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Original Scientific Paper

A STUDY OF MULTICRITERIA DECISIONMAKING FOR SELECTING SUPPLIERS OF LINEAR MOTION GUIDE

UDC 658.74:519.8

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Abstract. *Supplier evaluation and selection is becoming more and more important for companies in today's logistics and supply chain management. Decision making in supplier selection domain, as an essential component of supply chain management, is a complex process due to the fact that a wide range of diverse criteria, stakeholders and possible solutions are embedded into this process. This paper focuses on the application of some single and hybrid multi criteria decision making approaches for the selection of suppliers of transportation and logistics equipment. The analytic hierarchy process (AHP), stepwise weight assessment ratio analysis (SWARA) and technique for the order preference by similarity to ideal solution (TOPSIS) have been implemented in the "Lagerton" company in Serbia for evaluation and selection of the supplier in the case of procurement of THK Linear motion guide components. The best ranked supplier has been suggested to the company and the sensitivity analysis of ranking orders according to the criteria weights variations has been done.*

Key words: *Supplier selection, MCDM, AHP, TOPSIS, Linear motion guide*

JEL Classification: C44, C52.

INTRODUCTION

In today's highly competitive and interrelated environment, the effective selection of suppliers is very important to the success of a logistics and supply chain management functions in an industrial setting. These functions deal with the analysis, design and management of flows of row materials, goods, information, people and energy, and involves a wide range of activities such as: transportation (internal and external), handling,

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packaging, storage, scheduling and inventory management, purchasing, energy supplies, service, maintenance, life cycle cost management, customer relationship management, etc. (Madić & Petrović, 2016). Today, organizations are under tremendous pressure of global competition, and companies strive to achieve excellence in delivering high quality and low cost products and services to their customers by improving the efficiency of their supply chain system to gain competitive advantages (Moghaddam, 2015).

Including all of the activities related to the capital, material and information flows between its members, supply chain involves the suppliers, manufacturers, distributors, retailers, and customers who are accompanying with each other in satisfying the end customers' requirements and needs (Bowersox at al., 2002). The process of supply chain management seeks to relate and integrate these activities to enable the supply chain and its members to realize their goals. Supply chain management is considered as one of the most important competitive strategies used by modern companies which main aim is to connect and integrate various suppliers in order to satisfy market demand. Namely, the modern companies establish their own supply chain striving to find more efficient suppliers in order to increase their supply chain competitiveness. So, a key issue in establishing a supply chain and improving its efficiency and competitiveness is to find or select more collaborative suppliers who can develop long term efficient relationships. One of the most important activities that impacts the company's performance as well as the entire supply chain competitiveness is evaluation and selection of suppliers.

Supplier evaluation and selection is a multi-criteria decision making problem (MCDM) involving a set of different and opposite criteria. Information and communication technology, financial position, flexibility in meeting customer needs, reputation and position in industry, attitude, flexibility, packaging ability, management and organization, geographical location, production facilities and capacity, personnel capability, warranties and claim policies, repair service, payment options, parity, cost can be considered as main criteria that influence the supplier selection of a given product in a supply chain management (Madić et al., 2014).

1. LITERATURE REVIEW

In this section, some studies that were performed in previous years on the multi-criteria supplier selection were analyzed in order to determine the criteria and appropriate methods that were used for the selection of suppliers. According to international scientific journals and books, available in electronic databases such as Elsevier's Science Direct, Taylor & Francis, Springer and Wiley, there has been a steady increase in research for the last five years in the area of multi-criteria supplier selection. Such distribution of the published papers and books is presented in Figure 1.

Various MCDM methods and different optimization techniques have been proposed to aid the supplier selection process. According to Yıldız & Yayla (2015) 16 percent of the supplier selection studies presented in the reviewed literature were from the automotive sector, 13 percent from the manufacturing sector and only 4 percent from the transportation-logistics sector.

A number of very extensive reviews of MCDM methods for supplier evaluation and selection have already been conducted. To the best of authors' knowledge, the most recent reviews have been published by Chai et al. (2013), Govindan et al. (2015), Simić et al. (2017), and Ghorabaee et al. (2017).

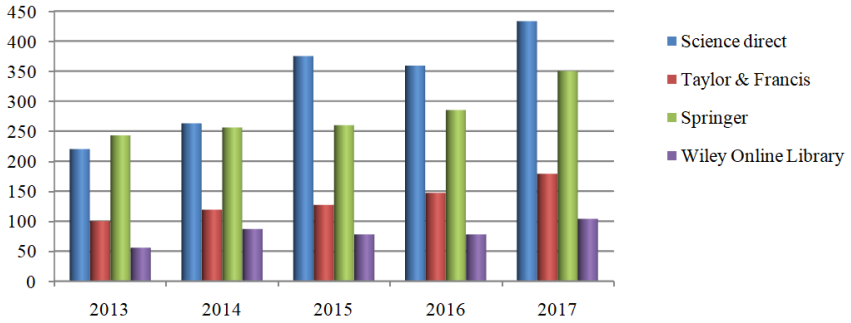

Fig. 1 Increase of researches in supplier selection field for the last five years

Especially in the field of transportation and logistics single MCDM approaches and case studies are considered individually. The case study research done by Cieśla (2016) considers supplier selection of aluminum for a hypothetical manufacturer of transportation equipment located in Poland. Evaluation of five suppliers has been conducted using a weighted scoring method, a strengths and weaknesses method and a graphical method according to the following criteria: price, location, market position, date of payment, completion terms, availability on the market, quality (e.g. ISO certificate). Šimunović et al. (2011) applied AHP method for the purpose of systematic evaluation and selection of suppliers. They considered evaluation and selection of three suppliers of a mechanical part for the company dealing with the assembly of agricultural machines, according to five criteria: cost, delivery time, deferred payment, parity and packing. Shyur and Shih (2006) proposed the usage of AHP and TOPSIS methods as a hybrid MCDM approach for strategic supplier selection. Authors evaluated four vendors according to seven criteria: on-time delivery, product quality, price/cost, facility and technology, responsiveness to customer needs, professionalism of salesperson, and quality of relationship with vendor. Finally, an approach proposed by Jamil et al. (2013) evaluated the effectiveness of five decision making tools based on AHP and TOPSIS methods and their fuzzy extensions. They concluded that all considered MCDM methods are applicable and accurate for supplier selection in automotive industry. However, in case when the number of suppliers (alternatives) becomes large or when more criteria need to be considered, the decision maker may be faced with computational problem in the case of AHP method (pairwise comparison in a big matrix).

As seen from literature, many MCDM methods have been proposed for solving supplier selection problem. AHP method and its hybrid extensions with other MCDM methods represents appropriate decision making tool, but in some cases the results show great variation in the final ranking scores. In those cases, there is a need to compare final ranking scores obtained using AHP method with some other MCDM approaches. In this paper real life example of evaluation and selection of suppliers for linear motion guide components is solved by using different MCDM methods.

Also, summarizing the considered criteria in literature, supplier selection evaluations are generally based on price, logistics costs, quality, delivery characteristics, flexibility, supplier background capacity and rating.

2. SUPPLIER SELECTION STRATEGIES AND CRITERIA

After making a decision to buy the needed resources, it is necessary to make an adequate supplier selection, which means a set of activities within the supply chain management process that includes several different stages – to identify potential suppliers as supply sources, evaluate them, select the right suppliers among them, evaluate supplier performance and develop the productive supplier relationship for future partnership (Hokey, 2015).

The process of searching for the appropriate supplier is often complicated and for making it simpler a company should first explore and leverage the reliable source of information about the potential suppliers. The list of potential suppliers that the company uses to acquire its resources represents a kind of supplier base (Wisner et al., 2012). An effective supplier base significantly contributes to competitive advantage of the company and is often critical to its success. It is thus vital to understand the strategic role of suppliers and relationship with them.

After preparing a short, manageable list of the potential suppliers and gathering information about them, it is necessary to investigate if they are indeed worthy of serious consideration for cooperation. That primarily means to evaluate the suppliers and compare them in terms of their ability to provide right products and/or services with the right price at the right time (Hokey, 2015). This ability can be reflected in certain supplier evaluation attributes, given in Table 1.

Although the importance of these attributes to supplier evaluation can vary between companies, considering these attributes will help to identify the strengths and weaknesses of each potential supplier and select the appropriate ones. Among these attributes, some studies on supplier evaluation (Min & Galle, 1991; Verma & Pullman, 1998) have shown that quality, price, and delivery services/performance are the most dominant factors for evaluating and selecting a particular supplier, strategically important for a company.

However, the process of selecting the competent suppliers for important resources, which can potentially impact the competitive advantage of the company, is a complex one and should be based on multiple criteria. So, in addition to cost and delivery performance, companies should also consider how their suppliers can contribute to product and process technology. This means that in the process of supplier selection companies should consider some of the following factors (Wisner et al., 2012):

- *Process and product technologies* with the help of which suppliers should be competent to produce superior products at a reasonable cost,
- *Willingness to share technologies and information*, which allows the use of the supplier's capabilities and to focus on core competencies,
- *Quality* – high and consistent product quality directly affect the quality of the finished goods,
- *Cost*, including primarily the unit price of the material and the total cost of ownership, which can significantly affect the purchase decision,
- *Reliability* of supplier characteristics,
- *Capacity* of a supplier to fill orders to meet requirements and the ability to fill large orders, if needed,
- *Communication capability*, which facilitates communication between the parties,
- *Location* – geographical location can affect the delivery, transportation and logistical costs,
- *Service* – suppliers should be able to back up their products and provide good services when needed.

Table 1 Supplier evaluation attributes

Criteria	Attributes
Quality	Quality of products
	Warranty
	Quality certification
	Willingness to take the corrective actions
Price	Competitive price
	No hidden costs
Delivery services	Good packaging
	Geographical location
	Delivery on schedule
	Prompt responses to emergent delivery requests
Production capacity and technical capacity	Adequate facility, equipment, and know-how
	Adequate maintenance
	Skilled labour
	Technical ability for innovation
	Information technology
Financial stability	Credit rating
	Cash flow, liquidity, profitability
	Bank reference
Environmental compliance	Environment policy
	ISO 14000 certification

Source: Hokey, M. (2015) The Essentials of Supply Chain Management: New Business Concepts and Applications, Pearson Education LTD, p. 284

There are numerous other strategic and tactical factors that a company should take into account when choosing suppliers. The ability of the company to select competent strategic suppliers directly affects its competitive success.

In the conventional supply chain management, the companies evaluate and select their suppliers based on price, quality, delivery time, and provided services. These criteria should be treated as conventional criteria which mostly play a key role in supplier evaluation and selection. But besides the conventional supplier selection, the number of researches incorporates the environmental and social factors in supplier evaluation and selection (Green at al., 1996; Enarsson, 1998). Namely, with paying more attention to the exhaustible natural resources and industrial pollution, sustainable supply chain management and sustainable supplier selection have been significantly attracted. In order to produce sustainable products in a sustainable supply chain, it must consider the sustainability criteria in selecting the appropriate suppliers.

Supply performance measurement is another important basis for selecting a supplier and negotiates with him. Namely, it is important to hold each logistics activity accountable to business measurements that align the activity with the other logistics activities, which in the final motivate highly competitive performance. Doing so requires a set of financial, productivity, quality, and response-time metrics (Frazelle, 2002). These indicators are a set of measures for monitoring the performance of internal supply organization in the company and the performance of its suppliers. The most important are the supply financial indicators and they include the following: total supply cost (all the costs related to supply planning, supplier management, and procurement execution), purchase order cost (affecting the size of order quantities and related inventories), supplier return on inventory and total

acquisition cost (total ownership cost or total logistics cost). All these supplier metrics should be a foundation for a supplier selection and negotiation program (Frazelle, 2002).

3. MCDM METHODS - THE METHODOLOGICAL FRAMEWORK OF THE RESEARCH

Decision analysis is concerned with those situations where a decision maker has to choose the best alternative among several candidates while considering a set of conflicting criteria (Chatterjee, 2011). In order to evaluate the overall effectiveness of the candidate alternatives, rank and select the most appropriate (the best) supplier, the primary objective of a MCDM methodology is to identify the relevant supplier selection problem criteria, assess the alternatives information relating to those criteria and develop methodologies for evaluating the significance of criteria. In this section a brief description of the applied MCDM methods is given. In order to calculate criteria weights, AHP and SWARA methods are used, while AHP and TOPSIS methods are used for evaluation of alternatives.

3.1. Analytic hierarchy process method

The Analytic Hierarchy Process (AHP) method was originally proposed by Thomas Saaty (1977, 1980). It represents one of the best known and the most commonly used MCDM method. The AHP can be implemented in a few simple consecutive steps:

Step 1: Computing the vector of criteria weights. The vector of criteria weights can be computed by creating a *pairwise comparison matrix* $\boldsymbol{A}$ where each element a_{ij} of the matrix $\boldsymbol{A}$ represents the importance of the i^{th} criterion relative to the j^{th} criterion. The comparisons between two elements are assembled, using the values from 1 to 9 from fundamental Saaty scale. Final determination of criteria weights w_j is based on geometric mean method as shown by following equation:

$$GM_j = \left(\prod_{j=1}^{n} a_{ij}\right)^{1/n}, \quad w_j = \frac{GM_j}{\sum_{j=1}^{n} GM_j} \tag{1}$$

where GM_j are geometric means of each row and n is the number of considered criteria.

Step 2: Testing the consistency of results. The pairwise comparisons made by AHP method are subjective and this method tolerates inconsistency through the amount of redundancy in the approach. The value that measure consistency of the subjective comparisons is *consistency index CI*:

$$CI = \frac{\lambda_{max} - n}{n-1} \tag{2}$$

where λ_{max} is the maximum eigenvalue of the *pairwise comparison matrix* $\boldsymbol{A}$. Finally, the ratio *CI*/*RI*, that is termed the *consistency ratio CR*, should be less than 0.1. In Eq. 2 *RI* is the *Random Index* (tabular value), i.e. the consistency index when the entries of matrix $\boldsymbol{A}$ are completely random.

Step 3: Comparison of alternatives with respect to each criterion. This step implies determination of pairwise alternative comparison matrix $\boldsymbol{B_j}$, where elements of this matrix b_{kl} represent the preference of the k^{th} alternative relative to the l^{th} alternative according to criterion j. The comparisons have to be done using the values from 1 to 9 from Saaty scale in the same way as described in Step 1.

Step 4: Synthesize the global ratings. The final step is the multiplication of local priorities by the weight of the respective criterion and the results are summed up to produce the overall priority of each alternative (global ratings).

3.2. Stepwise weight assessment ratio analysis

The Stepwise Weight Assessment Ratio Analysis (SWARA) method was developed by Kersuliene et al. (2010) with an aim to identify importance of criteria and relative weights of criteria. According to Stanujkić *et al.*(2015) the process of determining the relative weights of criteria using SWARA method can be implemented using five following steps:

Step 1: The criteria should be sorted in descending order based on their expected significances.
Step 2: Starting from the second criterion, the respondent (decision maker) expresses the relative importance of criterion j in relation to the previous (j-1) criterion, for each particular criterion. This ratio is called the *Comparative importance of average value*, s_j;
Step 3: Determine the coefficient k_j as follows:

$$k_j = \begin{cases} 1 & j = 1 \\ s_j + 1 & j > 1 \end{cases}; \tag{3}$$

Step 4: Determine the recalculated weight q_j as follows:

$$q_j = \begin{cases} 1 & j = 1 \\ \dfrac{k_j - 1}{k_j} & j > 1 \end{cases}; \tag{4}$$

Step 5: The relative weights of the evaluation criteria can be determined as follows:

$$w_j = \frac{q_j}{\sum_{k=1}^{n} q_k}, \tag{5}$$

where w_j denotes the relative weight of criterion j and n is the total number of criteria.

3.3. Technique for the order preference by similarity to ideal solution

The Technique for the Order Preference by Similarity to Ideal Solution (TOPSIS) method was introduced by Hwang and Yoon (1981). The ordinary TOPSIS method is based on the concept that the best alternative should have the shortest Euclidian distance from the ideal solution and at the same time the farthest from the anti-ideal solution. TOPSIS method can be implemented using following steps:
Step 1: Method starts with determination of a *Decision matrix* $X = (x_{ij})_{m \times n}$, in which element x_{ij} indicates the performance of alternative A_i when it is evaluated in terms of decision criterion C_j, (for i = 1, 2, 3,..., m and j = 1, 2, 3,..., n):

$$X = [x_{ij}] = \begin{matrix} \\ A_1 \\ A_2 \\ \\ A_m \end{matrix} \begin{matrix} \begin{matrix} C_1 & C_2 & & C_n \end{matrix} \\ \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \end{matrix}; \tag{6}$$

Step 2: Determine the normalized decision matrix which elements are r_{ij} :

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}, \tag{7}$$

Step 3: Obtain the weighted normalized decision matrix whose elements are v_{ij} by multiplying each column j of the normalized decision matrix by its associated weight w_j (obtained using e.g., AHP or SWARA method):

$$v_{ij} = r_{ij} \cdot w_j, \tag{8}$$

Step 4: Determine the positive ideal and the negative ideal solutions:

$$\begin{aligned} V^+ &= (v_1^+, v_2^+, ..., v_n^+) = \{(\max_i \{v_{ij} \,|\, j \in B\}), (\min_i \{v_{ij} \,|\, j \in C\})\} \\ V^- &= (v_1^-, v_2^-, ..., v_n^-) = \{(\min_i \{v_{ij} \,|\, j \in B\}), (\max_i \{v_{ij} \,|\, j \in C\})\} \end{aligned}, \tag{9}$$

where B and C are associated with the maximization and minimization criteria sets, respectively.

Step 5: Calculate the separation measures (Euclidean metric) from the positive ideal solution and the negative ideal solution. The separation of each alternative from the positive ideal solution is given as:

$$S_i^+ = \sqrt{\sum_{j=1}^{n} (v_{ij} - V_j^+)^2}. \tag{10}$$

The separation of each alternative from the negative ideal solution is given as:

$$S_i^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - V_j^-)^2}. \tag{11}$$

Step 6: Calculate the *relative closeness* of the *i*-th alternative A_i to the positive ideal solution:

$$P_i = \frac{S_i^-}{S_i^+ + S_i^-}. \tag{12}$$

The relative closeness P_i can have values between [0, 1], whereby, P_i = 0 represents negative ideal solution, while P_i = 1 stands for positive ideal solution. According to P_i values the alternatives can be ranked. The best alternative has the highest value P_i because it is the closest to the positive ideal solution.

4. CASE STUDY - THK LINEAR MOTION GUIDE SUPPLIER SELECTION

The proposed MCDM methods for supplier evaluation and selection have been implemented in the "Lagerton" company (Limited Liability Company) in Serbia which is the authorized distributor of a number of mechanical components. In order to illustrate and validate the applicability of proposed MCDM methods a real-life problem, considering evaluation and selection of linear motion guide technologies supplier, is solved here.

Linear motion guide is a product of THK Company from Japan. It provides a component that enables linear rolling motion for practical usage in high-precision, high-rigidity, energy-saving, high-speed machines.

The "Lagerton" company procures components for a known buyer (Figure 2):

- Slide block SRS 12 GM UU;
- Rail SRS 12/570 – 10 – 10.

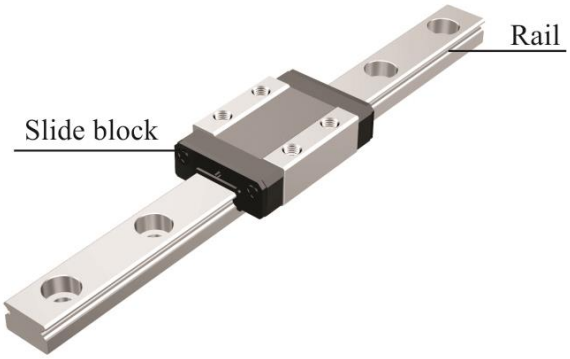

Fig. 2 THK Linear motion guide components

The company acquires components through a selection of the best supplier from European market qualified suppliers. Four companies (S_1, S_2, S_3 and S_4) have been evaluated and the main criteria for evaluation and selection that were used are: product price (C_1), transportation costs (C_2), delivery time (C_3), company rating (C_4) and established cooperation (C_5). The first three criteria are minimization criteria where lower attribute values are preferred. The last two criteria are maximization criteria where higher attribute values are preferable. Company rating (C_4) and established cooperation (C_5) are qualitative criteria and both are numerically represented using the values from 1 to 9 from fundamental Saaty scale.

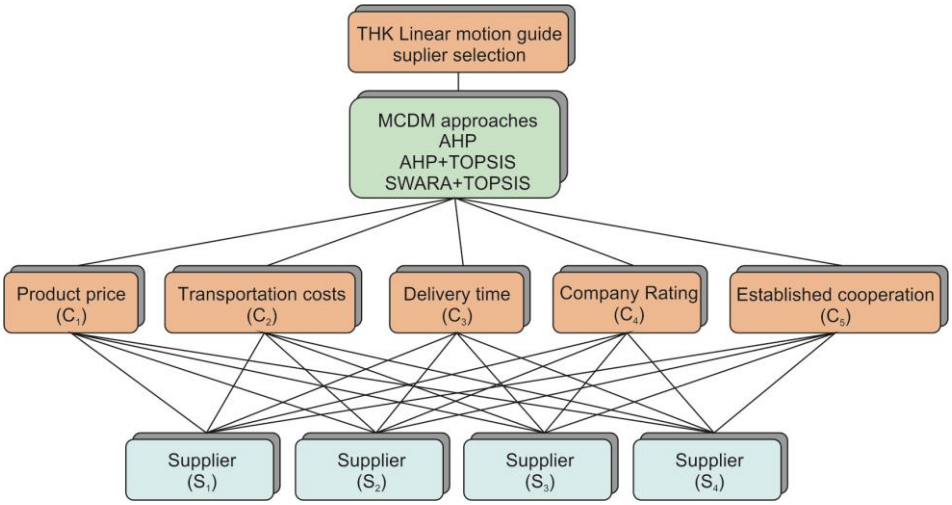

Fig. 3 A model for supplier selection of THK Linear motion guide components

In an interview, the management team of the "Lagerton" company, responsible for evaluation and selection of suppliers, estimated performance ratings of four suppliers and the results are shown in Table 2.

Table 2 Suppliers performance ratings– decision matrix

	Criteria				
	C_1 [EUR]	C_2 [days]	C_3 [EUR]	C_4 [-]	C_5 [-]
Alternatives	min	min	min	max	max
S_1	350	50	15	9	9
S_2	390	60	15	9	1
S_3	400	60	15	5	1
S_4	367	60	7	4	1

Source: The internal documentation of the "Lagerton" company

The management team also evaluated the significance of the defined criteria by creating a pairwise comparison matrix (Table 3):

Table 3 Evaluation of the criteria – pairwise comparison matrix

Criteria	C_1	C_2	C_3	C_4	C_5
C_1	1	3	5	9	0.333
C_2	0.333	1	3	7	0.333
C_3	0.2	0.333	1	5	0.333
C_4	0.111	0.143	0.2	1	0.143
C_5	3	3	3	7	1

Source: The internal documentation of the "Lagerton" company

As described in Section 3, AHP and SWARA methods are used in order to calculate criteria weights. Based on pairwise comparison matrix (Table 3), criteria weights are obtained as shown in Table 4:

Table 4 Criteria weights obtained using AHP and SWARA methods

Criteria weights	C_1	C_2	C_3	C_4	C_5
AHP	0.298	0.170	0.100	0.032	0.400
SWARA	0.242	0.181	0.136	0.119	0.322

Table 4 clearly indicates that management team singled out C_5 - established cooperation as the most important criterion, more significant than C_1 - product price. On the other hand, C_4 - rating of the company is the least significant criterion probably due to the fact that all the considered companies are almost similar in renown, quality etc.

In order to evaluate suppliers AHP method and two hybrid combinations of MCDM methods (AHP+TOPSIS and SWARA+TOPSIS) are used. The application of the proposed hybrid MCDM approaches gives the complete ranking of the suppliers as shown in Table 5. The complete rankings are given according to calculated utility functions (Step 4 for AHP and Eq. 12 for TOPSIS) for each approach.

Table 5 Complete rankings of the suppliers according to different MCDM approaches

Supplier	S_1	S_2	S_3	S_4
AHP	0.459	0.176	0.169	0.196
	(1)	**(3)**	**(4)**	**(2)**
AHP+TOPSIS	0.922	0.033	0.006	0.0846
	(1)	**(3)**	**(4)**	**(2)**
SWARA+TOPSIS	0.876	0.128	0.028	0.128
	(1)	**(2)**	**(4)**	**(2)**

According to this table, the supplier order preference is given below: Supplier S_1> Supplier S_4> Supplier S_2> Supplier S_3. The best choice is Supplier S_1 and the worst choice is supplier S_3.

