Analysis of the Trade Performance of the European Union and Serbia on the Base of FF-WASPAS and WASPAS Methods

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Abstract

In this paper, based on a multicriteria analysis, the trade performance of selective countries of the European Union and Serbia is reviewed. In this paper, based on a multicriteria analysis, the trade performance of selective countries of the European Union and Serbia is reviewed.According to the results of the FF-WASPAS method, Germany's trade ranks first in terms of performance. They are followed by: France, Italy, Hungary, Greece, Croatia, Slovenia, Austria, Serbia, Bulgaria and Romania. Croatia's trade performance is better than Slovenia's. According to the results of the FF-WASPAS method, Serbia is in a worse position than Croatia and Slovenia.

According to the results of the classic WASPAS method, Germany's trade ranks first in terms of performance. Followed by: Italy, France, Greece, Romania, Bulgaria, Hungary, Austria, Serbia, Croatia and Slovenia. The leading countries of the European Union (Germany, France and Italy) are among the top five countries (along with Greece and Romania). Serbia is in a better position compared to Croatia and Slovenia.

Numerous factors influenced the performance positioning of trade between the European Union and Serbia: economic climate, foreign direct investments, asset management, new business models (multichannel sales, private label, sales of organic products), new concepts of cost, sales and profit management (cost calculation by activity, customer management, product category management, etc.), the Covid-19 pandemic, the energy crisis, etc. A key factor is the digitization of the entire business. The target profit can be achieved by adequately controlling them.

Keywords: *efficiency, costs, income, profit, trade, European Union, Serbia, determinants*

JEL classification: L81, M41
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1. Introduction

The issue of measuring and analyzing trade performance using various methods of multi-criteria decision-making is very challenging, continuously current, significant and complex. In this paper, starting from that, as a subject of research, a comparative analysis of the trade performance of selective countries of the European

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Union and Serbia is carried out based on SF-WASPAS and the classical WASPAS method. The aim and purpose of this is to investigate the given problem as complex as possible theoretically, methodologically and empirically in order to improve the performance of trade between the European Union and Serbia in the future by applying relevant measures.

There is an increasingly developed literature devoted to the problem of measuring and analyzing the performance of companies from all sectors, which means trade, using various methods of multi-criteria decision-making, including the SF-WASPAS and WASPAS methods. They are increasingly applied to trade when solving complex decision-making problems, in addition to classical financial analysis (Harangi-Rákos & Fenyves, 2021; Lucas & Ramires, 2022; Baicu et al., 2022; Marques et al., 2022; Maxim, 2021). Likewise, their application in the evaluation of trade performance and efficiency is increasing (Saaty, 2008; Ersoy, 2017; Gaur et al., 2020; Görçün et al., 2022; Lukic et al., 2020; Lukic & Hadrovic Zekovic, 2021, 2022; Lukic, 2022,2023). This is also the case with the use of FF-WASPAS and classic WASPAS methods for these purposes (Lukic et al., 2021).

Effective control of critical factors of business success (price, costs, quality, time, innovation) by applying multi-criteria analysis (FF-WASPAS and WASPAS methods) can influence the achievement of target business and financial performance and trade efficiency of the countries of the European Union and Serbia. The research of the treated problem in this work using multicriteria analysis is based on statistical data from Eurostat.

2. Methodology

Fermatean Fuzzy Sets (FFSs) are a good tool for more accurate and flexible management of uncertain information (Senapati & Yager, 2020). It can be successfully used in the decision-making process. Three components are used in defining FFSs. These are: degree of membership (α),degree of non-membership $(\beta)$and degree of indeterminacy (π).We will present some features and operators of FFSs.

Definition 1. *Suppose that X is a universe of discourse. Then the Fermatean fuzzy set can be $\tilde{\mathcal{R}}$ defined as follows:*

$$\tilde{\mathcal{R}} = \{\langle x, \alpha_{\mathcal{R}}(x), \beta_{\mathcal{R}}\rangle : x \in X\} \quad (1)$$

wherein $\alpha_{\mathcal{R}}(x): X \to [0,1], \beta_{\mathcal{R}}(x): X \to [0,1], and\ 0 \leq \left(\alpha_{\mathcal{R}}(x)\right)^3 + \left(\beta_{\mathcal{R}}(x)\right)^3 \leq 1.$ *In addition, the degree of uncertainty is* $\pi_{\mathcal{R}}(x) = \sqrt[3]{1 - \left(\alpha_{\mathcal{R}}(x)\right)^3 - \left(\beta_{\mathcal{R}}(x)\right)^3}$. *For convenience, we use* $\tilde{\mathcal{R}} = (\alpha_{\mathcal{R}}, \beta_{\mathcal{R}})$ *to represent FFS* (Senapati & Yager, 2019).

Definition 2. *Let be* $\tilde{\mathcal{R}} = (\alpha_R, \beta_R)$and $\tilde{S} = (\alpha_S, \beta_S)$*two Fermatean fuzzy sets i* λ *positive real number* $(\lambda \leq 0)$. *Then the following operators can be defined for FFSs* (Senapati & Yager, 2019a).

$$\tilde{\mathcal{R}} \oplus \tilde{S} = \left(\sqrt[3]{\alpha_{\mathcal{R}}^3 + \beta_S^3 - \alpha_{\mathcal{R}}^3 \alpha_S^3}, \beta_{\mathcal{R}} \beta_S \right) \quad (2)$$

$$\tilde{\mathcal{R}} \oplus \tilde{S} = \left(\alpha_{\mathcal{R}} \alpha_S, \sqrt[3]{\beta_{\mathcal{R}}^3 + \beta_S^3 - \beta_{\mathcal{R}}^3 \beta_S^3} \right) \quad (3)$$

$$\lambda . \tilde{\mathcal{R}} = \left(\sqrt[3]{1 - (1 - \alpha_{\mathcal{R}}^3)^{\lambda}}, \beta_{\mathcal{R}}^{\lambda} \right) \quad (4)$$

$$\tilde{\mathcal{R}}^{\lambda} = \left(\alpha_{\mathcal{R}}^{\lambda}, \sqrt[3]{1 - (1 - \beta_{\mathcal{R}}^3)^{\lambda}} \right) \quad (5)$$

Definition 3. *Suppose that* $\tilde{\mathcal{R}} = (\alpha_{\mathcal{R}}, \beta_{\mathcal{R}})$*FFS. The score* $\mathcal{T}$*function and accuracy function* $\mathcal{A}$*for FFS are defined as follows* (Senapati & Yager, 2019a)*:*

$$\mathcal{T}(\tilde{\mathcal{R}}) = \alpha_{\mathcal{R}}^3 - \beta_{\mathcal{R}}^3 \quad (6)$$

$$\mathcal{A}(\tilde{\mathcal{R}}) = \alpha_{\mathcal{R}}^3 + \beta_{\mathcal{R}}^3 \quad (7)$$

