Measurement and Analysis of Dynamics of Financial Performance and Efficiency of Trade in Serbia Using Iftopsis and Topsis Methods

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ABSTRACT

Due to the nature of the trade, it is challenging to research the factors of the dynamics of financial performance and trade efficiency in Serbia. With this in mind, this paper measures and analyses the dynamics of financial performance and trade efficiency in Serbia using the IFTOPSI and TOPSIS methods. The results obtained from empirical research show that according to the IFTOPSIS method, the top five years in order include: 2004, 2020, 2015, 2007 and 2017. The worst year is 2006; and according to the TOPSIS method, the top five years in order include: 2020, 2019, 2017, 2018 and 2011. The worst year is 2002. Recently, according to both methods, the financial performance and efficiency of trade in Serbia have improved. This was influenced by: economic climate, inflation, exchange rate, inflow of foreign direct investments, management of human resources, assets, capital, sales and profit, implementation of new business models (multichannel sales, sales of organic products, private label), cost management (for example, costing by activity), customers and product categories. The digitisation of the entire business has a significant role in this. The impact of the COVID-19 pandemic has been mitigated with e-commerce. Adequate control of these and other factors can influence the achievement of the target financial performance and trade efficiency in Serbia.

KEYWORDS: *financial performance, efficiency, factors, Serbian trade, IFTOPSIS-TOPSIS method.*

JEL CLASSIFICATION: *L81, M31, M41, O32*

1. INTRODUCTION

As is known, research on the factors of financial performance dynamics and trade efficiency based on multi-criteria decision-making methods is increasingly applied (Đalić *et al*., 2020; Kovač *et al*., 2021; Lalić *et al*., 2021; Mikšić *et al*., 2021; Stankovič *et al*., 2020; Saaty, 2008; Trung, 2021; Božanić *et al*., 2022; Pamučar *et al*., 2021; Yager, 2009; Stević & Brković 2020; Stević et al., 2020). It enables a better understanding of the impact of key factors on financial performance and trade efficiency. Bearing that in mind, the subject of research in this paper is the analysis of factors of the dynamics of financial performance and trade efficiency in Serbia based on the IFTOPSIS and TOPSIS methods. The purpose and goal of this is to assess the situation in terms of financial performance and efficiency of trade in Serbia as realistically as possible in order to improve it in the future by taking appropriate measures. In recent times, multi-criteria decision-making methods are increasingly being used individually or integrated in the literature to measure financial performance and trade efficiency (Ersoy, 2017; Lukić, 2022a; Lukić, 2022b). This is also the case with literature in Serbia (Lukić & Hadrović-Zekić, 2019; 2021; Lukić, 2020; Lukić & Hadrović-Zekić, 2022; Lukić, 2021a, b, c; Lukić et al., 2020a, b; Lukić et al., 2021; Lukić & Kozarević, 2021). However, in this paper, for the first time, the IFTOPSIS and TOPSIS methods are used when

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measuring and analysing the dynamics of financial performance and trade efficiency in Serbia. This, among other things, reflects the scientific and professional contribution of this work. Permanent evaluation of the dynamics of financial performance and efficiency of trade in Serbia using the IFTOPSIS and TOPSIS methods enables an overview of the real situation and improvement in the future by taking relevant measures. Also, comparing with the results of other methods of multi-criteria decision-making. This reflects the basic research hypothesis in this work. The research of the treated problem in this paper is based on the empirical data from the Agency for Economic Registers of the Republic of Serbia. At the same time, we should take into account the fact that there are no restrictions in terms of international comparability because they are "produced" in accordance with relevant international standards.

2. INTUITIONISTIC FUZZY SETS 1

The intuitionistic fuzzy set was introduced by Atanassov (1986) by extending the classical fuzzy set as a suitable way to solve the vagueness. It has wide applications in many fields, such as: medical diagnosis, decision-making problems, and pattern recognition.
The intuitionistic fuzzy set A in the finite set X can be written as:

$$A = \{\langle x, \mu_A(x), v_A(x) | x \in X \rangle\}$$

where are the $\mu_A(x), v_A(x): X \to [0,1]$members of the function and the nonmembers of the function, respectively, so that

$$0 \leq \mu_A(x) + v_A(x) \leq 1 \quad (1)$$

The third parameter of IFS (Intuitionistic Fuzzy Sets) is $\pi_A(x)$, known as the intuitionistic fuzzy index or the degree of hesitation whether *x* belongs to A or not

$$\pi_A = 1 - \mu_A(x) - v_A(x) \quad (2)$$

It is obvious that everyone $x \in X$:

$$0 \leq \pi_A(x) \leq 1 \quad (3)$$

If it is $\pi_A(x)$small, the knowledge of *x* is more certain. If it is $\pi_A(x)$excellent, the knowledge about *x* is more uncertain. Obviously, when $\mu_A(x) = 1 - v_A(x)$for all elements of the universe, the concept of fuzzy set is usually renewed (Shu *et al.*, 2006).
Let A and B be the IFSs of the set X, then the multiplication operator is defined as follows (Atanassov, 1994):

$$A \otimes B = \{\mu_A(x).\mu_B(x), v_A(x) + v_B(x) - v_A(x).v_B(x) | x \in X\} \quad (4)$$