One of the most interesting research tasks related to the supplier selection decision making problem is to explore the influence of criteria weights variations to the ranking orders obtained according to the selected MCDM approaches. In this study, the Monte Carlo simulation covering 1000 different scenarios of criteria weights was implemented for both hybrid approaches. Values of criteria weights are randomly chosen from the intervals which was defined as ±10%, ±20% ... ±100% of original criteria weights. The changes of alternative ranks relative to the first solution (obtained with original criteria weights) were monitored and the sums of all ranking changes were calculated. The results are shown in Figure 4.

This figure clearly show that different scenarios of criteria weights do not significantly affect the ranking of alternatives in both hybrid combinations of the MCDM methods up to 50 percent of criteria weights changes. It should be noted that the best alternative – supplier S_1 and the worst alternative – supplier S_3 remain unchanged for all scenarios of criteria weights.

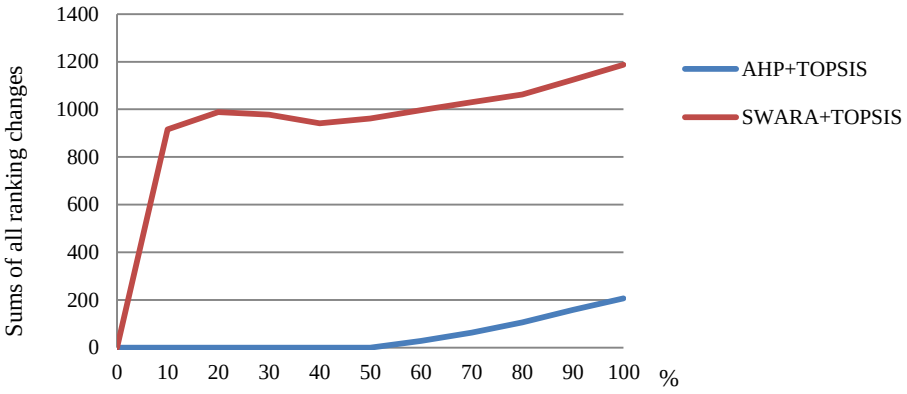

Fig. 4 Stability of the alternative ranks relative to the criteria weights changes

CONCLUSION

This research has demonstrated the applicability of some single and hybrid MCDM approaches (AHP, AHP+TOPSIS and SWARA+TOPSIS) in the selection of suppliers of transportation and logistics equipment. As a final conclusion, few points can be emphasized as follows:

- In the case of THK linear motion guide components procurement all considered approaches give insignificant variation in the final ranking scores. Supplier S_1 is suggested to the Serbian company "Lagerton" as the best choice.
- Application of different MCDM approaches to the problem of supplier selection helps to make more objective and reliable decisions. AHP method is one of the most used for supplier selection in transportation and logistics industries. On the other hand, hybrid approaches, such as combination of different MCDM methods as illustrated in this study, can provide computationally more efficient procedure.
- In the formulation and solving procedure of supplier selection problems MCDM methods often involve active participation of decision makers. This is particularly related to relative importance of criteria formulation as well as to analysis, ranking and selection of the final solution, which means the best alternative. Therefore,the most important future endeavours are directed to the development of expert and intelligent decision making systems.

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STUDIJA VIŠEKRITERIJUMSKOG ODLUČIVANJA ZA IZBOR DOBAVLJAČA LINEARNIH PROFILISANIH VOĐICA

Evaluacija i izbor dobavljača postaju sve važniji za kompanije u današnjoj logistici i upravljanju lancima snabdevanja. Donošenje odluka u domenu izbora dobavljača, kao osnovne komponente upravljanja lancima snabdevanja, predstavlja kompleksan proces zbog činjenice da su širok spektar različitih kriterijuma, različite interesne grupe i mnoštvo različitih rešenja uključeni u ovaj proces. Ova studija je usmerena na primenu pojedinačnih i hibridnih pristupa višekriterijumskom odlučivanju za izbor dobavljača opreme u oblasti transporta i logistike. Metode višekriterijumskog odlučivanja AHP, SWARA i TOPSIS primenjene su u kompaniji "Lagerton" u Srbiji za evaluaciju i izbor dobavljača komponenti linearnih profilisanih vođica proizvođača THK iz Japana.Najbolje rangirani dobavljač predložen je kompaniji i urađena je analiza senzitivnosti određenih rangova na promenu težinskih koeficijenata razmatranih kriterijuma.

Ključne reči: *Izbor dobavljača, MCDM, AHP, TOPSIS, Linearne tehnologije*

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Original Scientific Paper

THE ROLE OF TECHNOLOGICAL READINESS IN THE GLOBAL COMPETITIVENESS OF SERBIAN ECONOMY

UDC 334.34:62(497.11+497)

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Abstract. *Technological readiness has been an important determinant of the economic and social development in recent decades. Therefore, technological readiness has a substantial impact on the global competitiveness of national economies in the contemporary business environment. The purpose of this paper is to evaluate the level of Serbian economy competitiveness in terms of technological readiness and to identify the critical factors for its further development. The analysis is based on the data published by World Economic Forum in annual The Global Competitiveness Reports in the period from 2013 to 2017. The research is conducted through comparative analysis and benchmarking method. The results show significant deviations and negative trend of technological readiness of Serbia in comparison not only with European countries but alsowith Balkan countries. The conclusions of this research may serve as the directions for technological readiness policy makers in Serbia and other Balkan countries.*

Key words: *technological readiness, competitiveness, Serbia, Balkan countries, European countries.*

JEL Classification: Q55, O33, O57

INTRODUCTION

Technological readiness is one of key growth elements in every national economy. It is almost impossible to imagine any aspect of human activity without the use of technology tools.

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Furthermore, technology has a substantial role in creating the way of living, working, communicating, and playing in the modern society. Considering such important role in social life and business operations, the results achieved in technological readiness largely define the quality of citizens' life and the attractiveness of the economy in a particular country. Consequently, the level of competitiveness in terms of technological readiness to a great extent determines the general competitiveness of the national economy in a globalised world. These are the key reasons why technological readiness requires special treatment in designing the strategic development of a country and why it should be monitored and improved in each national economy that advocates an open development model.

The level of technological readiness development varies from region to region, i.e. from country to country. Europe has been the leading region in the field of technological readiness in the world for many years. According to World Economic Forum (2017-2018), there are seven European countries in the world's top ten most developed economies in terms of technological readiness. However, although Europe as a region achieves impressive results in this area, the level of technological readiness development diverges among European countries. Furthermore, there are large differences of the development level even within the European Union (EU). Thus, it is expected that greater differences exist between EU countries and other European countries that are not EU members, such as some Balkan countries.

The intention of this paper is to evaluate the level of competitiveness of Serbia and other Balkan countries in the field of technological readiness, through benchmarking the results achieved by Balkan countries with the results achieved by top European countries. The purpose is to identify the factors of technological readiness that are critical for competitiveness of Serbia and other Balkan countries, i.e. factors that require a priority in the development policy of Balkan countries with the aim of bridging the gap with the top European destinations in the future. The study is useful to policy makers of Balkan countries in the process of defining development goals and implementing strategic plans in the field of technological readiness.

This paper contains four separate segments. The first segment of the paper provides a theoretical background and literature review. Research methodology and data basis are defined in the second segment of the paper. The research results are presented and discussed in the third segment. The last segment summarizes the conclusions and recommendations for improving the technological readiness in Serbia and other Balkan countries.

1. THEORETICAL BACKGROUND AND LITERATURE REVIEW

Countries and companies in the globalized market are permanently faced with the need to change and develop its structures, processes, and technologies. Continuous improvement of these segments provides survival in the market and gaining competitive advantage. At almost each segment of the country and company strategic planning there are technology-related decisions as well as the use of technologies with different characteristics in nature (Oztemel & Polat, 2006; Petković & Lukić, 2014). These decisions have a huge impact on all their business operations.

There are numerous studies in the economic literature that examine some of the aspects of technological readiness. One of these aspects refers to e-readiness, which is defined as "the ability of a country, enterprise or organizational unit to be prepared, willing to adopt, use and benefit from e-innovations such as e-business, e-government, e-procurement, e-learning, etc." (Lou, 2010, quoted in: Aboelmaged, 2014, p. 639). Most of the studies

examine e-readiness on the country-level (Bui, Sankaran & Sebastian, 2003; Mutula & van Brakel, 2006; Hanafizadeh et al., 2009; Seyed & Sattary, 2009), but there are also studies which test the impact of e-readiness on the firm-level (Naseebullah et al., 2011; Heeks et al. 2011; Muafi et al., 2012; Aboelmaged, 2014; Gilabert et al., 2014). The authors of these studies argue that e-readiness is one of the crucial factors for improving performances and competitiveness of companies, industries, and even the whole economy.

An important prerequisite for successful development of technological readiness (on the country-level or firm-level) is the existence of efficient information and communication technologies (ICT). Therefore, there is a lot of empirical evidences in the literature that examines the influence of ICT on business operations and firms' performances, but also on productivity and competitiveness of national economies. Some of them analyse the impact of the ICT on development and competitiveness of the hospitality sector (Siguaw, Enz & Namasivayam, 2000; Ham, Kim & Jeong, 2005; Mosleh & Shannak, 2009), tourism industry (Buhalis & Zoge, 2007), and hotel sector (Avcikurt et al., 2011; Mihali et al., 2015). Research findings of these studies point out to the importance of ICT in simpler, low-cost, and better service provision in these sectors. Other studies (Ray et al., 2004; Gursoy & Swanger, 2007; Spyros et al., 2011) are related to different factors of ICT which represent important resources in the process of gaining sustainable competitive advantage. For example, Piccoli (2004), McAfee & Brynjolfsson (2008), and Lukić & Mirković (2014) consider that investment in ICT is a facility to enhance productivity and reduce costs.

Opposite to the above-mentioned studies, there are researches as Mihalič, Praničević & Arnerić (2015) which are based on the so-called ICT paradox theory. The authors of this theory argue that there is no significant impact of ICT investments on firms' value, firms' performance, and its competitive advantage (Willcocks & Lester, 1999; Carr, 2004; Aral et al., 2006; Lee & Connolly, 2010). However, dominant part of the technological readiness researches confirm its great significance in economic and social development of national economies, but also in successful business operations of firms in a globalized market.

2. Research Methodology and Data Basis

The aim of this research is to analyse the level of Serbian economy competitiveness in terms of technological readiness, but also to identify the critical factors for improving the competitive position of Serbia in this field in the future. The identification and analysis of factors that determine technological readiness competitiveness of the national economies are based on the methodology of the *World Economic Forum*. Secondary data published in the *Global Competitiveness Report* in the period from 2013-2014 to 2017-2018 represent the data basis for the research.

The *World Economic Forum* (WEF) in its *Global Competitiveness Report* (2017-2018, p. 11) define competitiveness as „the set of institutions, policies, and factors that determine the level of productivity of an economy, which in turn sets the level of prosperity that the economy can achieve". Based on this definition, WEF ranks countries according to their results (scores in the interval from 1 to 7) that are summarized in the *Global Competitiveness Index* (GCI). The GCI is a composite index that combines 114 indicators which are grouped in 12 pillars.

The Technological readiness pillar is the ninth pillar of GCI, by which WEF captures key technological aspects of national competitiveness in one measure that allows comparisons across countries and over time. It consists of the following 7 indicators:

(1) Availability of latest technologies;
(2) Firm-level technology absorption;
(3) Foreign direct investment (FDI) and technology transfer;
(4) Internet users (% pop.);
(5) Fixed-broadband Internet subscriptions (/100 pop.);
(6) Internet bandwidth (kb/s/user) and
(7) Mobile-broadband subscriptions (/100 pop.).

The analysis of technological readiness competitiveness of Serbia in this research does not pretend to specify and formulate a unified recommendation for technological readiness development policy. The purpose of this paper is to identify the critical factors of technological readiness competitiveness of Serbia and other Balkan countries. Benchmarking of the results achieved by Balkan and top ten European countries is used to determine the critical indicators as segments of the technological readiness development policy of Serbia and other Balkan countries in the future period.

The following ten Balkan countries are included in the analysis: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Macedonia, Montenegro, Romania, Serbia, and Slovenia. Since the study involves ten Balkan countries, the authors define the following group of top ten European countries (according to global rank in terms of technological readiness) as a benchmarking group: Denmark, Finland, Germany, Iceland, Luxembourg, Netherlands, Norway, Sweden, Switzerland, and the United Kingdom.

3. RESEARCH RESULTS AND DISCUSSION

3.1. Analysis of score and rank of Serbia in the Technological readiness pillar

The analysis of technological readiness competitiveness of Serbia is based on data about score and rank of this pillar in GCI. Table 1 indicates the score and rank of Serbia in the Technological readiness pillar in the period from 2013-2014 to 2017-2018.

Table 1 The score and rank of Serbia in Technological readiness pillar of GCI (from 2013-2014 to 2017-2018)

Year	Number of surveyed countries	Technological readiness pillar		Changes in Technological readiness pillar	
		Score	Rank	Score	Rank
2013-2014	148	3.9	60	-	-
2014-2015	144	4.4	49	+ 0.5	+ 11
2015-2016	140	4.5	51	+ 0.1	- 2
2016-2017	138	4.1	70	- 0.4	-19
2017-2018	137	4.2	72	+ 0.1	- 2
*Total**	-	-	-	+ 0.3	- 12

* Note: The results obtained by comparison of score and rank in 2013-2014 and in 2017-2018

Source: World Economic Forum, The Global Competitiveness Report, 2013-2014, 2014-2015, 2015-2016, 2016-2017, 2017-2018

Table 1 shows that Serbia is located in the first half of the global list in terms of technological readiness in the period from 2013-2014 to 2015-2016, while in the period from 2016-2017 to 2017-2018 it belongs to the group of countries located in the second

half of the global list. It is also important to note that Serbia has made moderate oscillations of results in the Technological readiness pillar in the mentioned period (from 2013-2014 to 2017-2018). The score ranged from 3.9 to 4.5, while the rank ranged from 49 to 72, which is obvious considering that the number of surveyed countries in that period varied from 137 to 148. It is also obvious that Serbia improved its score by 0.3, and at the same time lowered its ranking by 12 positions.

Data presented in Table 2 indicate the score and rank of Serbia in GCI in the period from 2013-2014 to 2017-2018. Comparison of score and rank of Technological readiness pillar (Table 1) and score and rank of GCI (Table 2) provides insight into its interdependence, i.e. provides assessment of the impact of Technological readiness pillar onto the global competitiveness of Serbia.

Table 2 The score and rank of Serbia in GCI (from 2013-2014 to 2017-2018)

Year	Number of surveyed countries	GCI		Changes in GCI	
		Score	Rank	Score	Rank
2013-2014	148	3.8	101	-	-
2014-2015	144	3.9	94	+ 0.1	+ 7
2015-2016	140	3.9	94	-	-
2016-2017	138	4.0	90	+ 0.1	+ 4
2017-2018	137	4.1	78	+ 0.1	+ 12
*Total**	-	-	-	+ 0.3	+ 23

* Note: The results obtained by comparison of score and rank in 2013-2014 and in 2017-2018

Source: World Economic Forum, The Global Competitiveness Report, 2013-2014, 2014-2015, 2015-2016, 2016-2017, 2017-2018

Analysis and comparison of data from Table 1 and Table 2 show that Technological readiness pillar has a strong impact on the global competitiveness of Serbia in the period from 2013-2014 to 2015-2016. In other words, changes in score and rank of Technological readiness pillar (Table 1) and changes in score and rank of GCI (Table 2) in the mentioned period are almost the same. However, this conclusion cannot be drawn from the same analysis for the period from 2016-2017 to 2017-2018. It is graphically illustrated in Figure 1.

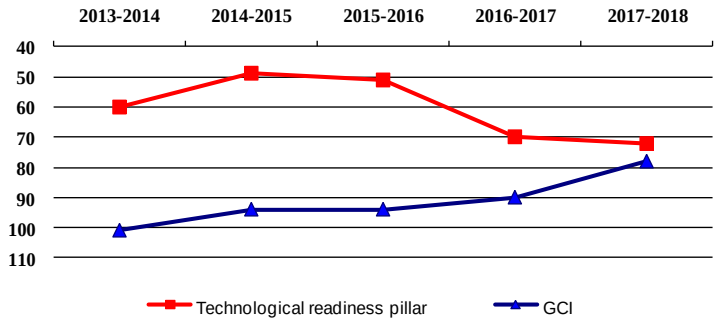

Fig. 1 Rank of Serbia in the Technological readiness pillar and GCI (from 2013-2014 to 2017-2018)

Source: Author's presentation based on data from Table 1 and Table 2

Figure 1 clearly indicates the correlation between technological readiness competitiveness and global competitiveness of Serbia in selected years. For example, a rank increase of technological readiness competitiveness for 11 places in 2014-2015 is followed by a rank increase of GCI for 7 places in the same year. After that, a little decrease of technological readiness competitiveness for 2 places in 2015-2016 had passed without changing GCI rank. However, next year's ranking of Serbia in both competitiveness categories indicates a completely different correlation between them. A rank decrease of technological readiness competitiveness for 19 places in 2016-2017 but also for 2 places in 2017-2018 is followed by a rank increase of GCI for 4 places in 2016-2017 and 12 places in 2017-2018.

It is a very important finding that the comparison of the first and the last year in the observed period (from 2013-2014 to 2017-2018) shows that Serbia achieved a rank decrease in Technological readiness pillar for 12 places and increase in GCI for 23 places, whereby the score was increased for 0.3 in both competitiveness categories. Although the number of countries covered by WEF Reports (from 2013-2014 to 2017-2018) varied from 137 to 148, previous finding implies that the technological readiness represents a very dynamic competitiveness factor that requires rapid development. In other words, although Serbia has improved the results in the area of technological readiness (for 0.3), its competitiveness in this area has dropped (for 12 places). This points to the fact that other countries have made much more progress in the observed period.

It is also important to note that the level of technological readiness competitiveness of Serbia is higher than the level of its global competitiveness. Nevertheless, there is a trend of constant convergence of these competitiveness categories in recent years. The result of this convergence is that Serbia is positioned in 72nd place in the world with a score of 4.2 according to the Technological readiness pillar in 2017-2018, which is only for 6 places better position than in GCI (78th place and a score of 4.1). It is a big difference compared to 2013-2014, when Serbia reached 60th place (score 3.9) in technological readiness competitiveness and 101st place (score 3.8) in global competitiveness.

In order to identify the reasons that led to such global position of Serbia in terms of technological readiness, it is necessary to analyse all indicators of this pillar. Table 3 represents score and rank of Serbia in Technological readiness pillar by its indicators in the period from 2013-2014 to 2017-2018.

Data presented in Table 3 show that the most significant increase of technological readiness competitiveness in the period from 2013-2014 to 2017-2018 is recorded in the Availability of latest technologies indicator (rank growth for 31 places and score growth for 0.3). Also, a positive trend is achieved in the following indicators: Firm-level technology absorption (rank growth for 20 places), Fixed-broadband Internet subscriptions/100 pop. (rank growth for 15 places), FDI and technology transfer (rank growth for 14 places), and Internet users % pop. (rank growth for 11 places). However, these remarkable results could not compensate negative trend in other indicators.

The great decrease of technological readiness competitiveness in the observed period is recorded in the Internet bandwidth kb/s/user indicator (rank decline for even 59 places and score decline for 44.2). Beside Internet bandwidth, the negative trend is also recorded in the Mobile-broadband subscriptions/100 pop. (rank decline for 14 places), although the score is increased for 27.2.

Table 3 The score and rank of Serbia in Technological readiness pillar by its indicators (from 2013-2014 to 2017-2018)

Indicators of Technological readiness pillar	2013-2014		2014-2015		2015-2016		2016-2017		2017-2018		Change (2013-2014 – 2017-2018)	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
I_1 Availability of latest technologies	4.1	118	4.2	106	4.0	107	4.1	103	4.4	87	+ 0.3	+ 31
I_2 Firm-level technology absorption	3.7	137	3.8	127	3.8	127	3.8	122	3.9	117	+ 0.2	+ 20
I_3 FDI and technology transfer	3.9	115	4.0	108	3.8	110	3.7	109	3.9	101	-	+ 14
I_4 Internet users % pop.	48.1	67	51.5	65	53.5	65	65.3	56	67.1	56	+ 19	+ 11
I_5 Fixed-broadband Internet subscriptions /100 pop.	10.2	61	13.9	49	15.6	50	16.8	52	18.9	46	+ 8.7	+ 15
I_6 Internet bandwidth kb/s/user	70.5	29	108.9	26	112.4	26	20.5	90	26.3	88	- 44.2	- 59
I_7 Mobile-broadband subscriptions /100 pop.	40.2	41	54.8	35	61.1	41	71.8	39	67.4	55	+ 27.2	- 14

Source: World Economic Forum, The Global Competitiveness Report, 2013-2014, 2014-2015, 2015-2016, 2016-2017, 2017-2018

3.2. Analysis of score and rank of Technological readiness pillar of the top 10 European countries as a group for benchmarking

In order to analyse the technological readiness competitiveness of Balkan countries, it is relevant to find the competitive position of the top 10 European countries with the best results in technological readiness. The top 10 European countries are the benchmarking group of countries which serves for comparison with 10 Balkan countries. Table 4 shows the scores of top 10 European countries according to indicators within the Technological readiness pillar (2017-2018).

Table 4 The score of top 10 European countries in the indicators of Technological readiness pillar (2017-2018)

Indicator	Luxembourg	Switzerland	Netherlands	United Kingdom	Sweden	Germany	Iceland	Norway	Denmark	Finland	Average score of top 10 European countries
I_1	6.3	6.5	6.4	6.3	6.5	6.1	6.3	6.6	6.0	6.6	6.36
I_2	5.7	5.9	5.9	5.6	6.0	5.7	5.9	5.8	5.7	5.9	5.81
I_3	5.8	5.4	5.5	5.5	5.3	5.4	4.3	5.1	4.9	4.8	5.2
I_4	97.5	89.4	90.4	94.8	91.5	89.6	98.2	97.3	97.0	87.7	93.34
I_5	36.7	46.3	42.2	39.2	36.3	38.1	37.6	40.4	42.8	31.2	39.08
I_6	8,397.9	269.2	196.1	449.1	505.6	107.5	997.8	269.0	239.9	216.4	1,164.85
I_7	90.2	103.7	87.8	91.4	125.2	80.2	104.0	101.8	124.2	153.0	106.50
TRP *	*6.5*	*6.4*	*6.3*	*6.3*	*6.3*	*6.2*	*6.2*	*6.1*	*6.1*	*6.0*	*6.24*
	1	*2*	*3*	*4*	*5*	*8*	*10*	*11*	*12*	*16*	-

* Note: Technological readiness pillar (upper row – score; lower row – global rank)
Source: World Economic Forum, The Global Competitiveness Report, 2017-2018

With seven countries in the world's top 10, Europe continues to dominate the rankings of technological readiness (Table 4). Furthermore, all of the world's top 5 countries are European countries. Luxembourg records the highest score of Technological readiness pillar among 137 countries (6.5), followed by second-ranked Switzerland (6.4), third-ranked Netherlands (6.3), fourth-ranked United Kingdom (6.3), and fifth-ranked Sweden (6.3). The first five European countries are followed by Germany, Iceland, Norway, Denmark, and Finland.

The scores of top 10 European countries presented in Table 4 show that Norway and Finland record the best score in I_1 (Availability of latest technologies), Sweden is the best in I_2 (Firm-level technology absorption), Luxembourg in I_3 (FDI and technology transfer) and in I_6 (Internet bandwidth kb/s/user), Iceland in I_4 (Internet users % pop.), Switzerland in I_5 (Fixed-broadband Internet subscriptions/100 pop.), and finally Finland is the best in I_7 (Mobile-broadband subscriptions/100 pop).