These functions are used to compare two FFSs, i.e. $\tilde{\mathcal{R}} = (\alpha_{\mathcal{R}}, \beta_{\mathcal{R}})$*and* $\tilde{S} = (\alpha_S, \beta_S)$*. They exist when different conditions are met* (Senapati & Yager, 2019a)*:*

1. $If\ \mathcal{T}(\tilde{\mathcal{R}}) < \mathcal{T}(\tilde{S}), then\ \tilde{\mathcal{R}} < \tilde{S};$
2. $If\ \mathcal{T}(\tilde{\mathcal{R}}) > \mathcal{T}(\tilde{S}), then\ \tilde{\mathcal{R}} > \tilde{S};$
3. $If\ \mathcal{T}(\tilde{\mathcal{R}}) = \mathcal{T}(\tilde{S}), then$
   - i. $f\ \mathcal{A}(\tilde{\mathcal{R}}) < \mathcal{A}(\tilde{S}), then\ \tilde{\mathcal{R}} < \tilde{S};$
   - ii. $If\ \mathcal{A}(\tilde{\mathcal{R}}) > \mathcal{A}(\tilde{S}), then\ \tilde{\mathcal{R}} > \tilde{S};$
   - iii. $If\ \mathcal{A}(\tilde{\mathcal{R}}) = \mathcal{A}(\tilde{S}), then\ \tilde{\mathcal{R}} = \tilde{S}.$

Definition 4. *Complement FFS* $\tilde{\mathcal{R}} = (\alpha_{\mathcal{R}}, \beta_{\mathcal{R}})$*is defined as follows* (Senapati & Yager, 2019a)*:*

$$Com(\tilde{\mathcal{R}}) = (\beta_{\mathcal{R}}, \alpha_{\mathcal{R}}) \quad (8)$$

Definition 5. *Let be a* $\tilde{\mathcal{R}}_i = (\alpha_{\mathcal{R}}, \beta_{\mathcal{R}})$ $(i = 1,2, \dots, n)$*set of n FFSs, and* $w = (w\_1, w\_2, \dots, w\_n)^T$*the corresponding weight vector for the* $\tilde{\mathcal{R}}_i = \sum_i w_i = 1$. *Fermatean fuzzy weighted average (FFWA) aggregate operator is defined based on the following equation (* Senapati & Yager, 2019b*):*

$$FFWA(\tilde{\mathcal{R}}_1, \tilde{\mathcal{R}}_2, \dots, \tilde{\mathcal{R}}_n) = \left(\sum_{i=1}^{n} w_i \alpha_{\mathcal{R}_i}, \sum_{i=1}^{n} w_i \beta_{\mathcal{R}_i} \right) \quad (9)$$

Definition 6. *In Definition 3, the function score FFS is defined. Let's assume that* $\tilde{\mathcal{R}} = (\alpha_{\mathcal{R}}, \beta_{\mathcal{R}})$*FFS. The value* $\mathcal{T}(\tilde{\mathcal{R}})$*can vary in the range from -1 to 1. According to this range, a positive score FFS function is defined which always gives a positive defuzzified value.*

$$\mathcal{T}^P(\tilde{X}_{ij}) = 1 + \mathcal{T}(\tilde{X}_{ij}) \quad (10)$$

WASPAS is a method of multi-criteria decision-making (MCDM) which is widely used for various decision-making problems. It is a combination of two popular multi-criteria decision-making methods: the **Weighted Sum Model (WSM)**, and the **Weighted Product Model (WPM)** (Zavadskas et al., 2012). In this paper, a new, more efficient method based on Fermatean fuzzy sets and the classic WASPAS method for decision making in an uncertain environment. The definitions and operators of Fermatean fuzzy sets are used in the extended WASPAS method. Let *n*, *m* and *p* denote the number of alternatives, the number of criteria and decision makers, respectively. The procedure of the extended **Fermatean Fuzzy WASPAS method** takes place through several steps.

Step 1: Forming a group of decision makers. In this step, experts are chosen to define the problem. They should have enough knowledge about the subject.

Step 2: Defining a set of alternatives. A group of decision makers should evaluate the problem and list possible and important alternatives for the evaluation process.

Step 3: Defining a set of evaluation criteria. Alternatives should be evaluated against some criteria. A group of decision makers should research and define the evaluation criteria. Criteria should be defined on the basis of data obtained on alternatives from already available existing studies of related topics.

Step 4: Defining the weight of each criterion (w_j). In this step, for example, the **SMART (Simple Multi-Attribute Rating Technique) method** (Zardari et al., 2014) can be used to determine the weight of the criteria. According to this method, the decision maker is asked to assign 10 points to the least important criterion, i.e. the important criteria. They should give an increasing number of points (up to 100) for other more important criteria. The sum of points of all criteria assigned by decision makers is calculated. By normalizing the sum of the points, the weighting coefficients of the criteria are determined.

Step 5: Defining linguistic terms and corresponding Fermatean fuzzy scopes. In this step, some linguistic terms such as "very low" and "very high" and their corresponding FFS should be defined by decision makers.

Step 6: Evaluation of alternatives. Linguistic terms defined in the previous step based on Fermatean fuzzy sets are used in the evaluation process. Here, the evaluation of the i -th alternative with respect to the j -th criterion by the k -th decision maker is symbolized by $\tilde{E}_{ijk} = \left(\alpha_{E_{ijk}}, \beta_{E_{ijk}}\right)$.