3. INTUITIONISTIC FUZZY TOPSIS

Denote by the $A = \{A_1, A_2, \ldots, A_m\}$set of alternatives and $X = \{X_1, X_2, \ldots, X_n\}$the set of criteria. The procedure for intuitionistic fuzzy TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) proceeds as follows (Boran *et al.*, 2009):

Step 1. Determining the weight of decision makers.

Suppose that the decision group contains *l* decision makers. The importance of decision makers are linguistic concepts expressed by intuitionistic fuzzy numbers.
Let be the $D_k = [\mu_k, v_k, \pi_k]$intuitionistic fuzzy number for the evaluation of *k* - that decision makers. Then the weight of *k* - those decision makers is obtained as:

$$\lambda_k = \frac{\left(\mu_k + \pi_k\left(\frac{\mu_k}{\mu_k + v_k}\right)\right)}{\sum_{k=1}^{l}\left(\mu_k + \pi_k\left(\frac{\mu_k}{\mu_k + v_k}\right)\right)} \quad (5)$$

and $\sum_{k=1}^{l} \lambda_k = 1$.

Step 2. Constructing an aggregated intuitionistic fuzzy decision matrix based on the opinions of decision makers.

Let be the $R^k = \left(R_{ij}^{(k)}\right)_{mxn}$ intuitionistic fuzzy decision matrix for each decision maker. $\lambda = \{\lambda_1, \lambda_2, \lambda_3, \ldots, \lambda_l\}$is the weight of each decision maker, and $\sum_{k=1}^{l} \lambda_k = 1, \lambda_k \in [0,1]$.In the process of group decision-making, all opinions about individual decisions must be combined into a group opinion to construct an aggregated intuitionistic fuzzy decision-making matrix. For these purposes, the IFWA (Intuitinistic Fuzzy Weighted Averaging) operator proposed by Xu (2007) is used. $R = \left(r_{ij}\right)_{mxn}$,wherein:

$$r_{ij} = IFWA_\lambda\left(r_{ij}^{(1)}, r_{ij}^{(2)}, \ldots, r_{ij}^{(l)}\right) = \lambda_1 r_{ij}^{(1)} \oplus \lambda_2 r_{ij}^{(2)} \oplus \lambda_3 r_{ij}^{(3)}, \ldots, \oplus \lambda_l r_{ij}^{(l)}$$
$$= \left[1 - \prod_{k=1}^{l}\left(1 - \mu_{ij}^{(k)}\right)^{\lambda_k}, \prod_{k=1}^{l}\left(v_{ij}^{(k)}\right)^{\lambda_k}, \prod_{k=1}^{l}\left(1 - \mu_{ij}^{(k)}\right)^{\lambda_k} - \prod_{k=1}^{l}\left(v_{ij}^{(k)}\right)^{\lambda_k}\right] \quad (6)$$

It's here $r_{ij} = \left(\mu_{A_i}(x_j), v_{A_i}(x_j), \pi_{A_i}(x_j)\right) (i = 1,2, \ldots, m; j = 1,2, \ldots, n)$.

The aggregated intuitionistic fuzzy decision matrix is defined as follows:

$$R = \begin{bmatrix} \left(\mu_{A_1}(x_1), v_{A_1}(x_1), \pi_{A_1}(x_1)\right) & \left(\mu_{A_1}(x_2), v_{A_1}(x_2), \pi_{A_1}(x_2)\right) & \ldots & \left(\mu_{A_1}(x_n), v_{A_1}(x_n)\right), \pi_{A_1}(x_n) \\ \left(\mu_{A_2}(x_1), v_{A_2}(x_1), \pi_{A_2}(x_1)\right) & \left(\mu_{A_2}(x_2), v_{A_2}(x_2), \pi_{A_2}(x_2)\right) & \cdots & \left(\mu_{A_2}(x_n), v_{A_2}(x_n), \pi_{A_2}(x_n)\right) \\ \vdots & \vdots & \ddots & \vdots \\ \left(\mu_{A_m}(x_1), v_{A_m}(x_1), \pi_{A_m}(x_1)\right) & \left(\mu_{A_m}(x_2), v_{A_m}(x_2), \pi_{A_m}(x_2)\right) & \cdots & \left(\mu_{A_m}(x_n), v_{A_m}(x_n), \pi_{A_m}(x_m)\right) \end{bmatrix}$$

$$R = \begin{bmatrix} r_{11} & r_{12} & r_{13} & \cdots & r_{1m} \\ r_{21} & r_{22} & r_{23} & \cdots & r_{2m} \\ r_{31} & r_{32} & r_{33} & \cdots & r_{3m} \\ \cdots & \cdots & \cdots & \ddots & \vdots \\ r_{n1} & r_{n2} & r_{n3} & \cdots & r_{nm} \end{bmatrix}$$

Step 3. Determining the weight of the criteria.
It cannot be assumed that all the criteria are significant. It is necessary, in order to obtain W, to combine all the individual opinions of the decision makers about the importance of each criterion.