3.3. Comparative analysis of indicators in Technological readiness pillar in the Balkan countries

With the aim of analysing the achievements of Serbia and other Balkan countries in the terms of technological readiness, the scores of all seven indicators within the Technological readiness pillar (2017-2018) of Balkan countries are presented in Table 5. The information

Table 5 The scores of indicators within the Technological readiness pillar of Balkan countries (2017-2018)

Indicator	Slovenia	Bulgaria	Croatia	Montenegro	Greece	Romania	Macedonia**	Bosnia and Herzegovina	Serbia	Albania	The highest score of Balkan countries	Average score of Balkan countries	The highest score of the top 10 European countries	Average score of the top 10 European countries
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
I_1	5.7	4.7	4.8	4.5	4.9	4.7	4.9	4.5	4.4	4.4	5.7 Slovenia	4.75	6.6 Nor/Fin	6.36
I_2	4.9	4.5	4.2	4.3	4.3	4.2	4.5	4.2	3.9	4.4	4.9 Slovenia	4.34	6.0 Sweden	5.81
I_3	4.2	4.7	3.7	4.4	3.7	4.1	4.1	3.8	3.9	4.9	4.9 Albania	4.15	5.8 Luxembourg	5.20
I_4	75.5	59.8	72.7	69.9	69.1	59.5	70.4	69.3	67.1	66.4	75.5 Slovenia	67.97	98.2 Iceland	93.34
I_5	28.3	23.3	24.6	18.5	32.5	20.7	17.2	17.4	18.9	8.2	32.5 Greece	20.96	46.3 Switzerland	39.08
I_6	239.2	175.9	119.0	202.9	68.7	155.5	53.9	98.5	26.3	57.0	239.2 Slovenia	119.69	8,397.9 Luxembourg	1,164.85
I_7	62.3	88.4	79.7	60.7	51.3	73.7	56.2	37.4	67.4	52.6	88.4 Bulgaria	62.97	153.0 Finland	106.50
*TRP**	*5.4*	*5.1*	*5.0*	*4.9*	*4.8*	*4.8*	*4.3*	*4.3*	*4.2*	*4.1*	-	-	-	-
	35	*39*	*43*	*48*	*50*	*51*	*61*	*69*	*72*	*78*	-	-	-	-

* Note: Technological readiness pillar (upper row – score; lower row – global rank)

** Note: Data for Macedonia (excluded in WEF 2017-2018) are from WEF 2016-2017

Source: World Economic Forum, The Global Competitiveness Report, 2016-2017, 2017-2018

Legend: Indicates that the score is below the average score of Balkan countries

Indicates that the score is above the average score of Balkan countries

serves to understand the relative position of Serbia in the group of Balkan countries and European countries, according to each indicator compared to the highest score and the average score of the Balkan countries, as well as the highest score and the average score of the top 10 European countries.

Data presented in Table 5 indicate that the average score of every indicator in the Technological readiness pillar of Balkan countries lags much behind the average score of these indicators of top 10 European countries (see column 13 and 15). Serbia is the ninth-ranked country out of 10 Balkan countries. According to these data, it is obvious that Balkan countries and especially Serbia have many options for improvement of almost all their performances that determine the technological readiness competitiveness.

Based on the previous analysis, it is possible to identify the list of critical indicators of Technological readiness pillar in Balkan countries. Those indicators need to be priority in development policies and improvements as soon as possible in order to reach the average score of the group. The list of critical indicators of Technological readiness pillar in Balkan countries is shown in Table 6.

Table 6 Indicators within the Technological readiness pillar which require priority of development policy by Balkan countries (2017-2018)

Country	The critical indicators which show the deviations from the average score of the group of Balkan countries	Number of critical indicators
Slovenia	I_7	1
Bulgaria	I_1, I_4	2
Croatia	I_2, I_3, I_6	3
Montenegro	I_1, I_2, I_5, I_7	4
Greece	I_2, I_3, I_6, I_7	4
Romania	I_1, I_2, I_3, I_4, I_5	5
Macedonia	I_3, I_5, I_6, I_7	4
Bosnia and Herzegovina	I_1, I_2, I_3, I_5, I_6, I_7	6
Serbia	I_1, I_2, I_3, I_4, I_5, I_6	6
Albania	I_1, I_4, I_5, I_6, I_7	5

Source: Author's calculation

Analysis of data presented in Table 6 shows that Serbia and Bosnia and Herzegovina, with 6 critical indicators, are the worst positioned Balkan countries according to the total number of deviations below the average score of Technological readiness pillar (observed by indicators). Albania and Romania show deviations in 5 indicators. Macedonia, Greece, and Montenegro have 4 critical indicators. Croatia has poorer performances in 3 indicators. Bulgaria shows deviations in 2 critical indicators, while Slovenia has only one critical indicator. All mentioned countries must necessarily make a lot of effort to make improvements that bring them closer to the average score of the Balkan countries. This particularly refers to Serbia and Bosnia and Herzegovina.

Beside above analysis, it is very important to identify indicators in which most Balkan countries record a deviation. Table 6 indicates that Internet users (I_4) need urgent actions in four Balkan countries. All other indicators (Availability of latest technologies – I_1, Firm-level technology absorption – I_2, FDI and technology transfer – I_3, Fixed-broadband Internet subscriptions – I_5, Internet bandwidth – I_6, Mobile-broadband subscriptions – I_7) require intervention and improvement by the majority of Balkan countries (6 out of 10 countries).

3.4. Benchmarking of technological readiness competitiveness of Balkan countries in relation to the top 10 European countries

The goal of this research segment is to analyse critical indicators in the Technological readiness pillar of Balkan countries with special emphasis on Serbia. This analysis implies the comparison of the average score of the indicators in a Technological readiness pillar of the Balkan countries and top 10 European countries.

Balkan countries recorded worse performances than top 10 European countries in all 7 indicators of the Technological readiness pillar according to average score. The difference between the average score of the top 10 European countries and Balkan countries isachieved as follows (columns 13 and 15 in Table 5): Internet bandwidth (1,045.16 kb/s/user), Fixed-broadband Internet subscriptions/100 pop. (18.2), Mobile-broadband subscriptions/100 pop. (43.53), Internet users (25.37 % pop.), Availability of latest technologies (1.61), Firm-level technology absorption (1.47), and FDI and technology transfer (1.05).

The important conclusion of this benchmarking is that all indicators in the Technological readiness pillar of all Balkan countries deviate from the average score of the top 10 European countries. That indicates complete inferiority of technological readiness performances of Balkan countries in comparison with the top 10 European countries.

The purpose of such benchmarking is to identify benchmark standards that are relevant to guiding and defining development policy, goals, and actions (Bendell, Boulter & Gatford, 1997; Codling, 1998; Bogetoft, 2012). Benchmark standards are target levels that each Balkan country can set in the technological readiness development strategy on the national level. Such benchmarking allows determination of priorities in development policy for each analysed country. The criteria are based on the urgency or time priority. Firstly, Balkan countries should improve indicators that deviate from the average score of the Balkan countries. When they meet that, the aim should be the average score of the top 10 European countries. After reaching that score, they could set a higher goal – the level of performance of the best countries in the group of top 10 European countries. Systematization of indicators within the Technological readiness pillar according to the priority of their necessary improvement by Balkan countries is presented in Table 7.

Table 7 Specification of indicators within the Technological readiness pillar according to priority of their necessary improvement by Balkan countries

Country	The first level priority of indicators – the benchmark is the average of Balkan countries	The second level priority of indicators - the benchmark is the average of top 10 European countries
Slovenia	I_7	I_1, I_2, I_3, I_4, I_5, I_6
Bulgaria	I_1, I_4	I_2, I_3, I_5, I_6, I_7
Croatia	I_2, I_3, I_6	I_1, I_4, I_5, I_7
Montenegro	I_1, I_2, I_5, I_7	I_3, I_4, I_6
Greece	I_2, I_3, I_6, I_7	I_1, I_4, I_5
Romania	I_1, I_2, I_3, I_4, I_5	I_6, I_7
Macedonia	I_3, I_5, I_6, I_7	I_1, I_2, I_4
Bosnia and Herzegovina	I_1, I_2, I_3, I_5, I_6, I_7	I_4
Serbia	I_1, I_2, I_3, I_4, I_5, I_6	I_7
Albania	I_1, I_4, I_5, I_6, I_7	I_2, I_3

Source: Author's presentation

Grouping of indicators into different priority levels as shown in Table 7 provides guidance in defining priorities into technological readiness development strategy of each Balkan country. The column for third level priority of indicators (for which the benchmark is the best country among top 10 European countries) does not exist in Table 7, because there is no Balkan country that exceeds the average score of top 10 European countries in any indicator of the Technological readiness pillar.

It is found that Serbia as target country of this analysis has six critical indicators in the first level priority, while Slovenia as best-ranked country in the Balkan group has one indicator in the first level priority (Table 7). A number of critical indicators of other Balkan countries in the first level priority varies from two (Bulgaria) to six (Bosnia and Herzegovina). All other indicators of the Technological readiness pillar are in the second level priority, for which the benchmark is the average of top 10 European countries.

CONCLUSION

A general conclusion that can be recognized in this paper is that the level of technological readiness competitiveness of Serbian economy is higher than the level of its global competitiveness, but also that there is a trend of constant convergence of this competitiveness categories in recent years. Although Serbia has improved the results in the area of technological readiness in last five-year period from 2013-2014 to 2017-2018 (for 0.3), its global competitiveness in this area has dropped for twelve places (it should be noted that the number of countries covered by WEF Reports in the period from 2013-2014 to 2017-2018 varied from 137 to 148). This points to the fact that other countries have made much more progress in the observed period. It implies that the technological readiness represents a very dynamic competitiveness factor that requires the rapid development of Serbian economy in the future.

Research findings of benchmarking method that is applied in the paper point out the competitive factors (indicators) that need to be improved by Serbia and other Balkan countries and indicate the priority of its improving. The important conclusion of the research is that the average score of all indicators in the Technological readiness pillar of Balkan countries is much lower than the average score of the top 10 European countries. Serbia and Bosnia and Herzegovina, with six critical indicators in the first level of priority, are the worst positioned Balkan countries according to the total number of deviations below the average score of indicators in Technological readiness pillar. Slovenia is the best-ranked country in the Balkan group, with only one indicator in the first level priority.

Internet users as an indicator of Technological readiness pillar need urgent actions in four Balkan countries including Serbia, while all other indicators (Availability of latest technologies, Firm-level technology absorption, FDI and technology transfer, Fixed-broadband Internet subscriptions, Internet bandwidth, and Mobile-broadband subscriptions) require intervention and improvement by six out of ten Balkan countries. After achieving improvements in these indicators which are in the first level of priority, Balkan countries should strive to advance the indicators which should reach the average of the top 10 European countries.

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ULOGA TEHNOLOŠKE SPREMNOSTI U GLOBALNOJ KONKURENTNOSTI PRIVREDE SRBIJE

Tehnološka spremnost predstavlja važnu determinantu ekonomskog i društvenog razvoja poslednjih decenija. Stoga, tehnološka spremnost značajno utiče na globalnu konkurentnost nacionalnih ekonomija u savremenom poslovnom okruženju. Cilj ovog rada je da utvrdi nivo konkurentnosti privrede Srbije u pogledu tehnološke spremnosti i da identifikuje kritične faktore za njen budući razvoj. Analiza se zasniva na podacima Svetskog ekonomskog foruma, objavljenim u godišnjim Izveštajima o globalnoj konkurentnosti u periodu od 2013. do 2017. godine. Istraživanje je realizovano primenom komparativne analize i metode benčmarkinga. Rezultati su pokazali značajna odstupanja i negativan trend tehnološke spremnosti Srbije ne samo u poređenju sa evropskim zemljama, već i sa balkanskim zemljama. Zaključci ovog istraživanja mogu poslužiti kao smernice donosiocima odluka u oblasti politike razvoja tehnološke spremnosti Srbije i drugih balkanskih zemalja.

Ključne reči: *tehnološka spremnost, konkurentnost, Srbija, zemlje Balkana, zemlje Evrope.*

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MONETARY *VERSUS* FISCAL DOMINANCE IN EMERGING EUROPEAN ECONOMIES

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Abstract. *The conventional macroeconomic paradigm is that monetary policy provides the nominal anchor for inflation expectations and that fiscal policy is disciplined in implementing credible and timely revenue-expenditure measures when debt rises, in order to ensure sustainability. In this scenario, monetary policy is active, whereas fiscal policy is passive, which is referred to as monetary dominance. However, the proponents of the Fiscal Theory of the Price Level emphasize that another regime may be possible – the one of fiscal dominance. In this setup, primary balance follows some arbitrary path, not necessarily compatible with the evolution of government debt, and monetary policy is faced with limited room for maneuver, as it has no option but to adjust to fiscal developments. Following these theoretical foundations, the aim of this paper is to empirically ascertain the prevailing policy regime (monetary versus fiscal dominance) in five emerging European economies (Hungary, Romania, Bulgaria, Serbia, and Macedonia). In line with expectations, results overwhelmingly suggest that monetary policy may have been subordinated to fiscal policy over the period of analysis in all economies under scrutiny and that fiscally-led regime prevailed.*

Key words: *Fiscal Theory of the Price Level, fiscal dominance, monetary dominance, emerging European economies*

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INTRODUCTION

The 2007/2008 financial crisis and the accompanying Great Recession have brought an abrupt shift in the attitude towards fiscal policy among both researchers and policymakers. Although often neglected as a macroeconomic policy tool, in the wake of the recent crisis it was once again proven that fiscal policy too can have powerful and effective transmission channels that affect aggregate demand. Arestis (2011, p. 144) argues that it was precisely fiscal policy that "saved the world from the second Great Depression and produced only the Great Recession". Yet, this stabilization came at a price. Government measures to rescue the financial sector, provide safety nets for workers and the unemployed and stimulate the economy devastated public finances all over the world. In the aftermath of the Great Recession, and in some cases even after fiscal consolidation actions, many countries are still faced with substantial fiscal deficits and sizeable debt burdens.

In light of these considerations, concerns have emerged about the broader macroeconomic consequences of fiscal developments. Often embedded within such concerns is the issue whether or not fiscal trajectories can jeopardize monetary policy objectives. Namely, under the so-called fiscally dominant regime central bank independence may not be sufficient to anchor inflation expectations. In particular, price stability cannot be guaranteed without a sustainable fiscal position of the government. Taking into account the fact that fiscal dominance is more likely to be a problem in developing economies than in advanced economies (Montiel, 2011; Zoli, 2005), the idea of this paper is to search for evidence of such dominance in five emerging European economies.

The rest of this paper is organized as follows: Section 1 outlines an overview of the main theoretical arguments concerning the issue of monetary *versus* fiscal dominance nexus. Section 2 introduces the empirical methodology and presents our dataset. Section 3 lays out results of empirical investigation with accompanying discussion, while the last section offers some concluding remarks.

1. THE RELEVANCE OF DIFFERENT REGIMES - THEORETICAL BACKGROUND

Traditional macroeconomic analysis is based on the fact that fiscal policy makers determine the level of the primary budget balance in order to ensure fiscal sustainability regardless of the price level, whereas monetary authorities are expected to set the desired price level without any constraints. Under these circumstances, the prices are determined exogenously, in the money market (for instance, following the quantitative theory of money) as opposed to the primary balance which adjusts endogenously in line with the intertemporal budget constraint. The aforementioned scenario is referred to in the literature as Ricardian or Monetary Dominant (hereinafter: MD) regime.

However, as Bajo-Rubio et al. (2009, 2014) highlights, a new trend of economic thought has emerged in the 1990s - Fiscal Theory of the Price Level (hereinafter: FTPL). Sims (1994), Leeper (1991) and Cochrane (2001), have laid the FTPL groundwork and the theory was further developed for instance by Leeper (2010, 2013), Cochrane (2011) and many others.

The proponents of FTPL challenge the aforementioned conventional assumptions and imply that fiscal authorities may be able to set primary balances that follow some arbitrary process, not necessarily compatible with sustainability. In such a case, the path of the primary budget balance becomes exogenously determined, while the prices now adjust endogenously

in order to maintain sustainability. Although monetary policy may still be able to control inflation, it is certainly far less powerful than it would be under MD regime. In fact, as observed by Sargent & Wallace (1981), the only thing that monetary authorities can control in this scenario is the timing of inflation. These propositions represent the essence of the Fiscal Theory of the Price Level and the regime based on them is called non-Ricardian or Fiscal Dominant (hereinafter: FD).

The issue of whether a particular economy operates in a monetary or fiscally-led regime is determined by the behavior of monetary and fiscal authorities. In fact, as explained by Komulainen & Pirttila (2000) there are two equilibrium conditions that are critical for price level determination. The first one is well known and refers to quantitative theory of money:

$$M_t\, V = P_t\, Y \tag{1}$$

where M_t stands for money used in the period t, Y represents the income (GDP), V is the velocity of money and P_t is the price level.

The second condition, according to the same authors (Komulainen & Pirttila, 2000) is:

$$W_t/P_t = E_t \sum_{j=1}^{\infty} \beta^{j-1} \left(s_j + \tau_j\right) \tag{2}$$

where W_t denotes government liabilities that themselves represent the sum of the stock of net interest bearing liabilities of the government (B_t) and M_t (i.e. $W_t = B_t + M_t$), β is the discount factor and the sum of s_j and τ_j represent the expected government primary surplus which includes both primary surplus itself (s) and the central bank transfers (seigniorage, τ).

The first equation (1) is evidently the money demand function while the second equation (2) expresses the present value of the government intertemporal budget constraint. Equilibrium requires both of these equations to hold, and since we are looking at two equations with one unknown (P), the following equilibrium condition can be derived:

$$M_t\, V/Y = (B_t + M_t) \,/\, E_t \sum_{j=1}^{\infty} \beta^{j-1} (s_j + \tau_j) \tag{3}$$

Decisions of economic policy makers influence the formation of public debt, primary surplus and money (B_t, s_j, M_t). Consequently, fiscal (B_t, s_j) and monetary (M_t) policy must be coordinated in order to achieve the desired price level. But, as emphasized by Komulainen & Pirttila (2000), two special cases of such coordination can exist. In the first scenario, fiscal policy makers react first and independently set the level of debt and deficit (B_t, s_j) which requires prices to be determined from the equation that refers to the current value of the intertemporal budget constraint (Eq. 2). In this case, fiscal variables determine the price level and monetary variables adjust. On the other hand, if monetary authorities act first and determine the monetary policy variables independently, then the only thing left for fiscal policy makers is to adjust variables B_t and s_t to this (monetary determined) price level. Evidently, in the first case, there exists a fiscally-led regime, while the second case is referred to as the monetary dominance.

Finally, it should be stated that the issue of monetary versus the fiscal dominance is closely related to the indirect way of fiscal sustainability analysis by means of Bohn's (1998) fiscal reaction function framework (see details below). However, it is essential to emphasize that in the equilibrium, fiscal sustainability can exist in both MD and FD regime. The crucial difference is how this sustainability has been achieved, or in the words of Sargent & Wallace (1981) "who has imposed discipline on whom?". Specifically, in the monetary dominant regime, the primary budget balance is set in order to ensure fiscal sustainability, independently

of the price level. In this case fiscal policy is subordinated to monetary policy, or as Leeper (1991) puts it - monetary policy is active whereas fiscal policy is reactive. In contrast,, in FD regime fiscal policy makers tend to set the primary budget balance exogenously to the level of government debt, and monetary policy must accommodate such fiscal path, even at the cost of excessive monetary tightening. In this scenario fiscal policy dominates over monetary policy and may undermine its goals. Furthermore, in case of fiscal dominance tighter monetary policy today can cause higher inflation in the future (or even immediately if rational agents anticipate this) – a scenario to which Sargent & Wallace (1981) refer to as the unpleasant monetarist arithmetic.

2. EMPIRICAL FRAMEWORK AND DATA

According to Bajo-Rubio et al. (2014) in the game theory, the solution for the monetary *versus* fiscal dominance nexus would be given by the leader–follower model. In particular, it would be determined by the matter of fact which policymaker has moved first - the central bank or the fiscal authority. However, in economic practice, distinction between the two regimes is a pure empirical question centered around ways to examine whether fiscal authorities tend to set an endogenous or exogenous path for primary deficits.

In addressing this issue, we follow the so-called backward-looking approach proposed by Bohn (1998) who searches for a systematic relationship between the primary surplus and one period lagged level of government debt. Yet, instead of estimating fiscal reaction function *per se* (Eq. 4) we are more interested in the direction of causality between the two variables in the system:

$$PB_t = a + b \cdot D_{t-1} + e_t \tag{4}$$

where PB denotes primary balance (surplus/deficit) scaled by GDP, D represents government debt (scaled by GDP), a and b are parameters and e_t stands for a white noise error.

In a series of papers Bohn (1998, 2005, 2007) emphasizes that a positive and significant estimate of parameter b indicates fiscal sustainability as well as prevalence of monetary dominant regime over the period of analysis. However, the proponents of FTPL argue that under certain circumstances the unbiased estimate $b > 0$ can also indicate fiscal dominance. Accordingly, although the question of monetary *versus* fiscal dominance is closely related to the indirect way of fiscal sustainability investigation by means of Bohn's (1998) fiscal reaction function, that framework may not be able to give a definite answer to the prevalence of a certain policy regime. Hence, following the recent literature on this issue (Bajo-Rubio et al. (2009, 2014), Mackiewicz-Lyziak (2015), Afonso (2017), etc.), in order to distinguish between the two regimes, we resort to Granger causality tests between primary balance and public debt. In this sense, unidirectional causality running from primary surplus to government debt would suggest fiscal dominance, while unidirectional causality running the other way around may be an indication of MD regime.

The above-mentioned causal relationships are addressed by applying Toda & Yamamoto (1995) Granger non-causality test. Theoretically simple and calculationally straightforward TY causality procedure involves a Modified WALD (MWALD) test in an augmented VAR(k+dmax) model, where k refers to the optimal lag length (i.e. the correct VAR order) and dmax stands for maximal order of integration of underlying time series. The general specification of the augmented (k + dmax) VAR model for two variables is as follows:

$$X_t = \Sigma_{j=1}^{k+dmax} \alpha_j X_{t-j} + \Sigma_{j=1}^{k+dmax} \beta_j Y_{t-j} + \varepsilon_t \quad (5)$$

$$Y_t = \Sigma_{j=1}^{k+dmax} \gamma_j X_{t-j} + \Sigma_{j=1}^{k+dmax} \delta_j Y_{t-j} + \eta_t \quad (6)$$

where α_j, βj, γj and δj are parameters of the model, k is the optimal number of lags in the original VAR model, dmax is the maximum order of integration of the series in the system and εt and ηt are two independent white noise errors.

Our investigation is focused on five emerging European economies, namely: Hungary, Romania, Bulgaria, Serbia and Macedonia. Quarterly data on primary balance and government consolidated gross debt, both in percent of GDP (variables PB and D, respectively) cover the period from 2005Q1 to 2016Q4 and come from official sources (Eurostat in case of EU countries and national Ministries of Finance in case of Serbia and Macedonia). We use general government data for all economies, with the only exception of Macedonia in case of which similar to Trenovski & Tashevska (2015), in the absence of such data we resort to central government statistics instead. Prior to econometric modeling all the data series have been seasonally adjusted using TRAMO/SEATS method.

3. Results and Discussion

As the first step of the analysis, we investigate the order of integration of the primary surplus and government debt variables. To this end, we use common unit root tests such as standard Augmented Dickey Fuller (ADF) test as well as more robust DF-GLS test (Elliott et al., 1996). Complementary, we also rely on Kwiatkowski-Phillips-Schmidt-Shin (KPSS) stationarity test (Kwiatkowski et al., 1992).

The null hypothesis under ADF and DF-GLS test is one of a unit root, while KPSS test has stationarity as null. As highlighted by Hatemi-J (2002) from statistical point of view, not rejecting the null hypothesis does not necessarily imply accepting it. Hence, a combination of unit root and stationarity tests seems like a reasonable procedure, since the null hypothesis in one test is the alternative hypothesis in the other. Finally, it should be noted that lag lengths in cases of ADF and DF-GLS test are determined using sequential procedure of Ng & Perron (1995), with max lag set to 6. The bandwidth for the KPSS stationarity test is based on the Newey–West estimator using the Bartlett kernel function.

Table 1 Unit root and stationarity tests (variables in levels)

Country	Variable	ADF	DF-GLS	KPSS
Hungary	PB	-2.952 (1)	-2.910 (1)	0.118 (4)
	D	-1.145 (1)	-1.279 (1)	0.180 (6)
Romania	PB	-2.395 (1)	-2.457 (1)	0.153 (5)
	D	-1.309 (1)	-1.145 (1)	0.117 (5)
Bulgaria	PB	-1.860 (1)	-1.975 (1)	0.193 (2)
	D	-2.073 (1)	-0.755 (1)	0.226 (5)
Serbia	PB	-0.155 (3)	-0.636 (3)	0.231 (5)
	D	-2.798 (1)	-1.407 (1)	0.185 (6)
Macedonia	PB	-2.229 (1)	-2.359 (1)	0.162 (4)
	D	-1.813 (2)	-1.673 (3)	0.204 (5)

Notes: Constant and trend are included as deterministic components. At 5% significance level critical values are: -3.515 for the ADF test, -3.190 for DF-GLS test and 0.146 for the KPSS test. Lags are shown in parentheses.

Source: Authors

As can be observed on Table 1 the underlying variables in levels seem to exhibit a non-stationary kind of behavior over the period of analysis. However, after first-order differencing all time series become stationary (Table 2). These findings suggest that both PB and D may be considered integrated of order one, i.e. I(1) in all economies of our sample.