Step 7: Aggregating the evaluation of decision makers. In the previous section, the aggregation operator in equation (9) was defined. Using this equation and equal weights $\left(w_k = \frac{1}{p}\right)$, the evaluations given by each decision maker in step 6 are aggregated. Accordingly, the aggregated evaluations or elements of the decision matrix $\left(\tilde{X}_{ij} = \left(\alpha_{X_{ij}}, \beta_{X_{ij}}\right)\right)$are represented as follows:

$$\tilde{X}_{ij} = FFWA\left(\tilde{E}_{ij1}, \tilde{E}_{ij2}, \dots, \tilde{E}_{ijp}\right) = \left(\frac{1}{p}\sum_{k=1}^{p} \alpha_{E_{ijk}}, \frac{1}{p}\sum_{k=1}^{p} \beta_{E_{ijk}}\right) \quad (11)$$

Step 8: Normalization of the decision matrix. In the classic WASPAS method, the linear normalization method is used to normalize the decision matrix. When we use Fermatean fuzzy scopes, we deal with elements that range from 0 to 1. Therefore, the normalization method should not be used to change the value scale. However, if we have non-benefit (cost) criteria, we must make certain modifications. In this study, the concept of the complement of FFS is used to transform the values related to non-beneficial criteria. The complement is defined in equation (8). Let BC and NC be the sets of benefit and non-benefit criteria, respectively. The elements of the normalized decision matrix can be defined as follows:

$$\widetilde{N}_{ij} = \begin{cases} \tilde{X}_{ij} & if\ j \in BC \\ Com\left(\tilde{X}_{ij}\right) & if\ \in NC \end{cases} \quad (12)$$

Step 9: Calculating WSM and WPM measures. But based on the addition, multiplier and other operators of FFSs defined in the previous section (equation (2) to (5)), we can calculate measures related to WSM and WPM.

$$\tilde{Q}_i^S = \underset{j=1}{\overset{m}{\oplus}} \left(w_j \oplus \widetilde{N}_{ij}\right) \quad (13)$$

$$\tilde{Q}_i^P = \underset{j=1}{\overset{m}{\oplus}} \left(\widetilde{N}_{ij}^{w_j}\right) \quad (14)$$

Step 10: Calculating the WASPAS measure. The WASPAS measure is calculated by combining the WSM and WPM measures. It is necessary to define the combined parameter $\gamma$and its value in this step. In this calculation step, the following formula is used:

$$\tilde{Q}_i = \gamma \tilde{Q}_i^S \oplus (1-\gamma) \tilde{Q}_i^P \quad (15)$$

Step 11: Ranking alternatives based on positive values $\tilde{Q}_i$. Definition 6, presented in the previous section, is used to compare the values $\tilde{Q}_i$and rank the alternatives.

WASPAS (Weighted aggregates sum product assessment) was proposed by Zavadskas et al. (2012). It respects the unique combination of two well-known approaches of multi-criteria decision making (MCDM - Multi-Criteria Decision Making): the method of weighted sums (WS - Weighted Sum) and the method of weighted products (WP - Weighted Product). The WASPAS method is used to solve various complex problems in multi-criteria decision-making (for example, production decision-making) (Chakraborty & Zavadskas, 2014; Zavadskas, 2013a,b). An advanced fuzzy WASPAS method was developed for solving complex problems under uncertainty.

The procedure of the WASPAS method consists of the following steps (Urosevic, 2017):

Step 1. Determining the optimal performance rating for each criterion.

The optimal performance rating is calculated as follows:

$$x_{0j} = \begin{cases} \max\limits_i x_{ij}; & j \in \Omega_{max} \\ \min\limits_i x_{ij}; & j \in \Omega_{min} \end{cases}, \qquad (16)$$

where: x_{0j}denotes the optimal performance rating *of* that criterion, Ω_{max}denotes the benefit criterion (the higher the value, the better), Ω_{min}denotes the set of cost criteria (the lower the value, the better), *m* denotes the number of alternatives (*i*= 0,1,..., *m*), and *n* denotes the number of criteria (*j*= 0,1,..., *n*).

Step 2. Determination of the normalized decision matrix.

The normalized performance rating is calculated as follows:

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{x_{0j}}; & j \in \Omega_{max} \\ \dfrac{x_{0j}}{x_{ij}}; & j \in \Omega_{min} \end{cases}, \qquad (17)$$

where: r_{ij}denotes the normalized performance rating of the *i*- th alternative in relation to the *j* - th criterion.

Step 3. Calculation of the relative importance of the *i*- th alternative based on the WS method.

The relative importance of the *i*- th alternative, based on the WS method, is calculated as follows:

$$Q_i^{(1)} = \sum_{j=1}^{n} w_j r_{ij}, \qquad (18)$$

where: $Q_i^{(1)}$indicates the relative importance of the *i*- th alternative in relation to the *j* - th criterion, based on the WS method.

Step 4 . Calculation of the relative importance of the *i*- th alternative, based on the bzi WP method.

The relative importance of the alternative, based on the WP method, is calculated as follows:

$$Q_i^{(2)} = \prod_{j=1}^{n} r_{ij}^{w_j}\ , \qquad (19)$$

where: $Q_i^{(2)}$denotes the relative importance of the *i*- th alternative in relation to the *j* - th criterion, based on the WP method.

Step 5 . Calculating the overall relative importance for each alternative.

The total relative importance (common generalized criterion of weight aggregations of additive and multiplicative methods) (Zavadskas, 2012) is calculated as follows:

$$Q_i = \lambda Q_i^{(1)} + (1-\lambda) Q_i^{(2)} = \lambda \sum_{j=1}^{n} w_j r_{ij} + (1-\lambda) \prod_{j=1}^{n} r_{ij}^{w_j} \qquad (20)$$

wherein: λ coefficient i $\lambda \in [0, 1]$.

When decision-makers have no preference for the coefficient, the value is 0.5, and equation (5) is expressed as:

$$Q_i = 0.5 Q_i^{(1)} + 0.5 Q_i^{(2)} = 0.5 \sum_{j=1}^{n} w_j r_{ij} + 0.5 \prod_{j=1}^{n} r_{ij}^{w_j} \qquad (21)$$

3. Results and discussion

In the context of empirical research, an analysis of the trade performance of the European Union and Serbia will first be performed based on the FF-WASPAS method. Then, the trade performance of the European Union and Serbia will be analyzed using the classic WASPAS method.

The performance analysis of trade between the European Union and Serbia based on the **FF-WASPAS** method is based on the following criteria: C1 - Enterprises - number, C2 - Persons employed - number, C3 - Turnover or gross premiums written, C4 - Value added at factor cost and C5 - Personnel costs. They belong (according to Eurostat statistics) to the key performance indicators of trade because they fully reflect its character. Alternatives are selective countries of the European Union and Serbia: A1 - Bulgaria, A2 - Germany, A3 - Greece, A4 - France, A5 - Croatia, A6 - Italy, A7 - Hungary, A8 - Austria, A9 - Romania, A10 - Slovenia and A11 - Serbia. The selection of the European Union countries was made according to the criteria of the leading countries of the European Union and the countries surrounding Serbia. Table 1 shows the relevant initial data for 2020. (In this paper, all calculations and results are the authors.) Figure 1 shows the number of trading companies by observed countries of the European Union and Serbia. (All pictures are the author's). There are therefore significant differences in the number of trading companies between the observed countries of the European Union and Serbia, which is reflected in their performance. The situation is similar with other analyzed criteria.