Let $w_j^{(k)} = \left[\mu_j^{(k)}, v_j^{(k)}, \pi_j^{(k)}\right]$*X be the* intuitionistic fuzzy number of criteria $_j$ determined by *k* decision makers. The weight of the criteria is determined using the *IFWA* operator:

$$w_j = IFWA_\lambda\left(w_j^{(1)}, w_j^{(2)}, \ldots, w_j^{(l)}\right) = \lambda_1 w_j^{(1)} \oplus \lambda_2 w_j^{(2)} \oplus \lambda_3 w_3^{(3)} \otimes \ldots \oplus \lambda_l w_j^{(l)}$$
$$= \left[1 - \prod_{k=1}^{l}\left(1 - \mu_j^{(k)}\right)^{\lambda_k}, \prod_{k=1}^{l}\left(v_j^{(k)}\right)^{\lambda_k}, \prod_{k=1}^{l}\left(1 - \mu_j^{(k)}\right)^{\lambda_k} - \prod_{k=1}^{l}\left(v_j^{(k)}\right)^{\lambda_k}\right] \quad (7)$$

$$W = [w_1, w_2, w_3, \ldots, w_j]$$

It's here $w_j = (\mu_j, v_j, \pi_j)(j = 1,2, \ldots, n)$.

Step 4. Constructing the aggregate weight intuitionistic fuzzy decision matrix.

After determining the weights of the criteria (*W*) and the aggregated intuitionistic fuzzy decision matrix, the aggregated weighted intuitionistic fuzzy decision matrix is constructed according to the following definition (Atanassov, 1986):

$$R \otimes W = \{\langle x, \mu_{A_i}(x).\mu_W(x), \nu_{A_i}(x) + \nu_W(x) - \nu_{A_i}(x).\nu_W(x)\rangle | x \in X\} \quad (8)$$

and

$$\pi_{A_i}.w(x) = 1 - w_{A_i}(x) - \nu_W(x) - \mu_{A_i}(x).\mu_W(x) + \nu_{A_i}(x).\nu_W(x) \quad (9)$$

Consequently, the aggregated weight intuitionistic fuzzy decision matrix is defined as follows:

$$R' = \begin{bmatrix} (\mu_{A_1W}(x_1), \nu_{A_1W}(x_1), \pi_{A_1W}(x_1)) & (\mu_{A_1W}(x_2), \nu_{A_1W}(x_2), \pi_{A_1W}(x_2)) & \cdots & (\mu_{A_1W}(x_n), \nu_{A_1W}(x_n)), \pi_{A_1W}(x_n) \\ (\mu_{A_2W}(x_1), \nu_{A_2W}(x_1), \pi_{A_2W}(x_1)) & (\mu_{A_2W}(x_2), \nu_{A_2W}(x_2), \pi_{A_2W}(x_2)) & \cdots & (\mu_{A_2}(x_n), \nu_{A_2}(x_n), \pi_{A_2}(x_n)) \\ \vdots & \vdots & \ddots & \vdots \\ (\mu_{A_mW}(x_1), \nu_{A_mW}(x_1), \pi_{A_mW}(x_1)) & (\mu_{A_mW}(x_2), \nu_{A_mW}(x_2), \pi_{A_mW}(x_2)) & \cdots & (\mu_{A_mW}(x_n), \nu_{A_mW}(x_n), \pi_{A_mW}(x_m)) \end{bmatrix}$$

$$R' = \begin{bmatrix} r'_{11} & r'_{12} & r'_{13} & \cdots & r'_{1m} \\ r'_{21} & r'_{22} & r'_{23} & \cdots & r'_{2m} \\ r'_{31} & r'_{32} & r'_{33} & \cdots & r'_{3m} \\ \cdots & \cdots & \cdots & \ddots & \vdots \\ r'_{n1} & r'_{n2} & r'_{n3} & \cdots & r'_{nm} \end{bmatrix}$$

$r^i = (\mu'_{ij}, \nu'_{ij}, \pi'_{ij}) = (\mu_{A_iW}(x), \nu_{A_iW}(x), \pi_{A_iW}(x))$ is an element of the aggregated weight intuitionistic fuzzy decision matrix.

Step 5. Determination of the intuitionistically fuzzy positive-ideal solution and the intuitionistically fuzzy negative-ideal solution.

