation as "*surges in insurance rates due to societal factors such as the high value of court judgments and the expansion of liability.*"[2] In contrast to general economic inflation, which insurers can mitigate using different pricing models and loss reserves, social inflation can result from factors that are difficult to predict, such as increased costs from: increases in the number and amount of judgments; legal proceedings taking longer than reasonably expected; annulment of legal limitations for non-material claims, etc.

Although social inflation is an old-new phenomenon, most of the discussion focuses on developed countries, more specifically, the United States of America. Dunsavage (2019) identifies the problem of "litigation funding"[3] in Florida where attorneys have no limit on commissions when representing insureds in claims settlement litigation. Additionally, Dunsavage (2020a; 2020b) highlights US claims movement trends according to data from the National Association of Insurance Supervisors and discusses how the Covid-19 crisis is fueling social inflation. Also, Dunsavage (2021) points out that motor third-party liability insurance, professional liability insurance, product liability insurance, and directors' and officers' liability insurance are the most affected insurance classes in terms of social inflation.

Furthermore, Oh (2021) finds abnormal growth in the amount of judgments and settlements in the US for the period 2011-2019 and estimates the significant impact of social inflation on insurance prices in the long run. Meanwhile, Heim (2022) outlines the causes and consequences of social inflation with an emphatic reference to the problematic reform of the tort law framework in the United States. Finally, the Geneva Association (2020) goes a step further and analyzes the problem of "litigation funding" and social inflation outside the US, but again including only a small set of developed and developing countries. The literature ignores the existence of social inflation in less developed countries, although the potential for its development exists, due to low rule of law and higher frequency of claims in motor third-party liability insurance.

[2] In this context, the term "nuclear verdicts" is known. Nuclear verdicts are court judgments or settlements that exceed a cumulative amount of $10 million (Oh, 2021). These types of compensations are often much larger than the actual case and have significant effects, not only on the insurance company and policyholders, but often on the insurance industry as a whole in terms of risk-taking philosophy and approach to risk-taking.

[3] Litigation funding is the practice of third parties financing litigation in order to receive a certain percentage of the funds that the plaintiff would receive.

A theoretical model of social inflation is studied by Oh (2021) and shows that a shock to the insurer's loss distribution has a "double kick" effect on insurance supply through higher effective marginal cost and interaction of increased uncertainty with the capital requirement. It is more important to examine the impact of social inflation on insurance supply. Firstly, the basis is to identify and to compare commercial and personal auto insurance prices before and after the famous Tracy Morgan settlement in 2015. This is widely known as the watershed moment for social inflation. After the comparison between commercial and personal auto lines was made it was concluded that corporate defendants are more exposed to social inflation risk than individual defendants (Haran et al., 2016). Heim (2022) noticed that social inflation seems to be a key driver of increased claims costs. With increased claims cost, come increased insurance prices. The newer phenomenon in insurance is social inflation, that revolves around the idea that insurance claims costs are rising faster than the normal rate of inflation.

Social inflation is a newer phenomenon in insurance that revolves around the idea that insurance claims costs are rising faster than the normal rate of inflation. Possible drivers of this are expanded liability and evolving litigation strategies. According to this there is a variety of puzzling issues (Oh, 2021).

3. DATA AND METHODOLOGY

In order to answer the main question of this paper, that is, whether social inflation is a reality or a myth in the region and in the Republic of North Macedonia, we use data on the amount of gross premiums collected and the amount of claims paid in MTPL insurance in 11 countries from the Balkans for the period 2011-2020 using XPRIMM's insurance industry databases and reports,[4] and data on inflation movements for the same period and the same set of countries using the World Bank database. [5] We expect claims growth to exceed average growth in the general price level if social inflation is a problem in the region. In addition, in order to analyze the potential drivers of social inflation, we extract data from the World Bank database on the death rate caused by traffic accidents (per 100,000 inhabitants) and the rule of law index. Higher traffic accident mortality should be correlated with abnormal growth in MTPL insurance claims, and that effect potentially depends on the country's institutional development.

We only have data on the total amount of claims, the amount of which may decrease/increase due to a decrease/increase in the number of claims or a decrease/increase in the amount of individual claims. In that context, the increased amount of claims may be caused by a higher number of policies sold resulting in a higher number of claims, rather than by abnormal growth in the amount of claims. Due to this shortcoming, first of all, we normalize the amount of claims with the amount of premiums and calculate the indicator, amount of claims paid per unit of premium in MTPL insurance. In addition, we calculate the annual growth of the same indicator for two equal periods, 2011-2015 and 2016-2020, and compare it with the average inflation for the same periods per individual country. If this indicator is significantly higher than the average inflation, then the problem of social inflation potentially exists.

[4] Data on premiums and claims are expressed in euros according to the current exchange rate. More about the data source at https://www.xprimm.com/About-us-42.htm

[5] We use the platform DataBank (https://databank.worldbank.org/) from the World Bank for extracting data for the selected indicators.

Aggregate claims analysis at the country level can overlook individual movements within each insurance industry. Therefore, we analyze the movements of the amount of claims at the company level in the Republic of North Macedonia for the period 2018-2021. We extract the data from the reports on the insurance industry of the Insurance Supervision Agency of the Republic of North Macedonia. We normalize the amount of liquidated claims by the number of concluded MTPL insurance contracts for the current year. We compare the newly created indicator, amount of liquidated claims per insurance contract, with the predicted amount of liquidated claims per insurance contract under the assumption that the growth of claims follows the inflation rate in the Republic of North Macedonia (starting from 2018). If the real indicator exceeds the forecast, then this indicates that the company is facing social inflation, that is, the amount of claims per insurance contract is growing faster than the growth of the general level of prices.

4. ANALYSIS

Figure 1 shows the average amount of claims paid out per unit of premium and the death rate caused by a traffic accident in the eleven countries of the Balkans ordered by the rule of law index. It is expected that average claim payout would be higher where the death

Fig. 1 Average amount of claims paid per unit premium, average rule of law index and average mortality caused by traffic accidents (per 100,000 inhabitants) for the period 2011-2020[6]
Source: Authors' calculations based on data from XPRIMM and the World Bank

[6] Data on the death rate from traffic accidents is not available for Kosovo 1244.

rate is higher. According to the data, the mortality rate is not too high in Slovenia, Hungary and Romania, and yet the payment of claims per unit of premium is significant. For example, in Slovenia, on premiums of €100,000, as much as €60,000 is paid for claims, although the death rate from traffic accidents is the lowest. In countries with a better rule of law, the payment of claims per unit of premium corresponds to the death rate from traffic accidents. On the other hand, in Bosnia and Herzegovina and Albania there are no large claims payments per unit premium, while the mortality rate is significantly higher. The situation is similar with all non-EU countries in the sample, i.e. in countries with worse rule of law there is no significant relationship between the payment of claims per unit premium and the death rate from traffic accidents. Based on these data, we can say that large payments of claims and the problem of social inflation are most likely present in more developed countries, that is, EU member states where there is a better rule of law.

Figure 2 shows the average annual growth of the amount of claims paid per unit premium in MTPL insurance for two equal periods, 2011-2015 and 2016-2020, which is compared with the average inflation for each of the countries examined, individually. From what is shown, we can notice that this indicator is significantly higher than the average inflation in Romania (for the period 2016-2020), Croatia (for the period 2011-2015) and Slovenia (for the period 2011-2015). For the rest of the countries, the indicator is at the level of the growth of the general level of prices or a significant annual decline is observed

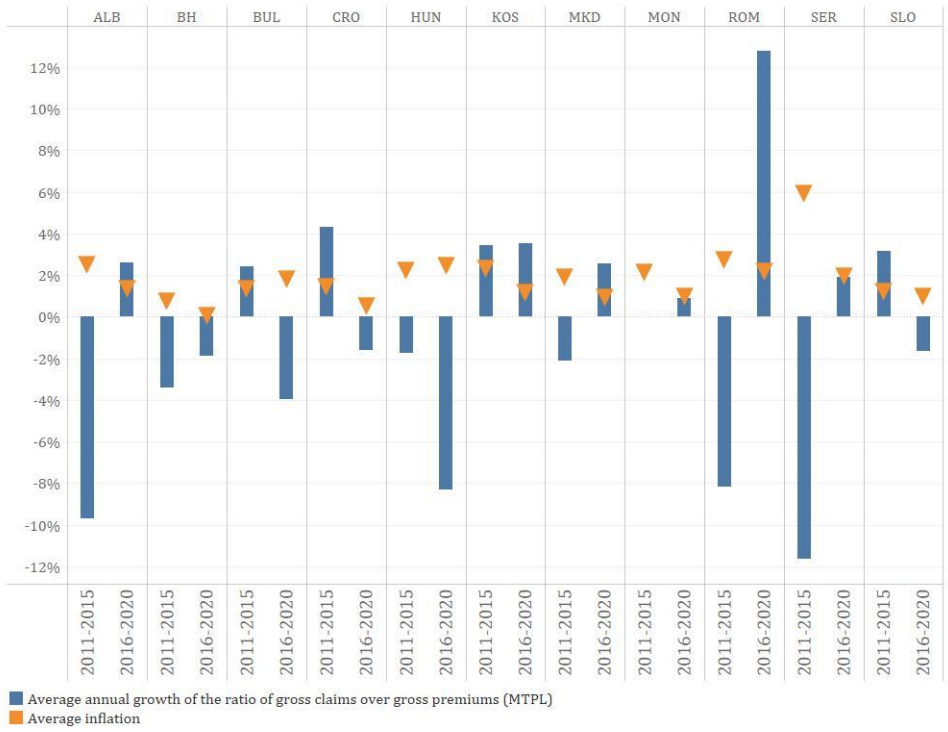

Fig. 2 Average annual growth of the amount of claims paid per unit premium and average inflation for two five-year periods (2011-2015 and 2016-2020)
Source: Authors' calculations based on data from XPRIMM and the World Bank

for certain countries. If we look at the section on the Republic of North Macedonia, we will notice that for the first examined period (2011-2015) the average annual growth of the amount of claims paid per premium is decreasing instead of increasing according to the average inflation, while for the second period (2016-2020) that indicator is slightly higher than average inflation. From the graph, we can conclude that in general the EU countries where the examined indicator is significantly higher than the average inflation (Romania, Croatia and Slovenia) are potentially facing the problem of social inflation, unlike the rest of the countries, mainly non-EU countries, where a lower growth rate of the amount of claims paid per unit premium can be observed compared to average inflation.

Lastly, Figure 3 shows the indicator – the average amount of liquidated claims per MTPL insurance contract, for the last four years, at the level of companies in the Republic of North Macedonia (colored rectangles). We compare it with the predicted amount of liquidated claims per insurance contract, assuming that the growth of claims follows the inflation rate in the Republic of North Macedonia (red dots), in order to determine whether there is social inflation. As we can see from the graph itself, the insurance industry in the Republic of North Macedonia does not face such situation, when the amount of claims per insurance contract grows faster than the growth of the general level of prices, which

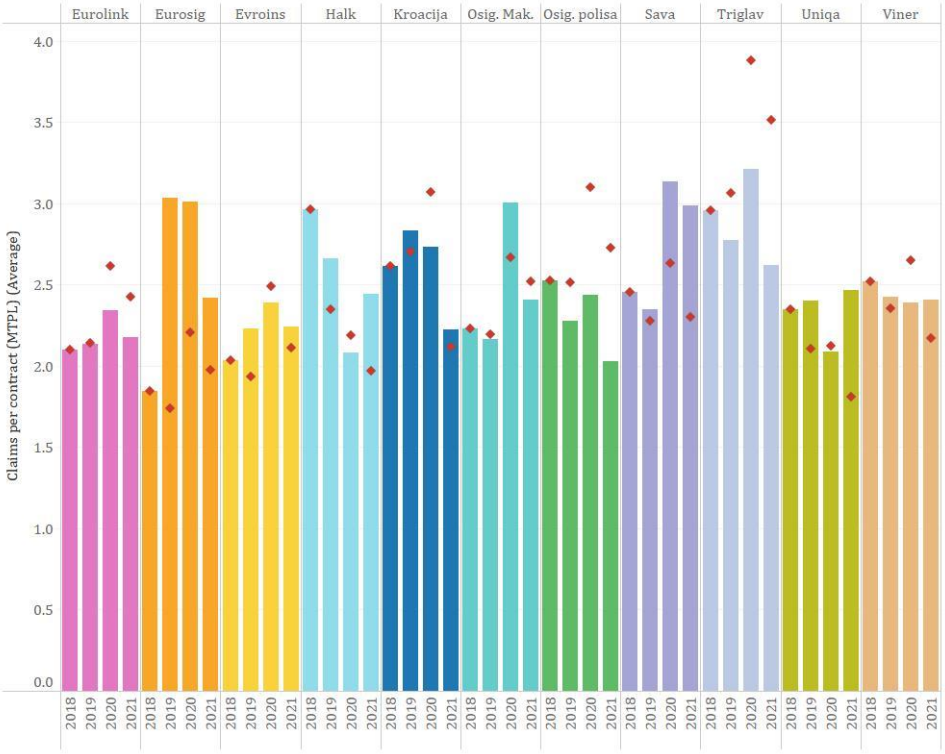

Fig. 3 Amount of liquidated claims per insurance contract (rectangle) and simulated amount of liquidated claims per insurance contract (point) by companies in the Republic of North Macedonia (in 000 denars)
Source: Authors' calculations based on data from the Insurance Supervision Agency of the Republic of North Macedonia

indicates that there is no social inflation. The only exception are the insurance companies, Eurosig and Sava, which in the last two or three years have been facing an abnormal growth in the amount of claims. But despite that, we cannot say with certainty that there is a systematic occurrence of social inflation.