Table 1. Initial data

	Wholesale and retail trade; repair of motor vehicles and motorcycles					
		Enterprises - number	**Persons employed - number**	**Turnover or gross premiums written - million euros**	**Value added at factor cost - million euros**	**Personnel costs - million euros**
		C1	**C2**	**C3**	**C4**	**C5**
A1	Bulgaria	138,125	498,112	67,379.3	7,350.6	3,352.4
A2	Germany	542,120	6,513,411	2,119,183.7	330,287.8	205,616.5
A3	Greece	221,763	747,649	106,976.0	12,734.2	8,471.1
A4	France	697,283	3,565,852	1,331,409.7	193,620.0	139,143.7
A5	Croatia	35,393	238,580	35,379.7	5,822.6	3,182.7
A6	Italy	1,043,209	3,357,013	945,227.6	132,334.7	70,509.9
A7	Hungary	137,046	575,367	104,756.1	12,739.3	6,462.6
A8	Austria	76,938	676,322	249,457.7	39,101.8	25,727.4
A9	Romania	174,754	889,711	128,164.3	19,613.7	8,392.9
A10	Slovenia	25,787	121,518	34,082.1	4,537.5	2,811.3
A11	Serbia	29,975	273,189	36,658.5	4,371.0	2,340.7

Source: Eurostat

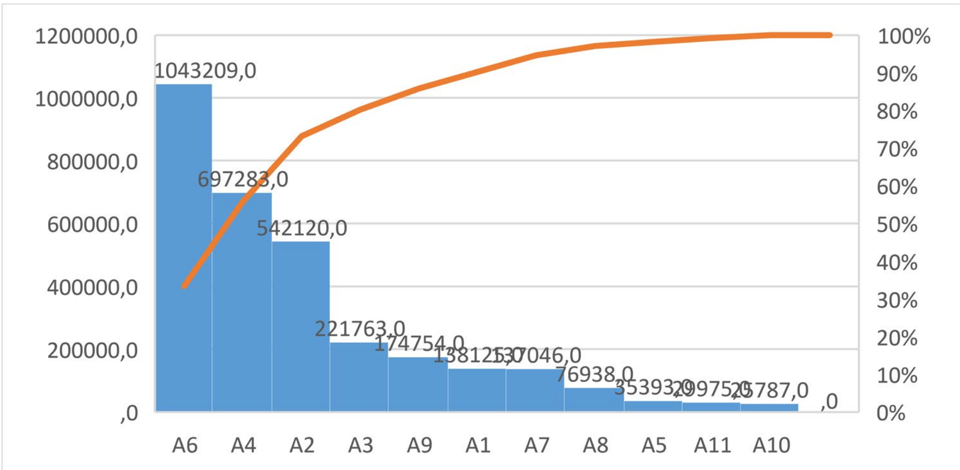

Figure 1. Number of trading companies by observed countries of the European Union and Serbia

Table 2 shows the descriptive statistics of the initial data. It shows that criterion C1 ranges from 25787.00 (Slovenia) to 1043209.00 (italy), criterion C2 ranges from 121518.00 (Slovenia) to 6513411.00 (Germany), criterion C3 ranges from 34082.10 (Slovenia) to 2119183.70 (Germany), criterion C4 ranges from 4371.00 (Serbia) to 330287.80 (Germany), and criterion C5 ranges from 2340.70 (Serbia) to 205616.50 (Germany). The average criteria is: C1 - 283853.9091, C2 - 1586974.9090, C3 - 468970.4273, C4 - 69319.3818 and C5 - 43273.7454. (Statistics in this paper are the author's).

Tabela 2. Descriptive statistics

Statistics						
		C1	C2	C3	C4	C5
N	Valid	11	11	11	11	11
	Missing	0	0	0	0	0
Mean		283853.9091	1586974.9090	468970.4273	69319.3818	43273.7454
Median		138125.0000	676322.0000	106976.0000	12739.3000	8392.9000
Std. Deviation		332925.32740	2030749.48700	696214.81930	106583.29630	68478.16286
Minimum		25787.00	121518.00	34082.10	4371.00	2340.70
Maximum		1043209.00	6513411.00	2119183.70	330287.80	205616.50

The correlation analysis of the initial data is presented in Table 3.

Table 3. Correlation

Correlations						
		C1	C2	C3	C4	C5
C1	Pearson Correlation	1	.755**	.730*	.699*	.675*
	Sig. (2-tailed)		.007	.011	.017	.023
	N	11	11	11	11	11
C2	Pearson Correlation	.755**	1	.991**	.990**	.974**
	Sig. (2-tailed)	.007		.000	.000	.000
	N	11	11	11	11	11
C3	Pearson Correlation	.730*	.991**	1	.999**	.994**
	Sig. (2-tailed)	.011	.000		.000	.000
	N	11	11	11	11	11
C4	Pearson Correlation	.699*	.990**	.999**	1	.995**
	Sig. (2-tailed)	.017	.000	.000		.000
	N	11	11	11	11	11
C5	Pearson Correlation	.675*	.974**	.994**	.995**	1
	Sig. (2-tailed)	.023	.000	.000	.000	
	N	11	11	11	11	11
**. Correlation is significant at the 0.01 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

Therefore, there is a strong correlation between the observed statistical variables at the level of statistical significance.

Table 4 shows the Friedman test.

Table 4. Friedman Test

NPar Tests	
Friedman Test	
Ranks	
	Mean Rank
C1	3.55
C2	5.00
C3	3.45
C4	2.00
C5	1.00

Test Statistics[a]	
N	11
Chi-Square	41.818
df	4
Asymp. Sig.	.000
a. Friedman Test	

In this case, it rejects the null hypothesis that there is no difference between the observed statistical variables. Namely, there is a significant difference between the observed statistical variables (Asymp. Sig. .000).

Table 5 shows the linguistic terms and FFSs.

Tables 5. The linguistic terms and FFSs

Linguistic Terms	**Abbreviation**	**Fermatean Fuzzy Number**	
		μ	**ν**
Very Very Low	VVL	0.10	0.90
Very Low	VL	0.10	0.75
Low	L	0.25	0.60
Medium Low	ML	0.40	0.50
Medium	M	0.50	0.40
Medium High	MH	0.60	0.30
High	H	0.70	0.20
Very High	VH	0.80	0.10
Very Very High	VVH	0.90	0.10

Table 6 shows the evaluation of the criteria and alternatives in relation to the criteria by the decision makers. Figure 2 shows the weight coefficients of the criteria.