Table 2 Unit root and stationarity tests (variables in first differences)

Country	Variable	ADF	DF-GLS	KPSS
Hungary	PB	-8.089 (0)	-7.469 (0)	0.239 (3)
	D	-7.430 (0)	-7.513 (0)	0.322 (5)
Romania	PB	-10.886 (0)	-10.233 (0)	0.077 (4)
	D	-4.551 (0)	-3.699 (0)	0.212 (4)
Bulgaria	PB	-7.421 (0)	-7.435 (0)	0.090 (1)
	D	-3.898 (0)	-2.958 (0)	0.781 (4)
Serbia	PB	-3.312 (2)	-1.748 (2)	0.657 (4)
	D	-3.499 (0)	-3.538 (0	0.463 (5)
Macedonia	PB	-9.263 (0)	-9.099 (0)	0.082 (3)
	D	-3.452 (1)	2.098 (2)	0.453 (4)

Notes: Only constant is included as deterministic component. At 5% significance level critical values are: -2.930 for ADF test, -1.948 for DF-GLS test and 0.463 for KPSS test.
Lags are shown in parentheses.
Source: Authors

At this point it is important to emphasize that we acknowledge the fact that traditional unit root tests may not allow us to precisely differentiate between formally integrated and stationary but very persistent time series, especially keeping in mind our relatively small sample size (see also Lame et al., 2014). This further corroborates our choice of strategy for Granger causality tests, namely Toda & Yamamoto (1995) approach that is applicable irrespective of integration and cointegration properties exhibited by data. Nevertheless, the choice for the maximum order of integration (dmax) in all cases remains one (dmax=1).

In line with the empirical methodology outlined earlier, the next step is to determine the appropriate lag length (k) for country-specific bivariate VAR models. For this purpose usual information criteria are employed (Akaike info criterion - AIC and Schwartz Bayesian information criterion - SIC). However, in some cases additional lags are included in order to account for autocorrelation issues. This yielded dynamically stable, well-specified VAR models, namely VAR(2) for Serbia and Macedonia, VAR(3) for Hungary and Bulgaria and VAR(4) for Romania, that represent an adequate base for undertaking the Toda & Yamamoto (1995) Granger causality testing.

The results of the Toda & Yamamoto (1995) Granger non-causality tests for variables under scrutiny are presented in Table 3. As can be seen on this table, the results reflect a rather homogeneous pattern in all emerging economies under investigation. Not surprisingly, gathered empirical evidence indicates Granger causality that runs from primary surplus to government debt, while causality that goes in the opposite direction has not been found. This suggests fiscally-led regime in Romania and Serbia (at 5% significance level) as well as in Hungary and Bulgaria (at 10% level). In case of Macedonia no definite conclusion can be drawn at usual significance levels, although some (albeit weak) evidence found at the 15% significance level also confirms fiscal dominance in this country, which is in line with the earlier findings of Trenovski & Tashevska (2015).

Table 3 Toda & Yamamoto Granger non-causality tests

Null Hypothesis	k+dmax	Chi-square	p-value
Hungary			
D does not Granger cause PB	3+1	1.307	0.728
PB does not Granger cause D		6.868	0.076
Romania			
D does not Granger cause PB	4+1	7.044	0.134
PB does not Granger cause D		18.854	0.001
Bulgaria			
D does not Granger cause PB	3+1	0.801	0.849
PB does not Granger cause D		6.512	0.089
Serbia			
D does not Granger cause PB	2+1	2.009	0.366
PB does not Granger cause D		6.510	0.039
Macedonia			
D does not Granger cause PB	2+1	0.296	0.863
PB does not Granger cause D		4.020	0.134

Source: Authors

CONCLUDING REMARKS

Following theoretical foundations of the Fiscal Theory of the Price Level, the aim of this paper was to shed some light on the issue of monetary *versus* fiscal dominance in five emerging European economies (Hungary, Romania, Bulgaria, Serbia, and Macedonia). Results overwhelmingly indicate that the non-Ricardian (FD) regime prevailed, which further suggests that fiscal (not monetary) policy may have been the nominal anchor for inflation expectations in economies under scrutiny. These findings strongly emphasize the need for prudent fiscal policies in all of the examined countries, even though some of them are reporting solid fiscal performance after the full effect of post-crisis consolidation measures. Previous considerations are of vital importance especially in those economies that adopted the inflation targeting regime (Hungary, Romania and Serbia) having in mind that it is well documented that fiscal dominance reduces the ability of monetary authority to effectively set policy to achieve its own objectives. Taking into account all of the above, a general conclusion would be that credible fiscal policy is absolutely essential not only in terms of strengthening the capacity of public finances and further reduction of deficit pressures, but also in a broader economic context that refers to the efficiency of monetary policy strategies, the success of the implemented exchange rate regimes and consequently the preservation of aggregate macroeconomic stability.

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MONETARNA *VERSUS* FISKALNA DOMINACIJA U EVROPSKIM EKONOMIJAMA U RAZVOJU

Konvencionalno makroekonomsko stanovište podrazumeva da je monetarna politika ključna za usidravanje inflacionih očekivanja, dok je fiskalna politika disciplinovana u sprovođenju kredibilnih i blagovremenih prihodno-rashodnih mera u slučaju rasta javno duga, a kako bi osigurala održivost. U ovom scenariju monetarna politika je aktivna, dok je fiskalna politika pasivna, što se u literaturi označava kao monetarna dominacija. Međutim, zagovornici fiskalne teorije nivoa cena naglašavaju da može postojati još jedan režim – režim fiskalne dominacije. U ovoj postavci, primarni budžetski saldo prati neki arbitraran put, koji nije nužno kompatibilan sa evolucijom javnog duga, a monetarna politika se suočava sa ograničenim prostorom za manevar budući da na raspolaganju nema mnogo opcija i u krajnjoj instanci je prinuđena da se prilagodi fiskalnim kretanjima. Prateći opisan teorijski okvir, cilj ovog rada je da empirijski utvrdi preovlađujući režim (monetarna versus fiskalna dominacija) u pet evropskih ekonomija u razvoju (Mađarska, Rumunija, Bugarska, Srbija i Makedonija). U skladu sa očekivanjima, rezultati ukazuju na to da je monetarna politika tokom perioda analize bila potčinjena fiskalnoj u svim analiziranim ekonomijama, odnosno da je preovladavao režim fiskalne dominacije.

Ključne reči: *fiskalna teorija nivoa cena, fiskalna dominacija, monetarna dominacija, emergentne evropske ekonomije*

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FOREIGN DIRECT INVESTMENT IMPACT ON MARKET CONCENTRATION IN THE MANUFACTURING SECTOR OF BOSNIA AND HERZEGOVINA

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Abstract. *There is no consensus regarding the effect of foreign direct investment on market concentration in the literature of foreign direct investment and the theory of industrial organization. The aim of the research is to empirically investigate this impact in the context of the manufacturing sector of Bosnia and Herzegovina. To achieve this aim we estimate the econometric model by applying ordinary least square method. The sample of 21 industries comprising the manufacturing sector of Bosnia and Herzegovina was used for model estimation. Cross-sectional sample data was obtained from the Central Bank of Bosnia and Herzegovina and the financial reports of 4924 companies registered in the aforementioned industries for the year 2016. The results suggest that the impact of foreign direct investment on market concentration can best be described with a convex function.*

Key words: *foreign direct investment, market concentration, competition*

JEL Classification: F21, F23, L11

INTRODUCTION

Foreign direct investment may have different sorts of impact on the host economy: the increase in output, employment and export, the transfer of new technologies and knowledge and the growth of productivity. Another significant effect of foreign direct investment is the modification of market structure. The aim of the research is to examine the impact of foreign direct investment on the market structure of the manufacturing sector of Bosnia and Herzegovina.

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According to the data of The United Nations Conference on Trade and Development (UNCTAD), in 2016, Bosnia and Herzegovina recorded the inflows of foreign direct investment of 258.24 million USD, which constituted 1.75% of gross domestic product (UNCTAD, 2017). Such results could be characterized as modest, considering the levels of investment flows preceding the Global financial crisis. Future growth of foreign direct investment inflows can be expected with the further globalization, liberalization of the economy of Bosnia and Herzegovina, the acceleration of the reforms and European Union accession (Domazet, 2016). This brings up the question of the potential effects of the aforementioned growth, and this research aims to provide a partial answer.

The impact of foreign direct investment on market concentration is the question with an interesting theoretical aspect. There is still no consensus regarding this question in the theory of industrial organization. At least two conflicting hypotheses exist: the first - that foreign investments increase market concentration, and the second - that, to the contrary, they reduce it. There are theoretical viewpoints according to which the impact of foreign direct investment on market concentration levels can best be described with nonlinear functional forms, particularly in transition countries. The aforesaid hypotheses were tested in a vast number of empirical works in both developed and developing countries without conclusive results. For this reason, it is import to conduct further empirical research in order to improve the understanding of this problem, especially in the countries in which similar research has not previously been conducted. Such are all the countries in Southeastern Europe, including Bosnia and Herzegovina.

This research aims to provide the answer to the question of foreign direct investment impact on market concentration. We test the hypothesis that the impact of foreign direct investment on market concentration is statistically significant, and that it can best be described by a quadratic functional form. The sample includes 21 industries which constitute the manufacturing sector of Bosnia and Herzegovina. The cross-sectional data was obtained from the financial reports of 4924 companies in 2016. It was used to test the hypothesis by estimating a multiple econometric model, using the method of ordinary least squares. The results confirm the initial hypothesis that the impact of foreign direct investment on market concentration levels can be described by the convex functional form. It can be concluded that this functional form is suitable for describing the effect of foreign direct investment on market concentration in transition countries.

The paper is organized as follows. The first section reviews the related theoretical and empirical research. The second section outlays the applied econometric methodology, the construction of the variables used in the model and provides preliminary descriptive analysis of the sample used. In the following section the key empirical results of the research were described, upon which the relevant conclusions were drawn.

1. FOREIGN DIRECT INVESTMENT AND MARKET CONCENTRATION

Foreign direct investment can affect the host economy in different ways. One possible effect which is described in the theory of foreign direct investment is the impact on host country market structure (Markusen & Venables, 1999). Market structure can be defined as the level and the type of rivalry which exists among the companies active in the related industries, offering similar products and employing similar marketing strategies (Dunning & Lundan, 2008, p. 531). The information regarding market structure can be obtained

from market concentration. High levels of market concentration indicate an uneven distribution of market power, where one or few market subjects realize a dominant position compared to the other market subjects. The dominant position implies that the companies with the highest market share can act independently from their competitors, buyers and suppliers. Such a dominant position could be abused, which could in turn reflect on the dominant company influencing market prices and imposing unfavorable terms of trade to the other market subjects.

The dominant position of a company is not forbidden *per se*, but its abuse is. The abuse is problematic, as the monopolist is not under competitive pressure to improve the efficiency. In this situation, the prices are higher than in the case of higher competition, at the expense of the other competitors and the final consumers. The abuse of market power transfers the assets from the consumers to capital owners, which increases the inequality of the income distribution. The above-average profits realized from the abuse of dominant position by foreign companies can either be repatriated or retained and reinvested, which, as indicated by Newfarmer and Marsh (1981, p.73), can further strengthen their dominant position and increase the income distribution inequality.

The impact of foreign direct investment on market concentration is a controversial topic with two conflicting hypotheses (Forte, 2016, p. 241). The first hypothesis states that foreign direct investment reduces concentration on host country markets and spurs competition in the industries with entry barriers which are too high for local companies. The second hypothesis is that multinational companies increase market concentration levels by entering the markets of host country, reducing the intensity of the competition and raising entry barriers for the potential competitors.

In the short term, the effect of foreign direct investment on market concentration largely depends on the foreign company's mode of entry. One of the most common modes of entry in the recent decades is mergers and acquisitions. This mode does not impact market concentration levels in the short term, as the acquisitions of local companies change neither the total number of companies on the market nor their market shares. It could potentially increase competition when the acquisition target is a company with poor performances which would leave the market in the absence of the acquisition. In the case of greenfield investment, a foreign investor creates an entirely new company on the host market, which instantly increases the number of competitors and reduces market concentration. The impact of joint ventures on market concentration cannot be theoretically determined in advance, as it depends on the concrete arrangement among the partners.

In the long term, the effect of foreign direct investment on market concentration depends on the competitive strength and technological level of other companies active on the host country's markets. If the local companies manage to benefit from the potential positive spillover effects and the technology diffusion occurs, then the gradual reduction of the differences in technology and efficiency between local and foreign companies can be expected. This results in the increase of competition intensity manifested in the decrease of host market concentration. However, if the local companies are not on the sufficient level of technological development, the existing technological gap between local and foreign companies widens. As a result, the relative efficiency of foreign companies compared to the local ones improves, and, consequently, they perform better, effectively crowding out of the local companies from the market and increasing the market concentration in the long run.

The effects of foreign direct investment on host country market structure also depend on the impact of foreign companies on raising or lowering market entry barriers. The entry

barriers can be raised when foreign companies apply superior technology, organization, management and marketing, realizing competitive advantage over the domestic companies. Additionally, foreign companies have a considerable financial power, allowing them to tolerate losses in the short term until they neutralize any potential advantage of the local companies, as well as to engage in themselves in price wars against local competitors (Blomström, 1986, p. 524). These companies also face lower supply risks as they tend to rely on better, cheaper and more secure inputs in production from their global supply chains, unlike local companies. Likewise, foreign companies are advantageous due the information accumulated by all the affiliates over a long period and a number of markets (Newfarmer & Marsh, 1981, p. 49). The strength of these companies further allows them to lobby with the host country policymakers more successfully. The financial sector of a host country can also be more interested in financing foreign companies, which are perceived as less risky than local companies, due to their size and reputation (Kokko & Thang, 2014, p. 57).

Multinational companies and local companies compete in production factors markets as well (Barrios *et al*., 2005, p. 1762). Particularly important is the ability to attract high quality workforce by foreign companies, due to the ability to offer higher salaries than their domestic counterparts. Besides, the superior working conditions in foreign companies might attract potential entrepreneurs, reducing the entrepreneurship development of the host country, and consequently lowering the number market entrants (Grossman, 1984). The previously described dynamics are likely to result in the increase of market concentration through crowding out of local competitors from the market and pressuring the remaining competitors to consolidate and merge as a response to the challenges brought by the presence of foreign affiliates.

Foreign direct investment can also reduce the entry barriers. If monopolistic structures already exist on the host market, the entry of foreign investors can spur the competition either directly or indirectly, through the creation of additional demand on the related host country markets and the spillover effects which could increase local companies' productivity.

There are factors with the opposing effects of foreign direct investment on market concentration. Thus, the theoretic models cannot precisely predict the eventual outcome. Caves (1971) was among the first to establish the theoretical problem of the effect of foreign direct investment on market concentration. In their seminal work investigating the determinants of market concentration, Caves and Porter (1980) single out economies of scale as the key determinant of market concentration, while predicting a negative effect of foreign direct investment. There is also a theoretical model in the literature predicting either a positive or negative effect of foreign direct investment on market concentration, depending on the position of the concrete market in the value chain (Markusen & Venables, 1999), and the theoretical model describing the effect of foreign direct investment on market concentration with the convex function (Barrios *et al.*, 2005).

As a result of contradicting theoretical expectations, it is necessary to isolate the net effect of foreign direct investment on market concentration in host countries, through empirical research. The search of the existing literature showed that there have been at least 16 empirical researches investigating this problem in the period from 1970 to 2017, which are discussed below. The aforementioned researches observed both developed and developing countries, obtaining different results and drawing different conclusions. The consensus regarding neither the direction of the foreign direct investment effect on market concentration nor the optimal methodological framework has yet been reached.

The initial studies exploring the relationship between foreign direct investment and market concentration were conducted in developed countries. One of the first such pioneering works was performed by Rosenbluth (1970), who empirically found a weak, yet statistically significant correlation between the two variables. Following this research, Caves (1974) has also empirically demonstrated how multinational companies act as a driving force of the competition on the markets of The United States, Canada and Australia. Using the example of the Greek manufacturing sector, Bourlakis (1987) demonstrated that foreign direct investment increase market concentration. To the contrary, Driffield (2001) reached a contrasting conclusion by observing the manufacturing sector of the United Kingdom. Similarly, negative impact of foreign direct investment on market concentration was identified in the manufacturing sector of Portugal (Forte & Sarmento, 2014). Finally, Barrios, Görg and Strobl (2005) found that the impact of foreign direct investment on market concentration can best be described by a quadratic function in the case of Irish manufacturing sector.

The existing empirical studies based on developing countries indicate a positive impact of foreign direct investment on market concentration. One of the earliest such studies was conducted by Lall (1979) who found a positive impact of foreign direct investment on market concentration in the case of Malaysian manufacturing sector. Similarly, Newfarmer and Marsh (1981) found a positive correlation between foreign direct investment and market concentration in the case of Brazilian electric industry. More generalizable results were obtained by Blomström (1986) and Willmore (1989) who studied the entire manufacturing industries of Brazil and Mexico respectively. Both authors identified a positive impact of foreign direct investment on market concentration. More recently, Singh, Joseph and Abraham (2011) and Adam and Khalifah (2012) reported similar findings by observing Indian and Malaysian manufacturing industries respectively. Lastly, Kokko and Thang (2014) studied the entire economy of Vietnam, determining a similar positive impact found in the previous studies in developing countries.

The empirical literature treating transition countries is limited. The only work observing a transition country in a manner similar to the previously discussed studies is the one by Amess and Roberts (2005). The authors report that in the case of Polish manufacturing sector foreign direct investment increases market concentration to a certain extent, after which its effect is reversed.

Additionally, Rutkowski (2006) analyzed 13 transition countries from Central and Eastern Europe finding a negative impact of foreign direct investment on market concentration. Orazalin and Dulambaeva (2013) report the same findings for the case of 26 transition countries of the Commonwealth of Independent States and Central and Eastern Europe. Both of these cross-country studies use the perception of local managers as the measurement of market concentration which is an imprecise and unreliable measurement.

It is not possible to draw an unambiguous conclusion regarding the impact of foreign direct investment on market concentration from the previous empirical work. The best solution for future research of the problem seems to be the observation of an individual country and groups of markets and case analysis.

The existing research of market concentration in Bosnia and Herzegovina predominantly focused on individual market concentration and competition analysis, such as the analysis of insurance industry (Tomaš, 2013) and the analysis of personal consumption market (Kasumović & Meholjić Kalajdžić, 2013). So far, the effect of foreign direct investment on the market concentration of the markets of Bosnia and Herzegovina has not yet been investigated, which is the objective of this research.

2. METHODOLOGY

The research design is based on secondary data. Drawing from the theory of industrial organization, the most extensively defined econometric model was specified, considering conventionally accepted practice of the related empirical work and the availability of data. By applying the deductive methodological approach, the model was gradually restricted by excluding the statistically insignificant variables. The reduced model was estimated by applying the appropriate econometric methods, using the second hierarchical level of industries of Statistical classification of economic activities in the European Community (NACE revision 2) which comprise the manufacturing sector as the unit of analysis. The most empirical research regarding the impact of foreign direct investment on market concentration is based on cross-sectional data analysis, which was also implemented in this research. The approach entails the estimation of a single regression equation for a specified moment in time on cross-sectional data regarding foreign direct investment and other variables potentially affecting market concentration. This allows the estimation of the effects of foreign direct investment on market concentration levels in the state of equilibrium. However, the process of reaching the equilibrium is dynamic, hence the occurring adjustments might somewhat blur the quantitative results. Panel data analysis could improve the results clarity and resolve the possible problems of endogeneity. However, is not applicable in this research due to the nature of the data under disposal.

Following the approach of Forte and Sarmento (2014), the model is specified in the most general form as:

$$C = f(FDI, D) \tag{1}$$

where C represents market concentration, FDI foreign direct investment and D vector of other market concentration determinants. Next is the question of functional form in the equation (1). Linear functional form for all the determinants of market concentration is most commonly used in the literature, which was implemented in the research. Foreign direct investment variable is included in both linear and nonlinear functional form in the related research, depending on the characteristics of the country observed. Amess and Roberts (2005) propose the application of quadratic function for transition countries. Given the fact that Bosnia and Herzegovina is a transition country and the results of preliminary statistical analysis revealing the suitability of this approach, the foreign direct investment variable was modeled with a quadratic functional form.

Dependent variable in the research is market concentration (C). The definition of relevant market is crucial for the operationalization of this variable. It consists of three components: product, spatial and temporal. The relevant product market in the research is defined as a second level of hierarchy (2-digit code) of Statistical classification of economic activities in the European Community. Such a definition of relevant product market is problematic as the level of aggregation is high, and it implicitly assumes that the observed companies operate only in the sectors of their corresponding statistical class. Therefore, the interpretation of market concentration should be made with caution. The estimated concentration on a market defined as described is merely an approximation, most likely higher than the actual level of market concentration. Regardless of the limitations, the presented definition of relevant market was implemented in the research, due to the availability of data regarding foreign direct investment. The relevant market was spatially determined as the territory of Bosnia and Herzegovina. It is plausible that there are

companies in certain industries which are focused on more narrowly geographically defined markets. Nevertheless, given the high level of data aggregation, the relevant market determination as a territory of a country can be considered an adequate approximation.

The majority of previous research of foreign direct investment effects on market concentration employed discrete indicators of market concentration, that is, different ratios of concentration. Some of the exceptions include studies conducted by Amess and Roberts (2005) and Blomström (1986), which utilize Herfindahl-Hirschman index (*HHI*). The advantages of employing HHI index are multifold. Firstly, this indicator is cumulative and the information obtained from it is more precise. Secondly, this indicator is suitable for comparison of concentration in different industries, which precisely is the aim of the research. Finally, the indicator is used in antitrust procedures of numerous regulatory bodies, including *inter alia* the European Commission. For the outlined reasons, the research employs HHI index as the main measurement of market concentration. The index is determined for every industry following the approach of Hirschman (1964) as:

$$\sum_{i=1}^{n_j} S_i^2 = \sum_{i=1}^{n_j} \left(\frac{R_i}{R_j} \right)^2 = \sum_{i=1}^{n_j} \left(\frac{R_i}{\sum_{i=1}^{n_j} R_i} \right)^2 \tag{2}$$

where S_i^2 represents market share of every individual company calculated as a ratio of total income of an individual company (R_i) and the total income of all the companies in a given industry (R_j), $i = 1,...,n_j$ is the index of individual companies within the same industry, where n_j is the total number of companies in j-th industry, while j represents the index of two-digit codes of industries. The problem with the application of the equation (2) reflects in the fact that the total revenue of an individual company does not necessarily exclusively refer to one industry. However, the data from the analytical accounting for the companies of Bosnia and Herzegovina are not publicly available, which prevents the precise separation of revenues according to the originating industries. Moreover, the computation of HHI index based on the revenue data from publicly available financial reports implies that the analysis omits the gray economy which, according to some estimates, comprises 24.5% of gross domestic product of Bosnia and Herzegovina (Ernst and Young, 2016, p. 36). As a result, the computed market concentration indicators in the research represent conservative estimates, and the actual levels of market concentration are likely lower.

To verify the robustness of the results, the alternative, discrete, measurement of market concentration was also used in the research – concentration ratio for eight of the largest companies in each observed industry (*CR8*), measured by total revenue. This indicator was determined for sets of companies sorted in descending order by total revenue as a ratio of the revenue of individual company and the sum of revenues of all the companies in the given industry.

Foreign direct investment levels are the independent variable in the research. The paper follows the definition of foreign direct investment, provided by Organization of Economic Cooperation and Development (OECD), according to which they represent a lasting interest of the investors, a resident of one country, in the company which is a resident of another country, where the lasting interest is defined as direct or indirect ownership of over 10% of voting-rights equity (OECD, 2008). The definition is used because the same definition is adopted by the Central Bank of Bosnia and Herzegovina

(*Centralna banka Bosne i Hercegovine*) in the compilation of foreign investment statistics, which was the source of data in the analysis. The independent variable was calculated as a ratio of total stock of foreign direct investment at two-digit industry level in Bosnia and Herzegovina at the end of 2016 and the total value of liabilities of all companies in each of the two-digit industries, which is based on the approach first employed by Bourlakis (1987, pp. 723-724). On the basis of previous research and preliminary statistical analysis, it is expected that the effect of foreign direct investment on market concentration can be described with a U-shaped function. That means that initially, when the levels of foreign direct investment are low, additional foreign direct investment results in the reduction of concentration level, but on the higher levels of foreign direct investment, it leads to the increase of market concentration.

The theory of industrial organization predicts an array of determinants affecting market concentration. Some of the most common include: differentiation levels (*DIF*), economies of scale, capital intensity (*KL*) and market size (R). To obtain more precise results of eventual direct isolated effect of foreign direct investment on market concentration, it is necessary to include the aforementioned variables in the model as control variables.

Differentiation levels (*DIF*) measures the importance of product differentiation for different industries. The level of differentiation is approximated in the research as a ratio of sum of the accounting position Intangible assets from the balance sheet of all the companies from a given industry and the total value of assets of all the companies in the industry. As the higher differentiation level in an industry can be understood as an entry barrier for new potential competitors, a positive effect of the variable can be expected.

