АНАЛИ

ЕКОНОМСКОГ ФАКУЛТЕТА У СУБОТИЦИ

THE ANNALS OF THE FACULTY OF ECONOMICS IN SUBOTICA

Vol. 60
ISSN 2683-4162 (online)
УДК 330

51
2024

ЕКОНОМСКИ
ФАКУЛТЕТ
У СУБОТИЦИ
Универзитет
у Новом Саду

Анали
Економског факултета у Суботици

број 51

Суботица, 2024. године

Назив издања:
Journal:

Анали Економског факултета у Суботици

The Annals of the Faculty of Economics in Subotica

Vol. 60, број 51/2024, ISSN 0350-2120, e-ISSN 2683-4162, УДК 330

За издавача:
For Publisher:

Небојша Гвозденовић, Декан - Dean
nebojsa.gvozdenovic@ef.uns.ac.rs

Редакција:
Editorial Office:

Бојан Лековић, главни и одговорни уредник - Editor in Chief
bojan.lekovic@ef.uns.ac.rs

Марко Алексић, секретар редакције – Journal Secretary
anali@ef.uns.ac.rs

Техничка подршка:
Technical support: **Александар Вугделија,** Универзитет у Новом Саду, Економски факултет у Суботици

Језичка редакција:
Language lector: Лектор и коректор за енглески језик:
Жељко Буљовчић

Издавач:
Publisher: **Универзитет у Новом Саду**
Економски факултет у Суботици
http://www.ef.uns.ac.rs

Корице:
Front cover: **Економски факултет у Суботици**

Тираж:
Issue: 100 примерака

Штампа:
Press: **Издавачко предузеће Епоха доо Пожега**

ISSN: 0350-2120
e-ISSN: 2683-4162

По решењу Министарства за информације Републике Србије бр. 651-576/96-03

Адреса редакције:
Editorial Office: Економски факултет у Суботици
Сегедински пут 9-11, 24000 Суботица
Телефон: 024/628-000

CIP - Каталогизација у публикацији
Библиотека Матице српске, Нови Сад

378.633(497.113 Subotica)
330

ANALI Ekonomskog fakulteta u Subotici = The Annals of
the Faculty of Economics in Subotica / glavni i odgovorni urednik Bojan Leković. –
1965, 1–1981, 7 ; 1996, 1– . – Subotica : Ekonomski fakultet, 1965-1981 ;

1996– (Požega : Izdavačko preduzeće Epoha doo) . – 24 cm

Dva puta godišnje.

ISSN 0350–2120

COBISS.SR–ID 16206850

Садржај / Contents

ОРИГИНАЛНИ НАУЧНИ РАД / Original scientific article

Dražen Marić, Ksenija Leković, Sanja Džever
The impact of online recommendations on tourist's decision-making during the COVID-19 pandemic
Утицај онлајн препорука на доношење одлука туриста током пандемије COVID-19 003-013

Bojana Vuković, Teodora Tica, Dejan Jakšić
Challenges of using digital technologies in audit
Изазови примене дигиталних технологија у ревизији 015-030

Daniela Nuševa, Radenko Marić, Goran Vukmirović, Nikola Macura
Key determinants of consumers' decision making on the purchase of wristwatches on the Serbian market
Кључне детерминанте одлучивања потрошача о куповини ручних сатова на тржишту Републике Србије 031-048

Goran Pavlović
The COVID-19 pandemic and its effect on human capital and financial performance: evidence from Serbian banks
Ефекти пандемије COVID-19 на људски капитал и финансијске перформансе: случај банкарског сектора Србије 049-061

Nađa Đurić
Conceptual model of key predictors and consequences of customer satisfaction
Концептуални модел кључних предиктора и консеквенци сатисфакције потрошача 063-079

Danica Cicmil
The impact of inflation and interest rates on real estate indices in the US and EU
Утицај инфлације и каматних стопа на индексе некретнина у САД и ЕУ 081-090

Nenad Tomić
Oligopoly structure in the cryptocurrency market
Олигополска структура на тржишту криптовалута 091-104

Dekkiche Djamal, Ouled Brahim Laila
Effect of trade openness on economic growth within BRICS countries: an ARDL panel approach
Утицај отворености трговине на економски раст унутар земаља БРИКС-а: приступ АРДЛ панела 105-121

Igor Milojević, Marko Savićević, Miloš Dimitrijević
Impact of knowledge transfer on ecological innovations of acquired companies in Serbia
Утицај трансфера знања на еколошке иновације преузетих компанија у Републици Србији 123-137

Jovana Galić
Internal profitability determinants of organic production companies in Republika Srpska
Интерни фактори профитабилности привредних друштава која се баве органском производњом у Републици Српској 139-152

Списак рецензената часописа „Анали Економског факултета у Суботици“ у 2024. години (број 51) / Reviewers of the journal “Anali Ekonomskog fakulteta u Subotici” in 2024 (No 51) 154

Техничко упутство за форматирање радова / Technical instructions for paper formatting

Оригинални научни рад
Original scientific article

UDC: 338.48:[616.98:578.834-036.21
338.48:004.738.5
DOI:10.5937/AnEkSub2200012M

Original scientific article

Анали Економског факултета у Суботици – The Annals of the Faculty of Economics in Subotica
Vol. 60, No. 51, pp. 003-013
Received: 28/09/2022
Accepted: 06/12/2022
Published online: 14/12/2022

The impact of online recommendations on tourist's decision-making during the COVID-19 pandemic

Утицај онлајн препорука на доношење одлука туриста током пандемије COVID-19

Dražen Marić
University of Novi Sad, Faculty of Economics in Subotica, Subotica, Republic of Serbia,
drazen.maric@ef.uns.ac.rs https://orcid.org/0000-0002-8904-2834
Ksenija Leković
University of Novi Sad, Faculty of Economics in Subotica, Subotica, Republic of Serbia,
ksenija.lekovic@ef.uns.ac.rs https://orcid.org/0000-0002-3548-6958
Sanja Džever*
University of Novi Sad, Faculty of Economics in Subotica, Subotica, Republic of Serbia,
sanja.dzever@ef.uns.ac.rs https://orcid.org/0000-0003-1285-3484

Abstract: Electronic word-of-mouth recommendation system (eWOM) has been present since the emergence of the Internet, and it was preceded by the long-term use of the traditional recommendation system (WOM). Interaction between consumers can result in a positive and/or negative impact on their further behaviour on the market. Tourism industry attaches particular importance to the analysis of decision-making, given that the intangible nature of services makes the entire process difficult for tourists. Therefore, the aim of the paper is to examine the impact of online recommendations on the behaviour of tourist consumers in the decision-making process during the period of the COVID-19 virus pandemic. The subject of the paper is the electronic word-of-mouth recommendation system, with a special focus on tourism. During the pandemic, the consumers' lifestyle was altered enormously, while tourism was affected by restrictions and difficult business operations. Empirical research, conducted on the territory of the Republic of Serbia, included a sample of 268 respondents with different socio-demographic characteristics. The analysis of the obtained data was performed using the statistical software platform IBM SPSS Statistics and the Pearson's Correlation test, after which hypotheses 1, 2, 3 and 4 were accepted.
Keywords: recommendations; eWOM; decision-making process; tourism; COVID-19.
JEL classification: M31, L83

Сажетак: Електронски систем препорука потрошача од уста до уста (eWOM) заступљен је од појаве интернета, а претходи му дуговремена употреба традиционалног система препорука (WOM). Међусобна интеракција потрошача може резултирати позитивним и/или негативним утицајем на даљи ток њиховог понашања на тржишту. Туристичка индустрија придаје посебно велики значај анализи доношења одлука, с обзиром да неопипљив карактер услуга отежава туристима целокупан процес одлучивања. Према томе, циљ рада је испитати утицај онлајн препорука на понашање потрошача туриста у процесу доношења одлука током периода пандемије вируса COVID-19, односно, предмет рада јесте електронски систем препорука потрошача од уста до уста, с посебним осврtом на туризам. За време трајања наведене пандемије стил живота потрошача се модификовао у великој мери, док је туризам био погођен

* Corresponding author

рестрикцијама и отежаним пословањем. Емпиријско истраживање спроведено је на територији Републике Србије на случајном узорку од 268 испитаника различитих социо-демографских карактеристика. Анализа добијених података вршена је путем статистичко-софтверске платформе IBM SPSS Statistics и Пирсоновог теста корелације, након чега су хипотезе 1, 2, 3 и 4 прихваћене.
Кључне речи: препоруке; eWOM; процес доношења одлука; туризам; COVID-19.
ЈЕЛ класификација: М31, Л83

Introduction

According to Grubor et al. (2019), the influence of word-of-mouth communication (WOM) has enormously escalated through the expansion of the Internet, so it has influenced consumers' behaviour in significant directions. If consumers are not able to observe the true attributes of a product, it can impact on difficulties in decision-making process (Jalilvand, Esfahani, & Samiei, 2011). Thus, because of the intangible nature of tourism services, WOM has been accepted as the most useful source of information among travel consumers. An electronic word-of-mouth (eWOM) is innovated version that provides new possibilities, especially in reaching unapproachable market segments (Grubor, Leković, & Tomić, 2019). All information can be found online, making it simple to share and reach a huge audience of potential visitors. Due to the fact that social networks play an increasingly significant role in consumers' lives and act as informational systems for them, marketers and managers must be sufficiently familiar with new technologies and the alternatives they offer (Petronijević, & Janičić, 2021).

Therefore, the subject of the paper is the eWOM recommendation system, with a special focus on tourism.

As well as the other industries, tourism has been especially interesting for researchers due to COVID-19 virus pandemic. The first indications of the pandemic were visible at the end of 2019, while the consequences are still evident. The COVID-19 has been powerful enough to bring the tourism industry almost to an absolute halt. In order to re-establish their image and rebuild connections with the tourists, destinations have implemented crisis measures (Aktan, Zaman, Farías, Raza, & Ogadimma, 2022). According to Luković and Stojković (2020), the quick spread of COVID-19 has had a negative impact on international travel, especially on popular tourist locations like France, Italy, and Spain, as well as to nations where outbound travel is extremely common, such China and the United States.

Therefore, the aim of the paper is to examine the impact of online recommendations on the behaviour of tourist consumers in the decision-making process during the specific period of the COVID-19 virus pandemic.

1. Literature review

Tourism is the world's largest industry and is growing rapidly. Tourism is becoming a popular leisure activity globally, since millions of people travel from one place to another on daily basis. There is intense competition in tourism environment, and because of the tourists' increased knowledge, destinations face competitive threat to be replaced by other destinations. Therefore, it is essential for the destinations to maintain their competitiveness

by understanding the potential tourist behaviour in the process of choosing the destination (Dahiya & Batra, 2016).

Even though it is important to focus on the revisit of each of the tourists, there are also other factors to consider regarding the tourists' decisions. "Willingness to recommend the destination" has been referred by various authors as an indicator of travel destination loyalty. Tourists can recommend the destination to their families, friends, and the environment, regardless of revisiting it by themselves (Agapito, Oom Do Valle & Da Costa Mendes, 2011).

In industries like tourism, information can be especially recognized as the key factor influencing consumer behaviour. WOM is one of the available strategies referred to information transfer because it is communication that involves consumers discussing their experiences after service consumption (Grubor, Leković, & Tomić, 2020).

Tourists are in search process for various information on destinations or travel topics (explanations, recommendations, ratings, pictures, etc.). The process is referred to as the stage of collecting the information, which is usually before any decision has been made by the consumer. In this stage, communication between tourism providers and potential tourists is crucial because superior quality communication through a travel website should make an impact on the tourists' decision making (Nor Azazi & Shaed, 2020). According to Ismagilova et al. (2020), information is regarded as helpful if the information can be used in making a purchase decision. Also, when electronic word-of-mouth communications are being useful, they can remarkably influence an individual's purchase intention.

According to Dwityas & Briandana (2017), there are three phases of travelers' decision-making. Phase 1 is called "before the travel". This phase consists of the introduction of wants/demands to go traveling, gathering information and evaluation, and the travel decision making, which includes purchasing some products that should be carried out before the travel (tickets, booking of hotel rooms, etc.). "When travelling" represents Phase 2, which consists of the consumption of products in the scope of tourism (such as food, attractions, transportation, etc.), and searching for additional information. Finally, Phase 3, called "after the travel", consists of evaluating travel experiences and rating the satisfaction level. Travellers are going to save the impression of their experiences to embark on further travel activities in the future, depending on the rate of satisfaction they feel.

Marketers should do their research for each of these phases, because of the industry's significance. Radović, Pejanović, & Kosić (2013) state that the significance of tourism is multiple:

- Economic: direct economic impacts (impact on social product and national income, impact on the employment level of the local population and the level of their living standards, etc.) and indirect economic impacts (agriculture, mining, etc.);
- Social: cultural, educational, health effects, etc. are significant;
- Political: tourism has been seen as a factor of preserving peace in the world.

Despite all the advantages, the policy of restricting visits to tourist destinations because of the COVID-19 pandemic has had an effect on the management of tourist areas experiencing losses (Yan Syah, Rianto Rahadi, & Farid, 2021). COVID-19 is a global pandemic that appeared first in China but started to spread quickly across the entire world through human-to-human transmission (Rahman, Gazi, Bhuiyan, & Rahaman, 2021). The main effect of COVID-19 on the world is a tragedy for individuals, affecting the health of hundreds of thousands of people, but it is also having a growing effect on the economy and the global economy (Gajić et al., 2021). International travel restrictions, as well as the implementation of quarantine to combat the spread of the COVID-19 pandemic, cause significant losses in the tourism industry. It should be noted that the current crisis is biological in nature, and no effective vaccine to prevent the COVID-19 virus has been developed. In order to tackle COVID-19, widespread quarantine and extensive self-isolation have emerged as the key strategies. Consequently, most governments strongly restrict the freedom of travel for residents (Lyulyov et al., 2020). Most nations have implemented short-term travel restrictions to prevent the spread of disease, raising concerns about the COVID-19 pandemic's impact on the global tourism industry (Rahman, Gazi, Bhuiyan, & Rahaman, 2021).

Also, WOM communication becomes interesting in promoting a product or service because consumer behaviour in relation to traditional advertising and other marketing communications is less responsive. Thus, in the conditions of the COVID-19 pandemic, eWOM is a solution in conveying something without direct interaction with consumers (Yan Syah, Rianto Rahadi, & Farid, 2021).

2. Methodology

Regarding the aim of research, the survey was conducted in the post COVID-19 period (from July to September 2022) on the territory of Serbia. In line with post-pandemic consequences, respondents received a questionnaire through social media platforms Facebook and LinkedIn. It was filled in by 268 respondents in total, who have been using travellers' websites.

For the purposes of writing this paper, the convenience sample has been narrowed down to respondents who had read online recommendations of other tourists specifically during the COVID-19 pandemic, i.e., from 2020 to 2022.

Table 1: Number of consumers who had read online recommendations during the COVID-19

"I read online recommendations of the other tourists during the pandemic."				
		Frequency:	Percentage:	Cumulative percentage:
Valid:	Yes	132	49.3%	49.3%
	No	136	50.7%	100.0%
	Total:	268	100.0%	

Source: the authors' research

Table 2 gives the presentation of the sample, since the tourist consumers have different socio-demographic profiles regarding genders, age groups, education levels, etc. This structure is visible in the first section of the questionnaire.

Table 2: Socio demographic structure of the participants (N = 132)

Feature:	Item:	Frequency:	Percentage:
Gender:	Female	82	62.1%
	Male	50	37.9%
Age:	18 - 20	6	4.5%
	21 - 30	78	59.1%
	31 - 40	25	18.9%
	41 - 50	19	14.4%
	50+	4	3.1%
Education level:	Secondary school diploma	31	23.5%
	Bachelor's degree	57	43.2%
	Master's degree	29	22.0%
	Ph.D.	15	11.4%
Employment status:	Student	29	22.0%
	Employed	86	65.2%
	Unemployed	7	5.3%
	Retired	1	0.8%
	Employer	9	6.8%
Marital status:	Married	101	76.5%
	Single	31	23.5%
Mode of travel:	Solo	5	3.8%
	Friends	44	33.3%
	Family	34	25.8%
	Partner	49	37.1%
Frequency:	Once a year	37	28.0%
	Twice a year	44	33.3%
	Several times a year	51	38.6%
Usage of travellers' website:	0-2 years	61	46.2%
	3-6 years	50	37.9%
	More than 6 years	21	15.9%

Source: the authors' research

In addition to socio-demographic parts, the questionnaire contained the second section, i.e. 17 constructs modified by the authors and originally created by Nilashi et al.

(2022). The respondents in the convenience sample were asked to rate the set of statements through a Likert scale.

The paper presents a part of research testing correlations of tourist destination choice and several variables related to eWOM and the source of the eWOM, presented in Table 3.

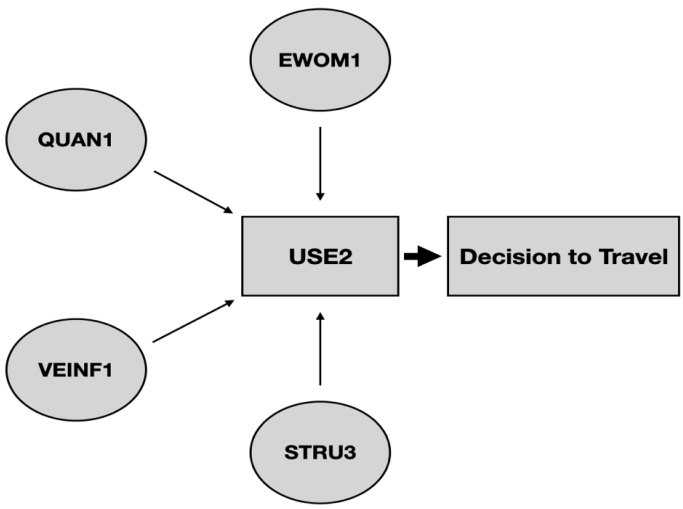
Table 3: Survey items significant for the paper

Factor:	Items:	Survey questions:
eWOM usefulness	USE2	I have chosen travel destination based on the online recommendations.
Visual and external information	VEINF1	Many reviewers take photos of the destinations.
Source trustworthiness	STRU3	I think the source of the comments is accurate and reliable.
Existing eWOM	EWOM1	The website presents WOM in a clear way.
eWOM quantity	QUAN1	I have found many reviews on the website.

Source: the authors' research based on the survey originally created by Nilashi et al. (2022)

The significant items were processed using IBM SPSS Statistics, a statistical software platform. According to International Business Machines Corporation - IBM (2021), the platform offers a user-friendly interface and a robust set of features that enable the rapid extraction of useful insights from data.

Figure 1: Research framework



Source: the authors' research

In order to analyse the impact of online recommendations on tourists' decision making during COVID-19, the variables were tested through Pearson's Correlation test.

Pearson's Correlation is a measure of the linear association between 2 normally distributed random variables (Schober, Boer, & Schwarte, 2018).

3. Results and discussion

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

H_1: Visual and external information has a positive influence on decision to travel

Table 4: Correlation of eWOM usefulness and visual and external information

Correlations			
		USE2:	VEINF1:
USE2:	Pearson correlation	1	.298**
	Sig. (2-tailed)		<.001
	N	132	132
VEINF1:	Pearson correlation	.298**	1
	Sig. (2-tailed)	<.001	
	N	132	132
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: the authors' research

The obtained data have a statistically significant correlation, given the fact that p is < 0.001, which is lower than the significance limit, i.e., p < 0.01. Since the coefficient r is equal to 0.298, the statistical relationship is characterized by low intensity, i.e., intensity in the set 0.1 - 0.3. The positive sign testifies that the increase of one of the variables will affect the increase of the other. In other words, if online recommendations contain more photos and visual information, it is more likely that tourist consumers are going to choose a travel destination based on it.

H_2: Source trustworthiness has a positive influence on decision to travel

Table 5: Correlation of eWOM usefulness and source trustworthiness

Correlations			
		USE2:	STRU3:
USE2:	Pearson Correlation	1	.340**
	Sig. (2-tailed)		<.001
	N	132	132
STRU3:	Pearson Correlation	.340**	1
	Sig. (2-tailed)	<.001	
	N	132	132
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: the authors' research

The obtained data have a statistically significant correlation, given the fact that p is < 0.001, which is lower than the significance limit, i.e., p < 0.01. Since the coefficient r is 0.340, the statistical relationship is characterized by medium intensity, i.e., intensity in the set 0.3 - 0.5. The positive sign testifies that the increase of one of the variables will affect

the increase of the other. In other words, if tourist consumers start to think more that the source of the comments is accurate and reliable, it is also more likely that they are going to choose a travel destination based on it.

H_3: Existing eWOM has a positive influence on decision to travel

Table 6: Correlation of eWOM usefulness and visual and existing eWOM

Correlations			
		USE2:	EWOM1:
USE2:	Pearson correlation	1	.383**
	Sig. (2-tailed)		<.001
	N	132	132
EWOM1:	Pearson correlation	.383**	1
	Sig. (2-tailed)	<.001	
	N	132	132
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: the authors' research

The obtained data have a statistically significant correlation, given the fact that p is < 0.001, which is lower than the significance limit, i.e., p < 0.01. Since the coefficient r is equal to 0.383, the statistical relationship is characterized by medium intensity, i.e., intensity in the set 0.3 - 0.5. The positive sign testifies that the increase of one of the variables will affect the increase of the other. In other words, the more clearly a website presents WOM, the more likely it is that tourist consumers are going to choose a travel destination based on it.

H_4: eWOM quantity has a positive influence on decision to travel

Table 7: Correlation of eWOM usefulness and eWOM quantity

Correlations			
		USE2:	**QUAN1:**
USE2:	Pearson Correlation	1	.321**
	Sig. (2-tailed)		<.001
	N	132	132
QUAN1:	Pearson Correlation	.321**	1
	Sig. (2-tailed)	<.001	
	N	132	132
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: the authors' research

The obtained data have a statistically significant correlation, given the fact that p is < 0.001, which is lower than the significance limit, i.e., p < 0.01. Since the coefficient r is 0.321, the statistical relationship is characterized by medium intensity, i.e., intensity in the set 0.3 - 0.5. The positive sign testifies that the increase of one of the variables will affect the increase of the other. In other words, if a website contains more reviews, it is more likely that tourist consumers are going to choose a travel destination based on it.

Conclusion

With the aim of contributing to the recovery of the tourism industry from COVID-19 restrictions, electronic word-of-mouth recommendation system (eWOM) has been presented as a powerful weapon by many authors.

In this paper, it has been proven by testing the set of variables that there are significant correlations between existing eWOM, its quantity, source trustworthiness and visual information with eWOM usefulness in travel. All of the correlations are positive, which results in accepting the established hypotheses:

- H_1: Visual and external information have a positive influence on decision to travel.
- H_2: Source trustworthiness has a positive influence on decision to travel.
- H_3: Existing eWOM has a positive influence on decision to travel.
- H_4: eWOM quantity has a positive influence on decision to travel.

Similar results were presented by Nilashi and associates (2022): The results in both stages of data analyses indicated the significant role of the eWOM during the current COVID-19 pandemic for the decision to travel. The authors suggested that there is a positive impact of source trustworthiness on e-trust (H_8) and that the quantity of eWOM has a huge impact on e-trust (H_4). According to them, the number of eWOM on the electronic portal is a significant factor, as the volume of the online reviews reflects the popularity of the seller or the product. The authors also suggested that there is a positive impact of existing eWOM on e-trust (H_1). When a person utilizes an online portal, he or she evaluates the feedback left by other users to get over any uncertainty regarding the calibre of the services being offered. Internet reviews that are present on the online portal are regarded as the face of the company's online reputation. Customers can advertise for the company online, which helps it rank higher in search results, increase sales, provide managers feedback, and encourage customers to make a purchase.

However, this study has a limitation of quite a small number of significant respondents out of the total number. Future research should utilize a wider range of databases. The second limitation of this study is also linked to the respondents, i.e., their place of residence. During the COVID-19, different countries implemented different forms and degrees of restrictions, not also generally but also in terms of measures related to tourist industry. Thus, there is an assumption that travellers from different countries had different perceptions of eWOM and tourism at the same time. Future research of international character should deal with this issue.

Despite the limitations, this study can make a significant contribution because the survey was conducted in 2022, which means it represents a sample of the most recent pattern of consumers' extremely variable behaviour. The findings should help travel managers and marketing experts better understand the significance of eWOM.

References

Agapito, D., Oom Do Valle, P., & Da Costa Mendes, J. (2011). Understanding tourist recommendation through destination image: a CHAID analysis. *Tourism & Management Studies*, *7*(7), 33.

Aktan, M., Zaman, U., Farías, P., Raza, S.H., & Ogadimma, E.C. (2022). Real bounce forward: experimental evidence on destination crisis marketing, destination trust, e-WOM and global expat's willingness to travel during and after COVID-19. *Sustainability*, *14*(3), 1111. Doi: https://doi.org/10.3390/su14031111

Dahiya, K. S., & Batra, D. K. (2016). Tourist decision making: exploring the destination choice criteria. *Asian Journal of Management Research*, *7*(2), 140-153.

Dwityas, N. A., & Briandana, R. (2017). Social media in travel decision making process. *International Journal of Humanities and Social Science*, *7*(7), 2221-0989.

Gajić, T., Popov Raljić, J., Čerović, S., Aleksić, M., & Sikimić, V. (2021). Attitude of employees on the application and significance of HACCP system in rural tourist households in Serbia during COVID-19. *Economics of Agriculture*, *68*(4), 929-944. Doi: https://doi.org/10.5937/ekoPolj2104929G

Grubor, A., Leković, K., & Tomić, S. (2019). Tourists' recommendations: WOM becomes digital. *ENTRENOVA - ENTerpriseREsearchInNOVAtion Conference*, Rovinj, Croatia, *IRENET - Society for Advancing Innovation and Research in Economy*, Zagreb, *5*, 493-501. Doi: https://doi.org/10.2139/ssrn.3492235

Grubor, A. Leković, K., & Tomić, S. (2020). Tourists' recommendations: socio-demographic analysis. *ENTRENOVA - ENTerpriseREsearchInNOVAtion Conference*, Virtual Conference, *IRENET - Society for Advancing Innovation and Research in Economy*, Zagreb, *6*, 441-449. Doi: https://doi.org/10.2139/ssrn.3492235

IBM Corporation. (2021). IBM SPSS Statistics. https://www.ibm.com/products/spss-statistics (7 September 2022)

Ismagilova, E., Slade, E. L., Rana, N. P., & Dwivedi, Y. K. (2020). The effect of electronic word of mouth communications on intention to buy: a meta-analysis. *Information Systems Frontiers*, *22*(5), 1203-1226. Doi: https://doi.org/10.1007/s10796-019-09924-y

Jalilvand, M.R., Esfahani, S.S., & Samiei, N. (2011). Electronic word-of-mouth: challenges and opportunities. *Procedia Computer Science*, *3*, 42-46. Doi: https://doi.org/10.1016/j.procs.2010.12.008

Luković, S., & Stojković, D. (2020). Covid-19 pandemic and global tourism. *Hotel and Tourism Management*, *8*(2), 79-88. Doi: https://doi.org/10.5937/menhottur2002079L

Lyulyov, O., Us, Y., Pimonenko, T., Kwilinski, A., Vasylieva, T., Dalevska, N., Polcyn, J., & Boiko, V. (2020). The link between economic growth and tourism: COVID-19 impact. *Proceedings of the 36th International Business Information Management Association (IBIMA)*, November 2020, Granada, Spain.

Nilashi, M., Abumalloh, R. A., Alrizq, M., Alghamdi, A., Samad, S., Almulihi, A., Althobaiti, M.M., Ismail, M. Y., & Mohd, S. (2022). What is the impact of eWOM in social network sites on travel decision-making during the COVID-19 outbreak? A two-stage methodology. *Telematics and Informatics*, *69*, 101795. Doi: https://doi.org/10.1016/j.tele.2022.101795

Nor Azazi, N. A., & Shaed, M. M. (2020). Social Media and Decision-Making Process among Tourist: A Systematic Review. *Malaysian Journal of Communication*, *36*(4), 395-409. Doi: https://doi.org/10.17576/JKMJC-2020-3604-24

Petronijević, A., & Janičić, R. (2021). Factors that influence cultural tourists to use e-WOM before visiting Montenegro. *Ekonomika,* *67*(3), 1-18. Doi: https://doi.org/10.5937/ekonomika2103001P

Radović, G., Pejanović, R., & Kosić, K. (2013). Koncept organizovanja održivog razvoja ruralnog turizma u Republici Srbiji. *Anali Ekonomskog fakulteta u Subotici*, *49*(29), 421-432.

Rahman, M. K., Gazi, M.A. I., Bhuiyan, M. A., & Rahaman, M.A. (2021). Effect of COVID-19 pandemic on tourist travel risk and management perceptions. *PLoS ONE*, *16*(9). Doi: https://doi.org/10.1371/journal.pone.0256486

Schober, P., Boer, C., & Schwarte, L. A. (2018). Correlation coefficients: appropriate use and interpretation. *Anaesthesia & Analgesia Journal*, *126*(5), 1763-1768. Doi: https://doi.org/10.1213/ANE.0000000000002864

Yan Syah, L., Rianto Rahadi, D., & Farid, M. M. (2021). The influence of Word-of-Mouth online and celebrity endorser on attitudes and intentions of tourists to visit Indonesia during the COVID-19 pandemic. *Journal of Management and Leadership*, *4*(2), 38-60. Doi: https://doi.org/10.47970/jml.v4i2.240

UDC: 3.073.526:004
DOI: 10.5937/AnEkSub2300014V

Original scientific article

Анали Економског факултета у Суботици – The Annals of the Faculty of Economics in Subotica
Vol. 60, No. 51, pp. 015-030
Received: 11/10/2022
Accepted: 23/02/2023
Published online: 06/03/2023

Challenges of using digital technologies in audit

Изазови примене дигиталних технологија у ревизији

Bojana Vuković
University of Novi Sad, Faculty of Economics in Subotica, Subotica, Serbia, bojana.vukovic@ef.uns.ac.rs, https://orcid.org/0000-0002-2147-8877
Teodora Tica*
University of Novi Sad, Faculty of Economics in Subotica, Subotica, Serbia, teodora.tica@ef.uns.ac.rs, https://orcid.org/0000-0002-7376-2124
Dejan Jakšić
University of Novi Sad, Faculty of Economics in Subotica, Subotica, Serbia, dejan.jaksic@ef.uns.ac.rs, https://orcid.org/0000-0003-1711-1869

Abstract: Every company must consider the changes in a digital environment. In the era of digital transformation, the company understands the importance of information technologies, and makes adjustments in the form of structural changes. Modern technology usage provides the possibility of the analysis of previously unimaginable types and amounts of data, and introduces significant changes in the field of auditing. By simplifying the audit work, digitalization has also created new opportunities for IT auditing. The aim of this paper is to present the opportunities and challenges of key digital trends in auditing, or the usage of big data analytics, artificial intelligence, blockchain technology, and robotic process automation. There is an emerging need for auditors to take advantage of digital technology usage and respond to the challenges of digitalization in a systematic and high-quality way. The progress of using digital technologies in auditing is contributing to more reliability and better quality reporting, which is leading to increased trust among stakeholders in the results of audit work.
Keywords: audit, digitalization, digital technologies
JEL classification: M42

Сажетак: Свака компанија треба да размотри промене у дигиталном окружењу. У ери дигиталне трансформације, компаније увиђају важност информационих технологија, те се прилагођавају у виду структуралних промена. Употреба модерних технологија пружа могућност анализе до тада незамисливе врсте и количине података и уводи значајне промене у област ревизије. Олакшавајући рад ревизора, дигитализација такође ствара нове могућности за ИТ ревизију. Циљ овог рада јесте да представи могућности и изазове употребе кључних дигиталних трендова у ревизији, односно употребу аналитике великих података, вештачке интелигенције, блокчејн технологије и роботске аутоматизације процеса. Постоји потреба да ревизори искористе предности употребе дигиталних технологија и одговоре на изазове дигитализације на систематичан и квалитетан начин. Напредак у употреби дигиталних технологија у ревизији доприноси већој поузданости и квалитетнијем извештавању, што утиче на раст поверења заинтересованих страна у резултате ревизорског рада.
Кључне речи: ревизија, дигитализација, дигиталне технологије
ЈЕЛ класификација: M42

*Corresponding author.

Introduction

Modern organizations must embrace digital and advanced technology to stay ahead of the competition on local and international markets and meet customers' growing requirements (Musabegović et al., 2021). Digitization is a new trend that requires personnel changes, new approaches to management, and changes in business processes (Nazarova et al., 2021). The application of information technologies is of critical importance for the realization of operational tasks, the storage of financial and operational data as well as the preparation of financial and other managerial reports (Gray & Abdolmohammadi, 2016). Digital business transformation modifies the existing manner of conducting business by using modern and contemporary technology to improve operating performance and satisfaction of customers (Ivanović & Marić, 2021). In an era characterized by digital transformation, management must focus on the risks associated with the functioning of information technologies. Information technology risks do not only threaten the digital environment but also the entire business of a company (Aditya et al., 2018). The digital transformation of business requires constant improvement and optimization of the audit function (Nazarova et al., 2021). The use of new technologies in auditing affects the growth of the auditing companies' competitiveness. The challenges of IT auditing in the context of digitization are reflected in the enhanced available data volume, the new technology appearance and reform regulations and requirements (Dzuranin & Cand Mălăescu, 2016). The increased volume of available data leads to the emergence of problems related to the integrity, reliability, completeness, and security of data. The application of new technologies leads to new chances and risks for companies, which has an indirect impact on IT auditing since it faces new requirements and risks.

Technological advances and the resulting digitization of data and processes have strongly influenced the inputs, tools, and information available in the audit process (Lugli & Bertacchini, 2022). The incorporation of technology into the critical operations of a large number of organizations increases the complexity and importance of IT auditing. For an auditor performing an audit in an IT environment, it is important to understand the characteristics of that environment, since different information and telecommunication technologies present the auditor with different challenges, sometimes making her job easier, and sometimes making it more difficult. The role of IT audit varies across companies, even if they are in the same industry (Aditya et al., 2018). In other words, the role of IT audit cannot be universal since each company is characterized by a different IT audit universe and IT specificities of each audit engagement. Despite the comprehensive and overwhelming impact of information technology, it cannot be said that the fundamental role of audit services has changed. Auditors should still gather evidence that enables them to form an opinion on some aspect of the audit client's activities and to inform interested parties about factual findings. In addition, the basic structure of the audit approach remains unchanged when the audit is conducted in an IT environment. Contracting, planning, testing, and reporting are still the basic framework in which auditing is carried out in an IT environment. Information technologies can be applied at any stage of the audit process (Mariia & Viktoriia, 2020).

The aim of this paper is to analyse the role and importance of digitalisation in the automation of operations and the audit methodology, starting from the planning, control, documentation, and audit itself, to the preparation of the audit opinion. Digital technologies represent a key source of data for decision-making, internal management, planning, and reporting issues. By changing the nature of accounting and auditing jobs, new technologies such as big data, blockchain technology, artificial intelligence, and robotic process automation also affect the growth of audit process flexibility and efficiency.

1. Information technologies and audit

Not so long ago, computers were completely unknown in the business environment, but the situation has changed radically in recent decades (Since, 2021). Today, it is difficult even to imagine that it is possible to successfully organize a business without applying some form of information and telecommunication technologies (Andrić et al., 2011). Companies in numerous industries have transformed their products and activities and transferred them to the digital ecosystem to improve their business and become leaders (Aditya et al., 2018). These technologies have entered every pore of economic life and imposed themselves as a *conditio sine qua non* of survival on the market. Information technologies have an indirect influence on the function of accounting data verification. They also influence the determination of the audit subject since the auditor evaluates the quality of the accounting data processing system. On the other hand, auditors rely on a wide range of computer-assisted techniques and tools in their work, which significantly increases the demand for qualification levels in the field of information technology.

The business conditions in which auditors operate are becoming more and more complex under the influence of globalization, growth in the scope and type of activities, and the use of electronic data. Computer-assisted audit methods can be used to perform a variety of audit procedures, including testing of information processing in the client's accounting system, analytical review of procedures to identify uncertainties, access to data files and libraries, software compliance tests, and testing management and accounting systems (Nazarova et al., 2021). At a time when thousands of accounting transactions take place almost simultaneously, it is not easy to be sure of your conclusions. Auditors are confronted with different IT environments for different clients. Additionally, the same information technologies change extremely quickly, and audit clients respond to these changes with more or less success. The same software platforms can provide different quality of accounting processing in different companies, depending on the success of the software adaptation procedures, staff training, resistance to changes, etc. (Andrić et al., 2015).

The application of information technologies does not affect the change in the purpose of the audit process. However, it should be borne in mind that it directly affects the sequence and methods of its implementation, audit planning, documentation process, assessment of materiality and audit risk, as well as the determination of the scope, content, and method of audit process implementation and evaluation of corroborating audit evidence (Mariia & Viktoriia, 2020). For a long time, IT auditing focused on compliance and disclosure of what happened in the previous period. A modern approach to IT auditing requires the audit to be risk-oriented and focused on business contribution. In other words,

modern IT audit is considered the "right hand" of the subject of the audit, which should contribute to the continuous improvement of business performance, which means that IT audit is to be focused on the future instead of the past (Aditya et al., 2018). Moreover, with the introduction of digital technologies, both the auditors and the clients inevitably support the introduction of sustainable “green” business (Stojanović, 2020).

2. Auditor skills in a digital age

Establishing a digital workplace should be a priority for many firms, but it should not be directed only by technology, while ignoring employees, data, and procedures (Raković et al., 2022). The processing of accounting data by computer usage led to the growth of the required auditor’s skills and competencies. The complex IT environment in which the audit is performed must not lead to the formulation of an audit opinion at a level of assurance that is less than reasonable, as required by generally accepted auditing standards. If the audit wants to keep its place as a central mechanism for ensuring the stability of financial markets, auditors in the IT environment must provide quality audit reports that will contain an opinion that increases the credibility of financial statements to an acceptable level. However, the auditor must take into consideration that the accounting and control environment affected by information technologies also requires specific audit approaches (Andrić et al., 2011). The absence of regulations dealing with specific areas of information system testing by auditors is also noticeable (Andrić et al., 2015).

The exponential increase in the volume of accounting data creates inherent limitations for a traditional audit to provide a reasonable assurance service. Large amounts of information must be used effectively for the audit engagement to be conducted with high quality. Large and complex data sets are analysed in a modern environment with the application of robust and predictive software solutions. In addition, competence in working with large data sets opens opportunities for auditors to offer new consulting services to the market (Earley, 2015; Richins et al., 2017). In addition, data analytics can be used in the area of non-financial data and external data to improve audit planning processes, especially risk assessment, as well as in areas that require auditor subjective judgment, such as going concern and valuation issues (Earley, 2015).

Since data analytics has the potential to improve data availability and insight into data from various databases and sources, auditors gain the ability to use data analytics to detect fraud (Tang & Karim, 2019). An important modern outcome of audit in the IT environment is an improved level of audit testing. The audit profession is currently experiencing a paradigm shift from traditional audits with samples to digital audits of complete data analysis due to breakthroughs in digital technologies (Fotoh & Lorentzon, 2020). The audit approach in the digital environment, which is based on risk assessment, provides the possibility to direct the audit approach towards the detection of anomalies instead of searching through limited data sets, which is the characteristic of the traditional audit approach. By anomalies, we usually mean discrepancies between the data and the auditor's expectations of the data based on knowledge of the business. When combined with artificial intelligence, data analytics has the potential to improve future audits by leading to

the creation of a knowledge base that can be used across different audit engagements and different periods (Earley, 2015). Despite the high expectations that data analytics will enable the testing of complete data sets rather than the sampled data which has been the dominant audit approach for decades, auditors must be aware that this does not mean that they will be able to provide more than reasonable assurance, nor that the meaning of the term "reasonable assurance" will change (Fotoh & Lorentzon, 2020).

3. Digital technologies

Digital technologies today encompass all aspects of business, which affected the change in the speed of business operations of organizations, the level of flexibility in terms of decision-making, strategic positioning, and the achievement of economic efficiency (Bhimani & Willcocks, 2014). The application of digitization in the audit process affects the time reduction necessary for issuing audit reports. A key differentiating factor from the competition is the perception of auditors as professionals who can keep up with technological advances. Companies use digital technologies to reduce costs, improve operational efficiency and improve internal control systems (Fotoh & Lorentzon, 2020).

3.1. Big Data

Big Data analysis provides the ability to process data in real-time, and examine entire data sets instead of focusing on samples. Big data represents an extremely large database that includes financial and non-financial data, emails, social media data, internet pages, phone calls, financial market files, market trends data, customer behavior data and other internal and external data. Big Data Framework includes internal and external data in the audit process (Yudowati & Alamsyah, 2018). The key dimensions of Big Data include volume, variety, and velocity, while additional dimensions are veracity, variability and value (Gandomi & Haider, 2015). Volume implies the size of the data, so big data sizes are presented in multiple terabytes and petabytes. Big data volume is conditioned by factors such as time and type of data, as well as industry type. Diversity encompasses the structural heterogeneity of a data set or a wide range of data types, sources and formats. The last characteristic is the speed with which data is generated, analysed and acted upon and moving in and out of companies, given that existing, traditional systems cannot manage such large data sources. Veracity refers to the unreliability that characterizes some data sources, and tools are used to manage and mine uncertain and imprecise data. Variability implies changes in the speed of data flow, while complexity refers to the generation of large data from different sources. The last attribute of big data is value because big data is characterized by a density with a relatively low value, i. e. low value in relation to the volume.

According to Dagilienė & Klovienė (2019), the use of Big Data and Big Data analytics in external audits relies on the following contingent factors: environment, company size, technology, strategic orientation and structure. Earley (2015) considers that the key benefits of using Big Data in auditing are possibility of testing a large number of transactions, providing a more comprehensive insight into the client's process, easier detection of fraud through the use of methods and technologies, and offer resources and a

better solution to the client's problem. The key motives for applying big data technology are reflected in minimizing hardware costs, determining the big data value before committing a large volume of company resources, and reducing processing costs (Khan et al., 2014).

Big Data and Big Data analytics affect the accounting and auditing practice and nature (Appelbaum, 2016). The need for advanced analytical tools usage was also imposed by the regulatory authorities and the quality control system. Big data techniques as audit tools could add value to the audit process and improvement of audit results quality through reliability, sufficiency, and relevance of evidence (Gepp et al., 2018). The use of Big Data has the best application in the planning and execution phase of auditing, that is, the collection and evaluation of audit evidence. BDA has an indirect influence on the audit planning process since strategies and audit plans are developed relying on information from the client's environment. On the other hand, there is a direct impact on substantive testing, assessments, and reports. The application of Big Data tools provides the auditor with a better perception of the client's environment, a focus on the areas of greatest risk and a reduction in the probability that the auditor will form an opinion that is not correct.

Data analytics represents the process of reviewing, cleansing, transforming and modelling Big Data in order to determine information and patterns that can be used and to form conclusions and support decision-making (Rickett, 2017). The Big Data tools usage has limited use in small auditing companies, since they often do not have enough competent staff, and have limited technology at their disposal. On the other hand, large audit companies treat Big Data and Big Data analytics as a long-term competitive advantage in the audit market and an integral segment of assurance practice which leads to building long-term trust with customers (Dagilienė & Klovienė, 2019). The issue of data reliability verification is given special attention in Big Data-based auditing which provides the opportunity for auditors to perform activities based on structured and unstructured information. According to El Monem Serag et al. (2020) the application of BDA affects the improvement of audit relevance by expanding the scope of audit services, developing a new audit profile, developing a culture of innovation at the level of audit companies, and improving the role of audit as a governance mechanism. As a direct result of the digital revolution that businesses are experiencing, the function of audit specialists is undergoing transition. The use of technology for handling ever-increasing amounts of data can contribute to the delivery of high audits and enables auditors to concentrate mostly on evaluating threats and gaining corporate ideas (Salijeni et al., 2021).

3.2. Artificial intelligence

Artificial or machine intelligence represents the ability of machines to imitate the natural intellect of humans and cognitive skills. It is the ability of the algorithm to repeat the process, for example, to review invoices or control payment and inventory. This is the principle that defines this form of technology as smart and intelligent. Artificial intelligence provides the opportunity to determine extreme and negative values, extremely high amounts of payments in the off-season, double entries of suppliers, and invoices through programmed algorithms. Artificial intelligence represents computer systems in human

intelligence form that includes technologies such as data mining, machine learning, image and speech recognition, and sentiment analysis. Sophisticated models based on machine learning serve to encode accounting entries and improve fraud detection (Ukpong et al., 2019). The key difference between standard digital systems and systems based on machine learning is that one is built for data, while the other is built from data. Therefore, data management is the basis for the application of key audit automation capabilities.