Table 6. Evaluation of criteria and alternatives in relation to criteria by decision makers

KIND	Criteria	DM1	DM2	DM3	SUM	Wj
1	**C1**	100	100	100	300	**0.39**
1	**C2**	70	80	60	210	**0.28**
1	**C3**	50	20	40	110	**0.14**
1	**C4**	30	20	50	100	**0.13**
-1	**C5**	10	10	20	40	**0.05**
				Total Sum	**760**	**1**

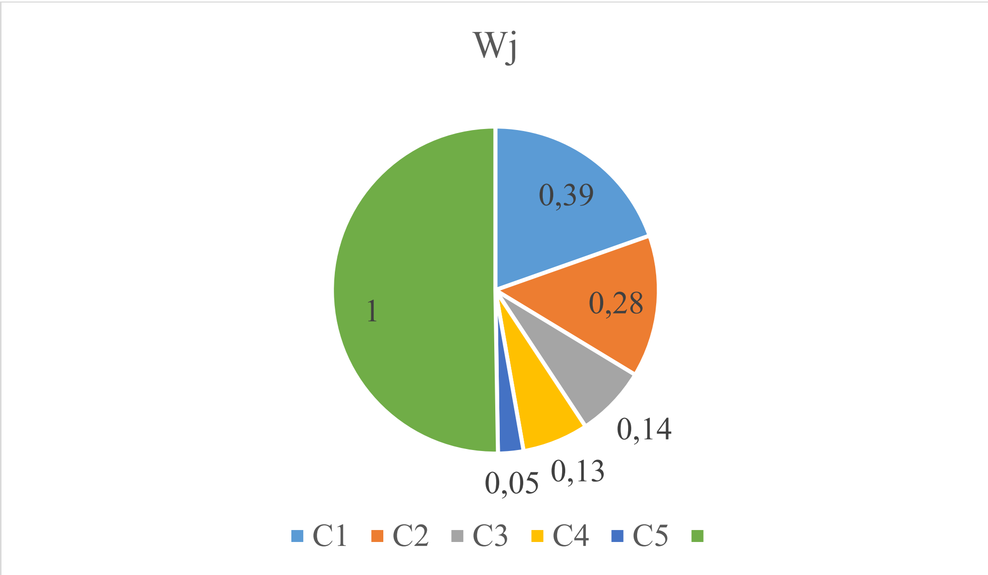

Figure 2. Weighting coefficients of criteria

The most important criteria is the number of companies. They are followed by: number of employees, sales, added value by factor costs and personnel costs. By effectively controlling the number of companies and employees, as well as sales, the target profit can be achieved.

Table 7 shows the initial aggregated matrix.

Table 7. Initial Aggregated Matrix

Initial Aggregated Matrix	0.39	0.39	0.28	0.28	0.14	0.14	0.13	0.13	0.05	0.05
	1	1	1	1	1	1	1	1	-1	-1
	C1		**C2**		**C3**		**C4**		**C5**	
A1	0.73	0.17	0.15	0.70	0.50	0.40	0.30	0.57	0.47	0.43
A2	0.90	0.10	0.90	0.10	0.90	0.10	0.90	0.10	0.90	0.10
A3	0.70	0.20	0.47	0.43	0.53	0.37	0.53	0.37	0.50	0.40
A4	0.80	0.10	0.80	0.10	0.80	0.10	0.80	0.10	0.80	0.10

Initial Aggregated Matrix	0.39	0.39	0.28	0.28	0.14	0.14	0.13	0.13	0.05	0.05
	1	1	1	1	1	1	1	1	-1	-1
	C1		**C2**		**C3**		**C4**		**C5**	
A5	0.63	0.27	0.60	0.30	0.57	0.33	0.50	0.40	0.70	0.20
A6	0.70	0.20	0.77	0.17	0.70	0.20	0.70	0.20	0.90	0.10
A7	0.25	0.62	0.87	0.10	0.53	0.37	0.80	0.10	0.70	0.20
A8	0.10	0.75	0.83	0.10	0.80	0.10	0.73	0.17	0.80	0.10
A9	0.28	0.58	0.47	0.43	0.83	0.13	0.50	0.40	0.43	0.47
A10	0.63	0.27	0.57	0.33	0.60	0.30	0.47	0.43	0.70	0.20
A11	0.57	0.33	0.53	0.37	0.53	0.37	0.53	0.37	0.57	0.33

Table 8 shows the normalized matrix.

Table 8. Normalized Matrix

Normalized Matrix	0.39	0.39	0.28	0.28	0.14	0.14	0.13	0.13	0.05	0.05
	1	1	1	1	1	1	1	1	-1	-1
	C1		**C2**		**C3**		**C4**		**C5**	
A1	0.73	0.17	0.15	0.70	0.50	0.40	0.30	0.57	0.43	0.47
A2	0.90	0.10	0.90	0.10	0.90	0.10	0.90	0.10	0.10	0.90
A3	0.70	0.20	0.47	0.43	0.53	0.37	0.53	0.37	0.40	0.50
A4	0.80	0.10	0.80	0.10	0.80	0.10	0.80	0.10	0.10	0.80
A5	0.63	0.27	0.60	0.30	0.57	0.33	0.50	0.40	0.20	0.70
A6	0.70	0.20	0.77	0.17	0.70	0.20	0.70	0.20	0.10	0.90
A7	0.25	0.62	0.87	0.10	0.53	0.37	0.80	0.10	0.20	0.70
A8	0.10	0.75	0.83	0.10	0.80	0.10	0.73	0.17	0.10	0.80
A9	0.28	0.58	0.47	0.43	0.83	0.13	0.50	0.40	0.47	0.43
A10	0.63	0.27	0.57	0.33	0.60	0.30	0.47	0.43	0.20	0.70
A11	0.57	0.33	0.53	0.37	0.53	0.37	0.53	0.37	0.33	0.57

Table 9 shows the weighted normalized matrix for WSM.

Table 9. Weighted Normalized Matrix for WSM

	1	1	2	2	3	3	4	4	5	5
Weighted Normalized Matrix for WSM	**C1**		**C2**		**C3**		**C4**		**C5**	
A1	0.56	0.49	0.10	0.91	0.27	0.88	0.15	0.93	0.16	0.96
A2	0.74	0.40	0.67	0.53	0.56	0.72	0.54	0.74	0.04	0.99
A3	0.53	0.53	0.31	0.79	0.29	0.86	0.28	0.88	0.15	0.96
A4	0.63	0.40	0.56	0.53	0.46	0.72	0.45	0.74	0.04	0.99
A5	0.48	0.59	0.40	0.72	0.31	0.85	0.26	0.89	0.08	0.98
A6	0.53	0.53	0.53	0.61	0.39	0.79	0.38	0.81	0.04	0.99
A7	0.18	0.83	0.63	0.53	0.29	0.86	0.45	0.74	0.08	0.98
A8	0.07	0.89	0.60	0.53	0.46	0.72	0.40	0.79	0.04	0.99
A9	0.21	0.81	0.31	0.79	0.49	0.75	0.26	0.89	0.18	0.96
A10	0.48	0.59	0.38	0.74	0.33	0.84	0.24	0.90	0.08	0.98
A11	0.42	0.65	0.35	0.76	0.29	0.86	0.28	0.88	0.13	0.97

Table 10 shows the calculation of WSM.