In summary, the results show that the emergence of the phenomenon of social inflation depends on the regional and temporal context. Countries that belong to the European Union and that have a better rule of law potentially face abnormal growth in MTPL insurance claims depending on the death rate from traffic accidents. However, social inflation in these countries can occur in certain periods of time and is not a long-term phenomenon. On the other hand, countries that do not belong to the European Union and that have a worse rule of law do not face the problem of social inflation. Although the above may represent good news for insurance companies in these countries, the results may indicate a bigger problem in terms of citizens' trust in institutions and the education of policyholders related to the process, rights and obligations after the occurrence of damage from MTPL insurance. Furthermore, non-EU countries have less competitive insurance markets with a concentration of market power in just a few companies. Low institutional development supplemented by concentration of power in the insurance industry can prevent the proper functioning of the system and the fair fulfillment of the rights and obligations of policyholders and insurance companies.

5. Conclusion and Recommendations

Insurance companies are not immune to the negative effects of inflation in the post-pandemic period. In addition, companies face an old-new type of inflation, so-called social inflation. Social inflation includes all the influences through which the amount of insurance companies' claims grows faster than the general economic inflation - the average rise in prices. This phenomenon in the long run may increase existing insurance prices, cause reduced supply and demand for insurance, as well as reduced capacity by increasing the number of exclusions in insurance contracts. The literature so far, analyzes this phenomenon in the USA and in some of the developed countries, but a similar analysis is missing for the Balkan region where the insurance markets are relatively undeveloped and where the dominant share is taken by MTPL insurance, as the class of insurance most affected by social inflation.

The purpose of this paper is to find out whether the insurance companies in the Republic of North Macedonia and in the countries of the Balkans face the problem of social inflation and abnormal growth in the amount of claims. The results show that the emergence of the phenomenon of social inflation depends on the regional and temporal context. Countries that belong to the European Union and that have a better rule of law potentially face abnormal growth in motor third-party liability insurance claims depending on the death rate from traffic accidents. However, social inflation in these countries can occur in certain periods of time and is not a long-term phenomenon. On the other hand, countries that do not belong to the European Union and that have a worse rule of law do not face the problem of social inflation. Analyzing the Macedonian motor liability insurance market, we do not find systematic evidence of the existence of social inflation and abnormal growth in the amount of claims.

This paper presents the first analysis of the phenomenon of social inflation for the countries of the Balkans. In addition, we analyze the problem of social inflation in a specific and international context where there are differences in the institutional development of the selected countries. We discuss that social inflation is a problem of developed countries where there is a better rule of law and there is more trust in the institutions by the citizens. On the other hand, in less developed countries such as the Republic of North Macedonia, there is no solid evidence of the existence of an abnormal increase in claims. In that context, low institutional development and low trust in institutions potentially prevent the development of social inflation. In addition, highly concentrated insurance markets may prevent the development of social inflation. Although the absence of social inflation in the region should be understood in a positive context, it can nevertheless hide a significant problem in terms of citizens' trust in institutions and the education of policyholders related to the process, rights and obligations after the occurrence of damage from MTPL insurance. Based on the conclusions, we recommend to the regulatory bodies in the region to increase their efforts in educating the population about the rights and obligations of the insured persons after the occurrence of damages in MTPL insurance. In addition, we recommend that insurance companies and institutions should work towards protecting the interests of consumers in order to restore citizens' trust in institutions and the insurance industry as a whole.

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SOCIJALNA INFLACIJA U OSIGURANJU OD AUTOODGOVORNOSTI

Industrija osiguranja se suočava sa negativnim efektima inflacije u postpandemijskom periodu. Pored ekonomske inflacije, industrija osiguranja se suočava i sa fenomenom socijalne inflacije, odnosno abnormalnog rasta šteta uzrokovanih različitim društvenim faktorima. U ovom radu ispitujemo da li se osiguravajuća društva na Balkanu suočavaju sa socijalnom inflacijom. Analiziramo stopu rasta šteta od autoodgovornosti u 11 zemalja regiona za period 2011-2020, uključujući i detaljniju analizu tržišta

osiguranja u Republici Severnoj Makedoniji. Rezultati pokazuju da ne postoji sistematsko postojanje socijalne inflacije, ali su uočljivi povremeni abnormalni pomaci za pojedine zemlje u regionu, posebno zemlje EU, odnosno pojedine kompanije u Republici Severnoj Makedoniji. Pored toga, nalazimo da se socijalna inflacija javlja u zemljama sa višim indeksom vladavine prava, što ukazuje da niska institucionalna razvijenost i nisko poverenje u institucije potencijalno sprečavaju razvoj socijalne inflacije. Rad doprinosi aktuelnoj literaturi analizirajući problem u međunarodnom kontekstu iu novom regionu, kao i dajući preporuke za kreatore politike.

Ključne reči: *Socijalna inflacija, Balkan, Osiguranje od autoodgovornost*

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Original Scientific Paper

THE IMPACT OF CORPORATE INCOME TAX ON FDI INFLOW IN EMERGING EU ECONOMIES

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Abstract. *After global financial crisis, intensive tax policies adjustments were applied in emerging European Union (EU) economies, for the sake of tax competitiveness. In order to ensure that aim, emerging EU economies most often choose the policy of tax reduction and particularly lowering corporate income tax rate. This paper deals with the impact of corporate income taxes on foreign direct investment (FDI) inflow in selected emerging EU economies (Czech Republic, Hungary, Lithuania, Latvia, Poland, Slovakia, Slovenia) between two crises (global financial and pandemic), namely, over the period 2010-2019. Using classical panel data models (Fixed Effects and Random Effects model), the research shows that it is expected that corporate income taxes reduction provides FDI inflow. Observing the relationship between other factors (corruption index, competitiveness index and short-term interest rate) and FDI inflows, positive relations are confirmed. Panel-corrected standard errors (PCSE) estimator, implemented as robustness check, confirmed the results and conclusions based on FE model. However, negative relationship between corporate income taxes and FDI in the case of PCSE model is only verified in case of Hungary and Latvia, indicating tax competitiveness existence.*

Key words: *Corporate income tax, FDI, emerging EU economies, panel analysis, PCSE Method.*

JEL Classification: C33, H25, F21.

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1. INTRODUCTION

While some forms of global networks have existed for a long time, the recent technological advances transformed our world into a global village. Globalization is an omnipresent term and process, key for thinking about economic interdependencies and connections. Ergo, that means freer movement of people, goods, services and capital. Easier crossing of the border for factors of production, especially capital mobility, imposed a market competition of world proportions.

Capital mobility emphasized the term of 'tax competitiveness', since it manifests the multinational companies' decisions of resources allocation (Devereux et al. 2002). Taxes influence companies' decisions about the location, establishment, and expansion of their business (Desaia et al. 2004). Thus, the tax system can have a key role in the economic development of a country (Budryte, 2005). Many economic policy makers emphasized the importance of tax policies as a key factor for the smooth functioning of the economy (Blechová, 2016) and decisions on investment localization. Namely, one of the components of gross domestic product (GDP), and thus a generator of economic growth, are investments (Ercegovac & Beker Pucar, 2021a). Capital owners have been directing their investments towards economies with favourable business conditions.

Significant number of economic researchers pointed out that corporate income tax is one of the key determinants for choosing the location in which to invest. In the context of EU member states, economies have retained the right to fiscal sovereignty, which obviously gave them the opportunity to create unified tax policies. Although, to some extent, there is a tendency within the EU to harmonize tax policies, or at least bring them closer. Hence, tax policy-making has still been left on a national level. Therefore, without the influence of EU institutions, member state governments decide on tax rates and tax bases. EU economies retained the freedom to participate in the market struggle and to adjust tax policies for the sake of tax competitiveness. Specific interest in this paper is oriented towards different tax strategies chosen by emerging EU economies in the period between the two crises, the financial crisis and the crisis caused by the Covid-19, and their effects on the decision in relation to investments localization.

The aim of this paper is to examine the relationship between the statutory corporate tax rate and the inflow of foreign direct investment (FDI) in selected emerging EU economies (the Czech Republic, Hungary, Lithuania, Latvia, Poland, Slovakia, Slovenia) using available empirical data. Many authors dealt with this relationship in a theoretical context, but few have just demonstrated the impact of the corporate income tax rate on the decision to allocate investment in emerging EU economies. Furthermore, as the corporate income tax rate is not the only factor that determines investors, it was important to consider the impact of short-term interest rates on capital inflows. Moreover, this paper examines the impact of the competitiveness of emerging economies, and the presence of corruption in the public sector, which may be determining for the investment decision. Therefore, the main hypotheses of this paper are:

H_1: In selected emerging EU economies, there is a negative relationship between FDI and corporate income tax rate in the period 2010-2019.

H_2: The positive relations between corruption index, competitiveness index, short-term interest rate and FDI inflows exist in seven emerging EU economies in the period 2010-2019.

The paper is structured as follows: after the Introduction section, Section 2 reviews existing evidence in the empirical literature, Section 3 analyzes investments and factors that influence the decision on the location of investments in emerging EU economies. Section 4 presents used methods and data, while Section 5 discusses estimation results, and final section outlines concluding remarks.

2. LITERATURE REVIEW

Vast literature deals with papers that examine tax role in economic policy of the emerging EU economies. Aničić et al. (2015) in their research pointed out that tax systems should provide international competitiveness of the country. Budryte (2005) noted that in contemporary world, surviving market struggle is truly challenging. Wulfgramm et al. (2016) emphasized that in majority of countries tax policy is one of the central issues, therefore tax systems are subject of constant theoretical and political examinations (Aničić et al. 2012). Moreover, tax policy is one of the main determinants of FDI inflow (Janeba, 1993). Namely, tax competitiveness ensures smooth functioning of the economy (Blechová, 2016). Furthermore, in case of Ireland, by lowering corporate income tax rates significant amount of FDI was attracted, and thus achieved an economic boom (Stewart, 2011). That is in line with Desaia et al. (2004) who indicated that taxes determine owners' decisions on the localization of their capital and business. Hence, economies with lower rates attract more investments than the economies with higher rates due to the capital mobility (Devereux et al. 2002). Spill-over effect and tax avoidance schemes (Hong & Smart 2007) are inevitable since the tax system burdens taxpayers too much. Consequently, investors' profits are reduced by higher taxes (Bellak & Leibrecht, 2005). However, as Keightley & Sherlock (2014) explained, tax competitiveness could be achieved without compromising public revenues by simultaneously lowering corporate income tax rates while expanding the tax base (de Mooij & Nicodème, 2008).

The tax system is based on the trade-off between efficiency and equality (Aničić et al. 2015), depending on the country's preferences. The tax system may be more inclined to increase economic growth, i.e. reduce inequality. In fact, the structure of the tax system reflects the importance of taxes in an economy. The structure of taxes is influenced by the following factors: economic development, level of market development, education of the population, structure of the working age population, size of government, pension system, as well as social policy. Tax policy must be carefully designed; otherwise, it could have negative effects on the economy. If the tax system burdens taxpayers too much, tax evasion is inevitable (Hong & Smart, 2007).