Artificial intelligence technologies such as visual recognition, natural language processing, audio processing, and text analysis create the basis for its application in auditing (Issa et al., 2017). In audit engagements, Artificial intelligence is applied to enhance warehouse operations and issues of inventory affecting the lesser possibility of human errors. Artificial intelligence techniques can scan words, recognize documents, linguistic patterns, and physical shapes and derive supporting information from receipts, reports, records, sheets, transactions, and contracts for further human examination. In the context of artificial intelligence, substantial data and processing power are needed, available in large volumes nowadays. Also, there has been an increase in both proprietary and open-source artificial intelligence software over the past few years (Kokina & Davenport, 2017). Through artificial intelligence, the auditor's time and potential are saved in order to perform tasks with greater added value. In order to fulfil the requirements of Artificial Intelligence usage, the auditing company capabilities should be built in the following areas: data management, data pre-processing, automation with low-variability, and complex automation of tasks (Naqvi, 2020). The development of complex systems based on artificial intelligence, reflected in the form of expert systems and neural networks, aims to help auditors in decision-making, considering the shortcomings of the manual decision-making process.

Under the influence of the digital economy, the traditional audit activity model is replaced with an intelligent AI audit. Artificial intelligence may affect recruitment criteria defined by audit firms, which will unexceptionally include software engineering skills related to Artificial Intelligence. Finally, audit firms would have to be more familiarized with the clients' accounting high-tech software, which would subsequently affect their independence. In the application of Artificial intelligence, it is necessary to consider the correct setting of the algorithm and the reduction of the risk of misuse due to the collection of a large amount of sensitive data, such as personal data. In the following table, a comparison is made between the AI-based audit process and the traditional audit process (Issa et al., 2017).

Table 1: The comparison between AI-Enabled Automated Audit Process and Traditional Audit Process

Phase	Automated Audit Process enabled by Artificial intelligence	Traditional Audit Process
Pre-Planning	Big Data is collected and analysed by Artificial intelligence. The organizational structure of the client, operational methods, accounting, and financial systems feed into AI system.	The client’s industry is examined by the auditor. The client’s organizational structure, operational methods, accounting, and financial systems are examined by the auditor.

Contracting	Al uses the risk level estimation from the Pre-Planning phase. Al calculates audit fees and the number of hours. The database of contracts is analysed by AI and the contract is prepared by AI The contract is signed by the auditor and the client.	Auditor prepares an Engagement letter based on the estimated client risk. The contract is signed by the auditor and the client.
Internal Controls Understanding and Risk Factors Identifying	Flowcharts, questionnaire answers, and narratives are entered into the AI system Image recognition and text mining are used to analyse flowcharts, questionnaire answers, and narratives. The walkthrough is conducted by drones. The generated video is analysed by AI Risk factors are identified by visualization and pattern recognition. All these data are aggregated by AI in order to identify fraud, and illegal-acts risk factors.	Understanding documents through Flowcharts, Questionnaires, Narratives, Walkthrough. Auditors aggregate information and identify factors of risks. The scope, nature, and timing of substantive tests are determined by understanding IC.
Control Risk Assessment	Controls are continuously examined by continuous control monitoring systems Proper IC implementation is verified by process mining runs by AI. Logs are automatically generated in order to ensure the integrity.	Client's IC policies and procedures examination Assessment of risk for each attribute Controls test Risk reassessment Testing of controls documentation Sampling-based tests on a periodical basis Nature, extent, and timing depend on IC Tests Test of details of a sample of transactions Test of details of balances Analytical procedures
Substantive Tests	Quality of Data and Evidence are ensured by Continuous Data Quality Assurance. Data provenance is examined by AI. Test of details of transactions on 100% of the population. Test of details of balances on a continuous basis. Continuous pattern recognition, outlier detection, benchmarks, and visualization.	Clarity, sufficiency, and acceptability of collected evidence must be evaluated by the auditor. The auditor could collect more evidence or withdraw from the engagement.
Evidence Evaluation	This becomes part of the previous phase	
Reporting	A predictive model for estimating the	Previous information in order to

	identified risks is used by AI. Continuous audit report, graded for example 1-00, rather than categorical opinion (adverse, qualified).	issue a report is aggregated by the auditor. There is categorical opinion such as clean, adverse, and qualified.

Source: Issa et al. (2017)

3.3. Blockchain technology

Blockchain technology was developed due to the bitcoin introduction as a new value unit. It eliminates the necessity for a mediator by enabling direct communication between buyers and sellers. Based on the principle of a chain where each of the participants represents a single link or node, blockchain technology enables all parties in the chain to be equally presented with data, and to carry out different exchanges of values, rights, obligations, and transactions. This is the reverse of the present practice, in which individuals may see distinct records that are individually modified and evolved. This technology can affect all recording processes or how transactions are initiated, authorized, recorded, and also eliminates the need for transaction processors that is centralized. By using the blockchain, it is easy to access all the activities of the past periods. The application of blockchain technology can lead to a reduction in transaction costs and a reduction in transaction settlement time. The adoption of blockchain-based accounting systems is conditioned by the following factors: uncertainty, relative advantage, support of top management, industry, technology readiness, regulatory framework, trust, and competition (Sujata & Shalini, 2021).

According to Nezhyva & Miniailo (2020), blockchain technology is suitable for accounting and auditing since it ensures monitoring of all transactions and system changes, and prevents distortion and manipulation. Blockchain technology represents the primary source of data verification that accountants report to users of accounting-generated information (Supriadi et al., 2020). Joining blockchain technology is usually done by downloading software and the bitcoin ledger. Further, mentioned manner of logging also avoids the blockchain from recording the same element many times in multiple locations which has contributed to an improvement in the accurate reporting of the information compiled by the software platforms. However, blockchain technology cannot completely replace audit judgment, i.e. whether assets and liabilities have been properly valued and qualified and whether a transaction has been conducted between related parties.

There are two basic classifications of blockchain networks depending on whether everyone who has access to the Internet has access to the data in the form of a public blockchain or the data could only be shared with certain participants in the form of a private blockchain (Bonyuet, 2020). Similarly, there is a centralized and a decentralized blockchain. In a centralized blockchain, a central authority provides the ability to access or view data, while in a decentralized blockchain there is the same access level for every participant (O'Leary, 2017). As a result of blockchain technology, smart contracts are created that represent computer code on the blockchain that performs activities under certain circumstances and affects the improvement of business processes, cost efficiency, and the reduction of operational errors. Blockchain provides the possibility of standardizing financial databases and formats so that information is not entered and reconciled in multiple

databases, which leads to an increase in the speed of transactions, saving time and reducing the possibility of human error or fraud (Kokina et al., 2017). On the other hand, limiting circumstances for the use of blockchain technology are reflected in incompatible standards related to encryption methods and information storage, transaction irreversibility that may limit its use in accounting can lead to transactions cancellation, growth in energy costs, blockchain impact on the environment, the possibility of hacking, and employee training problems (Desplebin et al., 2021).

The key features of blockchain technology embodied in the form of transparency, decentralization, security and traceability together with smart contracts affect the way of performing audits and all control activities (Gauthier & Brender, 2021). Blockchain could improve audit quality and narrow the expectation gap between regulatory bodies, auditors, and financial statement users (Kend & Nguyen, 2020). Relying on blockchain-based digitization, auditors could increase the degree of automation, analytics, and machine learning capabilities such as automatically flagging unusual transactions to relevant parties in real-time. With the use of blockchain technology, there is a basis for a greater degree of standardization and transparency of financial reporting and accounting which affects more efficient data analysis. The use of blockchain in the provision of financial services includes the areas of dealing with securities, trade financing, and the internationalization of payments, and some other banking processes. The consumer and industrial products industry uses blockchain in the context of digitalization, and tracking the basis of transactions in various goods. The use of blockchain technology in healthcare organizations aims to ensure the integrity of electronic medical records, invoices, and claims. Blockchain technology usage in the public sector aims to support property registries, such as land registries.

3.4. Robotic process automation

Robotic process automation means software that provides the possibility of realizing activities according to certain rules, with a combination of different application programs and sources. It is software that starts other software applications, and can be used to automate determining business processes (Zemankova, 2019). RPA uses structured input, processes input data through rules, and creates specific outputs. From a cognitive perspective, task automation is a repetitive, low-skill task that could be automated by robotic process automation (Naqvi, 2020). Companies usually find it challenging to recognize which processes could be subject to robotization. Robotization affects simpler and more frequent reporting compared to the previous standardized annual reporting and on the accuracy of data entry through robotic control. Moreover, robotic processes could be run continuously, with unchanged output quality. One of the leading benefits is quick adaptability to new tasks. Considering the ratio of low installation and programming costs in relation to considerable benefits, as well as a wide range of activities that could be subject to robotization, it seems clear why Robotic process automation is becoming an indispensable tool in modern business, including audit engagement.

Robotic process automation provides a number of benefits as they could operate without stopping, they are faster, more resilient, and can be simply adaptable. An improper configuration could quickly interrupt hundreds and thousands of transaction data in a short time. This is because Robotic process automation is able to immediately manage large quantities of operations. Because of this, it is of the greatest priority that they are correctly installed and configured. The key disadvantage of the application of robotization in the audit process is reflected in the insufficient workforce capable of programming the automated process. The key benefits of applying RPA in auditing include time savings from the aspect of repetitive processes, the possibility of daily uninterrupted work, speed, robustness and greater scalability. Robotic process automation processes can influence the growth of customer and seller satisfaction by reducing the time between issuing an invoice and payment, application and approval of credit, purchase order and its realization. The use of RPA in revenue audit can affect the growth of audit quality, considering that it is a high-risk area. In this direction, the use of RPA in the process of reconciliation, analytical procedures, control, and detailed testing is presented in the following figure:

Table 2: Steps of Robotic Process Automation for Revenue Audit

Reconciliation	Log in to FTP in order to obtain audit evidence that is provided by the client. Enter the query to search for a listing of sales and trial balance. Extract listing of sales and trial balance. Import listing of sales and trial balance to Excel or IDEA. Calculate total sales per listing. Compare total sales per listing to total sales per trial balance.
Analytical Procedure	Login to workpaper software of audit in order to access audit workpapers in the previous year. Enter the query to search for the revenue amount that is audited. Extract a report with revenue balance from the previous year. Import report to Excel or IDEA. Compare the total amount of revenue from the current year to the total amount of revenue from the previous year. In case the difference exceeds the materiality threshold, an alert should be generated.
Internal Control Testing & Substantive Testing	Log in to FTP in order to obtain audit evidence that is provided by the client. Enter the query to look for order of purchase, invoice, and shipping listings. Extract and Import listings. Compare quantity and price across the three listings. In case some items do not match, an alert should be generated.

Source: Moffitt et al. (2018)

Regardless of the extent to which audit firms decide to digitalize their clients' engagement, each innovative implementation would contribute to changes such as increasing the accuracy and worth of audit evidence and judgments, given that new technologies would attempt to review all client data, without previous sampling (Alles & Gray, 2020). Additionally, audit firms would develop a culture of innovation, which would require further training from existing employees, while new skills would be required from future employees. Audits engagements performed by audit teams specialized in digitalization are related to audit fees that are between 13 and 35 percent higher than audit fees for engagements that do not support new techniques and technologies.

Conclusion

Digitalization implies the emerging technologies usage in order to create a new business model with opportunities for income and added value creation. Digitization affects the growth of audit quality through the transformation of audit companies into digital companies using modern analytical and robotics tools. There is a new auditor profile developed through required competencies in various technologies and by providing IT-oriented audit services. Digital technologies led by Big Data analytics, Artificial intelligence, Blockchain technology, and Robotic process automation create new risks, challenges and opportunities for the practice of accounting and auditing. The use of digital technologies provides new opportunities for better knowledge of the client and better documentation, reduces the audit risk level, and provides support to the auditor's decision-making process.

Big Data has an impact on the level of audit responsibility, understanding of the client's environment, assessment of the internal control effectiveness, risk and materiality, and analytical procedures implementation. It also provides better identify operational risks, and also impacts audit fees level, productivity, accuracy, and effectiveness of the audit opinion formation. Artificial Intelligence represents a hybrid technology set on the basis of which auditing is changed and supplemented enabling continuous annual auditing, relying on automated data collection, document scanning, testing logical errors, and improved fraud detection based on advanced machine learning. The key impact of blockchain technology is reflected in the implementation of audits in real-time, the reduction of activities performed by accountants and financial managers in the long term, the reduction of audit preparatory work on an annual level, easy insight into the origin and history of company operations, and improving the work of the internal control functions and facilitating reporting. Activities that are defined by constantly repeating rules such as opening and closing accounts, request sending for bank payments, change of employee records, standardized templates, receiving new purchase orders, monitoring the consumption of raw materials, and automatically changing the protection system are subject to robotization. The application of RPA technology as a process driven is based on the fact that too many simple repetitive tasks burden auditors such as preparing audit data, organizing files, integrating audit data from different files, conducting audit testing in Excel, and copying and pasting data (Cohen et al., 2019). Proactive use of digital technologies is of key importance for the auditing profession, as well as harmonizing new technological trends with auditing procedures. Incorporating digitalization into the process of conducting an audit aims to raise the quality of the audit and provide a reliable information base to all interested parties who rely on the audit work results in the decision-making process.

References

Aditya, B. R., Hartanto, R., & Nugroho, L. E. (2018). The role of IT audit in the era of digital transformation. *IOP Conference Series: Materials Science and Engineering, 407*(1), 1-6. Doi: https://doi.org/10.1088/1757-899X/407/1/012164

Alles, M.G., & Gray, G.L. (2020). Will the medium become the message? A framework for understanding the coming automation of the audit process. *Journal of Information Systems, 34*(2), 109–130. Doi: https://doi.org/10.2308/isys-52633

Andrić, M., Jakšić, D., & Mijić, K. (2015). *Aktuelni uticaj informacionih tehnologija na proces revizije*. Subotica: Univerzitet u Novom Sadu, Ekonomski fakultet u Subotici.

Andrić, M., Mijić, K., Jakšić, D., & Vuković, B. (2011). Implementation of accounting software as a support to company management. *TTEM*, 296–309.

Appelbaum, D. (2016). Securing big data provenance for auditors: the big data provenance black box as reliable evidence. *Journal of Emerging Technologies in Accounting, 13*(1), 17-36. Doi: https://doi.org/10.2308/jeta-51473

Bhimani, A., & Willcocks, L. (2014). Digitisation, 'Big Data' and the transformation of accounting information. *Accounting and Business Research 44*(4), 469-490. Doi: https://doi.org/10.1080/00014788.2014.910051

Bonyuet, D. (2020). Overview and impact of blockchain on auditing. *The International Journal of Digital Accounting* Research*, 20*, 31-43, Doi: https://doi.org/10.4192/1577-8517-v20_2

Cohen, M., Rozario, A., & Zhang, C. (2019). Exploring the use of robotic process automation in substantive audit procedures. *CPA Journal, 89*(7), 49–53.

Dagilienė, L., & Klovienė, L. (2019). Motivation to use big data and big data analytics in external auditing. *Managerial Auditing Journal, 34*(7), 750-782. Doi: https://doi.org/10.1108/MAJ-01-2018-1773

Desplebin, O., Lux, G., & Petit, N. (2021). To be or not to be: blockchain and the future of accounting and auditing. *Accounting Perspectives, 20*(4), 743-769. Doi: https://doi.org/10.1111/1911-3838.12265

Dzuranin, A., & Cand MălăescuI, I. (2016). The current state and future direction of IT audit: challenges and opportunities. *The Journal of Information Systems, 30*(1), 7–20. Doi: https://doi.org/10.2308/isys-51315

Earley, C. E. (2015). Data analytics in auditing: opportunities and challenges. *Business Horizons, 58*(5), 493-500. Doi: https://doi.org/10.1016/j.bushor.2015.05.002

El- Monem Serag, A. A., & Al-Aqiliy, L. M. (2020). A proposed framework for big data analytics in external auditing and its impact on audit quality with a field study in Egypt. *Alexandria Journal of Accounting Research*, *4*(3), 1-60. Doi: https://doi.org/10.21608/ALJALEXU.2020.124109

Fotoh, L. E., & Lorentzon, J. I. (2020). Critical issues of the audit expectation gap in the era of audit digitalisation. In: *Proceedings of Hawai'i Accounting Research Conference* (HARC), 1–32. https://scholarspace.manoa.hawaii.edu/items/49c8cdcd-d14c-493c-9dad-063a9ccb4d1a

Gandomi, A., & Haider, M. (2015). Beyond the hype: big data concepts, methods, and analytics. *International Journal of Information Management, 35*(2), 137-144. Doi: https://doi.org/10.1016/j.ijinfomgt.2014.10.007

Gauthier, M. P., & Brender, N. (2021). How do the current auditing standards fit the emergent use of blockchain? *Managerial Auditing Journal, 36*(3), 365-385. Doi: https://doi.org/10.1108/MAJ-12-2019-2513

Gepp, A., Linnenluecke, M. K., O'Neill, T. J., & Smith, T. (2018). Big Data techniques in auditing research and practice: current trends and future opportunities. *Journal of Accounting Literature, 40*(1), 102-115. Doi: https://doi.org/10.1016/j.acclit.2017.05.003

Gray, J. M., & Abdolmohammadi, M. (2016). Information technology audits by internal auditors: exploring the evolution of integrated IT audits. In *ProQuest Dissertations and Theses.*

Issa, H., Sun, T., & Vasarhelyi, M. A. (2016). Research ideas for artificial intelligence in auditing: the formalization of audit and workforce supplementation. *Journal of Emerging Technologies in Accounting, 13*(2), 1-20. Doi: https://doi.org/10.2308/jeta-10511

Ivanović, T., & Marić, M. (2021). Application of modern enterprise resource planning (ERP) systems in the era of digital transformation. *Strategic Management*, *26*(4), 28-36. Doi: https://doi.org/10.5937/StraMan2104028I

Kend, M., & Nguyen, L.A. (2020). Big Data analytics and other emerging technologies: the impact on the Australian audit and assurance profession. *Australian Accounting Review, CPA Australia, 30*(4), 269-282. Doi: https://doi.org/10.1111/auar.12305

Khan, N., Yaqoob, I., Hashem, I., A., T., Inayat, Z., Ali, W., K., M., Alam, M., Shiraz, M., & Gani, A. (2014). Big data: survey, technologies, opportunities, and challenges. *The Scientific World Journal*, *18*. Doi: https://doi.org/10.1155/2014/712826

Kokina, J., & Davenport, T. (2017). The emergence of artificial intelligence: how automation is changing auditing. *Journal of Emerging Technologies in Accounting, 14*(1), 115-122. Doi: https://doi.org/10.2308/jeta-51730

Kokina, J., Mancha, R., & Pachamanova, D. (2017). Blockchain: emergent industry adoption and implications for accounting. *Journal of Emerging Technologies in Accounting, 14*(2), 91-100. Doi: https://doi.org/10.2308/jeta-51911

Lugli, E., & Bertacchini, F. (2022). Audit quality and digitalization: some insights from the Italian context. *Meditari Accountancy Research, ahead-of-print.* Doi: https://doi.org/10.1108/MEDAR-08-2021-1399

Mariia, N., & Viktoriia, M. (2020). Digitalization of audit. *Knute Bulletin, 3*(131), 123–134. Doi: https://doi.org/10.31617/visnik.knute.2020(131)09

Moffit, K., Rozario, M., A., & Vasarhelyi, M., A. (2018). *Robotic Process Automation for Auditing. Journal of Emerging Technologies in Accounting, 15*(1), 1-10, Doi: https://doi.org/10.2308/jeta-10589

Musabegović, I., Ozer, M., Lazić, M., & Jovanović, S. (2021). Interplay between digital technologies and business performance in banking industry: global and regional perspectives. *Ekonomika*, *67*(3), 75-92. Doi: https://doi.org/10.5937/ekonomika2103075M

Naqvi, A. (2020). *Artificial Intelligence for Audit, Forensic Accounting, and Valuation: A Strategic Perspective*. New Jersey: John Wiley & Sons.

Nazarova, K., Nezhyva, M., Hotsuliak, V., Novikova, N., & Fedorenko, O. (2021). Digital audit as an imperative for Ukraine's way out from the COVID-crisis and a tool to increase the competitiveness of the state. *SHS Web of Conferences, 100*, 01001. Doi: https://doi.org/10.1051/shsconf/202110001001

Nezhyva, M., & Miniailo V. (2020). Digitalization of audit in the conditions of the COVID 19. *Bichik Khtey, 3*, 123-134. Doi: http://doi.org/10.31617/visnik.knute.2020(131)09

O'Leary, D. (2017). Configuring Blockchain architectures for transaction information in blockchain consortiums: the case of accounting and supply chain systems. *Intelligent Systems in Finance, Accounting and Management, 24*(4), 138-147. Doi: https://doi.org/10.2139/ssrn.3102671

Rakovic, L., Sakal, M., & Matkovic, P. (2022). Digital workplace – advantages and challenges. *Anali Ekonomskog fakulteta u Subotici*, *58*(47), 65-78. Doi: https://doi.org/10.5937/AnEkSub2247065R

Richins, G., Stapleton, A., Stratoppoulos, T., & Wong, C. (2017). Big Data analytics: opportunity or threat for the accounting profession? *Journal of Information Systems, 31*(3), 63–79. Doi: https://doi.org/10.2308/isys-51805

Rickett, L., K. (2017). The use of Big Data in auditing and barriers to adoption. *Business Faculty Publications, 62*(3-4). 319. Doi: https://engagedscholarship.csuohio.edu/bus_facpub/319

Salijeni, G., Samsonova-Taddei, A., & Turley, S. (2021). Understanding how Big Data technologies reconfigure the nature and organization of financial statement audits: a sociomaterial analysis. *European Accounting Review, 30*(3), 531-555. Doi: https://doi.org/10.1080/09638180.2021.1882320

Since, F. (2021). How the internal audit function is evolving: the impact of digitalization. *Strategic Direction, 37*(7), 24–26. Doi: https://doi.org/10.1108/SD-06-2021-0055

Stojanović, D. (2020). Sustainable economic development through green innovative banking and financing. *Economics of Sustainable Development*, *4*(1), 35-44. Doi: https://doi.org/10.5937/ESD2001035S

Sujata, S., & Shalini, C. (2021). Exploring Factors Influencing Adoption of Blockchain in accounting applications using technology–organization–environment framework. *Information Journal of International Technology Management*, *30*(1), 30-68. Doi: https://scholarworks.lib.csusb.edu/jitim/vol30/iss1/2

Supriadi, I., Prasetyo, H., D., & Suprihandari, M., D. (2020). The effect of applying blockchain to the accounting and auditing. *Ilomata International Journal of Tax & Accounting, 1*(3), 161-169. Doi: https://doi.org/10.52728/ijtc.v1i3.101

Tang, J., & Karim, K. E. (2019). Financial fraud detection and big data analytics–implications on auditors' use of fraud brainstorming session. *Managerial Auditing Journal, 34*(3), 324–337. Doi: https://doi.org/10.1108/MAJ-01-2018-1767

Ukpong, E., G., Udoh, I., & Essien, I. T. (2019). Artificial intelligence: opportunities, issues and applications in accounting and auditing in Nigeria. *Journal of Accounting & Marketing, 8*(1), Doi: https://doi.org/10.4172/2168-9601.1000309

Yudowati, S., & Alamsyah, A. (2018). Big Data framework for auditing process. *International Journal of Engineering & Technology, 7*(4.38), 908-911. Doi: https://doi.org/10.14419/ijet.v7i4.38.27606

UDC: 681.114.8:332.852.1
DOI: 10.5937/AnEkSub2300021N

Original scientific article

Анали Економског факултета у Суботици – The Annals of the Faculty of Economics in Subotica
Vol. 60, No. 51, pp. 031-048
Received: 22/03/2023
Accepted: 12/06/2023
Published online: 19/06/2023

Key determinants of consumers' decision making on the purchase of wristwatches on the Serbian market

Кључне детерминанте одлучивања потрошача о куповини ручних сатова на тржишту Републике Србије

Daniela Nuševa
University of Novi Sad, Faculty of Economics in Subotica, Subotica, Republic of Serbia,
daniela.nuseva@ef.uns.ac.rs, https://orcid.org/0000-0002-0990-428X
Radenko Marić*
University of Novi Sad, Faculty of Economics in Subotica, Subotica, Republic of Serbia,
radenko.maric@ef.uns.ac.rs, https://orcid.org/0000-0002-8870-8702
Goran Vukmirović
University of Novi Sad, Faculty of Economics in Subotica, Subotica, Republic of Serbia,
goran.vukmirovic@ef.uns.ac.rs, https://orcid.org/0000-0003-1270-2344
Nikola Macura
University of Novi Sad, Faculty of Economics in Subotica, Subotica, Republic of Serbia,
nikola.macura@ef.uns.ac.rs, https://orcid.org/0009-0006-9917-6998

Abstract: The COVID-19 pandemic and other global challenges that have appeared in the past years have caused market transformation and crucial changes on the demand side, forcing manufacturers and retailers to rethink their sales and marketing strategies. In particular, high-frequency durable consumer products such as wristwatches have proven to be sensitive. This paper aims to analyze the consumers' needs and define the indicators that directly influence the decisions to buy wristwatches in the Serbian market. The research was organized in two phases. Theoretical research has identified indicators influencing purchase decisions, such as price, brand, design, ease of use, and warranty. Empirical research examined their influence on the purchase decision depending on different segments of respondents: gender, age, education, and employment status. The obtained results showed significant differences as to how the mentioned indicators influence the purchase decision, depending on the demographic indicators. According to these results, a series of measures was proposed to improve the sales and marketing strategy for placing wristwatches on the Serbian market. Guidelines for future research are outlined in the paper.
Keywords: consumer behaviour, purchase decision, retail, wristwatches, the Republic of Serbia.
JEL classification: D12, L81, M31.

Сажетак: Пандемија вируса ЦОВИД-19 и други глобални изазови који су се појавили протеклих година довелу су до трансформације трижишта и пресудних промена на страни потражње, и присилили произвођаче и трговце на мало да размотре своје продајне и маркетиншке стратегије. Нарочито су се трајна роба широке потрошње као што су ручни сатови показала осетљивом на те процесе. Циљ овог рада је анализа потрошачких потеба и дефинисање индикатора који директнуо утичу на одлуке о куповини ручних сатова на тржишту Републике Србије. Истраживање је организовано у две фазе.

* Corresponding author.

Треоријским истраживањем су идентификовани показатељи који утичу на одлуке о куповини, као што су цена, бренд, дизајн, лакоћа коришћења и гарантни рок. Емпиријским истраживањем је испитан њихов утицај на доношење одлука о куповини у зависности од различитих сегмената испитаника: пола, година старости, нивоа образовања и запослености. Добијени резултати показали су значајне ранлике у погледу начина на који наведени показатељи утичу на одлучивање о куповини, у зависности од демографских показатеља. У складу са тим резултатима, предложен је низ мера за унапређивање продајне и маркетиншке стратегије за пласман ручних сатова на тржишту Републике Србије. У раду су назначене и смернице за даљње истраживање.
Кључне речи: понашање потрошача, одлука о куповини, малопродаја, ручни сатови, Република Србија.
ЈЕЛ класификација: D12, L81, M31.

Introduction

A wristwatch is an instrument, device, or a gadget measuring time, that is, telling the time, worn on a strap or a metal bracelet round your wrist. (Collins Dictionary, 2022; Britanicca Dictionary, 2022). It represents a product reflecting an individual's need to determine the time of day precisely. However, for most consumers today, this is of secondary importance. Namely, in parallel with the improvement of wristwatch functions, it has also become an integral element of an individual's style. There is an increasing focus on different aspects and details of the watch that speak about the owner's social status, fashion style, self-evaluation, personality expression, etc. (Malhotra, 2020). The wristwatch has become one of the key fashion accessories for men and women, even children. This is especially important to understand because a wristwatch is one of the durable consumables that have a longer life span and are used for many years. Therefore, these factors are most often the basis of the need to buy a new watch, especially by customers who already own one.

The global watch industry is highly profitable, with an estimated annual sales of 49 billion USD (McKinsey, 2021). It has seen a decline in sales since 2016, especially of luxury wristwatches, primarily because China launched a campaign aimed at limiting gifts to government officials and thus reducing the corruption level in the country. A further drop in revenue of 25-30% in this segment occurred in 2020 due to the impact of the COVID-19 pandemic (McKinsey & Company, 2021; Gouveia et al., 2021). The global industry is highly concentrated with the dominance of Swiss luxury watch manufacturers, known for precision, quality, innovation, etc. The Swiss watch industry achieved exports of over 15 billion Swiss francs in 2021 (Statista, 2022). The wristwatch has evolved, from mechanical and quartz, all the way to smart ones, which is a modern innovation. Smartwatches are surely a consequence of the development of mobile digital technologies characterized by access to information anywhere at any time (Perry et al., 2001). Mobility implies that we are talking about wearable devices. Wearable technology and wearable devices are phrases used for smart electronic devices used every day that can be worn, such as clothing accessories or fashion accessories (Almuraqab, 2021; Wright & Keith, 2014). Smartwatches also enable monitoring numerous parameters that can be extremely important to an individual, for example, related to their health condition, sports activities, etc. In addition to implementing the latest technologies in the watch industry, the development of mobile digital technologies and devices affects this industry in a way that raises the question of choosing between existing alternatives. There are opinions that mobile devices

(primarily phones) will significantly reduce the need to wear wristwatches. On the other hand, there are opposing standpoints that smartwatches will replace mobile devices due to their attractiveness in terms of size, position on the body, and the possibility to be worn always and everywhere by an individual (Bonino et al., 2012), as well as incorporating all the functions of mobile phones. Regardless of these dilemmas, it can be stated that there will still be a need for an individual to carry with him a device based on which he will be able to determine the exact time at any moment in any place and which will satisfy certain aesthetic characteristics.

Based on the previous observation, *the paper's aim* is to understand the consumers' decision-making process on the purchase of durable consumer goods with a high frequency of purchase. The subject of this paper is to analyze consumer needs and define indicators that directly influence the decision to buy wristwatches in the Serbian market. The research was conducted on the national market based on an anonymous questionnaire. Respondents were segmented based on demographic characteristics: gender, age, education, and work status. *The obtained results* show significant deviations in the influence of various indicators on making a decision on the purchase of watches, depending on the demographic characteristics of the respondents. In a *practical point,* the paper enables manufacturers and retailers to understand the importance of certain indicators for making purchase decisions and, depending on this, to tailor their sales and marketing strategies to a specific segment of consumers.

The structure of the paper is as follows: 1) The *Theoretical background* analyzes the current state and future trends in the wristwatch market. The chapter lists and defines clearly the key indicators impacting the purchase decision; 2) *The Methodology* chapter presents the research goal, set hypothesis, research sample and statistical analysis, and data processing method; 3) In the *Research results*, the set hypotheses are tested and the results are presented clearly; 4) The *Discussion* chapter includes the interpretation of the obtained results, according to results of similar studies, and a series of measures for improving sales and marketing strategies for placing wristwatches in the Serbian market and 5) *The Conclusion* summarizes the most significant research results, points out its shortcomings and gives guidelines and suggestions for future research.

1. Theoretical background

The COVID-19 pandemic and the changes in the market, which caused a decline in sales and income during the previous years, have led to the transformation of the market and forced the manufacturers of wristwatches to rethink their marketing strategies. Projections of the global wristwatch market indicate that it will grow at an average growth rate of 4.8% between 2021 and 2026, from $62.8 billion in 2021 to $78.2 billion in 2026 (Global Market Estimates, 2022). It is currently facing an increase in demand for luxury brands and new product models, as well as an increasing number of strategic alliances and partnerships (Market Research, 2022). In addition, the digitization of business, growth of online shopping, a greater presence of all supply chain participants on social networks, etc., contribute to the expansion of the market, especially in the coming years. According to

forecasts, the luxury watch market, which consists of luxury brands with product offerings priced between $3,601 and $30,000 and ultra-luxury with prices above $30,000, should see slower growth rates of 1 to 3% annually from 2019 by 2025 (McKinsey & Company, 2021). Among the luxury brands, Swiss companies stand out, and above all Rolex, which as the leader, having achieved a market share of 28.8% and an estimated turnover value of CHF 8 billion in 2021. It was followed in the same year by Omega with 7.5% and Cartier watches with 6.9 market share (Statista, 2022). In addition, the pre-owned watch market, as projections indicate, will become the fastest-growing segment, with sales valued at $29 billion to $32 billion by 2025, driven by the demand generated by younger consumers, collectors, and cost-conscious buyers (McKinsey & Company, 2021). On the other hand, stagnation or decline in sales of mid-brand watches, priced between $180 and $3,600, is expected.

Given that a wristwatch today represents one of the most frequent consumer durables, as well as an indispensable fashion accessory, several studies investigated the needs of customers and the determinants that influence them when making purchase decisions (Durge, 2022; Deloitte, 2021; Bölen, 2020; Cervellon et al., 2019). Common to the mentioned studies is that the following appeared as the most influential indicators of the purchase decision in almost all markets covered by the research: price/value ratio, brand, design, ease of use, and warranty.

The *price/value* ratio is a significant determinant when purchasing, since the customer unconsciously analyzes whether the price is in line with his assessment of the product value. The customer's perception creates an image of a satisfactory or unsatisfactory quality level, good or bad, which they then compare with the price he paid. The price represents what he gives up or what he sacrifices to get the product (Zeithmal, 1988). Therefore, the company must create a quality that the customer will recognize. He should feel the satisfaction of buying and using the product because it creates a perceived value for the customer as a result of his perceived gain or loss. According to Kotler, customer price/value ratio is the difference between the real value the customer receives and the costs he pay to obtain the product (Hong & Zhuqing, 2012). Creating value for the customer is achieved in the stages of product development, communication programs, distribution channels, and pricing. In the first three phases of value creation, costs are incurred, while just the price is the instrument of the marketing mix through which revenues are generated (Netseva-Porcheva, 2011).

In the conditions of strong market competition, the *brand* represents one of the most important resources that the company possesses (Matović et al., 2019). Brand possesses its identity, that is, it has a personality. Brand personality is defined as a set of human characteristics associated with a particular brand (Aaker, 1997). It evokes certain associations in consumers, so they are often not fully aware of their motives and emotions when they make a purchase decision. The decision-making process is simplified by the fact that when purchasing, they are primarily guided by their views of the brand's characteristics, and not by the characteristics of the product itself. This suggests that there is a significant influence of the brand on the consumers' perception of product quality (Filipović & Šapić, 2020; Teas & Agarwal, 2000; Dodds et al., 1991). Consumers are

attracted to certain brands because they can identify with them. They attribute to them traits that correspond to their perception of their personality, that is, the way they perceive their lifestyle, values, or ideals. The greater the congruence between the experience of one's personality and the brand's personality, the greater the consumer's preference and loyalty toward a particular brand (Govers & Schoormans, 2005, Abosag et al., 2020).

Each product, each brand, has a suitable *design*. It can be a crucial factor in the process of making a purchase decision because the physical appearance represents the first impression that the customer gets not only about the product but also about the company. Its role is to contribute to differentiation from competing products and to be aesthetically attractive to the customer. Numerous studies have shown that a large percentage of purchase decisions (about 73%) are made exclusively at the point of sale, so packaging and product design should ensure that the brand is recognized and stands out (Rettie & Brewer, 2000). Therefore, companies invest significant resources in the process of creating innovative designs that will be in line with the needs of their target group (Miletić et al., 2021). The design creation process can be defined as a series of creative steps which the designer uses to develop appropriate design solutions for a specific client (Cheng, 2018).

The term *ease of use* is very often identified with the usability of the product in a narrower sense. It is defined as the product's ability to be used by people easily and effectively (Keinonen, 1997). Ease of use as a determinant is of particular influence for products that imply a higher level of technology and complexity because it has a calming effect on the customer by strengthening his belief and self-confidence that he will be able to use the product easily.

In marketing, the *warranty* has a special place. On the one hand, it represents a means of protecting the rights of consumers, while on the other hand, it represents a means of promoting producers. It provides customers with the necessary assurance or security that the product meets the appropriate level of quality, that is, the product is the same as the manufacturer promoted and presented it in the market. A warranty is a contractual relationship that regulates the issue of providing compensation to the buyer by the issuer of the warranty (manufacturer or supplier), by the terms of the warranty, and in situations when the product does not fulfill its predefined characteristics or functions within the warranty period (Ullah & Islam, 2011).

The novelty of the paper is the systematization and precise analysis of the impact of all the mentioned variables (indicators) on the consumers' decisions to buy wristwatches. In this way, the gap in research will be filled, because not a single academic study on the Serbian market has dealt with this issue. Given that previous research (Gajić, 2022; Puška et al., 2018; Witek, 2016) indicated the existence of differences in making purchase decisions according to the demographic characteristics of consumers, special emphasis in the research is directed towards the importance of gender, age, education, and employment status. Defining the importance of indicators and demographic characteristics of consumers for making a purchase decision is important to take adequate measures to implement a more

effective sales and marketing strategy for the placement of wristwatches in the Serbian market.

2. Methodology

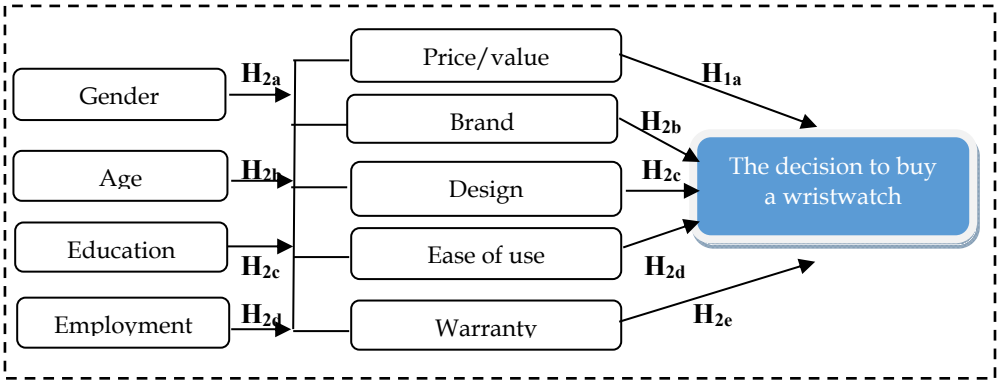
2.1. Research aim and research hypotheses

The objective of the research is to analyze and define the influence of various indicators on the decision to buy wristwatches in the Serbian market. Based on the results of previous research, price/value ratio, brand, design, ease of use, and warranty were selected as key indicators influencing the purchase decision. To obtain the most objective results, the influence of the given indicators had to be tested separately depending on the gender, age, education level and employment status of the respondents. Based on the subject and goal of the research, the following two basic and several supporting research hypotheses were created:

H_1: Indicators such as price/value ratio, brand, design, ease of use, and warranty have a statistically significant impact on the consumers' decision to purchase a wristwatch. In order to confirm the basic hypothesis **H_1**, it should be preceded by five supporting hypotheses: **H_{1a}**: Price/value ratio has a statistically significant impact on the consumer's decision to purchase a wristwatch; **H_{1b}**: Brand strength has a statistically significant impact on the consumer's decision to purchase a wristwatch; **H_{1c}**: Design has a statistically significant impact on the consumer's decision to purchase a wristwatch **H_{1d}**: Ease of use has a statistically significant impact on the consumer's decision to purchase a wristwatch and **H_{1e}**: The warranty length has a statistically significant influence on the consumer's decision to buy a wristwatch.

H_2: The influence of price/value, brand, design, ease of use, and warranty on the purchase decision of a wristwatch is statistically different by demographic characteristics of consumers. In order to confirm the basic hypothesis **H_2**, it should be preceded by four supporting hypotheses: **H_{2a}**: The influence of the price/value ratio, brand, design, ease of use, and warranty on the purchase decision of a wristwatch, statistically differs depending on the gender of the consumer; **H_{2b}**: The influence of price/value ratio, brand, design, ease of use, and warranty on the purchase decision of a wristwatch, statistically differs depending on the consumer's age; **H_{2c}**: The influence of the price/value ratio, brand, design, ease of use, and warranty on the purchase decision of a wristwatch are statistically different depending on the consumer's level of education; **H_{2d}**: The influence of price/value ratio, brand, design, ease of use, and warranty on the purchase decision of a wristwatch is statistically different depending on the consumer's employment status. The set research hypotheses are illustrated by Figure 1.

Figure 1: Model of the research hypotheses



Source: the authors

2.2. Research variables

The established research hypotheses and the subject of the research require testing based on one dependent and a larger number of independent variables (interval and grouping). The dependent variable is the decision to buy a wristwatch on the Serbian retail market, which was evaluated on a Likert scale (0-5 scale) through three statements. Indicators of making a purchase decision appear as independent variables: price/value ratio, brand strength, design, ease of use, and warranty length (Durge, 2022; Deloitte, 2021; Bölen, 2020; Cervellon et al., 2019). The impact of the given indicators was also evaluated based on three statements of the Likert-type measurement. The grouping independent variables are the demographic characteristics of consumers: gender, age, level of education, and employment status.

2.3. Research sample

The research was carried out electronically through a Google form survey on a random sample of 137 users of wristwatches on the Serbian market during the period from September to November 2022. The sample is uniform in terms of employment status and level of education, whereas minor deviations can be read in the gender of the respondents (female respondents 71.5%) and age (80.3% of respondents are youths). The objective reasons for the indicated deviations in the sample are the lack of interest of older consumers, primarily male, to participate in this type of research. Table 1 presents detailed view of the structure of the research sample.

Table 1: Structure of the research sample

Ord.no.	Demographic characteristics	Sample structure		Demographic characteristics	Sample structure	
1	**Gender**	**number**	**(%)**	**Education**	**number**	**(%)**
2	Male	39	28.5	Elementary	2	1.5
3	Female	98	71.5	High school	35	25.5
4	**Age**			College	19	13.9
5	Up to 20	20	14.6	University	81	59.1
6	21 – 30	90	65.7	**Employment**		
7	31 – 40	4	2.9	Employed	43	31.4
8	41 – 50	17	12.4	Unemployed	15	10.9
9	51 – 60	6	4.4	Students	74	54.0
10				Entrepreneurs	5	3.6
19	**TOTAL**	**137**	**100.0**		**137**	**100.0**

Source: the authors' calculation

Cronbach's alpha, Skewness, and Kurtosis coefficients were applied to determine the relevance of the selected questions and scales. Table 2 presents values of these coefficients.

Table 2: Reliability of the selected scales

Indicators	Cronbach's alpha	Kurt.	Skew.
Price/ value ratio	0.754	-1.263	0.461
Brand strength	0.920	-1.137	-0.318
Design	0.861	-.945	-0.403
Ease of use	0.759	-1.362	0.068
Warranty length	0.817	-1.221	-0.329
Purchase decision	0.784	-1.078	0.461

Source: the authors' calculation

Results from the table above demonstrate that the set of indicators is closely grouped and there are no statistically significant deviations in the coefficients. This means that the selected questions can be used to examine consumer attitudes when making decisions about buying wristwatches on the Serbian market.

2.4. Data processing method

The research was carried out electronically based on a created questionnaire using Google Forms. The questions in the questionnaire were created based on similar research and indicators that were tested in the studies of Durga, 2022; Deloitte, 2021; Bölen, 2020; Cervellon et al., 2019. The created questionnaire was forwarded to small retailers and retail chains in the Serbian market (Mercator, Idea, Lidl, Delhaize, Univerexport, Aroma) who marketed it further to their customer bases. The first group of questions consists of generally informative demographic data. After that, using a Likert scale, the respondents

ranked the influence of individual indicators on deciding to buy wristwatches. Each indicator was tested through three statements as follows: Price/value ratio – price is an indicator of quality; I choose a watch regardless of price and price is the principal choice when buying; Brand – I buy branded watches; a brand is not a measure of quality and watches with a weaker brand attract me more; Design - I choose watches with a striking design; design is key when choosing a watch and modern design compromises the functionality of the watch; Ease of use – functionality is a measure of the quality of the watch; the watch should have as few secondary functions as possible and the watch must be accurate and precise; The length of the warranty – I pay attention to the warranty when I buy a watch; the warranty is proof of quality and the warranty constraints and conditions me when choosing a watch. The return rate of completely filled questionnaires was 33.4% (137/410).

IBM SPSS Amos 23 software was used to analyze and process the collected data. Hypotheses were tested using the SEM method (Path Analysis). Differences in the influence of demographic indicators were assessed through Multiple Regression Analysis.

3. Research results

The respondents' answers are presented in Table 3. The table contains the most important characteristics of descriptive statistics (Mean, Max., Min., Standard error - SE, and standard deviation - SD).