Table 10. Calculation for WSM

	1	1	2	2	3	3	4	4	5	5	Y	0.5		
	1-(μ*μ*μ)	v	1-(μ*μ*μ)	v	1-(μ*μ*μ)	v	1-(μ*μ*μ)	v	1-(μ*μ*μ)	v				
Calculation for WSM	**C1**		**C2**		**C3**		**C4**		**C5**		**QiS**		**YQiS**	
A1	0.82	0.49	1.00	0.91	0.98	0.88	1.00	0.93	1.00	0.96	0.59	0.35	0.47	0.59
A2	0.60	0.40	0.70	0.53	0.83	0.72	0.84	0.74	1.00	0.99	0.89	0.11	0.77	0.34
A3	0.85	0.53	0.97	0.79	0.98	0.86	0.98	0.88	1.00	0.96	0.60	0.31	0.49	0.55
A4	0.75	0.40	0.82	0.53	0.90	0.72	0.91	0.74	1.00	0.99	0.79	0.11	0.66	0.33
A5	0.89	0.59	0.93	0.72	0.97	0.85	0.98	0.89	1.00	0.98	0.59	0.32	0.48	0.56
A6	0.85	0.53	0.85	0.61	0.94	0.79	0.95	0.81	1.00	0.99	0.71	0.21	0.59	0.45
A7	0.99	0.83	0.75	0.53	0.98	0.86	0.91	0.74	1.00	0.98	0.70	0.27	0.57	0.52
A8	1.00	0.89	0.79	0.53	0.90	0.72	0.94	0.79	1.00	0.99	0.70	0.26	0.57	0.51
A9	0.99	0.81	0.97	0.79	0.88	0.75	0.98	0.89	0.99	0.96	0.55	0.41	0.45	0.64
A10	0.89	0.59	0.95	0.74	0.97	0.84	0.99	0.90	1.00	0.98	0.58	0.32	0.47	0.57
A11	0.92	0.65	0.96	0.76	0.98	0.86	0.98	0.88	1.00	0.97	0.54	0.36	0.44	0.60

Table 11 shows the weighted normalized matrix for WPM.

Table 11. Weighted Normalized Matrix for WPM

	1	1	2	2	3	3	4	4	5	5
Weighted Normalized Matrix for WPM	**C1**		**C2**		**C3**		**C4**		**C5**	
A1	0.88	0.12	0.59	0.48	0.90	0.21	0.85	0.30	0.96	0.18
A2	0.96	0.07	0.97	0.07	0.98	0.05	0.99	0.05	0.89	0.40
A3	0.87	0.15	0.81	0.29	0.91	0.19	0.92	0.19	0.95	0.19
A4	0.92	0.07	0.94	0.07	0.97	0.05	0.97	0.05	0.89	0.33
A5	0.84	0.20	0.87	0.20	0.92	0.18	0.91	0.21	0.92	0.28
A6	0.87	0.15	0.93	0.11	0.95	0.11	0.95	0.10	0.89	0.40
A7	0.58	0.46	0.96	0.07	0.91	0.19	0.97	0.05	0.92	0.28
A8	0.40	0.58	0.95	0.07	0.97	0.05	0.96	0.08	0.89	0.33
A9	0.61	0.44	0.81	0.29	0.97	0.07	0.91	0.21	0.96	0.16
A10	0.84	0.20	0.85	0.22	0.93	0.16	0.90	0.22	0.92	0.28
A11	0.80	0.25	0.84	0.24	0.91	0.19	0.92	0.19	0.94	0.22

Table 12 shows the calculation of WPM.

Table 12. Calculation for WPM

	1	1	2	2	3	3	4	4	5	5	(1-ϒ)	0.5		
Calculation for WPM	μ	1-(v*v*v)	μ	1-(v*v*v)	μ	1-(v*v*v)	μ	1-(v*v*v)	μ	1-(v*v*v)				
	C1		C2		C3		C4		C5		QiP		(1-ϒ)QiP	
A1	0.88	1.00	0.59	0.89	0.90	0.99	0.85	0.97	0.96	0.99	0.39	0.53	0.31	0.73
A2	0.96	1.00	0.97	1.00	0.98	1.00	0.99	1.00	0.89	0.93	0.80	0.41	0.67	0.64
A3	0.87	1.00	0.81	0.98	0.91	0.99	0.92	0.99	0.95	0.99	0.56	0.36	0.45	0.60
A4	0.92	1.00	0.94	1.00	0.97	1.00	0.97	1.00	0.89	0.96	0.72	0.34	0.59	0.58
A5	0.84	0.99	0.87	0.99	0.92	0.99	0.91	0.99	0.92	0.98	0.56	0.37	0.45	0.61
A6	0.87	1.00	0.93	1.00	0.95	1.00	0.95	1.00	0.89	0.93	0.65	0.42	0.53	0.65
A7	0.58	0.90	0.96	1.00	0.91	0.99	0.97	1.00	0.92	0.98	0.45	0.50	0.36	0.71
A8	0.40	0.81	0.95	1.00	0.97	1.00	0.96	1.00	0.89	0.96	0.32	0.61	0.25	0.78
A9	0.61	0.92	0.81	0.98	0.97	1.00	0.91	0.99	0.96	1.00	0.42	0.49	0.34	0.70
A10	0.84	0.99	0.85	0.99	0.93	1.00	0.90	0.99	0.92	0.98	0.55	0.38	0.44	0.61
A11	0.80	0.99	0.84	0.99	0.91	0.99	0.92	0.99	0.94	0.99	0.53	0.37	0.43	0.61

Table 13 and Figure 3 shows the obtained results of FF-WASPAS.