Economies of scale in the markets are often quantified with the minimal efficient scale of production of a facility in a given industry. Precise computation of this measurement requires the information regarding the physical production scale of individual companies, which is not available in Bosnia and Herzegovina. Therefore, fixed costs (*FC*) are used as a substitute instead, calculated as a ratio of total fixed costs (sum of accounting positions Labor costs, Amortization costs and Provisions from the income statement) for all the companies of a given industry, and sum of total business expenses of all the companies in the industry. It is likely that in the industries with relatively high fixed costs fewer companies can survive. Thus, a positive effect of this variable on market concentration is expected.

Capital intensity (*KL*) might also have an impact on market concentration. The research follows the approach of Adam and Khalifah (2012) and Forte and Sarmento (2014), where the capital intensity is measured as the ratio of total assets and total number of employees in a given industry. It is probable that the more capital intensive industries will contain a smaller number of companies compared to the other industries, hence the positive effect of this variable on market concentration can be expected.

Finally, market concentration may also be affected by market size (*R*). The research measures market size as total revenues of all the companies competing on the relevant market. As larger markets allow more companies to operate, the negative effect of this variable on market concentration is anticipated.

The sample data consists of 21 two-digit manufacturing industries. The manufacturing sector consists of 24 such industries; three industries were, however, excluded from further analysis because the data regarding foreign investments in these industries was not available. Data regarding foreign direct investment stock were obtained from *Panorama Nekto* database of the Central Bank of Bosnia and Herzegovina. All the other data used in the research are obtained from the financial reports of 4924 companies

registered in the manufacturing sector for the year 2016. The reports are publicly available on the web-sites of Financial Intelligence Agency (*Finansijsko-informatička agencija*) and Agency for Intermediary, IT and financial services (*Agencija za posredničke, informatičke i finansijske usluge*). For the purpose of descriptive statistical analysis, all of the relevant markets were grouped in three categories, according to the level of market concentration measured by HHI index. For each category an average value of foreign direct investment (*FDI*) on the markets was determined. The results are presented in Table 1.

Table 1 The average values of foreign direct investment levels on relevant markets with respect to the categories of market concentration

HHI	Number of markets	Number of companies	Average *FDI* (%)
Less than 1000	13	4 237	8.9
1000-2000	5	541	19.81
More than 2000	3	146	12.05
Total	21	4 924	

Source: Author's calculations based on the data provided by the Central Bank of Bosnia and Herzegovina, Financial Intelligence Agency and the Agency for Intermediary, IT and financial services

Table 1 shows that the majority of markets in the manufacturing sector of Bosnia and Herzegovina is within the zone of low concentration, as defined by the European Commission. Most of the companies in Bosnia and Herzegovina (86%) compete on these markets. The lowest market concentration was recorded in the following industries: Manufacture of wood and of products of wood and cork, Manufacture of food products and Manufacture of rubber and plastic products (with the values of HHI index on the markets equaling approximately 71, 173 and 184, respectively). Three markets can be described as highly concentrated: Manufacture of coke and refined petroleum products, Manufacture of tobacco products and Manufacture of paper and paper products (with HHI index values of approximately 4752, 3778 and 2526, respectively). The highest level of foreign direct investment was reported in Tobacco products industry (38.85%). It is noticeable that the markets with higher levels of foreign direct investment are also the markets characterized by a higher market concentration.

The descriptive statistics of the variables considered in the research is provided in Table 2.

Table 2 Descriptive statistics of the variables used in the empirical research

Variable	Average	Minimum	Maximum	St. deviation
HHI	1 144	73	4 752	1 217
CR8	0.61	0.17	1.00	0.23
FDI	0.12	- 0.24	0.38	0.14
DIF	0.01	0.00	0.02	0.01
FC	0.24	0.11	0.44	0.09
KL	203 763.10	33 392.37	609 395.20	145 648.50
R	643 341 489	74 010 669	2 721 897 968	633 824 175

Source: Author's calculations based on the data provided by the Central Bank of Bosnia and Herzegovina, Financial Intelligence Agency and the Agency for Intermediary, IT and financial services for the year 2016

The econometric analysis is initiated by estimating the most general form of the model, including all the considered variables and the intercept. The model is presented in the equation (3) as:

$$HHI = \beta_0 + \beta_1 FDI + \beta_2 FDI^2 + \beta_3 DIF + \beta_4 FC + \beta_5 KL + \beta_6 R + \varepsilon \quad (3)$$

Market concentration was expressed in terms of quadratic function of foreign direct investment levels and the linear function of control variables. The impact of all the factors not explicitly included in the model is encompassed by error term ε. The model represented by the equation (3) was estimated using ordinary least squares method and performed by the software package Eviews 8. Statistically insignificant variables were iteratively excluded from the model, using the threshold of 10% significance. Variables differentiation level (*DIF*), the share of fixed expenses in total expenses (*FC*), market size (*R*) and the intercept were thus eliminated. The reduced model maximizes Schwarz information criterion as well as the adjusted coefficient of determination and F-statistic. Significant reduction of the model was expected, because of a relatively small sample size, so the lack of statistical significance of the excluded variables does not necessarily rule out the possibility that these variables actually affect market concentration. However, in this concrete case it is capital intensity and foreign direct investment levels that predominantly determine market concentration, which can be expressed in terms of the equation (4):

$$HHI = \beta_1 FDI + \beta_2 FDI^2 + \beta_3 KL + \varepsilon \quad (4)$$

The model represented by the equation (4) was estimated using ordinary least squares. The residuals of the model are normally distributed, demonstrated by the value of Jarque-Bera statistics of 0.02. Autocorrelation of model residuals was tested using Durbin-Watson and Breusch-Godfrey LM test. Neither of the tests revealed the presence of autocorrelation. Breusch-Pagan and Glejser tests indicated no problems with heteroskedasticity. There is no statistically significant correlation between the regressors, meaning that multicollinearity is not present in the model, thus the estimates of the effects of the variables on market concentration are satisfactorily precise and separated. Finally, Ramsey regression equation specification error test indicated correct specification of the model represented by the equation (4) in terms of functional form, the choice of independent variables and the fulfillment of Gauss-Markov assumptions regarding the error term.

3. RESULTS AND DISCUSSION

The ordinary least squares estimation results of the equation (4) are presented in Table 3. The adjusted coefficient of determination shows that most of the variations of market concentration in the manufacturing sector of Bosnia and Herzegovina (76.29%) were explained by the model. The regression is statistically significant at 1% level.

Table 3 Regression Results

Dependent variable: HHI Number of observation: 21				
Variable	Coefficient	Std. error	t-statistic	p-value
KL	0.00465*	0.000942	4.93	0.0001
FDI	-3 449.47**	1 276.06	-2.70	0.0146
FDI^2	16 407.64**	6 352.39	2.58	0.0188
R^2	0,786618	$\overline{HHI}$		1144451
$\bar{R}^2$	0,762909	$S(\overline{HHI})$		1217083
Std. error of reg.	592,6224	Schwarz information crit.		15,88777
SSR	6321625	DW-statistic		1,969173
F-statistic	48,22432	Probability (F)		0,0000

Source: Author's calculations

Foreign direct investment (*FDI*) statistically significantly affects market concentration measured by HHI index, after controlling for capital intensity of the industry. The effect can be described with quadratic functional form, as expected, and is significant at 5% level. This confirms the hypothesis that foreign direct investment affects market concentration negatively in the industries in which foreign direct investment levels are low, whereas after certain optimal point additional investments cause the increase in market concentration. Point estimate of the optimal point equals 10.51%, and the confidence interval equals (0.30%, 17.07%). The robustness of the obtained results was confirmed by replacing dependent variable with the ratio of concentration (*CR8*) and re-estimating the model. In this case the effect of foreign direct investment on market concentration was again statistically significant (this time at 10% level). The results are in line with the findings of Barrios *et al.* (2005) and Amess and Roberts (2005).

As anticipated, the control variable of capital intensity has a statistically significant and positive effect on market concentration at 1% level. The higher the capital requirements in an industry, the fewer companies can respond to such requirements and, in general, only few companies can maintain sufficiently large scale of production to be profitable.

The results suggest that there is an optimal point of foreign direct investment levels which minimizes market concentration. This is possibly due to the existence of monopolistic structures in the industries with low foreign direct investment levels. With the increase of foreign direct investment inflows, these structures disintegrate and the inefficient companies leave the market or restructure. The positions of the companies leaving the market are taken by the more efficient foreign companies. Their presence leads to positive spillover effects which improve the performances of other, local companies which eventually results in the intensified competition and is reflected by the reduced values of HHI index. However, the results reveal that such dynamic exists only to the extent where foreign companies do not become dominant market subjects. At that point dominant foreign companies seem to dominate the local counterparts by applying some or all of the factors such as: superior technology, possibilities of lobbying, greater financial strength and possibilities to acquire resources on the factors of production markets. The insufficiently developed local companies leave the market or consolidate in response to the described competitive pressures, which results in the progressive growth of HHI index. It should be taken into account that the increase of HHI index cannot be considered detrimental *per se*. It implies

that few companies realize dominant market position, but it does not necessarily signify the abuse of it. Nevertheless, such situation, regardless of its effect on final product market prices limits the possibilities of small local competitors' development.

CONCLUSION

The research investigated the impact of foreign direct investment on market concentration in the manufacturing sector of Bosnia and Herzegovina. The ordinary least squares model of the impact of foreign direct investment on market concentration was estimated based on cross-sectional financial data of 4924 companies from 21 markets for the year 2016.

The results reveal the existence of statistically significant effect of foreign direct investment on market concentration, robust to the choice of market concentration measurement, which can best be described with quadratic U-shaped functional form. In other words, when the levels of foreign direct investment are lower, their additional inflows lead to the reduction of market concentration, which is true up to a certain optimum. After this point, the additional inflows of foreign direct investment progressively increase market concentration.

These results confirm the findings of the related research in transition countries, particularly the one by Amess and Roberts (2005). It is, therefore, possible that there is certain regularity in transition countries regarding the effect of foreign direct investment on market structure in manufacturing sector. The inflows of foreign direct investment are simultaneously followed by both positive and negative effects affecting the market structure. On the markets with significant foreign companies' presence, the additional inflows of foreign direct investment results in the negative effects overpowering the positive ones, leading to the consolidation of market subjects and the increase of market concentration.

Such results might have important implications for the policy regarding the attraction and promotion of foreign direct investment and antitrust policy. The interest of transition countries in attracting foreign direct investment expecting their positive effects is evident from their efforts and provided incentives. However, the potential negative effects must also be taken into consideration. The results suggest that in the foreign investment promotion policies it is necessary to take into account the local companies' level of development and their ability to absorb the expected spillover effects. Excessive insistence on foreign investments in the markets where local companies are insufficiently developed to compete with foreign counterparts can limit their growth possibilities and even survival. Eventually, such dynamics might lead to the domination of foreign companies over the markets of Bosnia and Herzegovina. It is therefore worthwhile for antitrust policy to beware the possibilities of dominant position abuse by the largest foreign companies.

At the moment, however, the majority of the industries comprising the manufacturing sector of Bosnia and Herzegovina are within the zone of low concentration and the overall state of competition can be described as satisfactory. In the previous years, the country has made progress in antitrust regulation. Still, the room for improvement exists in the efficiency of the Competition Council and the harmonization of the Bosnian competition regulation with the regulation of the European Union. Finally, the industries with the highest foreign presence are also the most concentrated, which raises concerns regarding the possibilities of market power abuse by the dominant foreign companies, especially with the further foreign direct investment inflows.

Further research regarding the effect of foreign direct investment on market concentration, should be based on larger sample, including time component and lower aggregation level of data in order to allow the application of panel data methodology. This would increase the precision of the estimates and help investigate the possible existence of the simultaneous effect between the two analyzed variables. Furthermore, future work should focus on the effect of market concentration on final consumers in order to provide better understanding of the problem as a whole. It should investigate whether the increased market concentration has an impact on profit margin and final product prices on respective markets.

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UTICAJ STRANIH DIREKTNIH INVESTICIJA NA KONCENTRACIJU TRŽIŠTA U SEKTORU PRERAĐIVAČKE INDUSTRIJE BOSNE I HERCEGOVINE

U literaturi stranih direktnih investicija i teorije industrijske organizacije ne postoji jedinstven stav po pitanju uticaja stranih direktnih investicija na stepen tržišne koncentracije. Cilj ovog rada je empirijsko ispitivanje ovog uticaja u slučaju prerađivačke industrije Bosne i Hercegovine. U tu svrhu ocenjen je ekonometrijski model metodom običnih najmanjih kvadrata. Pri tome je korišćen uzorak od 21 delatnosti sektora prerađivačke industrije Bosne i Hercegovine. Izvori korišćenih uporednih podataka su Centralna banka Bosne i Hercegovine i finansijski izveštaji 4.924 preduzeća iz tih delatnosti za 2016. godinu. Rezultati istraživanja ukazuju na to da se uticaj stranih direktnih investicija na stepen tržišne koncentracije najbolje može opisati konveksnom funkcijom.

Ključne reči: *strane direktne investicije, koncentracija tržišta, konkurencija*

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Review Paper

BALANCED SCORECARD AND *LEAN* BUSINESS CONCEPT

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Abstract. *Changing modern business environment necessarily triggers the need to constantly search for new business concepts, management modes, and performance measurement systems. In recent decades, lean business concept has been widely applied in companies. This concept focuses on creating value for customers. The value refers to the delivery of products and services with all the characteristics required by customers, just in time, and at the lowest price possible. As the basic task of the company is to satisfy different needs, it is understandable that the company success will depend on the success in satisfying its customers' needs. In this sense, the research subject in this paper is defining a possible system of performance measures in companies that apply lean business concept. The research results show that Balanced Scorecard can be applied in companies that apply the basic lean principles. This is because it primarily takes into account the value delivered to customers, and, based on this value, forms performance measures within the given perspectives. Also, an important aspect of Balanced Scorecard refers to internal processes and learning and growth, which lean concept is particularly concerned with.*

Key words: *Balanced Scorecard, Lean concept, performance measures*

JEL Classification: M41

INTRODUCTION

Modern companies that strive to deliver the required value to customers while searching for perfection apply, among other things, *lean* business concept. *Lean* business concept involves eliminating all forms of waste from business processes so that the customer gets the required value. The goal is to establish a continuous flow of operations without interruption and delay, and reduce operating costs.

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In new business conditions, characterized by the application of basic *lean* business concept principles, designing an efficient performance measurement system is one of the prerequisites for successful business and preserving the competitive advantage. In such business conditions, orientation to financial performance measures only is insufficient to effectively manage the company, so managers must also focus their attention on non-financial performance measures. The number and variety of performance measures depend on the characteristics of the company's business. In this sense, a company should develop its own performance measurement system. Taking into account both financial and non-financial performance measures and the basic principles of *lean* business concept, Balanced Scorecard comes to the fore.

Balanced Scorecard enables translating the company strategy into concrete actions and performance measures through four balanced interrelated perspectives: financial, customer, internal processes, and learning and growth perspective. As such, Balanced Scorecard is suitable for use in both production and service companies.

In this sense, the paper is divided into three parts. The first part points to basic principles of *lean* business concept. The second part explains Balanced Scorecard perspectives, and points to its compatibility with the basic principles of *lean* business concept. Finally, using the example of a telecommunication service provider, key performance measures are introduced, with the application of Balanced Scorecard.

1. *LEAN* BUSINESS CONCEPT

Lean business concept creates business processes that generate greater value for customers, increasing the speed of performance, minimizing waste and balancing the flows of materials, information, and money. It is long, hard and time-consuming work, but the result of its implementation is sure success. To yield long-term effects, changes occurring in a company as a result of *lean* concept application must include organizational structure, business culture, and performance reporting system. This does not mean abandoning the existing organizational structure, business culture, and reporting systems, but their continuous improvement, because organization, culture, and reporting identified indicate advantages, disadvantages, potential business problems, and areas where some of the *lean* techniques and practices need to be applied (Al-Ashaab et al., 2016). *Lean* business concept is not universal and cannot be applied in every company in the same way (Sekerez, 2009). Company managers and employees determine areas in which changes will be introduced.

To secure the benefits of applying *lean* business concept, the following principles must be respected (Womack & Jones, 2003; Olesen et al., 2015):

- Specify value,
- Value Stream,
- Flow,
- Pull system,
- Perfection.

The starting point of *lean* business concept is **value** definition. The value of a product or service is defined by the value end-user. The delivered product or service must satisfy the customer's needs in terms of price, functionality, quality, costs, and the like. Value is created by manufacturers or service providers. Producing value is the reason for the

existence of a company. The company creates value if it reduces internal waste, in terms of non-value-added activities and their associated costs, thereby increasing the total value delivered to customers. Further increase in the value created can be achieved by adding new features to products which customers are interested in, in shorter delivery time and in the scope needed (Hines et al., 2004).

Identifying values in *lean* business concept implies understanding all the activities that are performed in a company to produce a particular product, and optimizing the entire process. Business processes carried out in a company must be considered from the end-customer perspective. Observing the processes in this way helps identify three types of activities in a company. These are: value-added activities, non-value-added activities that cannot be omitted from business processes, and non-value-added activities that can be omitted from business processes (Schiman & Brewton, 2009, p. 10). Establishing a Value stream makes the balance between activities performed and the reasons why they are being performed. **Value stream** means a set of specific activities that are necessary to accomplish three main business tasks of a company. These tasks relate to: solving business problems, information management, and physical transformation (Womack & Jones, 2003, p. 11). Identifying Value stream for each product or family of products requires a lot of effort, but this process removes large amounts of waste in a company. What is important when identifying Value stream is that they can be managed as a whole and used to measure the result achieved. In this way, conditions will be provided in which the company does not compete with competition, but focuses its efforts on achieving perfection by identifying and eliminating activities that are considered excessive. Established value streams in a company relate to the entire business process, not just to individual segments. When determining value streams in a company, Value stream mapping has an important role (Andrade et al., 2016).

Once the value and value streams are identified, it is possible to connect all value-added activities into an **uninterrupted flow**. This implies providing conditions for the uninterrupted flow of information, material, and other resources without delay, continuously, one by one. In this sense, this principle of *lean* business concept aims at eliminating all unnecessary waste on the resource path through the company.

The next principle of *lean* business concept is to bring the product flow in line with customer requirements (***pull system***). There are two well-known systems for harmonizing product flow and customer requirements push and pull system. The application of the *push* system means that more work should be done to fill the warehouse with the finished products (Melton, 2005, p. 666). Unlike the *push* system, the *pull* system requires one-piece processing. *Pull* system focuses on customer demands, and, as such, tends to provide conditions for the acquisition of resources, data, and information and the production of products to start when a signal from the market is received. This implies that production begins when a customer needs a product. The introduction of the *pull* system allows the company to have the appropriate level of inventory to deliver the required value at the time when there is a need for it. In fact, the difference between *push* and *pull* systems is precisely in the signal that initiates supply or production. *Kanban* is used as a convenient signal for production in *lean* business conditions according to *pull* principle.

The last principle of *lean* business concept is **tendency towards perfection**. Advocates of *lean* business concept tend to think that first it is necessary to make the tasks and activities in the company "right" (to perform them in the right way, without interruption and waste), and only then to start optimizing them. It is clear that when the value and Value stream in the company are identified and their uninterrupted process ensured, the process of

lean transformation does not end. This means that the process of reducing effort, time, space, costs, and business errors never ends. When the company wins customers' attention, it wants to retain it indefinitely, anticipating future needs and creating products that will meet their needs, thus building the image of a sensitive company and creating its image on the market as a faster producer of products, better than competitors' (Novićević et al., 2013, p. 151).

Lean business concept presented in this way differs in relation to traditionally accepted business principles. Table 1 gives a comparative overview of traditional and *lean* business concepts.

Table 1 Traditional and *lean* business concept

Traditional concept	*Lean* concept
Complex processes	Simple and easily detectable processes
Improvements are made on the basis of financial statements	Improvements are made on the basis of process observation
Improvements are made by accelerating value-added activities	Improvements are made by reducing non-value-added activities
Push business system	*Pull* business system
Serial flows	Flows in the company occur one by one – simultaneously
Control as inspection	Control as prevention
Managers answer questions about process improvement	Managers ask questions to employees to improve processes

Source: Womack. & Jones, 2003; Schimann & Brewton, 2009.

The traditional business concept applied to complex and demanding processes. Complex business processes caused a number of business problems, and control in mass production conditions was greatly hampered. Traditional business concept focused on providing benefits to equity holders. However, such an orientation in terms of applying *lean* business concept is unacceptable. Traditional business concept was designed for mass production conditions and worked in such conditions for many years. However, numerous changes both in and outside the company have led to traditional business concept becoming inadequate for application in a dynamic and highly competitive business environment. Business processes in companies that apply *lean* business concept are documented and easy to see. These business processes are easier to manage and control. When business processes are easy to see, management is considerably easier too. *Lean* business concept shortens lead time, so improving business processes can be done by eliminating non-value-added processes and activities (Womack & Jones, 1994). Such efforts result in *lean* processes, which ensure high-quality products for customers at low prices, just in time and without keeping inventory. *Pull* system replaced serial flows, thus creating the basis for the implementation of controls for the purpose of preventive action, rather than inspection.

Lean concept includes philosophy, culture, and business principles embedded in employee behavior, which ensures elimination of all forms of waste and obstacles in material and information flows, in order to improve business processes and deliver value required by customers. In this sense, *lean* business concept focuses on education and

training of employees, on the one hand, and on providing the highest value for customers, on the other. *Lean* business concept aims to satisfy the needs of customers and achieve the strategic goals of the company through efficient execution of business processes.

Lean concept focuses on daily incremental improvements. The advocates of *lean* concept believe that it is better to improve company operations immediately by 10%, rather than wait for the moment when operations can be improved by 100%. Waiting for the moment when business can be fully improved takes time, while market conditions are ruthlessly changing, so the company can be late with its response to demand and thus lose battle with the competition.

2. BALANCED SCORECARD –A PERFORMANCE MEASUREMENT SYSTEM WITHIN *LEAN* BUSINESS CONCEPT

Balanced Scorecard was first used by Robert Kaplan and David Norton at Harvard Business School in the early nineteen-nineties. The basic idea was to create a new performance measurement system for organizations. Combining financial and non-financial performance measures in one report, Balanced Scorecard enabled managers to get more relevant information about the activities that are performed in the company that they manage. The authors emphasized that managers needed new management tools in conditions in which knowledge and information were power. Balanced Scorecard is based on cause-effect relationship between everyday activities in the business process and strategic goals, to verify whether the company is on the right path to achieve the defined strategy.

The initial goal of Balanced Scorecard was to help managers in implementing a long-term strategy and facilitate company performance management. However, later it became a widely accepted business language in modern business conditions, contributing to better strategy implementation. By setting a system of balanced performance measures, Balanced Scorecard facilitates the implementation of company strategy, provides an effective and efficient system of performance measures, allows for successful communication of managers with employees and external stakeholders, and determines the framework for management activities.

In addition to the above, Balanced Scorecard objectives also include: translating the company strategy into a coherent set of performance measures to control the targeted achievements (Garengo & Biazzo, 2013), providing information to manage the process of value creation, securing long-term and short-term financial and non-financial performance measures, harmonizing company systems and subsystems and providing for the measurement of the impact of organizational structure elements on the overall company operations (Garengo & Biazzo, 2012).

Balanced Scorecard is an understandable framework that contains the following perspectives and tries to answer the following questions (Janjić, 2006):

a) Financial perspective – how do stakeholders see us?
b) Customer perspective – how should we appear before customers?
c) Internal process perspective – what do we need to achieve?
d) Learning and growth perspective – can we continually improve and create value?

a) Financial perspective of performance measurement defines long-term business goals of the company. This perspective focuses on shareholders, and all other measures

are causally related and result in improved financial indicators. This is because financial indicators such as income growth, cost reduction, productivity growth, risk reduction provide the necessary links that permeate all other perspectives. The main task within this area is to provide return on shareholders' investment (Vasiljevic et al., 2014). In addition to this measure, revenue and profit growth, rise in market share, cash flow and the like can be monitored.

A good information base for measuring improvement within a financial perspective is value stream costing. Value stream costing provides relevant, accurate and understandable cost information that will help managers make business decisions and effectively carry out their activities. The basic characteristics of Value stream costing are that it is (Baggaley & Maskell, 2003, p. 26):

- Focused on Value stream,
- Simple and easy to use,
- Focused on measuring Value stream performance,
- Oriented to eliminate the calculation and allocation of overhead costs, and
- Clear and understandable to all company employees.

The simplicity of Value stream costing arises from the fact that detailed data on actual company costs is not used to calculate costs. Costs are calculated at the Value stream level at the end of each week. Value stream costing is easy, simple, and understandable to most company employees, not just accountants. Data on Value stream costs presented in reports correspond to actual costs incurred in a particular week. Thus, when broken down and presented for a shorter period, costs allow for increasing the quality of financial information from the aspect of timeliness, which leads to faster decision-making (for more on value strem costing see Antić & Novićević (2013).

b) In the past, companies mostly concentrated on their internal potentials, such as product performance and technological innovation. Today, in changed business conditions, they have to shift their focus to external, i.e. customer orientation. It is clear that if a company wants to do business in the long run, it has to create products and services that have value for customers.