Let's assume they are J_1 and J_2 benefit criterion and cost criterion, respectively. A^* is an intuitionistic fuzzy positive-ideal solution and A^- is an intuitionistic fuzzy negative-ideal solution. In doing so , they $A^*$are A^-obtained as follows:

$$A^* = (\mu_{A^*W}(x_j), \nu_{A^*W}(x_j)) \text{ and } A^- = (\mu_{A^-W}(x_j), \nu_{A^-W}(x_j)) \quad (10)$$

wherein

$$\mu_{A^*W}(x_j) = \left(\left(\max_i \mu_{A_i.W}(x_j) | j \in J_1 \right), \min_i \mu_{A_i.W}(x_j) | j \in J_2 \right) \quad (11)$$

$$\nu_{A^*W}(x_j) = \left(\left(\min_i \nu_{A_i.W}(x_j) | j \in J_1 \right), \left(\max_i \nu_{A_i.W}(x_j) | j \in J_2 \right) \right) \quad (12)$$

$$\mu_{A^-W}(x_j) = \left(\left(\min_i \mu_{A_i.W}(x_j) | j \in J_1 \right), \left(\max_i \mu_{A_i.W}(x_j) | j \in J_2 \right) \right) \quad (13)$$

$$\nu_{A^-W}(x_j) = \left(\left(\max_i \nu_{A_i.W}(x_j) | j \in J_1 \right), \left(\min_i \nu_{A_i.W}(x_j) \right) | j \in J_2 \right) \quad (14)$$

Step 6. Calculation of separation measures.

For the purposes of determining the separation between alternatives on an intuitionistic fuzzy set, distance measures proposed by Atanassov (1999), Szmidt & Kacprzyk (2000) and Grzegorzewski (2004) can be used, including the generalisation of Hamming distance, Euclidean distance, and their normalised distance measures. After choosing the distance measure, the separation measures of S_{i^*}each S_{i^-}alternative from the intuitionistically fuzzy positive-ideal and negative-ideal solutions are determined. In this paper, the normalised Euclidean distance is used.

$$S^* = \sqrt{\frac{1}{2n}\sum_{j=1}^{n}\left[\left(\mu_{A_iW}(x_j) - \mu_{A^*W}(x_j)\right)^2 + \left(\nu_{A_iW}(x_j) - \nu_{A^*W}(x_j)\right)^2 + \left(\pi_{A_iW}(x_j) - \pi_{A^*W}(x_j)\right)^2\right]} \quad (15)$$

$$S^- = \sqrt{\frac{1}{2n}\sum_{j=1}^{n}\left[\left(\mu_{A_iW}(x_j) - \mu_{A^-W}(x_j)\right)^2 + \left(\nu_{A_iW}(x_j) - \nu_{A^-W}(x_j)\right)^2 + \left(\pi_{A_iW}(x_j) - \pi_{A^-W}(x_j)\right)^2\right]} \quad (16)$$

Step 7. Calculation of the coefficient of relative closeness to the intuitionistic ideal solution. The coefficient of relative closeness of the alternative $A_i$in relation to the intuitionistic fuzzy positive-ideal solution $A^*$is defined as follows:

$$C_{i^*} = \frac{S_{i^-}}{S_{i^*} + S_{i^-}} \; where\; 0 \leq S_{i^*} \leq 1 \quad (17)$$

Step 8. Ranking of alternatives.
After the relative closeness coefficient of each alternative has been determined, the alternatives are ranked in descending order C_{i^*}\`s.

4. TOPSIS METHOD

The TOPSIS method (*Technique for Order Preference by Similarity to Ideal Solution*) is very successfully used in evaluating the financial performance of companies. It is a multi-criteria decision-making technique that was first developed and applied by Hwang & Yoon (1981; 1995). According to this method, alternatives are defined by their distances from the ideal solution. The goal is to choose the optimal alternative that is closer to the optimal solution, that is, the farthest from the negative ideal solution (Young *et al*., 1994). A positive ideal solution maximises utility, i.e. minimises costs (relative to the given problem). Conversely, a negative ideal solution maximises costs, i.e., minimises utility. The TOPSIS method consists of six steps (Üçüncü *et al*., 2018):

Step 1. Creating the initial matrix.

In the displayed initial matrix A_{ij}, " m " indicates the number of alternatives, and " n " indicates the number of criteria:

$$A_{ij} = \begin{vmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{vmatrix}$$

Step 2. Formation of the weighted normalised decision matrix.