Table 3: Indicators of descriptive statistics

Indicators	Mean	Max.	Min.	SE	SD
Price/ value ratio	4.05	5.00	2.00	0.0740	0.8863
Brand strength	3.81	5.00	2.00	0.9203	1.1138
Design	4.17	4.00	1.00	0.0332	0.6314
Ease of use	3.54	4.00	1.00	0.0850	1.0407
Warranty length	2.97	5.00	1.00	0.1314	1.0702

Source: the authors' calculation

The respondents have given the highest average score (M=4.17) to the indicator of wristwatch design, considering the appearance of the watch to be the most important determinant in deciding the purchase. The price (M=4.05) is also seen as a significant variable, linking only a high price to a higher quality wristwatch and vice versa. The brand received medium marks (M=3.81), and this indicator shows the largest deviations. Half of the respondents consider it completely unimportant, while the rest of the respondents give it crucial importance. The respondents have put slightly less importance on the ease of use (M=3.54), considering that it is implied in using the watch. The length of the warranty takes up the last place (M=2.97), bearing in mind that our consumers still do not have a sufficiently high awareness and culture about the importance of complaints and warranties. The highest degree of agreement in the answers can be seen in the case of design

(SD=0.6314), which shows that the scores for this indicator were uniform in the vast majority of respondents. On the other hand, the deviations are most expressed with the brand (SD=1.1138).

Table 4 presents the individual contributions of each independent indicator using the "Enter" method. The model is statistically significant ($F(120; 4) = 3.48$; $p < 0.01$), which means that the set of tested variables is significant on the purchase decision of a wristwatch in the Serbian market.

Table 4: Indicators of individual contributions of independent indicators

Indicators	Stand. coefficient		*t*	*Sig.*
	Beta	St. error		
(const.)	0.847	0.983	3.521	0.001
Price/ value ratio	0.784**	0.701	1.223	0.000
Brand strength	0.726*	0.672	0.921	0.036
Design	0.937**	0.522	1.008	0.000
Ease of use	-0.411	0.681	1.107	0,150
Warranty length	0.523	0.873	0.872	0.064

** Correlation is significant at the level 1%, Correlation is significant at the level 5%

Source: the authors' calculation

Design (ß=0.937; $p<0.01$) and price/value ratio (ß=0.784; $p<0.01$) stand out as indicators that are statistically significant in predicting the decision to buy a wristwatch. A noticeable connection can also be seen with brand strength (ß=0.726; $p<0.05$). A positive correlation is noticeable with all three indicators, which implies that with the increase in the value of these indicators, consumers exclusively consider their influence crucial for making a purchase decision. There are no statistically significant correlations with the remaining two indicators.

The determined existence of a connection between the independent variables (indicators) and the dependent variable (purchase decision) enables testing of the basic hypothesis $\mathbf{H_1}$ and the first group of supporting research hypotheses $\mathbf{H_{1a}}$ **-** $\mathbf{H_{1e}}$. The necessary tests will be carried out utilizing the Path Analysis method. Table 5 presents the results of the conducted testing.

Table 5: Path analysis

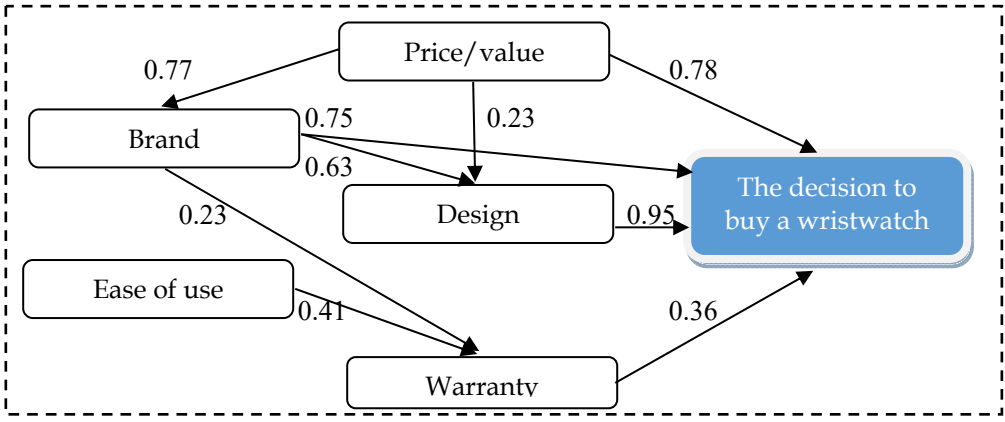
Ord. no.	Path	Path coefficient	*t* value	Result
1	Price/ value ratio » purchase decision	0.780	10.611	Support
2	Brand » purchase decision	0.751	4.141	Support
3	Design » purchase decision	0.953	2.077	Support

4	Ease of use » purchase decision	0.442	11.051	Reject
5	Warranty » purchase decision	0.359	10.226	Support
6	Price/ value ratio » Brand	0.771	1.4300	Support
7	Price/ value ratio » Design	0.232	1.506	Support
8	Price/ value ratio » Ease of use	0.021	14.001	Reject
9	Price/ value ratio » Warranty	0.744	3.227	Reject
10	Brand » Design	0.627	9.011	Support
11	Brand » Ease of use	0.114	3.527	Reject
12	Brand » Warranty	0.225	7.260	Support
13	Design » Ease of use	0.354	10.611	Reject
14	Design » Warranty	0.482	4.141	Reject
15	Ease of use » Warranty	0.407	14.001	Support

Source: the authors' calculation

The table above shows that the price/value ratio, brand strength, design, and warranty length have a statistically significant influence on the decision to buy a wristwatch in the Serbian market. This means that the main hypothesis **H_1** is partially accepted because the supporting hypotheses **H_{1a}, H_{1b}, H_{1c}** and **H_{1e}** are accepted. For ease of use, no statistically significant impact is detected, which means that **H_{1d}** is rejected. Certain significance exists in the mutual influence between indicators, which we see in Figure 2, which presents a structural model, that is, an illustration of the way of their influence.

Figure 2: Structural model

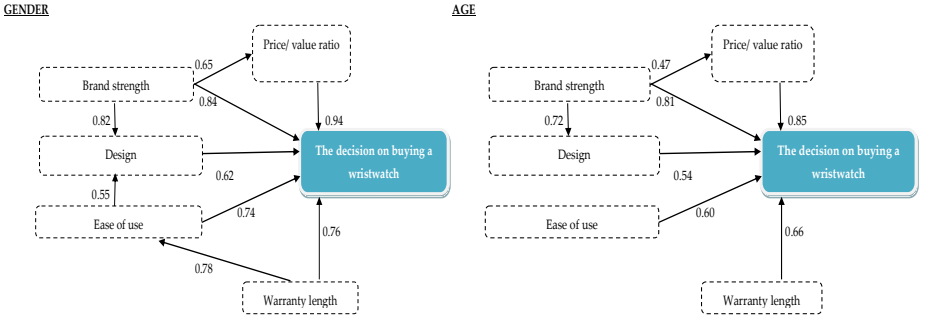


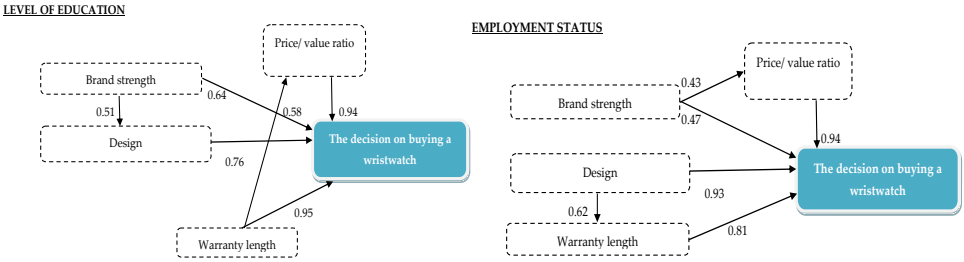
Source: the authors

Given that respondents with different demographic characteristics participated in the research, it is necessary to examine whether the influence of indicators on making a purchase decision differs among certain demographic groups. The "Enter" method confirmed that the regression model is statistically significant for all demographic categories. For gender ($F(120; 4)=3.48$; $p<0.01$), the model predicts 52.7% of the criterion variance, for age ($F(120; 4)=3.48$; $p<0.05$) the model predicts 62.6% of the variance of the criteria, for the level of education ($F(120; 4)=3.48$; $p<0.05$) the model describes 41.9% of the variance of the criteria and for the employment status ($F(120; 4) =3.48$; $p<0.01$) the model describes 49.1% of the criterion variance.

In addition to the price/value ratio and design indicators, which are statistically significant for the purchase decision for all demographic categories, the influence of other indicators varies depending on the analyzed category of respondents. For example, in terms of gender, female respondents point out the ease of use (ß=0.740; $p<0.05$) and brand (ß=0.922; $p<0.01$), while men prefer the length of the warranty (ß=0.774; $p <0.01$). Older respondents consider the length of the warranty (ß=0.844; $p<0.01$) and ease of use (ß=0.556; $p<0.05$) to be important, while for younger respondents it is the brand (ß=0.817; $p<0.01$) and watch design (ß=0.960; $p<0.01$). Respondents with a higher level of education prefer the warranty (ß=0.738; $p<0.01$) in contrast to those with a lower level of education who support brand strength (ß=0.6720; $p<0.01$). When it comes to employment status, employees give the most support to price and quality (ß=0.966; $p<0.01$), entrepreneurs to the brand (ß=0.573; $p<0.01$), while for the unemployed, it is a warranty (ß=0.870; $p<0.05$). The obtained results confirmed the second research hypothesis **H_2**, as well as supporting hypotheses **H_{2a}** – **H_{2d}**, and we conclude that the differences that exist in the demographic categories of respondents are statistically significant in predicting the differences that appear in the influence of various indicators on the decision to buy a wristwatch. The following figure (Figure 3) presents the influence paths of the indicators, especially for each of the analyzed demographic categories.

Figure 3: Structural models





Source: the authors

Based on the results presented, it is noticeable that, depending on the demographic category of the consumer, some indicators related to making a purchase decision appear. For instance, in the case of gender, there is a statistically significant influence of the ease of use, that is, the watch functionality is an important category that determines the purchase decision, primarily among female respondents. On the other hand, this indicator is not significant when consumers are classified according to their level of education and employment status. In the same way, the length of the warranty is the strongest among respondents of different levels of education, at the same time influencing the quality itself, that is, the watch value. Furthermore, brand strength is of more importance among younger consumers, while older consumers prefer a lengthier warranty and ease of use. Finally, employed respondents prefer a fair price-to-value ratio and the design of the wristwatch itself.

4. Discussion

The need for the conducted research arose from the fact that in recent years, the buying habits of consumers on the market have been changing rapidly, especially in the segment of deciding on the purchase of a wristwatch. The decline in demand for classic watches (McKinsey & Company, 2021; Gouveia et al., 2021) and the sharp growth in the placement of smartwatches (Almuraqab, 2021) led to the projection of a five-year growth rate of global demand for wristwatches of 4.8% (Global Market Estimates, 2022), with significantly changed consumer behavior patterns. Based on the conducted research and confirmed hypotheses, it follows that the price/value ratio, the brand strength, the design/appearance of the watch, and the length of the given warranty are the most influential regarding the decision to buy a wristwatch. It partially confirms the results of previous studies (Durge, 2022; Deloitte, 2021; Bölen, 2020; Cervellon et al., 2019) which consider these indicators as unavoidable determinants that influence consumers when making purchase decisions. The research also confirmed significant differences in the impact of these indicators depending on the demographic characteristics of consumers. A specific consumer segment shows preferences for different indicators. For instance, women prefer the ease of use, over-50-year-olds have a preference for the length of the given warranty, under-30-year-olds for the strength of the brand, highly educated consumers for the warranty, employees for the price, etc. Such conclusions can represent a roadmap for

the creators of the sales and marketing strategy to target their activities on the domestic market towards a certain segment of consumers. In practice, this would entail taking the following measures:

1) Clear segmentation of the national market according to the specified categories of consumers into male - female, under 30 years of age, from 30 to 50 and over 50 years of age, highly educated - low educated, employed - unemployed - entrepreneurs - students).
2) In wristwatch advertising techniques, highlight the priority indicators for the target consumer segment. For example, if a retailer is addressing younger consumers, emphasize the brand of the wristwatch or the length of the warranty if they are unemployed and the like.
3) Minimize the importance of indicators that have no impact on consumers. For example, ease of use among the younger population and employees, brand strength among the elderly, etc.
4) Continuously monitor changes on the global market and adapt the domicile placement of wristwatches to global trends.

Only in this way, by accepting the mentioned recommendations, manufacturers and retailers of wristwatches will be able to count on success and survival in the domestic market. Otherwise, if they do not follow and accept the changes in the behavior patterns of watch buyers/consumers, they will not be able to cope with the increasingly tough competition mainly from Chinese and South Korean companies.

Conclusion

Today, more than ever, the global market is exposed to substantial changes in the norms of consumer behavior, especially when purchasing durable consumer goods. This phenomenon is particularly noticeable in fast-growing industries such as wristwatches. An increasing number of brands and manufacturers are appearing, as well as models, which is especially visible in the segment of smartwatches. In other words, the offer of watches on the world market is one of the most diverse in the world; there are practical watches from any price category, watches with different functions and mechanisms, etc. In addition to using smartphones, computers, and other devices, consumers use and buy watches. However, the motive for purchase has changed. It has moved from the basic function of the watch, which is to show the time, to the watch as a fashion detail, brand, status symbol, investment tool, etc. When looking at the marketing aspect of the watch industry, one should consider the most significant demand factors, the most important of which are the price/value ratio, design, brand, and ergonomic features of the watch. In addition to having an irreplaceable role in everyday life, a watch has a functional, status and aesthetic purpose. Hence the need for a large study that would look at the needs of consumers and define the indicators that directly affect the decision to buy wristwatches in the Serbian market. The goal of the work was to precisely define the importance of specific indicators that determine the decision to buy a wristwatch in the domestic market. Given that previous

research points to significant indicators such as price/value ratio, brand, design, ease of use, and warranty, research hypotheses were set and tested through Multiple Regression Analysis and Path Analysis methods. The hypotheses confirm that the price/value ratio, brand strength, design/appearance, and warranty length have a statistically significant impact on the purchase decision. Also, the research showed that depending on the demographic categories of consumers such as gender, age, education, and employment, the intensity and manner of influence of these indicators changes. Based on the obtained results, a set of recommendations was proposed that the creators of the sales and marketing strategy should implement to improve the conditions for the placement of wristwatches on the Serbian market.

The shortcomings of the research lie in the limitation of the sample to the Serbian market and the examination of domestic consumers. The reason for choosing such a sample is the technical impossibility of conducting research outside the borders of Serbia, as well as the familiarity of the authors of the study with the employment conditions and the position of consumers in the domestic market. The structure of the questionnaire itself can also be a shortcoming. Namely, based on previous studies, questions with pre-prepared answers were selected in the questionnaire, which can lead to the conclusion that respondents were guided toward some of the statements offered.

As *guidelines for future research*, we suggest conducting a large-scale study that would include the Western Balkans and Southeastern Europe and a comparative analysis of data between EU and non-EU countries. In the sample itself, more open-ended questions should be included, which will leave respondents free to record their realistic observations and attitudes. In this way, a more complete scientific and academic contribution to the problem of identifying the determinants that determine consumers' decisions to buy wristwatches will be obtained.

References

Aaker, J. L. (1997). Dimensions of brand personality. *Journal of Marketing Research*, *34*(3), 347-356. Doi: https://doi.org/10.1177/002224379703400304

Abosag, I., Ramadan, Z. B., Baker, T. & Jin, Z. (2020). Customers' need for uniqueness theory versus brand congruence theory: the impact on satisfaction with social network sites. *Journal of Business Research*, *117*, 862-872. Doi: https://doi.org/10.1016/j.jbusres.2019.03.016

Almuraqab, N. A. S. (2021). Determinants that influence consumers' intention to purchase smart watches in the UAE: a case of university students. *Advances in Science, Technology and Engineering Systems Journal*, *6*(1), 1249-1256. Doi: https://dx.doi.org/10.25046/aj0601142

Bölen, M. C. (2020). From traditional wristwatch to smartwatch: understanding the relationship between innovation attributes, switching costs and consumers' switching intention. *Technology in Society*, *63*, 101439. Doi: https://doi.org/10.1016/j.techsoc.2020.101439

Bonino, D., Corno, F. & Russis, L. (2012). dWatch: a personal wrist watch for smart environments. *Procedia Computer Science*, *10*, 300 – 307. Doi: https://doi.org/10.1016/j.procs.2012.06.040

Britanicca Dictionary. (2022). *Wristwatch*. Retrieved March 10 from https://www.britannica.com/dictionary/wrist-watch

Cervellon, M. C., Poujol, J. F., & Tanner Jr, J. F. (2019). Judging by the wristwatch: salespersons' responses to status signals and stereotypes of luxury clients. *Journal of Retailing and Consumer Services*, *51*, 191-201. Doi: https://doi.org/10.1016/j.jretconser.2019.04.013

Collins Dictionary. (2022). Retrieved March 11, from https://www.collinsdictionary.com/dictionary/english/wristwatch

Cheng, J. (2018). Product design process and methods, product lifecycle management – terminology and applications. *Intechopen*, 35-49.

Filipović, J., & Šapić, S. (2020). The impact of consumers' traveling and media activities on consumer behaviour towards purchasing global brands. *Menadžment u hotelijerstvu i turizmu*, *8*(1), 25-35. Doi: https://doi.org/10.5937/menhottur2001025F

Govers, P. C. M. & Schoormans, J. P. L. (2005). Product personality and its influence on consumers preference. *Journal of Consumer Marketing*, *22*(4), 189-197. https://doi.org/10.1108/07363760510605308/full/html

Deloitte. (2021). *The Deloitte Swiss Watch Industry Study: Adapting to a changing landscape*. Retrieved March 8, from https://www2.deloitte.com/content/dam/Deloitte/ch/Documents/consumer-business/deloitte-ch-en-swiss-watch-industry-study-2021.pdf

Dodds, W. B., Monroe, K. & Grewal, D. (1991). Effects of price, brand, and store information on buyers' product evaluations. *Journal of Marketing Research*, *28*(3), 307-319. Doi: https://doi.org/10.1177/002224379102800305

Durge, Y. (2022). Understanding consumer's preferences towards the wristwatch product category through the lens of demographic profiling. *Journal of Positive School Psychology*, *6*(7), 1553-1564. Retrieved March 7, from https://journalppw.com/index.php/jpsp/article/view/11554/7466

Galić, J. (2022). Socio-demographic profile of organic food consumers in Republika Srpska. *Anali Ekonomskog fakulteta u Subotici, 58*(48), 3-14. Doi: https://doi.org/10.5937/AnEkSub2248003G

Global Market Estimates. (2022). *Wrist Watch Market*. Retrieved March 1, from https://www.globalmarketestimates.com/market-report/wrist-watch-market-3440

Gouveia, M., Neves, A., Patricio, D., Mota, J., Rafael, F., Vieira, J., Santos, M. & Nelles, S. (2021). *Wristwatches Industry Report 2020/2021*, *International Industry Analysis*. Retrieved March 8, from https://www.strategosinstitute.com/uploads/93dc71606efd0b02ca874253ceb8bc143b68d0a2472a60302e910cc68841adeb.pdf

Hong, S. & Zhuqing, S. (2012). New thoughts of customer value study. *Physics Procedia*, *24*, 1232-1237. Doi: https://doi.org/10.1016/j.phpro.2012.02.184

Keinonen, T. (1997). *Expected usability and product preference*. Proceedings of the 2nd conference on Designing interactive systems: processes, practices, methods, and techniques, 197-204.

Malhotra, G. (2020). Consumers' insights to purchase G-shock wristwatch. *Academy of Marketing Studies Journal*, *24*(4), 1-13. Retrieved March 10, from https://www.proquest.com/openview/e0ce64b10fbe5aa505b922a050899f8b/1?pq-origsite=gscholar&cbl=38744

Market Research. (2022). *Global Wristwatch Market 2022-2026*. Retrieved March 1, from https://www.marketresearch.com/Infiniti-Research-Limited-v2680/Global-Wristwatch-32557307/

Matović, V., Stanić, M., & Drinić, I. (2019). Impact branding on consumer preference towards buying a certain product: comparative analysis of brands Nike and Adidas. *Ekonomika*, *65*(3), 35-44. Doi: https://10.5937/ekonomika1903035M

McKinsey & Company. (2021). *The State of Fashion, Watches and Jewellery*. Retrieved February 12, from https://www.mckinsey.com/industries/retail/our-insights/state-of-fashion-watches-and-jewellery

Miletic, V., Ćurčić, N., & Kostić, Z. (2021). Openness of companies in Serbia to creativity, new ideas and innovation. *Anali Ekonomskog fakulteta u Subotici*, *57*(46), 21-34. Doi: https://doi.org/10.1177/002224298805200302

Netseva-Porcheva, T. (2011). Value-based pricing - a success factor in the competitive struggle. *Marketing 42*(4), 227-236. Doi: https://doi.org/10.5937/markt1104227N

Perry, M., O'Hara, K., Sellen, A., Brown, B. & Harper, R. (2001). Dealing with mobility: understanding access anytime, anywhere. *ACM Transactions on Computer-Human Interaction*, *8*(4), 323-347. Doi: https://doi.org/10.1145/504704.504707

Puška, A., Stojanović, I., Šadić, S., & Bečić, H. (2018). The influence of demographic characteristics of consumers on decisions to purchase technical products. *The European Journal of Applied Economics*, *15*(2), 1-16. Doi: https://doi.org/10.5937/EJAE15-16576

Statista. (2022). Estimated market share of the leading Swiss watch brands worldwide in 2021. Retrieved February 12, from https://www.statista.com/statistics/940579/market-share-of-swiss-watch-brands-worldwide/

Rettie, R. & Brewer, C. (2000). The verbal and visual components of package design. *Journal of Product & Brand Management*, *9*(1), 56-70. Doi: https://doi.org/10.1108/10610420010316339/full/html

Teas, R. K. & Agarwal, S. (2000). The effects of extrinsic product cues on consumers` perceptions of quality, sacrifice, and value. *Journal of the Academy of Marketing Science 28*, 278-290. Doi: https://doi.org/10.1177/0092070300282008

Ullah, G. M. S. & Islam, M. R. (2011). Effects of warranty on purchase decision of electronic products: an empirical research from the perspective of Bangladesh. *Industrial Engineering Letters*, *1*(1), 13-23. Doi: http://hdl.handle.net/10361/6254

Witek, L. (2016). Influence of socio-demographic characteristics of consumers on attitudes towards cause related marketing. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, *64*(6), 2173-2182. Doi: http://dx.doi.org/10.11118/actaun201664062173

Wright, R. & Keith, L. (2014).Warable Technology: If the tech fits, wear it. *Journal of Electronic Resources in Medical Libraries*, *11*(4), 204-216. Doi: https://doi.org/10.1080/15424065.2014.969051

Zeithmal, V. A. (1988). Consumer perception of price, quality and value: a means-end model and synthesis of evidence. *Journal of Marketing*, *52*, 2-22. Doi: https://doi.org/10.1177/002224298805200302

UDC: 616.98:578.834-036.21:336(497.11)
DOI: 10.5937/AnEkSub2300022P

Анали Економског факултета у Суботици – The Annals of the Faculty of Economics in Subotica
Vol. 60, No. 51, pp. 049-061
Received: 30/05/2023
Accepted: 04/07/2023
Published online: 07/07/2023

Original scientific article

The COVID-19 pandemic and its effect on human capital and financial performance: evidence from Serbian banks

Ефекти пандемије COVID-19 на људски капитал и финансијске перформансе: случај банкарског сектора Србије

Goran Pavlović
University Metropolitan, Faculty of Management, Belgrade, Republic of Serbia,
goran.pavlovic@metropolitan.ac.rs, https://orcid.org/0000-0002-5557-9262

Abstract: Human capital holds significant importance for banks, as it includes specific knowledge and skills. It serves as a crucial determinant of financial performance. However, human capital is susceptible to various factors that can exert negative effects. The COVID-19 stands as one such factor, necessitating bank restructuring and potentially resulting in a depreciation of human capital value and subsequent performance decline. The objective of the research is to investigate the influence of the COVID-19 pandemic on the human capital of banks in the Republic of Serbia and evaluate its implications on financial performance. The research spanned across all banks operating in the Republic of Serbia throughout the period of 2019 to 2021. The Wilcoxon Signed Rank test was employed to assess the difference in human capital value over the observed period. Furthermore, the regression analysis was implemented to investigate the impact of human capital on ROA, ROE, and NPM. Results showed that COVID-19 pandemic has led to a decrease in the value of human capital in banks in the Republic of Serbia. The financial performance of banks is positively influenced by human capital in the short term. However, over the long term, the value of human capital depreciates, resulting in a diminishing impact on financial performance.
Keywords: human capital, banking, financial performance, COVID-19, profitability
JEL classification: J24, G21, D22, M21

Сажетак: Људски капитал има веома велики значај у банкарству, будући да укључује специфична знања и вештине запослених, које могу деловати на остваривање финансијских перформанси. Међутим, људски капитал је подложан различитим факторима који могу имати негативне ефекте. COVID-19 је један од таквих фактора, који захтева реструктурирање банака и потенцијално резултира смањењем вредности људског капитала и последично опадањем перформанси. Циљ истраживања је испитивање ефекта COVID-19 на људски капитал банака у Републици Србији и процена импликација таквог утицаја на финансијске перформансе. Истраживањем су обухваћене све банке које су пословале у Републици Србији од 2019. до 2021. године. За процену разлике у вредности људског капитала у посматраном периоду коришћен је Wilcoxon Signed Rank тест. Такође, у студији је примењена регресиона анализа како би се испитао утицај људског капитала на ROA, ROE и стопу нето добитка. Резултати су показали да је пандемија COVID-19 довела до смањења вредности људског капитала у банкама у Републици Србији. Људски капитал остварује статистички сигнификантан утицај на финансијске перформансе

банака у кратком року, док се дугорочна вредност смањује услед погоршања вредности људског капитала.
Кључне речи: људски капитал, банкарство, финансијске перформансе, COVID-19, профитабилност
ЈЕЛ класификација: J24, G21, D22, M21

Introduction

Banking is a knowledge-based industry sector where the emphasis is on the continuous process of innovation and maximizing the quality of services provided (Milošević, Dobrota, Dmitorović, & Barjaktarović-Rakočević, 2021). It is evident that human capital, which encompasses specific competencies and skills, holds special importance in the banking sector. The resource-based view of the firm postulates that creating business success and gaining a competitive advantage requires resources that are rare, valuable, and cannot be imitated, as is the case with human capital (Soevarno & Tjahjadi, 2020). Bontis (2001) states that human capital includes special knowledge, skills, competencies, as well as employees' ability to innovate and solve complex problems. In the modern business landscape and era of globalization, the development of knowledge is crucial alongside the advancement of information technology. Knowledge development has emerged as a socially responsible practice towards employees, capable of fostering the growth of human capital and exerting a positive influence on financial outcomes (Aleksić, Pjanić, Berber & Slavić, 2022). Considering the unique value and intangible nature of human capital, which makes it challenging to build or replicate, it can be assumed that human capital significantly influences the financial performance. Since human capital represents one of the most vital components of a bank's intellectual capital, we should consider the contribution that employees' competencies can make to the financial results achieved by banks (Milošević et al., 2021; Ousama, Hammami & Abdulkarim, 2019).

Given that human capital represents an asset of banks, it is evident that it is influenced by numerous internal and external factors. One such factor is the COVID-19 pandemic, which rapidly transitioned from the health to the economic sector and caused global economic and financial problems. COVID-19 represents a specific form of systemic risk that banks have faced, resulting in significant financial consequences (Xiazi & Shabir, 2022; Bentley, Kehoe, & Chung, 2021). Considering that the financial market in Serbia is primarily bank-centric (banks account for more than 90% of the total financial assets) (Cvetković, Cogoljević & Ranđelović, 2021; Živković & Vojinović, 2018; Ercegovac, Vlaović Begović & Jovin, 2019) and coupled with the debt moratorium and the redirection of consumer needs towards essential products during COVID-19, there has been a substantial decline in the total income of banks. Consequently, banks are facing a shortage of financial resources to invest in human capital. Restructuring banks in order to cope with the expected financial consequences during the COVID-19 has become a necessity (Vasić, 2020). Unfortunately, such restructuring inevitably affects human capital, often with negative implications. In an attempt to improve the financial situation, banks aim to minimize costs, and employee downsizing has become a prevalent strategy during the COVID-19. However, it is often overlooked that such a strategy may have long-term adverse consequences on the value created by banks (Bentley et al., 2021), especially if

downsizing is not planned and executed precisely to preserve valuable human capital. Consequently, banks may find themselves in a situation where, even after implementing restructuring measures, they achieve worse financial performance than before the changes were made. Considering these points, the objective of the research is to investigate the influence of the COVID-19 pandemic on the human capital of banks in Serbia and evaluate its implications on financial performance.

This paper is structured into several key sections. Following the introductory discussion, a literature review is conducted to explore the existing body of knowledge related to the examined problem. Based on these findings, hypotheses are formulated to align with previous research outcomes. The second part of the paper presents the research methodology, while the third part focuses on the results and discussion. The final section encompasses the conclusion, implications, limitations, and suggestions for further research.

1. Literature review and hypotheses

The transition from an economy dominated by physical assets to a knowledge-based economy, where the knowledge, skills, and abilities of employees are the most critical factors, emphasizes the significance of human capital as a fundamental driver of innovation and competitive advantage (Soevarno & Tjahjadi, 2020). As a central component of intellectual capital, human capital encompasses the aforementioned knowledge, skills, abilities, as well as employees' experience, willingness to learn, and develop (Peković, Pavlović & Zdravković, 2020). A focus on continuous learning is essential for improving human capital and ensuring a competitive advantage. Human capital includes employees' tacit knowledge, which is difficult to imitate, as well as their values, attitudes, overall education, motivation, willingness to cooperate, and knowledge sharing (Buallay, Hamdan, Reyad, Badawi & Madbouly, 2019; Simić & Slavković, 2019; Kovjanić & Vukadinović, 2021). As one of the most important assets, human capital often demonstrates a positive impact on Return on Assets (ROA) and other financial performance indicators (Soevarno & Tjahjadi, 2020).

Since employees' knowledge is one of the key factors influencing the performance of banks, employees in the banking sector are required to possess specific competencies and continuously improve and learn (Isa & Muafi, 2022). In fact, human capital stands out as the most crucial determinant of the performance and value added by financial organizations (Mirza, Hasnaoui, Naqvi & Rizvi, 2020). Among the three components of intellectual capital (structural and relational capital being the other two), human capital has the greatest statistically significant and positive impact on the performance of banks (Githaiga, 2022). Liu, Liu & Zhang (2021) point out that human capital in banking can be measured by the total formal and informal education in the field of finance, as well as by experience represented by the number of years working in banking. Considering the above, increasing human capital in banks through education and experience can be beneficial for generating financial performance, which is supported by studies demonstrating the statistically significant and positive impact of banks' human capital on their financial

performance (Milošević et al., 2021; Soevarno & Tjahjadi, 2020; Buallay et al., 2019; Githaiga, 2022).

However, the value of human capital, and consequently the performance achieved by banks, is influenced by numerous factors, including the previously mentioned COVID-19. As a specific form of systemic risk, COVID-19 has increased market volatility and financial vulnerability of banks, resulting in a decline in overall performance (Mirza et al., 2020; Xiazi & Shabir, 2022; Bentley et al., 2021). To maintain operations and minimize losses, many banks have implemented downsizing strategies, leading to significant reductions in the number of employees, particularly in high-skilled positions where employees command higher salaries. This strategy has also resulted in a significant reduction in the recruitment of qualified candidates and mass layoffs (Hamouche, 2021). The COVID-19 has led to a substantial increase in layoffs, impacting human capital in the banking sector (Bentley et al., 2021). Such strategies diminish the overall value of human capital in banks. The negative impact on human capital is further exacerbated by the new organizational changes that require reduced physical and social contact, as well as limited personal communication, teamwork, and knowledge sharing (Dissanayake, 2020). It is possible that banks will reduce investments in human capital to temporarily minimize operating costs, but these decisions overlook the fact that it threatens the creation of long-term value, even after the factors that led to the need for reducing human capital are eliminated (Bentley et al., 2021). The reason for this is that the departure of human capital represents a permanent loss of valuable and unique knowledge. Additionally, existing employees will have to handle a larger workload after the reduction of human capital, potentially leading to overtime work (Slavković, Bugarčić, Ognjanović & Pavlović, 2020). These factors highlight the specific nature and importance of human capital in creating long-term value and competitive advantage. Therefore, investing in employees and human capital should not be treated as an expense to be minimized, but rather as an opportunity that can enhance performance.

Based on the above considerations, this research assumes that during the COVID-19 period there was a decrease in the value of human capital of banks. Moreover, it is posited that human capital exerted a statistically significant and positively influential role on the financial performance of banks in the Republic of Serbia during the initial period. However, due to the decrease in the total value of human capital, it is assumed that the effects of the aforementioned impact on financial performance are of a short-term nature. Consequently, the following research hypotheses have been formulated:

H1: The COVID-19 led to a decrease in the value of human capital in banks in the Republic of Serbia.

H2: The financial performance of banks is positively influenced by human capital in the short term. However, over the long term, the value of human capital depreciates, resulting in a diminishing impact on financial performance.

2. Research methodology

Research in the field of the impact of intellectual capital on the financial performance of banks in the Republic of Serbia, as well as works that highlight the general importance of intellectual capital in banking in the Republic of Serbia exist (Peković et al., 2020; Bontis, Janošević, & Dženopoljac, 2013; Kovjanić & Vukadinović, 2021). According to the author's knowledge, there is a dearth of research specifically addressing the impact of human capital on the financial performance. It can be safely said that there are no studies in the Republic of Serbia that examines the effect of COVID-19 on the change of the human capital of banks and the effects of such change on financial performance, which is the specific theoretical and practical value of this paper.

To achieve the research objectives and test the defined hypotheses, a study was conducted on the population of banks that are active in the Republic of Serbia. All banks that operated on the Serbian financial market in the period 2019-2021 were included in the research. The independent variable is represented by human capital coefficient (HCE), measured with the VAIC methodology developed by Professor Pulić (Pulić, 2000). VAIC is is comprised of three elements: human capital, structural and relational capital. According to the aforementioned methodology, the first step in calculating human capital implies the determination of the value added (VA) by substracting total costs (IN) from total income (OUT):

$$VA = OUT - IN \quad (1)$$

Since VAIC methodology is based on the information from the balance sheet (Bontis et al., 2013), payroll costs are taken as an equivalent for investment in employees (HC) (Pulić, 2000; Sowearno & Tjahjadi, 2020). However, investments in employees should be excluded from the total costs, as they are considered investments rather than expenses, providing long-term benefits, which leads to a new model:

$$VA=OUT - (IN-HC) \quad (2)$$

When the added value is determined using the model (2), the second approach is calculating the value of the human capital coefficient (HCE) as a ratio of value added (VA) and total investment in employees (HC) (Pulić, 2000):

$$HCE = VA / HC \quad (3)$$

In model (3) HC includes wages, salary allowances and other personal expenses (payroll costs) during one fiscal year and as such describes the contribution of human resources to the created value (VA) (Janošević, Dženopoljac & Bontis, 2013).

The dependent variable is derived from three indicators of financial performance: Return on equity (ROE), computed as the ratio of net profit to banks' equity; Return on assets (ROA), computed as the ratio of net profit to banks' total assets; and Net profit margin (NPM), computed as the ratio of net profit to income.

The analysis covers a three-year period: 2019, which represents the year before the onset of the COVID-19; 2020, when the pandemic began and significant decisions were made to restructure banks, including changes in human capital; and 2021, a year characterized by financial stabilization and recovery in the banking sector. Financial reports for all banks that are active in Serbia are available for the year 2021.

3. Results and discussion

The first stage of statistical analysis entails the utilization of descriptive statistical analysis. Results in Table 1 shows that HCE decreased from 0.5955 in 2019 to 0.2709 in 2020. As expected, the value of human capital of banks in Serbia has decreased during the COVID-19. In 2021, as banks recovered financially, the value of human capital increased to 0.6177. Nonetheless, an inquiry arises regarding the potential amplification of the impact of human capital on financial performance. On average, all banks achieve positive financial performance except for the NPM, which is negative in 2020. Similar findings have been reported in other studies, showing a decline in bank profitability during the COVID-19 (Mirza et al., 2020; Xiazi & Shabir, 2022; Bentley et al., 2021).

Table 1: Descriptive statistics

Year	Variable	Min	Max	Mean	Stand. deviation
2019	HCE	-1.72	5.07	0.5955	1.3924
	ROA	-3.95	3.68	0.5586	1.8224
	ROE	-6.96	34,23	10,1550	12.3341
	NPM	-140.79	78.63	8.8764	47.3233
2020	HCE	-1.71	6.91	0.2709	1.6613
	ROA	-3.99	4.17	0.0273	1.7436
	ROE	-9.46	36.04	6.3714	11.5921
	NPM	-171.51	67.86	-6.2764	54.8244
2021	HCE	-0.99	3.39	0.6177	1.1234
	ROA	-3.25	2.31	0.4173	1.2359
	ROE	-4.84	24.97	9.1132	9.7554
	NPM	-155.15	56,48	8.3759	41.9785

Source: the authors' research

Prior to conducting the correlation analysis, it is imperative to examine the data distribution. In order to achieve this objective, the Kolmogorov-Smirnov (KS) and Shapiro-Wilk (SW) tests were employed. The outcomes of the normality tests, as presented in Table 2, reveal that the ROE exhibits a normal distribution across all analysed years, along with HCE in 2021. However, the remaining indicators exhibit statistically significant results, indicating a departure from a normal distribution. Hence, non-parametric tests should be employed accordingly.

Table 2: Normality tests

Year	Variable	KS			SW		
		Statistics	df	Sig.	Statistics	df	Sig.
2019	HCE	0.190	22	0.037	0.889	22	0.018
	ROA	0.234	22	0.003	0.917	22	0.066
	ROE	0.131	22	0.200*	0.944	22	0.236*
	NPM	0.288	22	0.000	0.830	22	0.002
2020	HCE	0.316	22	0.000	0.653	22	0.000
	ROA	0.232	22	0.003	0.895	22	0.024
	ROE	0.126	22	0.200*	0.944	22	0.244*
	NPM	0.285	22	0.000	0.796	22	0.000
2021	HCE	0.166	22	0.119*	0.904	22	0.036
	ROA	0.241	22	0.002	0.861	22	0.005
	ROE	0.125	22	0.200*	0.931	22	0.131*
	NPM	0.299	22	0.000	0.661	22	0.000

Source: the authors' research

In order to test the first (H1) hypothesis, it is necessary to apply the Wilcoxon Signed Rank test. The corresponding outcomes are presented in Table 3.

Table 3: The difference in human capital of banks in the observed years

Test statistics	Degrees of freedom	Standard error	Sig.	HCE Mean Rank 2019	HCE Mean Rank 2020	HCE Mean Rank 2021
8,455	2	0.302	0.015	2.32	1.5	2.18

Source: the authors' research

The results in the Table 3 show that the human capital of banks differs by observed years. As anticipated, the value of human capital is highest at the outset of the period, specifically before the onset of the COVID-19. During pandemic in 2020, human capital reached its lowest value. In 2021 investment in human capital increased. However, it should be noted that the value in 2021 is lower compared to 2019, indicating that the financial recovery of banks in 2021 was not sufficient to facilitate additional investments in human capital. Accordingly, the research hypothesis (H1) can be accepted and it can be stated that the *COVID-19 had negative impact on the value of human capital in banks in the Republic of Serbia.*

Regarding the correlation analysis, the outcomes of Spearman's correlation coefficient are presented in Table 4. Correlation coefficient values in the interval up to +/-0.29 can be considered low, values from +/-0.3 to +/-0.49 as moderate, and values above +/-0.5 as high (Cohen, 1988).

Table 4: Results of the correlation analysis

Year	Variable	HCE	ROA	ROE	NPM
2019	HCE	1	0.750**	0.727**	0.671**
	ROA	0.750**	1	0.932**	0.936
	ROE	0.727**	0.932	1	0.929**
	NPM	0.617**	0.936**	0.929**	1
2020	HCE	1	0.730**	0.596**	0.681**
	ROA	0.730**	1	0.958**	0.917**
	ROE	0.596**	0.958**	1	0.967**
	NPM	0.681**	0.917**	0.967**	1
2021	HCE	1	0.542**	0.477*	0.547**
	ROA	0.542**	1	0.924**	0.935**
	ROE	0.477*	0.924**	1	0.922**
	NPM	0.547**	0.935**	0.922**	1

** 0.01 Significance level (2-tailed); *- 0.05 Significance level

Source: the authors' research

Narrowing the focus to solely examine the correlation between human capital (HCE) and financial performance (ROA, ROE and NPM), it is observed that a high correlation was achieved during 2019 and 2020. The highest degree of correlation in 2019 was achieved between HCE and ROA (0.750). During 2020, the highest degree of correlation exists again between HCE and ROA (0.730). Although it is a high degree, a certain decrease in correlation between those two variables is noticeable. Namely in the 2019, the value of human capital in the banks of the Republic of Serbia was at a satisfactory level, as a result of which a positive correlation was achieved with financial performance. During the 2021, the highest level of correlation was achieved between HCE and NPM (0.547). It is noticeable that the correlation of HCE and NPM in 2021 is lowest comparing with the period of 2019 and 2020. Similar observations can be made regarding the correlation between HCE and ROA, as well as HCE and ROE.

As correlation only indicates the strength and direction of the relationship, it is important to conduct regression analysis to obtain a more accurate understanding concerning the influence exerted by human capital on the financial performance. The results are presented in Table 5.

Table 5: Regression analysis

Year	Regression model	R^2	β	t	Sig.	Durbin Watson	VIF
2019	HCE → ROA	0.540	0.735	4.846	0.000*	1.755	1.000
	HCE → ROE	0.565	0.751	5.094	0.000*	1.951	1.000
	HCE → NPM	0.388	0.623	3.558	0.002**	0.796	1.000
2020	HCE → ROA	0.487	0.698	4.353	0.000*	1.707	1.000
	HCE → ROE	0.523	0.739	4.906	0.000*	1.891	1.000
	HCE → NPM	0.200	0.487	2.497	0.021**	0.797	1.000
2021	HCE → ROA	0.097	0.312	1.469	0.157	1.959	1.000
	HCE → ROE	0.132	0.363	1.745	0.096***	2.570	1.000
	HCE → NPM	0.099	0.37	1.821	0.084***	1.864	1,000

****- 0.1 Significance level; **-0.05 Significance level; *-0.001 Significance level*

Source: the authors' research

The results show that the HCE has a statistically significant and positive impact on financial performance (observed by ROA, ROE and NPM). During 2019, human capital describes 54% of the variability of ROA, with statistically significant results at the 0.001 level. Additionally, HCE describes 56.5% of ROE and 38.8% of NPM variability (with statistically significant results at the 0.001 and 0.05 levels, respectively). Durbin Watson test results in this period show the absence of autocorrelation, as the value was close to 2 (Bontis et al., 2013), except in the case of the regression model between HCE and NPM (0.796), making this model less reliable. In 2020, there was a slight decline in the results, but they remained statistically significant. The coefficient of determination between HCE and ROA was 48.7%. HCE explained 52.3% of ROE and 20% of NPM variability, which is also a decrease from 2019. However, the impact of HCE on financial performance was still statistically significant in all cases (at the 0.001 level when it comes to ROA and ROE and 0.05 level when it comes to NPM). It is worth noting that the COVID-19 hit Serbia in March 2020, leading to changes in bank restructuring. Despite these changes, employees managed to generate high performance with their knowledge and skills. Only later in 2020 did changes in the domain of human capital occur, and thus the regression results for 2021 should be examined. Durbin Watson test results in this period show the absence of autocorrelation, as the value was close to 2 (Bontis et al., 2013), except in the case of the regression model between HCE and NPM (0.797), making this model slightly less reliable. However, in 2021 human capital had a significantly lower impact on financial performance. The coefficient of determination between HCE and ROA was only 9.7%; between HCE and ROE 13.2% and finally between HCE and NPM 9.9%. These values were notably lower compared to previous periods. Therefore, it can be concluded that even though banks attempted to improve the previously reduced value of human capital, it did not result in positive effects, leading to the absence of significant impact of human capital on financial performance in 2021. The results of the Durbin Watson test in this period indicated the absence of autocorrelation, as the value was close to 2 (Bontis et al., 2013), except in the case of the regression model between HCE and ROE (2.570), where a slight presence of autocorrelation was observed, making this model less reliable than others. No

multicollinearity was observed in all periods and models, as the VIF factor was less than 5 (Field, 2020).