In addition to the above, the tax system of open economies certainly affects the competitiveness of the economy. The tax system, i.e. tax rates, could be a generator or a negative factor for the FDI inflow, and consequently the level of employment (Janeba, 1993). Investor profits are reduced by increasing tax rates (Bellak & Leibrecht, 2005), since it increases the cost of labor and reduces disposable profit after tax (Aničić et al. 2012).

This paper also draws on the literature that analyzes tax systems of the EU economies. Within the EU, toward elimination of harmful competition between members, there are tendencies for tax harmonization (Gropp & Kostial, 2001). Glavaški & Beker Pucar (2020) pointed out that strengthening the fiscal framework is necessary due to the shortcomings of unfinished EU project that were visible after global financial crisis.

However, tax harmonization is not favourable for all economies equally, since in core EU countries elasticity of investment movements in relation to tax changes is lower than in peripheral EU countries (Gropp & Kostial, 2000). According to Baldwin & Krugman (2002), that could be explained as tax harmonization failure. Thus, Sørensen (2004) in his paper discussed whether more conventional corporate tax harmonization should still be a long-term policy goal for the EU.

The large number of studies also researched the impact of FDI inflows, since it is often seen as one of the factors that increases the economic growth of the country (Hunady & Orviska, 2014). FDI had essential role for the emerging EU economies (Andrašić et al. 2018). The emerging EU economies went through successful transitions thanks to capital inflow in multinational companies (Bevan & Estrin, 2004; Walkenhorst, 2004). Thus, presence of foreign capital has several beneficial impacts on economy, including: (*i*) competitiveness and technology improvements, (*ii*) unemployment reduction, (*iii*) better position on the international market, (*iv*) rise in exports, and (*v*) foreign currency inflow (OECD, 2008; Denisia, 2010; Ercegovac & Beker Pucar, 2021b). Although, the global economic environment has significantly changed after the financial crisis (Zubair et al. 2020), some business factors such as: the Corruption Index, Competitiveness Index (Dunning & Zhang, 2008), and the Short-Term Interest Rate (Talpos & Vancu, 2009) still notably affect investment localization decisions (Dunning, 1992). The idea of this paper is to fill the gap that exists in the literature regarding corporate income tax impact on FDI localization decision in emerging EU economies using Fixed vs. Random-effects model estimator and Panel-corrected standard errors (PCSE) estimator, given the obvious scarcity of scientific papers dealing with this topic after the global crisis.

3. SOVEREIGNTY OF TAX POLICY BACKGROUND AND FDI

Tax policy is one of the central issues of every state (Wulfgramm et al. 2016), because taxes represent the most significant public revenue. By creating tax policies, the state is able to collect money from taxpayers, on various bases. In addition, taxes are a significant determinant of economic growth. However, state's tax system depends on the goals which have to be achieved, such as: reducing the fiscal deficit, increasing investment or achieving certain social goals.

Although taxes are only one of the key factors influencing the FDI inflow, the growing impact of globalization has conditioned the national governments of almost all member states of EU to reform tax systems (Budryte, 2005). In order to survive the market struggle, emerging EU economies have been particularly active in reversing their tax systems. Corporate income tax distinguishes as the most important tax form that determines the FDI inflow. Namely, the corporate tax rate level determines the country's tax competitiveness level, thus lower rates make the country more attractive for investment. Keightley & Sherlock (2014) explained that tax competitiveness could be achieved without compromising public revenues, according to de Mooij & Nicodème (2008) the solution is lowering corporate income tax rates while expanding the tax base.

The race for tax competitiveness was causing problems within the EU. Especially as Glavaški & Beker Pucar (2020) pointed out the global recession has highlighted all the shortcomings of the unfinished EU project. Namely, lowering tax rates generates various problems within the EU single market with regard to the free movement of people, goods, services and capital, of which the movement of capital is crucial. Different tax rates

within the single market lead to the "migration" of capital from Member States with higher tax rates to Member States with lower rates, significantly affecting economic growth and unemployment rate. For that reason, the EU has insisted for the last two decades on establishing tax harmonization (Gropp & Kostial, 2001; Devereux et al. 2002), in order to discourage the transfer of multinational company's capital from one country to another. However, the harmonization success is questionable. Since national governments have disagreed on the corporate income tax rate, the room for capital movement was left. This is explained in the paper by Baldwin & Krugman (2002), who pointed out that tax harmonization cannot suit all economies equally. There is a well-founded fear that if it occurs, tax harmonization will harm at least one economy. The reason for this is in the different elasticities of investment between core countries and peripheral countries (Gropp & Kostial, 2000). Therefore, Sørensen (2004) in his paper implied that the EU should not insist on harmonization, but to remain at the level of reducing the cost of tax liabilities, which would result in more efficient redistribution. That could be confirmed by empirical data analysis based on corporate income tax rates in selected EU economies, and potential effects on investments localization decisions.

In this paper the selected economies are seven emerging EU economies, including Czech Republic, Hungary, Lithuania, Latvia, Poland, Slovakia, and Slovenia. Estonia as a part of Baltic countries is omitted due to data gap. Empirical data related to emerging EU economies show that corporate income tax rates are lower than the Eurozone average in the period from 2010 to 2019 and ranged between 24.4% and 23% (Figure 1). Furthermore, most of the observed emerging EU economies had followed the corporate income tax rates reduction which occurred in Ireland and was followed by economic boom. Namely, one of the most important reasons for Ireland's success has been recorded by lowering the corporate income tax rate to 12.5%. Tax competitiveness has been achieved, which attracted FDI and led to an economic boom. However, despite the fact that Ireland recorded a significant inflow of FDI, only Hungary lowered the corporate income tax rate to 9% in 2017, positioning itself as the country with the lowest corporate income tax rate in the EU. Poland and the Czech Republic recorded an unchanged tax rate of 19% in the observed period, while Slovenia had changes in tax rates in the observed period from the initial 20% in 2010, to 19% as recorded in 2019 (Figure 1). When it comes to the Baltic countries, Lithuania and Latvia had the same rate of 15% until 2018, afterwards, Latvia adjusted the rate upwards (to 20%). The economy with the highest rate in 2019 is Slovakia, which recorded an increase in the corporate income tax rate in 2012 from 19% to 23%, and then decreased in 2016 to 21% that remained unchanged until the end of the observed period (Figure 1).

On the other hand, FDI movements recorded more fluctuations in comparison to tax rate changes in the emerging EU economies. Since FDI was recognized as a generator of the economy (Hunady & Orviska, 2014), FDI was targeted as a crucial factor for the emerging EU economies in the 1990s (Andrašić et al. 2018). If historical aspect was taken into account, most of the selected emerging economies of the EU were former countries of the Soviet Union and Yugoslavia. Thus, economic organization of those countries was based on planned economy and state or public ownership. Namely, new socio-political circumstances in the context of disintegration of ex countries, forced former socialist countries to turn to the liberal capitalism (EU accession in 2004), where laissez faire rules apply and capital is privately owned. The foreign capital inflow and the presence of multinational companies have played a crucial role in the successful transition and adaptation to new frameworks (Bevan & Estrin,

2004; Gerschewski, 2013). The foreign capital inflow is generally recognized as the most important component of FDI, since, FDI brings with it new technologies (Stanišić, 2008) and knowledge (Ercegovac & Beker Pucar, 2021a). Furthermore, FDI enable productivity growth, thus boosting the overall economy of the inflowing economy (OECD, 2008; Ercegovac & Beker Pucar, 2022).

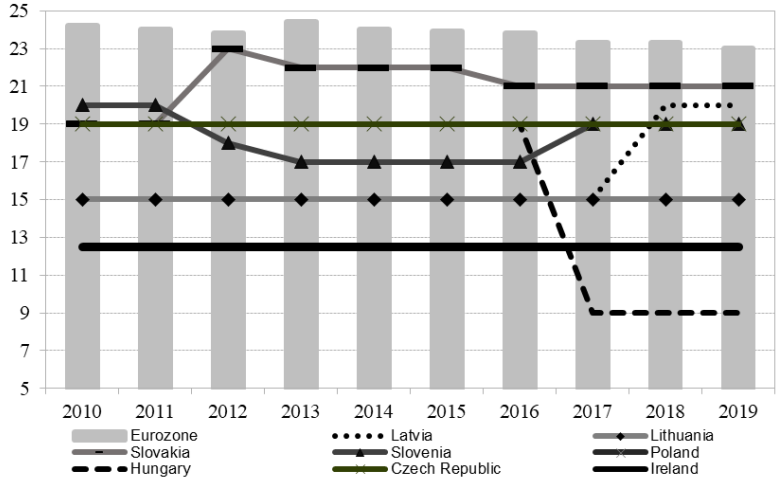

Fig. 1 Corporate income tax rates in selected emerging economies of the EU, Ireland and the Eurozone, in the period 2010-2019
Source: Authors' presentation based on data from Trading economics.

The 2008 world financial crisis fundamentally changed the investment priorities (Zaubir et al. 2020). Therefore, it is important to identify the most important determinants that influence the decision to localize investments. Corporate income tax was recognized as a crucial factor for the inflow of FDI, often inducing economic policy makers to lower tax rates. However, in addition to the corporate income tax rate, there are some other factors that play a significant role when it comes to FDI. Hence, the business environment significantly determines the attractiveness of host country as an investment location (Dunning, 1992; Dunning & Zhang, 2008).

As can be seen in Figure 2, almost all selected emerging EU economies in the observed period recorded a tendency to increase the FDI inflow. Poland has the absolute largest investments inflow, followed by the Czech Republic, while Slovenia, Lithuania and Latvia are at the back of the selected emerging EU economies, observing the absolute amounts. However, in those economies the FDI did not record significant oscillations. Hungary is an economy that has recorded more drastic changes in the FDI inflow in the observed period. The first decline was recorded in 2013, followed by growth in 2014. However, another sharp decline in the FDI inflow was recorded, and even the withdrawal of existing FDI (in 2015 and 2016). The slowdown in FDI that was noticed in 2013 may be linked to a number of measures with potential detrimental impacts on the business environment (European Commission, 2015). From 2017 to 2019, there was a constant increase in the inflow of FDI in Hungary, which is, among other things, a consequence of lower income tax rates (correction in 2017 to 9%).

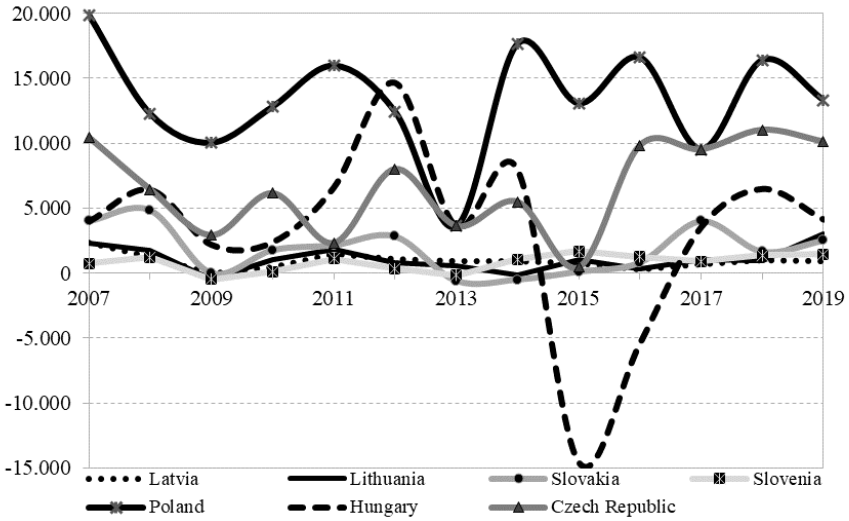

Fig. 2 Inflow of FDI in selected emerging EU economies in the period 2010-2019
Source: Authors' presentation on OECD database.

According to the fact that the descriptive analysis points to the causality in the movement of foreign direct investment towards corporate taxes differentials, the subject of the econometric analysis in the continuation of the paper will be the assessment of this connection using the panel model.