The normalised decision matrix (R_{ij} ; i=1,…,m; j=1,…,n) is determined by the following equation with matrix elements A_{ij} :

$$r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^{m} a_{ij}^2}} \quad (18)$$

$$t = 1,2,3,\ldots,m \; j = 1,2,3,\ldots,n$$

$$R_{ij} = \begin{vmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{vmatrix}$$

In the following equation, the weight measure " j " is represented by W_{ij}. The weight-normalised decision matrix (V_{ij}; $i=1,\ldots,m$; $j=1,\ldots,n$) was determined using the equation shown below with the elements of the normalised matrix:

$$V_{ij} = W_{ij} * r_{ij} \quad (19)$$
$$i = 1,2,3,\ldots,m \; j = 1,2,3,\ldots,n$$

Step 3. Determination of positive and negative-ideal solutions.

The value of the positive-ideal solution (A^{+}) and the negative-ideal solution (A^{-}) is determined from the value of the weight-normalised matrix (V_{ij}). A^{+} is a better, and A^{-} [a] worse performance score.

The value of the positive-ideal solution (A^{+}) and the negative-ideal solution (A^{-}) is determined by applying the following equations:

$$A^{+} = \{v_i^{+},\ldots,v_n^{+}\} = \left\{\left(\max_i v_{ij}, j \in j\right)\left(\min_i v_{ij}, j \in j'\right)\right\} \; i = 1,2,\ldots,m \; (20)$$
$$A^{-} = \{v_i^{-},\ldots,v_n^{-}\} = \left\{\left(\min_i v_{ij}, j \in j\right)\left(\max_i v_{ij}, j \in j'\right)\right\} \; i = 1,2,\ldots,m \; (21)$$

where j is related to the benefit criterion, and j' is related to the cost criterion.

Step 4. Determination of special measures (i.e. the distance of the alternatives from the ideal and negative-ideal solution).

The distance from the positive-ideal solution (S_i^{+}) and the negative-ideal solution (S_i^{-}) for each alternative according to the given criterion is determined using the following equation:

$$S_i^{+} = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^{+})^2} \quad (22)$$

$$S_i^{-} = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^{-})^2} \quad (23)$$

$$i = 1,2,3,\ldots,m \; j = 1,2,3,\ldots,n$$

Step 5. Determination of the coefficient of relative closeness to the ideal solution.

Separate measures of the positive-ideal solution (S_i^+) and the negative-ideal solution (S_i^-) were used to determine the relative closeness to the ideal solution (C_i^+) for each decision point. C_i^+ represents the relative closeness to the ideal solution and takes a value in the range $0 \leq C_i + \leq 1$. " C_i^+ " = 1 shows the relative closeness to the positive-ideal solution. " C_i^+ " = 0 shows relative closeness to the negative-ideal solution.

The relative proximity to the ideal solution (C_i^+ ; i=1,...,m; *j=1,...,n*) was determined using equation :

$$C_i^+ = \frac{S_i^-}{S_i^- + S_i^+} \qquad (24)$$

$i = 1,2,3, \ldots, m$

Step 6. Sorting alternatives according to relative superiority
Determining the relative superiority of the results (score) represents the achieved company performance. High scores correspond to better performance. The results can be used to determine the ranking of the company within the industry (Üçüncü *et al*., 2018).

5. ANALYTICAL HIERARCHY PROCESS (AHP)

Given that the weighting coefficients of the criteria when applying the TOPSIS method are determined using the AHP method, we will briefly refer to its theoretical and methodological characteristics. The Analytical Hierarchy Process (AHP) method proceeds through the following steps (Saaty, 2008):

Step 1. Forming a matrix of comparison pairs

$$A = [a_{ij}] = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ 1/a_{12} & 1 & \cdots & a_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1 \end{bmatrix} \qquad (25)$$

Step 2. Normalisation of the matrix of comparison pairs

$$a_{ij}^* = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}}, i,j = 1, \ldots, n \qquad (26)$$

Step 3. Determination of relative importance, i.e. vector weights

$$w_i = \frac{\sum_{i=1}^{n} a_{ij}^*}{n}, i,j = 1, \ldots, n \qquad (27)$$

Consistency index - CI (consistency index) is a measure of the deviation of *n* from λ_{max} and can be represented by the following formula:

$$CI = \frac{\lambda_{max} - n}{n} \qquad (28)$$

If CI < 0.1 of the estimated value of coefficients a_{ij} are consistent, and the deviation of λ_{max} from *n* is negligible. This means, in other words, that the AHP method accepts an inconsistency of less than 10%. Using the consistency index, the consistency ratio CR = CI/RI can be calculated, where RI is the random index.

6. RESULTS AND DISCUSSION

The selected criteria for the needs of the research of the treated problem in this work are. C1 – return on capital, C2 – return on assets, C3 – return on sales, C4 – asset turnover ratio, C5 – financial leverage and C6 - net profit per employee. They fully correspond to the character of trade operations. They are elements of a strategic profit model. They were chosen for those reasons. Alternatives were observed for individual years in the period 2002-2020. Table 1 shows the initial data.