The empirical findings derived from the regression analysis indicate a significant and positive relationship between human capital and the financial performance of banks. However, this impact was observed to be short-term. During the COVID-19 period, the reduced value of human capital led to a temporary improvement in effects due to lower operating costs. Nevertheless, in the long run, the decrease in the value of human capital, including employees' knowledge, skills, and competencies, resulted in a decline in value. Despite the banks' efforts to increase the value of human capital in 2021, it did not reach pre-COVID-19 levels, leading to the absence of a statistically significant impact. Therefore, the second hypothesis (H2) can be accepted and it can be stated that *the financial performance of banks is positively influenced by human capital in the short term. However, over the long term, the value of human capital depreciates, resulting in a diminishing impact on financial performance.*

Conclusion, implications, limitations, and further research

Human capital fulfils a pivotal role within the banking sector, encapsulating knowledge, skills, abilities, experiences, willingness to learn, share knowledge, work in teams, and loyalty to the organization, all of which significantly impact financial performance, as confirmed by this research. Conducted over a three-year period and including all banks that were active in the Republic of Serbia, the study yielded compelling evidence indicating a robust and statistically significant positive impact of human capital on financial performance, including ROA, ROE, and NPM. By developing and retaining human capital, banks are better equipped to leverage market potential, foster innovation, and gain a competitive advantage. However, the value of human capital is subject to various factors, often considered as a system risk. The COVID-19 serves as one such factor, leading to significant financial challenges in the global banking market. To minimize costs and mitigate losses, banks often resort to decisions that involve reducing investments in human capital. While such decisions may yield immediate benefits in terms of cost reduction and short-term profitability, long-term consequences must be taken into account. By diminishing the value of human capital, banks directly undermine the overall knowledge level within the organization, ultimately leading to decreased performance. Furthermore, the reduction in human capital places an increased workload and overtime on existing employees, negatively impacting their satisfaction and, subsequently, the achieved performance. Based on the research findings, it is evident that human capital had a significant influence on the financial performance of banks during the pre-pandemic period. This influence continued in the subsequent year, likely because strategic changes in human capital within banks did not occur immediately at the beginning of the year but rather later when the impact of COVID-19 became more pronounced. Although the value of human capital increased in the following year, this growth was insufficient to compensate for the earlier loss of knowledge, which is the reason for the absence of a significant influence of human capital on financial performance.

The findings of this research hold both theoretical and practical significance. From a theoretical perspective, they contribute to scientific knowledge in the field of human capital in banks and lay the groundwork for future research. Taking into account the scarcity of research conducted in the specific domain, particularly in the context of the COVID-19 and its effects on human capital and financial performance, these results provide valuable insights. Additionally, the practical significance of the research lies in disseminating the obtained information to top managers and human resource managers in banks. The research results provide valuable insights into the imperative nature of investing in human capital to achieve better financial performance and gain a competitive advantage. This reaffirms the notion that investing in employees is not an expense but an investment that yields long-term benefits.

The research findings are accompanied by certain limitations that can guide future research. Firstly, the study encompasses all banks that were active in Serbia. In order to acquire better understanding of the subject matter, future research could consider expanding the scope to include banks from other regions or countries. Additionally, the analysis covers a three-year period. To assess whether there has been an improvement in human capital following the COVID-19, it is advisable to extend the time coverage in future studies and examine data from subsequent years, beyond 2021. Furthermore, this paper operationalizes the dependent variable using three indicators: ROA, ROE, and NPM. To provide a more holistic perspective of the relationship between human capital and financial performance, it would be beneficial for future research to incorporate additional financial indicators. Including a broader range of financial metrics would contribute to a more comprehensive knowledge about the relationship between human capital of banks and their financial performance. By addressing these limitations and conducting further research, scholars can advance the existing knowledge in the field, delve into the effects of the pandemic on human capital, and explore the influence of human capital on a wider range of financial performance indicators, thus enriching the understanding of this important relationship in the banking industry.

References

Aleksić, M., Pjanić, M., Berber, N., & Slavić, A. (2022). The impact of corporate social responsibility on the financial performance in the Republic of Serbia. *Journal of Engineering Management and Competitiveness, 12*(2), 95-103. Doi: https://doi.org/10.5937/JEMC2202095A

Bentley, F.S., Kehoe, R.R., & Chung, H. (2021). Investing for keeps: firms' prepandemic investments in human capital decreased workforce reductions associated with COVID-19 financial pressures. *Journal of Applied Psychology*, *106*(12), 1785-1804. Doi: https://doi.org/10.1037/apl0001002

Bontis, N. (2001). Assessing knowledge assets: a review of the models used to measure intellectual capital. *International Journal of Management Reviews*, *3*(1), 41-60. Doi: https://doi.org/10.1111/1468-2370.00053

Bontis, N., Janošević, S., & Dženopoljac, V. (2013). Intellectual capital and corporate performance of Serbian banks. *Актуальні проблеми економіки*, 4, 287-299.

Buallay, A., Hamdan, A.M., Reyad, S., Badawi, S., & Madbouly, A. (2019). The efficiency of GCC banks: the role of intellectual capital. *European Business Review*, *32*(3), 383-404. Doi: https://doi.org/10.1108/EBR-04-2019-0053

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. New York: Routledge. Doi: https://doi.org/10.4324/9780203771587

Cvetković, M., Cogoljević, M., & Ranđelović, M. (2021). The impact of economic development on the efficiency of the financial sector. *Ekonomika, 67*(3), 107-117. Doi: https://doi.org/10.5937/ekonomika2103107C

Dissanayake, K. (2020). Encountering COVID-19: Human resource management (HRM) practices in a pandemic crisis. *Colombo Journal of Multi-Disciplinary Research*, *5*(1-2), 1-22. Doi: https://doi.org/10.4038/cjmr.v5i1-2.52

Ercegovac, D., Vlaović Begović, S., & Jovin, S. (2019). Analiza ključnih pokazatelja bankarskog sektora Republike Srbije. *Anali Ekonomskog fakulteta u Subotici*, *55*(41), 81-94. Doi: http://doi:10.5937/AnEkSub1941081E

Field, A. (2000). *Discovering statistics using SPSS for Windows*. Thousand Oaks: Sage Publications.

Githaiga, P.N. (2022). Intellectual capital and bank performance: the moderating role of income diversification. *Asia-Pacific Journal of Business Administration*, 1-19. Doi: Doi: https://doi.org/10.1108/APJBA-06-2021-0259

Hamouche, S. (2021). Human resource management and the COVID-19 crisis: implications, challenges, opportunities, and future organizational directions. *Journal of Management & Organization*, 1-16. Doi: https://doi.org/10.1017/jmo.2021.15

Isa, E.S.A., & Muafi, M. (2022). Human capital, organizational learning and their effects on innovation behavior and performance of banking employees. *International Journal of Finance & Banking Studies*, *11*(1), 2-18. Doi: https://doi.org/10.20525/ijfbs.v11i1.1533

Janošević, S., Dženopoljac, V., & Bontis, N. (2013). Intellectual capital and financial performance in Serbia. *Knowledge and Process Management, 20*(1), 1-11. Doi: https://doi.org/10.1002/kpm.1404

Kovjanić, M., & Vukadinović, P. (2021). Intelektualni kapital kao strateška performansa banke sa osvrtom na banke. *Bankarstvo*, *50*(1), 90-107.

Liu, G., Liu, Y., & Zhang, C. (2021). Human capital in the financial sector and corporate debt maturity. *China Economic Review*, 69, 1-21. Doi: https://doi.org/10.1016/j.chieco.2021.101652

Milošević, N., Dobrota, M., Dmitorović, V., & Barjaktarović-Rakočević, S. (2021). Managerial perception of human capital, innovations, and performance: evidence from banking industry. Engineering Economics, *32*(5), 446-458. Doi: http://dx.doi.org/10.5755/j01.ee.32.5.26032

Mirza, N., Hasnaoui, J.A., Naqvi, B., & Rizvi, S.K.A. (2020). The impact of human capital efficiency on Latin American mutual funds during Covid- 19 outbreak. *Swiss Journal of Economics and Statistics, 156*(16), 1-7. Doi: https://doi.org/10.1186/s41937-020-00066-6

Ousama, A.A., Hammami, H., & Abdulkarim, M. (2019). The association between intellectual capital and financial performance in the Islamic banking industry. An analysis of the GCC banks. *International Journal of Islamic and Middle Eastern Finance and Management*, *13*(1), 75-93. Doi: https://doi.org/10.1108/IMEFM-05-2016-0073

Peković, J., Pavlović, G., & Zdravković, S. (2020). The influence of intellectual capital on financial performance of commercial banks in the Republic of Serbia. *Ekonomika*, *66*(2), 103-111. Doi: https://doi.org/10.5937/ekonomika2002103P

Pulić, A. (2000). VAIC - an accounting tool for IC management. *International Journal of Technology Management*, *20*(5), 702-714. Doi: https://doi.org/10.1504/IJTM.2000.002891

Simić, M., & Slavković, M. (2019). The role of human capital in entrepreneurial innovativeness: evidence from Serbia. FACTA UNIVERSITATIS Series: Economics and Organization, *16*(1), 49-58. Doi: https://doi.org/10.22190/FUEO1901049S

Slavković, M., Bugarčić, M., Ognjanović, J., & Pavlović, G. (2020). Knowledge management and downsizing: implications for organizational performance. *Acta Economica, 19*(35), 35-51. Doi: https://doi.org/10.7251/ACE2135035S

Soeawarno, N., & Tjahjadi, B. (2020). Measures that matter: an empirical investigation of intellectual capital and financial performance of banking firms in Indonesia. *Journal of Intellectual Capital*, *21*(6), 1085-1106. Doi: https://doi.org/10.1108/JIC-09-2019-0225

Vasić, V. (2020). Očekivanja i izazovi bankarskog sektora u 2021. godini. *Bankarstvo*, *49*(4), 4-8.

Xiazi, X., & Shabir, M. (2022). Coronavirus pandemic impact on bank performance. *Frontiers in Psychology*, 13:1014009, 1-14. Doi: https://doi.org/10.3389/fpsyg.2022.1014009

Živković, S., Vojinović, Ž. (2017). Bankoosiguranje u Srbiji – trendovi i perspektive. *Zbornik radova EkonBiz*, 166-175.

UDC: 658.818(497.11)
DOI: 10.5937/AnEkSub2300024D

Original scientific article

Анали Економског факултета у Суботици – The Annals of the Faculty of Economics in Subotica
Vol. 60, No. 51, pp. 063-079
Received: 25/05/2023
Accepted: 14/07/2023
Published online: 03/08/2023

Conceptual model of key predictors and consequences of customer satisfaction

Концептуални модел кључних предиктора и консеквенци сатисфакције потрошача

Nađa Đurić
Faculty of Economics, University of Kragujevac Kragujevac, Republic of Serbia, nadja.djuric@ef.kg.ac.rs
https://orcid.org/0000-0003-4358-7465

Abstract: Satisfied customers represent an important resource for a company. So far research has shown that customer satisfaction has an impact on the return on investment, the growth of the company's market share, and shareholder value. The importance of research on customer satisfaction is seen in the fact that it most often leads to loyalty, which represents an important prerequisite to a company's long-term profitability. In line with the significance of these two concepts in companies' success, the topics of this research are the determinants of customer satisfaction and the relationship between satisfaction and loyalty. The goal of the research is the identification of key variables and the measurement of their respective impact on customer satisfaction. An adapted expectancy-disconfirmation model was used for the identification of key determinants. Satisfaction was viewed as a function of customer expectations and perceived product performance, and an additional component, the company's image. This research was carried out on the territory of the Republic of Serbia through an online survey. The obtained conclusions can help companies in Serbia to better the quality of provided services, with the end goal being achieving an agreeable level of customer satisfaction and loyalty, and with it, higher profitability.
Keywords: Customers satisfaction, customer loyalty, perceived quality, company's image, customer expectations
JEL classification: M31

Сажетак: Задовољни потрошачи представљају значајан ресурс за компанију. Досадашња истраживања указују на то да задовољство има утицај на повраћај улагања, раст тржишног удела компаније и вредност за акционаре. Значај истраживања сатисфакције потрошача огледа се у чињеници да она најчешће води ка лојалности, која представља важан предуслов дугорочне профитабилности компанија. У складу са значајем ова два концепта за успех компанија, предмет истраживања овог рада су детерминанте задовољства потрошача и однос сатисфакције и лојалности. Циљ спроведеног истраживања је идентификовање кључних варијабли и мерење утицаја сваке од њих на сатисфакцију потрошача. За идентификовање кључних детерминанти сатисфакције примењен је адаптирани модел непотврђивања очекиваног. Сатисфакција је посматрана као функција очекивања потрошача и уочених перформанси производа и додатне детерминанте, имиџа компаније. Истраживање је спроведено на подручју Републике Србије путем онлине анкете. Добијени закључци могу помоћи компанијама у Србији да унапреде квалитет пружених услуга, са крајњим циљем да се оствари одговарајући ниво сатисфакције и лојалности клијената, а самим тим и веће профитабилности.
Кључне речи: Задовољство потрошача, лојалност потрошача, перципирани квалитет, имиџ компаније, очекивања потрошача
ЈЕЛ класификација: M31

Introduction

Customer satisfaction is a concept that attracts more and more attention in today's business world. In an ever-changing and provocative commercial environment, with a constant tendency towards the customer expectations growth, the price and the quality of a product cannot be enough for reaching and keeping an advantage over competitors on their own (Ozkan, Cek & Eyupoglu, 2022). Integration of the quality of the service provided, customer satisfaction, and customer loyalty creates a mutual relationship between the service provider and the user of said service (Hermans, 2015). In most cases, customer satisfaction opens a path for reaching the competitive advantage, while their loyalty makes keeping that advantage possible (Mittal, Han, Lee & Sridhar, 2021). It is a well-known fact that higher satisfaction level leads to repeated purchasing and creates loyalty with existing customers, but even more importantly, it also leads to the spread of positive reviews which attract new clients, and that increases competitiveness in the market and the company's profitability.

Scientific literature has multiple different definitions of satisfaction, and a consensus still hasn't been reached about the true meaning of this term, precisely because of the different approaches to it. A certain number of authors defines satisfaction as a result/condition, i.e. "the buyer's cognitive state of being adequately or inadequately rewarded for the sacrifices he has undergone" (Howard & Sheth, 1969). Another approach is to view satisfaction as an evaluation process, which gives us the definition of satisfaction as „an overall evaluation of purchasing experience focusing on the comparison of a product's or a service's perceived performance in relation to pre-shopping expectations" (Fornell, 1992). Oliver (1977) defined satisfaction as "an estimation of whether the characteristics of a product or a service, or the product or the service themselves, have accomplished an acceptable level of fulfilling the need that led them to go shopping".

It is important for companies to identify the main prerequisites for achieving customer satisfaction, because based on them, they can conclude which aspects of business they should invest the most resources in. Customer satisfaction is often considered the key to the company's success and long-term competitiveness because it leads to repeated purchasing and creates a pool of loyal clients. The main question service providers are faced with is which are the determinants of satisfaction and loyalty, i.e. which factors influence the long-term use of a company's service/product (Fattah & Dahleez, 2021). Measurement of customer satisfaction is the focus of marketing and management teams, which endeavour to raise the satisfaction level, and with it the competitive advantage, with proper evaluation and allocation of necessary resources. Based on the results of these measurements, different effects can be observed, and adequate measures can be taken, with the goal of advancing the business (Maričić, Veljković & Đorđević, 2012).

The first attempt to measure customer satisfaction on a national level happened in Sweden in 1989; its primary goal was to follow and compare the satisfaction index between individual branches, as well as comparing the results of a specific company with the average of the branch, comparing the results in different time intervals, predicting long-

term results and effects; also, answering different questions, like the one about the sensitivity of certain branches (and companies) to the customer satisfaction, about the effects of overall quality and price, about the effect customer expectation has on satisfaction, about the effect of customer complaints and the effect of word of mouth propaganda etc. (Fornell, 1992). While certain countries started creating their own national barometers for measuring and identifying the index of customer satisfaction (for example: Singapore, Germany, Switzerland, Taiwan), most of the countries started using pre-existing models, among which the aforementioned Swedish and American measurement models are used the most. American barometer emphasizes the necessity of measuring the quality of products and the quality of services separately. The European Customer Satisfaction Index (ECSI) was defined at the end of the 20th century and, unlike ACSI and SCSB, along with customer expectation, perceived quality, and perceived value, emphasizes the image as an important determinant for satisfaction.

In this research, the adapted expectancy-disconfirmation model was used for detecting the main determinants of satisfaction. The expectancy-disconfirmation model contains four components: expectation, perceived performances, dissatisfaction, and satisfaction (Churchill & Surprenant, 1982). By this model, customers form expectations for products/services pre-shopping. Then the product is experienced and evaluated, after which the results (performance of the product) are compared to the expectations. The outcome of this process is either confirmed or disconfirmed expectations. In cases where the performance meets the expectations, a "neutral expectancy-disconfirmation" occurs, which implies that the user got the expected level of the quality of a service. If the performance of the product did not satisfy the initial expectations, a "negative expectancy-disconfirmation" occurs; then the customers become dissatisfied with the quality of the product/service they were given. Satisfaction occurs in the scenario of the "positive expectancy-disconfirmation", where the performance goes beyond the expectations. This situation is the most optimal one, because it represents the highest level of satisfaction, which can quite easily be transformed into loyalty.

The results of research done by numerous authors (Andreassen & Lindestad, 1998; Martensen, Grønholdt & Kristensen, 2000; Kencana & Suputra, 2015; Rehman & Ishaq, 2017, etc.) point to the fact that another important determinant of satisfaction is company's image. Image pertains to the name of the brand and the type of associations customers get from the product/brand/company (Ciavolino & Dahlgaard, 2007).

Therefore, as important determinants of customer satisfaction, we can state the examination of perceived quality which reflects perceived performances, customer expectations, and company image. This paper especially focuses on questioning whether satisfaction is a resultant of the factors of expectation and perceived performances. Accordingly, the subjects of the paper's research are the connections between perceived quality, customer expectation, company's image, and customer satisfaction on one side, and the examination of the connection between customer satisfaction and customer loyalty. The

goal of this research is to identify the key determinants of customer satisfaction, detecting their effects on satisfaction, and consequently, the effect of satisfaction on customer loyalty.

The data were analysed in the Statistical Package for Social Sciences (SPSS, Version 20.0). The testing of the established research hypotheses was done by implementing correlation analysis, with the goal of testing the direction and strength of the connection between observed variables. The second step of analysing research hypotheses pertains to the use of multiple regression analysis to determine the effect of customer expectation, perceived quality, and company image on customer satisfaction.

Based on the defined subject and the goal of the research, this paper was structured into three interconnected units. The review of the literature about expectancy-disconfirmation model, determinants of satisfaction, and the relationship between customer satisfaction and customer loyalty is shown in the first part of the paper. Cited results of previous empirical research resulted in setting research hypotheses. The second part contains the description of research methodology. The third part of the paper contains the results of the correlational and the regression analysis, which were used to review the validity of set hypotheses.

1. Theory and hypotheses

1.1. Oliver's expectancy-disconfirmation model

The adaptation-level theory implies that the reaction of an individual to the received stimulant depends on the perception and reaction to similar stimuli in the past (Helson, 1964). Oliver (1980) applied this theory to studying customer satisfaction, claiming that satisfaction primarily depends on previously created expectations. According to his model, customers evaluate satisfaction with a product in comparison to their expectations of the product's performances. If the performance is above expectations, the satisfaction grows. If the performance (perceived quality) are below the expectations, satisfaction is lowered. Oliver (1980) concluded that expectation confirmation has a positive connection to a moderate level of customer satisfaction. Positive disconfirmation (perceived performances above expectations) increases customer satisfaction, while negative disconfirmation (perceived performances below expectations) leads to decreasing customer satisfaction.

The direct impact of expectancy-disconfirmation and customer satisfaction has been extensively researched. Bearden & Teel (1983) use a review of satisfaction determinants and customer complaints to show their positive connection. The same result was identified in the research of Khalifa & Liu (2007) & Chrissikopoulos (2014) etc.

In the cited research, customer satisfaction is primarily viewed as a function of customer expectation, and the observed the performances of products. However, results of more recent empirical research show that another significant determinant of satisfaction is company image (Rust, Moorman & Dickson, 2002; Kencana & Supurta, 2015). In fact, positive associations customers have towards some company will affect their experience and satisfaction with shopping a product/service from that company. Having in mind the

significance of company's image for customer satisfaction, other than the examination of basic determinants of satisfaction (expectations and perceived quality), this paper also researches the implications the image has on customer satisfaction.

1.2. Determinants of customer satisfaction

1.2.1. Customer expectations

Customer expectations relate to the anticipation of said product/service in the eyes of customer, which are the result of the active promotion of company/product, the experiences transferred from other users of company's services, or based on the previous experience with the company (Tenenhaus, Vinzi, Chatelin & Lauro, 2005).

The client generates expectations from a service and a product in a phase that precedes the shopping, and then, with the experience, creates comparative judgement between the received results and the initial expectations (Tejedor, Elola, Ajami & Bosch, 2019). Customer expectations and customer satisfaction are closely connected, and both are important factors while considering repeated shopping (Li & Liu, 2014). Satisfaction is achieved when the actual service experience exceeds the customer's anticipated expectations. Customer expectations are influenced by various factors and are formed based on their belief that the service will be delivered as desired. Satisfaction with the service is determined by the alignment between previously formed expectations and the perceived experience (Jevtić, Tomić & Leković, 2020). Halilovic & Cicic (2013) point out that expectations serve as a predecessor to determining the level of client satisfaction, where it was confirmed that expectation has a direct impact on satisfaction. During the research of client satisfaction on an online store, Hu, Kettinger & Poston (2015) came to the conclusion that satisfaction depends on expectations, as well as that their relationships are dynamic, and they evolve over time.

According to Oliver's expectancy-disconfirmation model, customer expectations have a positive effect on satisfaction. Satisfaction is achieved when the actual service experience exceeds the customer's anticipated expectations. Duan et al. (2022) point out that previous expectations of customers have a positive effect on satisfaction, i.e. if the expectations are met, customer satisfaction consequently grows as well. As the expectations grow, the expectancy-disconfirmation decreases, and vice versa. The positive correlation between expectations and satisfaction was confirmed by other authors as well (Lin, Wei & Lekhawipat, 2018; Szymanski & Henard, 2001; Spreng & Mackoy, 1996; Spreng, MacKenzie & Olshavsky, 1996).

However, Bayol (2000) concluded that customer expectations have a significant effect on the perceived value of a service, but that, on the other hand, they don't have a significant effect on customer satisfaction. Based on the previously stated results, the following hypothesis has been set:

H1: Customer expectations have a significant effect on customer satisfaction.

1.2.2. Perceived quality

Perceived performances can be defined as beliefs about the attributes of a product or the outcome of a used service (Cadotte, Woodruff & Jenkins, 1987). Since quality is a key component of performances (values), this research views the effect of quality on satisfaction.

Previous research was divided into the measurement and the effect of performances (values) on satisfaction and the effect of the measurement of quality on satisfaction. According to the disconfirmation model, perceived performances have a positive impact on satisfaction, which further implies that quality also has a direct effect on satisfaction. Besides Oliver (1987), a positive and meaningful relationship between perceived quality and satisfaction has been proven by Spreng, MacKenzie & Olshavsky (1996), Lankton & McKnight (2012), Wang et al. (2019). Tejdor, Eloa, Ajami & Bosh (2019) concluded that the perceived quality of service has the biggest impact on satisfaction, by researching customer satisfaction in the wine industry. Bayol (2000) had come to the conclusion that perceived quality has the biggest impact on customer satisfaction, while the perceived performance of a service has a smaller and moderately positive impact, by analysing the satisfaction of customers with mobile service providers.

On the other hand, some research doesn't identify perceived quality as an important determinant of satisfaction: Westbrook (1981) analysed the determinants of customer satisfaction in outlets and concluded that perceived quality does not have a significant impact on satisfaction; similar conclusions were made by Bearden & Teel (1983), Oliver (1980) etc. In order to research the effect perceived quality has on customer satisfaction, the following hypothesis was set:

H2: Perceived quality has a meaningful effect on customer satisfaction.

1.2.3. Company's image

Other than basic determinants of satisfaction by the expectancy-disconfirmation model, the effect the company's image has on customer satisfaction was also examined. The reason a company's image was introduced as a determinant can be seen in previous studies, which point to a significant effect the image has on satisfaction and loyalty.

A company's image can also be defined as the way the public sees an organization and its products or services (Ciavolino & Dahlgaard, 2007). Attitudes towards a certain brand and satisfaction are considered different concepts in the literature about customer satisfaction (Oliver, 1980). According to Oliver (1981), customer satisfaction is relatively fleeting, while the attitudes towards a brand are relatively lasting.

Consumers' product choices are significantly influenced by the brand. A strong and clear brand image inspires a higher level of confidence during shopping. Furthermore, brand equity is a crucial predictor of market success, a source of competitive advantage, and an essential element of business operations (Gluhović, 2019).

Organizational culture, organization's politics, the employees' image, products and services, and marketing communication about the organization have the most effect in creating a picture about that organization (Rust, Moorman & Dickson, 2002). In research, done by Kencana and Supurta (2015), of determinants that affect the satisfaction of customers using smartphone services, it has been proven that the company's image and brand definitely do have an impact on customer satisfaction, while the impact on loyalty is bigger.

Sondoh et al. (2007) used a sample of 97 Malaysian women who were using colour cosmetics and determined that the image has a high impact on satisfaction and loyalty. Kim & Kim (2004) used a sample of 394 fast food consumers in Korea to identify the strong effect that a brand has on customer satisfaction. In accordance with the latest research on the effect of a brand on customer satisfaction, the following research hypothesis was defined:

H3: Company image has a direct effect on customer satisfaction.

1.3. Satisfaction and loyalty

Customer satisfaction is a critical element for the long-term business development and profitability (Bernhardt, Donthu & Kennett, 2000). One unsatisfied user of a service can damage the organization and its business by spreading negative experiences, than ten very satisfied users of the same service (Mohsan et al., 2011). Still, the effect of satisfied customers is not the same for a company as the effect of repeated shopping, which leads to generating loyal clients. The loyalty of a company's customers has been recognized as a dominant business factor for an organization's success (Kandampully & Suhartanto, 2000).

Even though a great number of researchers concluded that satisfaction often leads to loyalty, there is a notable amount of research that resulted in the conclusion that satisfaction is weakly connected with loyalty or repeated shopping in certain situations. Olsen (2007) pointed out that the relationship between satisfaction and loyalty varies between different industries and that many factors can influence the level of the relation, such as commitment, trust or the degree of involvement of the customer. Auh & Johanson (1997) researched the relationship between satisfaction and loyalty in the automobile industry and came to the conclusion that the relationship is complex, and it varies depending on the level of satisfaction and the category of customers. Kencana & Supurta (2015) got similar results, proving that satisfaction has no significant impact on loyalty, and that customer loyalty is primarily influenced by image and expectations.

On the other hand, Biscaia, Rosa, Sá & Sarricio (2017) come to the conclusion that in most cases customer loyalty is actually the result of those customers'

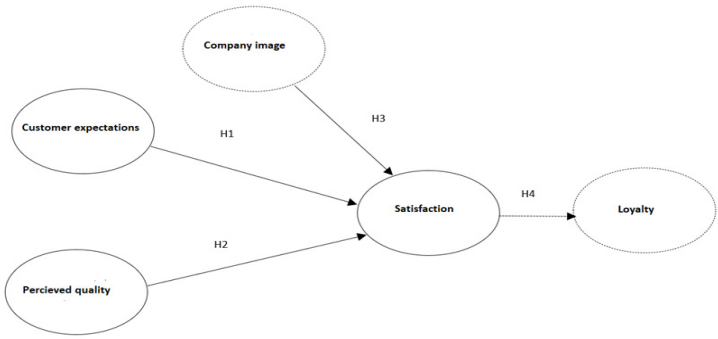
satisfaction; they also concluded that the main preface to repeated shopping is previous satisfaction. Researching the interrelationships of customer satisfaction and loyalty in a Nigerian national airline, Ganiyu (2017) concluded that customer satisfaction is tightly connected to customer loyalty and has potential to increase it directly. Due to given conclusions stated in previous research, the following hypothesis was set:

H4: The satisfaction of customers with a bought product/service significantly affects their loyalty.

2. Research methodology

The primary data was also collected using the survey method, which is most commonly used in this type of research. The online survey was conducted between May 16th and June 8th, 2022. The sample includes 196 individuals who were surveyed regarding the benefits of the voluntary health insurance program. For the measurement of customer satisfaction by using the expectancy-disconfirmation model, by which satisfaction is viewed as a function of expectation and the products' performances, this research was expanded to include a company image as an important satisfaction determinant, as identified by reviewing the relevant literature. The research model is shown in Picture 1. Other than identifying the satisfaction determinants, this model gives the opportunity to analyse the relationship between satisfaction and loyalty.

Picture 1. Research model



Source: the author

3. Results

To determine the strength of the connection between researched variables, the correlation analysis was conducted; the results are shown in Table 1.

Table 1: Correlation analysis

	Customer expectations	Perceived quality	Customer satisfaction	Customer loyalty	Company image
Customer expectations	1	.894**	.857**	.856**	.879**
Perceived quality	.894**	1	.877**	.866**	.895**
Customer satisfaction	.857**	.877**	1	.892**	.878**
Customer loyalty	.856**	.866**	.892**	1	.871**
Company image	.879**	.895**	.878**	.871**	1

*Value is significant on the level of 0.01

Source: the author's research

Based on the obtained values of correlation coefficient, it can be concluded that there is a statistically significant connection on the level of 0.01 between all analysed variables. The strongest correlation exists between the variables of company image and perceived quality, as well as between satisfaction and loyalty. From Table 3, we conclude that there is the smallest correlation between the variables of customer expectations and customer loyalty.

To test the first three established hypotheses, a multiple regression analysis that examines the effect of three independent variables on the dependent variable of customer satisfaction was carried out (Table 2). Multicollinearity is not considered a problem if the value of the VIF coefficient (Variance Inflation Factor) is less than 10 in all pairings of variables. This model, with the help of independent variables (customer expectations, perceived quality and company image) explains 81.5% of the variability of the dependent variable (customer satisfaction), as shown by the coefficient of determination (R^2). The results of the research show that the dependent variable of satisfaction is statistically significantly impacted by all three independent variables: customer expectation (β=0,229; $p<0.02$), perceived quality (β=0.361; $p<0.01$) and company image (β=0.350; $p<0.01$), which confirms the established hypotheses (H1, H2 and H3). Based on the size of the coefficient, it is concluded that perceived quality has the most significant impact, followed by image, with customer expectation as the lowest impact.

Table 2: The effect of customer expectations, perceived quality and company image on satisfaction

Model	Beta	t	Significance(p)	R^2	VIF
Customer expectations	0.229	3.149	0.002	0.815	5.486
Perceived quality	0.361	4.728	0.000		6.037
Company image	0.350	4.533	0.000		6.170

Dependent variable: Customer satisfaction

Source: the author's research

The last research hypothesis of this paper is tested by setting client satisfaction as an independent variable and client loyalty as a dependent variable. The effect of customer satisfaction with a service on clients' loyalty was examined using a simple linear regression. Based on the coefficient of determination, we come to the conclusion that satisfaction describes 79.5% of the variability of loyalty and has a strong effect on loyalty, as seen by the high value of the beta regression coefficient.

Table 3: The effect of customer satisfaction on loyalty

Model	Beta	t	Significance(p)	R^2	VIF
(Constant)		4.347	0.000	0.795	
Customer satisfaction	0.892	27.41	0.000		1.000

Source: the author's research

Discussion

Starting with the main goal of the research and the developed research model, the obtained results show that, out of all viewed variables, perceived quality has the most significant effect on satisfaction, which points out the importance of creating a high-quality offer. These results are in accordance with the results obtained by Tejedor, Elolaa, Ajami, and Bosch (2019), Anderson & Sullivan (1993), Johnson & Fornell (1991), and Nguyen, Nguyen, Nguyen, & Phan (2018). This shows the consistency of the conclusion that quality is the most important predictor of satisfaction. Furthermore, this represents an input for companies that, in the case of limited resources for investing in generating customer satisfaction, priority should be given to the quality of the products and services.

The next most important determinant of satisfaction is company image, which means that in the wide spectrum of activities undertaken by managers, an important position should be given to the conception and implementation of a strategy for regular advancement of the brand's image. If we have the knowledge that the brand's image reflects the overall customer perception, it can be an instrument for achieving a competitive advantage.

These results are consistent with the results of authors Hossain, Yesmin, Jahan & Kim (2021), who also concluded that image has a significant effect on satisfaction. However, these results do not match with the conclusions made by Kencana & Supurta (2015), which show that image does not have an important effect on satisfaction. The differences can be explained by the fact that the research by mentioned authors was limited on the impact of the brand in the smartphone industry. In other words, unlike the quality of the products, which was identified as the basic predictor of satisfaction in the biggest number of examinations, image can have a weaker effect in specific industries. Almsalam (2014) used a sample of 250 clients of 5 banks in Damask to prove that customer expectation has a significant positive effect on customer satisfaction, and that the perceived quality of a service has a significant positive effect on user satisfaction as well.

In addition to the differences in the results of research done by Bayol (2000) and Kencana & Supurta (2015), there are also similarities in saying that expectations have a

weaker effect on satisfaction than image and perceived quality. The factors that influence expectations for satisfaction were criticized by LaTour & Peat (1979), who pointed out that expectations cannot be determinants of satisfaction in situations where customers do not have their favourite brands available. In such situations, customers are not satisfied with buying a certain brand, even when the quality exceeds expectations. Customers' values and wishes have more of an effect on satisfaction than their expectations from a service, according to Mattila and Wirtz. Similar conclusions, that dispute the theory that satisfaction is a resultant of fulfilled expectations, come from authors Spreng & Dixon (1992), Stanforth & Lennon (1997), and Barbeau, Sweet & Fortier (1985); Barbeau et al. also point out that the fulfilled/unfulfilled need coming from the bought product or a used service has a bigger effect on satisfaction than the expectations from said product/service. At the same time, the results are not consistent with the conclusions of Li & Liu (2014), who touch on the importance of customer expectation as a satisfaction determinant for companies that operate in a dynamic environment. A highly positive and statistically significant effect that customers' satisfaction with services has on loyalty shows that a bigger satisfaction of client with the services leads to a bigger client loyalty and repeated shopping. A great number of authors confirm this strong statistical connection (Lin & Yin (2022), Ertemel, Civelek, Pektas & Cemberci (2021)). This is important for companies because, by offering a high-quality product, they get satisfied customers and could end up making satisfied customers into loyal ones. This is relevant information for a company, because loyalty is a truer measure of quality than satisfaction. To recommend a product or a service to other people has bigger consequences and demands more commitment than simply pointing out that someone is more or less satisfied with the product/service (Coenders & O'Loughlin, 2002).

In fact, authors Martensen, Gronholdt & Kristensen (2000) point out that satisfaction is the most important determinant of loyalty, which helps companies to keep clients. The results match this conclusion, as around 80% of the loyalty variable is explained by the satisfaction variable.

Conclusion

In today's conditions of outstanding competition and the ever-growing customer demands, satisfaction and loyalty of customers/users of services have become one of the key factors to survive in the market. The main goal of this paper was to discover the key dimensions of customer satisfaction. The conclusion is that perceived quality and company image have the biggest effect on satisfaction, while customer expectations have the smallest effect. This implies that, in the modern conditions of business, the companies' priority is to deliver a high quality of a service, and also to make sure that the company's image is sold in the most positive way possible.

The contribution and the originality of this research can be seen in the use of an expanded and adapted satisfaction model made by author Oliver (1980), with the inclusion

of the additional determinant of the company image. A very small number of studies in Serbia examine the determinants of customer satisfaction in line with the theoretical concept of Oliver's model. This study expands the theoretical knowledge about the most important determinant of satisfaction, as related to viewing the cumulative effect of expectations, performances and company image on customer satisfaction. The other contribution is seen in the confirmation of the important effect satisfaction has on customer loyalty. The practical contribution is seen in the potential use of the results of this research, which can be useful to the companies who focus on creating a base of satisfied and loyal customers.

The obtained results enable the identification of certain practical implications that can be helpful to a company's management team while making relevant decisions, having in mind that customers want products and service that are more than a simple satisfaction of their expectations and that give a high level of quality for a longer time (Cossio-Silva et al., 2016). The implications of the conducted research refer to giving input to managers so that the process of allocation of limited financial resources gives an important spot to the conception and the implementation of the strategy of the continued advancement of brand image, and the ensuring of maximum quality of every attribute of a product/service that a customer perceives. Strong brand image and high quality of the products will have positive effects on customer satisfaction and loyalty, which further has a positive impact on the establishment of a long-term profitability on realistic bases. With the obtained results, the concept of creating satisfied customers through controlling expectations from a product/service has been overcome. In order to generate satisfied and loyal customers, the companies' management has to direct the activities to the practice of frequent marketing of a product, forming positive relationships with the public, the innovating the product range, and advancing management systems with quality.

Companies can expect significant positive effects due to an increased number of satisfied and loyal customers: they are willing to pay more for the new models of the products belonging to a certain brand; they tell their friends and family about their positive impressions about the brand; they make suggestions about eventual upgrades to some of the characteristics of the product/service belonging to that brand (Heskett, Sasser & Schlesinger, 1997). Managers can use this research as a starting point of learning the ways to measure brand image, customer satisfaction and loyalty, and the ways brand image effects customer satisfaction.

Certain limitations of this study pertain to the fact that satisfaction is viewed as a resultant of perceived quality, customer expectations and image. Latest studies of satisfaction include some additional determinants, such as customer wishes (Spreng & Mackoy, 1996), customer care after a used service (Smith & Wright, 2004), customer trust (Jaiyeoba, Svotwa & Roberts-Lombard, 2020), and other determinants that could have a significant impact on satisfaction. Future research should include additional variables in order to conclude which one of them has the most significant effect. Besides, advanced studies can also be oriented to questioning which exact dimensions of perceived quality of service have the most impact on satisfaction.

References

Almsalam, S. (2014). The effects of customer expectation and perceived service quality on customer satisfaction. *International Journal of Business and Management Invention, 3*, 79-84.

Anderson, E.W. & Sullivan, M.W. (1993). The antecedents and consequences of customer satisfaction for firms. *Marketing Science, 12*, 125-143.

Andreassen, T.W. & Lindestad, B. (1998). Customer loyalty & complex services: the impact of corporate image on quality, customer satisfaction & loyalty for customers with varying degrees of service expertise. *International Journal of Services & Industrial Management, 9*, 7-23.

Auh, S. & Johnson, M. (1997). The complex relationship between customer satisfaction and loyalty for automobiles. *Customer Retention in the Automotive Industry*, 141-166. Doi: https://doi.org/10.1007/978-3-322-84509-2_7

Barbeau, A. & Sweet, S. & Fortier, M. (2010). A path-analytic model of self-determination theory in a physical activity context. *Journal of Applied Biobehavioral Research*, *14,* 103-118. Doi: https://doi.org/10.1111/j.1751-9861.2009.00043.x

Bayol, M., Foye, A.D., Tellier, C., & Tenenhaus, M. (2000). Use of PLS path modelling to estimate the European Consumer Satisfaction Index (ECSI) model. *Statistica Applicata, 12*(3), 361-375.

Bearden, W. O. & Teel, J. E. (1983). Selected Determinants of Consumer Satisfaction and Complaint Reports. *Journal of Marketing Research, 20* (1), 21-28.

Bernhardt, K. L., Donthu, N., & Kennett, P. A. (2000). A longitudinal analysis of satisfaction and profitability. *Journal of Business Research, 47*(2), 161-171. Doi: https://doi.org/10.1016/S0148-2963(98)00042-3

Biscaia, A.R., Rosa, M.J., Sá, P.M. & Sarrico, C.S. (2017). Assessing customer satisfaction and loyalty in the retail sector. *International Journal of Quality & Reliability Management*, *34*, 1508-1529.

Churchill, G. A., & Surprenant, C. (1982). An investigation into the determinants of customer satisfaction. *Journal of Marketing Research, 19*(4), 491-504.

Ciavolino, E. & Dahlgaard, J. (2007). ECSI – Customer satisfaction modelling and analysis: A Case Study. *Total Quality Management, 18*(5), 545-554. Doi: https://doi.org/10.1080/14783360701240337

Duan, X., Ni, X., Shi, L., Zhang, L., Ye, Y., Mu, H., Li, Z., Liu, X., Fan, L.& Wang ,Y.(2019). The impact of workplace violence on job satisfaction, job burnout, and turnover intention: the mediating role of social support. *Health Quality of Life Outcomes*, *17*(1). Doi: https://doi.org/10.1186/s12955-019-1164-3.

Ertemel, A.V., Civelek, M.E., Eroglu Pektas, G.O., Cemberci, M. (2021). The role of customer experience in the effect of online flow state on customer loyalty. *PLoS ONE, 16*(7). Doi: https://doi.org/10.1371/journal.pone.0254685

Fattah, F.& Dahleez, K.A. (2021). Influence of service quality on consumer loyalty: a mediation analysis of health insurance. *The TQM Journal, 33*(8), 1787-1805. Doi: https://doi.org/10.1108/TQM-09-2020-0219

Fornell, C. (1992). A national customer satisfaction barometer: the Swedish experience. *Journal of Marketing, 56*, 6-21. Doi: https://doi.org/10.2307/1252129

Ganiyu, R.A. (2017). Customer satisfaction and loyalty: a study of interrelationships and effects in Nigerian domestic airline industry. *Oradea Journal of Business and Economics, 2*, 7-20.

Gluhović, N. (2019). Influence of country of origin image on brand equity of consumers in Bosnia and Herzegovina: the case of smartphone market. *Anali Ekonomskog fakulteta u Subotici*, *56*(43), 15-29. Doi: https://doi.org/10.5937/AnEkSub2001015G

Halilovic S., Cicic, M. (2013). Understanding determinants of information systems users' behaviour: a comparison of two models in the context of integrated accounting and budgeting software. *Behaviour & Information Technology. 32*(4), 359-370.

Helson, H. (1964). *Adaptation-level theory: an experimental and systematic approach to behavior.* Harper and Row: New York.

Hermans, O. (2015). Service integrated relationships (SIR): A strategic process framework for managing the customer as a resource. *Journal of Creating, 1*(1), 119-129. Doi: https://doi.org/10.1177/2394964315569630

Heskett, J., Sasser, E., Schlesinger, L. (1997). *The Value Profit Chain*. New York: The Free Press.

Hossain, M.A., Yesmin, M.N., Jahan, N. & Kim M. (2021). Effects of service justice, quality, *social influence* and *corporate image* on *service satisfaction* and customer loyalty: moderating effect of bank ownership. *Sustainability, 13* (3). Doi: https://doi.org/10.3390/su13137404

Howard, J.A. & Sheth, J.N. (1969). *The Theory of Buyer Behavior*. John Wiley, New York.

Hu, T., Kettinger, W.J. & Poston, R.S. (2015). The effect of online social value on satisfaction and continued use of social media. *European Journal of Information Systems, 24*(4), 391-410. Doi: https://doi.org/10.1057/ejis.2014.22

Jaiyeoba, O., Svotwa, D.T. & Roberts-Lombard, M. (2020). Precursors and outcome of customer satisfaction/delight in business-to-consumer relationships in Botswana. *South African Journal of Business Management, 51*, 1-11.

Johnson, M. D., & Fornell, C. (1991). A framework for comparing customer satisfaction across individuals and product categories. *Journal of Economic Psychology, 12*, 267-286.

Jevtić, J., Tomić, S. & Leković, K. (2020). Customer experience in the tourism industry – Determinants influencing complaint behaviour. *Hotel and Tourism Management*, *8* (2), 25-33.

Kandampully, J. & Suhartanto, D. (2000). Customer loyalty in the hotel industry: the role of customer satisfaction and image. *International Journal of Contemporary Hospitality Management, 12* (6), 346-351.

Kencana, I. P. E. N. & Suputra G.S. (2015). The determinants of customers' loyalties of Smartphone. *Journal Mathematica, 5*(2), 92-104.

Khalifa, M. & Liu, V. (2007). Online consumer retention: contingent effects of online shopping habit and online shopping experience. *European Journal of Information Systems 16*(6), 780–792.

Kim, G. & Kim, H. (2004). Measuring customer based restaurant brand equity: investigating the relationship between brand equity and firm's performance. *Journal Cornell Hotel & Restaurant Administration Quarterly, 45*(2): 115-131.

Lankton N. & McKnight H. (2012). Examining two expectation disconfirmation theory models: assimilation and asymmetry effects. *Journal of the Association for Information Systems, 13*, 88-115.

LaTour S. & Peat N. (1980). The role of situationally-produced expectations, others' experiences, and prior experience in determining consumer satisfaction. *Advances in Consumer Research, 7*, 588-592.

Li, D. & Liu, J. (2014). Dynamic capabilities, environmental dynamism, and competitive advantage: evidence from China. *Journal of Business Research, 67* (1), 2793-2799.