The focus of this perspective is on analyzing different types of customers, their level of satisfaction, and processes of distributing products and services to customers. In this regard, the heart of performance measurement within the customer perspective would be (Kaplan & Norton, 1996, p. 67):

- Market share,
- Customer retention
- Customer acquisition,
- Customer satisfaction and
- Customer profitability.

Regardless of how these areas look generic for all company types, they have to be tailored to target groups of customers, which the future company growth and business depend on.

Market share shows how much the company is penetrating the desired market. The company can achieve significant sales growth on the market that it did not designate as the target, without increasing sales on the target market. Thus, measuring the market share with target customers will send financial signals on the strategy necessary for achieving the desired results.

Customer retention along with customer acquisition allows for the discovery of customer needs. Customer satisfaction measurement gives feedback on how well the company works. However, the importance of customer satisfaction should not be overemphasized. In fact, achieving a certain level of satisfaction is not sufficient to achieve a satisfactory level of customer loyalty and profitability. Only when customers determine their purchase as complete and absolutely satisfactory can the company count again on purchase by those customers.

Value for customers is an attribute that companies provide through their products and services, to ensure loyalty and satisfaction in the target market segment. Identifying value for customers is key to understanding the way to achieve satisfaction, retain old and acquire new customers, and achieve market share. Although the value varies from customer to customer in different market segments, certain attributes occur with all customers, classified into attributes of products and services, customer relationships, and image and reputation. Product/service attributes show the functionality of products and services, their price and quality. The image and reputation that the company has with customers allow the company to define its importance for its customers. Customer relationship is a very important category for the success of products and services. It includes the delivery of products to customers, which includes both delivery time and how customers experience purchase.

Through the customer perspective, Balanced Scorecard highlights the value that is delivered to customers, which implies that the product or service has all the required qualities. As value is one of the key principles of *lean* business concept, it is clear that this performance measurement system is suitable for use in a modern business environment.

c) Internal process perspective refers to the identification of critical internal processes that must take place in a company. Critical internal processes enable the company to create value for customers in target market segments and to meet all stakeholder expectations regarding financial results. Measures in this perspective must focus on internal processes that have the greatest impact on customer satisfaction and the achievement of financial goals of companies.

Within this perspective, the company is most often considering the following issues (Novićević et al., 2006):

- How good is the company's business?
- Do the products and services offered meet customer expectations?
- What are the critical processes for achieving both customer and stakeholder satisfaction?
- What activities should a company perform?
- What activities should it retain in the future?
- What are the internal processes that a company needs to improve if it does not achieve its goals?

Performance measures in this perspective can be: production time, quality criteria, time to market, and the like (Pimentel & Major, 2014). In order to successfully achieve defined performance measures within this perspective, companies should apply one of the *lean* business concept techniques – value stream mapping. Value stream mapping is the starting point for the formation of an uninterrupted flow through all the processes in the company. Value stream map represents a picture of all the processes performed in the company, from the supply of raw materials to the delivery of the finished product to customers or the provision of services. Value stream map helps company managers (Rother & Shook, 2003, p. 4):

- Perceive the flow, not just one part of the process,
- See not only losses, but sources of losses in the Value stream,
- Build a generally understandable language about the production process,
- Bring *lean* business concept and techniques in line,
- Provide the basics for building an implementation plan,
- Establish links between flows of information and materials,
- Present a qualitative tool that shows in detail how to organize a business to form a flow, and
- Provide means of communication, business planning and business process management.

Technically, Value stream mapping is nothing but drawing material and information flow with a pen on paper. It involves monitoring product flow from suppliers to customers. At the beginning, Value stream mapping is a very difficult and demanding task. However, once a map of all processes is drawn, i.e. a map of material and information flows, it is easy to see how customer value is created, as well as the places where there are losses and non-value-added activities. It should be taken into consideration that the map represents the flow of the product through the organization rather than the map of the entire organization.

Value stream mapping process takes place in four phases: preparation for mapping, mapping the present state, mapping the future state, and planning and implementation. Value stream mapping involves multidisciplinary teams, which separately show processes that add value and processes that do not add value. The number of processes in the Value stream map depends on the size and complexity of the company. Created in this way, Value stream map guides managers towards necessary process improvement and helps them focus on specific goals. After identifying the Value stream map, *lean* concept techniques are applied to improve the process. These techniques range from those aimed at reducing the set-up to those that reduce space to perform certain processes.

d) The last but not least is learning and growth perspective. It refers to the creation of an infrastructure in which the organization will be able to create value in the long run. This perspective identifies factors necessary for the present and future success of the company.

The main sources of organizational learning and growth are: people, system, and organizational procedures. The other three perspectives of Balanced Scorecard clearly show the big gap between the capabilities of people, systems, and processes, and what is required to achieve the goals. In order to eliminate this gap, companies must invest in employee education, improve the information and technology system, and harmonize procedures and organizational routines. These goals are crucial within the learning and growth perspective.

In order to create a company that operates according to *lean* business principles, it is necessary to create an organization that learns at three levels (Chiarini et al., 2016, p. 67). These levels include the individual level, the function (group) level, and the company level.

Individual learning is considered a starting point for all other learning. This learning is determined by preferences, interests, and abilities of individuals. When establishing a *lean* company, particular attention should be paid to the needs of individuals and their motivation to learn and make progress. In that sense, if an individual sees a *lean* company as the reason to eliminate the need for their work, it will be very difficult to have motivation for further learning. Focusing the company organization on Value stream indicates the existence of redundant workers and effort spent in company processes. For the success of a *lean* company, it is important that employees be fully committed to

Value stream to which they are assigned. Traditional organization of business by departments must be replaced with teams with a clear focus, to ensure smooth flow without limitations and delays.

The next learning level is the group or function level in a company. Employees with relevant knowledge are associated with the corresponding function in the company. However, the functions in the company are much more than a set of knowledge. A request for new knowledge implies a lot of time and effort to get that knowledge. Within functions, training of employees with a lower degree of professional skills is carried out, with a search for new knowledge that will improve business processes. In this way, the learning organization will be created. The focus on establishing a Value stream exceeds the need to organize a company by functions. In this sense, company division into functions must be overcome by the establishment of multifunctional teams that will lead to close cooperation within the company (Womack & Jones, 1994).

Learning at the organization level refers to all those activities that encourage the application of organizational rules, routines, and business policies. In that sense, learning at the organization level refers to the process of institutionalization and the construction of a new organizational structure (Tortorella et al., 2015).

The success in forming a *lean* company will depend directly on the ability of managers to synchronize all levels of learning and the needs of individuals participating in it. Establishing a Value stream is the best way to satisfy all these needs. By forming a *lean* company, it is possible to market products more quickly, increase sales, and develop a more efficient strategy.

Lean company is a flexible and innovative organization. It involves directing all parts of the company into one Value stream to increase productivity, improve quality and operational excellence by eliminating unnecessary resource spending. The organization of business around the Value stream is important because value streams established in a *lean* company represent new business profit centers (Katko, 2014, p. 14). The company requires fundamental changes in business organization to be accessible for all forms of cooperation. Traditional focus on narrow organizational parts and business processes in which knowledge, skills and ideas are jealously guarded must be replaced by a new way of doing business. The basic difference between narrow organizational parts and business processes, on the one hand, and value streams, on the other hand, is precisely in the fact that value streams generate revenue.

3. Application of BSC in Telecommunication Companies

Literature abounds in practical examples of the BSC implementation process, generally suited to large companies. Commercial application can be too expensive or too difficult for small and medium businesses, so free and publicly available software is a good way to start developing a performance measurement system in them.

In small and medium-sized businesses, vision and strategy are not always rigorously documented, organizational culture and management culture are different in relation to large companies, it is difficult to retain competent staff with resources seriously limited, and the current status is highly dependent on aspirations, goals, and experiences of owners or managers. Selection and implementation of a competitive strategy is at the heart of entrepreneurs' activities, but strategic management is still a non-conscious process. Most small and medium-sized businesses operate with poor forecasting and

planning systems and are vulnerable to business failures mainly due to poor risk management, inadequate decision-making, and implicit strategic planning.

During 2000 and 2001, the so-called "SAKE" system was established, a publicly funded project in Finland, where three pilot companies took part in designing their performance measurement systems. The goal of the project was to create a simple instrument for measuring performance adequate for small and medium businesses, which will help them build their own system of measures without the assistance of external consultants. The required system characteristics are specified and programmed in the Basic programming language, and up to now over 300 companies have downloaded software from the Internet or purchased a compact disk.

The case study, which will be in focus in the following segments, is based on the ongoing development project in "Telekolmio Oy", a Finnish medium-sized company in the telecommunications services sector. "Telekolmio Oy" has divided its business into four departments: mobile and information technology, voice systems, data processing, and data security services. The company employs 104 workers and had a turnover of 16,500,000 euros in 2002. Prior to this project, it did not have a developed performance measurement system. Although the development of mobile and internet technology posed high challenges to the company, management accounting was carried out in an old way. The company needed a system that would measure the achievement of operational goals derived from strategic ones, so the first task was to accept a performance measurement system in the data security department, which would serve as a pilot project (Tenhunen et al., 2004).

The process of designing a new performance measurement system, illustrated in Figure 1, begins by defining the existing basic and accompanying processes and activities. An important starting point for designing a new system is to identify the connection between the processes themselves. Key management, sales, material management, production design and marketing staff are in charge of defining and describing the connection between the processes.

The next step is to define the vision and strategic goals of the company. Based on a ***vision***, defined as "*to be a market leader in its field*", the following strategic ***values*** are identified: *customer trust*, *team work*, *entrepreneurial personality*, and *profitable business*.

When visualizing the company ***strategy*** and explaining its purpose, determining the type of action or event that will lead to the desired goal, determining the causality between different performance dimensions, and eliminating unnecessary or overlapping performance measures, significant help comes from a success map, which indicates the causal relationships leading to successful business. The essence of the success map is that the quality of processes depends largely on employee skills and innovation, customer satisfaction is conditioned by process quality, and financial performance is a logical consequence of customer satisfaction. "Telekolmio Oy" has formulated and developed *functional strategies*, in order to increase business efficiency of both an organizational data security department, and company as a whole. By developing special skills, i.e. the core of competence in the data security department, managers can increase the competence of the entire company.

Respecting the vision, values, and strategy, ***key success factors*** have been identified, and grouped into four perspectives: financial perspective, customer perspective, process perspective, and learning and innovation perspective (Nejatian & Zarei, 2013). Consequently, key success factors are related to: *profitable business and focus on core actions, customer interface management and comprehensive customer-related project management, professional telephone line management and continuous improvement, development of interactions, technological knowledge, and innovation*.

In line with strategic values and key success factors, ***strategic goals*** are set. Long-term goals are determined at company level, and then for each department within the organizational structure. Within the financial perspective, goals of concentration on profitable customers and areas, *profit growth*, and *profitable growth* are defined; customer perspective focuses on goals of *personal customer consulting* and *contracts with key customers*; process perspective focuses on *efficient and high-quality standards*, *efficient project management*, and *networking with local partners*; and learning and innovation perspective involves *focusing on core competences* and *demanding applications*.

For the purpose of achieving strategic goals, working groups are formed and an ***action plan*** created. The plan determines the global goals of profitability, continuous improvement, and innovation, and consists of *documented management for all major projects, employee development planning, organization of co-operation between stakeholders*, and *introduction of innovation*.

Finally, the company chooses ***dimensions and performance measures***. Finance, customer, internal process, and learning and innovation dimensions have been selected. The first version of the developed system of measures for the pilot department has a total of 13 measures. In the future, it will be interesting to examine whether it is possible to expand the measurement system in the value chain backwards, which will mean networking with subcontractors and their measurement or evaluation in terms of monitoring the impact on the company performance.

The selected balanced package consists of both operational and strategic performance measures, on the basis of which strategic and operational controls are carried out. The system of measures corresponding to a formulated and developed strategy and key success factors includes *profit*, *financing costs*, *return on equity and borrowed capital*, *ratio of timely services*, *market share ratio*, *ratio of sales increase*, *customer satisfaction*, *ratio of profitable activities and high-quality processes*, *inventory turnover ratio*, *staff training time*, and *development of professional skills and core competences*.

An integral part of the project is the development of a performance measurement manual that contains the form for each measure, frequency of measurement, goal value, range and purpose of a particular measure. The manual also contains explanation of the sources of information on measurement and weight factors in the system. In other words, the manual provides detailed information about the designed performance measurement system.

After the completed manual, training sessions covering the business philosophy of the company and the relationship between strategic goals and the necessary activities are carried out. In the context of training, it is a real challenge to acquire complete staff for the implementation of new ways of thinking and everyday activities.

The initial idea is that the performance measurement system needs to be developed, implemented, and tested in the data security department, after which it needs to be extended to other departments at the company level. After the development of the pilot system, the company has decided to build systems for other departments as well as for the company as a whole.

The design of the performance measurement system lasted for about three months. During that time, there was full commitment to its design, development, and implementation, as well as the adequate allocation of necessary resources to the development team. The use of the finished "SAKE" application further accelerated the process. The main causes for postponing system trial run were data availability and the necessity of changing the attitudes of all employees in order to initiate comprehensive measurement.

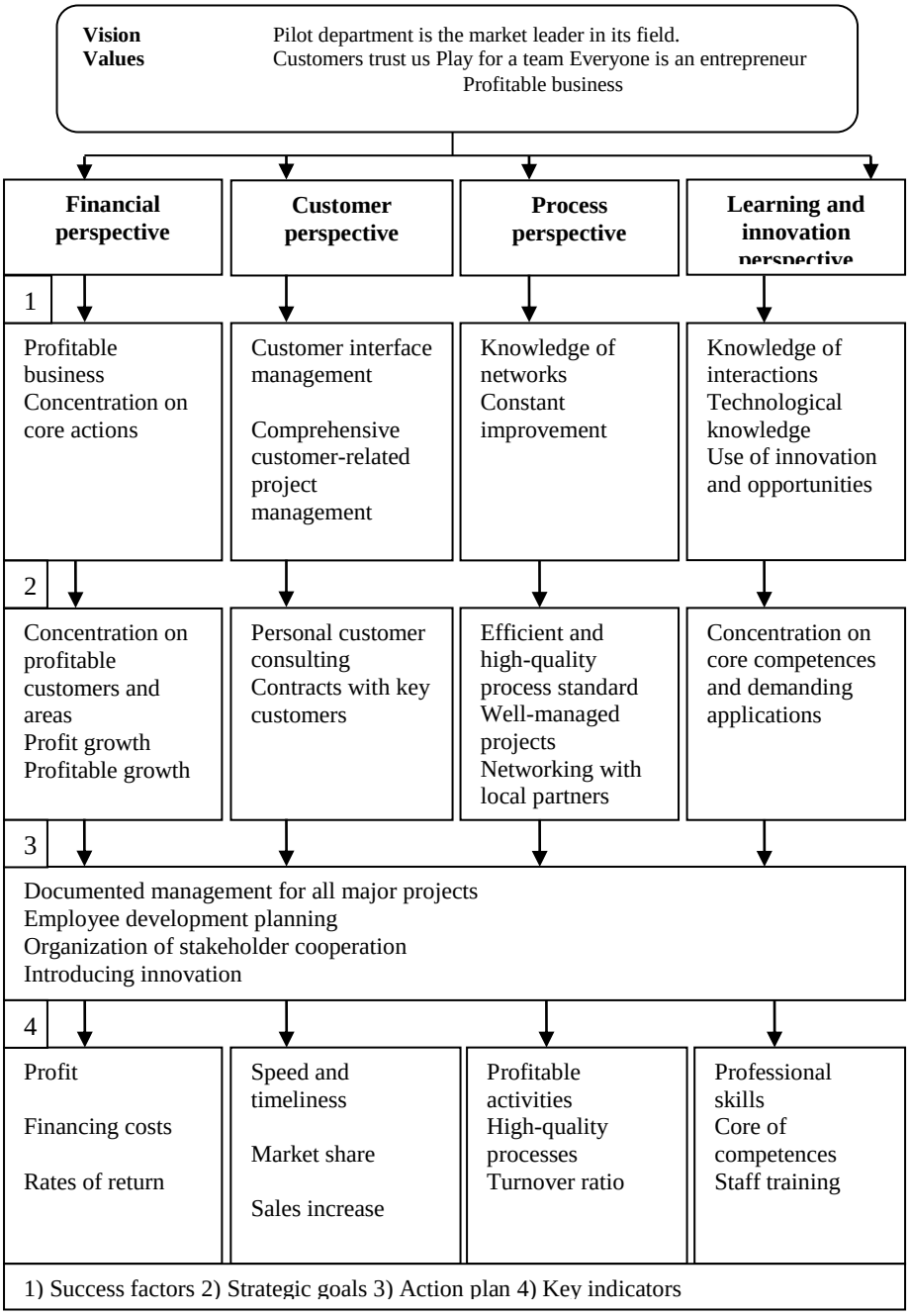

Fig. 1 Target plan of the "Telekolmio Oy" pilot department
Source: Tenhunen et al., 2004

CONCLUSION

Going through several development stages, Balanced Scorecard has become a performance measurement system that translates the company strategy into concrete actions and performance measures through four balanced interrelated perspectives: financial perspective, customer perspective, internal process perspective, and learning and growth perspective. The goal of Balanced Scorecard implementation is to achieve the highest possible functionality and relevance of strategic goals. Each of the Balanced Scorecard perspectives is closely related to *lean* business concept principles, so this system is indispensable for measuring the performance of modern companies.

Emphasizing the importance of shareholders, financial perspective defines long-term goals of the company. In order to obtain adequate data for measuring the financial success of a company, *lean* concept proposes the application of value stream costing. This cost accounting system helps managers clearly identify the information they need to make business decisions and plan further operations. This is because the purpose of value stream costing is to provide simple, clear and timely information.

Identifying value is an essential feature of *lean* business concept. The value is determined by the customer, as the end-user of this value. The value delivered to customers will determine the success of the company itself. External value determination, as a premise of a modern business environment, is also present in the Balanced Scorecard application.

Internal process perspective is closely related to customer satisfaction and the achievement of financial goals. In this sense, *lean* business concept requires the consideration of all business processes, identification of obstacles and shortcomings, and elimination of all unnecessary spending. For these purposes, it is necessary to apply a value stream map. Multidisciplinary teams are involved in Value stream mapping, separately presenting processes that add value and processes that do not add value. Value stream map guides managers towards necessary process improvement and helps them focus on specific goals.

Learning and growth are important aspects in modern companies, and, as such, they are included in the *lean* business concept and Balanced Scorecard. In this sense, it is necessary to create an organization that can permanently produce value for customers, adapting to their different requirements. The success of a company will depend directly on the ability of managers to use their knowledge and skills to bring employees in line with the company goals and to constantly strive for their own improvement.

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BALANCED SCORECARD I *LEAN* KONCEPT POSLOVANJA

Promene savremenog poslovnog ambijenta nužno izazivaju potrebu da se stalno traga za novim konceptima poslovanja, načinima upravljanja i sistemima mera performansi. Poslednjih decenija veoma aktuelan za primenu u preduzećima jeste lean koncept poslovanja. Ovaj koncept podrazumeva i u prvi plan ističe kreiranje vrednosti za potrošače. Pod vrednošću se podrazumeva isporuka proizvoda i usluga koji poseduju sve zahtevane karakteristike od strane potrošača u što kraćem vremenskom periodu i po što nižoj ceni. Kako je osnovni zadatak preduzeća da zadovolji različite potrebe, razumljivo je što od uspešnosti zadovoljavanja potreba potrošača zavisi i uspešnost samog preduzeća. Rezultati istraživanja pokazuju da se Balanced Scorecard može primeniti u preduzećima koja primenjuju osnovne lean principe. Ovo iz razloga što prvenstveno uvažava vrednost koja se isporučuje potrošačima, a na osnovnu te vrednosti formira i mere performansi u okviru predviđenih perspektiva. Takođe, važan aspekt Balanced Scorecard odnosi se na interne procese i učenje i rast, o čemu lean koncept posebno brine.

Ključne reči: *Balanced Scorecard, Lean koncept, mere performansi*

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Review Paper

HARMONIZATION OF ACCOUNTING REGULATIONS IN THE EUROPEAN UNION WITH SPECIAL REFERENCE TO THE EU CENTRAL AND EASTERN EUROPEAN COUNTRIES

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Abstract. *The emergence and development of a unified European market imposes a need for harmonization of financial reporting of business entites in the European Union. Directives and Regulations are the basic instruments for harmonization of national regulatory frameworks with aquaris, on the one hand, and for hamozication of accounting practices among member countries, as well as those which are claiming membership, on the other. According to the model of financial reporting, the countries of Central and Eastern Europe belong or belonged to the mixed economy model. Our country belongs to the same model. In this paper, we will describe the reaches of certain Central and Eastern Europe economies in harmonization of financial reporting in relation to the current regulations of the European Union. Using comparative analysis, we will point out the essential features of the regulatory frameworks of certain national economises. Positive experiences of these countries in the development of accounting regulations could be applied in our country*.

Key words: *financial reporting, harmonization, Central and Eastern Europe, international accounting regulations*

JEL Classification: M40, M41

INTRODUCTION

The countries of Central and Eastern Europe, during the transition period, carried out socio-economic reforms in order to achieve economic prosperity and higher living standards. The more dynamic economic development of troubled transitional economies

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was conditioned by the attraction of foreign capital. The liberalization of economic flows and the establishment of markets in these countries caused the reform of the accounting systems. In the area of financial reporting, the reforms were concerned with the development of existing regulations and practices in accordance with internationally accepted ones. This was done in order to raise the quality of financial statements in terms of relevance, comparability, and transparency of financial information for foreign users. The higher quality of financial reports had a positive influence on the general level of confidence in the financial system of these countries, and therefore, on their competitiveness and appeal for attracting foreign direct and portfolio investments. Most of these countries have been, or continue to be strategically oriented towards European integration. Because of that, the implemented reforms in the legal and accounting systems of these countries are based on the acquis communautaire of the European Union. With regard to the other members of the Union, the countries of Central and Eastern Europe differ in terms of socio-economic origin, historical evolution, and the achieved level of development. In the continuation of this paper, we will look at the peculiarities of the accounting systems of individual Member States and candidates, as well as the scopes of harmonization of accounting regulations in relation to the current legal framework of the European Union.

1. HARMONIZATION OF THE ACCOUNTING REGULATIONS OF THE ANALYZED COUNTRIES OF CENTRAL AND EASTERN EUROPE WITH THE REGULATORY FRAMEWORK OF THE EUROPEAN UNION

The accounting systems of individual countries are determined by the economic and political environment, the legal and tax system, professional practice and education. Depending on the key features reflected in: the dominant sources of financing, accounting culture, the legal system, the tax system, the financial reporting objectives, the primary users of the financial statements, the accounting principles, the volume of disclosures, etc., national accounting systems had been usually classified in two large groups before accepting of IFRSs in most countries of the World:

- Continental European Accounting System (Germany, France, Greece, Belgium, Switzerland);
- British-American Accounting System (United Kingdom, Netherlands, Ireland).

The model of mixed economy stood out in Europe during the last decade of the 20th century. This model was characteristic of countries that had implemented transition reforms and had switched to the market economy, which was formally acknowledged by the accession to the European Union. Also, this model is characteristic of those countries that are still in this process, most of which are striving to join the EU.

The European Union law was the basis for the transformation of accounting in most Central and Eastern European countries that transposed the requirements of European directives into their national frameworks and accepted the application of the IAS/IFRS for certain categories of entities, during the transition period. The legacies of pre-communist and communist systems, together with national culture and the needs conditioned by global trends, have influenced the development of accounting practices of these countries. The process of the accounting reform was determined and motivated by: political, economic and social conditions and changes; the need of transition economies to attract foreign direct investment; harmonization of internal accounting principles with relevant European directives and the IAS/IFRS framework (MacLullic & Gurău, 2004).

Transition economies have multiple benefits from the harmonization of financial reporting. The harmonization and application of international regulations makes financial statements understandable to foreign investors and creditors. This reduces the information asymmetry and portfolio risk, and avoids the additional costs associated with the conversion of financial information due to differences in applied accounting standards. However, the process of harmonization is conditioned by certain problems, such as the level of development of these economies, the accounting tradition, the strength of the accounting profession, etc.

In order to assess the achieved level of harmonization of six selected countries with the harmonized framework for financial reporting in the European Union, we will analyze their national accounting regulatory frameworks. The Table 1 provides a chronological overview of the most significant events in the development of the accounting legislation of Poland, the Czech Republic, Slovakia, Hungary, Romania and Bulgaria.