Table 1. Initial data

		Return on capital, (net profit/ capital), (%)	Return on assets, (net profit/assets), (%)	Return on sales, (net profit/sales), (%)	Asset turnover ratio, (sales/assets)	Financial leverage, (assets/ capital)	Net profit per employee (in thousands of dinars)
		C1	**C2**	**C3**	**C4**	**C5**	**C6**
A1	2002	4.70	1.78	1.35	1.317212	2.63355	45.60267
A2	2003	7.06	2.43	1.83	1.327465	2.899927	71.67583
A3	2004	10.99	3.18	2.46	1.293924	3.452468	135.6546
A4	2005	7.78	3.58	3.71	0.96272	2.175503	251.8691
A5	2006	10.47	4.92	4.63	1.063005	2.127991	378.97
A6	2007	11.43	4.93	4.58	1.075847	2.319261	439.9337
A7	2008	10.67	4.04	3.59	1.125516	2.637236	394.3352
A8	2009	9.24	3.36	3.31	1.016669	2.747177	355,718
A9	2010	13.54	3.88	3.23	1.199631	3.490269	398.3957
A10	2011	13.78	4.26	3.41	1.249036	3.237669	458,832
A11	2012	13.07	3.14	3.14	1	4.15847	483.0372
A12	2013	12.01	4.15	3.10	1.338372	2.892232	464.417
A13	2014	11.42	4.03	3.35	1.202561	2.834034	453.7864
A14	2015	11.83	4.33	3.49	1.242987	2.730319	596.82
A15	2016	12.24	4.53	3.50	1.294561	2.704095	510,636
A16	2017	13.33	5.17	3.87	1.335581	2.579056	589.9769
A17	2018	12.09	4.82	3.62	1.331181	2.504928	555.2917
A18	2019	12.99	5.20	3.86	1.344921	2.500271	627.8299
A19	2020	14.46	6.03	4.67	1.29141	2.398594	751.3026
	Statistics						
	Mean	11.2158	4.0926	3.4053	1.2112	2.7907	419.1623
	Median	11.8300	4.1500	3.4900	1.2490	2.7041	453.7864
	Std. Deviation	2.50340	1.02844	.84647	.12982	.49932	186.51413
	The minimum	4.70	1.78	1.35	.96	2.13	45.60
	Maximum	14.46	6.03	4.67	1.34	4.16	751.30
	NPar Tests Friedman Test						
	Test Statistics[a]						
	19						
	67,177						
	4						
	.000						
	a. Friedman Test						

Source: author's calculation after Agency for Economic Registers of the Republic of Serbia data

In the period 2002 - 2020, in Serbian trade, the return on capital ranged from 4.70 - 14.46%, return on assets 1.78 - 6.03%, return on sales 1.35 - 4.67%, asset turnover ratio .96 - 1.34, financial leverage 2.13 - 4.16 and net profit per employee (in thousands of dinars) 45.60 - 751.30. Recently, according to the presented financial indicators, the financial performance and efficiency of trade in Serbia have improved. Their values are above average. It is a consequence of the efficient management of the entire trade business.

6.1 Ranking of alternatives based on the IFTOPSIS method

In the further analysis of the problem treated in this paper, we will first look at the dynamic ranking of trade in Serbia based on the IFTOPSIS method. Table 2 shows the evaluation of the criteria by the decision makers.

Table 2. Evaluation criteria

Linguistic Terms for Rating the Importance of Criteria and the Decision Makers				
Fuzzy Linguistic Descriptor	**Abbreviation**	**Intuitionistic Fuzzy Number**		
		μ	**ν**	**π**
Very Important	**VI**	0.90	0.10	0
Important	**I**	0.75	0.20	0.05
Medium	**M**	0.50	0.45	0.05
Unimportant	**U**	0.35	0.60	0.05
Very Unimportant	**VU**	0.10	0.90	0

Decision Makers	**Importance**	**Intuitionistic Fuzzy Number**			**Weight of Decision Maker**	
		μ	**ν**	**π**		
DM1	**VI**	**0.9**	**0.1**	**0**	0.90	**0.503**
DM2	**I**	**0.75**	**0.2**	**0.05**	0.79	**0.441**
DM3	**VU**	**0.1**	**0.9**	**0**	0.10	**0.056**
				SUM	**1.79**	**1.00**

Kind of Criteria	Criteria	DM1	DM2	DM3
1	**C1**	**VI**	**VI**	**I**
1	**C2**	**I**	**I**	**I**
1	**C3**	**I**	**I**	**M**
1	**C4**	**M**	**I**	**M**
1	**C5**	**U**	**M**	**I**
1	**C6**	**I**	**VU**	**M**