Lin, C., Wei, Y. H., Lekhawipat, W. (2018). Time effect of disconfirmation on online shopping. *Behaviour and Information Technology, 37*(1), 87-101. Doi: https://doi.org/10.1080/0144929X.2017.1406004

Lin, W. & Yin, W. (2022). Impacts of service quality, brand image, and perceived value on outpatient's loyalty to China's private dental clinics with service satisfaction as a mediator. *PloS one, 17*(6). Doi: https://doi.org/10.1371/journal.pone.0269233

Maričić, B., Veljković, S. & Djordjevic, A. (2012). Customer satisfaction measurement. Marketing, *43*, 235-244.

Martensen, A., Gronholdt, L. & Kristensen, K. (2000). The drivers of customer satisfaction and loyalty, cross-industry findings from Denmark. *Total Quality Management, 11*, 544–553.

Mattila, A. & Wirtz, J. (2001). Congruency of scent and music as a driver of in-store evaluations and behaviour. *Journal of Retailing, 77*(2), 273-289.

Mittal, V., Han, K., Lee, J., Sridhar, S. (2021). Improving business-to-business customer satisfaction programs: assessment of asymmetry, heterogeneity, and financial impact. *Journal of Marketing Research, 58*(4), 615-643. Doi: https://doi.org/10.1177/00222437211013781

Mohsan, F., Nawaz, M., Khan, M., Shaukat, M. & Aslam, N. (2011). Impact of Customer Satisfaction on Customer Loyalty and Intentions to Switch: Evidence from Banking Sector of Pakistan*, International Journal of Business and Social Science, 2*(16).

Nguyen, H., Nguyen, H., Nguyen, N., Phan, A. (2018). Determinants of customer satisfaction and loyalty in Vietnamese life-insurance setting. *Sustainability, 10*, 1151-1168. Doi: https://doi.org/10.3390/su10041151

Oliver R. L. & DeSarbo, W. S. (1988). Response determinants in satisfaction judgment, *Journal of Consumer Research, 14*, 495- 507.

Oliver, R. L. (1980). A Cognitive model of the antecedents and consequences of satisfaction decisions. *Journal of Marketing Research, 17*(4), 460–469.

Oliver, R.L. (1977). Effect of expectation and disconfirmation on postexposure product evaluations: an alternative interpretation. *Journal of Applied Psychology, 62*, 480-486. DOI: https://doi.org/10.1037/0021-9010.62.4.480

Oliver, R.L. (1981) Measurement and evaluation of satisfaction processes in retail settings. *Journal of Retailing, 5*, 25-48.

O'Loughlin, C. & Coenders, G. (2002). Application of the European Customer Satisfaction Index to Postal Services. Structural Equation Models versus Partial Least Squares. *Working Papers of the Department of Economics*, Department of Economics, University of Girona.

Olsen, J. (2005). The institutional dynamics of the European University. *ARENA* Doi: https://doi.org/10.1007/978-1-4020-5971-1_2

Ozkan, M., Cek, K., Eyupoglu S.Z. (2022). Sustainable development and customer satisfaction and loyalty in North Cyprus: the mediating effect of customer identification. *Sustainability,* 14, (9). Doi: https://doi.org/10.3390/su14095196

Rehman, H.U. & Ishaq, Z. (2017). The impact of brand image on purchase intention: moderating role of store image in Pakistan's retail sector. *Journal of Brand Management 9*(3), 55-64.

Rust, R.T., Moorman, C. & Dickson, P.R. (2002). Getting return on quality: cost reduction, revenue expansion, or both? *Journal of Marketing, 66*(4), 7-24. Doi: https://doi.org/10.1509/jmkg.66.4.7.18515

Smith, R. & Wright, W. (2004). Determinants of customer loyalty and financial performance. *Journal of Management Accounting Research,16*, 183-205. Doi: https://doi.org/10.2308/jmar.2004.16.1.183

Sondoh, S. L., Omar, M. W., Wahid, N. A., Ismail, I., & Harun, A. (2007). The effect of brand image on overall satisfaction and loyalty intention in the context of colour cosmetic. *Journal Asian Academy of Management, 12*(1), 83-107.

Spreng R. & Dixon A. (1992). Alternative comparison standards in the formation of consumer satisfaction/dissatisfaction. In *Enhancing Knowledge Development in Marketing*. American Marketing Association, 85-91.

Spreng, R. & Mackoy R., (1996). An empirical examination of a model of perceived service quality and satisfaction. *Journal of Retailing, 72*(2), 201-214. Doi: https://doi.org/10.1016/S0022-4359(96)90014-7

Spreng, R.A., MacKenzie, S.B. & Olshavsky, R.W. (1996) A re-examination of the determinants of consumer satisfaction. *Journal of Marketing, 60*, 15-32.

Stanforth, N. F., & Lennon, S. J. (1997). The effects of customer expectations and store policies on retail salesperson service, satisfaction, and patronage. *Clothing and Textiles Research Journal, 15*(2), 115-124.

Szymanski, D. M. & Henard, D. H. (2001). Customer satisfaction: a meta-analysis of the empirical evidence. *Journal of the Academy of Marketing Science, 29*, 16-35. Doi: https://doi.org/10.1177/009207030102900102

Tejedor, J., Elola, L., Ajami, M., Bosch, S. (2019). The implication of wine quality in a new model of the European Customer Satisfaction Index. *Total Quality Management & Business Excellence, 30*(2), 1-18. Doi: https://doi.org/10.1080/14783363.2017.1355232

Tenenhaus, M., Vinzi, V., Chatelin Y. & Lauro, C. (2005). PLS path modelling. *Computational Statistics & Data, 48*(1), 159-205. Doi: https://doi.org/10.1016/j.csda.2004.03.005

Westbrook, R.A. (1981). Source of consumer satisfaction with retail outlets. *Journal of Retailing, 57*(3), 68-85.

UDC: 332.21:336.781(4)
DOI: 10.5937/AnEkSub2300025C

Original scientific article

Анали Економског факултета у Суботици – The Annals of the Faculty of Economics in Subotica
Vol. 60, No. 51, pp. 081-090
Received: 27/02/2023
Accepted: 15/07/2023
Published online: 04/08/2023

The impact of inflation and interest rates on real estate indices in the US and EU

Утицај инфлације и каматних стопа на индексе некретнина у САД и ЕУ

Danica Cicmil
University of Novi Sad, Faculty of Economics in Subotica, Subotica, Republic of Serbia
cicmildanica@yahoo.com https://0000-0001-6373-5264

Abstract: This paper investigates the relationship between real estate indices, inflation and interest rates in both Europe and the USA. The main objective is to examine the impact of inflation and interest rates on the respective real estate indices and test specific hypotheses. The study utilizes cointegration analysis to assess the long-term equilibrium and the speed of adjustment between the variables. The analysis reveals the presence of cointegrating relationships in both regions, indicating a long-term equilibrium between the variables The findings support the hypothesis that inflation has a significant and positive impact on the real estate indices in both regions. However, the hypothesis stating a significant and negative impact of interest rates on the indices is not supported.
Keywords: interest rate, inflation rate, real estate indices, VECM

Сажетак: Овај рад истражује однос између индекса некретнина, инфлације и каматних стопа у Европи и САД. Главни циљ је испитивање утицаја инфлације и каматних стопа на релевантне индексе некретнина и тестирање специфичних хипотеза. Студија користи коеинтеграциону анализу за процену дугорочне равнотеже и брзине прилагођавања између променљивих. Анализа открива постојање коеинтегрисаних односа на обе локације, што указује на дугорочни равнотежу између променљивих. Резултати подржавају хипотезу да инфлација има значајан и позитиван утицај на индексе некретнина у обе регије. Међутим, хипотеза која тврди значајан и негативан утицај каматних стопа на индексе није поткрепљена.
Кључне речи: каматна стопа, стопа инфлације, индекс некретнина, ВЕЦМ
ЈЕЛ класификација: E31, E37, E43

Introduction

Examining the relationship between inflation, interest rates, and the real estate index provides important insights into the broader economic environment. Inflation and interest rates are fundamental indicators of the economy's overall well-being, and fluctuations in these metrics can signify changes in the broader economic context. Therefore, comprehending the interplay between these variables and real estate indexes is crucial in obtaining a comprehensive overview of the present economic conditions and possible future trends.

The main focus of this paper is to investigate the relationship between macroeconomic factors, such as interest rates and inflation, and selected real estate indices

in the United States and the European Union. The aim is to define and explain any corelation and cointegration among variables. In order to achieve this goal, the following parameters are included in the analysis: inflation in the United States, inflation in the European Union, interest rate in the United States, interest rate in the European Union, the MSCI Europe Real Estate Index, and the Dow Jones Real Estate Index.

The Federal Reserve sets the interest rate, known as the federal funds rate, to manage the money supply and control inflation in the United States. Similarly, the European Central Bank sets the main refinancing rate to manage the money supply and achieve its economic goals in Europe. Inflation is measured by the Consumer Price Index in the United States and the Harmonized Index of Consumer Prices in the European Union, with both central banks aiming to keep inflation around 2% (ECB, 2022; FED, 2022; Kennon, 2022). The MSCI Europe Real Estate Index and the Dow Jones Real Estate Index are widely used as benchmarks for real estate-related investments, as they track the performance of real estate companies listed on the major stock exchanges in their respective regions (MSCI, 2022; S&P, 2022).

This paper begins with an introduction that sets the stage for the subsequent sections. In section 1, the theoretical background of the relationship between the real estate index and inflation/interest rate are explicated, highlighting how this nexus has been explored in previous studies. Section 2 provides a detailed overview of the comparative analysis of real estate indices specificities in the EU and USA. Section 3 presents the results of the study and engages in a thorough discussion of the outcomes. Finally, the paper concludes with a summary of the research findings and their implications for future studies in this area.

1. Literature review of the real estate indices determinants

There are many papers investigating the relationship between macreconomics factors. One study considered inflation, interest rate and stock returns in the UK, and found a bidirectional relationship between stock returns and inflation (Hasan, 2008). Additionally, research has been conducted to examine the relationship between stock returns, changes in production and interest rates in three European countries, with results indicating that stock returns are affected by changes in interest rates and future change in production (Peiró, 1996). The relationship between inflation and dividend yields has also been investigated, with a positive correlation found between dividend yields and inflation (Wei, 2010).

The current literature on quantitative analysis of property performance primarily relies on linear models. However, some researchers have suggested that non-linear, regime-based models could provide additional insights into the relationship between real interest rates and property market behavior, such as VAR or VECM. To test this hypothesis, a study was conducted using a Threshold Autoregressive (TAR) model on property company data. The findings suggest that the behavior of the property market differs significantly between high and low interest rate regimes (Liziere & Satchell, 1997). Several studies have examined the effect of interest rates on the Real Estate Investment Trusts (REITs) market. One such study explored the movement of REIT price changes during past interest-rate

cycles, particularly during the rising interest-rate environment in early 1994 in the United States. The study found that the movement of REIT prices has a low correlation with changes in interest rates and a lower correlation with interest rates than with movements in the stock market as a whole (Mueller & Pauley, 1995). However, further study investigated whether the level and volatility of interest rates affect the excess returns of major Asian listed property markets within a time-varying risk framework. The study employs a three-factor model with excess return volatility, interest rate level and interest rate volatility as its factors. The findings of the study show that property stocks are generally sensitive to changes in the long-term and short-term interest rates and to a lesser extent, their volatility (Liow & Huang, 2006). One of the past studies that looked at the relationship between macroeconomics and real estate returns used REIT stock data as a proxy for real estate returns. The study employed a method where the returns of REIT stocks are regressed against the returns of the Standard and Poor's 500 Stock Index. The results indicated that prices, nominal rates, output and investment all directly influence the real estate series. Additionally, the study finded that nominal interest rates explain the majority of the variation in the real estate series (McCue & Kling, 1994). However, the negative correlation between inflation and REIT returns has been suggested to be driven by changes in monetary policies (Glascock, Lu, & So, 2002). This observation is supported by the results of previous studies, such as Darrat and Glascock's (1989) research, which also found evidence of monetary effects on REIT returns.

The relationship between real estate price changes and stock returns has also been a topic of interest in several country-specific studies. The results indicate a significant relationship between stock returns and both rents and value changes. Additionally, GDP growth rates are found to significantly influence real estate prices. Real estate is shown to provide a good long-term hedge against inflation but a poor year-to-year hedge (Quan & Titman, 2003). One of the study aimed to investigate the inflation hedging effectiveness of residential real estate over a 26-year period from 1969 to 1994. The results indicate that residential real estate is a strong hedge against both expected and unexpected inflation. The study suggests that including real estate in an investment portfolio can help decrease the variance of the portfolio returns, particularly during periods of high unexpected inflation, as financial assets are not reliable inflation hedges during such periods (Bond & Seiler, 1998).

This paper aims to utilize the accumulated knowledge from previous studies and conduct a comprehensive analysis, using multiple VECM between parameters, in order to compare the real estate market and the factors that influence it in the EU and the US. The research is expected to contribute to the existing literature on the subject and provide useful insights for investors and policymakers.

2. Comparative analysis of real estate indices specificities in the EU and USA

This section presents a comparative analysis of real estate indices in the EU and the USA, focusing on their specificities and characteristics. Descriptive statistics are provided for the variables used in the model, and conclusions are drawn based on the descriptive analysis undertaken. The real estate indices utilized in this study are the MSCI Europe Real Estate Index for the EU and the Dow Jones Real Estate Index for the USA. These indices serve as representative indicators of the real estate markets in their respective regions, allowing for meaningful comparisons and insights. To gain a deeper understanding of the data and to identify key patterns and trends, descriptive statistics have been calculated for the variables under consideration. These statistics include counts, means, standard deviations, minimum and maximum values, and quartiles. The analysis of the real estate indices in the EU and USA reveals the following findings. Firstly, the MSCI Europe Real Estate Index demonstrates a moderate level of volatility, as indicated by an average index value of 1605.53 (SD = 202.54). In contrast, the Dow Jones Real Estate Index exhibits relatively lower volatility compared to its EU counterpart, with an average index value of 298.78 (SD = 57.16). Moreover, when examining the inflation rates, it is observed that the EU experienced an average inflation rate of 1.91%, while the USA had a slightly higher average inflation rate of 2.43%. These inflation rates contribute to the overall understanding of the economic context in which the real estate markets operate.

Table 1: Descriptive statistics of used parameters

	MSCI Europe Real Estate Index	Dow Jones Real Estate Index	Inflation EU	Inflation USA	ECB Interest Rate	FED Interest Rate
count	155	155	155	155	155	155
mean	1605.53	298.78	1.91	2.43	0.35	0.64
std	202.54	57.16	2.17	2.04	0.50	0.86
min	1164.81	177.64	-0.60	-0.23	0.00	0.05
25% (25th percentile)	1470.57	253.94	0.55	1.30	0.00	0.09
50% (median)	1596.25	301.55	1.40	1.86	0.05	0.16
75% (75th percentile)	1732.06	328.31	2.30	2.60	0.75	1.10
max	2093.27	453.47	10.60	8.99	2.50	4.10

Source: the authors calculation based on data

3. Results and discussion

In this analysis, the goal is to investigate the relationship between inflation, interest rates, and real estate indices in the EU and USA. The aim is to examine the impact of these economic factors on the MSCI Europe Real Estate Index and Dow Jones Real Estate Index. Two hypotheses have been formulated for this study:

- H1: The significant and positive impact of inflation on real estate indices in the USA and EU
- H2: The significant and negative impact of interest rates on real estate indices in the USA and EU

A dataset has been collected, including the MSCI Europe Real Estate Index, Inflation EU, ECB Interest Rate, Dow Jones Real Estate Index, Inflation USA and FED Interest Rate. The data has been carefully prepared to ensure accuracy and consistency. Any necessary data cleaning or preprocessing steps have been performed to prepare the variables for analysis. For the sake of modelling, the Vector Error Correction Model (VECM) is a used as it is specifically designed to capture the long-run equilibrium relationship and short-term dynamics among multiple variables. The VECM extends the concept of cointegration, which implies a stable long-term relationship between variables, allowing for the examination of both the short-run and long-run dynamics of the system (Wooldridge, 2002). By incorporating the error correction mechanism, the VECM accounts for the speed at which variables adjust to deviations from their equilibrium, making it suitable for analysing economic relationships characterized by disequilibrium and adjustment processes. The VECM has been extensively applied in various fields, such as macroeconomics, finance, and international economics, to study relationships among economic variables and forecast future trends. Its flexibility and ability to handle non-stationary time series data make it a valuable tool for empirical research and policy analysis.

Firstly, a Johansen cointegration test was conducted to examine the long-term relationship among the variables. The test calculates eigenvalues, critical values, and determines the number of cointegrating relationships. These results provide insights into whether a stable equilibrium relationship exists among the variables. Further, Vector Error Correction Model (VECM) has been fitted to capture the short-term dynamics and adjustment process towards the long-term equilibrium. The appropriate lag order and cointegration rank have been determined based on established criteria. The model estimates loading coefficients, which represent the short-term impact of the variables on each other. At the end, using the estimated VECM model, the hypotheses regarding the impact of inflation and interest rates on real estate indices in the EU have been tested. The significance and direction of these effects were analysed by examining the estimated coefficients. The findings have been compared to the formulated hypotheses.

Table 2: Summary of results for the eigenvalue and critical value for the EU

	Eigenvalue	Critical Value 1%	Critical Value 5%	Critical Value 10%
Eigenvalue 1	68.00091312	27.0669	29.7961	35.4628
Eigenvalue 2	14.5000215	13.4294	15.4943	19.9349
Eigenvalue 3	1.14908121	2.7055	3.8415	6.6349

Source: the author's calculation based on data

The table provides the eigenvalues and critical values for the cointegration analysis of the MSCI Europe Index, inflation in EU, and ECB interest rate. Eigenvalues represent the strength of the cointegrating relationships. A higher eigenvalue indicates a stronger long-term relationship. In this case, we have three eigenvalues: 68.00091312, 14.5000215, and 1.14908121. The critical values in the table represent the thresholds for determining the significance of the eigenvalues. The values in each column correspond to different confidence levels (1%, 5%, and 10%). If the eigenvalue exceeds the critical value in any of the columns, it suggests the presence of cointegration at the corresponding confidence level.

Eigenvalue 1 (68.00091312): The first eigenvalue is significantly larger than the critical values at all confidence levels. This indicates a strong cointegrating relationship among the variables, suggesting a long-term equilibrium relationship between the MSCI Europe Index, inflation, and interest rate.

Eigenvalue 2 (14.5000215): The second eigenvalue is also larger than the critical values at all confidence levels but to a lesser extent compared to the first eigenvalue. It suggests the presence of an additional cointegrating relationship, though it may be relatively weaker compared to the first one.

Eigenvalue 3 (1.14908121): The third eigenvalue is smaller than the critical values at all confidence levels. This indicates that it is not statistically significant and does not contribute to the cointegrating relationships among the variables.

Overall, the table suggests the presence of at least two cointegrating relationships among the MSCI Europe Index, inflation, and interest rate. The first relationship is the strongest, indicating a significant long-term connection between these variables. The second relationship is relatively weaker but still significant. The third eigenvalue is not significant, implying it does not contribute significantly to the cointegration analysis.

Table 3 Summary of results for the loading coefficients and ECT coefficients for the EU

Coefficients	**P-values**
Loading coefficients	
0.0019	68.00091312
-0.0000207883203	14.400021
-0.0000219137173	1.14908121

ECT Coefficients	
1.0	53.50089163
-1621.74063	13.35094029
2187.01629	1.14908121

Source: the author's calculation based on data

In conclusion, the analysis provides insights into the relationships between the MSCI Europe Index, inflation, and interest rate, while considering the two hypotheses. Regarding the first hypothesis, which suggests that the impact of inflation on the MSCI Europe Index is significant and positive, the findings indicate that inflation has a negative influence on the index in the long run. This implies that as inflation increases, the MSCI Europe Index tends to decrease. Therefore, the results do not support the hypothesis, suggesting a contrary relationship between inflation and the MSCI Europe Index. As for the second hypothesis, which proposes that the impact of interest rates on the MSCI Europe Index is significant and negative, the analysis reveals a similar outcome. The interest rate is found to have a negative influence on the MSCI Europe Index over time, indicating that as interest rates rise, the index tends to decline. Therefore, the results support the hypothesis, suggesting a negative relationship between interest rates and the MSCI Europe Index. Furthermore, the speed of adjustment towards the long-run equilibrium is found to be significant, implying that any deviations from the equilibrium between the variables are corrected relatively quickly. This suggests that the financial markets exhibit a strong tendency to revert to their long-term equilibrium state.

In summary, the analysis provides evidence that both inflation and interest rates have significant impacts on the MSCI Europe Index. While inflation exerts a negative influence and contradicts the first hypothesis, interest rates have a negative impact and support the second hypothesis. These findings contribute to a better understanding of the dynamics and interdependencies within the financial markets, highlighting the importance of considering inflation and interest rates when analysing the MSCI Europe Index.

Table 4: Summary of results for the eigenvalue and critical value for the USA

	Eigenvalue	Critical Value 1%	Critical Value 5%	Critical Value 10%
Eigenvalue 1	41.60626587	27.0669	29.7961	35.4628
Eigenvalue 2	16.17606205	13.4294	15.4943	19.9349
Eigenvalue 3	1.1576633	2.7055	3.8415	6.6349

Source: the author's calculation based on data

Eigenvalue 1: The eigenvalue of 41.60626587 is greater than all the critical values (27.0669, 29.7961, 35.4628) at the 1%, 5%, and 10% significance levels. This indicates that there is at least one cointegrating relationship present among the Dow Jones Real Estate Index, inflation in the USA, and the Fed interest rate. The eigenvalue being significantly larger than the critical values suggests that this cointegrating relationship is statistically significant.

Eigenvalue 2: The eigenvalue of 16.17606205 is also greater than all the critical values (13.4294, 15.4943, 19.9349) at the 1%, 5%, and 10% significance levels. This indicates the presence of a second cointegrating relationship among the variables. Similarly, the eigenvalue being larger than the critical values suggests that this relationship is statistically significant as well.

Eigenvalue 3: The Eigenvalue of 1.1576633 is smaller than the critical values (2.7055, 3.8415, 6.6349) at all significance levels. This implies that the third eigenvalue is not statistically significant, indicating that it does not contribute to a cointegrating relationship among the variables. In summary, the analysis suggests the presence of two significant cointegrating relationships among the Dow Jones Real Estate Index, inflation in the USA, and the Fed interest rate. These relationships imply a long-term connection between the variables, indicating that changes in one variable are associated with changes in the others. The third eigenvalue is not statistically significant and therefore does not contribute to the cointegrating relationships.

Table 5: Summary of results for the loading coefficients and ECT coefficients for the USA

Coefficients	**P-values**
Loading coefficients	
0.00286244	41.60626587
0.00017086	16.176066205
-0.00018377	1.1576633
ECT coefficients	
1.0	25.43020383
-133.04366568	15.01839875
-25.27135383	1.1576633

Source: the author's calculation based on data

The loading coefficient of 0.00017086 suggests that inflation in the USA has a positive impact on the Dow Jones Real Estate Index in the long run. This aligns with H1, indicating that inflation has a significant and positive influence on the index. The loading coefficient of -0.00018377 implies that the Federal Reserve (Fed) interest rate has a negative impact on the Dow Jones Real Estate Index in the long run. This supports H2, indicating that the interest rate has a significant and negative influence on the index.

Overall, the analysis reveals that both inflation and the Federal Reserve (Fed) interest rate have a significant impact on the Dow Jones Real Estate Index in the USA. Inflation positively influences the index, supporting H1, while the interest rate negatively affects the index, supporting H2. The error correction terms indicate that any deviations from the long-run equilibrium are corrected relatively quickly. These findings provide empirical evidence supporting the hypotheses and can be valuable for understanding the dynamics and relationships between the Dow Jones Real Estate Index, inflation, and the Federal Reserve (Fed) interest rate in the USA.

Conclusion

In this study, a comprehensive analysis was conducted to examine the relationship between the real estate indices (Dow Jones Real Estate Index in the USA and MSCI Europe Index in Europe), inflation, and interest rates in both regions. The main objective was to evaluate the impact of these factors on the respective indices and test specific hypotheses. The analysis revealed the presence of cointegrating relationships in both regions, indicating a long-term equilibrium between the variables. In the USA, the Dow Jones Real Estate Index showed a positive and relatively small impact on itself, while inflation and the interest rate had a negative influence on the index. In Europe, the MSCI Europe Index displayed a similar pattern, with a positive impact from the index itself and negative effects from inflation and interest rates. The speed of adjustment towards the equilibrium was significant only in USA, suggesting relatively quick corrections of deviations from the long-run equilibrium. The findings support the hypothesis that inflation has a significant and positive impact on the real estate indices in both regions. However, the hypothesis stating a significant and negative impact of interest rates on the indices was not supported.

For future research, it is recommended to explore additional variables such as GDP growth, employment rates, or housing market indicators to gain a more comprehensive understanding of the dynamics between the real estate indices, inflation, and interest rates in both Europe and the USA. Moreover, conducting a comparative analysis between different regions or countries within Europe would provide valuable insights into the regional variations in the relationship between these factors and real estate markets.

The findings from this analysis have practical implications for various stakeholders. Investors and portfolio managers can utilize these results to make informed decisions regarding real estate investments, considering the impact of inflation and interest rates on the indices. Policy-makers and central banks can also take into account these relationships when formulating monetary and economic policies, recognizing the potential influence of real estate markets on overall economic stability. Additionally, the findings can serve as a foundation for further research and modelling to develop more robust forecasting models for real estate indices, aiding in risk management and investment strategies.

References

Bond, M., & Seiler, M. (1998). Real estate returns and inflation: an added variable approach. *Real Estate Economics*, *26*(3), 481-504. Doi: https://doi.org/10.1080/10835547.1998.12090932

Darrat, A. F., & Glascock, J. L. (1989). The impact of monetary factors on real estate investment trust returns. *Journal of Real Estate Research*, *5*(3), 387-400. Doi: https://doi.org/10.1007/BF01096936

ECB. (2022). European Central Bank. Retrieved from www.ecb.europe.eu. Retrieved data: Jun 2023.

FED. (2022). Federal Reserves. Retrieved from www.federalreserve.gov. Retrieved data: Jun 2023.

Glascock, J., Lu, C., & So, R. (2002). REIT returns and inflation: perverse or reverse causality effects? *The Journal of Real Estate Finance and Economics*, *24*, 301-317. Doi: http://dx.doi.org/10.1023/A:1015221515787

Hasan, M. (2008). Stock returns, inflation and interest rates in the United Kingdom. The European Journal of Finance, *14*(8), 725-741. Doi: https://doi.org/10.1080/13518470802042211

Liow, J. (2022). The Balance Money. Retrieved from https://www.thebalancemoney.com/. Retrieved data: Jun 2023.

Liow, K., & Huang, Q. (2006). Interest rate risk and time-varying excess returns for Asian property stocks. *Journal of Property Investment & Finance*, *24*(6), 556-576. Doi: http://dx.doi.org/10.1108/14635780610659919

Liziere, C., & Satchell, S. (1997). Property company performance and real interest rates: a regime-switching approach. *Journal of Property Research*, *14*(2), 85-97. Doi: https://doi.org/10.1080/095999197368654

McCue, T., & Kling, J. (1994). Real estate returns and the macroeconomy: some empirical evidence from real estate investment trust data, 1972-1991. *Journal of Real Estate Research*, *9*(2), 151-161.

Mueller, G., & Pauley, K. (1995). The effect of interest-rate movements on real estate investment trusts. *Journal of Real Estate Research*, *10*(3), 319-325. Doi: https://doi.org/10.1080/10835547.1995.12090793

MSCI. (2022). MSCI Inc. Retrieved from www.msci.com. Retrieved data: Jun 2023.

Peiró, A. (1996). Stock prices, production and interest rates: comparison of three European countries with the USA. *Empirical Economics*, *21*(2), 221-234.

Quan, D., & Titman, S. (2003). Do real estate prices and stock prices move together? An international analysis. *Real Estate Economics*, *31*(4), 183-207. Doi: https://doi.org/10.1111/1540-6229.00771

Wei, C. (2010). Inflation and stock prices: no illusion. Journal of Money, Credit and Banking, *42*(1), 325-345. DOI: https://doi.org/10.1111/j.1538-4616.2009.00289.x

UDC: 336.74:004.78.056.55
DOI: 10.5937/AnEkSub2300026T

Original scientific article

Анали Економског факултета у Суботици – The Annals of the Faculty of Economics in Subotica
Vol. 60, No. 51, pp. 091-104
Received: 12/06/2023
Accepted: 01/08/2023
Published online: 11/08/2023

Oligopoly structure in the cryptocurrency market

Олигополска структура на тржишту криптовалута

Nenad Tomić
Faculty of Economics, University of Kragujevac, Kragujevac, Republic of, Serbia, ntomic@kg.ac.rs, https://orcid.org/0000-0003-1565-3197

Abstract: Blockchain technology has been announced as the driving force behind the democratization of digital business. Various interest groups believed that cryptocurrencies would enable fast, cheap and anonymous payments over the Internet. The absence of a central institution and the possibility of the participation of the wider community in the maintenance of the system should have created electronic money adapted to individuals, not the financial elite. However, the question arises whether cryptocurrencies really provide equal opportunities for all participants. The subject of the paper is the degree of centralization of the most famous cryptocurrency systems in terms of wealth distribution and the possibility of participation in their maintenance. The goal of the paper is to determine the degree of inequality in various aspects of the functioning of the cryptocurrency system. The results of the analysis indicate that cryptocurrencies function separately from the traditional financial system, but do not enable the financial inclusion of marginalized social groups. No current cryptocurrency community provides equality of participants, neither in terms of mining, nor in terms of wealth distribution. It can be concluded that the mining of cryptocurrencies and their secondary circulation show clear characteristics of oligopolistic structures.
Keywords: oligopoly, cryptocurrencies, mining pools, financial inclusion, market restrictions
JEL classification: D43, G32, O16

Сажетак: Блокчејн технологија је најављена као покретачка снага демократизације дигиталног пословања. Различите интересне групе су сматрале да ће криптовалуте омогућити брза, јефтина и анонимна плаћања путем интернета. Одсуство централне институције и могућност учешћа шире заједнице у одржавању система требало је да од криптовалута створи електронски новац прилагођен појединцима, а не финансијској елити. Међутим, поставља се питање да ли криптовалуте заиста пружају једнаке шансе за све учеснике. Предмет рада је степен централизације најпознатијих система криптовалута у погледу расподеле богатства и могућности учешћа у њиховом раду. Циљ рада је утврђивање степена неравноправности у различитим аспектима функционисања система криптовалуте. Резултати анализе указују да криптовалуте функционишу одвојено од традиционалног финансијског система, али не омогућавају финансијску инклузију маргинализованих друштвених група. Ни једна актуелна криптовалутна заједница не омогућава равноправност учесника, ни у погледу рударења, ни у погледу расподеле богатства. Може се закључити да рударење криптовалута и њихов секундарни промет показују јасне одлике олигополских структура.
Кључне речи: олигопол, криптовалуте, рударски пулови, финансијска инклузија, тржишна ограничења
ЈЕЛ класификација: D43, G32, O16

Introduction

Blockchain technology has been announced as the driving force behind the democratization of digital business (Chen, 2018). Its meaning is reflected in the decentralized management

of large databases. Data entry is performed with the application of consensus protocols, which provide a chance for the inclusion of a large number of interested individuals and prevent the arbitrariness of malicious individuals and groups. Achieving a consensus on changing the state of the system involves voting by members. Thanks to the mentioned positive characteristics, blockchain is seen as a technological basis for the further evolution of electronic money, but also the development of contract applications, applications in healthcare, transport, political decision-making and for device communication in the Internet of Things.

Cryptocurrencies represent the first and best-known aspect of the application of blockchain technology. Since the emergence of Bitcoin in early 2009, interest in cryptocurrency business has been steadily growing. The high volatility of the most famous cryptocurrencies makes them unsuitable to be units of account and for storing value (Ammous, 2018). However, the number of cryptocurrencies and the number of market participants are increasing every year. From the very beginning, it was believed that cryptocurrencies would enable fast, cheap and anonymous payments over the Internet. Speculative investors have found in cryptocurrencies unregulated investment instruments, which can bring high returns on investments in a short period of time. The absence of a central institution and the possibility of wider community participation in maintaining the system should have created conditions adapted to individuals, not the financial elite.

The real question is whether cryptocurrencies really provide equal opportunities for all participants. In the literature, there are claims of pronounced inequality in the cryptocurrency community in terms of wealth distribution and access to the mining process (Cong, He & Li, 2019; Vaz & Brown, 2020). That is why the subject of the paper is the centralization of the most famous cryptocurrency systems in terms of wealth distribution and the possibility of participation in their maintenance. The goal of the paper is to determine the degree of inequality in various aspects of the functioning of the cryptocurrency system.

The paper is structured in three parts. In the first part, it will be explained how cryptocurrencies were supposed to contribute to the democratization of the financial system. In the second part, contradictions in the proclaimed goals and the technical design of the consensus protocol will be pointed out. The third part will bring conclusions about the forms of concentration in the cryptocurrency market, drawn on the basis of certain indicators.

1. Characteristics of cryptocurrencies

Electronic money was first mentioned in the work of Chaum (1983), who pointed out the absence of privacy in transactions with payment cards. He proposed the development of electronic money based on a blind signature, which allows authentication and prevents double spending, but does not provide the ability to identify the payer. In further papers, it was proposed that the medium for the development of electronic money should be prepaid cards. With the commercial use of the Internet, attention is focused on the possibility of developing server-based electronic money. Theoretical considerations agreed that electronic

money, regardless of the medium used for its disposal, should be as close as possible to cash in terms of its characteristics. Okamoto & Ohta (1991) defined the key features that electronic money must have in order to be acceptable for use, with anonymity and user security being considered the most important. Matonis (1995) supplemented the list, introducing the reduction of state influence as a necessary characteristic. The meaning of this feature is reflected in the possibility of electronic money being guided by market criteria, rather than the political ones. Despite the great efforts invested in the development of the electronic money system, not a single operational solution has attracted enough users. At the beginning of the XXI century, representatives of the first generation of electronic money lost the fight with electronic payment systems based on the existing payment infrastructure, such as Paypal.

Cryptocurrencies are a new class of electronic money, based on blockchain technology (Nakamoto, 2008). Bitcoin, as their first representative, offered an innovative concept of electronic money that does not have a central issuing institution. This money is automatically issued at a predetermined rate, which halves every four years. Newly created cryptocoins can be earned by community members, who help in maintaining the system. They use their computers to solve a complex calculation problem, which will enable the confirmation of transactions made in the previous period and prove that it is not a double spending of funds (Lee & Chuen, 2016, p. 19). The user who finds the solution first offers it to the other participants in the network for confirmation. If the solution turns out to be correct, the user gets a reward in the form of newly created cryptocoins. Confirmed transactions are then packed into memory units called blocks, which are linked to each other, creating a chain of blocks. That algorithmic process is called "mining" in cryptocurrency jargon, and the individuals who participate in it are "miners."

The fact that it is possible to earn money by engaging available computing resources in compliance with the rules has attracted a large number of technology enthusiasts. Contrary to expectations, after the first two years of stagnation, the value of Bitcoin began to rise, and a secondary market was created. Investors who are not engaged in mining but only in buying and selling Bitcoin on specialized exchanges, have appeared. Parallel to this process, other cryptocurrencies were emerging. A cryptocurrency community was created, which had both breadth and depth of offerings.

One should bear in mind that Bitcoin and other cryptocurrencies fulfilled two key expectations, defined in the nineties of the XX century. First, payments made with Bitcoin are pseudo-anonymous, in the sense that the individual making them cannot be personally identified. Since Bitcoin is stored in an electronic account that is unique to each user, payments can be tracked in terms of payer and payee account numbers, but it is not possible to link individuals to observed accounts beyond any doubt. Second, neither Bitcoin nor any other cryptocurrency is subject to government regulation in terms of supply control, restrictions on disposition and use, or user tracking. Each cryptocurrency has its own payment infrastructure, which functions on a user-to-user basis, without the need for the participation of the state or financial intermediaries. In developing countries, a large number of adults who have access to mobile telephony and/or the Internet do not have the opportunity to use the services of financial institutions. Certainly, such persons also exist in

developed countries, within marginalized groups. It is estimated that there are approximately 1.7 billion people in the world with access to the Internet and no access to financial services (Demirgüç-Kunt et al. 2018). Therefore, cryptocurrencies theoretically enable the financial inclusion of a large number of such individuals. In the literature, claims can be found that cryptocurrencies could also affect the reduction in the inequality of income distribution (Kamau, 2022). With this in mind, optimistic expectations have been created that cryptocurrencies will set the financial system free from state control and corporate aggressiveness.

In practice, the traditional financial system and the cryptocurrency community had no meeting points. Commercial banks have not started using cryptocurrencies in their business, investment banks and investment funds have only been marginally interested in including them in their portfolio. Many countries have also issued official warnings to institutions and citizens not to use cryptocurrencies, as they are unregulated and may expose them to the loss of funds. Therefore, the cryptocurrency community, although constantly growing, was formed practically separately from all traditional financial flows (Baker, 2022). As previously emphasized, cryptocurrencies do not fulfil any of the basic functions of money due to their volatility. Therefore, the expectation that cryptocurrencies will enable fast, cheap and anonymous payments over the Internet has not been fulfilled. Instead, a community of technology experts for mining and speculative investors was formed. The nature of the parties involved and the relationships within the community led to the rapid abandonment of the idea of democracy and free competition and the emergence of oligopolistic structures.

2. Restrictions on free competition in the mining process

Depending on access control and the availability of roles in the system, blockchain technology can be operationalized in one of two ways. For the development of cryptocurrencies, the public blockchain is most often used, that is, a blockchain where permission is not required to perform a certain role. Any stakeholder that meets the technical criteria can become a miner (Lin & Liao, 2017). Also, any interested individual can buy cryptocurrency from an online exchange and use it to send money. For the development of blockchain-based business applications, a private blockchain is most often used, that is, a blockchain that requires permission to participate. Such systems are accessed on the basis of invitations and it is known in advance which of the members can play the role of a miner, and who can only perform transactions. A permission-based blockchain is not applicable to cryptocurrencies, as it limits the number of potential users. However, some modifications are in use, in which the role of the miner is predetermined, while the roles of payer and payee can be taken by anyone. Such are blockchains of cryptocurrencies Ripple, Stellar and NEM.

After choosing the type of blockchain, the choice of consensus protocol is crucial. These are mechanisms that automate the decision-making process in an environment where there is no mutual trust between the participants (Lamport, 1978). Confirmation of performed transactions is done on the basis of a consensus protocol. Due to the freedom of

access and the unlimited number of members, miners cannot be sure whether there are malicious individuals or groups among them, who want to abuse the transaction confirmation process. That is why the mentioned mechanisms must be resistant to system crash errors and to the so-called Byzantine errors, where malicious individuals intentionally send false messages to cause confusion. The economic results achieved by the miners depend on the chosen consensus protocol.

The problem is that consensus protocols in public blockchains are competitive. A miner who wins or earns the right to mine the next block receives financial compensation for the work done. The compensation itself can be in the form of a commission charged for transactions included into the block, in the form of newly created cryptocoins, or in a combination of the two mentioned forms. In each of the above cases, there is a pronounced competition among miners to win the right to mine a block. With some protocols, competition occurs on a technical basis, because there is a criterion regarding the computer resources used for mining. In others, the competition is of a purely financial nature, as it is necessary to invest funds in a specific cryptocurrency in order to acquire the right to mine.

Bitcoin and the majority of other current cryptocurrencies, such as Ether, Monero, ZCash and others, use the proof-of-work (PoW) protocol. With this protocol, each miner generates a block of executed transactions, while solving a complicated mathematical problem of the reverse hash function. Namely, the hash value of the entire record of the block and an arbitrarily added number called nonce should have some given value (for example, start with the string 0000). To get the given value, the miner changes only the nonce, because small changes in the contents of the block lead to a large change in the hash value. Finding a solution is very computationally intensive, as it requires a huge number of calculations based on trials and failures. In contrast, checking the accuracy of the results is trivial (Narayanan et al. 2016, pp. 104-105).

Mining has become a very lucrative business since the rise in the price of Bitcoin in 2012. Since the graphics card in modern computer systems (graphical processing unit - GPU) is more capable of performing a large number of calculations in a unit of time than the processor, miners began to equip their computers with the most expensive models, creating market disturbances (Osbourne, 2018; Warren, 2018). One began with the assembly of special computer machines intended exclusively for mining, which can perform a greater number of calculations per second and thus increase the chances of mining a block. Also, miners started to join together in the so-called mining pools, which access mining together and share the obtained reward. Although PoW promised an equal chance for all participants, soon all miners who could not follow the race in technical equipment had to withdraw.

PoW creates huge costs for miners in terms of acquisition of technical equipment and electricity consumption. There are many academic papers on the topic of the economic unsustainability of the PoW protocol (de Vries, 2018; Todorović & Tomić, 2019). The pronounced cost component additionally contributes to the centralization of the mining process. Another protocol that creates competition on a technical basis is proof-of-capacity (PoC). Although it is not as computationally intensive as PoW, and therefore does not lead

to high electricity consumption, PoC gives advantage to miners who have more available space on their hard disks. Thus, protocols that create competition on a technical basis require high initial investments in equipment, in order for miners to even engage in generating blocks.

Another large group of protocols requires initial investments in the chosen cryptocurrency before engaging in mining. The most popular among them is proof-of-stake (PoS), which is implemented in Peercoin and Cardano cryptocurrencies. Roughly speaking, each miner's stake is calculated, which depends on the amount of cryptocoins he owns and the length of time he holds them. The miner with the highest stake score gets the right to mine the block. After generating the block, the miner moves to the back of the list, and the next highest stake score assumes the role of a miner. However, not all users get their turn in this way, because when calculating, the length of tenure has an upper limit. Therefore, the PoS protocol favors rich miners. Although there are a large number of protocols (proof-of-importance - POI, proof-of-believability - PoBe) that modify the basic premises of PoS by introducing additional criteria for the selection of miners, practically all of them still favor rich miners (Tomić, Todorović & Jakšić, 2021, p. 372). An extreme example is the proof-of-burn protocol (PoB) where miners must first purchase some amount of a cryptocurrency and then send it to an irretrievable address (so that it is irrevocably alienated) in order to qualify for the selection. The problem is that each investment of this type is valid only for a certain period of time, after which the investment score is deleted. So not only does a miner have to invest a lot of money to be selected to mine a block, but he needs to do it continuously.

Although there was a promise that the blockchain would allow all interested parties to get involved in the maintenance and control of the system and earn money from it, this has not been achieved in practice. All public blockchain consensus protocols favor wealthy participants. With private blockchains, the roles are already predetermined, so ordinary users have no access. It can be concluded that regardless of the approach in the operationalization of the blockchain, there is no free competition for the role of the miner. The structure is oligopolistic, where the rich participants are in a situation to secure a privileged position in advance, or to buy it afterwards.

3. Formation of oligopolistic structures

Bitcoin is designed so that its supply increases over time, with miners receiving new cryptocoins as a reward. A small number of miners at the very beginning contributed to a large concentration of Bitcoins in the possession of the system's creators. The above applies to all cryptocurrencies that function according to the same principle. With the increase in the number of miners and the creation of a secondary market, the number of Bitcoin owners has grown exponentially. This necessarily led to a dispersion of ownership and thus a reduction in inequality in the cryptocurrency community. However, the question arises as to how quickly inequality has decreased. At the end of 2013, after almost a full five years of operation, the 927 richest accounts contained more Bitcoins than all the rest (about a million at that time), which indicates a too slow reduction of centralization (Wile, 2013).

Several authors have tried to determine the centralization of the market through the comparative calculation of the GINI coefficient for the largest cryptocurrencies. The first comprehensive analysis was performed by Srinivasan & Lee (2017), which presented a cross-section of the state of the Bitcoin and Ether markets in July 2017. The authors emphasized that analyzing only the centralization of ownership is not enough, so they calculated GINI coefficients according to 6 parameters: centralization of miners who generate blocks, centralization of software used to manage cryptocurrencies (from the perspective of users and from the perspective of developers), centralization of cryptocurrency exchanges, centralization of users according to the countries of the world and the centralization of ownership. The results of their research are presented in Table 1.

Table 1: GINI coefficient for Bitcoin and Ether according to the given parameters

Parameters	Bitcoin	Ether
Mining	0.4	0.82
Software	0.915	0.92
Developers	0.79	0.91
Exchanges	0.83	0.85
Users' country of origin	0.84	0.85
Ownership	0.65	0.76

Source: Srinivasan & Lee (2017)

Based on the obtained results, it can be concluded that the Ether market is more centralized than the Bitcoin market according to all observed parameters. The conclusion supports the claim that the lower the market capitalization of a cryptocurrency, the more centralized its community is (Sedgwick, 2018). The drastic differences in the above analysis are manifested in terms of the miners who generate the block - while this segment is extremely centralized with Ether, Bitcoin shows a more even distribution of rewards. Such a result may be somewhat of a surprise, considering that at the time of analysis, both cryptocurrencies used the PoW algorithm. However, to fully understand the degree of centralization of the Bitcoin mining system, it is necessary to take into account the mining pools, which will be discussed later.