Table 13. Results of FF-WASPAS

	Results of FF-WASPAS	QiS		YQiS		QiP		(1-Y)QiP		Qi		Positive Score Function		Ranking
Bulgaria	**A1**	0.59	0.35	0.47	0.59	0.39	0.53	0.31	0.73	0.51	0.43	**1.0541**	**1.0541**	**10**
Germany	**A2**	0.89	0.11	0.77	0.34	0.80	0.41	0.67	0.64	0.85	0.21	**1.6152**	**1.6152**	**1**
Greece	**A3**	0.60	0.31	0.49	0.55	0.56	0.36	0.45	0.60	0.58	0.33	**1.1614**	**1.1614**	**5**
France	**A4**	0.79	0.11	0.66	0.33	0.72	0.34	0.59	0.58	0.76	0.19	**1.4271**	**1.4271**	**2**
Croatia	**A5**	0.59	0.32	0.48	0.56	0.56	0.37	0.45	0.61	0.58	0.34	**1.1510**	**1.1510**	**6**
Italy	**A6**	0.71	0.21	0.59	0.45	0.65	0.42	0.53	0.65	0.68	0.29	**1.2927**	**1.2927**	**3**
Hungary	**A7**	0.70	0.27	0.57	0.52	0.45	0.50	0.36	0.71	0.61	0.37	**1.1753**	**1.1753**	**4**
Austria	**A8**	0.70	0.26	0.57	0.51	0.32	0.61	0.25	0.78	0.58	0.40	**1.1334**	**1.1334**	**8**
Romania	**A9**	0.55	0.41	0.45	0.64	0.42	0.49	0.34	0.70	0.50	0.45	**1.0352**	**1.0352**	**11**
Slovenia	**A10**	0.58	0.32	0.47	0.57	0.55	0.38	0.44	0.61	0.57	0.35	**1.1402**	**1.1402**	**7**
Serbia	**A11**	0.54	0.36	0.44	0.60	0.53	0.37	0.43	0.61	0.54	0.37	**1.1052**	**1.1052**	**9**

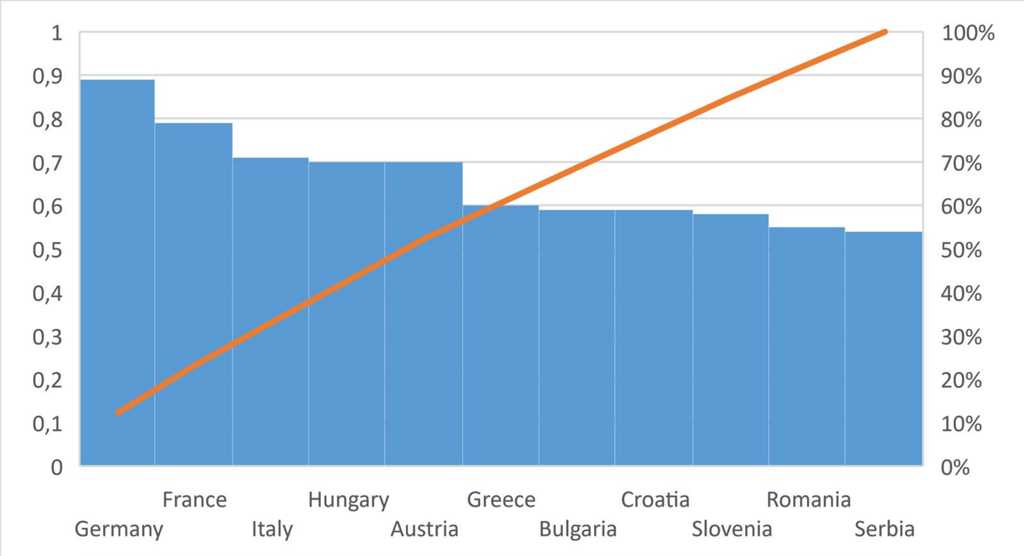

Figure 3. Ranking (Results of FF-WASPAS)

According to the results of the FF-WASPAS method, Germany's trade ranks first in terms of performance. They are followed by: France, Italy, Hungary, Greece, Croatia, Slovenia, Austria, Serbia, Bulgaria and Romania. Croatia's trade performance is better than Slovenia's. According to the results of the FF-WASPAS method, Serbia's trade is in a worse position than Croatia and Slovenia.

The performance analysis of trade between the European Union and Serbia based on the classical **WASPAS** method will be performed on the basis of the same criteria and alternatives as with the FF-WASPAS method. The same criteria weights are used. Table 14 shows the initial matrix.

Table 14. Initial Matrix

Initial Matrix					
weights of criteria	0.39	0.28	0.14	0.13	0.05
kind of criteria	1	1	1	1	-1
	C1	**C2**	**C3**	**C4**	**C5**
A1	138,125	498,112	67,379.30	7,350.60	3,352.40
A2	542,120	6,513,411	2,119,183.70	330,287.80	205,616.50
A3	221,763	747,649	106,976.00	12,734.20	8,471.10
A4	697,283	3,565,852	1,331,409.70	193,620.00	139,143.70
A5	35,393	238,580	35,379.70	5,822.60	3,182.70
A6	1,043,209	3,357,013	945,227.60	132,334.70	70,509.90
A7	137,046	575,367	104,756.10	12,739.30	6,462.60

Initial Matrix					
weights of criteria	0.39	0.28	0.14	0.13	0.05
kind of criteria	1	1	1	1	-1
	C1	**C2**	**C3**	**C4**	**C5**
A8	76,938	676,322	249,457.70	39,101.80	25,727.40
A9	174,754	889,711	128,164.30	19,613.70	8,392.90
A10	25,787	121,518	34,082.10	4,537.50	2,811.30
A11	29,975	273,189	36,658.50	4,371.00	2,340.70
MAX	1043209	6513411	2119183.7	330287.8	205616.5
MIN	25787	121518	34082.1	4371	2340.7

Table 15 shows the normalized matrix.

Table 15. Normalized Matrix

Normalized Matrix					
weights of criteria	0.39	0.28	0.14	0.13	0.05
kind of criteria	1	1	1	1	-1
	C1	**C2**	**C3**	**C4**	**C5**
A1	0.1324	0.0765	0.0318	0.0223	0.6982
A2	0.5197	1.0000	1.0000	1.0000	0.0114
A3	0.2126	0.1148	0.0505	0.0386	0.2763
A4	0.6684	0.5475	0.6283	0.5862	0.0168
A5	0.0339	0.0366	0.0167	0.0176	0.7354
A6	1.0000	0.5154	0.4460	0.4007	0.0332
A7	0.1314	0.0883	0.0494	0.0386	0.3622
A8	0.0738	0.1038	0.1177	0.1184	0.0910
A9	0.1675	0.1366	0.0605	0.0594	0.2789
A10	0.0247	0.0187	0.0161	0.0137	0.8326
A11	0.0287	0.0419	0.0173	0.0132	1.0000

Table 16 shows the weighted normalized matrix.