	DM1			**DM2**			**DM3**		
	0.503	**0.503**	**0.503**	**0.441**	**0.441**	**0.441**	**0.056**	**0.056**	**0.056**
	1-μ	ν	π	1-μ	ν	π	1-μ	ν	π
C1	**0.1**	**0.1**	**0**	**0.1**	**0.1**	**0**	**0.25**	**0.2**	**0.05**
C2	**0.25**	**0.2**	**0.05**	**0.25**	**0.2**	**0.05**	**0.25**	**0.2**	**0.05**
C3	**0.25**	**0.2**	**0.05**	**0.25**	**0.2**	**0.05**	**0.5**	**0.45**	**0.05**
C4	**0.5**	**0.45**	**0.05**	**0.25**	**0.2**	**0.05**	**0.5**	**0.45**	**0.05**
C5	**0.65**	**0.6**	**0.05**	**0.5**	**0.45**	**0.05**	**0.25**	**0.2**	**0.05**
C6	**0.25**	**0.2**	**0.05**	**0.9**	**0.9**	**0**	**0.5**	**0.45**	**0.05**

Source: author's calculation

Table 3 shows the linguistic criteria for ranking the alternatives.

Table 3. Linguistic Terms for Rating the Alternatives

Linguistic Terms For Rating The Alternatives				
Fuzzy Linguistic Descriptor	**Abbreviation**	**Intuitionistic Fuzzy Number**		
		μ	**ν**	**π**
Extremely Good	**EG**	1.00	0.00	0
Very Very Good	**VVG**	0.90	0.10	0
Very Good	**VG**	0.80	0.10	0.10
Good	**Mr**	0.70	0.20	0.10
Medium Good	**MG**	0.60	0.30	0.10
Fair	**F**	0.50	0.40	0.10
Medium Bad	**MB**	0.40	0.50	0.10
Bad	**B**	0.25	0.60	0.15
Very Bad	**VB**	0.10	0.75	0.15
Very Very Bad	**VVB**	0.10	0.90	0.00

Source: author's conception

Table 4 shows the initial aggregated matrix.

Table 4. Initial Aggregated Matrix

Initial Aggregated Matrix																		
	1			**1**			**1**			**1**			**1**			**1**		
	0.895	0.104	0.001	0.750	0.200	0.050	0.740	0.209	0.051	0.632	0.315	0.054	0.451	0.497	0.052	0.543	0.406	0.051
	C1			**C2**			**C3**			**C4**			**C5**			**C6**		
A1	0.749	0.147	0.104	0.648	0.251	0.101	0.761	0.136	0.103	0.700	0.200	0.100	1,000	0.000	0.000	0.681	0.202	0.117
A2	0.643	0.255	0.102	0.560	0.339	0.101	0.654	0.245	0.101	0.559	0.341	0.101	1,000	0.000	0.000	0.816	0.162	0.022
A3	0.859	0.100	0.041	0.761	0.136	0.103	0.795	0.104	0.101	0.795	0.104	0.101	1,000	0.000	0.000	0.815	0.147	0.037
A4	0.653	0.245	0.101	0.506	0.394	0.100	0.755	0.141	0.104	0.654	0.245	0.101	1,000	0.000	0.000	1,000	0.000	0.000
A5	0.552	0.347	0.101	0.452	0.448	0.101	0.695	0.205	0.100	0.547	0.352	0.101	1,000	0.000	0.000	0.451	0.425	0.124
A6	1,000	0.000	0.000	1,000	0.000	0.000	0.516	0.382	0.102	1,000	0.000	0.000	1,000	0.000	0.000	0.586	0.307	0.107
A7	0.423	0.475	0.102	0.780	0.188	0.032	0.511	0.387	0.103	0.699	0.190	0.111	1,000	0.000	0.000	1,000	0.000	0.000
A8	1,000	0.000	0.000	0.777	0.199	0.023	0.650	0.249	0.102	0.432	0.443	0.125	1,000	0.000	0.000	0.718	0.192	0.090
A9	0.568	0.324	0.108	0.495	0.405	0.100	0.759	0.220	0.021	0.535	0.334	0.131	1,000	0.000	0.000	1,000	0.000	0.000
A10	1,000	0.000	0.000	0.392	0.505	0.102	0.553	0.337	0.110	1,000	0.000	0.000	1,000	0.000	0.000	0.586	0.307	0.107
A11	0.718	0.173	0.110	1,000	0.000	0.000	0.453	0.447	0.101	0.511	0.387	0.103	1,000	0.000	0.000	0.543	0.354	0.103
A12	1,000	0.000	0.000	0.711	0.178	0.111	0.718	0.173	0.110	0.400	0.500	0.100	1,000	0.000	0.000	0.492	0.383	0.125
A13	0.609	0.286	0.105	0.498	0.399	0.103	0.553	0.334	0.113	0.812	0.151	0.037	1,000	0.000	0.000	0.561	0.312	0.127
A14	1,000	0.000	0.000	1,000	0.000	0.000	0.465	0.434	0.101	1,000	0.000	0.000	1,000	0.000	0.000	0.762	0.216	0.022
A15	0.791	0.174	0.035	0.630	0.282	0.088	0.783	0.185	0.032	0.853	0.100	0.047	1,000	0.000	0.000	0.681	0.202	0.117
A16	1,000	0.000	0.000	1,000	0.000	0.000	0.439	0.458	0.103	0.711	0.178	0.111	1,000	0.000	0.000	0.543	0.354	0.103
A17	0.575	0.320	0.104	0.757	0.214	0.029	1,000	0.000	0.000	0.643	0.255	0.102	1,000	0.000	0.000	0.650	0.225	0.125
A18	0.676	0.209	0.116	0.547	0.352	0.101	0.581	0.311	0.108	1,000	0.000	0.000	1,000	0.000	0.000	0.561	0.312	0.127
A19	1,000	0.000	0.000	0.825	0.144	0.031	0.714	0.175	0.110	0.705	0.185	0.110	1,000	0.000	0.000	0.658	0.220	0.122