The key parameter in this analysis is the distribution of wealth, i.e. the dispersion of ownership. The balances on individual accounts were analyzed, because it is not possible to connect individuals with accounts, and therefore not to determine whether one individual actually possess funds on several accounts. Bitcoin's score of 0.65, although very high, is not as bad as expected and is comparable to the centralization of wealth in countries like Australia and El Salvador during the same period (Ventura, 2018). With a score of 0.76, Ether showed comparability with countries like Jordan and Panama. However, the above results actually hide the true dimension of inequality in cryptocurrency communities. In order to exclude accounts with negligible amounts of cryptocurrencies, the authors set minimum amounts for both cryptocurrencies. Although this move made sense when it comes to low amounts on unused accounts, the authors set the minimum amounts unreasonably high at 185 Bitcoins, i.e. 2477 Ether. The market value of the set limits at the time was actually US$500,000. In other words, the GINI coefficient in terms of ownership is calculated only for the wealthy participants, who are called "whales" in the jargon,

because of their size and influence in the market (Redman, 2020). Thus, both cryptocurrencies show extremely high inequality in the distribution of wealth even when looking only at wealthy participants. The authors admitted that including all individual accounts holding any amount of cryptocurrency would result in GINI coefficients of over 0.99 for both cryptocurrencies considered, which is unmatched by any country.

Suberg (2019) performed a wealth distribution analysis for Bitcoin, Ether, Bitcoin Cash and Litecoin. In doing so, he compares the GINI coefficients for 2018 and 2019, the percentage of each cryptocurrency held by the richest account and the top ten accounts, as well as the minimum number of miners needed to take majority control of the mining process. The results are presented in Table 2. They show that there was an increase in ownership concentration in 2019 for all observed cryptocurrencies, except for Bitcoin. Also, it has been confirmed that cryptocurrencies with lower market capitalization exhibit more pronounced inequalities and lower security. However, the author did not state whether he used any criteria when including accounts in the analysis of the GINI coefficient, although from the obtained values it can be concluded that he did.

Table 2: GINI coefficient for Bitcoin, Ether, Bitcoin Cash and Litecoin on given parameters

Parameters	Bitcoin	Ether	Bitcoin cash	Litecoin
Market capitalization in USD on 31.12.2019.	130.4 billion	14.1 billion	3.7 billion	2.6 billion
GINI 2018	0.66	0.69	0.73	0.83
GINI 2019	0.64	0.78	0.75	0.83
The percentage of wealth held by the richest account	0.62%	1.96%	2.79%	2.58%
Share of wealth held by the 10 richest accounts	3.84	7.27%	9.38%	10.36%
The number of users required to take over the network	4545	322	1109	189

Source: Suberg (2019)

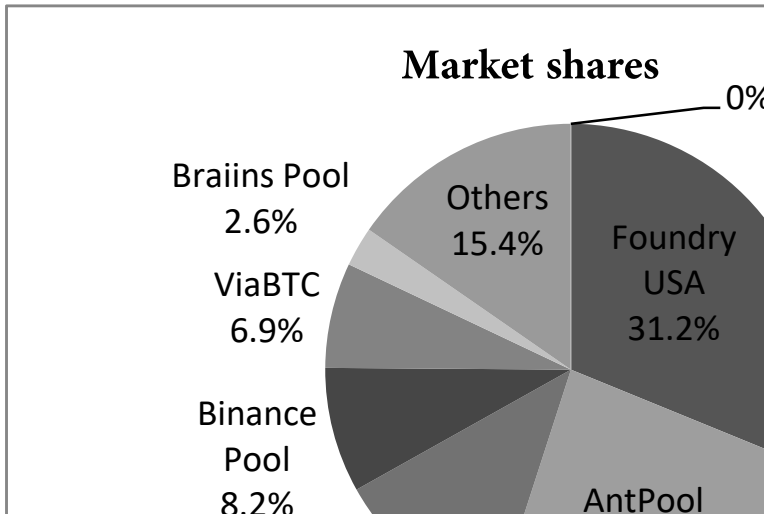
The last row of the table shows the minimum number of miners needed to achieve control over 51% of the mining power. With the mutual cooperation of the specified number of miners, transactions that did not actually happen can be written into the block, because the rest of the network has no way to prevent its adoption. Therefore, if a sufficient number of malicious individuals begin to cooperate, all funds can be fraudulently transferred to their accounts. Certainly, in theory such a move would be counterproductive, as a cryptocurrency that suffers an attack would lose value practically instantly, making it expensive and unprofitable to take over. However, the fact that just over 4,500 users are enough to take control of the system of the most popular global cryptocurrency speaks of the low level of security of the whole concept.

Later research confirmed the results obtained by Srinivasan & Lee (2017) and Suberg (2019). Sai, Buckley & Gear (2021) concluded that 0.01% of the richest accounts

hold about 58% of all Bitcoins, that is, that 0.16% of the richest accounts hold over 72% of Bitcoins.

Due to the number of cryptocurrencies based on the PoW concept, the competition between miners is most pronounced with this protocol. In the previous part, it was explained that the pronounced cost component puts a lot of pressure on independent miners, making individual mining unprofitable. This is why oligopolistic structures appear in the form of pools, which control large computing power (Eyal & Sirer, 2018, p. 96). Miners join together and perform as a team, where it does not matter which of the pool members first reached the solution and generated the block, because the reward is divided among the pool members according to the predetermined criteria. Pools increase the chance of individual miners to win a prize, but lead to deepening inequality and reduce the security of the system. Figure 1 shows the percentage share of the leading Bitcoin pools in the total generated blocks. The share was calculated on a sample of three days at the end of May 2023.

Figure 1: Shares of Bitcoin mining pools according to generated blocks, 3-day sample, May 2023



Source: btc.com

It can be seen that the structure of the mining pools is extremely centralized, with two largest pools mining over 50% of the blocks, while the four largest pools mining over 75% of the blocks. The fact that miners who are not members of the pool accounted for only 0.42% of blocks in the observed period also speaks of the degree of centralization. The obtained results are not consistent with the analysis performed by Srinivasan & Lee (2017), which showed a relatively low concentration in the mining domain (GINI of 0.4). However, the aforementioned authors did not deal with the analysis of pools, but with the analysis of individual miners, where they did not determine whether the miner is a member of a pool or not. It can be concluded that individual miners have a statistically insignificant share, while

the entire mining is organized according to the oligopoly principle. An additional problem is that pools do not provide an opportunity for their members to earn equally. The best example is Huobi.pool, which in the period before the pandemic was the sixth largest in the world. Within the pool, its own token called Huobi.pool Token (HPT) was developed as a unit of account for sharing mining rewards. As much as 70% of all HPTs were in just one account, which means that 70% of earnings were used by a single entity. Thus, while pools increase an individual's chance to successfully engage in mining, they also increase inequality within their own structure.

Before the COVID19 pandemic, it was estimated that about 65% of the total computing resources invested in Bitcoin mining came from China, while Russian and American miners each had a 7% share (Gogo, 2020). Numerous authors emphasize that a high concentration of miners in a non-democratic state could be a threat to the stability of the Bitcoin system. (Chester, 2019). However, in September 2021, China banned cryptocurrency trading and mining (Yu & Wallace, 2021), which led some miners to migrate to the US and Kazakhstan. Later data indicate that with or without the tacit consent of the state, the mining community in China continued to exist in a reduced form (Partz, 2022). Regardless of the political organization of the country where the miners come from, the real problem is that the vast majority of them, who are supposed to maintain a global network and make it safe, are actually centrally organized. During the year 2021, the American company Foundry created a disruption in the mining community by recruiting a large number of miners to the ranks of their newly established pool. Already at the end of 2021, Foundry became the largest pool and it holds that position to the mid-2023. Although one might think that it is good that the American pool has broken the dominance of Chinese miners, in fact the situation is even worse now than before the pandemic, because the two largest pools together have 55% of the total computing power. Regardless of the fact that at first glance they seem opposite, because AntPool's headquarters is in China, their size facilitates the potential coordination of joint action and possible cooperation in order to abuse the system.

Conclusion

The concept of cryptocurrencies theoretically enables the financial inclusion of marginalized social groups. Blockchain technology limits the political influence of the state and the corporate influence of financial institutions by decentralizing the management of issuing money and processing transactions. The cryptocurrency community offers chances for greater equality of participants compared to the traditional financial market. The aforementioned claims speak of the great potential of cryptocurrencies and the high expectations placed before them. However, cryptocurrencies have not met any of these expectations up to this point.

Cryptocurrencies function in parallel with the traditional financial system, so theoretically they enable online payments for users who do not have access to financial services, but have telecommunication services. In practice, there is a problem of how such users can get possession of the first amount of cryptocurrency. If the user wants to buy

them in secondary market, he needs first to invest fiat money. Therefore, some form of financial service is still necessary. Another way is to engage in mining. In the previous discussions, it was explained that mining cryptocurrencies that have a developed secondary market is actually a very expensive endeavor. The user would have to invest significant funds in equipment and become part of some global pool of miners. It is not clear which individuals do not have access to financial services and at the same time have significant amounts of money at their disposal, so that they can participate in the mining process and earn from it. A possible answer is wealthy individuals in countries that are excluded from international financial flows due to economic sanctions, but they were certainly not the primary target of inclusion. It can be concluded that cryptocurrencies currently do not enable the financial inclusion of marginalized social groups.

With the exception of few projects, such as the Petro token in Venezuela, all cryptocurrencies are actually private projects. Major international financial institutions have shown very little interest in investing in cryptocurrencies. Therefore, the influence of states and the corporate sector is very limited. However, it would be wrong to conclude that only thanks to these facts, blockchain technology has enabled decentralization. The basic premise, that all participants have an equal opportunity to participate in maintaining the system and making decisions, has not been fulfilled. Mining is run by large pools in which there is pronounced inequality. Almost all independent miners have been forced out of the market due to cost pressure. All consensus protocols favor rich miners and penalize those with limited resources. It is clear that blockchain has brought the same corporate pressure from the big players to the small ones, only in a seemingly altered form.

No single cryptocurrency community provides equality of participants. GINI coefficients, which are listed in the third part of the paper, speak in favor of an extremely uneven distribution of wealth. Inequalities are visible in the mining process, but also in secondary market. Large investors, known as whales, often use their position to create market disruptions to crowd out smaller investors. In the literature, one can find a large number of described situations during which a small number of investors led to a sudden change in the direction of the price movement through massive transactions. The difference with capital markets is that here there is no institution that can prevent such malicious market behaviour or the use of insider information. This is why inequality within cryptocurrency communities is even more pronounced than in traditional financial markets.

It can be concluded that oligopoly structures characterize both the mining process and the secondary market of all major cryptocurrencies. The examples given for Bitcoin apply to a greater or lesser extent to all other cryptocurrencies. Mining pools crowd out independent miners, while at the same time they establish a very unfavourable internal hierarchical structure. Wealth is very unevenly distributed in favor of early adopters of cryptocurrencies and wealthy individuals who have invested large amounts in the mining process and secondary market. Increasing the number of participants does not lead to redistribution and does not reduce inequalities. On the contrary, it only increases the number of the "poor", that is, users with a minimum amount of funds. The institution of trust and regulation in traditional financial markets was created over a long period of time. Therefore, the situation in cryptocurrency communities cannot be expected to change

quickly, especially without the existence of a consensus on the formation of institutions that will perform some form of supervision and control in order to create equal conditions for participants.

The availability of data and the method of their determination is the main limitation of the paper. It could be seen that different authors set their own criteria when determining the GINI coefficient of the cryptocurrency market, making cross-comparison of research impossible. Further research should monitor key indicators over a longer period of time and pay particular attention to disruptions that occur during sudden changes in the price of Bitcoin and other leading currencies, such as those that took place in late 2017 and early 2021.

References

Ammous, S. (2018). Can cryptocurrencies fulfil the functions of money? *The Quarterly Review of Economics and Finance*, *70*, 38-51. Doi: https://doi.org/10.1016/j.qref.2018.05.010

Baker, T. (2022). Let's stop treating crypto trading as if it were finance. *Columbia Law School blog on corporations and capital markets*, November 19. Retrieved May 5, 2023, from https://clsbluesky.law.columbia.edu/2022/11/29/lets-stop-treating-crypto-as-if-it-were-finance/

Chaum, D. (1983). Blind signatures for untraceable payments. *Advances in Cryptology Proceedings of Crypto '82*. 199-203.

Chen, Y. (2018). Blockchain tokens and the potential democratization of entrepreneurship and innovation. *Business horizons*, *61*, 567-575. Doi: https://doi.org/10.1016/j.bushor.2018.03.006

Chester, D. (2019). The dangers of mining pools: centralization and security issues. *Cointelegraph.com*, November 4, retrieved May 5, 2023, from https://cointelegraph.com/news/the-dangers-of-mining-pools-centralization-and-security-issues

Cong, L. W., He, Z., & Li, J. (2019). Decentralized mining in centralized pools. *The Review of Financial Studies, 34*(3), 1191-1235. Doi: https://doi.org/10.1093/rfs/hhaa040

de Vries, A. (2018). Bitcoin's Growing Energy problem. *Joule*, *2*(5), 801-805. Doi: https://doi.org/10.1016/j.joule.2018.04.016

Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar, S., & Hess, J. (2018). *The Global Findex database 2017: Measuring financial inclusion and the fintech revolution*. World Bank Group

Eyal, I., & Sirer, E. G. (2018). Majority is not enough: Bitcoin mining is vulnerable. *Communications of the ACM*, *61*(7), 95–102. Doi: https://doi.org/10.1145/3212998

Gogo, J. (2020). 65% of global bitcoin hashrate concentrated in China. *Bitcoin.com*, May 7. Retrieved May 5, 2023, from https://news.bitcoin.com/65-of-global-bitcoin-hashrate-concentrated-in-china/

Kamau, R. (2022). How Bitcoin can help solve the world's income inequality problem. *Forbes,* June 20. Retrieved May 4, 2023, from https://www.forbes.com/sites/rufaskamau/2022/06/20/how-bitcoin-can-help-solve-the-worlds-income-inequality-problem/?sh=4e9120885871

Lamport, L. (1978). Time, clocks and the ordering of events in a distributed system. *Communications of the ACM*. *21*(7), 558–565. Doi: https://doi.org/10.1145/359545.359563

Lee, D., & Chuen, K. (2016). *Handbook of digital currency*. London, UK: Elsevier

Lin, I.C., & Liao, T.C. (2017). A survey of blockchain security issues and challenges. *International Journal of Network Security*, *19*(5), 653-659. Doi: https://doi.org/10.6633/IJNS.201709.19(5).01

Matonis, J. (1995). Digital cash and monetary freedom. *INET'95 Internet society annual conference*, Honolulu, Hawaii.

Nakamoto, S. (2008). *Bitcoin: A peer-to-peer electronic cash system*. Retrieved April 29, 2023, from http://Bitcoin.org/Bitcoin.pdf

Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S. (2016). *Bitcoin and cryptocurrency technologies*. Princeton, NJ, USA: Princeton university press.

Okamoto, T., & Ohta, K. (1991). Universal electronic cash. *Advances in cryptology CRYPTO'91*, Feigenbaum J. (ed.) Berlin: Springer-Verlag. 324-350

Osbourne, C. (2018). Cryptocurrency miners bought 3 million GPUs in 2017. *ZDNet*, March 1. Retrieved May 2, 2023, from https://www.zdnet.com/finance/blockchain/cryptocurrency-miners-bought-3-million-gpus-in-2017/

Partz, H. (2022). China returns as 2nd top Bitcoin mining hub despite the crypto ban. *cointelegraph.com*, May 17. Retrieved May 5, 2023, from https://cointelegraph.com/news/china-returns-as-2nd-top-bitcoin-mining-hub-despite-the-crypto-ban

Redman, J. (2020). Onchain Data Shows Rising Bitcoin Whale Index Surpassing 4-Year High. *Bitcoin.com*, October 27. Retrieved May 4, 2023, from https://news.bitcoin.com/onchain-data-shows-rising-bitcoin-whale-index-surpassing-4-year-high/

Sai, A.R., Buckley, J., & Gear, A.L. (2021). Characterizing Wealth Inequality in Cryptocurrencies. *Frontiers in Blockchain 4,* article 730122, Doi: https://doi.org/10.3389/fbloc.2021.730122

Sedgwick, K. (2018). Most cryptocurrencies are more centralized than you think. *Bitcoin.com*, January 26. Retrieved May 5, 2023, from https://news.bitcoin.com/most-cryptocurrencies-are-more-centralized-than-you-think/

Srinivasan, B.S., & Lee, L. (2017). Quantifying decentralization. *News. Earn*, July 28, Retrieved May 3, 2023, from https://news.earn.com/quantifying-decentralization-e39db233c28e (18.11.2020.)

Suberg, W. (2019). Bitcoin wealth inequality drops in 2019 unlike Ether, Litecoin: Report. *Cointelegraph.com*, December 19, retrieved May 3, 2023, from https://cointelegraph.com/news/bitcoin-wealth-inequality-drops-in-2019-unlike-ether-litecoin-report (18.11.2020.)

Todorović, V., & Tomić, N. (2019). Unsustainability of cryptocurrency concept based on the Proof-of-work algorithm. *Bankarstvo*, *48*(1), 46-63. Doi: https://doi.org/10.5937/bankarstvo1901046T

Tomić, N., Todorović, V., & Jakšić, M. (2021). A survey on consensus protocols in permissionless blockchains. *Contemporary issues in economic, business and management, EBM 2020* – Kragujevac: Faculty of economics University of Kragujevac, 365-374.

Vaz, J., & Brown, K. (2020). Sustainable development and cryptocurrencies as private money. *Journal of Industrial and Business Economics*, *47*, 163-184. Doi: https://doi.org/10.1007/s40812-019-00139-5

Ventura, L. (2018). Wealth distribution and income inequality by country 2018, *Global Finance*, November 26. Retrieved May 3, 2023, from

Warren, T. (2018). Bitcoin mania is hurting PC gamers by pushing up GPU prices. *The Verge*, January 30. Retrieved May 2, 2023, from https://www.theverge.com/2018/1/30/16949550/bitcoin-graphics-cards-pc-prices-surge

Wile, R. (2013). 927 people own half of all bitcoins. *BusinessInsider*, December 10. Retrieved May 4, 2023, from https://www.businessinsider.com/927-people-own-half-of-the-bitcoins-2013-12

Yu, E., & Wallace, J. (2021). China declares cryptocurrency transactions illegal; Bitcoin price falls. *Wall Street Journal*, September 24. Retrieved May 5, 2023, from https://www.wsj.com/articles/china-declares-bitcoin-and-other-cryptocurrency-transactions-illegal-11632479288

UDC: 338.12:33(100)
DOI: 10.5937/AnEkSub2300028D

Original scientific article

Анали Економског факултета у Суботици – The Annals of the Faculty of Economics in Subotica
Vol. 60, No. 51, pp. 105-121
Received: 09/082023
Accepted: 28/11/2023
Published online: 12/12/2023

Effect of trade openness on economic growth within BRICS countries: an ARDL panel approach

Утицај отворености трговине на економски раст унутар земаља БРИКС-а: приступ АРДЛ панела

Dekkiche Djamal *
Oran Graduate School of Economics, Oran, Algeria, djamal.dekkiche@ese-oran.dz
https://orcid.org/0000-0002-1463-4413
Ouled Brahim Laila
Ghardaia University of Economic, Ghardaia, Algeria. ouladbrahim.laila@univ-ghardaia.dz,
https://orcid.org/0009-0008-6259-4840

Abstract: This paper investigates the connection between trade openness and economic growth in the BRICS countries (Brazil, Russia, India, China, and South Africa) using an autoregressive distributed lag (ARDL) panel approach. The study aims to shed light on the importance of international trade in fostering economic growth, particularly for developing countries. We assess the long-term equilibrium relationship between trade openness and economic growth in the BRICS context using a comprehensive panel dataset and advanced econometric techniques. The findings indicate a positive and significant impact of trade openness on economic growth, emphasizing the need for policies promoting trade liberalization and attracting foreign direct investment. This study contributes to the existing literature by offering empirical insights into the specific dynamics of trade openness and economic growth within the BRICS countries.
Keywords: economic growth, trade openness, BRICS countries, ARDL dynamic panel model.
JEL classification : F14, F43, F41, C23

Сажетак: Овај рад истражује везу између отворености трговине и економског раста у земљама БРИКС-а (Бразил, Русија, Индија, Кина и Јужна Африка) користећи ауторегресивни дистрибуирани приступ панела (АРДЛ). Циљ студије је да се расветли значај међународне трговине у подстицању економског раста, посебно за земље у развоју. Користећи свеобухватан панел скуп података и напредне економичне технике, процењујемо дугорочни еквилибријумски однос између отворености трговине и економског раста у контексту БРИКС-а. Закључци указују на позитиван и значајан утицај трговинске отворености на економски раст, наглашавајући потребу политике промовисања либерализације трговине и привлачења директних страних инвестиција. Ова студија доприноси постојећој литератури нудећи емпиријске увиде у специфичну динамику отворености трговине и економског раста унутар земаља БРИКС -а.
Кључне речи: отвореност трговине, економски раст, земље БРИКС-а, АРДЛ модел динамичког панела.
ЈЕЛ класификација: F14, F43, F41, C23

* Corresponding author

1. Introduction

The intricate association between trade liberalization and economic development has been thoroughly investigated within economics. Understanding the underlying causes and consequences of trade liberalization is of utmost significance for policymakers, particularly in developing countries pursuing pathways to achieve sustainable economic growth. The BRICS countries, composed of B*razil,* R*ussia*, I*ndia*, C*hina*, and S*outh* A*frica* (Zafar et al., 2022), have emerged as significant actors in the global economy and present a unique context for analysing the link between trade liberalization and economic progress.

The research conducted by Chen and Been-Lon (1999) investigates the correlation between trade openness and economic development in East Asia and Latin America, representing one of the pioneering research endeavours in this field. The research findings suggest a positive connection between trade liberalisation and economic expansion in the specified regions. Hadri (2000) presents a significant scholarly contribution examining stationarity in heterogeneous panel data. This work offers a valuable econometric methodology for investigating the correlation between trade liberalisation and economic growth.

In a chronological progression, Irwin and Tervio (2002) undertake a thorough examination of the potential of trade to augment income, utilising data from the twentieth century. The analysis provides evidence supporting trade's positive impact on income. In a recent study, Brueckner and Lederman (2015) employ a panel data approach to investigate the connection between trade liberalisation and economic growth in Sub-Saharan Africa. Their research findings indicate a positive correlation, implying that increased trade openness may contribute to economic growth within this region.

Numerous investigations have concentrated explicitly on the BRICS nations. Bayar (2016) delves into the influence of openness and economic liberty on economic progress in the transitioning economies of the European Union (Brkić et al., 2020). Their research outcomes underscore the affirmative link between openness and economic growth. In a separate research, Burange, Ranadive, and Karnik (2019) conducted an in-depth analysis of the BRICS countries, examining the interconnection between trade liberalisation and economic expansion. Their research furnishes empirical data affirming a positive association between these two aspects.

Banday, Murugan, and Maryam (2020) employ panel data evaluation to investigate the correlation between foreign direct investment, trade openness, and economic development in the BRICS nations. Their investigation offers additional proof of the beneficial impact of trade liberalisation on economic progress in the BRICS setting. These contemporary research pieces emphasise the significance of considering panel data and its distinct attributes when scrutinising the connection between trade liberalization and economic growth, specifically in the BRICS nations.

Beyond the studies on BRICS nations, other pertinent research explores the effect of trade liberalisation on economic development in various country scenarios. For example, Dritsaki and Stamatiou (2019) delve into the effect of market openness on Poland's economic

growth by employing an autoregressive distributed lag-bounds testing methodology. Their research results propose a positive correlation between market openness and economic growth.

Multiple researchers have also delved into the significance of policy harmonisation in the relationship between trade and growth. Chang et al. (2009) underscored the beneficial influence of policy synergies on economic growth, stressing that trade openness by itself might not be enough to attain enduring economic evolution. Chatterjee and Naka (2022) offered valuable perspectives on the political and economic metamorphoses within the BRICS nations, investigating the contribution of land policies in determining their growth paths.

Although current research underscores a positive link between trade liberalisation and economic development in the BRICS nations, certain studies have scrutinised individual country instances. Bayar (2016) investigated the influence of openness and economic liberty on economic progress within the transitioning economies of the European Union. Bechtini and Hassen (2018) probed the correlation between trade liberalisation and economic expansion in Tunisia. These studies offer a valuable understanding of the distinctive circumstances of these countries and contribute to the comprehensive comprehension of the link between trade and growth.

Even with the substantial amount of existing research, there remain voids in our comprehension of the precise processes by which trade liberalisation influences economic development in the BRICS nations. For example, the academic literature could gain from further detailed investigations of the pathways through which foreign direct investment and policy harmonisation impact economic growth. Moreover, there's a requirement for studies that account for possible variances across different sectors and regions within the BRICS countries. While most theoretical investigations have not yet arrived at a definitive and unambiguous conclusion regarding how trade liberalisation impacts growth, the lion's share of applied studies converges on a particular notion: trade openness catalyses economic growth.

In order to fill these voids, this paper aims to elucidate the connection between trade liberalisation and economic progress in the BRICS nations. By amalgamating the results of pertinent studies and pinpointing major patterns and areas needing further research, this review enriches the current body of knowledge and delivers valuable insights for subsequent research efforts and policy formulation. The last part of this work is arranged in the following manner. The first section is a review of the available literature. Section 2 lays out the methodology, data, and variables involved in the analysis. This is followed by Section 3, which deals with the empirical findings and their interpretation. Lastly, Section 4 wraps up the paper by providing conclusions and recommendations and suggesting potential directions for subsequent research.

Given the facts presented above, the primary research question that arises is:

How significantly does the policy of trade opening contribute to the economic growth of the BRICS group of countries?

In response to the primary research question, the subsequent hypotheses have been formulated:
H1: There is a discernible and substantial correlation between the degree of trade opening and the rate of economic expansion within the BRICS group of nations;
H2: Trade Openness leads to the influx of foreign investment because the most important effect of openness in a country is its ability to attract capital, which raises the growth rates within the BRICS group of countries.

2. Literature review

Extensive scholarly investigations have investigated trade liberalisation's effect on economic development, employing various research methodologies, temporal scopes, and geographic contexts. The study conducted by Mercan et al. (2013) investigated the connection between trade openness and economic growth within the BRICS nations and Turkey. Panel data spanning from 1989 to 2010 was utilised for this investigation. The findings of their inquiry revealed a positive and statistically significant correlation between openness and economic progress.

In the research carried out subsequently (Bayar, 2016), an exploration was undertaken to unravel the long-term correlations between economic growth, openness, and economic freedom in the transitioning economies of the European Union (EU) from 1996 to 2012. The analysis relied on real GDP per capita as the dependent variable. To quantify trade openness, the researcher utilised the combined total of exports and imports as a percentage of GDP (Al Kasasbeh et al., 2022). Financial openness was represented using the Chinn-Ito index (KAOPEN), while economic freedom was approximated by employing the panel Augmented Mean Group (AMG) method.

The study conducted by Brueckner and Lederman (Brueckner & Lederman, 2015) tested the link between trade openness and economic growth in Sub-Saharan Africa (Daniel Chindengwike St John & Daniel Chindengwike, 2023). The researchers used least squares and system GMM estimates (Generalised Method Moments) to analyse this link. The results of the analysis indicate a statistically significant positive relation between trade openness and economic expansion. Table 1. Provides studies focused on examining the relationship between economic growth and openness.

Table 1. Review of the most important studies that have been exposed to the link between trade openness and economic expansion

Study	Period and sample	Methodology	Findings
(Penelitian Ilmu Ekonomi et al., 2020)	1986-2017 in Indonesia	Generalised Method of Moments (GMM method)	The variables significantly affect the trajectory of economic development in Indonesia. The economic development of Indonesia is significantly influenced by factors such as trade, foreign direct investment (FDI), inflation, and the size of the workforce.

(Yusuf & Omar, 2091)	1981 to 2017 in Tanzania	Co-integration, VECM, and Granger causality	During the study period, there was a positive association between trade liberalisation and Tanzania's economic growth. The findings derived from the Granger causality analysis revealed a lack of causal linkage between trade liberalisation and economic expansion in Tanzania.
(Yahya Khan et al., 2020)	1981-2019 in Pakistan	Co-integration approach,	The effect of trade openness on economic development and its influence on other variables investigated in previous research, including foreign direct investment, inflation, exchange rate, and interest rate, is substantial.
(Kamsin et al., 2020)	1980-2018 in MALAYSIA	ARDL bound test (Autoregressive distributed lag model)	Capital formation and Foreign direct investment (FDI) are commonly used as indicators to assess the effect of trade liberalisation mechanisms and measure trade openness.
(Ram, 2010)	India from 1950 to 2008	Co-integration, Granger causality, and Error Correction Model	A long-term connection between openness and economic growth results in an equilibrium relationship. There exists a positive correlation between economic expansion and trade openness.
(Din et al., 2003)	1960-2001 In Pakistan	error-correction model, Granger causality	No causal relationship has been established between trade openness, measured by the total value of exports and imports, and short-term economic growth.
(Bechtini & Hassen, 2018)	Tunisia from 1980- 2014	Granger Causality and Error-Correction Model and	The effect of economic openness on Tunisia's growth is substantial and favourable. The presence of a bidirectional causal connection hinders the progress of economic growth.
(Dritsaki & Stamatiou, 2019)	1990-2016 in Poland	The (ARDL) autoregressive distributed lag and the error correction model (ECM) technique is utilised in the analysis.	The temporal data utilised in the model are of an annual frequency and encompass the time period from 1990 to 2016. The data used in the model is obtained from reputable sources such as the United Nations Conference on Trade and Development (UNCTAD) the Organisation for Economic Co-operation and Development (OECD), and global growth indices. The variable "trade openness" denotes the per capita value of real exports and imports, whereas "financial development" is quantified by the value of real domestic credit extended to the private sector. The test model demonstrates equilibrium connections between trade openness, financial development, and economic development, both in the long and short run (Al Kasasbeh et al., 2022)
(Idris et al., 2018)	From 1977 to 2011, 86 developing and OECD nations	Generalised Method of Moments (GMM)	In the case of developing countries, they should think about FDI because it helps growth, while government spending may hurt growth.

(Chang et al., 2009)	From 1996 to 2010 studying 34 countries were grouped into 17 dev. and developing countries	Balanced Panel Dataset	The findings suggest a positive association between trade openness and economic growth in developing nations, while a negative correlation is observed in developed countries.
(Tahir & Khan, 2014)	1990-2009 in Asian developing countries	Panel econometric techniques and 2SLS	The economies of developing Asian countries have greatly benefited from trade liberalisation. Economic growth in the studied countries has been influenced by domestic investment. However, human capital has shown a negative effect on economic growth.
(Cieślik & Tarsalewska, 2011)	1974–2006 in 97 developing countries	Estimation methods using panel data.	Both foreign direct investment (FDI) and international trade positively contribute to economic growth.

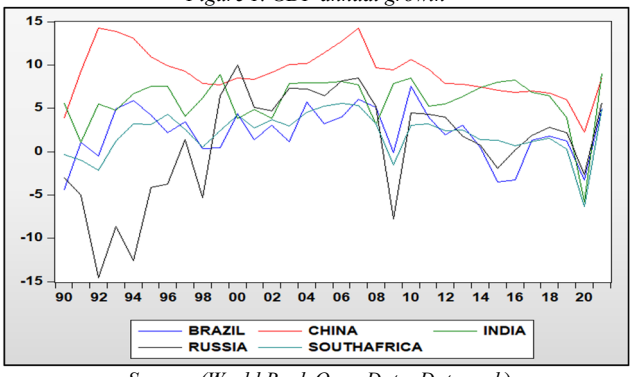
Source: summary of the research team

3. Data and methodology

3.1. Data

In the past two decades of the twentieth century, developed economies experienced average GDP growth of 2.9%, while developing economies had a higher growth rate of 3.6%. However, from 2000 to 2010, the growth rates shifted to 1.9% for developed countries and a significant 6.2% for developing countries. Projections from the International Monetary Fund (IMF), as stated by (Radulescu et al., 2014), indicate that this gap will continue to persist between 2011 and 2015, with developing countries projected to achieve a growth rate of 6.6% compared to 2.5% for advanced countries. Notably, within the group of emerging economies, the BRIC countries have stood out with an average GDP growth rate of 7.9% from 2000 to 2010. This growth rate is expected to increase further to 8.1% between 2011 and 2015, as depicted in Figure 1.

Figure 1. GDP annual growth



Source: (World Bank Open Data Data, n.d.)

To investigate how openness affects economic expansion, we employed Panel data analysis for the BRICS countries, including B*razil*, R*ussia*, I*ndia*, C*hina*, and S*outh* A*frica* (Andre et al., 2018), with rapid growth rates from 1990 to 2019. This group was chosen, as it constitutes a global economic power (Chatterjee & Naka, 2022). They play an important and growing role on the international scene, not only because of their size and population but because of their growing influence on economic output, trade cooperation and global policy.

We used growth rate (GROWTH), measured as annual %, and trade openness (OPENNESS) expressed in measure as export plus imports on GDP as the dependent variables. Foreign direct investment expressed in the balance of payments, $ US courants, gross capital formation defined in constant 2010 US$, and period average were used as independent variables. The data were taken from GDP growth (annual %) - Brazil, Russian Federation, India, China, South Africa | Data, n.d.. The variables utilised in the analysis are summarised in Table 1.

Table 1. Variables definition

Variable Name	Definition	Source
GROWTH	GDP growth (annual %)	Word bank data
OPENNESS	Measure as exports plus imports on GDP	Word bank data
FDI	Foreign direct investment, net (balance of payments, $ US courants)	Word bank data
GCF	Gross capital formation (constant 2010 US)	Word bank data

Source: summary of the research team (World Bank Open Data | Data, n.d.)

3.2. Model

This study draws upon the methodologies employed in several prior works, namely, Mercan et al. (2013), Rani & Kumar (2019), Banday et al. (2020), Burange et al. (2019) Peasah & John, (2017). According to Peasah and John (2017), a comprehensive set of econometric methods is utilised to investigate the connection between openness and economic growth, explicitly emphasising BRICS countries. These techniques encompass both long-term and short-term dynamics. In order to explore the short and long-term associations, we employed the panel autoregressive distributed lag (ARDL) methodology (Wang et al., 2011) initially suggested by Pesaran and Smith. According to (Pesaran & Smith, 1995), the empirical model is defined as follows:

$$\boldsymbol{GROWTH_{it} = \beta_0 + \beta_{1t} OPENNESS_{it} + \beta_{2t} FDI_{it} + \beta_{3t} GCF_{it} + U_{it}} \text{……...(2)}$$

Where the subscript i = 1…,…N means the country and t=1,…….T denotes the time period.

$GROWTH_{it}$ is GDP growth (annual %);

$OPENNESS_{it}$ (Mazumdar et al., 1 C.E.) refers to how a country's economy is set up regarding foreign trade. The size of an economy's listed imports and exports is a good way to measure its openness. (Mazumdar et al., 1 C.E.),

where:

Trade Openness Index = $\frac{\text{exports+imports of goods and services}}{\text{GDP}}$ (Kotcherlakota & Sack-Rittenhouse, 2000).

FDI_{it} Foreign direct investment, net (Balance of Payments, $ US courants)

GCF_{it}; Gross capital formation (constant 2010 US);

U_{it} is the residual term that is assumed to be normally distributed.

4. Estimation process and empirical findings

4.1. Descriptive statistics

The estimation procedure commences by conducting preliminary tests to verify the series' normality and evaluate the explanatory variables' heterogeneity..

Table 2 summarises the descriptive statistics for each variable. The findings indicate that all variables follow a normal distribution. Additionally, Table 3 presents the correlation test results as a correlation matrix. Upon examining the absolute values ranging from 0.33 to 0.41, 0.25, 0.09, and -0.02 in .

Table 2, we can assume that there are no concerns regarding multicollinearity among the explanatory factors. These values are below the commonly used threshold of 0.80 for detecting multicollinearity (Shrestha, 2020).

Table 2. Descriptive statistics

	GROWTH	OPEN	FDI	GCF
Mean	4.209963	30.45110	3.98E+10	3.15E+11
Median	4.460228	26.08149	1.55E+10	2.11E+11
Maximum	14.23139	64.56938	2.91E+11	5.11E+12
Minimum	-14.53107	5.871485	-75722412	9.86E+09
Std. Dev.	4.742430	16.40856	6.13E+10	5.94E+11
Skewness	-0.822392	0.337777	2.424886	6.676762
Kurtosis	4.831521	1.833482	8.682053	52.92961
Jarque-Bera	37.87364	11.35712	348.7876	16695.51
Sum of observations	631.4944	4567.664	5.98E+12	4.73E+13
Sum Sq. Dev.	3351.106	40116.89	5.60E+23	5.26E+25
Observations	150	150	150	150

Source: the authors' calculation

Table 3. Correlation matrix of variables

	GROWTH	OPEN	FDI	GCF
GROWTH	1.00			
OPEN	0.09	1.00		
FDI	0.33	0.41	1.00	
GCF	-0.02	0.14	0.25	1.00

Source: the authors' calculation

4.2. Unit root tests

In order to evaluate the existence of unit roots in the panel data regression model, various tests are employed, such as the LLC (Levin-Lin-Chu) test (Levin et al., 2002), the IPS (Im-Pesaran-Shin) test (Im et al., 2003), and the Fisher-ADF (Augmented Dickey-Fuller) test (Dickey & Fuller, 1979). The tests are predicated on the supposition that the null hypothesis posits the existence of a unit root in all panels. In addition, we utilise the Lagrange multiplier (LM) test introduced by Hadri (Hadri, 2000) to investigate the null hypothesis that all panels exhibit stationarity. Table 4 provides a summary of the outcomes obtained from the unit root tests.

Table 4. Unit Root test (Dickey & Fuller, 1979)

			GROWTH		OPEN		FDI		GCF	
			STAT	**P-VALUE**	**STAT**	**P-VALUE**	**STAT**	**P-VALUE**	**STAT**	**P-VALUE**
AT LEVEL	**C**	**LLC**	2.6036-	*0.0046	1.1712-	0.1208	0.5781-	0.2816	0.4666	0.6796
		IPS	3.6696-	*0.0001	0.4054	0.6574	0.3085	0.6212	1.3134	0.9055
		ADF FISHER	3.7412-	*0.0004	0.5217	0.6971	0.3698	0.6429	0.5281	0.6993
		Hadri-LM	1.5673-	*0.9415	31.7835	0.0000	32.9274	0.0000	5.8581	0.0000
AT 1ST DIFFERENCE	**C**	**LLC**			6.1918-	*0.0000	6.3106-	*0.0000	1.8214-	*0.0343
		IPS			6.3597-	*0.0000	7.2916-	*0.0000	2.7149-	*0.0033
		ADF FISHER			9.2000-	*0.0000	10.9092-	*0.0000	3.4610-	*0.0008
		Hadri-LM			1.2327-	*0.8912	1.5301-	*0.9370	2.2713	0.0116
Order of integration (I)			**I (0)**		**I (1)**		**I (1)**		**I (1)**	

(*) Significative at 5%

Source: Authors' calculations

The findings from the ADF, LLC, IPS, and Hadri tests collectively indicate that the dependent variable (GROWTH) exhibits integration at order I(0), thus suggesting its stationarity. The ADF unit root test provides additional evidence supporting the stationarity of the dependent variable at the level. In contrast, it can be observed that the series OPEN, FDI, and GCF exhibit integration at the order I(1), indicating the need for differencing to attain stationarity. Furthermore, the statistical significance of the LLC statistics for these variables has been established at a significance level of 5%, causing the rejection of the null hypothesis (H0). Hence, it can be observed that all the dependent variables demonstrate stationarity after undergoing the process of differencing. Therefore, it is appropriate to proceed with the implementation of a co-integration test in order to investigate the presence of a long-term or non-linear association between variables such as economic growth, trade openness, gross fixed capital formation, and foreign direct investment. It is crucial to acknowledge that the variables in the model exhibit a combination of I(0) and I(1) order of integration, which is consistent with the utilisation of panel ARDL estimators

4.3. Panel co-integration tests

This study employs the Pedroni cointegration test to analyse the long-term association between the variables. The findings of this analysis are displayed in Table 5. The table encompasses two distinct categories of residual tests, as proposed by Pedroni (1999). The

initial classification, presented in the primary section of Table 5, encompasses four subordinate assessments: panel-v, panel ADF statistics, panel-rho and panel PP. The sub-tests pertain to the amalgamation of the regression residuals within the panel's dimensions. The second category, which can be observed in the second panel of Table 5, encompasses three sub-tests: group rho, group ADF statistics and group PP. The sub-tests in question entail aggregating the residuals of the regression across the different dimensions of the panel. It is imperative to acknowledge that irrespective of their respective categories, all seven sub-tests share the null hypothesis of no cointegration.

The results obtained from the Pedroni cointegration test reveal that a statistically significant association exists for five out of the seven statistics investigated. According to previous research conducted by Narayan, Smyth, and Prasad (Narayan et al., 2007) as well as Lee (Lee et al., 2008), it has been proposed that the rejection of the null hypothesis of no cointegration can be inferred when a minimum of four statistical measures demonstrate significance (El-Shazly, 2013), thus indicating the existence of cointegration. This study emphasises the significance of the panel-augmented Dickey-Fuller (ADF) and group ADF statistics, which demonstrate robust estimations and improved qualities for small sample sizes. Based on the empirical evidence and consistent with prior scholarly investigations, it can be deduced that a persistent relationship exists among the variables under scrutiny. This inference is supported by the statistical significance of five out of the seven metrics, comprising panel ADF and group ADF.

Except for the panel rho-statistics, panel v-statistics and group rho-statistics, all other statistical measures in Pedroni's cointegration test (as presented in Table 5) exhibit statistical significance, consequently, rejecting the null hypothesis of no cointegration. The variables OPEN, FDI, and GCF have been determined to show cointegration with the variable GROWTH. It should be noted that both the panel and group PP statistics indicate superior characteristics and enhanced reliability. The null hypothesis, which posits the absence of cointegration, is rejected at a significance level of 5% using both panel PP statistics and group PP statistics. Once cointegration has been established, the subsequent aim is to estimate the long-term relationships among the variables.

Table 5. The findings of co-integration tests

H0: No cointegration (if prob<0,05 we reject H0 and accept H1)				
meaning that there is a cointegration link				
			Weighted	
	Statistic	Prob.	Statistic	Prob.
Panel PP-Statistic	-2.696723	0.0035*	-2.936325	0.0017*
Panel rho-Statistic	-1.205315	0.1140	-1.116314	0.1321
Panel v-Statistic	1.456033	0.0727	1.234791	0.1085
Panel ADF-Statistic	-1.007046	0.1570	-1.637209	0.0508
H1: individual AR coefs. (Between-dimension)				
	Statistic	Prob.		
Group rho-Statistic	-0.315932	0.3760		
Group PP-Statistic	-3.204036	0.0007*		
Group ADF-Statistic	-1.671567	0.0473*		

*(reject the null hypothesis and accept the alternative hypothesis meaning that the variables are cointegrate)

Source: the authors' calculation

4.4. Panel mean group (PMG), dynamic fixed effect (DFE) and mean group (MG)

Table 6 displays the estimated outcomes from the PMG, MG, and DFE estimators. Additionally, Table 6 includes the Hausman specification test (h-test) to appraise the models ' efficiency and consistency (Alam & Murad, 2020). The results indicate that the process of trade openness yields a favourable and enduring impact on the economy's growth.

Furthermore, it is worth noting that both the PMG and the MG estimators exhibit a positive effect of openness on growth in the short term, reinforcing the coherence of the findings obtained from these estimators. However, as per the DFE estimator, it can be observed that although openness is conducive to long-term development, the coefficient for the short-term effect is not statistically significant.

The Hausman test checks if a homogeneity constraint exists on the long-term coefficients between countries. The negligible p-values of the Hausman h-test for both the MG and DFE estimators (0.416 and 0.943, respectively) are consistent with the null hypothesis of homogeneity limitation, as predicted from the test findings. This means the PMG estimator is superior to the MG and DFE estimators at estimating the coefficients (Zainol ABIDIN et al., 2021).

The PMG estimate finds a sizeable negative long-term coefficient for FDI, implying it retards economic development. The PMG estimate suggests that FDI has a positive but negligible influence on GDP growth in the short run. The findings of the MG estimator go against those of the PMG and DFE estimators. Using the PMG estimator, we find that FDI has a statistically significant negative long-term coefficient, implying it stunts economic expansion. On the other hand, the PMG estimate suggests that the effect of FDI on GDP growth in the near run is positive but marginal. While the PMG and DFE results are consistent, the MG estimator results are not.