4. METHODS OF ESTIMATION AND DATA

The analysis is based on panel data econometric framework, which allows the research on corporate income taxes and FDI across emerging EU countries and over the time. Namely, the intention is to analyze the negative relationship between corporate income taxes and FDI inflow (Hypothesis 1), as well as influence of other factors that affect FDI (Hypothesis 2). The sample contains the data on 7 emerging EU economies observed in the period between two global crises, 2010-2019. This period is selected in order to avoid structural breaks in the sample, as well as to analyze intensive adjustment of tax policies in emerging EU economies after global financial crisis. Initially, classical panel data models are used in this paper, allowing for some (restricted) heterogeneity in slope coefficients by inclusion of dummy variables. Namely, we implemented Fixed Effects and Random Effects specifications with time and/or individual effects. However, classical panel models could be limited if the model contains cross-section dependence, autocorrelation or heteroscedasticity. Therefore, Panel-corrected standard errors estimator recommended by Beck and Katz (1995) is used in order to encompasses heteroscedastic, autocorrelated and/or contemporaneously correlated disturbances. The general form of the empirical panel data equation can be written as follows:

$$y_{it} = b_0 + b_1 X_{it} + b_2 D_i + \mu_i + \lambda_t + u_{it} \quad (1)$$

where y_{it} is foreign direct investments of country *i* in the year *t*. X_{it} contains determinants of foreign direct investments which vary over *i* and *t*, while D_i is dummy variable for groups of economies *i*, or it is used to encompass outliers in the empirical data. Individual effects are represented by μ_i, along with time effects λ_t, and stochastic disturbance term u_{it}.

Dependent variable, y_{it}, foreign direct investment inflow (fdi_in_{it}) is measured in absolute amount in millions of dollars with inward perspective. FDI statistics cover all cross-border transactions and positions between enterprises which are in a FDI relationship: (*a*) direct investment positions (stock), (*b*) direct investment income flows, and (*c*) direct investment financial flows. Following the main results in the empirical studies, a set of potential explanatory determinants, X_{it}, are employed: corporate income taxes, macroeconomic stabilization variables, business environment variables, and dummy variables representing outliers. The most important independent variable is corporate income taxes variables, cit_{it}, showing the effects of tax competition between economies on investments localization decisions. It is expected that reduction of corporate income taxes provides FDI inflow, and *vice versa*. The effects of macroeconomic stabilization are represented by economic variables: GDP growth ($grow_{it}$) and short-term (ST_ir_{it}) or long-term interest rates (LT_ir_{it}). GDP growth should have positive influence on FDI, as well as influence of interest rate on FDI. Mentioned variables are defined using data from OECD statistics.

Business environment is encompassed in the model by introduction of competition indexes (*comp*) and corruption indexes (*corr*). The competitiveness of the economy is measured by a competitiveness index consisting of 98 variables. The variables are organized into twelve pillars: (*1*) institutions, (*2*) infrastructure, (*3*) adoption of ICT, (*4*) macroeconomic stability, (*5*) health, (*6*) workforce skills, (*7*) product market, (*8*) labor market, (*9*) financial system, (*10*) market size, (*11*) business dynamics and (*12*) ability to innovate. Positive relationship in the model between competitiveness index and FDI is expected, since that improving of business environment could attract investments. Another factor in the business environment that influences the decision of investments localization is the existence of corruption in the public sector. The decision is made by looking at the corruption index, which according to the degree of corruption shows that 0 means corruption at the highest level and 100 means economy without corruption. Thus, company owners gravitate towards countries that are more competitive compared to the rest of the world and where the presence of corruption is reduced to a minimum. Mentioned variables are defined using data from Trading Economics.

Finally, dummy variable is defined for Latvia ($dummyL$), since Latvia is the economy with the lowest corporate income taxes in the group of emerging EU economies, which means that expected sign in the regression is minus. Dummy variable is defined to take value 1 for Latvia, and 0 otherwise. Another dummy variable is defined to capture outliers identified in the case of Hungary ($dummyH$) in the years 2015 and 2016, due to negative values of FDI inflows. Namely, negative FDI positions are the result of situation in which loans from the affiliate to its parent exceed equity capital and the loans given by the parent to the affiliate. Therefore, dummy variable is defined to take value 1 for the years 2015 and 2016 in Hungary, and 0 otherwise. Consequently, the baseline model, derived from theoretical framework to test Hypothesis 1 and 2 and used variables, could be specified as:

$$fdi\_in_{it} = b_0 + b_1 cit_{it} + b_2 ST\_ir_{it} + b_3\, grow_{it} + b_4\, comp_{it} + b_5 corr_{it} + b_6 dummyH_i + b_7 dummyL_i + \mu_i + \lambda_t + u_{it} \quad (2)$$

5. TESTING THE IMPACT OF CORPORATE INCOME TAXES AND OTHER DETERMINANTS ON FDI LOCALIZATION

The procedure performed in order to estimate the impact of corporate income taxes on FDI inflow (Hypothesis 1), as well as other significant factors, consists from the following empirical steps. Since that sample included period between two global crises 2010-2019 for 7 emerging EU economies, we firstly tested cross-sectional dependence (CSD) in the panel. Results of Pesaran CD test are presented in Table 1, and imply null hypothesis, H_0: cross-sectional independence, against the alternative hypothesis, H_1: cross-sectional dependence between panels. Pesaran CD test showed that null hypothesis of cross-section independency has to be rejected for all analyzed variables. Detected dependence is expected due to the fact that all economies in the sample are members of EU, which links strong institutional framework. Analyzed emerging EU economies became EU members in 2004, and cross-section dependence is therefore expected due to specific institutional design of EU. Namely, those economies share the common market, common agricultural policy, customs union, tax harmonization, and finally, some of them are part of the monetary union (Lithuania, Latvia, Slovakia, and Slovenia). Those common policies inevitably lead to connections, spill-over effects and dependencies between emerging EU countries (Josifidis et al. 2018).

Table 1 Pesaran CD test

Pesaran CD test	CD-test	p-value	Corr.	Aps. (corr.)
fdi_in	2.43	0.015	0.168	0.241
cit	2.73	0.006	0.189	0.508
comp	14.49	0.000	1.000	1.000
corr	5.06	0.000	0.349	0.533
ST_ir	9.85	0.000	0.680	0.680
LT_ir	12.68	0.000	0.875	0.875
grow	3.89	0.000	0.268	0.429

Source: Authors' calculations.

Due to test results of cross-section dependence, second generation panel unit root test is used – Pesaran CIPS test (2007) which allows for cross-section dependence in the form of a single unobserved common factor. Pesaran CIPS is based on null hypothesis, H_0: non-stationarity of variable, against alternative hypothesis H_1: stationarity of variables. The results of the Pesaran CIPS for variables in the level and at the first differences in the model with constant are shown in Table 2. Panel unit root tests fail to reject null hypothesis at 5% significance level, meaning that variables *fdi_in*, *cit*, *comp*, *corr*, are non-stationary in the levels. Therefore, in the next step the stationarity of first differences is tested, and results showed that those variables are stationary in first differences. On the other hand, variables *grow* and *ST_ir* are stationary in the levels. Detected problem of nonstationarity is solved using transformation of non-stationary variables, in terms of first differences.

Table 2 Pesaran CIPS test

Pesaran CIPS test H_0: I(1) H_1: I(0)	Lags	Level of variables		First difference		Variables	Level of variables		First difference	
		Z(t)-stat.	p-values	*Z*(t)-stat.	p-values		*Z*(t)-stat.	p-values	*Z*(t)-stat.	p-values
	0	-0.907	0.182	-3.627	0.000		-0.838	0.201	-5.120	0.000
fdi_in	1	1.026	0.848	-1.513	0.000	*corr*	-0.127	0.450	-7.220	0.000
	2	8.427	1.000	8.427	0.000		8.427	1.000	-	-
	0	2.716	0.997	-4.227	0.000		-1.808	0.035	-6.695	0.000
cit	1	1.765	0.961	4.950	0.000	*comp*	0.670	0.749	-10.490	0.000
	2	7.247	1.000	8.427	0.000		8.427	1.000	-	-
	0	-3.057	0.001				-2.571	0.005		
grow	1	-1.717	0.043			*ST_ir*	-1.822	0.034		
	2	-1.622	0.056				-1.700	0.039		

Source: Authors' calculation.

Initially, all potential explanatory variables were included in the classic panel model, and econometric procedure 'from general to specific' is used to eliminate insignificant regressors. Table 3 represents only significant variables in the model: corporate income taxes, macroeconomic stabilization variables, business environment variables and dummy variables representing outliers. Those variables are significant in explaining FDI inflow in Fixed-effects model, while corporate income taxes were not significant in the Random-effects model. Results of the Hausman test indicated that efficient model is the one estimated using Fixed-effects specification.

It is expected that the reduction of corporate income taxes provides FDI inflow, which is confirmed in Fixed-effects model by negative sign of *cit* variable. Short-term interest rate (*sir*) affects FDI positively, promoting investments inflow, which is in line with analyses of Dupor (2000) who showed that rising interest rates stimulate foreign investors to invest in an economy. Business environmental variables showed that higher level of corruption index (*corr*) and higher competition index (*comp*) are important parameters for decision-making on investment. Outliers in data are captured by dummy variables for Latvia (*dummyL*), since Latvia is the economy with the lowest corporate income taxes in the group of emerging EU economies. Dummy variable (*dummyH*) is defined to capture outliers identified in the case of Hungary in the years 2015 and 2016 in context of negative values of FDI inflow; namely, values indicated that investment outflows exceeded inflows. Variable *dummyH* is significant in the model, showing that reduction of taxes influenced inversely on FDI, namely FDI increased in Hungary.

Results represented in Table 3 are related to the research hypothesis 1. This finding might be interpreted as acceptance of the hypothesis that negative link between corporate income tax rates and FDI inflows exists. Positive link between other factors (corruption index, competitiveness index and short-term interest rate) and FDI inflows is confirmed in seven emerging EU economies in the period 2010-2019; therefore, hypothesis 2 is accepted.

Table 3 Fixed vs. Random-effects model estimator for emerging EU economies in the period 2010-2019

	Fixed-effect model			Random-effects model		
Dependent variable: *fdi_in*	Coef.	Std. Error	P>(t)	Coef.	Std. error	P>(t)
cit	-844.65	242.28	0.001	13.384	192.321	0.945
ST_ir	1805.56	359.75	0.000	1579.951	293.683	0.000
comp	38.982	14.73	0.010	38.022	18.447	0.039
corr	260.001	111.37	0.023	194.3103	86.487	0.025
cons	1894.91	5314.93	0.723	-8772.661	5221.214	0.093
dummyL	-	-	-	-3006.191	1633.365	0.066
dummyH	-13482.19	2769.959	0.000	-13186.46	2966.424	0.000
R^2	0.34			0.46		
Wald chi^2	7.62	0.0001		65.88		0.000
Breusch-Pagan test				48.13	0.000	
Mean VIF	1.18					
Number of observations		70			70	

Source: Authors' calculations.

5.1 Robustness Check: PCSE Method

Due to detected problem of cross-section dependence and nonstationarity of variables, classical panel methods are limited. However, Beck and Katz (1995) recommended use of Panel-corrected standard errors (PCSE) estimator, which allows for heteroscedastisity, autocorrelation and contemporaneously correlation across panels. Due to detected problem of autocorrelation (Wooldridge test), heteroccedasticity (Wald test), cross-section dependence (Pesaran CD test), PCSE estimator is implemented (Table 4). Problem of nonstationarity is solved using transformation of non-stationary variables, in terms of first differences.

PCSE estimator confirmed the results and conclusions based on FE model. FDI is positively affected by short-term interest rate, corruption and competition index, while negatively by dummy variables. In Latvia, lowest corporate income tax rates in the sample indicated FDI inflow. In Hungary negative FDI inflow is detected in 2015 and 2016, and further, Hungary policymakers reacted with corporate income tax reduction in 2017 from 19% to 9%. Although the PCSE model confirmed that lower corporate tax rates in Latvia and Hungary imply higher FDI, variable *cit* is not significant, meaning that the same could not be generalized for the other 5 emerging EU economies in the sample.

Robust results represented in Table 4 could be interpreted as partial acceptance of the hypothesis 1 that negative link between corporate income tax rates and FDI inflows exists in Hungary and Latvia. However, this result could not be generalized for all analyzed emerging EU economies. Positive relation between other factors (corruption index, competitiveness index and short-term interest rate) and FDI inflows is confirmed using PCSE method in seven emerging EU economies in the period 2010-2019; therefore, hypothesis 2 is fully accepted.

Table 4 PCSE Estimator for emerging EU economies in the period 2010-2019

Panel-corrected standard errors (PCSE)			
Dependent variable: *fdi_in*	Coef.	Std. Error	P>(t)
cit	13.3847	159.258	0.993
ST_ir	157.951	370.611	0.000
comp	38.0224	14.429	0.008
corr	194.310	61.426	0.002
cons	-8772.661	4600.807	0.057
dummyL	-3006.191	750.678	0.000
dummyH	-13186.46	3532.147	0.000
R^2		0.51	
Number of observations		70	

Source: Authors' calculations.