Table 16. Weighted Normalized Matrix

Weighted Normalized Matrix	C1	C2	C3	C4	C5	Qi1
A1	0.0516	0.0214	0.0045	0.0029	0.0349	0.1153
A2	0.2027	0.2800	0.1400	0.1300	0.0006	0.7532
A3	0.0829	0.0321	0.0071	0.0050	0.0138	0.1409
A4	0.2607	0.1533	0.0880	0.0762	0.0008	0.5790
A5	0.0132	0.0103	0.0023	0.0023	0.0368	0.0649
A6	0.3900	0.1443	0.0624	0.0521	0.0017	0.6505
A7	0.0512	0.0247	0.0069	0.0050	0.0181	0.1060
A8	0.0288	0.0291	0.0165	0.0154	0.0045	0.0943

Weighted Normalized Matrix	C1	C2	C3	C4	C5	Qi1
A9	0.0653	0.0382	0.0085	0.0077	0.0139	0.1337
A10	0.0096	0.0052	0.0023	0.0018	0.0416	0.0605
A11	0.0112	0.0117	0.0024	0.0017	0.0500	0.0771

Table 17 shows the exponentially weight matrix.

Table 17. Exponentiallly weight Matrix

Exponentially weighted Matrix	C1	C2	C3	C4	C5	Qi2
A1	0.4545	0.4868	0.6171	0.6098	0.9822	0.0818
A2	0.7747	1.0000	1.0000	1.0000	0.7995	0.6194
A3	0.5467	0.5455	0.6583	0.6549	0.9377	0.1206
A4	0.8546	0.8448	0.9370	0.9329	0.8153	0.5145
A5	0.2672	0.3962	0.5638	0.5916	0.9848	0.0348
A6	1.0000	0.8306	0.8931	0.8879	0.8434	0.5556
A7	0.4531	0.5069	0.6564	0.6550	0.9505	0.0939
A8	0.3618	0.5304	0.7412	0.7578	0.8870	0.0956
A9	0.4982	0.5727	0.6752	0.6928	0.9381	0.1252
A10	0.2362	0.3280	0.5609	0.5727	0.9909	0.0247
A11	0.2505	0.4115	0.5667	0.5699	1.0000	0.0333

Table 18 and Figure 4 shows the ranking of alternatives according to the results of the classical WASPAS method.

Table 18. Ranking

					λ	**0.5**		
	Ranking							
	Alternatives	**Qi1**	**Qi2**	**Qi**	**Qi**			**Ranking**
Bulgaria	**A1**	0.1153	0.1153	0.1153	0.1153			**6**
Germany	**A2**	0.7532	0.7532	0.7532	0.7532			**1**
Greece	**A3**	0.1409	0.1409	0.1409	0.1409			**4**
France	**A4**	0.5790	0.5790	0.5790	0.5790			**3**
Croatia	**A5**	0.0649	0.0649	0.0649	0.0649			**10**
Italy	**A6**	0.6505	0.6505	0.6505	0.6505			**2**
Hungary	**A7**	0.1060	0.1060	0.1060	0.1060			**7**
Austria	**A8**	0.0943	0.0943	0.0943	0.0943			**8**
Romania	**A9**	0.1337	0.1337	0.1337	0.1337			**5**
Slovenia	**A10**	0.0605	0.0605	0.0605	0.0605			**11**
Serbia	**A11**	0.0771	0.0771	0.0771	0.0771			**9**

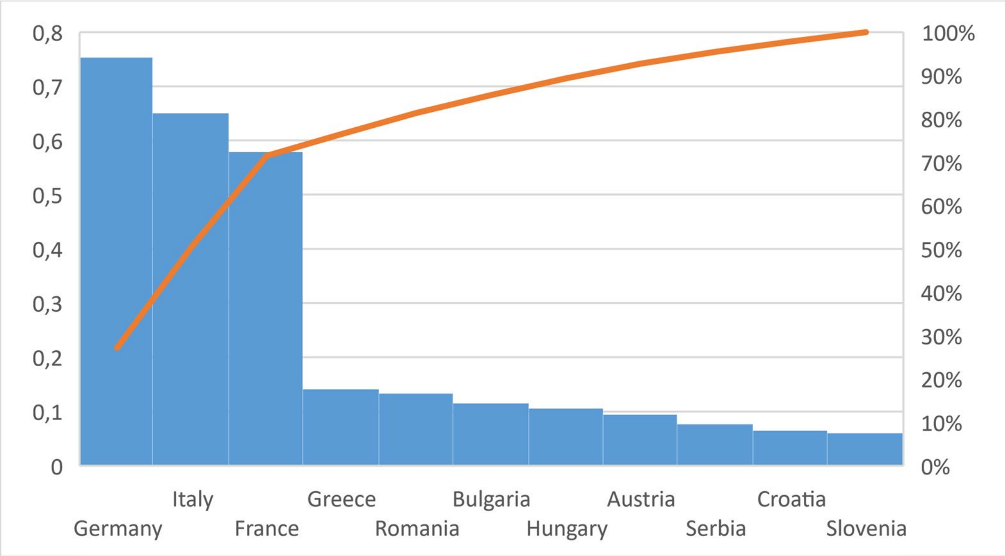

Figure 4. Ranking (WASPAS)

According to the results of the classic WASPAS method, Germany's trade ranks first in terms of performance. Followed by: Italy, France, Greece, Romania, Bulgaria, Hungary, Austria, Serbia, Croatia and Slovenia. The leading countries of the European Union (Germany, France and Italy) are among the top five countries in terms of trade performance (along with Greece and Romania). In terms of trade performance, Serbia is in a better position compared to Croatia and Slovenia. Determinants of performance are: political climate, economic climate, foreign direct investments, asset management, new business models (multichannel sales, private label, organic products), costing by activity, customer management, product category management, Covid-19 pandemic, energy crisis, etc. A key factor is the digitization of the entire business (Berman et al., 2018; Levy et al., 2019; Lukic, 2022e).

4. Conclusion

The results of empirical research using the FF-WASPAS and WASPAS methods point to the following conclusions: According to the results of the FF-WASPAS method, Germany's trade ranks first in terms of performance. They are followed by: France, Italy, Hungary, Greece, Croatia, Slovenia, Austria, Serbia, Bulgaria and Romania. Croatia's trade performance is better than Slovenia's. According to the results of the FF-WASPAS method, Serbia is in a worse position than Croatia and Slovenia in trade performance. According to the results of the classic WASPAS method, Germany's trade ranks first in terms of performance. Followed by: Italy, France, Greece, Romania, Bulgaria, Hungary, Austria, Serbia, Croatia and Slovenia. The leading countries of the European Union (Germany, France and Italy) are among the top five countries in terms of trade performance (along with Greece and Romania). In terms of trade performance, Serbia is in a better position compared to Croatia and Slovenia.

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