During the transition period, the countries of Central and Eastern Europe included the requirements of the Fourth, Seventh and Eighth Directive of the European Union in their normative acts. The reason for this was that most countries have become members, or were seeking EU membership, that is, the candidate status. Reforms in the accounting system were first implemented by Poland, the Czech Republic, Slovakia and Hungary, followed by Romania and Bulgaria. For those countries, the harmonization of the national law with European law resulted in their accession to the EU in 2004 and in 2007.

2. Compliance of National Accounting Regulations of the Analyzed Countries of Central and Eastern Europe with Current EU Regulations

The European Union, by means of regulations and directives as the most important instruments, seeks to harmonize accounting regulations, and achieve a higher level of comparability of financial statements of entities in the Member States. These acts differ from the point of view of the obligation, and the way they are applied in certain national economies. European Union regulations have the force of law in the community, which means that they are binding for the members, so there is no need to directly engage in individual national frameworks. The Directives do not have the force of law, but the Member States are the ones who decide on how to adopt and integrate these regulations into their regulatory framework. The most important acts that constitute the accounting regulatory framework in the European Union are:

- Directive 2013/34/ EU;
- Directive 2014/95/EU;
- Directive 2006/43/EU;
- Directive 2014/56/EU;
- Regulation 1606/2002/EC.

In all observed countries, the Accounting Act is the basic act that regulates financial reporting. Whereas, in Romania and Slovakia, the line ministries have developed regulations that further define the area of financial reporting, as well as the application of national and international standards. The latest amendments to national legislations and national standards adopted by professional organizations or relevant state authorities relate to the transposition of Directive 2013/34/EU and Directive 2014/95/EU. So, in the continuation of the paper, we will review the harmonization of national accounting systems of these countries with the requirements of European law regarding the most important issues.

Table 1 Chronology of the development of the accounting legislation of the observed countries in relation to the European Union

Country	Name of the act	The most important events for regulatory development and harmonization with the European framework and IFRS
Poland	Accounting Act	1994 - transposing the provisions of Forth and Seventh Directives 2000 - partial inclusion of IAS 2004 - adoption of a request of Regulation 1606/2002/EC 2008 - transposing the provisions of Forth, Seventh and Eighth Directives, as well as Directive 86/635/ EEC and Directive 91/674/ EEC 2013 - partial transposing provisions of Directive 2013/34/ EU 2016/2017 - transposing provisions of Directive 2013/34/ EU, Directive 2014/56/ EU, Directive 2014/95/ EU
The Czech Republic	Accounting Act	1993 - transposing the provisions of Forth and Seventh Directives 2003 - transposing the provisions of Forth, Seventh and Eight Directives and adoption of Regulation 1606/2002/ EC 2010 - precise application of IAS/IFRS 2015/2016 - transposing the provisions of Directive 2013/34/ EU 2017 - transposing the provisions of Directive 2013/34/ EU and Directive 2014/95/EU
Slovakia	Accounting act Decree	2002 - transposing the provisions of Forth, Seventh, Eighth Directive and adoption of IAS/IFRS 2005 - application of Regulation 1606/2002/ EC 2014 -transposing the provisions of Directive 2013/34/ EU 2016 - transposing the provisions of Directive 2013/34 /EU and Directive 2014/95/EU
Hungary	Accounting Act	1991 - partial transposing provisions of Forth Directive 2000 - transposing provisions of Forth, Seventh and Eighth Directive 2015 - transposing profisions of Directive 2013/34 EU
Romania	Accounting Act Orders of the Ministry of Public Finance	1991 - partial transposing provisions of Forth and Seventh Directive and adoption IAS 1999 - adoption of Order of Ministry of Public Finance No.403 on the application of Romanian's GAAP that are in line with Forth Directive and IAS 2001 - adoption of Order of Ministry of Public Finance No.94 on transposition of provisions of Fourth Directive and the mandatory application of IAS for the prescribed entities 2012 - adoption of Order of Ministry of Public Finance No. 881 on expanding the scope of mandatory application IAS/IFRS 2014 - adoption of Order of Ministry of Public Finance No 1802 transposing of provisions Directive 2013/34 EU 2016 - adoption of Order of Ministry of Public Finance No 1938 transposing of provisions Directive 2014/95 EU
Bulgaria	Accounting Act	1991 - changed form and content of financial statements 2001 - transposing of provisions of Forth, Seventh and Eight Directives and application of IAS 2007 - harmonization of Law and national standards with IFRS 2015 - transposing of provisions Directive 2013/34 EU and Directive 2014/95/ EU

Source: Adapted from information on the accounting systems of analyzed countries published through websites of national professional organizations, IFRS Foundation and scientific papers and professional publications

In the European Union, over the period of thirty years, the regulation of financial reporting has been based on the Fourth (Directive 78/660/EEC) and the Seventh (Directive 83/349/EEC) Directive. During this period, the Directives were amended several times, but were not subjected to a detailed revision. However, new disclosure requirements and new valuation rules, primarily in the field of accounting at fair value, burdened the existing regulations, making the Directives become too extensive. Another problem related to the application of these standards was the large number of options and the difficult comparison of the financial statements of different countries. The regulations became burdensome and complex, which was particularly evident in the case of small and medium-sized enterprises, as it was stated in a 2008 release, the essence of which is described as "Think Small First". Considering that over 99% of European companies belong to the category of small and medium-sized enterprises, a need for a regulatory reform in the field of accounting has arisen. The reform needs to be in accordance with the Small and Medium-sized Enterprise (SME) Development Strategy 2020. This strategy aims to achieve a sustainable and inclusive economy, with the improvement of sources of financing for this sector. This resulted in the adoption of the New Accounting Directive (Directive 2013/34/EU) on 26 June 2013. The changes in EU regulations are motivated by the creation of an incentive environment for the development of the small and medium-sized business sector, which implies the reduction of the administrative burden and the costs of financial reporting. With the new reclassification of the entities, it is expected that more than 90% of the entities will be classified into a micro group, that is, over 99% in the group of small and medium-sized entities. This will enable them to use simplified procedures in financial reporting.

The Directive seeks to fully harmonize financial reporting for small and micro entities. This is achieved through the reduction of options and necessary disclosures for the real and fair presentation of the operations of these entities, while taking into account the needs of users in individual national economies. The members can set additional requirements for medium and large entities. The result of such regulation is greater compliance at the lowest level, and also at the highest level, to which IFRS applies.

The following table shows the criteria for classification of the entities according to the New Accounting Directive and the national accounting criteria of the analyzed countries. Entities belong to a particular category if two of the three stipulated criteria for the current and previous reporting year are met.

It can be perceived that the members of the European Union partially harmonized the criteria for the classification of entities, primarily for micro and small enterprises. Apart from the Czech Republic, Romania and Bulgaria, the remaining members do not have the category of medium-sized entities (Gláserová et al., 2017). Because of that, the thresholds of criteria for large companies are lower than those prescribed by the directive. This undermines the European legislator's intentions regarding the facilitations for SMEs.

Also, differences in the requirements for the preparation of consolidated financial statements in relation to the New Accounting Directive can be noticed. The New Accounting Directive sets out the criteria for classification of entity groups into small, medium and large ones. Small entity groups are exempted from preparing consolidated financial statements, unless there are entities of public interest in the group. The Czech Republic, Slovakia, and Bulgaria have fully harmonized their criteria for the classification of entity groups, as well as the conditions for the exemption with the ones prescribed by the Directive. Meanwhile, Hungary, with the new legal amendment, raised the thresholds for preparing consolidated financial statements to all entity groups that

Table 2 Comparative overview of the criteria for the classification of entities according to the regulations of the analyzed countries and the requirements of Directive 2013/34/EU

	Directive 2013/34 EU	Poland	The Czech Republic	Slovakia	Hungary	Romania	Bulgaria
				Micro			
Total Assets in EUR	< 350,000	< 351,799	< 333,025	< 350,000	< 316,416	< 338,310	< 357,404
Net Sales in EUR	< 700,000	< 703,598	< 666,050	< 700,000	< 632,951	< 676,620	< 715,808
Average number of Employees	< 10	< 10	< 10	< 10	< 10	< 10	< 10
				Small			
Total Assets in EUR	< 4,000,000	< 3,987,054	< 3,700,278	< 4,000,000	< 3,797,709	< 3,963,953	< 4,090,335
Net Sales in EUR	< 8,000,000	< 7,974,108	< 7,400,555	< 8,000,000	< 7,595,417	< 7,893,906	< 8,180,670
Average number of Employees	< 50	< 50	< 50	< 50	< 50	< 50	< 50
				Medium			
Total Assets in EUR	< 20,000,000	-	< 18,501,388	-	-	< 3,963,953	< 319.429,092
Net Sales in EUR	< 40,000,000	-	< 37,002,775	-	-	< 7,893,906	< 338,585,183
Average number of Employees	< 250	-	< 250	-	-	< 50	< 250
				Large			
Total Assets in EUR	> 20,000,000	> 3,987,054	> 18,501,388	> 40,000,000	> 3,797,709	> 3,963,953	> 19.429. 092
Net Sales in EUR	> 40,000,000	> 7,974,108	> 37,002,775	> 80,000,000	> 7,595,417	> 7,893,906	> 38,585,183
Average number of Employees	> 250	> 50	> 250	> 50	> 50	> 50	> 250

Source: Adapted from information on the accounting systems of analyzed countries published through websites of national professional organizations, IFRS Foundation and scientific papers and professional publications

exceed two of the three stipulated criteria: total assets EUR 20,000,000, net sales revenue EUR 40,000,000 and average employment 250. This is narrower than what the European law is prescribing (Changes to the Accounting Act on Accounting related to the EU directive, 2015) Similar to Hungary, Romania envisages the preparation of consolidated financial statements for large groups of entities that exceed two of the three criteria: total assets EUR 23,681,717, net sales revenue EUR 47,363,435 and average employment 250 (Perrin et al., 2015). According to the Polish Accounting Act, the obligation to prepare consolidated financial statements exists in two cases:

a) Groups which, in the preceding and current financial years, did not exceed at least two of three of the following thresholds before intragroup eliminations: annual average employment 250, total assets of all group entities EUR 9,162,662; total sales and financial income of all group entities EUR 18,329,755;
b) Groups which, in the preceding and current financial years, did not exceed at least two of three of the following thresholds after intragroup eliminations: annual average employment 250, total assets of all group entities EUR 7,636,827; total sales and

financial income of all group entities EUR 15,273,536. (Doing Business in Poland Accounting and Auditing, 2016).

Member States have transposed the provisions of the Directive 2013/34/EU into their national frameworks, but there are still some differences between them. Differences are conditioned by the method of integrating the requirements of the Directive, but also by the fact that Regulation 1606/2002/EC on the area of the Union has established a financial reporting system based on two reporting bases, IFRSs and national standards. By comparing the requirements of national accounting frameworks of individual analyzed countries and Directive 2013/34/EU, it can be concluded that there are some differences in terms of the prescribed forms and scope of financial reporting. Poland, Romania, and Bulgaria partially provide a reduced amount of information for small and micro entities. However, the intention to reduce the size of the administrative burden for SMEs has not been fully achieved, as the systems of Poland, Slovakia and Hungary do not recognize the category of medium-sized entities. In addition, in Hungary, small entities have an obligation to prepare cash flow statements, while for a specific category of small entities, the preparation of business reports is also required. The Czech Republic, Romania and Bulgaria are expanding the mandatory set of financial statements with the cash flow statements and the statements of changes in equity. In Poland, the Czech Republic, Slovakia and Hungary, the entities are obliged to prepare the Business Report, that is, the Management Report. Whereas, in Romania, Poland, and Slovakia, the obligation to prepare reports on payments to state authorities, has been introduced. In general, Poland, the Czech Republic, Hungary, Slovakia, Romania, and Bulgaria have introduced the obligation to prepare additional reports stipulated by the Directive, while retaining the forms envisaged by IFRS, apart from Slovakia.

In the last three years, the European Union and the Member States have been actively trying to resolve corporate and non-financial reporting issues, in order to define a framework that would provide more responsible and transparent reporting on socially responsible behavior of the entities. In order to increase the transparency and comparability of non-financial information on entities' operations, the European Union, through the New Accounting Directive, introduced the obligation to disclose information on the business model, politics, risks and key performances related to environmental, social, and employment issues, including the protection of human rights, corruption and fraud for individual entity categories. With the adoption of the amendment, that is, the Directive 2014/95/EU, the obligation to prepare a non-financial report for all companies employing over five hundred employees, or whose asset value exceeds EUR 20 million, with a net income greater than EUR 40 million, was imposed. Entities that do not meet the required criteria present the aforementioned information as part of the Business report. Meanwhile, Member States may exclude small and medium entities from the obligation to publish this information. Directive 2014/95 was supposed to contribute to standardization in the preparation and presentation of the corporate social responsibility reports, which could potentially have a positive impact on their coexistence and comparability (Thomas & Maguire, 2014)

In that sense, Member States were obliged to transpose Directive 2014/95/EU into their national law by the end of 2016, which will come into force in 2018. All the analyzed states have fulfilled this requirement.

However, the specifics of national regulations in the field of financial reporting stem from the flexibility and inconsistency of the Directive itself, as well as certain differences

in the transposition of requirements. This will cause differences in accounting practices between individual countries. Namely, there are differences in the scope of application, given that the analyzed countries define differently large entities, as well as entities of public interest, and therefore, non-financial reporting entities. In all analyzed countries, with the exception of Romania, the characteristics and content of the non-financial reporting is identical to the requirements of Directive 2014/95/EU. Also, in all the analyzed Member States, non-financial information is presented in the Business Report or in a separate report, with the exception of Hungary, which does not require the preparation of an independent report. Although in the analyzed countries there is compliance regarding the characteristics, content and form of non-financial reporting, the Directive itself is flexible in relation to materiality of non-financial reporting, which allows for a different interpretation of this term. In addition, the Directive permits the application of various national, international and European reporting frameworks (EMAS, GRI standards, OECD guidelines, ISO standards), which is characteristic of the analyzed countries. The only exceptions are Slovakia and Bulgaria, where the former relies on international and European regulations, whereas the latter applies the act prescribed by the Ministry of Finance (Knežević, et al., 2017). The possibility of applying different frameworks, principles and initiatives in individual countries jeopardizes the coexistence and comparability of the presented information on sustainable development. In the area of the non-financial report auditing, the analyzed countries in accordance with the Directive, require verification that the non-financial report is delivered as part of the annual account, while Bulgaria also prescribes a review of its content. This approach to the regulation of reporting on sustainable development in the Union, and therefore in the analyzed countries, adversely affects the relevance and credibility of the information contained in the non-financial reports of the entities.

3. APPLICATION OF IFRS IN THE ANALYZED COUNTRIES OF CENTRAL AND EASTERN EUROPE

The strengthening of the European Union was reflected in the tendency to raise the competitiveness of the capital markets of European countries, and thereby, to reduce the domination that the US market had in the last decades of the previous century. It was precisely the development of the European single market that required the establishment of a regulatory framework for financial reporting. During the seventies and eighties, efforts were made to harmonize national accounting standards in the area of the community, but without any progress. The solution was offered in the form of developing a completely new set of standards, or accepting the IAS/IFRS. This was done by adopting Regulation 1606/2002/EC. This Regulation required the mandatory implementation of this set of accounting standards in the preparation of consolidated financial statements for entities whose securities were traded on organized markets in the Member States, with the possibility of expanding their application to other categories of entities, This Regulation required the mandatory implementation of this set of accounting standards in the preparation of consolidated financial statements for entities whose securities were traded on organized markets in the Member States, with the possibility of expanding their application to other categories of entities. The Regulation came into effect in 2005, while certain Member States had allowed the IAS/IFRS voluntary application even before this deadline.

According to ESMA (European Securities and Markets Authority) estimates, around 4,800 European quoted companies prepare their consolidated financial statements in

accordance with IFRS. Meanwhile, over 1,000 entities whose securities are traded on EU stock markets, prepare their individual financial statements, although, according to the European Regulations, they do not have the obligation to do so (Report on Enforcement and Regulatory Activities of Accounting Enforcers in 2014, 2014). In fact, in most Member States, the obligation to apply IFRS has been expanded.

In addition to harmonizing the national accounting frameworks with the current EU Directives, all analyzed countries, as Union members, have the obligation to apply IFRS in accordance with Regulation 1606/2002/EC. Also, the remaining countries have expanded the scope of the application of IFRS, while the implementation of national GAAP is prescribed for all other entities.

Since 2005, Poland has prescribed the mandatory application of IFRS for the preparation of consolidated financial statements of entities in the capital market. This also applies to financial institutions. On the other hand, for individual financial statements, this application is voluntary. Other entities apply the Polish Accounting Standard (PAR). This set of standards has been developed under the strong influence of IAS, but some discrepancies can be observed regarding the accounting treatment of fixed assets, property plant and equipment, non-current assets or disposal groups held for sale, inventory, capitalization of borrowing costs, etc. (Doing Business in Poland Accounting and Auditing, 2016).

The Czech Republic has extended the obligation to apply IFRS in the preparation of individual financial statements of entities whose securities are traded on regulated markets, while for other entities the application of this set of standards is permitted. Entities that do not apply international standards have the obligation to apply Decrees and Czech Accounting Standards. The Czech Republic national standards have been developed by the Ministry of Finance and contain descriptions of accounting methods and procedures that are regarded as the instruments for bookkeeping records. The Czech accounting system is rigid, with the accounting profession having a weak influence on it. Therefore, national standards cannot reflect the economic essence of transactions, as they are not developed under the influence of "best practice", which shows the differences in relation to IFRS. (Miková & Zárová, 2015).

Slovakia requires the preparation of financial statements in accordance with IFRS. The application of IFRS is required in the preparation of individual financial statements of public interest entities, as well as in the preparation of consolidated financial statements of entities that do not participate in the capital market. On the other hand, IFRS application is permitted for all quoted entities that are not considered to be subjects of public interest. Other entities apply Slovak GAAP. IFRS and Slovak GAAP are, to a significant extent, aligned with each other.

Hungary has expanded the scope of application of IFRS, allowing their usage in the preparation of consolidated financial statements of entities that are not participants in the capital market. The application of Hungarian Accounting Standards is mandatory in the preparation of individual financial statements. On the other hand, it is permissible to apply IFRS for the preparation of an additional set of financial statements next to a set prepared according to national standards. However, in Hungry, the application of IFRS is not deeply rooted, as there is not sufficient awareness of the significance of these standards for establishing business relationships.

Starting from 2012, Romania has expanded the obligation to apply IFRS to all entities whose securities are traded in capital markets, as well as to all credit institutions. IFRS

application is permitted in the preparation of consolidated financial statements of unquoted entities, as well as for other entities for which there is no obligation to apply Romanian Accounting Standards. National standards are developed on two levels, and are different in relation to IFRS and IFRS for SME. An extended set of standards are applied by SME that meet the prescribed criteria, while micro entities apply a simpler framework.

In Bulgaria, the obligation to apply IFRS has been extended to all entities of public interest, while other entities can decide between international and Bulgarian National Accounting Standards. The first version of the standards adopted in 2005, came into force in 2008, with the aim of aligning the financial reporting of small and medium-sized entities to the current European regulations, while avoiding the application of complex IFRS. In 2007, national standards were revised in order to achieve greater compliance with international standards. They are considered to be a shortened version of IFRS. (Basheva & Boyanov, 2015).

Based on the above, it can be noted that the observed countries of Central and Eastern Europe achieved a high degree of alignment in accounting regulations in the field of financial reporting for micro and small entities, by transposing the regulations of Directive 2013/34 EU. The higher level of compliance is also achieved in the field of reporting of large entities, by prescribing the application of IFRS. However, there are still some particularities of the national regulatory frameworks that are conditioned by:

- the differences in the classification of entities into individual categories, which affects the selection of the reporting base;
- the prescribed volume of financial reporting for individual entity categories;
- the prescribed scope of IFRS application;
- the specifics of national GAAP;
- the differences between national GAAP based on the New Accounting Directive that creates room for differences between standards of the analyzed countries, by providing different options, but also allows distinctions to exist in relation to IFRS (Obradović & Karapavlović, 2015).

In the area of non-financial reporting, the analyzed countries have mostly harmonized the regulations with the requirements of Directive 2014/95 EU. However, due to the flexibility of the Directive, the final outcomes of the application of national regulations regarding comparability and transparency of information on sustainable development have been brought into question (Stojanović-Blab et al., 2016, p. 1353).

CONCLUSION

In the last few years, the European Union has innovated accounting and financial reporting regulations in order to make this process more efficient for all entity categories. The new regulation should ensure less administrative burden and lower reporting costs for SME, with adequate information quality for the needs of the users. This is achieved by prescribing minimum requirements, while Member States can extend those requirements with national regulations. On the other hand, the new regulation should also enable greater transparency in reporting on corporate social responsibility and on payments to state authorities for large individual enterprises and entity groups. Furthermore, with the development of the Directives, the European legislator aimed to achieve greater compliance with IFRS. This has been achieved partly, as there are still differences between these two systems, primarily in the scope of reporting and the accounting treatment of particular issues.

Since the beginning of the 1990s to this day, Central and Eastern European countries have succeeded in building and establishing accounting systems to support their development in the market conditions of business. The harmonization of national accounting systems with international is inevitable, and the analyzed countries have achieved this, in the previous period, to a considerable extent. This process was also partially initiated with broader socio-political goals related to the membership status of these countries in the European Union. All the analyzed countries, harmonized national accounting and auditing regulations with the regulations of the European Union.

By establishing a regulatory framework, the European Union has achieved certain results in the harmonization of accounting and financial reporting in the Member States, primarily in the field of the application of basic accounting principles, valuation methods, and the form of financial statements. However, by analyzing the basic characteristics of the national regulations of the observed countries, certain specificities can be noticed. These specificities are the result of the differences in the transposition of European and international regulations. All of the analyzed members somewhat simplified their SME regulations in accordance with the New Accounting Directive. But the requirement to reduce the administrative burden for SMEs has not been fully honored, as there are no middle-sized entity categories in some countries. In addition, in almost all countries, the thresholds for mandatory audit are lower than those required by the Directive, which additionally burdens entities who, objectively, do not have the need to hire an independent auditor.

Regarding the applied reporting bases, all countries apply IFRS in accordance with Regulation 1606/2002 EC, while the scope of application of this set is extended to other entities. Because of that, it can be said that a higher level of harmonization has been achieved at the highest level of reporting. However, in all the analyzed countries, a national GAAP is applied for lower levels of reporting. The application of two systems of standards (national GAAP and IFRS), between which there are some differences, is also allowed for those levels of reporting. All of the above indicates that there are still differences caused by the specificities of certain national systems, but also by the specifics of the European Union law itself (flexibility, options, etc.), which negatively affects the comparability and transparency of financial statements in the region.

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HARMONIZACIJA RAČUNOVODSTVENE REGULATIVE NA PODRUČJU EVROPSKE UNIJE SA POSEBNIM OSVRTOM NA EU ZEMLJE CENTRALNE I ISTOČNE EVROPE

Nastanak i razvoj jedinstvenog evropskog tržišta nametnuo je potrebu usklađivanja finansijskog izveštavanja poslovnih subjekata na području Evropske Unije. Evropska Unija putem regulativa i direktiva, kao osnovnih instrumenata, podstiče harmonizaciju nacionalnih računovodstvenih okvira aquaris-om, s jedne, kao i harmonizaciju računovodstvenih praksi između pojedinih zemalja članica, odnosno, zemalja koje pretenduju na članstvo, s druge strane. Zemlje Centralne i Istočne Evrope pripadaju ili su pripadale prema modelu finansijskog izveštavanja tipu mešovite ekonomije, u koji spada i naša zemlja. U ovom radu, sagledaćemo domete određenih zemalja Centralne i Istočne Evrope u harmonizaciji finansijskog izveštavanja u odnosu na aktuelnu regulativu Evropske Unije. Komparativnom analizom ukazaćemo na opšte odlike regulatornih okvira pojedinih nacionalnih ekonomija, čija bi pozitivna iskustva mogla biti primenjena u razvoju računovodstvene regulative naše zemlje.

Ključne reči: *finansijsko izveštavanje, harmonizacija, Centralna i Istočna Evropa, međunarodna računovodstvena regulativa*

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Review Paper

MODELS OF DISTRIBUTION OF GDP AT THE GLOBAL LEVEL

UDC 658.86/.87(100)

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Abstract. *The problem of distribution has been drawing the attention of researchers for years. In their research they analyze the uniformity of distribution using Pareto model of distribution, the Lorenz curve and the Gini coefficient. Also some authors are testing the applicability of models from statistical physics to the problem of distribution to better describe it. In addition to the analysis of distribution at the level of states and certain groups such as the Forbes list, the problem is spreading to the global level, where we analyze the distribution of GDP as a measure of the wealth of individual countries.*
In this paper we analyzed the distribution of GDP of countries applying the Pareto model, Lorenz curve, Gini coefficient and Boltzmann Gibbs distribution from statistical physics. The analysis was done for 2015, while the Gini coefficient analysis was done during the period from 1990 to 2015.