Conclusions related to the robustness check using different methods of estimations are as follows: (1) PCSE method is the most reliable method compared with FE and RE methods; (2) negative relationship between corporate income taxes and FDI is confirmed in FE and PCSE model, although in the case of PCSE model only in case of Hungary and Latvia; (3) the magnitude of influence of explanatory variables on FDI inflow is slightly lower in PCSE model compared with FE; (4) residuals are stationary and cross-section independent in PCSE model. Hence, it is concluded that PCSE model is the most favourable one.

6. CONCLUSIONS

This paper analyzes the impact of changes in the corporate income tax rate on the investments localization decision in emerging EU economies. The results of classical panel models (Fixed-effects and Random-effects models) based on selected emerging EU economies (Czech Republic, Hungary, Lithuania, Latvia, Poland, Slovakia, and Slovenia) for the period between two crises, indicated negative link between corporate income tax rates and FDI inflows which is in line with economic investment theory (Talpos & Vancu, 2009). Results of the Hausman test showed that the model with Fixed-effect (FE) is more efficient in comparison to the one with Random-effect specification. Therefore, this paper confirms that reduction of corporate income taxes, i.e. achieving tax competitiveness, provides FDI inflow. Observing other factors, it is shown that short-term interest rate effects FDI positively (Dupor, 2000) and business environmental variables indicated that higher level of corruption index and higher competition index are significant factors for decision-making on investment. Furthermore, Panel corrected standard errors (PCSE) method is implemented, as robustness check, due to limitation of classical panel methods: problem of cross-section dependence and nonstationarity of variables. PCSE confirmed conclusions based on FE model; however, negative relationship between corporate income tax and FDI inflow was only detected in case of Hungary and Latvia. Between analysed emerging EU economies, Latvia and Hungary are at the same time economies with the highest score of tax competitiveness indexes, confirming that tax competitiveness exists in EU economies and that causes positive macroeconomic effects by foreign direct investment attraction.

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UTICAJ POREZA NA DOBITAK PREDUZEĆA NA PRILIV SDI U EKONOMIJAMA EU U RAZVOJU

Nakon globalne finansijske krize intenzivna prilagođavanja poreske politike primenjena su u ekonomijama Evropske unije (EU) u razvoju, zarad poreske konkurentnosti. Da bi ostvarile taj cilj, ekonomije EU u razvoju najčešće biraju politiku smanjenja poreza, a posebno snižavanja stope poreza na dobit preduzeća. Ovaj rad se bavi uticajem poreza na dobit preduzeća na priliv stranih direktnih investicija (SDI) u odabranim ekonomijama EU u razvoju (Češka, Mađarska, Litvanija, Letonija, Poljska, Slovačka, Slovenija) između dve krize (globalne finansijske i pandemijske), tj. , u periodu 2010-2019. Koristeći klasične modele panel podataka (model Fixed Effects i Random Effects), istraživanje pokazuje da se očekuje da smanjenje poreza na dobit preduzeća obezbedi priliv SDI. Posmatrajući odnos između ostalih faktora (indeks korupcije, indeks konkurentnosti i kratkoročne kamatne stope) i priliva SDI, pozitivni odnosi su potvrđeni. Panel-korigovan estimator standardnih grešaka (PCSE), implementiran kao provera robusnosti, potvrdio je rezultate i zaključke zasnovane na FE modelu. Međutim, negativna veza između poreza na dobit preduzeća i SDI u slučaju PCSE modela je verifikovana samo u slučaju Mađarske i Letonije, što ukazuje na postojanje poreske konkurentnosti.

Ključne reči: *porez na dobit preduzeća, SDI, ekonomije EU u razvoju, panel analiza, PCSE metoda.*

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LONG-RANGE CORRELATIONS AND CRYPTOCURRENCY MARKET EFFICIENCY

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Abstract. *This paper examines the market efficiency of the most significant cryptocurrencies, Bitcoin and Ethereum. In the paper, we use several different tests to check the normality of return distribution, long-run correlation and heteroscedasticity of return volatility. We compare the characteristics of cryptocurrency returns with the returns on stocks of the most important companies producing hardware components for cryptocurrency mining. The correlation of returns, trading volume and volatility between cryptocurrencies and selected stocks is tested using a Granger causality test. The research results reject the efficient market hypothesis and show that the cryptocurrency market is a completely new speculative market that is weakly correlated with the stock market.*

Key words: *efficient market hypothesis, cryptocurrency markets, random walk hypothesis, the long-run correlations.*

JEL Classification: G14, G15

INTRODUCTION

Cryptocurrencies are not issued by monetary authorities, but are privately issued money based on cryptographic algorithms; they are not legal tender, they have not reached the status of a generally accepted means of payment, and they may face a limited supply due to the limitation of the total available amount or the annual amount which can be "mined". The creation and transfer of cryptocurrencies is based on the blockchain technology where each block contains transactions, a time stamp, a digital signature to identify the account and a unique

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identification link (Van der Auwera et al., 2020). Investors treat cryptocurrencies as an asset and see them as an investment alternative for investing savings, as a way to diversify a portfolio or as an asset for speculation (Elliott & de Lima 2018).

After the success of Bitcoin, other cryptocurrencies appeared, but Bitcoin maintained its dominant position on this market. Bitcoin and Ethereum have the largest share of the total market capitalization on the cryptocurrency markets. In early 2017, the share of Bitcoin in total market capitalization was about 85%, and in late 2021, the share of Bitcoin was 40.21%, and Ethereum's 20.03% (Coinmarketcap, 2022). The cryptocurrency market is continuously developing and the popularity of cryptocurrencies is growing, which increases the volume of trading, and with it, interest in its effectiveness.

The aim of this paper is to check the market efficiency of the most important cryptocurrencies, Bitcoin and Ethereum. We compare the characteristics of cryptocurrency returns with the stock returns of the most important companies producing hardware components for cryptocurrency mining, Intel, AMD, Nvidia and TSMC. Also, the SP500 index is used as a proxy for global market trends.

The paper is organized as follows: the theoretical framework is presented in the first part of the paper. The second part of the paper presents an overview of literature. Research methodology and results are presented in the third part of the paper. Finally, the conclusion of the research is given in the fourth part of the paper.

1. THEORETICAL FRAMEWORK

1.1. Efficient Market Hypothesis

Examining the efficiency of the cryptocurrency market is based on the Efficient Market Hypothesis (EMH). Fama (1970) uses the term "efficient" to describe a market where "prices always fully reflect available information" but ignores the costs of obtaining and processing information. In his later paper, Fama (1991) modifies the EMH to make the simplest but economically reasonable statement that the prices of securities at any point in time fully reflect all available information to the extent that the profit based on that information does not exceed the cost of obtaining the information and transaction costs. When stock prices satisfy this claim, market participants cannot make above-average profits based on available information.

Within EMH, three sub-hypotheses of information efficiency can be distinguished, namely weak, semi-strong and strong form of EMH (Fama, 1970). The mentioned EMH forms differ in the information set and the perception of the information flow speed, that is, the speed and ability of the investor to adequately interpret the information.

The weak form of EMH assumes that current stock prices reflect all the information that has already been generated on the market at a given moment (historical prices, returns, volatility, etc.). Investors cannot make above-average profits based on historical market information, but they can create "above-average" returns by looking for private information that is not yet available to the market and trading in it at times when its appearance disrupts the market.

The semi-strong form of EMH assumes that the price of stocks quickly adjusts to all public information, which, in addition to market information, includes non-market information such as announcements of dividends, various coefficients (P/E, D/P, P/BV, etc.), companies' financial statements, competition, macroeconomic factors (inflation, unemployment), etc.

The strong form of EMH assumes that stock prices at any point in time fully reflect all available information (from public and private sources). No investor has monopolistic access to "sensitive" information, that is, there is no "superior" investor.

1.2. Random walk theory

The efficient market hypothesis evolved from the random walk theory. When the term random walk is applied to stock markets, it means that short-term changes in stock prices cannot be predicted. The random walk model and the submartingale represent two basic cases of the fair game model that describes expected sequences of price changes. The correlation of stock returns r_t at time t and r_{t+k} at time $t+k$ is expressed by their covariance. On an efficient market, with an appropriate choice of $f(\cdot)$ and $g(\cdot)$,

$$Cov\left[f(r_t), g(r_{t+k}) \right] = 0 \tag{1}$$

for each t and $k \neq 0$, where $f(\cdot)$ and $g(\cdot)$ are arbitrarily chosen functions. Equation (1.5) includes all versions of the random walk and martingale models. Campbell et al. (1997) consider three random walk models: *RW1*, *RW2* i *RW3*.

RW1 model ("independently and identically distributed returns") implies that the increase in prices is independently and identically distributed (IID), and in that case the process P_t is

$$P_t = \mu + P_{t-1} + e_t, \quad e_t \sim IID\ (0, \sigma^2) \tag{2}$$

where μ is the expected price change or *drift*. The price increase (innovation) e_t is independently and identically distributed with mean zero and variance σ^2, denoted $IID(0, \sigma^2)$.

RW2 ("independent returns") further relaxes the assumption of identical distribution and allows heteroscedasticity to appear in the innovation e_t, i.e. it allows time variability of the variance in the time series of stock returns.

RW3 ("uncorrelated returns") relaxes the assumption of independence of returns by introducing the possibility of dependence but not correlation of price innovations e_t. This is the weakest form of the random walk hypothesis and contains RW1 and RW2 as special cases.

1.3. Long-range correlations

In the case of a weak form of efficiency, investors cannot profit above average based on historical market information. However, if the presence of long-term memory in returns on financial assets allows investors to make above-average profits, then the hypothesis of a weak form of market efficiency is not supported. If we proceed from the assumption that cryptocurrency returns may not be independent and identically distributed, checking the existence of long-range correlations in the observed data must be done with some of the non-parametric tests. Hurst (1951) developed a robust R/S (rescaled range) non-parametric methodology for distinguishing between random and non-random series. R/S statistic is the range of partial sums of deviations of a time series from its mean, rescaled by its standard deviation (Peters, 1994):

$$(R/S)_n = \frac{1}{S_n}\left[\max_{1 \le k \le n} \sum_{t=1}^{k} (r_t - \bar{r}_n) - \min_{1 \le k \le n} \sum_{t=1}^{k} (r_t - \bar{r}_n) \right] = Cn^H \tag{3}$$

where r_t is calculated as $r_t = \left((x_1 - \bar{x}) + (x_t - \bar{x}) \right)$ and $\bar{x}$ denotes the mean of a time series of length N. The H exponent in the relation (3) is the Hurst exponent, R_n is the adjusted range S_n is its standard deviation and C is a constant.

If H=0.5, the observed series follows a random walk. If 0.5<H<1, observed series shows persistence and long memory. In the case that 0<H<0.5, the observed series shows the existence of anti-persistence, generating reversals much more often than a random walk.

Using the results of multifractality research in financial time series, the Inefficiency Index can be defined as follows (Gu et al., 2013):

$$InffIdx = |H(2) - 0.5| \tag{4}$$

where H(2) is the Hurst exponent calculated by MF-DFA when $q = 2$. If H (2) > 0,55 or H (2) < 0,45 then we assume that the market is inefficient.

2. REVIEW OF LITERATURE

The first research on the efficiency of the Bitcoin market shows its inefficiency, but also that this inefficiency decreases over time (Urquhart, 2016). The results of a portion of subsequent studies also do not support the EMH for the cryptocurrency market (Cheah et al., 2018; Al-Yahyaee et al., 2018; Vidal-Tomás et al., 2019) suggesting that cryptocurrency returns are not independent but predictable. Some authors, however, find evidence of cryptocurrency market efficiency (for example, Bariviera et al., 2017; Tiwari et al., 2018; Dimitrova et al., 2019, Mnif et. al, 2020). Tiwari et al. (2018) apply the market efficiency index based on the time-varying Hurst exponent and conclude that the Bitcoin market is efficient. Bariviera et al. (2017) apply Detrended Fluctuation Analysis (DFA) over a sliding window to calculate the Hurst exponent and find that the Hurst exponent significantly changes during the first years of Bitcoin's existence, with a tendency to stabilize since the beginning of 2014 around a value of 0.5 ± 0.05 which indicates a more informationally efficient market.