Results from the long-term estimation of the PMG model corroborate the findings from the short-term test, showing that trade openness and fixed capital formation substantially affect economic growth. Increasing exports and other trade openness helps nations perform better economically, which adds to economic growth. As demand falls, increased transparency becomes increasingly important (Mercan et al., 2013).

The analysis confirms that the global financial crisis of 2008 affected countries' economic growth through the export channel. Consistent with previous studies (Irwin & Tervio, 2002), which found a positive association between trade and income, the current research finds that nations with higher incomes are more likely to participate in international commerce (Fetahi-Vehapi et al., 2015). The error correction coefficient shows a process for correcting errors from the short to the long term, which is negative and statistically significant at the 0.05 level. To be more precise, about 45% of short-term errors can be fixed in the long run within a given amount of time, contributing to the restoration of long-term equilibrium.

Table 6. The PMG, MG and DFE estimators/Hausman tests

	MG		PMG		DFE	
variables	coeff	P>|z|	coeff	P>|z|	coeff	P>|z|
Long-run						
OPEN	.0273488	0.256	.0123064	0.539	.0145334	0.776
FDI	-4.81e-11	0.000	-2.29e-11	0.002*	-1.88e-11	0.229
GCF	3.78e-12	0.460	-1.79e-13	0.781	-1.19e-12	0.358
Error correction	-.7144577	0.000	-.6811438	0.000*	-.4710118	0.000
Short-run						
ΔOPEN	.0953948	0.297	.0907311	0.195	.0678734	0.146
ΔFDI	2.78e-11	0.048	1.70e-11	0.153	2.66e-11	0.069
ΔGCF	5.64e-11	0.049	5.80e-11	0.035	6.66e-13	0.464
intercept	2.450134	0.057	2.91943	0.001*	2.260907	0.000
No. Of states	5		5		5	
Observations	145		145		145	
Hausman test	MG vs PMG	Prob>chi2 = 0.4162[1]		Decision	MG	<=PMG
	DFE vs PMG	Prob>chi2 = 0.9439[2]		Decision	DFE	<=PMG
	DFE vs MG	Prob>chi2 = 0.5725		Decision	DFE	<=MG

Source: the authors' calculations

[1]PMG is efficient estimation than MG under the H0.
[2]PMG is more efficient estimation than DFE under H0.
(*) Significative at 5%

Conclusion

This research aimed to analyse the influence of trade openness on the economic growth of the BRICS countries, namely B*razil*, R*ussia*, I*ndia*, C*hina*, and S*outh* A*frica*. The findings of this research indicate that the BRICS countries have demonstrated a substantial acceptance towards trade openness, which has facilitated the adoption of advanced technologies and more efficient production methods. This, in turn, has contributed to enhancing overall productivity by optimising resource allocation. Consequently, the importance of policies promoting trade openness becomes evident in achieving integration into the global economy and fostering robust and sustainable economic growth.

The BRICS countries have consistently achieved high growth rates and exhibited proximity to each other, except during the years 2008 and 1997, when growth rates declined, particularly in Russia and South Africa, due to significant financial crises in those years.

According to the findings of the extensive investigation, it can be inferred that the Pooled Mean Group (PMG) model is the most suitable for estimation, as indicated by the Hausman test. Based on this model, it can be deduced that the level of trade openness in the BRICS countries exerts a positive and statistically significant effect on the economic growth rate within a limited time frame. Furthermore, the estimation results show a long-term equilibrium relationship, substantiated by a statistically significant and significant at the 5% level negative error correction factor.

Moreover, FDI plays a crucial role in accumulating physical capital and transferring human capital to the recipient country (Zarić, 2022), contributing to increased economic growth (Ercegovac & Pucar, 2022). Additionally, technology transfer enhances the efficiency of production factors, which helps bridge the technological gap between domestic and international institutions.

Based on our research findings, there are some recommendations and suggestions for future research:

Policy recommendations:

- Encourage and promote trade openness among the BRICS countries to stimulate economic growth. This can be achieved through bilateral and multilateral trade agreements, reducing trade barriers, and facilitating cross-border investments.
- Foster an environment that attracts and promotes (FDI) in the BRICS countries. This can be achieved by implementing investor-friendly policies, providing incentives for FDI, and improving the business climate.
- Enhance technology transfer initiatives to bridge the technological gap between domestic and international institutions. This can be done through partnerships, collaborations, and knowledge-sharing programs that facilitate the transfer of advanced technologies to support innovation and productivity growth.

Future research avenues:

- Explore the differential impacts of trade openness on specific sectors within the BRICS countries. Analyse how different industries and sectors respond to trade openness and identify the key growth drivers in each sector.
- Investigate the role of financial openness in supporting economic growth within the BRICS countries. Investigate the impacts of financial liberalisation, capital flows, and banking sector reforms on economic growth and financial stability.
- Conduct a comparative analysis of the BRICS countries' trade and investment patterns with other emerging economies or developed countries. Identify best practices and policy measures that can be adopted to enhance trade and investment cooperation further.
- Assess the social and environmental implications of trade openness in the BRICS countries.
- Investigate the potential effect on income inequality, labour market dynamics, and environmental sustainability to ensure that trade policies are inclusive and sustainable.

These recommendations and future study directions can provide policymakers, academics, and practitioners with valuable insights into the connection between trade openness and economic growth in the background of the BRICS countries.

At the end of this study, there exists a significant limitation: the model's insufficient length of time series. If longer periods were accessible, more factors could be added to the research, providing a more complete picture of the impact of trade openness on economic growth in the BRICS countries, moreover, in future work, we will try to address the same problematic regarding the BRICS group of countries, especially after the accession of Saudi Arabia, UAE, Egypt, Iran, Argentina and Ethiopia, while choosing longer periods so that the study has better and robust results.

References

Abidin Z.N., Abdul Karim, Z., Shaari, M.S., & Laila, N. (2021). The effect of foreign direct investment on total factor productivity in selected ASEAN+3 countries: new evidence using a panel ARDL study. *The Journal of Asian Finance, Economics and Business*, *8*(10), 109–117. Doi: https://doi.org/10.13106/jafeb.2021.vol8.no10.0109

Alam, M. M., & Murad, M. W. (2020). The impacts of economic growth, trade openness and technological progress on renewable energy use in organization for economic co-operation and development countries. *Renewable Energy*, *145*, 382–390. Doi: https://doi.org/10.1016/j.renene.2019.06.054

Al Kasasbeh, O., Alzghoul, A., & Alhanatleh, H. (2022). The impact of fiscal policy and trade liberalization on economic growth: evidence from structural breaks for Jordan. *International Journal of Professional Business Review*, *7*(6), e0850. Doi: https://doi.org/10.26668/businessreview/2022.v7i6.850

Andre, C., Balcilar, M., Chang, T., Gil-Alana, L. A., & Gupta, R. (2018). Current account sustainability in G7 and BRICS: evidence from a long-memory model with structural breaks. *Journal of International Trade and Economic Development*, *27*(6), 638–654. Doi: https://doi.org/10.1080/09638199.2017.1410853

Banday, U. J., Murugan, S., & Maryam, J. (2020). Foreign direct investment, trade openness and economic growth in BRICS countries: evidences from panel data., *13*(2), 211–221. Doi: https://doi.org/10.1080/19186444.2020.1851162

Bayar, Y. (2016). Impact of openness and economic freedom on economic growth in the transition economies of the european union. *South-Eastern Europe Journal of Economics*, *14*(1), 7–19.

Bechtini, m., & hassen, l. Ben. (2018). L'impact de l'ouverture sur la croissance économique en tunisie. *Revue des etudes multidisciplinaires en sciences economiques et sociales*, *3*(2), 2489–2068. https://revues.imist.ma/index.php/REMSES/article/view/12329

Brueckner, M., & Lederman, D. (2015). Trade openness and economic growth: panel data evidence from Sub-Saharan Africa. *Economica*, *82*, 1302–1323. https://onlinelibrary.wiley.com/toc/14680335/2015/82/s1

Brkić, I., Gradojević, N., & Ignjatijević, S. (2020). The impact of economic freedom on economic growth? New European dynamic panel evidence. *Journal of Risk and Financial Management, 13*(2), 26. Doi: https://doi.org/10.3390/jrfm13020026

Burange, L. G., Ranadive, R. R., & Karnik, N. N. (2019). Trade openness and economic growth nexus: a case study of BRICS. *Foreign Trade Review*, *54*(1), 1–15. Doi: https://doi.org/10.1177/0015732518810902

Chang, R., Kaltani, L., & Loayza, N. V. (2009). Openness can be good for growth: the role of policy complementarities. *Journal of Development Economics*, *90*(1), 33–49. Doi: https://doi.org/10.1016/j.jdeveco.2008.06.011

Chatterjee, M., & Naka, I. (2022). Twenty years of BRICS: political and economic transformations through the lens of land. *50*(1), 2–13. Doi: https://doi.org/10.1080/13600818.2022.2033191

Cieślik, A., & Tarsalewska, M. (2011). External openness and economic growth in developing countries. *Review of Development Economics*, *15*(4), 729–744. Doi: https://doi.org/10.1111/j.1467-9361.2011.00639.x

Daniel Chindengwike St John, J., & Daniel Chindengwike, J. (2023). The influence of traditional exports on economic growth in Tanzania: The VECM Analysis. *Journal of Business and Management*, *7*(01), 71–89. Doi: https://doi.org/10.3126/jbm.v7i01.54547

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, *74*(366), 427. Doi: https://doi.org/10.2307/2286348

Din, M.-U., Ghani, E., & Siddique, O. (2003). Openness and economic growth in Pakistan. *The Pakistan Development Review*, *42*(4), 795–807.

Dritsaki, c., & stagnation, p. (2019). Investigating the impact of market openness on economic growth for Poland: an autoregressive distributed lag bounds testing approach to cointegration. *International journal of economics and financial issues*, *9*(6), 123–131. Doi: https://doi.org/10.32479/ijefi.8327

El-Shazly, A. (2013). Electricity demand analysis and forecasting: a panel cointegration approach. *Energy Economics*, *40*, 251–258. Doi: https://doi.org/10.1016/j.eneco.2013.07.003

Ercegovac, D., & Pucar, E. B. (2022). The nexus between FDI and external balance of selected emerging European Economies – a panel data approach. *Anali Ekonomskog Fakulteta u Subotici*, *58*(47), 147-164. Doi: https://doi.org/10.5937/AnEkSub2247147E

Fetahi-Vehapi, M., Sadiku, L., & Petkovski, M. (2015). Empirical analysis of the effects of trade openness on economic growth: an evidence for South East European countries. *Procedia Economics and Finance*, *19*, 17–26. Doi: https://doi.org/10.1016/S2212-5671(15)00004-0

GDP growth (annual %) - Brazil, Russian Federation, India, China, South Africa | Data. (n.d.). Retrieved August 14, 2023, from https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=BR-RU-IN-CN-ZA&view=chart

Hadri, K. (2000). Testing for stationarity in heterogeneous panel data. *The Econometrics Journal*, *3*(2), 148–161.Doi: https://doi.org/10.1111/1368-423X.00043

Idris, J., Yusop Ab, Z., & Chin, L. (2018). Openness and economic growth in developing and OECD countries. *International Journal of Economics and Management Journal Homepage*, *12*(2), 693–702.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, *115*(1), 53–74. Doi: https://doi.org/10.1016/S0304-4076(03)00092-7

Irwin, D. A., & Tervio, M. (2002). Does trade raise income?: Evidence from the twentieth century. *Journal of International Economics*, *58*(1), 1–18.

Kamsin, K., Alin, J., & Kogid, M. (2020). Trade openness and economic growth: case of Malaysia. *Advanced International Journal of Banking, Accounting, and Finance*, *2*(4), 42–47. Doi: https://doi.org/10.35631/AIJBAF.24004

Kotcherlakota, V., & Sack-Rittenhouse, M. (2000). Index of openness: measurement and analysis. *Social Science Journal*, *37*(1), 125–130. Doi: https://doi.org/10.1016/S0362-3319(99)00062-2

Lee, C.-C., Chang, C.-P., Lee, C.-C., & Chang, C.-P. (2008). Energy consumption and economic growth in Asian economies: a more comprehensive analysis using panel data. *Resource and Energy Economics*, *30*(1), 50–65.

Mazumdar, D., Bhattacharjee, M., & Roy Chowdhury, J. (1 C.E.). Trade and Environment Nexus: a theoretical appraisal. *Https://Services.Igi-Global.Com/Resolvedoi/Resolve.Aspx?*, 1–17. Doi: https://doi.org/10.4018/978-1-5225-8547-3.ch001

Mercan, M., Göçer, İ., Bulut, Ş., & Dam, M. (2013). The effect of openness on economic growth for BRIC-T countries: panel data analysis 1. *Undefined*.

Narayan, P., Smyth, R., Prasad, A., Narayan, P., Smyth, R., & Prasad, A. (2007). Electricity consumption in G7 countries: a panel cointegration analysis of residential demand elasticities. *Energy Policy*, *35*(9), 4485–4494.

Peasah, N. A., & John, B. E. (2017). Analysis of the nexus between trade liberalization and economic growth: a panel study of BRICS countries. *Business and Economic Research*, *6*(2), 455–471. Doi: https://doi.org/10.5296/ber.v6i2.10235

Pedroni, P. (1999). Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and Statistics*, *61*(SUPPL.), 653–670. Doi: https://doi.org/10.1111/1468-0084.0610s1653

Penelitian Ilmu Ekonomi, J., Ifa, K., & Yahdi, M. (2020). Trade openness and economic growth in Indonesia. *Wiga : Jurnal Penelitian Ilmu Ekonomi*, *10*(2), 163–170. Doi: https://doi.org/10.30741/wiga.v10i2.599

Pesaran, M. H., & Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics*, *68*(1), 79–113. Doi: https://doi.org/10.1016/0304-4076(94)01644-F

Radulescu, I. G., Panait, M., & Voica, C. (2014). BRICS countries challenge to the world economy new trends. *Procedia Economics and Finance*, *8*, 605–613. Doi: https://doi.org/10.1016/S2212-5671(14)00135-X

Ram, P. R. (2010). Openness and Economic Growth in India. *Asian Profile*, *38*(3), 243–256.

Rani, R., & Kumar, N. (2019). On the causal dynamics between economic growth, trade openness and gross capital formation: evidence from BRICS countries, *20*(3), 795–812. Doi: https://doi.org/10.1177/0972150919837079

Shrestha, N. (2020). Detecting multicollinearity in regression analysis. *American Journal of Applied Mathematics and Statistics*, *8*(2), 39–42. https://doi.org/10.12691/ajams-8-2-1

Tahir, M., & Khan, I. (2014). Trade openness and economic growth in the Asian region. *Journal of Chinese Economic and Foreign Trade Studies*, *7*(3), 136–152. Doi: https://doi.org/10.1108/JCEFTS-05-2014-0006

Wang, Y., Wang, Y., Zhou, J., Zhu, X., & Lu, G. (2011). Energy consumption and economic growth in China: a multivariate causality test. *Energy Policy*, *39*(7), 4399–4406. Doi: https://doi.org/10.1016/j.enpol.2011.04.063

World Bank Open Data | Data. (n.d.).

Yahya Khan, G., Masood Anwar, M., & Anwar, A. (2020). Trade openness and economic growth nexus in Pakistan. *Global Economics Review*, *V*(III), 22–33. Doi: https://doi.org/10.31703/ger.2020(V-IV).03

Yusuf, S., & Omar, M. R. (2019). Trade openness and economic growth of Tanzania. *Asian Journal of Economics, Business and Accounting*, *12*(3) 1–10.

Zarić, S. (2022). Determinants of foreign direct investment in Central and Eastern Europe: panel data analysis results. *Anali Ekonomskog fakulteta u Subotici, (*48*)*, 35-49. Doi: https://doi.org/10.5937/AnEkSub2248035Z

Zeeshan Zafar, S., Zhilin, Q., Mabrouk, F., Ramirez-Asis, E., Alzoubi, H. M., Hishan, S.S., & Mivumbi, M. (2023). Empirical linkages between ICT, tourism, and trade towards sustainable environment: evidence from BRICS countries. *Economic research-Ekonomska istraživanja*, *36*(2). Doi: https://doi.org/10.1080/1331677X.2022.2127417

UDC: 005.591.6:338.43(497.11)
DOI: 10.5937/AnEkSub2300029M

Original scientific article

Анали Економског факултета у Суботици – The Annals of the Faculty of Economics in Subotica
Vol. 60, No. 51, pp. 123-137
Received: 21/07/2023
Accepted: 05/12/2023
Published online: 13/12/2023

Impact of knowledge transfer on ecological innovations of acquired companies in Serbia

Утицај трансфера знања на еколошке иновације преузетих компанија у Републици Србији

Igor Milojević*
Faculty of Economics, University of Kragujevac, Kragujevac, Republic of Serbia, igor.milojevic@ef.kg.ac.rs
https://orcid.org//0000-0002-4222-0963

Marko Savićević
Faculty of Economics, University of Kragujevac, Kragujevac, Republic of Serbia, marko.savicevic@kg.ac.rs
https://orcid.org/0000-0001-5168-1676

Miloš Dimitrijević
Faculty of Economics, University of Kragujevac, Kragujevac, Republic of Serbia, mdimitrijevic@kg.ac.rs
https://orcid.org/0000-0002-7922-8299

Abstract: Knowledge transfer is a key determinant of the development and implementation of innovations. It has not yet been sufficiently investigated how knowledge transfer can influence the environmental innovations of acquired companies in Serbia. This study investigates the role of knowledge transfer in acquired companies in Serbia and examines the impact of knowledge transfer on environmental innovation, *i.e.* on environmental innovation activities and strategy. The research was conducted based on the answers of 91 respondents, i.e. employees from five companies that were part of the acquisition process in Serbia. Collected primary data were processed in the SPSS program, using statistical analysis such as descriptive statistical analysis, correlational statistical analysis, and regression statistical analysis. Empirical results show that knowledge transfer in acquisition processes has a positive impact on the environmental innovations of acquired companies. The results show that knowledge transfer activities encourage the development and implementation of environmental innovations in those acquired companies. Since there is a lack of studies investigating the environmental orientation of acquired companies, this study contributes to the understanding of how knowledge sharing promotes the development of environmental innovations in acquired companies.
Keywords: knowledge transfer, acquisition, ecological innovations, sustainability
JEL classification: Q56; O44

Сажетак: Трансфер знања је кључна одредница развоја и имплементације иновација. Не постоје истраживања на тему како трансфер знања може да подстакне развој еколошких иновација у преузетим компанијама у Србији. Ова студија истражује улогу трансфера знања у преузетим компанијама у Србији и испитује утицај трансфера знања на еколошке иновације, односно на еколошке иновацијске активности и стратегију. Истраживање је спроведено на основу одговора 91 испитаника, односно запослених из пет компанија које су биле део процеса аквизиција у Србији. Прикупљени примарни

* Corresoponding author

подаци су обрађени у СПСС програму, коришћењем статистичке анализе попут дескриптивне статистичке анализе, корелационо статистичке анализе и регресионе статистичке анализе. Емпиријски подаци показују да трансфер знања у процесима аквизиције има позитиван утицај на еколошке иновације у преузетим компанијама. Такође, резултати истраживања потврђују да активности трансфера знања, од предузећа купца ка преузетом предузећу, подстичу развој и имплементацију еколошких иновација (еколошка иновативна стратегија и еколошке иновативне активности) у преузетим предузећима. Будући да недостају студије које истражују еколошку оријентацију преузетих компанија, ова студија доприноси разумевању колико трансфер знања, из предузећа купца у преузето предузеће, подстиче развој еколошких иновација у тим предузећима.
Кључне речи: трансфер знања, аквизиција, еколошке иновације, одрживи развој
ЈЕЛ класификација: Q56; 044

Introduction

In line with the current environmental revolution at the global level, the issue of environmental protection is a major concern for enterprises (Chuang and Huang, 2018). With the increasingly frequent consideration of environmental issues in the business sector, environmental procedures and regulations are accepted as a crucial part of company management. Some authors concluded that there are different incentives that motivate companies to implement activities in the field of environmental protection, such as financial resources (Friede et al., 2015), environmental legislation (Feng and Liao, 2016) and ethical consideration (Helfaya et al., 2018). Companies that are inclined to use innovative technologies in the production process and the concept of knowledge management usually support the vision of sustainable development.

The most important resource of the modern global economy is knowledge. During the past two decades, the concept of knowledge management has gained publicity and has been recognized as a major factor in the production and modernization of new products and services (Mardani et al., 2018). In addition, this concept has a dominant and decisive influence on the implementation and management of operational activities (Kasravi et al., 2017). One of the fundamental activities, or stages in the concept of knowledge management, is knowledge transfer. Argote and Ingram (2000) point out that knowledge transfer is the process of transferring knowledge and experience between different organizations and especially provides the opportunity for acquired companies to become more innovative. For this reason, a significant number of companies use this concept as a strategic resource, which ensures the achievement of competitive advantages on the market (Bolisani & Bratianu, 2018). A significant number of acquisitions are motivated by gaining access to knowledge, obtaining technical expertise, employee skills or specific new technologies. Acquisitions provide an opportunity for companies to expand their knowledge base and gain access to new knowledge that will be important for developing a sustainable competitive advantage. The acquisition process is relevant to research on the transfer of environmental knowledge to determine whether, among other things, better environmental performance is achieved through organizational transformation. Acquisitions in transition economies aim to further exploit knowledge and technology. Also, acquisitions provide access to cheap labor, natural resources, and local marketing knowledge (Marković & Savović, 2022).

According to Miletić et al. (2021), innovations and new creative ideas in business arise from unplanned technological changes and new knowledge. Crucial factors in the development of innovations are the market and the technology on the basis of which the idea is later commercialized. Environmental innovation is being researched increasingly to examine its impact elements that will aim to minimize the negative impact of business on the environment. Xu et al. (2017) point out that environmental innovation should be classified into environmental innovation strategies and environmental innovation activities. The ecological innovation strategy is a plan of recognizable environmental protection processes and practices, designed or proposed by the company's executive directors. Ecological innovation activities are directly implemented by employees in lower hierarchical positions. Examples of ecologically innovative activities are the development of ecological product designs, the promotion of ecological awareness among employees, the implementation of trainings on the topic of environmental protection, disposal of production hazardous and non-hazardous waste, and ecological management of the supply chain (Su et al., 2020). During the implementation of ecological innovative strategy and activities in the company, the common denominator of these two dimensions is the development and sharing of explicit and implicit knowledge. Some empirical studies show that by sharing and transferring knowledge between companies, as well as by including external knowledge and the environmental orientation of the company, innovations are successfully developed (Hamdoun et al., 2018). In line with the growing interest and relevance of the relationship between knowledge transfer and eco-innovation, our understanding of whether knowledge transfer to acquired firms affects the stimulation and implementation of eco-innovation remains rather unclear. Previous research that examined the effect of knowledge transfer on environmental innovations does not analyze the specific impact of the acquired companies in Serbia, which represents the research motivation of the authors of this study.

The subject of research in this paper is primarily focused on the effect of knowledge transfer in acquired companies on environmental innovations, specifically on environmentally innovative strategies and environmentally innovative activities. Consequently, from the subject of the research comes the proposition that examining how the transfer of knowledge to the acquired company affects the ecological innovations of those companies and whether it stimulates the development of new ecological solutions. Starting from the defined subject and goal of the research, the basic scientific assumption is that the transfer of knowledge from the acquiring company to the acquired company has a positive effect on environmental innovations after the acquisition. Taking into account the goal and subject of research work, the application of the qualitative methodology in work refers to the creation of a theoretical basis for the implementation of quantitative methodology, on the basis of which research hypotheses are accepted or rejected. Data were collected on the basis of a structured questionnaire, with the help of which data analysis was carried out, using various statistical methods and techniques. Also, for the research variables in the work, an analysis of the reliability of the application was carried out. Regression analysis was used to test hypotheses. After the introduction, in the first part of the paper, based on previous literature, the foundation for formulating

research hypotheses is laid. The third and fourth part of the paper present the methodology on the basis of which later in the next part the research is carried out and the results are presented. In the last part, a summary of previous research on this topic is presented, as well as the conclusion of this research with the contribution of the work and directions for future research.

1. Literature preview

1.1. Knowledge transfer

Knowledge is the main resource that creates and sustains the competitive advantage of companies in knowledge-based economies (Došenović & Zolak Poljašević). There are numerous definitions of knowledge, from representing information and skills acquired by a certain person through experience or education, to representing a theoretical or practical understanding of a subject. According to Bolisani and Bratianu (2018), knowledge as a multidimensional concept can be explicit and tacit. Explicit knowledge is formal knowledge that can be handed over to others because it is documented on paper or in specific databases (Ooi, 2014). Implicit knowledge represents knowledge that is difficult to transfer to another and appears in the form of intuition or study, which is difficult to explain or present (Maravilhas and Martins, 2019). Consequently, there is a continuous need for the development of employees, i.e. their knowledge, skills and abilities. Alavi and Tiwana (2002) describe the concept of knowledge management as "a necessity for achieving organizational effectiveness and competitiveness in the new millennium". Savović (2013) points out that there is an asymmetry of knowledge between the company carrying out the acquisition and the acquired company. More precisely, the acquiring company represents a crucial source of knowledge for the acquired company because it has significant intangible assets and capabilities that can contribute to the development of the acquired company. On the other hand, the acquired company contributes to the acquiring company through the existing knowledge of the local market.

One of the most common motives for carrying out acquisitions is employees. Empirical studies on knowledge transfer between companies led to the conclusion that knowledge transfer can facilitate communication between employees (Bresman et al., 1999), and influence the increase of employee productivity in acquired companies (Piscitello & Rabbiosi, 2003), but the transfer of implicit knowledge is quite difficult in acquired companies (Ranft, 1997). However, acquisition of the company and the existing knowledge base can represent a certain handicap, especially if certain problems arise with employees, which can cause a drop in productivity due to various affective reactions (Ahammad et al., 2016). Knowledge transfer, as an essential part of the concept of knowledge management, is dominantly significant for achieving a synergistic effect in acquisitions and is an indispensable parameter for examining the impact on the company's performance after the acquisition (Savović, 2013). Heo & Yoo (2008) analyzed the impact of knowledge transfer in the period after the implemented merger on the organizational performance of the company. The research results indicate that there was a

positive impact on organizational performance, emphasizing the personalization approach through knowledge transfer.

When talking about the relationship between knowledge transfer and innovation in companies, there are studies that analyzed the specific relationship and showed that knowledge transfer stimulates the generation of creative ideas for the development of new products and overall business. Cader (2008) points out that by transferring different types of knowledge in the acquired company, high-quality products are created, or more precisely, innovations are developed through which a competitive advantage is created in the market. Empirical research shows the positive impact of knowledge transfer on the innovativeness of companies (Wijk et al., 2008). The study by Ibidunni et al. (2020) shows that factors such as research and development and social connection have a partially positive impact on innovation in the company, while the third dimension, employee training, showed a statistically insignificant impact on innovation. Yu and Yan (2021) believe that the knowledge base (width and depth of knowledge) positively affects the growth of the company, which is driven by innovation. The research results show that organizational culture has a direct positive effect on the business innovation process and that it strengthens the impact of knowledge transfer on enterprise innovation. Habib et al. (2019) point out that knowledge transfer significantly increases the innovative abilities of employees in companies.

1.2 Knowledge transfer and environmental innovation

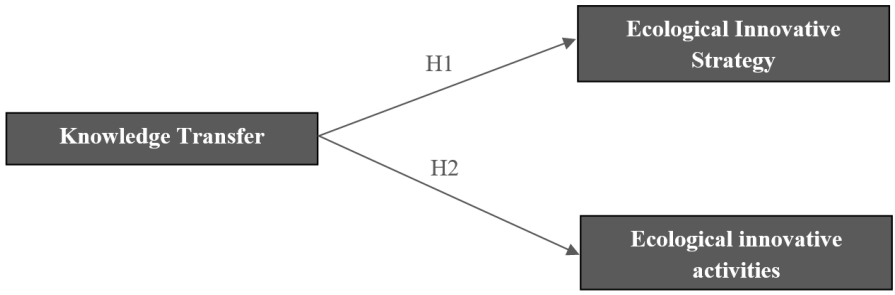
Creating value through product innovations, by the knowledge-based concept, implies the implementation of existing internal knowledge in a new way, as well as the application of new external knowledge. External knowledge can be acquired through research and development or by acquiring knowledge from other organizations through mergers and acquisitions (Savović, 2013). Innovation initiatives largely depend on the knowledge, skills and experience of employees in the value-creation process. Taking into account this notion, knowledge transfer can be seen as a relevant input for the creation of innovative activities and the strategy (Chiang & Hung, 2010). The use and transfer of knowledge is crucial in achieving innovation in the organization. In order to realize certain innovations from different fields, employees should take implicit knowledge from their colleagues and use well-founded defined explicit knowledge in the company (Ben Arfi et al., 2017). The promotion of knowledge transfer in the company will influence the development of new ideas that will later be the basis and reason for the implementation of activities in the field of environmental protection (Lundvall & Nielsen, 2007). The extended form of the environmental knowledge management model is environmental knowledge, which is also nurtured, maintained, used and shared in enterprises (Tseng, 2014). Environmental innovation strategy and environmental innovation activities are most often designed by the chief executive officers of the acquired companies. Due to constant environmental pollution and climate change, environmental innovation is considered a long-term remedy for it. Technology and its constant development contribute to mitigating polluting emissions by increasing energy efficiency in the production process (Hung et al., 2023).

Consequently, the transfer of knowledge from managers to other employees is essential for achieving environmental innovation. The dominant factor influencing the acquisition of external knowledge and the development of innovative solutions is social integration (Ebers & Maurer, 2014). Social integration mechanisms "enable the enterprise to share, communicate and transfer knowledge from the individual level to the enterprise level" (Lane et al., 2006). Based on this, by transferring knowledge from managers to other employees in the company, greater chances are provided for the implementation of ecologically innovative activities, an implementation that contributes to increasing results in the field of finance and environmental protection (Su et. al., 2020). According to Poch and others (2004), the transfer of knowledge about environmental protection promotes the generation of creative ecological ideas of the enterprise employees, which will indirectly positively affect the degree of innovation in the company as well as its performance. Consequently, it is assumed that sharing knowledge between the employees of the acquired companies would have a positive impact on the development and implementation of environmental innovations.

H1: The transfer of knowledge after the acquisition has a positive effect on the environmental innovation strategy of the acquired company.

H2: The transfer of knowledge after the acquisition has a positive effect on the environmental innovation activities of the acquired company.

Figure 1. Research model



Source: the authors' research

2. Materials and methods

Empirical research on the impact of knowledge transfer in the process of acquisitions on environmental innovations was conducted on a sample of acquired companies in Serbia, i.e. companies that were in the process of acquisition. A survey was used to collect primary data.

The research was carried out with the help of the Google Forms platform and by physically completing the survey, in the period from May to June 2022. Before the actual research and data collection, the target population for the needs of the research was

identified. The sample includes 91 managers and employees who are employed in five companies in Serbia, which were the subject of the acquisition. The respondents are employed in the acquired companies in operational, tactical and strategic positions that directly or indirectly influence the realization of ecological innovations with their knowledge or skills. Through the survey, the respondents expressed their views on adopted environmental innovation strategies (adapted from: Zhang et al., 2015; Chen, 2006) and activities (adapted from: Zhang et al., 2015; Chen, 2006; Wu and Qu, 2021), as well as the achieved knowledge transfer after acquisitions (adapted from: Gupta & Govindarajan, 2000). The statements answered by the respondents are shown in Table 5.

Dependent variables Environmental innovation strategy and Environmental innovation activities and the independent variable Knowledge transfer were assessed by all respondents in the sample (n=91). Based on a five-point Likert scale, the degree of agreement of respondents with the statements from the questionnaire was determined. Respondents chose answers from 1 (Strongly disagree) to 5 (Strongly agree). As shown in Table 1, the number of men in the sample (51.6%) is more numerous than the number of women (48.4%). Observed according to the age structure, the most numerous groups of respondents are in the age categories of 26 to 35 years (33%) and 36 to 45 years (27.5%). If we look at the years of service, we come to the following results: up to five years (15.4%), from 6-10 years (28.6%) and from 11-15 years (19.8%), while slightly higher participation of respondents with work experience of 16-25 years (15.4%) and over 25 years (20.9%).

Table 1. Sample description

Socio-demographic characteristics		**Frequency**	**Percentage**
Gender	Men	47	51.6%
	Women	44	48.4%
Age	18-25	7	7.7%
	26-35	30	33%
	36-45	25	27.5%
	46-55	18	19.8%
	>55	11	12.1%
Years of work	<5	14	15.4%
	6-10	26	28.6%
	11-15	18	19.8%
	16-25	14	15.4%
	>25	19	20.9%
Work position	Management	31	34.1%
	Operative	60	65.9%
Total		**91**	100%

Source: the a*uthors' calculation*

The collected data were analyzed in the statistical package for social sciences (Statistical Package for Social Sciences - SPSS, Version 23.0). Cronbach's Alpha coefficient was used to measure the reliability and internal consistency of the variables. Descriptive statistical analysis was used in order to measure the arithmetic mean and

standard deviation of the analyzed variables. The testing of the research hypotheses was carried out using a simple regression analysis.

3. Research result

In order to investigate the favorability and homogeneity of employees' attitudes toward the findings, a descriptive statistical analysis was conducted with indicators such as the arithmetic mean and standard deviation (Table 2). Variable Knowledge transfer has its arithmetic mean, which is 3.99, which means that the employees partially confirm the transfer of knowledge from the company carrying out the acquisition to the acquired company. Environmental innovations (Ecological innovative activities and Ecological innovative strategy) record values above 4, based on which it can be concluded that employees are relatively in agreement with the findings related to the implementation of innovations in the acquired companies, in the field of environmental protection.

Table 2. Arithmetic means, standard deviations, and Cronbach's Alpha coefficients of the analyzed variables

Variables	Mean	SD	Cronbach's alpha
Knowledge transfer	3.99	0.78	0.912
Ecological innovative strategy	4.07	0.68	0.825
Ecological innovative activities	3.94	0.79	0.904

Source: the authors' calculation

Cronbach's Alpha coefficient is used to check the internal consistency and stability of the primarily collected data. According to Hair et al. (2014), when the value of this coefficient is greater than 0.7, it can be concluded that the claims are reliable and consistent. Based on Table 2, it can be concluded that all three variables, which were observed in the research, have a very good internal consistency.

To determine the strength of the relationship between the variables, a correlational statistical analysis was conducted, the results of which are shown in the following table.

Table 3. Correlation statistics analysis

Variables	Ecological Innovative Strategy	Ecological Innovative Activities	Knowledge Transfer
Ecological Innovative Strategy	1	0.676**	0.588**
Ecological Innovative Activities	0.676**	1	**0.700****
Knowledge Transfer	0.588**	**0.700****	1

***Values are statically significant at level p < 0.01*

Source: the authors' calculation

Between all the analyzed variants, it can be concluded that there is a significant positive relationship at the level of 0.01, according to the values of the Pearson correlation coefficient. Ecological innovative activity as a variable records the strongest degree of linear correlation (0.700) with the variable Knowledge transfer, while the smallest connection between variables is present between Knowledge transfer and Ecological innovative strategy (0.588).

Table 4. Regression statistics analysis

	Ecological innovative strategy				**Ecological innovative activities**			
Variables	β	t	Sig.	VIF	β	t	Sig.	VIF
Knowledge transfer	0.588	6.861	0.000**	1.000	0.700	9.236	0.000**	1.000
***** Values are statically significant at level p < 0.01***	R^2=0.346; F= 47.070**				R^2=0.489; F=85.295**			

Source: the authors' calculation

It can be concluded that 34.6% of the variability of Environmental innovation strategy and 48.9% of the variability of Environmental innovation activity are described by the given regression models, which are shown by the coefficient of determination values of 0.346 and 0.489. The prior target values are statistically significant at the 0.01 level. The regression analysis has determined that Knowledge transfer has a statistically significant impact on the Environmental Innovation Strategy (β=0.588; p<0.01), as well as on the Environmental innovation activities (β=0.700; p<0.01) of the acquired companies in Serbia. Based on the obtained results, hypotheses H1 and H2 can be accepted, that is, the results show that knowledge transfer has a positive effect on environmental innovation in acquired companies.

Conclusions and discussion

A review of the literature in the field of company acquisitions shows that studies that analyze the impact of knowledge transfer on innovation are limited, especially since there is a limited understanding of the relevance of implementing environmental innovations in acquired companies, thus creating space and the need for research. According to Pavlović (2020), human capital is the most relevant determinant of success and sustainable competitive advantage, for the reason that the competencies of the company's employees cannot be imitated so easily, as is the case with tangible assets. Acquisitions represent one of the ways in which companies can acquire valuable and authentic knowledge, abilities and skills. In the preparation of the literature review, a theoretical model was constructed that indicates the relationships and impacts of knowledge transfer on company innovations, specifically on environmental innovations. The purpose of this paper is to examine the effects of knowledge transfer, from the acquiring company to the acquired company, on the environmental innovations of the acquired companies in Serbia. The results of empirical research show that the transfer of knowledge in acquisition processes

has a positive effect on the development of environmental innovations in those acquired companies. Previous research on this topic indicates that the concept of knowledge management has a positive effect on ecological innovation and encourages the development of ecological innovation activities (Yusr et al., 2017). According to Albort-Morant and others (2018), knowledge transfer improves the company's ability to use natural resources efficiently, which also affects the creation of an ecologically oriented company. With the help of knowledge transfer in the company, a realistic basis is created to produce quality products with low costs. If such high-quality products are created, it leads directly to the achievement of ecological sustainability, which affects the increase in customer satisfaction and loyalty.

This research offers several important theoretical contributions. The first contribution is in the research of knowledge transfer and its impact on environmental innovations of acquired companies. Previous research has mainly focused on the impact of knowledge transfer on innovation, with a very limited number of studies investigating its effects on environmental innovation in acquired firms (Wang et al., 2023; Ben Arfi et al., 2017). The contribution of this study is determining whether environmental knowledge transfer has a positive impact on environmental innovation in acquired companies.

Especially for countries in transition, the implications of this research are twofold. In a practical sense, the results of this research influence the strengthening of managers' awareness of the advantages created by knowledge transfer in acquisition processes, emphasizing environmental innovations in acquired companies and the impact of knowledge transfer on those innovations. Unlike previous works that analyzed environmental performance (Dubei et al., 2015) and environmental leadership (Singh et al., 2019), this research provides a theoretical and practical foundation for the development of environmental innovations in transition economies. In transition economies, such as Serbia, it is necessary for managers in foreign acquired companies to consider the option of implementing the transfer of knowledge in the field of environmental protection from the parent company, to encourage the development of ecological innovative strategies and activities in newly acquired companies. However, the implementation of knowledge transfer is not simple or easy; it is necessary to focus attention on three key prerequisites for implementation: documentation, technology, and direct communication (Perrin and Rolland, 2007). According to Su et al. (2020), managers should motivate other employees to absorb as much information as possible. In addition, an efficient system of environmental knowledge transfer should be developed to improve internal communication and information exchange. Also, communication with various external stakeholders can be useful for adapting the environmental innovation strategy and activities in the acquired company. Managers must focus on high environmental standards, which are beyond state regulations, with the aim of successfully transferring knowledge to other employees and thus generating environmental innovations. Through environmental innovation, companies introduce new technologies that enable employees to produce high-quality and environmentally friendly products that

affect the improvement of the environmental and financial performance of acquired companies.

There are several limitations of the research conducted, which should be investigated in the future. Primarily, the precision and accuracy of the results may be affected by an insufficient sample size. Directions for future research indicate the necessity of including a larger number of employees and a larger number of companies in the research itself. Second, our research was conducted exclusively in the acquired manufacturing companies in Serbia, and it is believed that many service and other companies face environmental problems. The next research on this topic should analyze a specific type of industry in the economic structure of Serbia or observe a specific region of Serbia in which they operate.

References

Abbas, J., & Sağsan, M. (2019). Impact of knowledge management practices on green innovation and corporate sustainable development: A structural analysis. *Journal of Cleaner Production*, *229*, 611-620. https://doi.org/10.1016/j.jclepro.2019.05.024

Ahammad, M., Glaister, K., (2010) Knowledge transfer and cross border acquisition performance: the impact of cultural distance and employee retention, *Working Paper Series*, 1-38. https://doi.org/10.1016/j.ibusrev.2014.06.015

Alavi, M., & Tiwana, A. (2002). Knowledge integration in virtual teams: the potential role of KMS. *Journal of the American Society for Information Science and Technology*, *53*(12), 1029-1037. https://doi.org/10.1002/asi.10107

Albort-Morant, G., Leal-Rodríguez, A. L., & De Marchi, V. (2018). Absorptive capacity and relationship learning mechanisms as complementary drivers of green innovation performance. *Journal of Knowledge Management*, *22*(2), 432-452. https://doi.org/10.1108/JKM-07-2017-0310

Arfi, W. B., Hikkerova, L., & Sahut, J. M. (2018). External knowledge sources, green innovation and performance. *Technological Forecasting and Social Change*, *129*, 210-220. https://doi.org/10.1016/j.techfore.2017.09.017

Bolisani, E., Bratianu, C. (2018). The elusive definition of knowledge. In: Emergent Knowledge Strategies. *Knowledge Management and Organizational Learning*, *4*, Springer, Cham. https://doi.org/10.1007/978-3-319-60657-6_1

Cader, H. A. (2008). The evolution of the knowledge economy. *The Journal of Regional Analysis & Policy*, *38*(2), 117-129. https://doi.org/10.22004/ag.econ.132351

Chuang, S.P., Huang, S.J. (2018), The effect of environmental corporate social responsibility on environmental performance and business competitiveness: the mediation of green information technology capital. *Journal of Business Ethics*, *150*(4), 991-1009. https://doi.org/10.1007/s10551-016-3167-x

Chen, Y. S., Lai, S. B., & Wen, C. T. (2006). The Influence of green innovation performance on corporate advantage in Taiwan. *Journal of Business Ethics*, *67*(4), 331–339. https://doi.org/10.1007/s10551-006-9025-5

Chiang, Y. H., & Hung, K. P. (2010). Exploring open search strategies and perceived innovation performance from the perspective of inter-organizational knowledge flows. *R&d Management*, *40*(3), 292-299. https://doi.org/10.1111/j.1467-9310.2010.00588.x

Došenović, D., & Zolak-Poljašević, B. (2021). The impact of human resource management activities on job satisfaction. *Anali Ekonomskog fakulteta u Subotici*, 45, 117-131. https://doi.org/10.5937/AnEkSub2145117D

Dubey, R., Gunasekaran, A., & Ali, S. S. (2015). Exploring the relationship between leadership, operational practices, institutional pressures and environmental performance: a framework for green supply chain. *International Journal of Production Economics*, *160*, 120–132. https://doi.org/10.1016/j.ijpe.2014.10.001

Ebers, M., & Maurer, I. (2014). Connections count: how relational embeddedness and relational empowerment foster absorptive capacity. *Research Policy*, *43*(2), 318-332. https://doi.org/10.1016/j.respol.2013.10.017

Feng, L., Liao, W. (2016), Legislation, plans, and policies for prevention and control of air pollution in China: achievements, challenges, and improvements. *Journal of Cleaner Production*, *112*, 1549-1558. https://doi.org/10.1016/j.jclepro.2015.08.013

Friede, G., Busch, T., Bassen, A. (2015), ESG and financial performance: aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance and Investment*, *5*(4), 210-233. https://doi.org/10.1080/20430795.2015.1118917

Gupta, A. & Govindarajan, V. (1991). Knowledge flows as the structure of control within multinational corporations. *Academy of Management Review*, *16*(4), 768-792. https://doi.org/10.5465/amr.1991.4279628

Habib, A., & Bao, Y. (2019). Impact of knowledge management capability and green supply chain management practices on firm performance. *International Journal of Research in Business and Social Science*, *8*(6), 240-255. https://doi.org/10.20525/ijrbs.v8i5.548

Hamdoun, M., Jabbour, C.J.C., Othman, H.B. (2018), Knowledge transfer and organizational innovation: impacts of quality and environmental management. *Journal of Cleaner Production*, *193*, 759-770. https://doi.org/10.1016/j.jclepro.2018.05.031

Helfaya, A., Kotb, A., Hanafi, R. (2018), Qur'anic ethics for environmental responsibility: implications for business practice. *Journal of Business Ethics*, *150*(4), 1105-1128. https://doi.org/10.1007/s10551-016-3195-6

Hung, B. Q., & Nham, N. T. H. (2023). The importance of digitalization in powering environmental innovation performance of European countries. *Journal of Innovation & Knowledge*, *8*(1), 1-14. https://doi.org/10.1016/j.jik.2022.100284

Heo, Dongcheol and Yoo, Youngjin. (2008). Knowledge sharing in post merger integration. *All Sprouts Content, 35*. Retrieved July 13, 2022, from https://aisel.aisnet.org/sprouts_all/35

Ibidunni, A. S., Kolawole, A. I., Olokundun, M. A., & Ogbari, M. E. (2020). Knowledge transfer and innovation performance of small and medium enterprises (SMEs): an informal economy analysis. *Heliyon*, *6*(8). https://doi.org/10.1016/j.heliyon.2020.e04740

Lane, P. J., Koka, B. R., & Pathak, S. (2006). The reification of absorptive capacity: A critical review and rejuvenation of the construct. *Academy of Management Review*, *31*(4), 833-863. https://doi.org/10.5465/amr.2006.22527456

Lundvall, B. and Nielsen, P. (2007). Knowledge management and innovation performance. *International Journal of Manpower*, *28*(3), 207-223. https://doi.org/10.1108/01437720710755218

Marković, D., & Savović, S. (2022). Cross-border acquisitions and profitability of acquired companies in Serbian cement industry. *Anali Ekonomskog fakulteta u Subotici*, *58*(48), 15-33. https://doi.org/10.5937/AnEkSub2248015M

Maravilhas, S., Martins, J. (2019). Strategic knowledge management a digital environment: tacit and explicit knowledge in Fab Labs. *Journal of Business Research*, *94*, 353-359. https://doi.org/10.1016/j.jbusres.2018.01.061

Mardani, A., Nikoosokhan, S., Moradi, M., Doustar, M. (2018. The relationship between knowledge management and innovation performance. *The Journal of High Technology Management Research*, *29*(1), 12-26. https://doi.org/10.1016/j.hitech.2018.04.002

Miletic, V., Ćurčić, N., & Kostić, Z. (2021). Openness of companies in Serbia to creativity, new ideas and innovation. *Anali Ekonomskog fakulteta u Subotici*, *57*(46), 21-34. https://doi.org/10.5937/AnEkSub2146021M

Noailly, J., & Ryfisch, D. (2015). Multinational firms and the internationalization of green R&D: a review of the evidence and policy implications. *Energy Policy*, *83*, 218-228. https://doi.org/10.1016/j.enpol.2015.03.002

Ooi, K.B. (2014). TQM: a facilitator to enhance knowledge management? A structural analysis. *Expert Systems with Applications*, 41(11), 5167-5179. https://doi.org/10.1016/j.eswa.2014.03.013

Pavlović, G. (2020). Strategijski značaj ljudskog kapitala za organizacione performanse u procesima akvizicija. Doctoral dissertation. University of Kragujevac, Faculty of Economics

Perrin, A., Rolland, N., & Stanley, T. (2007). Achieving best practices transfer across countries. *Journal of Knowledge Management*, *11*(3), 156-166. https://doi.org/10.1108/13673270710752171

Poch, M., Comas, J., Rodríguez-Roda, I., Sanchez-Marre, M., & Cortés, U. (2004). Designing and building real environmental decision support systems. *Environmental modelling & software*, *19*(9), 857-873. https://doi.org/10.1016/j.envsoft.2003.03.007

Ranft, A. & Michael, L. (2000). Acquiring new knowledge: The role of retaining human capital in acquisitions of high-tech firms. *The Journal of High Technology Management Research*, *11*(2), 295-319. https://doi.org/10.1016/S1047-8310(00)00034-1

Savović, S. (2013). Uticaj postakvizicione integracije i restrukturiranja na efikasnost preduzeća. Doctoral dissertation. University of Kragujevac, Faculty of Economics.