Key words: *The distribution of wealth, GDP, Pareto distribution, Lorenz curve, Gini coefficient, Boltzmann Gibbs distribution*

JEL Classification: D31, R12, C46

INTRODUCTION

For macroeconomic policy holders, it is important to consider the distribution of wealth. One of the goals that every government wants to achieve is the satisfactory rate of economic growth and development. Besides a large number of indicators, according to Cvetanović (2005) the degree of uniformity of distribution of wealth occupies an important place.

One of the aspects of the impact of policy development is the emergence of imbalances. Economic development is characterized by a marked inequality in time, space and population

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terms. Poor distribution of wealth and income in an economy can have negative effects on economic growth and development. The research by the World Bank in 1996 in the case of East Asia confirms that countries with a more even distribution of wealth and income have higher rates of economic growth. In each East Asian economy that has achieved solid economic growth rates in the period between 1965 and 1990, the inequality in income distribution was reduced (Kitanović & Golubović, 2006, p 345).

The issue of distribution of wealth and money is topical today. A large number of authors studies the distribution of wealth and money using various models and types of distributions, of which Pareto is the most common. This model was successfully applied in the papers of Levy & Solomon (1997); Klass et al. (2006); Dunford et al. (2014).

Over time, new models are forming that aim to better describe the distribution of wealth as the polynomial model by Oltean & Kusmartsev (2014). Also models from statistical physics which describe the process of money creation, exchange and distribution of wealth are used. These models made from statistical physics are gas models without savings, savings and uneven savings. Based on the well-known laws of thermodynamics these models describe economic processes of distribution. Some of the authors who have dealt with the development of these models are Yakovenko V. (2008), Dragulescu (2002) and Chakrabarti & Chatterjee (2003).

As we have seen, economists and physicists are mainly engaged in the issue of distribution of money, wealth and income to the level of a particular community, such as a country's population. A small number of papers deals with the application of the model distribution of wealth at the global level, but where countries are taken as individual entities. This problem was dealt with by Dunford et al. (2014), and also by Skipper R. (2011). In their they have successfully applied the Pareto distribution model which showed that at the global level there is also uneven distribution of wealth, where GDP is taken as a measure of wealth of a particular country. Also in paper Dunford et al. (2014) analyzed whether Pareto's 80-20 rule applies, where it is determined that the rule applied in 1989, while in the later period it is not confirmed.

The aim of this paper is to analyze the changes in disparities in the distribution of GDP at the global level by using Gini coefficient and checking whether the Pareto's 80-20 rule applies or a new rule can be found to this type of distribution. In the second part of paper the goal is to see if Boltzmann Gibbs distribution can be applied for the analysis of distribution of GDP worldwide.

1. DISTRIBUTION MODELS

In economics Lorenz curve is often used to study the distribution of wealth, income or assets. This model was developed by Max Lorenz in 1905 to present the inequality of wealth distribution. In addition to this problem, this model is used to study the disparities in the size of plants in ecology and biodiversity studies.

Together with the Lorenz curve, the Gini coefficient is used. The Gini coefficient was developed by the Italian statistician Corrado Gini and published in his paper "Variability and mutability". Its value represents the percentage of the area between the line of perfect uniformity of distribution and the observed Lorenz curve in the area between the two extreme positions of the Lorenz curve. This indicator is now often used as a measure of inequality in the distribution. The value ranges between 0 and 1. Higher values for the Gini

coefficient indicates uneven distribution, while Gini = 1 means full uneven distribution (Cvetanović, 2005, p. 94-95). In order to get the true Pareto Principle "80-20", the value of the Gini coefficient should be around 0.76 (Dunford et al., 2014, p. 143).

Vilfredo Pareto discovered in 1879 that the high levels of wealth (but also income) distribution is done according to the law degree distribution. Distribution parameters can be changed from one society to another, but regardless of the social and political conditions Pareto found that the distribution of wealth respects the general law of distribution, which is known as Pareto's law. If N is the number of people who have the wealth (money) exceeds the amount x, and A and α are constants, then $N = A/x^{\alpha}$ respectively,

$$\log(N) = \log(A) - \alpha \log(x) \tag{1}$$

In other words, the amount of logarithmic number of people with wealth above a certain limit on the logarithmic graph is a straight line. The coefficient α is determined by the slope and the right and is called the Pareto exponent which determines the degree of uniformity of the distribution of resources in the observed population (Dunford Ret al., 2014, p. 141). General Pareto distribution is given by the following probability density function:

$$P(W) = cW^{-(1+\alpha)}, \text{ for } W \geq W_0 \text{ for } W \geq W_o \tag{2}$$

where W is a wealth, $P(W)$ is a function of density, W_o is the lower limit of the level of richness and C is a constant and α is known as the Pareto-exponent (Levy & Solomon, 1997, p. 90).

A number of researchers proved that the model is excellent with the empirical data (Class. et al., 2006), but with certain corrections of the model itself (Clementi & Gallegati, 2005, p. 3). In the last few years a lot of papers point out that Pareto model is not ideal for the description of the overall distribution of wealth, but describes perfectly only the lower part of distribution, i.e. the distribution between the richest of society (about 3 to 5%), while in the poorer part which relates to the problem of divergence, which is described by Boltzmann Gibbs distribution (Dragulescu, 2002, p. 10).

This model of distribution has an important use as an indicator of the degree of inequality in the society in the distribution of the fluctuations in the stock markets (Levy & Solomon, 1997, p. 90).

Pareto originally developed the model to describe the distribution of wealth among individuals, since it seemed that most of the wealth of the society is in the possession of a small number of the members of the same community. It is known as Pareto principle "80-20", which says that 20% of the population controls 80% of the wealth of the community. When the value of the Pareto exponent is equal to 1.16, this means that in the observed population there is the "80-20" principle (Dunford et al., 2014, p. 142).

Many authors confirmed that the probability distribution and the cumulative probability of agent-based models can be described by Boltzmann Gibbs distribution in physics. A fundamental law of equilibrium in statistical physics is the Boltzmann Gibbs law, which states that the probability of P(ε) in order to find the physical system or sub-system in a state of energy ε is determined by an exponential function:

$$P(\varepsilon) = ce^{-\frac{\varepsilon}{T}} \tag{3}$$

In the equation c is the constant of normalization, and T is a temperature which is equal to the average energy per particle. The probability value may range to 1. In order equations described function in the system must apply the law of the conservation of energy, i.e. that is the summation of the energy that each particle has the same total sum of energy of the system that is constant and that the probability of the particles having energy equal to the sum of energy of two particles is equal to the probability that the product particles have a particle from that particular energy.

Dragulescu and Yakovenko (2001) used Boltzmann Gibbs distribution to describe the distribution of money between agents:

$$P(m) = ce^{-\frac{m}{T}} \tag{4}$$

where m is the amount of money that each agent has, and T is the "money temperature" that is equal to the average value of money which each agent has (Yakovenko, 2010). Dragulescu and Yakovlenko (2001) have shown that this model can be applied to describe the distribution of money and income on the example of the US and the UK. Based on the performance of the distribution function, it is obtained that the normalization constant is equal to the reciprocal value of "money temperature".

For the purposes of this study we will use the Gini coefficient for the analysis of uneven distribution for the period 1990 - 2015, while we apply Pareto's model and Boltzmann Gibbs model for 2015.

2. ANALYSIS OF THE EXISTENCE OF PARETO PRINCIPLE AT THE GLOBAL LEVEL

In the analysis we used the statistical data for GDP from United Nations, and we looked at the value of GDP in US dollars. The reporting period was from 1990 to 2015 for which data are available. The sample consists of 208 countries that existed in 2015 and the analysis was done for those 208 countries. The analysis was performed in the program Gretl.

Based on the values gained from the analysis that are seen in Figure 1 we can see that the value of the Gini coefficient in the period from 1990 to 1994 is moving upwards, indicating the increase of disparities in the distribution worldwide. This is the period of the disintegration of the USSR, Czechoslovakia and Yugoslavia, which has changed completely the distribution of power at the global level and the period of domination of the West and the USA lasted until 2002 when the Gini coefficient reached its maximum value. After that period, the distribution of power changes, as among the world's economies Asian tigers country are emerging, Russia is recovering from the period of the USSR disintegration and China is becoming more powerful. Also this is the period when BRICS slowly strengthen on the world economic scene, which leads to a drop in the value of the Gini coefficient which reaches its minimum value in 2013.

Also since 2008, the economic crisis has contributed to increasing the uniformity of distribution, but the Gini coefficient rises again in the period after 2013. Figure 2 shows the Lorenz curve for 2015.

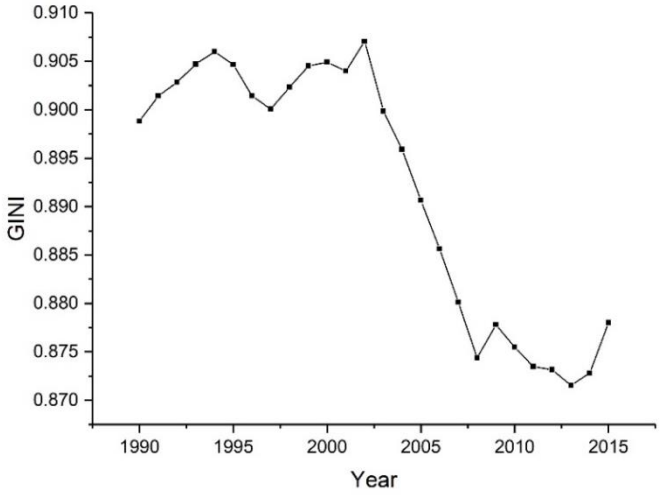

Fig. 1 Value of the Gini coefficient for the period 1990 - 2015
Source: Data processed by the author

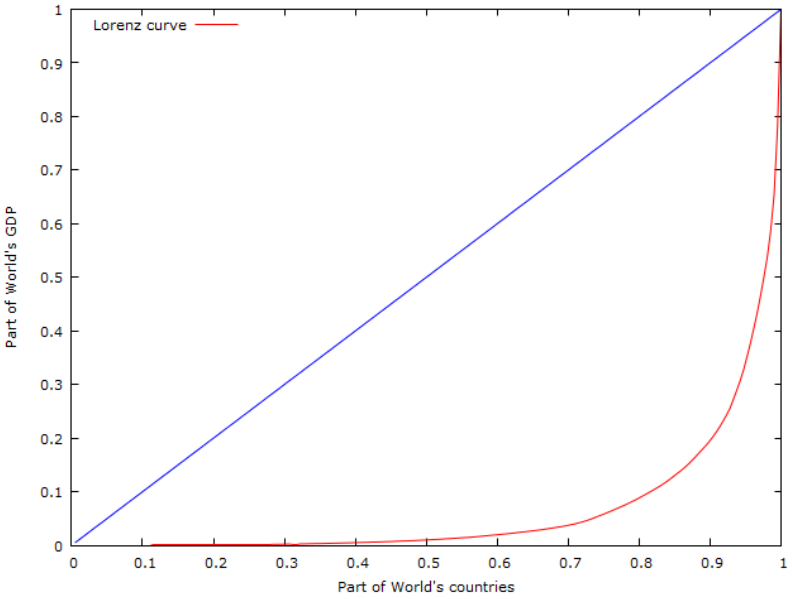

Fig. 2 Lorenz curve for 2015
Source: Data processed by the author

The value of the Gini coefficient shows a high degree of uneven distribution of the value of GDP at the global level, which is certainly caused by a number of factors: population, natural resources, the size of the territory, the technological development of the country, the structure of the economy, the education system and so on.

Based on the obtained value of the Gini coefficient when it comes to the distribution of GDP Pareto Principle does not apply because the Gini coefficient is much greater than the value necessary for the "80-20" rule, i.e. 0.76. It is better to say that for this distribution we can apply the "90-20" rule. This conclusion can be drawn from the values shown in Figure 3 which shows the relationship between the value of the richness of individual groups of countries.

Based on the values from Figure 3 in the initial period, the share of the richest 20% went up to nearly 95% of the total wealth, while in 2015 this amount was reduced to a little over 91%, which thus proves that when we talk about the distribution of GDP at the global level, the Pareto rule does not apply. Also it is important to note that here we took into account distribution between countries rather than among the population, as in all countries, there are small groups that are extremely wealthy compared to the rest, so for future research it would be interesting to try to determine whether the Pareto Principle applies in the distribution of wealth (income, money, etc.) at the level of individual countries or countries of the world.

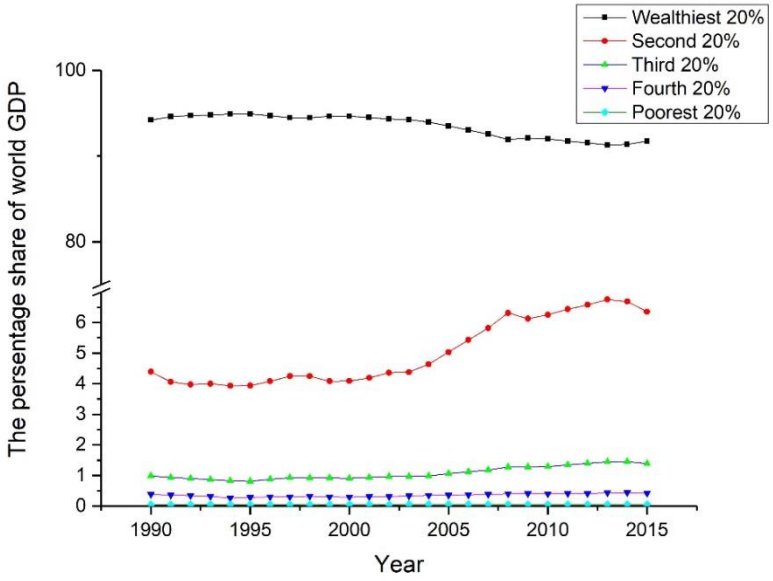

Fig. 3 Percent share in the global GDP per year
Source: Data processed by the author

3. Pareto and Boltzmann Gibbs Distribution of GDP at the Global Level

Testing the Pareto distribution will start by using the equation (1) where we will determine whether we can apply the Pareto distribution to determine the distribution of GDP of countries on the basis of their rank. The analysis was carried out in the Origin program and the results were as follows.

Based on the analysis in Origin and from Figure 4, we can see that the Pareto distribution function best describes the initial part of the distribution, i.e. distribution of GDP between the richest countries (the richest 42 countries, i.e. the richest 20%). This version of the Pareto distribution, Zipf's function can describe the distribution of wealth (GDP, money,...) only for the richest. The rest of the countries in the graph we see that it does not provide the best description of distribution, i.e. it is a country that ranked lower theoretical value different from the empirical value that is recorded. This finding was confirmed in the work of Skipper (2011) that this form of Pareto distribution can best describe just distribution of the world's richest countries. Also, many authors have tested the Pareto distribution and found that in the case of the distribution of wealth among individuals, the Pareto model is best to describe the 3-5% of the richest members of the population, while other models describe the rest of the mode of distribution, such as in the papers of Dragulescu and Yakovenko (2001).

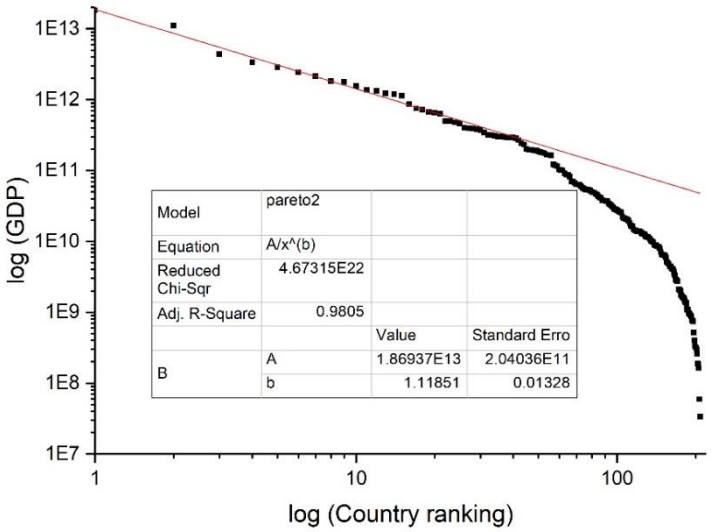

Fig. 4 Pareto distribution

Source: Data processed by the author

The following will apply the general Pareto distribution and Boltzmann Gibbs distribution to determine its applicability.

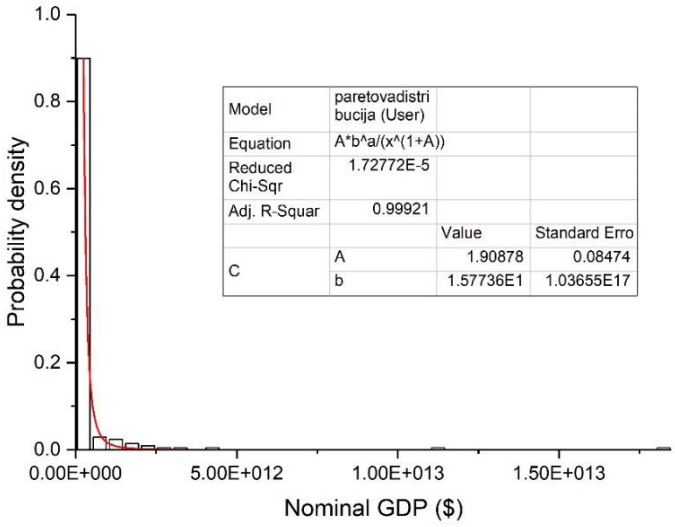

Fig. 5 Pareto distribution of nominal GDP
Source: Data processed by the author

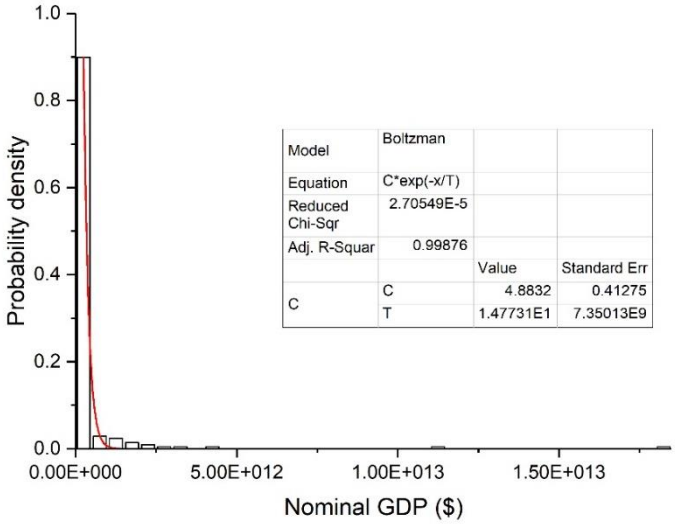

Fig. 6 Boltzmann Gibbs distribution of nominal GDP
Source: Data processed by the author

Based on Figure 5, we can see that the Pareto distribution describes well the distribution of GDP at world level. Our analysis took into account the 208 countries which are divided into groups depending on the value of their GDP. The coefficient of determination is very

high which shows that this model a 99.9% change in the value of the parameter described by this model. On the same data, we applied Boltzmann Gibbs model which is given by the equation (5) and the obtained results are shown in Figure 6. The Boltzmann Gibbs model describes well the distribution of GDP. The coefficient of determination in this case is somewhat lower than for the Pareto model.

We can conclude that both models describe well the distribution of world GDP countries. These models describe individual distribution made, not cumulative. Regarding the cumulative distribution, it is shown that the Pareto distribution model best describes the observed distribution of the richest part of the population, while the Boltzmann Gibbs model best describes the distribution of the rest. We will test the data for the distribution of world GDP which can be seen in Figure 7.

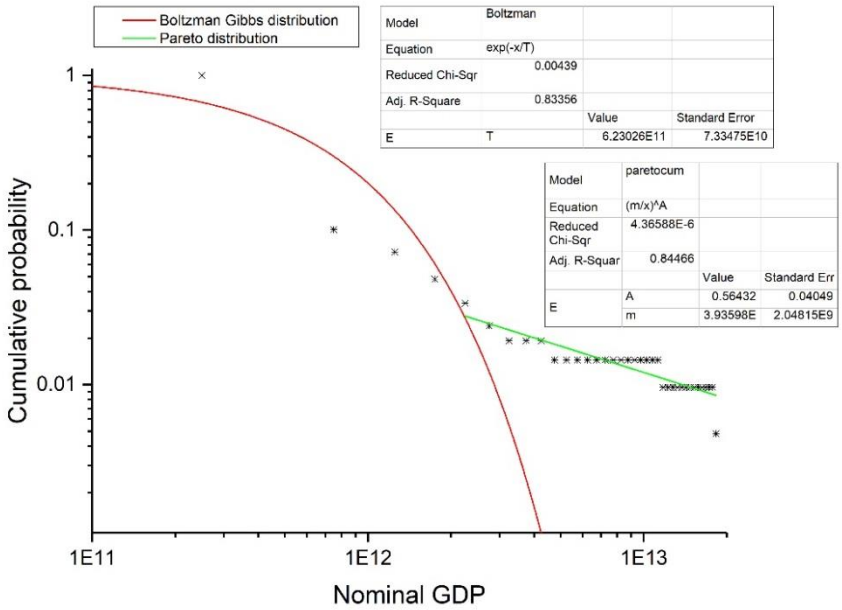

Fig. 7 The cumulative probability distribution
Source: Data processed by the author

Based on the analysis we can see that the combination of the Boltzmann and Gibbs and Pareto distribution perfectly describes the distribution of GDP at world level. We confirmed what Drăgulescu and Yakovenko (2001) stated in their work using this data. Specifically, the Pareto function describes the part that refers to the richest countries, while the poorest countries are best described by the Boltzmann Gibbs function. The information in the case of 208 countries are processed in groups of countries, depending on the value of the country's GDP. Based on the data we can conclude that the Pareto model perfectly describes the cumulative distribution relating to the distribution of wealth by 2.4% of the richest countries in the world, while the Boltzmann Gibbs distribution describes the distribution of the rest of the countries, which is another confirmation of the conclusions reached in the research by Dragulescu and Yakovenko (2001).

CONCLUSION

The problem of the distribution of money and wealth attracted the attention of many researchers. In addition to the Pareto model, which is most commonly used, there are other models that have been designed by econophysicists, like the Boltzmann Gibbs model from statistical physics.

In this paper we first analyzed the existence of Pareto's rule "80-20". We did not confirm the existence of this rule for the distribution of world GDP. In this paper we found that rule "90-20", i.e. 90% of the world GDP is created by 20% of the richest countries in the world (42 countries in total), exists and can be used as the Pareto rule when it comes to distribution of the world GDP. In future research, we can try to see if the new form of Pareto "80-20" exists, i.e. 80% of the world GDP is owned by 20 richest countries.

Secondly, in this paper we tested the Boltzmann Gibbs model of distribution to describe the distribution of GDP among countries worldwide. Using a sample of 208 countries, we found that the Boltzmann Gibbs distribution can be applied to describe the distribution of a number of the poorest countries, while the Pareto model can be applied to describe the distribution between the richest countries.

This finding confirms the research of Dragulescu and Yakovenko (2001) as well as other authors. They did theirs research on the examples of the problems of distribution of wealth among individuals. In a study in 2015, we showed that the Pareto distribution model describes the cumulative GDP of 2.4% of the world's countries, while the rest is described by the Boltzmann Gibbs distribution.

Further studies can test the application of other models, such as the Gamma function, to describe the distribution of GDP, as well as work on theoretical grounds for the applicability of the model to describe the distribution.

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MODELI DISTRIBUCIJE BDP NA SVETSKOM NIVOU

Problem distribucije okuplja pažnju istraživača godinama unazad. U svojim istraživanjima se bave analizom ravnomernosti raspodele primenom modela Paretove distribucije, Lorencove krive i Gini koeficijenta. Postoje i radovi gde se testiraju primenljivost modela iz statističke fizike kako bi se problem distribucije što bolje opisao. Pored analize distribucije na nivou država i određenih grupa poput Forbsove liste, problem se širi na svetski nivou gde se analizira distribucija BDPa kao mere bogatstva pojedinih zemalja.

U ovom radu analizirali smo distribuciju BDPa zemalja primenom Paretovog modela, Lorencove krive, Gini koeficijenta i Bolcman Gibsove raspodele iz statističke fizike. Izvršena je analiza za 2015. godinu, dok je na osnovu Gini koeficijenta izvršena analiza dinamike promene ravnomernosti distribucije u periodu od 1990. do 2015. godine.

Ključne reči: *Distribucija bogatstva, BDP, Paretova distribucija, Lorencova kriva, Gini koeficijent, Bolcman Gibsova raspodela*

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