Assuming that the efficiency of the cryptocurrency market changes over time, some authors base their research on the adaptive market hypothesis (AMH), and their results support AMH on these markets (Chu et al., 2019; Khuntia & Pattanayak; 2018, Noda; 2021).

The majority of studies focus on the Bitcoin market, while some examine market efficiency and multiple cryptocurrencies. Noda (2021) focuses his research on the Bitcoin and Ethereum markets and finds that the degree of their efficiency changes over time and that the level of efficiency on the Bitcoin market is higher than on the Ethereum market. Caporale et al. (2018) investigate long-memory behavior in the returns of several cryptocurrencies (Bitcoin, Litecoin, Ripple and Dash) and find evidence of market inefficiency. Vidal-Thomas et al. (2019) find market inefficiency by applying a portfolio approach to investigate the market efficiency of 118 cryptocurrencies. Mnif et al. (2022) conclude that the Bitcoin market is the most efficient on the short trade horizon.

3. METHODOLOGY AND RESEARCH RESULTS

3.1. Data and descriptive statistics

In this paper, we analyze the logarithmic returns of the two most important cryptocurrencies: Bitcoin (BTC) and Ethereum (ETH). A comparison with the properties of the financial series of stock price trends is made regarding the AMD (AMD), Intel (INTC), Nvidia (NVDA) and TSMC (TSMC) stocks. In addition, the stock market index S&P500 (SP500) is used as an indicator of market trends. Daily prices of cryptocurrencies (Bitcoin and Ethereum) expressed in US dollars are taken from the Coinbase website. The daily prices of the observed stocks are taken from the Yahoo!Finance website. Data on all series are in the interval from 04/01/2017 - 31/12/2021 (1258 observations).

Table 1 Descriptive statistics of logarithmic returns

	AMD	*BTC*	*ETH*	*INTC*	*NVDA*	*TSMC*	*SP500*
				Descriptive statistics			
Mean	0.002	0.003	0.005	0.000	0.002	0.001	0.001
Median	0.001	0.003	0.003	0.001	0.003	0.001	0.001
Maximum	0.182	0.258	0.410	0.178	0.164	0.119	0.090
Minimum	-0.277	-0.368	-0.323	-0.199	-0.208	-0.151	-0.128
Std. Dev.	0.035	0.050	0.068	0.022	0.030	0.020	0.012
Skewness	-0.243	-0.500	0.193	-0.872	-0.595	-0.182	-1.145
Kurtosis	8.919	8.239	7.303	18.935	9.248	8.508	24.923
				Nonnormality test			
Jarque-Bera (CV=5.9433)	1849.056	1491.363	978.527	13468.910	2120.322	1597.366	25466.460
p-val	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Kolmogorov-Smirnov (5%) (CV=0.0381)	0.454	0.439	0.421	0.466	0.463	0.472	0.479
p-val	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				Unit Root tests			
Augmented Dickey-Fuller test statistic	-37.756	-36.025	-35.154	-19.108	-39.789	-42.271	-10.606
p-val	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Phillips-Perron test statistic	-37.874	-36.152	-35.352	-43.550	-39.658	-42.065	-44.314
p-val	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KPSS-Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.071	0.110	0.282	0.181	0.181	0.117	0.079
Unit Root with Break Test	-38.548	-36.981	-36.001	-44.802	-40.509	-43.655	-45.249
Break Date:	5/2/2017	3/12/2020	6/12/2017	3/12/2020	11/19/2018	7/27/2020	1/25/2017
				Random Walk hypothesis/Variance/Heteroskedasticity test			
Variance Ratio Test	2.032	0.893	0.854	2.579	1.584	3.085	2.409
p-val	**0.158**	**0.844**	**0.864**	0.039	**0.382**	0.008	0.063
Rank Score Variance Ratio Test	2.791	1.701	1.584	4.277	2.717	4.709	3.594
p-val	0.012	**0.206**	**0.243**	0.000	0.018	0.000	0.001
Sign Variance Ratio Test	2.621	3.907	1.748	1.012	3.214	1.353	1.410
p-val	0.031	0.001	**0.185**	**0.596**	0.011	**0.374**	**0.727**
ARCH test (a=0.01, Lag=10, CV=23.209)	27.567	17.990	76.636	283.897	283.897	299.319	543.390
p-val	0.002	**0.055**	0.000	0.000	0.000	0.000	0.000
				Nonlinearity test			
BDS (Dim=6, S=1.0)	0.020	0.024	0.026	0.062	0.033	0.033	0.143
p-val	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Authors' calculations

Table 1 shows the descriptive statistics of the logarithmic returns of the cryptocurrencies Bitcoin (BTC) and Ethereum (ETH), as well as the returns of selected financial series. The table clearly shows, based on the values of the maximum and minimum values, as well as on the basis of the standard deviation, that the returns on cryptocurrencies are significantly higher compared to the selected stocks and significantly higher than the returns on the SP500 market index. The median for cryptocurrencies is lower than the mean, which indicates the presence of positive deviations. On the other hand, for the selected returns (except for AMD), the median is higher than the mean, which shows that in the observed period, the stocks of the selected companies and the SP500 index have more negative deviations. Taking into account the difference of the highest and lowest values, as well as the value of the standard deviation, the cryptocurrency Ethereum (ETH) has the most volatile behavior.

The returns of all series show a significantly higher value of the coefficient of kurtosis than expected for a normal distribution of returns, indicating that the distributions of returns are likely to have fat tails. The kurtosis of cryptocurrencies is slightly lower than that in selected stocks, and significantly lower than Intel (INTC) and SP500. The coefficient of skewness of daily returns is positive for all series except for Ethereum (ETH). This positive skewness is generally not present in stock markets.

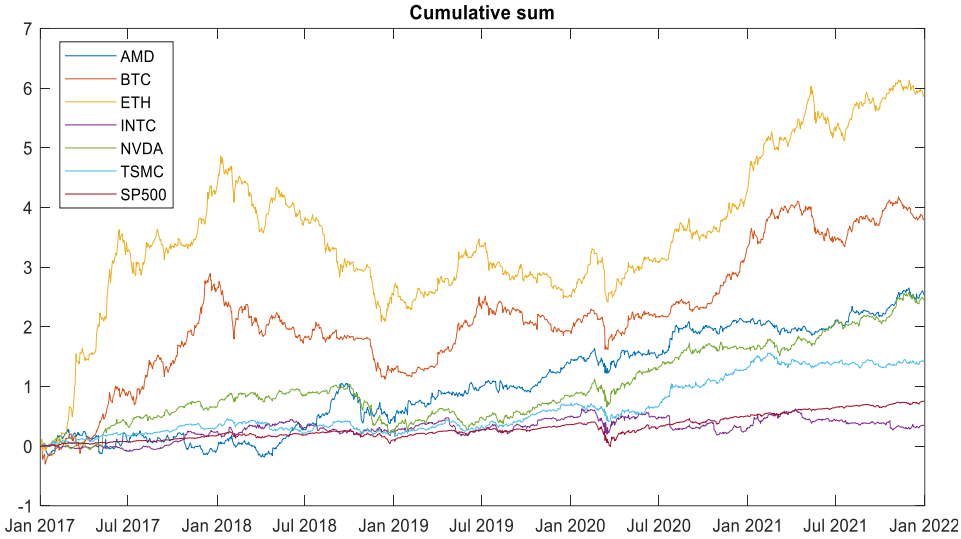
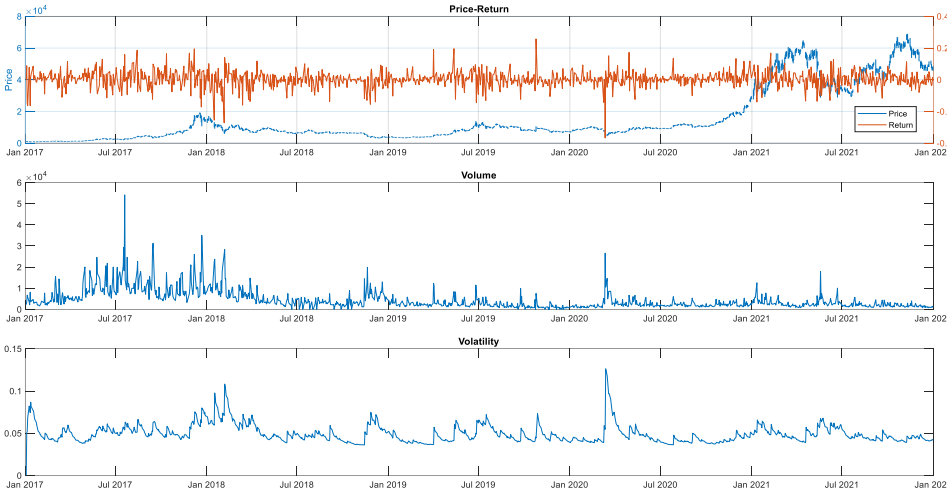
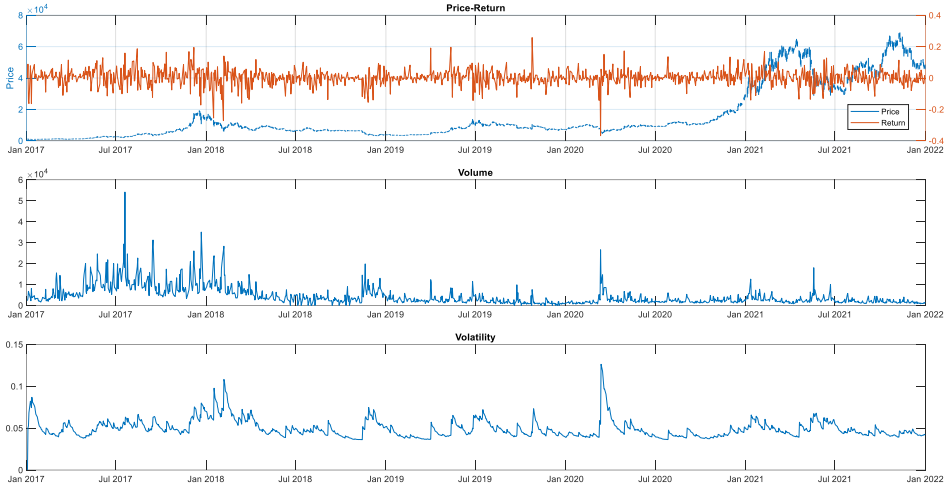


Fig. 1 Cumulative sum of logarithmic returns
Source: Authors' calculations

Figure 1 shows the cumulative returns of the selected time series in the observed period. During the entire observed period, the returns on cryptocurrencies are significantly higher than the returns on selected stocks and the SP500 index. In addition, cryptocurrencies have an upward trend from the beginning of 2017 to the end of 2017, and from May 2020 to the end of 2021. From 2018 to May 2020, returns are mostly negative. There is similar behavior on the stock market since May 2020.



a) Bitcoin – Price-Return, Volume, Volatility



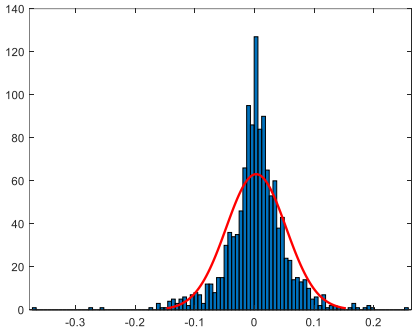
b) Ethereum – Price-Return, Volume, Volatility

Fig. 2 Graphical presentation of price and returns, trading volume and volatility for cryptocurrencies: a) Bitcoin (BTC) and b) Ethereum (ETH)
Source: Authors' calculations

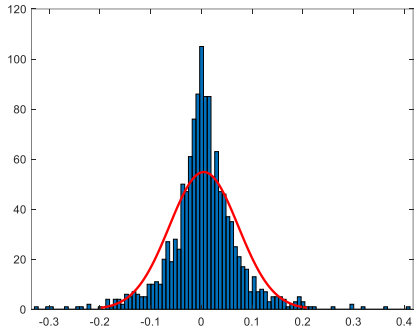
3.2. Test of normality of distribution of returns