Singh, S. K., Del Giudice, M., Chierici, R., & Graziano, D. (2020). Green innovation and environmental performance: the role of green transformational leadership and green human resource management. *Technological Forecasting and Social Change*, *150*, 119762. https://doi.org/10.1016/j.techfore.2019.119762

Su, X., Xu, A., Lin, W., Chen, Y., Liu, S., & Xu, W. (2020). Environmental leadership, green innovation practices, environmental knowledge learning, and firm performance. *Sage Open*, *10*(2), 1-14. https://doi.org/10.1177/2158244020922909

Tseng, S. M. (2014). The impact of knowledge management capabilities and supplier relationship management on corporate performance. *International Journal of Production Economics*, *154*, 39-47. https://doi.org/10.1016/j.ijpe.2014.04.009

Wang, M., Wang, Y., & Mardani, A. (2023). Empirical analysis of the influencing factors of knowledge sharing in industrial technology innovation strategic alliances. *Journal of Business Research*, *157*, 113635. https://doi.org/10.1016/j.jbusres.2022.113635

Wijk, R., Jansen, J. & Lyles, M. (2008). Inter- and intra-organizational knowledge transfer: a meta-analytic review and assessment of its antecedents and consequences. *Journal of Management Studies 45*(4), 830-853. https://doi.org/10.1111/j.1467-6486.2008.00771.x

Wu, H., & Qu, Y. (2021). How do firms promote green innovation through international mergers and acquisitions: the moderating role of green image and green subsidy. *International Journal of Environmental Research and Public Health*, *18*(14), 7333. https://doi.org/10.3390/ijerph18147333

Yu, D., & Yan, H. (2021). Relationship between knowledge base and innovation-driven growth: moderated by organizational character. *Frontiers in Psychology*, *12*, 1-14. https://doi.org/10.3389/fpsyg.2021.663317

Yusr, M. M., Mokhtar, S. S. M., Othman, A. R., & Sulaiman, Y. (2017). Does interaction between TQM practices and knowledge management processes enhance the innovation performance?. *International Journal of Quality & Reliability Management*, *34*(7), 955-974. https://doi.org/10.1108/IJQRM-09-2014-0138

Zhang, B., Wang, Z., & Lai, K. H. (2015). Mediating effect of managers' environmental concern: bridge between external pressures and firms' practices of energy conservation in China. *Journal of Environmental Psychology*, *43*, 203–215. https://doi.org/10.1016/j.jenvp.2015.07.002

Appendix:

The questionnaire

Statements
Knowledge transfer
1. After the acquisition, your business skills and knowledge are improved.
2. After the acquisition, managerial skills in your company have been improved.
3. After the acquisition, your company's marketing activities were improved and developed.
4. After the acquisition, technical skills and knowledge were improved.
5. After the acquisition, administrative and sales skills and knowledge were improved and developed.
Ecological innovative strategy
7. After the acquisition, our company sets short-term goals for the realization of ecological innovations and activities.
8. After the acquisition, our company has a clear long-term vision of implementing activities that contribute to environmental protection.
9. After the acquisition, our company adapted its business activities in order to reduce the negative impact on the ecological environment.
10. In our company, there is a clear plan of activities on how environmental protection is implemented.
Ecological innovative activities
11. After the acquisition, our company voluntarily undertakes some of the environmental activities, although the state regulations do not require it.
12. After the acquisition, our company uses materials and raw materials in the production process which can be recycled or reused in the same process.
13. After the acquisition, our company produces products that save material and energy fuels in the production process.
14. After the acquisition, our company constantly improves the production process in order to reduce the emission of hazardous substances and waste.
15. After the acquisition, our company has largely replaced traditional fuels with new, less polluting fuels.

Source: the authors' research

UDC: 631.147:338.439 (497.6 Republika Srpska)
DOI: 10.5937/AnEkSub2300030G

Original scientific article

Анали Економског факултета у Суботици – The Annals of the Faculty of Economics in Subotica
Vol. 60, No. 51, pp. 139-152
Received: 14/09/2023
Accepted: 05/12/2023
Published online:20/12/2023

Internal profitability determinants of organic production companies in Republika Srpska

Интерни фактори профитабилности привредних друштава која се баве органском производњом у Републици Српској

Jovana Galić

PhD student, University Novi Sad, Faculty of Economics in Subotica, Subotica, Republic of Serbia, jovana.galic@gmail.com, https://orcid.org/0000-0003-3915-1917

Abstract: This paper aims to investigate the value and influence of internal profitability determinants on profitability measured by return of assets of organic production companies in Srpska. For this purpose, abbreviated balance sheets of 21 companies engaged in this type of agricultural production in the period from 2014 to 2021 were provided and the regression model was defined. The results showed that the internal determinants of profitability, i.e. company age, liquidity ratio, debt measured by financial leverage, sales growth and capital turnover have a significant impact on profitability. While debt has a negative correlation, other determinants have a positive correlation. Research limitations refer to the sample because it does not include small-scale family farms, which are not required to submit financial reports.
Keywords: profitability, organic production, ROA, sustainability, financial analysis
JEL classification: Q12, Q13, M41

Сажетак: Циљ овог рада је да утврди величину и утицај интерних фактора профитабилности на профитабилност мјерену повратом на активу код привредних друштава која се баве органском производњом у Републици Српској. За ову сврху обезбјеђени су скраћени биланси 21 привредног друштва које се бавило овим видом пољопривредне производње у периоду од 2014. до 2021. године и дефинисан је регресиони модел. Резултати су показали да интерни фактори профитабилности старост друштва, рацио ликвидности, задужење мјерено финансијском полугом, раст продаје и обрт капитала имају значајан утицај на профитабилност и то на начин да леверић има негативан утицај, а остали фактори позитиван утицај. Истраживање је ограничено јер узорак не садржи податке о малим породичним пољопривредним газдинствима из разлога што они нису обвезници достављања финансијских извјештаја.
Кључне речи: профитабилност, органска производња, РОА, одрживост, финансијска анализа
ЈЕЛ класификација: Q12, Q13, M41

Introduction

Positive effects of organic production in environmental and health sense are already well known. Organic agriculture was developed as an alternative to conventional agriculture due to the high pollution of soil, water and air, food products that contain pesticide residuals

and generally disturbed ecosystems. Many studies compared the profitability of conventional and organic products with different methodologies but without consensus. The benefits that organic production brings in terms of protecting nature for the wellbeing of all future generations are immeasurable. "The growing demand is mainly attributable to consumer concerns about negative implications of conventional agriculture for human health and the environment." (Meemken & Qaim, 2018). On the other side, insufficiently developed awareness of its importance and potential is still present (Tomaš-Simin et al., 2019). Even if the yield is dominated by conventional manufacturing, organic farming production comes ahead when the benefits and usage are taken into account (Barjaktarovic et al., 2016).

The most critical period for organic production in terms of profitability is the time it takes to convert from conventional to organic production – the conversion period. During that time, producers are faced with high costs and lower production yield (Tomaš-Simin et al., 2019) while consumers would pay the conversion-grade produce around half of a premium price of organic produce (Tranter et al., 2009). There is a lack of consumer research related to organic production purchases in Republika Srpska, although in most cases, 31%-50% of the household budget is used for food purchases (Galić, 2022).

Considering geographical position, climate and land quality, Republika Srpska as entity of Bosnia and Herzegovina has significant potential for organic production, but the current volume of the production shows its initial phase of development. Organic agriculture is suitable for small farms and land areas which are characteristic for this region. Smaller family farms take a very important part of the total agricultural sector of Europe (Beyer & Hinke, 2020).

Profitability in agriculture depends on multiple determinants. Internal profitability determinants are characteristic of the company itself and are mostly influenced by management decisions. They are individual for each company and differ from industry to industry. The ones that affect profitability the most are company size, sales growth, debt ratio, quick ratio, company age, inventory level, fixed assets to total assets ratio, capital turnover (Andrašić et al., 2018) leverage and lagged profitability (Mijić & Jakšić, 2017), with no consensus on the impact (Andrašić et al., 2018).

External profitability determinants are shaped by the business environment: competition, concentration, market risks, gross domestic product (GDP), inflation, unemployment, interest rates, country risks and other influences outside the company.

1. Literature overview

The importance of the agricultural industry for economic growth is represented in the fact that 9.0% of the gross domestic product of Republika Srpska for 2020 is aggregated from agriculture, forestry, and fishing (Statistical Office of Republika Srpska, 2021) and has had a positive index for the past three years. Population census from 2013 shows that agriculture is the predominant economic activity of 34.50% of all households in Republika Srpska (Statistical Office of Republika Srpska, 2017) and agricultural land takes up

981,815 ha or 40.57% of its territory (Ministry of Agriculture, Forestry and Water Management of Republika Srpska, 2021). The agricultural industry is organized into different forms of enterprises – small-scale family farms, cooperatives or companies. The production type, value and structure of assets are different, but all of them are established to bring profit as a precondition for long-term existence and development, followed by the growth of the sector, economic growth, employment, innovation and technological changes (Mijić & Jakšić, 2017). Products are delivered to customers through various distribution channels (Sudarević & Galić).

According to FIBL data, organic production in Bosnia and Herzegovina in 2021 was present on 2.495ha (including in-conversion areas) which makes 0.14% of the total arable land, while the collection of wild plant species took place on 195.668ha, which together gives the 198.163ha of organic areas on the territory of Bosnia and Herzegovina (Willer et al., 2023). Compared to 2020 data, the area of agricultural land has grown by 47.50% (Willer et al., 2023). The same report shows that this increase is 627.8% for the past 10-year period. The growth is a positive indicator, but organic agriculture production still remains low even if it is identified as a comparative advantage, has favourable conditions and a possibility for the development of new economic activities (Mujčinović et al., 2017).

Profitability as a measure of a company's success has been analysed in numerous studies. As a key indicator of company's performance (Pjanić et al., 2018), profitability indicates the ability to generate a profit in relation to investment. Quality of financial reports and disclosures of agricultural companies influence profitability calculations and can be crucial for business activities (Mirović et al., 2019).

The financial position of the majority of legal entities from the agricultural sector of Republika Srpska in the period 2010-2012 had a border rating between poor and acceptable (Stojanović & Stojanović, 2015). Return on assets in the period 2011-2014 measured for Bosnia and Herzegovina was 4.45%, which is the lowest ratio compared to the other countries of Southeast Europe (Mijić & Jakšić, 2017) In the subsequent years (2012-2015), one-third of the enterprises from the sector were financially inefficient and had negative financial results (Vaško et al., 2018). Profitability measured by the average return on assets of cooperatives in Republika Srpska in the period from 2014 to 2018 was negative, and for other agribusinesses it was 0% (Stojanović & Knežić Roković, 2021).

Using the panel data method, Mijić & Jakšić (2017) analysed the determinants of agricultural industry profitability in Southeast Europe. According to this survey, agricultural enterprises in Serbia and Bosnia and Herzegovina are very similar, both positively affected by quick ratio, lagged profitability and growth, while one more factor – leverage is positively related to profitability in Bosnia and Herzegovina.

Andrašić et al. (2018) investigated the performance of agricultural companies in the region of Vojvodina in the Republic of Serbia for the period 2006-2015. Analysis showed that the average return on assets was 2.99%, the liquidity of the companies was lower than 1 and debt indicator was higher than reference value 1. The empirical research showed a significant impact of company size, current liquidity, debt, market share, sales revenue

growth, insurance and export on return on assets as the main profitability determinants, where company size and debt had a negative impact, but current liquidity, market share, sales revenue growth, insurance and export had a positive impact. Different determinants impact is found in case of meat processing enterprises in Serbia (Dakić & Mijić, 2020) where quick ratio and sales growth have significant positive impact on profitability while age, debt ratio and capital turnover have significant negative return on assets. Size and inventory have insignificant influence.

Companies listed on Banja Luka Stock Exchange as the only stock exchange in Republika Srpska have very low, but positive average return on assets (0.23% in 2017 and 0.58% in 2018) (Jakšić, 2019). According to this survey, analysis indicates that liquidity, growth (measured by sales growth) and previous profitability have a positive and significant impact on profitability, while the size of the company and proportion of fixed assets in total assets have no significant impact.

In recent years agri-food sector worldwide has been faced with multiple challenges: digitalization, new market solutions and innovations, changes in consumer conditions, disruptions in supply and demand, transport limitations due to COVID-19, unstable input and output prices and many others (Apostolopoulos et al., 2021). This caused a drop in profitability for many actors in this sector (Béné, 2020). In 2021, 76.4 ha were under organic agricultural production worldwide, which is 1,6% of total farmland (Willer et al., 2023). The region with the most organic agricultural land is Oceania, the country with the most organic producers is India followed by Uganda and Ethiopia, while the country with the largest market for organic food is United States followed by Germany (Willer et al., 2023).

2. Methodology and data

This study analyses the profitability determinants of organic produce companies in the region of Republika Srpska. The aim is to investigate the relationship between internal determinants of profitability where return on assets (ROA), size of the company, age, current liquidity ratio, debt ratio, sale growth and capital turnover ratio are used in the regression model.

Sample is consisted from 21 agricultural producers registered in Republika Srpska as companies with limited liabilities and cooperatives whose basic activity is organic production (see Table 2). The analysis is based on available short financial statements provided by Intermediary Agency for IT and financial services ad Banja Luka (abbreviated APIF) for the period from 2014 to 2021. Total number of observations is 135, with the remark that the number of legal entities changed in the observed period. The starting point for this research is the year 2014 because the Organic Production Law in Republika Srpska was adopted in 2013 ("Zakon o organskoj proizvodnji, Službeni glasnik Republike Srpske broj 12," 2013).

Small-scale family farms and cooperatives without financial reports are excluded from the sample. In this study, descriptive statistics and a multi-linear regression model will

be used. Return on assets (ROA) will be used as the dependent variable and size of company, age, current liquidity ratio, debt ratio, sale growth and capital turnover ratio will be used as independent variables. Ratio models are shown in Table 1. ROA will be used as a more suitable measure of profitability to eliminate capital structure. Data is consisted of a number of cooperatives that are established with minimum required capital.

Table 1: Explanatory variables

Dependent variable	**Calculation**
ROA – return on assets	Net income/ Total assets
Independent variables	**Calculation**
Size	Segments 1, 2 and 3
Age	Number of years
Current liquidity	Current assets/current liabilities
Debt	Total liabilities/Total capital
Sale growth	(Current period-previous period sales)/ previous period sales
Capital turnover ratio	Sales/(Assets-Obligations)

Source: the author's calculation

Return on assets (ROA) is an efficiency ratio that measures the ability to generate profit from company's assets. The higher ROA represents the more efficient company management in managing balance sheet assets to generate profits.

Segmentation of the sample is done according to the size of the assets. Segment 1 consists of legal entities with assets below BAM 500.000, segment 2 consists of legal entities with assets between BAM 500.001 and BAM 1.500.000 and segment 3 consists of those with assets value higher than BAM 1.500.001.

Age indicates the number of years the companies have been in the organic production business. Organic production in Republika Srpska was regulated by the Organic Production Law in 2013. Some sample companies were engaged in this business even before it was placed in the legal framework.

The current liquidity ratio is a liquidity ratio that measures the ability to cover companies' short-term obligations with its short-term assets. It is an important performance indicator. The reference value is 2.

Debt as leverage ratio used in this paper represents the ratio between total liabilities and total capital (shareholder equity + reserves + financial result from previous years) and shows financial structure. The reference value is 1.

Sale growth is a measure of the revenue change comparing two periods. It demonstrates the rate of growth and can be positive, neutral or negative.

Capital turnover compares the annual sales to the total capital. In this paper, total capital is calculated as the difference between assets and obligations, which means that reserves and financial results from previous years are included. A capital turnover ratio of less than 1 may indicate future liquidity problems, between 1.5 and 2 indicates good financial ground.

After a detailed analysis of the literature and in accordance with the aim of the research, the following hypothesis is set up:

H1: Internal factors – age, current liquidity ratio, debt ratio, sale growth and capital turnover ratio have a significant influence on the profitability (measured by return on assets – ROA) of organic production companies in Republika Srpska.

3. Results and discussion

Descriptive statistics showed that the return on assets (ROA) of organic production companies in Republika Srpska for the period from 2014 to 2021 the lowest ROA value is -0.48 in 2020, where also the highest value can be identified as 9.59 and refers to a start-up company.

Table 2: Return on assets of organic production companies in Republika Srpska for the period 2014-2021

		y2021	y2020	y2019	y2018	y2017	y2016	y2015	y2014
N	Valid	21	20	20	18	15	14	14	13
	Missing	0	1	1	3	6	7	7	8
Std. Deviation		.82645	2.13802	.18716	.27942	.03249	.08640	.11105	.07483
Minimum		-3.59	-.48	-.44	-1.00	-.03	-.01	-.15	-.12
Maximum		.66	9.59	.46	.39	.08	.29	.33	.17

Source: the author's calculation

Measuring return on assets (ROA) as the average value of all companies per each year, data showed that the minimum value is 0.0217, the maximum value is 0.8500 and the mean is 0.0509750 (Table 3). This leads to the conclusion that organic produce companies can achieve average returns 5.09% calculated as ROA, which is much higher than the average return on assets of companies that are listed on BLSE 0.23% in 2017 and 0.58% in 2018 (Jakšić, 2019) or compared to medium and large companies from the agricultural sector in AP Vojvodina, Republic of Serbia in period 2006-2015 where average ROA was 2.99% (Andrašić et al., 2018). The average profitability of fruit processing companies in Serbia is also lower, amounting to 4.2093% (Dakić & Mijić, 2018), but higher in meat production enterprises at 6.865% (Dakić & Mijić, 2020). On the other side, these findings are in the line with profitability of stock companies and limited liability companies in the agriculture, forestry and fishing sectors of Serbia, where average ROA for the period 2013-2016 was 5.043% (Vržina & Dimitrijević, 2020). Research has shown that ROA is higher in conventional food procedures compared to organic producers (Mitić & Čolović, 2022).

Compared to other industries, the average ROA is much lower than in Serbian cement industry (Marković & Savović, 2022), but higher than tourism sector in AP Vojvodina (Mirović et al., 2022) and the Republic of Serbia (Mitrović et al., 2021).

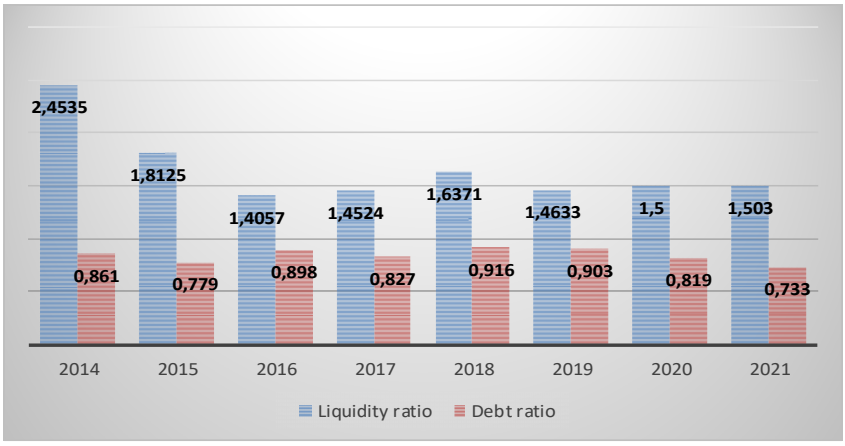
Table 3: Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
ROA	8	.02170	.08500	.0509750	.02167241
Size	8	3.00	3.00	3.0000	.00000
Liquidity	8	1.4057	2.4535	1.653438	.3484219
Age	8	9.1429	14.0000	10.657888	1.8145400
Sale growth	6	-.1553	.5037	.160617	.2379416
Debt ratio	8	.733	.916	.84194	.064777
Capital turnover	8	1.122	1.703	1.50295	.190839
Valid N (listwise)	6				

Source: the author's calculation

Figure 1 presents values of current liquidity and debt ratios for the tested sample. If the liquidity reference value is 2, results indicate that companies were liquid in 2014 only. Liquidity decrease is present in all subsequent years, especially in 2016, when the bottom value of 1.4057 was reached.

Figure 1: Current liquidity and debt ratios



Source: the author's calculation

In the tested years, average liquidity ratio is 1.5664 and volatility is σ=1.653438, which is below the reference value and lower than the ratio of agricultural companies in AP

Vojvodina amounting to 1.91 (Andrašić et al., 2018). This implies that the analysed companies are not liquid, but with a more acceptable ratio than the agricultural sector in Republika Srpska in previous years (Vaško et al., 2018). On the other side, the debt ratio is less volatile than the liquidity ratio σ=0.84194. The average debt ratio value is 0.84194 (below the reference value of 1), which implies that tested companies were either not indebted or much less indebted than the agricultural sector of Republika Srpska in previous years (Vaško et al., 2018).

Sales growth of the tested sample has a mean value of 0.160617, which is positive growth in sales. The higher rate was calculated on a sample of medium and large agricultural companies in Serbia (Andrašić et al., 2018), and lower on a sample of micro agricultural companies (Tekić et al., 2023).

The calculated capital turnover ratio has a mean value of 1.50295 as an indicator that revenue from sales is higher than total capital, giving good financial ground for future liquidity, which probably lies in the meat industry in Serbia (Dakić & Mijić, 2020).

Table 4: Reliability Statistics – Cronbach's *Alpha Test*

Cronbach's alpha[a]	Cronbach's alpha based on standardized items	N of items
.612	.540	7

Source: the author's calculation

The Cronbach alpha coefficient method was used to measure reliability. Based on obtained results, the test showed that there is a medium strong relation between variables and they are compatible and reliable (Table 4). The use of independent variables is justified.

Table 5: Variance inflation factor

Model		VIF
1	Age	9.182
	Liquidity	3.617
	Debit ratio	2.702
	Sale growth	2.755
	Capital turnover	6.443
	Number of companies	3.505
a. Dependent Variable: ROA		

Source: the author's calculation

Variable selection is checked by the Variance inflation factor test (VIF) and results below 10 indicate that there is no problem of multicollinearity between variables in the model.

The correlation matrix is calculated to determine correlations between ROA as the dependent variable and other independent variables. Calculation represents relations between independent variables too. Results show that the highest and most positive correlation is between ROA and capital turnover. According to that, companies with a higher capital turnover have higher returns on assets which is the opposite of previous research (Dakić & Mijić, 2020). The second strong correlation is between ROA and debt, but it is negative. It implies that companies with higher debt are likely to have lower returns on assets and the opposite. The negative relation between debt and ROA is in a line with previous research (Andrašić et al., 2018). Other variables – age, liquidity and sale growth – have significant and positive correlations with ROA.

Table 6: Correlation matrix

	ROA	Age	Liquidity	Debt	Sale growth	Capital turnover
ROA	1.000	.486	.313	-.766	.350	.805
sign.	.001					
Age	.486	1.000	.902	-.467	.193	.601
sign.	.020					
Liquidity	.313	.902	1.000	-.134	.475	.575
sign.	.001					
Debt	-.766	-.467	-.134	1.000	.043	-.478
sign.	.002					
Sale growth	.350	.193	.475	.043	1.000	.665
sign.	.004					
Capital turnover	.805	.601	.575	-.478	.665	1.000
sign.	.025					

Source: the author's calculation

Model Coefficients test the impact of independent variables on dependent one (see Table 7). This test directly examines the aim of this research and its hypothesis. According to the results, we can conclude that all independent variables have a statistically significant impact on the dependent variable and therefore hypothesis H1 is confirmed: Internal factors – size of the company, age, current liquidity ratio, debt ratio, sale growth and capital

turnover ratio have a significant influence on profitability (measured by ROA) of organic production companies in Republika Srpska.

Table 7: Model coefficients

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.016	.021		3.8741	.029
	Age	-.118	.028	-8.848	- 3.584	.045
	Liquidity	1.795	.017	10.833	4.587	.009
	Debt	-.935	.049	-2.852	-3.584	.036
	Sale growth	.312	.098	3.208	3.29	.040
	Capital turnover	1.122	.108	4.347	4.107	.017
R^2 = 0,597 or 59,7%						

Source: the author's calculation

Multi-linear regression model:

y= - 1,016 - 0,118X1 + 1,795X2 – 0,935X3 – 0,312X4 + 1,122X5

where

X1 – *Age,*

X2 – *Liquidity***,**

X3 – *Debt***,**

X4 – *Sales growth,*

X5 – *Capital turnover*.

The results of the multiple regression model show different direction and intensity impact. Variables age and debt have negative impact as well as previous research (Mirović et al., 2022) (Andrašić et al., 2018; Dakić & Mijić, 2020). Other variables have positive impact with different intensity. These findings are in line with previous research where the regression model indicates that liquidity, company growth and previous profitability have a significant and positive impact on the profitability of companies listed on BLSE (Jakšić, 2019, 52). Opposite to this, there are results which imply that increase of liquidity has negative effect on profitability (Mirović et al., 2022) as well as increase in capital turnover (Dakić & Mijić, 2020). Liquidity, sale growth and capital turnover have positive impact on

profitability, which is in accordance with previous research (Andrašić et al., 2018; Mijić & Jakšić, 2017).

Model results show statistically significant impact of all internal factors on ROA of agricultural enterprises (p-value less than 0.05), accounting for 59.7% of independent variables variations.

Conclusion

The goal of this paper was to investigate the internal profitability determinants and their influence on the profitability of organic production companies in Republika Srpska. For that purpose, data was collected from APIF for the 21 company and the period from 2014 to 2021. Organic produce is still on a low level even if it is identified as a comparative advantage. The average ROA as a measure of profitability is 5.09%, liquidity ratio is 1.65 and debt ratio is 0.84. These findings, together with a positive low sales growth and stable capital turnover, put organic production of Republika Srpska in a positive but economically underdeveloped framework. The empirical research shows a statistically significant impact of company age, current liquidity ratio, debt (leverage ratio), sales growth and capital turnover on profitability measured as return on assets.

The findings provide basic insights into the profitability of organic production companies in Repubika Srpska and identify which internal determinants are crucial for the successful business of the companies. They can be used by management for future business directions and decisions towards enhanced profitability, sustainability, and growth. The increased organic production and optimal financial structure, together with good geographical position and climate conditions, could be a generator of future development of new regional economic and environmental values. A recommendation for improving the agricultural branch is the expansion of organic agricultural areas due to positive company profitability with low volatility.

This research is a pioneer in Republika Srpska and good grounds for all future research that may apply the panel regression model or other suitable models and can be expanded to other internal and external determinants. The results presented do not claim to be representative of the entire sector and area because the sample consists of legal entities registered for this type of production, but without small-scale family farms. These farms do not submit financial reports, therefore they are excluded from the sample.

References

Andrašić, J., Mijić, K., Mirović, V., & Kalaš, B. (2018). The modelling factors of agricultural companies performances. *Custos e Agronegocio*, *14*(4), 223-240. ISSN 1808-2882

Apostolopoulos, N., Ratten, V., Petropoulos, D., Liargovas, P., & Anastasopoulou, E. (2021). Agri-food sector and entrepreneurship during the COVID-19 crisis : A systematic literature review and research agenda *Strategic Change 30*(2), pp. 159–167. Doi: https://doi.org/10.1002/jsc.2400

Barjaktarovic, M., Kuzman, B., & Zarkovic, S. (2016). Family holdings profitability in the organic food production in the Republic of Serbia. *Ekonomika Poljoprivrede*, *63*(4), 1309–1322. https://doi.org/10.5937/ekopolj1604309b

Béné, C. (2020). *Resilience of local food systems and links to food security – A review of some important concepts in the context of COVID-19 and other shocks*. 805–822.

Beyer, D., & Hinke, J. (2020). European benchmarking of determinants of profitability for companies with accrual accounting in the agricultural sector. *Agricultural Economics (Czech Republic)*, *66*(11), 477–488. https://doi.org/10.17221/128/2020-AGRICECON

Dakić, S., & Mijić, K. (2018). A panel analysis of profitability in the fruit and vegetable processing industry in Serbia. *Ekonomika poljoprivrede*, *65*(1), 307–321. https://doi.org/10.5937/ekopolj1801307d

Dakić, S., & Mijić, K. (2020). Regression analysis of the impact of internal factors on return on assets: A case of meat processing enterprises in Serbia. *Strategic Management*, *25*(1), 29–34. https://doi.org/10.5937/straman2001029d

Galić, J. (2022). Socio-demographic profile of organic food consumers in the Republic of Srpska. *Anali Ekonomskog Fakulteta u Subotici*, *58*(48), 3–14. https://doi.org/10.5937/aneksub2248003g

Jakšić, D. (2019). Analiza profitabilnosti i faktora profitabilnosti preduzeća na Banjalučkoj berzi u periodu 2017-2018. *Financing - naučni časopis za ekonomiju*, *2*, 45–53. Doi: https://doi.org/10.7251/FIN1902045J

Marković, D., & Savović, S. (2022). Cross-border acquisitions and profitability of acquired companies in Serbian cement industry. *Anali Ekonomskog Fakulteta u Subotici*, *58*(48), 15–33. Doi: https://doi.org/10.5937/aneksub2248015m

Meemken, E. M., & Qaim, M. (2018). Organic agriculture, food security, and the environment. *Annual Review of Resource Economics*, *10*, 39–63. Doi: https://doi.org/10.1146/annurev-resource-100517-023252

Mijić, K., & Jakšić, D. (2017). The determinants of agricultural industry profitability: evidence from Southeast Europe. *Custos e Agronegocio*, *13*(1), 154–173.

Ministarstvo poljoprivrede šumarstva i vodoprivrede Republike Srpske. (2021). *Strategija razvoja poljoprivrede i ruralnih područja Republike Srpske*.

Mirović, V., Kalaš, B., Milenković, N., & Andrašić, J. (2022). Profitability management of tourism sector in AP Vojvodina. *Strategic Management*, *27*(1), 57–63. Doi: https://doi.org/10.5937/straman2110004m

Mirović, V., Milenković, N., Jakšić, D., Mijić, K., Andrašić, J., & Kalaš, B. (2019). Quality of biological assets disclosures of agricultural companies according to international accounting regulation. *Custos e Agronegocio*, *15*(4), 43–58.

Mitić, V., & Čolović, M. (2022). Economic indicators of profitability in the production of organic and conventional food and psychological ways of overcoming the crisis in managers due to the possible decline of business during the COVID-19 pandemic. *Bizinfo Blace*, *13*(2), 99–107. Doi: https://doi.org/10.5937/bizinfo2202099m

Mitrović, A., Knežević, S., & Milašinović, M. (2021). Profitability analysis of hotel companies in the Republic of Serbia. *Menadzment u hotelijerstvu i turizmu*, *9*(1), 121–134. Doi: https://doi.org/10.5937/menhottur2101121m

Mujčinović, A., Nikolić, A., & Uzunović, M. (2017). Small scale organic farmers – source of growth in the Bosnia and Herzegovina agri-food sector. *Strategies for the Agri-Food Sector and Rural Areas – Dilemmas of Development,* 252–268.

Pjanić, M., Milenković, N., Kalaš, B., & Mirović, V. (2018). Profitability determinants of non-life insurance companies in Serbia. *Ekonomika Preduzeca*, *66*(5–6), 333–345. Doi: https://doi.org/10.5937/ekopre1806333p

Republički zavod za statistiku Republike Srpske. (2017). *Popis stanovništva, domaćinstva i stanova u Republici Srpskoj 2013. godine*.

Republički zavod za statistiku Republike Srpske. (2021). *Statistički godišnjak Republike Srpske 2021, drugo ispravljeno izdanje*.

Stojanović, T., & Knežić Roković, G. (2021). Financial analysis of agricultural cooperatives in the Republic of Srpska. In Ž. Vaško (Ed.), *X International Symposium on Agricultural Sciences AgroReS 2021* (pp. 221–230). University of Banja Luka Faculty, Faculty of Agriculture.

Stojanović, T., & Stojanović, S. (2015). Finansijska analiza položaja preduzeća iz poljoprivrednog sektora Republike Srpske. *Agro-Knowledge Journal*, *16*(4), 549–557. Doi: https://doi.org/10.7251/agrsr1504549s

Sudarević, T., & Galić, J. (2021). Fresh produce markets as direct distribution chanel for organic products in Republika Srpska. *Proceedings of the 26th International Scientific Conference Strategic Management and Decision Support Systems in Strategic Management*, 188–193. Doi: https://doi.org/10.46541/978-86-7233-397-8_139

Tekić, D., Mutavdžić, B., Milić, D., Zekić, V., Novaković, T., & Popov, M. (2023). Determinante profitabilnosti mikropoljoprivrednih preduzeća iz Republike Srbije. *Ekonomija - Teorija i Praksa*, *2*, 62–78. Doi: https://doi.org/10.5937/etp2302062T

Tomaš-Simin, M., Glavaš-Trbić, D., & Petrović, M. (2019). Organic production in the Republic of Serbia: economic aspects. *Ekonomija: teorija i praksa*, *12*(3), 88–101. https://doi.org/10.5937/etp1903088t

Tranter, R. B., Bennett, R. M., Costa, L., Cowan, C., Holt, G. C., Jones, P. J., Miele, M., Sottomayor, M., & Vestergaard, J. (2009). Consumers' willingness-to-pay for organic conversion-grade food: evidence from five EU countries. *Food Policy*, *34*(3), 287–294. https://doi.org/10.1016/j.foodpol.2009.03.001

Vaško, Ž., Ostojić, A., & Drinić, L. (2018). Financial performance analysis of the companies in the agricultural sector and food industry in the Republic of Srpska. *Агрознање*, *19*(2), 67. https://doi.org/10.7251/agren1802067v

Vržina, S., & Dimitrijević, M. (2020). Determinants of profitability of the agricultural sector of Vojvodina: the role of corporate income tax. *The European Journal of Applied Economics*, *17*(1), 1–19. https://doi.org/10.5937/ejae17-21368

Willer, H., Schlatter, B., & Trávníček, J. (2023). *The World of Organic Agriculture Statistics and Emerging Trends 2023*. https://doi.org/10.5281/zenodo.7572890

Zakon o organskoj proizvodnji, Službeni glasnik Republike Srpske broj 12. (2013). *Službeni Glasnik Republike Srpske Broj 12*, *12*, 1–6.

Списак рецензената часописа „Анали Економског факултета у Суботици“ у 2024. години (број 51) / Reviewers of the journal “Anali Ekonomskog fakulteta u Subotici” in 2024 (No 51)

Daniela Nuševa, Faculty of Economics in Subotica, University of Novi Sad, Republic of Serbia

Dražen Marić, Faculty of Economics in Subotica, University of Novi Sad, Republic of Serbia

Dušan Marković, Faculty of Economics, University of Beograd, Republic of Serbia

Dušan Saković, Faculty of Economics in Subotica, University of Novi Sad, Republic of Serbia

Jadranka Đurović-Todorović, Faculty of Economics, University of Niš, Republic of Serbia

Jelena Erić-Nielsen, Faculty of Economics, University of Kragujevac, Republic of Serbia

Ksenija Leković, Faculty of Economics in Subotica, University of Novi Sad, Republic of Serbia

Ljiljana Bonić, Faculty of Economics, University of Niš, Republic of Serbia

Mirjana Jemović, Faculty of Economics, University of Niš, Republic of Serbia

Nedeljko Tica, Faculty of Agriculture, University of Novi Sad, Republic of Serbia

Nemanja Berber, Faculty of Economics in Subotica, University of Novi Sad, Republic of Serbia

Nemanja Lojanica, Faculty of Economics, University of Kragujevac, Republic of Serbia

Ognjen Erić, Faculty of Economics, University of Banja Luka, Bosnia and Herzegovina

Olgica Glavaški, Faculty of Economics in Subotica, University of Novi Sad, Republic of Serbia

Suzana Đukić, Faculty of Economics, University of Niš, Republic of Serbia

Tomislav Sudarević, Faculty of Economics in Subotica, University of Novi Sad, Republic of Serbia

Veljko Marinković, Faculty of Economics, University of Kragujevac, Republic of Serbia

Veljko Mijušković, Faculty of Economics, University of Beograd, Republic of Serbia

Vera Zelenović, Faculty of Economics in Subotica, University of Novi Sad, Republic of Serbia

Техничко упутство за форматирање радова / Technical instructions for paper formatting

The paper should consist of:

Title of the paper (no more than 10 words) in English.

Subtitle (optional) in English.

Personal data of authors/coauthors: name, surname, title and Institution in English.

Abstract of 200 words or less, giving the factual essence of the article, should be written in English.

Key words (no more than 10) in English.

Text of the paper, in English, cannot exceed 12 pages.

Bibliography.

Guidelines for the paper format

Type your work in a common Word Processor (e.g. MS Word).

Page format: B5.

Margin: 2 cm every

Font: Times New Roman, size 11 (use it for title, subtitle, figures, tables, abstract, key words, and so on).

Titles, subtitles, names of the tables, illustrations, figures, etc should be written in Arabic numerals.

Figures, illustrations and schemes should be enclosed in the .jpg format (resolution 300*300 dpi) or in the vector form (.wmf or cdr) with enclosed fonts or fonts transformed in curves. Figures, illustrations and schemes should be black-and-white (grayscale). For the texts included in figures, illustrations and schemes font Arial, size 9 pt is preferred.

1. Referencing Guide

The references should specify the source (such as book, journal article or a web page) in sufficient detail to enable the readers to identify and consult it. The references are placed at the end of the work, with sources listed alphabetically (a) by authors' surnames or (b) by the titles of the sources (if the author is unknown). Multiple entries by the same author(s) must be sequenced chronologically, starting from the earliest, e.g.:

Ljubojević, T.K. (1998).
Ljubojević, T.K. (2000a).
Ljubojević, T.K. (2000b).
Ljubojević, T.K., & Dimitrijević, N.N. (1994).

Here is a list of the most common reference types:

A. Periodicals

Authors must be listed by their last names, followed by initials. Publication year must be written in parentheses, followed by a full stop. Title of the article must be in sentences case: only the first word and proper nouns in the title are capitalized. The periodical title must be in title case, followed by the volume number, which is also italicized:

Author, A. A., Author, B. B., & Author, C. C. (Year). Title of article. *Title of Periodical, volume number*(issue number), pages.

➲ Journal article, one author, paginated by issue

Journals paginated by issue begin with page 1 in every issue, so that the issue number is indicated in parentheses after the volume. The parentheses and issue numbers are not italicized, e.g.

Tanasijević, V. (2007). A PHP project test-driven end to end. *Management Information Systems, 5*(1), 26-35.

➲ Journal article, one author, paginated by volume

Journals paginated by volume begin with page 1 in issue 1, and continue page numbering in issue 2 where issue 1 ended, e.g.

Perić, O. (2006). Bridging the gap: Complex adaptive knowledge management. *Strategic Management, 14*, 654-668.

➲ Journal article, two authors, paginated by issue

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

➲ Journal article, two authors, paginated by volume

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

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

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

➲ **Journal article, three to six authors, paginated by volume**

Boškov, T., Ljubojević, K., & Tanasijević, V. (2005). A new approach to CRM. *Strategic Management, 13*, 300-310.

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

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

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

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

➲ **Magazine article**

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

➲ **Newsletter article with author**

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

➲ **Newsletter article without author**

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

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

Basic format for books

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

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

➲ **Book, one author**

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

➲ **Book, one author, new edition**

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

➲ **Book, two authors**

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

➲ **Book, three to six authors**

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

➲ **Book, more than six authors**

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

➲ **Book, no author or editor**

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

➲ **Group, corporate, or government author**

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

➲ **Edited book**

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

➲ **Chapter in an edited book**

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

➲ **Encyclopedia entry**

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

C. Unpublished Works

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

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

➲ **Paper or manuscript**

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

➲ **Doctoral dissertation**

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

➲ **Master's thesis**

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

D. Electronic Media

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

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

➲ **Article in an internet-only journal**

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

➲ **Document from an organization**

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

➲ **Article from an online periodical with DOI assigned**

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

➲ **Article from an online periodical without DOI assigned**

Online journal articles without a DOI require a URL.

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

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

2. Reference Quotations in the Text

➲ **Quotations**

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

> According to Mirković (2001), "The use of data warehouses may be limited, especially if they contain confidential data" (p. 201).
>
> Mirković (2001), found that "the use of data warehouses may be limited" (p. 201). What unexpected impact does this have on the range of availability?

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

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

➲ **Summary or paraphrase**

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

➲ **One author**

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

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

> Another study (Mirković & Boškov, 2006) concluded that…

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

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

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

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

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

➲ Six or more authors

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

> Yossarian et al. (2004) argued that…
>
> … not relevant (Yossarian et al., 2001).

➲ Unknown author

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

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

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

> ("The Objectives of Access Delegation," 2007)

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

➲ Organization as an Author

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

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

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

> The overview is limited to towns with 10,000 inhabitants and up (Statistical Office of the Republic of Serbia [SORS], 1978).
>
> The list does not include schools that were listed as closed down in the previous statistical overview (SORS, 1978).

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

> (Bezjak, 1999, 2002)

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

> (Griffith, 2002a, 2002b, 2004)

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

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

> (Bezjak, 1999; Griffith, 2004)

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

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

> Survey results published in Theissen (2004a) show that…

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

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

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

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

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

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

> (Hessenberg, n.d.)

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

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

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

> (Theissen, 2004a, chap. 3)
>
> (Keaton, 1997, pp. 85-94)

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

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

3. Footnotes and Endnotes

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

ISSN 0350-2120