Checking the normality of return distribution can be done using various statistical tests. One of the most famous is the Jarque-Bera test (Jarque and Bera, 1987), which is based on coefficients of skewness and kurtosis. The Kolmogorov-Smirnov test is based on the analysis of the deviation of the empirical cumulative distribution of the sample from the normal distribution. Both tests clearly reject the null hypothesis of normality of the daily return distribution of the selected financial time series (Table 1). Figure 3 shows the

histograms of Bitcoin and Ethereum cryptocurrencies, which clearly graphically show the deviation of the distribution of log returns from the expected normal distribution. Both tests clearly reject the null hypothesis of normality of the daily return distribution of the selected financial time series (Table 1)



a) BTC



b) ETH

Fig. 3 Histograms of cryptocurrencies compared to normal distribution

3.3. Tests of stationarity of returns

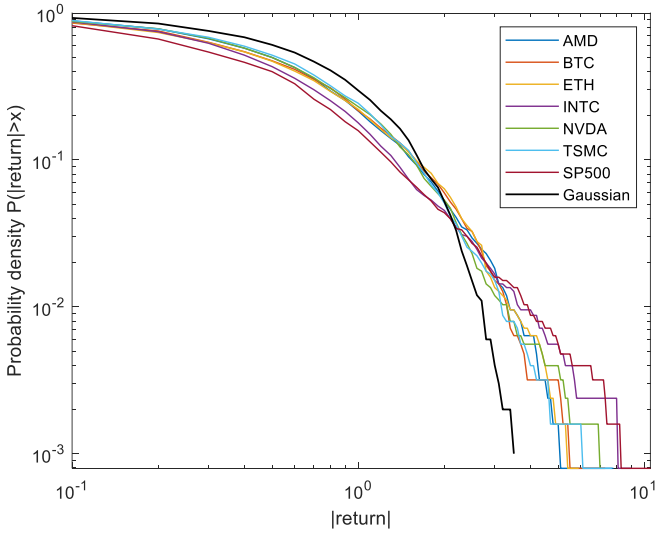
Testing the stationarity of the returns of the selected series is done using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The null hypothesis of these tests is that the time series is non-stationary. Table 1 shows that the null hypothesis is rejected at the 1% significance level because the p-value for the ADF and PP test is less than 0.01, indicating that the process is stationary. The null hypothesis for the PP test is that the observed series has a unit root. For the KPSS test, the null hypothesis is that the observed series is stationary. The tests (Table 1) clearly show (with 5% statistical significance) that all observed series do not have unit roots and are stationary. For all series (except Ethereum) weak stationarity cannot be rejected.

3.4. Power law of distribution of returns

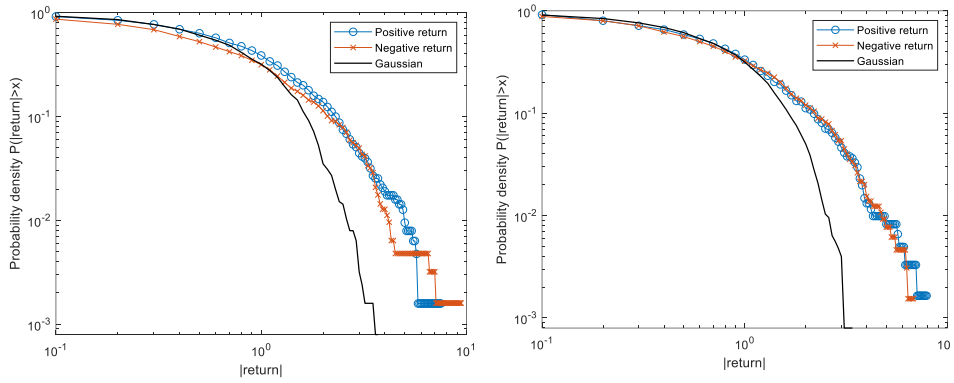
The random variable X shows the properties of the power law of the tail distribution if there are constants A and λ so

$$P(X > x) \sim x^{-\alpha}, x \geq x_{min} \quad (5)$$

where α is the power coefficient. The correlation is tested using a log-log plot of the tail of the distribution ($X>x$). Linear regression $\log(P(X>x))$ against $\log(x)$ gives coefficient α. As the law is directed towards the tail of the distribution, the regression is calculated only for values of x that exceed some given threshold (x_{min}). The presence of a power law distribution of returns has been observed in the stock market (Gabaix et al., 2003). Figure 4(a) shows the power law for the selected set of stocks. Also, Figure 4 (b,c) shows the power law for positive and negative log returns of Bitcoin and Ethereum cryptocurrencies.



a) Power law distribution of selected time series



a) BTC b) ETH

Fig. 4 Power law distribution of cryptocurrencies. a) distribution of returns of selected time series; b) Distribution of positive and negative log returns of Bitcoin (BTC); c) Distribution of positive and negative log returns of Ethereum (ETH)

Source: Authors' calculations

$$P(X > x) \sim x^{-\alpha}, x \geq x_{min}$$

The estimation of parameters α and x_{min} is based on the procedure described by Clauset, Shalizi, Newman (2007). The results are shown in Table 2 for all log returns of the selected series. In addition, the results for the distribution of positive returns and negative returns are shown separately. Finally, the range between the slopes of positive and negative returns is given (Range=$|\alpha(+)-\alpha(-)|$). Research results show that cryptocurrencies have similar dynamics to the stock market (parameter α is close to 3). The difference between the negative and positive tails of the distribution is significant, but similar to stock market behavior. However, significantly lower than the global market represented by the SP500 index.

Table 2 Power law parameters for selected data series. (+) and (-) indicate coefficients for positive log returns and negative log returns, respectively.

	Power Law distribution ($p(x) \sim x^{-\alpha}$ *for* $x >= x_{min}$)						
	α	X_{min}	α (+)	X_{min} (+)	α (-)	X_{min} (-)	*Range*
AMD	2.80475	0.72892	2.45786	0.50282	2.90595	0.72892	0.44808
BTC	2.85607	0.78591	3.07467	0.84342	2.74668	0.78593	0.32799
ETH	2.94765	0.91062	2.69633	0.68397	2.99773	0.92091	0.30140
INTC	3.09913	0.91523	3.13352	0.84037	3.13837	0.96179	0.00485
NVDA	3.53004	1.15357	2.95134	0.75291	3.14708	1.03856	0.19574
TSMC	3.20485	0.95544	3.12442	0.93705	3.26226	0.95544	0.13784
SP500	2.96575	0.98602	3.22375	0.78258	2.31110	0.48015	0.91265

Source: Authors' calculations

3.5. Serial correlation of returns

The efficient market hypothesis assumes that there is no significant serial autocorrelation of returns. The autocorrelation function of returns drops to zero very quickly and is one of the first documented stylized facts that gives indirect support to the EMH. To check serial correlation, we use the Ljung-Box Q-test, which tests the null hypothesis that all autocorrelation coefficients are equal to zero. The test is also used to check for randomness in time series. The test results are shown in Table 3. The table shows that despite the high statistical value, the null hypothesis can be accepted.

3.6. Serial correlation of volatility

Figure 1 clearly shows that the returns of both cryptocurrencies show periods where high and low returns are clustered together indicating volatility clustering.

The previously mentioned Ljung-Box Q-test and Engle's ARCH test are used to test the null hypothesis of the absence of significant serial autocorrelation of volatility. In contrast to returns, the Ljung-Box Q-test of the absolute value of returns and squared returns of the selected financial series strongly rejects the null hypothesis and indicates a significant temporal correlation of volatility (Table 3). The ARCH test examines the existence of clustering of volatility (heteroscedasticity) in time series. Like the previous test, the ARCH

test strongly rejects the null hypothesis of no volatility correlation (Table 3). It is a general observation that the volatility of financial series is clustered and persistent. Also, there is an asymmetry in volatility, with some stocks volatility more sensitive to negative returns (Takaishi, 2018).

Table 3 Results of Ljung-Box Q-test of serial correlation of returns (r), absolute value of returns ($|r|$) and square of returns r^2, and ARCH of existence of heteroscedasticity in the data.

	Ljung-Box Q-test (CV=18.3070)						ARCH (CV=18.3070)	
	r		*|r|*		r^2			
	Q-test	p-val	Q-test	p-val	Q-test	p-val	Stat	p-val
AMD	30.131	0.000	95.870	0.000	36.886	0.000	27.566	0.000
BTC	13.118	0.217	133.206	0.000	25.144	0.005	17.990	0.005
ETH	19.203	0.038	154.245	0.000	102.722	0.000	76.6360	0.000
INTC	138.601	0.000	682.162	0.000	472.631	0.000	283.897	0.000
NVDA	54.662	0.000	397.421	0.000	235.553	0.000	129.562	0.000
TSMC	95.219	0.000	488.278	0.000	520.639	0.000	299.319	0.000
SP500	363.258	0.000	2491.000	0.000	1756.100	0.000	543.389	0.000

Source: Authors' calculations

Based on the ARCH test, we conclude that returns are variable and choose the GJR-GARCH (Glosten-Jagannathan-Runkle GARCH) model for volatility modeling. The econometric literature is rich in various models from the ARCH/GARCH family (Bollerslev, 1992). In this paper, we use GJR-GARCH(1,1) to estimate the conditional mean and variance of returns on selected time series assuming a *t* distribution of returns. The assumed GJR-GARCH (1,1) process can be expressed as follows:

$$r_t = \mu + \varepsilon_t, \varepsilon_t = \sigma_t z_t \tag{6}$$

$$\sigma_t^2 = \omega + (\alpha + \gamma I_{t-1})\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 \tag{7}$$

$$I_{t-1} := \begin{cases} 0 \text{ if } r_{t-1} \geq \mu \\ 1 \text{ if } r_{t-1} < \mu \end{cases} \tag{8}$$

Table 4 gives the specifications of the GJR-GARCH(1,1) model for the selected time series. All estimated GJR-GARCH coefficients are statistically significant.

Table 4 Parameters of GJR-GARCH(1,1) model for selected time series

GJR-GARCH(1,1)-t	ω	β	α	γ
AMD	0.00007	0.88166	0.05415	0.04188
BTC	0.00003	0.92046	0.09529	-0.03152
ETH	0.00032	0.82304	0.17377	-0.04015
INTC	0.00001	0.91383	0.12578	-0.07923
NVDA	0.00009	0.73457	0.07570	0.21101
TSMC	0.00001	0.88769	0.07964	0.03606
SP500	0.00000	0.77255	0.04105	0.37279

Source: Authors' calculations

Since the value of the GARCH coefficient (β) is greater than the value of the ARCH coefficient (α), we can conclude that volatility is very persistent and clustered. A high value of the GARCH coefficient (β) implies persistent volatility clustering. The existence of Leverage effect (γ), indicates that negative news has a greater impact (γ >0) in AMD, NVDA, TSMC, SP500, while positive news has a greater impact (γ <0) in BTC, ETH, INTC. That is, cryptocurrency volatility is more sensitive to positive news.

3.7. Non-linearity test

The presence of non-linearity in the data can be checked using various tests; however, most empirical research on financial time series uses the Brock-Dechert-Scheinkman test (BDS test) (Brock et al., 1996). This test is based on the serial independence check of the correlation integral and serves as an indirect proof of the existence of nonlinearity in the sample of the unknown distribution of the time series. That is, it serves to distinguish random time series from non-linear stochastic processes. The null hypothesis about the IID process is rejected when the value of the BDS statistic is greater than the given critical value for the given confidence interval (1.645 (90% CI), 1.960 (95% CI), 2.326 (2% CI) and 2.576 (99% CI)). BDS test statistics show significantly higher values than the critical value (CV=1.960) of the selected time series so that the null hypothesis about the IID process can be rejected. Table 1 shows only the results for the embedding dimension DIM=6 and S=1.0. These results strongly suggest the potential existence of non-linear dependence in the selected time series.

3.8. Long-run correlation test

Checking the existence of long-term correlation of cryptocurrency returns and selected stock returns is based on the Hurst exponent and is shown in Table 5. To estimate the Hurst exponent, the MFDFA (Multifractal detrended fluctuation analysis) method is used for different scales of the observed time series (scale = [16, 32, 64, 128, 256, 512]), taking into account different degrees (q) of the partition function. The table shows the results for q=2 used to estimate the index of market inefficiency (InffIdx). Hurst's H(2) exponent is significantly higher than 0.55, that is, InffIdx is significantly higher than zero for both cryptocurrencies, which indicates that the cryptocurrency market is inefficient. However, individual stocks (AMD) and the market index SP500 also show inefficiency. The range between the highest and lowest values for the Hurst exponent (Range) shows that during the observed interval all time series had variable exponent values and had periods of high market efficiency. For the sake of comparison, Table 5 also shows the standard estimate for the Hurst exponent using the R/S analysis method. And its values for cryptocurrencies are significantly higher than the 0.5 expected for normally distributed data and an efficient market.

Table 5 Results of testing the long-term correlation in the data and the index of inefficiency

	H(2)	*InffIdx*	*Min Hurst*	*Max Hurst*	*Range*	*R/S Hurst*
AMD	0.58917	**0.08917**	0.21618	0.81897	0.60279	0.46130
BTC	0.59947	**0.09947**	0.31394	1.02880	0.71486	0.61250
ETH	0.62955	**0.12955**	0.28887	0.95359	0.66472	0.66690
INTC	0.52057	0.02057	0.19280	0.87512	0.68232	0.46640
NVDA	0.50463	0.00463	0.19871	0.77676	0.57805	0.53150
TSMC	0.49650	0.00350	0.17906	0.79443	0.61537	0.50700
SP500	0.57306	**0.07306**	0.05215	0.88239	0.83024	0.45320

Source: Authors' calculations

3.9. Correlation between series

Table 6 shows the return correlation coefficients between cryptocurrencies and selected stocks. All correlations have a statistical significance of 1% (p-value less than 0.001) and all are positive. Bitcoin (BTC) and Ethereum (ETH) show a high positive correlation during the observed period (r=0.665) which indicates that cryptocurrency returns have similar behavior and that the cryptocurrency market as a whole is moving in the same direction. Note that a large number of other cryptocurrencies are purchased using Bitcoin or Ethereum.

Table 6 Correlation results of cryptocurrencies, selected stocks and SP500 index. Correlations greater than 0.5 are marked in red

Correlation	*AMD*	*BTC*	*ETH*	*INTC*	*NVDA*	*TSMC*	*SP500*
AMD	1						
BTC	0.10460	1					
ETH	0.09263	**0.66518**	1				
INTC	0.35295	0.14118	0.11647	1			
NVDA	**0.64016**	0.15930	0.15554	**0.53257**	1		
TSMC	**0.47279**	0.09446	0.11301	**0.51571**	**0.59454**	1	
SP500	**0.50012**	0.18567	0.18850	**0.67673**	**0.65033**	**0.62876**	1

Source: Authors' calculations

Correlations of cryptocurrencies and selected stocks and the SP500 index show a positive but small correlation. However, a high positive correlation exists among the selected stocks, especially with the market trend as a whole represented by the SP500 index. All stocks are highly positively correlated with each other as well as with the SP500 index. The correlation between Intel (INTC) and AMD is positive but not that high. The results indicate that the behavior of cryptocurrencies differs from the behavior of the stock market.

3.10. Granger correlations

One way of testing statistical causality between stationary time series is the Granger causality test (Granger, 1969). Causality refers to the time sequence between observed series. According to the test, if the past values of the potentially causal variable (data series) better predict the current (lagged) value of the dependent variable (time series) than the past values of the dependent variable itself, we say that the hypothesized explanatory variable Granger-causes the hypothesized dependent variable. Granger causality is based on the generally accepted observation that a cause occurs before its effect. Granger tests the null hypothesis that there is no evidence of a causal relationship. If the null hypothesis is rejected with statistical significance, we conclude that there is causality in the tested direction. Then the test is repeated in the opposite order, to see if there is causality between the two variables in the opposite direction. The F-statistic shown is the Wald statistic for the null hypothesis.

Table 7 shows the results of Granger causality testing between volatility (VTY) and trading volume (VOL) of all observed time series. At the 5% significance level, the null hypothesis of mutual Granger causality cannot be rejected for all observed time series. The results show that cryptocurrencies do not show differences in volatility behavior and trading volume compared to the stock market. The results are in agreement with earlier research.

Table 7 Granger causality test between volatility and trading volume

Pairwise Granger Causality Tests
Sample: 1/04/2017 12/31/2021

Null Hypothesis:	*F-Statistic*	*Prob.*
AMDVTY does not Granger Cause AMDVOL	6.69286	0.0013
AMDVOL does not Granger Cause AMDVTY	190.257	0.0000
BTCVTY does not Granger Cause BTCVOL	14.8545	0.0000
BTCVOL does not Granger Cause BTCVTY	211.535	0.0000
ETHVTY does not Granger Cause ETHVOL	20.763	0.0000
ETHVOL does not Granger Cause ETHVTY	33.7269	0.0000
INTCVTY does not Granger Cause INTCVOL	3.50474	0.0303
INTCVOL does not Granger Cause INTCVTY	155.351	0.0000
NVDAVTY does not Granger Cause NVDAVOL	2.8523	0.0581
NVDAVOL does not Granger Cause NVDAVTY	209.425	0.0000
TSMCVTY does not Granger Cause TSMCVOL	5.77802	0.0032
TSMCVOL does not Granger Cause TSMCVTY	313.154	0.0000

Source: Authors' calculations

Table 8 shows the results of Granger causality testing between returns of all observed time series. The results show that cryptocurrencies do not show a significant correlation with the returns of the listed stocks. However, the results show that there is a Granger causality between the movement of stock returns of Intel (INTC) with all selected stocks and the market movement (SP500). Also, market movements (SP500) Granger-cause movements in the stock market

Table 8 Granger causality test between cryptocurrency returns and market movements

Pairwise Granger Causality Tests
Sample: 1/04/2017 12/31/2021

Null Hypothesis:	*F-Statistic*	*Prob.*
BTC does not Granger Cause AMD	2.78484	0.0621
INTC does not Granger Cause AMD	6.51704	0.0015
AMD does not Granger Cause INTC	9.58769	0.0000
AMD does not Granger Cause NVDA	2.6172	0.0734
SP500 does not Granger Cause AMD	3.86631	0.0212
BTC does not Granger Cause NVDA	2.32612	0.0981
BTC does not Granger Cause TSMC	2.74578	0.0646
ETH does not Granger Cause SP500	2.46053	0.0858
INTC does not Granger Cause NVDA	12.6769	0.0000
SP500 does not Granger Cause INTC	11.9537	0.0000
INTC does not Granger Cause TSMC	19.4915	0.0000
SP500 does not Granger Cause NVDA	24.2994	0.0000
NVDA does not Granger Cause SP500	3.10401	0.0452
TSMC does not Granger Cause NVDA	3.27035	0.0383
SP500 does not Granger Cause TSMC	22.5196	0.0000

The table only shows causes that cannot be rejected with a 5% confidence interval
(The null hypothesis is not rejected at 5% significant level).
Source: Authors' calculations

The results of testing the Granger causality between the trading volume of all observed time series are shown in Table 9. The results show that cryptocurrencies show a certain Granger

causality with the trading volume of the selected stocks. The correlation between the trading volume of Bitcoin (BTC_VOL) and the trading volume of Nvidia (NVDA_VOL) and TSMC (TSMC_VOL) cannot be dismissed. Also, the correlation of Ethereum (ETH_VOL) trading volume with Nvidia (NVDA_VOL) trading volume cannot be dismissed. Finally, the trading volumes of Bitcoin (BTC_VOL) and Ethereum (ETH_VOL) are mutually Granger related.

Table 9 Granger causality test of trading volume between cryptocurrencies and market movements

Pairwise Granger Causality Tests
Sample: 1/04/2017 12/31/2021

Null Hypothesis:	*F-Statistic*	*Prob.*
INTC_VOL does not Granger Cause AMD_VOL	3.07418	0.0466
ETH_VOL does not Granger Cause BTC_VOL	4.92155	0.0074
BTC_VOL does not Granger Cause ETH_VOL	52.7704	0.0000
NVDA_VOL does not Granger Cause BTC_VOL	11.4048	0.0000
BTC_VOL does not Granger Cause NVDA_VOL	14.4122	0.0000
TSMC_VOL does not Granger Cause BTC_VOL	4.57452	0.0105
BTC_VOL does not Granger Cause TSMC_VOL	3.46531	0.0316
NVDA_VOL does not Granger Cause ETH_VOL	15.6268	0.0000
ETH_VOL does not Granger Cause NVDA_VOL	6.37473	0.0018
TSMC_VOL does not Granger Cause ETH_VOL	3.99406	0.0187
TSMC_VOL does not Granger Cause INTC_VOL	2.39853	0.0913
INTC_VOL does not Granger Cause TSMC_VOL	8.66661	0.0002
NVDA_VOL does not Granger Cause TSMC_VOL	3.05422	0.0475

The table only shows causes that cannot be rejected with a 5% confidence interval
(The null hypothesis is not rejected at 5% significant level).
Source: Authors' calculations

Table 10 Granger causality test of volatility between cryptocurrencies and market movements

Pairwise Granger Causality Tests
Sample: 1/04/2017 12/31/2021

Null Hypothesis:	*F-Statistic*	*Prob.*
AMD_VTY does not Granger Cause INTC_VTY	16.5478	0.0000
NVDA_VTY does not Granger Cause AMD_VTY	3.03975	0.0482
AMD_VTY does not Granger Cause NVDA_VTY	6.85922	0.0011
BTC_VTY does not Granger Cause INTC_VTY	51.1661	0.0000
BTC_VTY does not Granger Cause TSMC_VTY	2.5083	0.0818
ETH_VTY does not Granger Cause INTC_VTY	6.19997	0.0021
NVDA_VTY does not Granger Cause INTC_VTY	22.0374	0.0000
INTC_VTY does not Granger Cause NVDA_VTY	28.6428	0.0000
TSMC_VTY does not Granger Cause INTC_VTY	9.66306	0.0000
INTC_VTY does not Granger Cause TSMC_VTY	56.8068	0.0000
NVDA_VTY does not Granger Cause TSMC_VTY	4.81175	0.0083

The table only shows causes that cannot be rejected with a 5% confidence interval
(The null hypothesis is not rejected at 5% significant level).
Source: Authors' calculations

Table 10 shows the results of Granger causality testing between the volatility of all observed time series. The results show that we cannot reject the causality of Bitcoin return volatility (BTC_VTY) and the volatility of Intel (INTC_VTY) and TSMC (TSMC_VTY). Also, the correlation of the volatility of Ethereum (ETH_VTY) with the volatility of Intel (INTC_VTY) cannot be dismissed. However, the results show that there is no significant volatility correlation between Bitcoin and Ethereum.

CONCLUSION

Our research has shown, using various tests, that the null hypothesis about the normality of the distribution of daily returns of the most important cryptocurrencies, Bitcoin and Ethereum, can be rejected. Research results based on the estimation of the parameter α of the power law show that cryptocurrencies have similar dynamics to the stock market and that the difference between the negative and positive tails of the return distribution is significant. The results of tests of serial autocorrelation of volatility indicate a significant temporal correlation of the volatility of cryptocurrencies. The existence of data non-linearity contradicts the efficient market theory and is strongly confirmed by the BDS test. Additional support for the inefficiency of the cryptocurrency market comes from the Hurst exponent and the Inefficiency Index. The results of testing the correlation and Granger causality of cryptocurrency returns, trading volume and volatility show that the cryptocurrency market is a brand new speculative market that is weakly correlated with the stock market.

Based on all the tests conducted in this research, we can conclude that the cryptocurrency market is inefficient and provides a potential opportunity for investors to predict price trends. In this paper, we did not investigate the strong form of market efficiency and possible profitability of investing in the cryptocurrency market, taking into account the risks and transaction costs.

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DUGOROČNA KORELACIJA I EFIKASNOST TRŽIŠTA KRIPTOVALUTA

Ovaj rad ispituje efikasnost tržišta najznačajnijih kriptovaluta, Bitcoin i Ethereum. U radu koristimo više različitih testova za proveru normalnosti distribucije prinosa, dugoročne zavisnosti i postojanja heteroskedastičnosti volatilnosti prinosa. Osobine prinosa kriptovaluta upoređujemo sa prinosima akcija najznačajnijih kompanija proizvođača hardverskih komponenti za rudarenje (mining) kriptovaluta. Međupovezanost prinosa, obima trgovanja i volatilnosti između kriptovaluta i izabranih akcija izvršena je pomoću Granger testa uzročnosti. Rezultati istraživanja odbaciju hipotezu o efikasnom tržištu i pokazuju da je tržište kriptovaluta potpuno novo spekulativno tržište koje je slabo korelisano sa tržištem akcija.

Ključne reči: *hipoteza efikasnog tržišta, tržište kriptovaluta, hipoteza slučajnog hoda, dugoročna korelacija*.

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