Source: author's calculation

Table 5 shows the weighted aggregated matrix.

Table 5. Weighted Aggregated Matrix

Weighted Aggregated Matrix																		
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	C1			C2			C3			C4			C5			C6		
A1	0.670	0.236	0.094	0.486	0.401	0.114	0.563	0.317	0.120	0.442	0.452	0.106	0.451	0.497	0.052	0.370	0.526	0.104
A2	0.576	0.332	0.092	0.420	0.471	0.109	0.484	0.403	0.113	0.353	0.548	0.099	0.451	0.497	0.052	0.443	0.503	0.055
A3	0.768	0.194	0.038	0.571	0.309	0.121	0.589	0.291	0.120	0.502	0.386	0.112	0.451	0.497	0.052	0.442	0.494	0.064
A4	0.585	0.324	0.092	0.380	0.515	0.105	0.559	0.321	0.120	0.413	0.482	0.105	0.451	0.497	0.052	0.543	0.406	0.051
A5	0.494	0.415	0.091	0.339	0.558	0.103	0.514	0.371	0.114	0.345	0.556	0.098	0.451	0.497	0.052	0.245	0.659	0.096
A6	0.895	0.104	0.001	0.750	0.200	0.050	0.382	0.511	0.107	0.632	0.315	0.054	0.451	0.497	0.052	0.318	0.588	0.094
A7	0.378	0.530	0.092	0.585	0.350	0.065	0.378	0.515	0.107	0.441	0.445	0.114	0.451	0.497	0.052	0.543	0.406	0.051
A8	0.895	0.104	0.001	0.583	0.359	0.058	0.481	0.406	0.113	0.273	0.618	0.109	0.451	0.497	0.052	0.390	0.521	0.090
A9	0.508	0.395	0.097	0.371	0.524	0.105	0.562	0.383	0.055	0.338	0.544	0.118	0.451	0.497	0.052	0.543	0.406	0.051
A10	0.895	0.104	0.001	0.294	0.604	0.102	0.409	0.476	0.115	0.632	0.315	0.054	0.451	0.497	0.052	0.318	0.588	0.094
A11	0.642	0.259	0.099	0.750	0.200	0.050	0.335	0.563	0.102	0.323	0.580	0.098	0.451	0.497	0.052	0.295	0.617	0.089
A12	0.895	0.104	0.001	0.533	0.342	0.124	0.531	0.346	0.123	0.253	0.657	0.090	0.451	0.497	0.052	0.267	0.634	0.099
A13	0.545	0.360	0.095	0.374	0.519	0.107	0.409	0.474	0.117	0.513	0.418	0.069	0.451	0.497	0.052	0.304	0.592	0.104
A14	0.895	0.104	0.001	0.750	0.200	0.050	0.344	0.553	0.103	0.632	0.315	0.054	0.451	0.497	0.052	0.413	0.535	0.052
A15	0.708	0.260	0.032	0.472	0.426	0.102	0.580	0.355	0.065	0.539	0.383	0.078	0.451	0.497	0.052	0.370	0.526	0.104
A16	0.895	0.104	0.001	0.750	0.200	0.050	0.325	0.571	0.104	0.449	0.436	0.114	0.451	0.497	0.052	0.295	0.617	0.089
A17	0.515	0.391	0.094	0.568	0.371	0.061	0.740	0.209	0.051	0.406	0.489	0.104	0.451	0.497	0.052	0.353	0.540	0.107
A18	0.605	0.291	0.104	0.410	0.482	0.108	0.430	0.456	0.115	0.632	0.315	0.054	0.451	0.497	0.052	0.304	0.592	0.104
A19	0.895	0.104	0.001	0.618	0.315	0.066	0.529	0.348	0.123	0.446	0.441	0.113	0.451	0.497	0.052	0.357	0.537	0.106

Source: author's calculation

Table 6 shows positive-ideal A^* and negative-ideal A^- solutions.

Table 6. Positive-Ideal A^* and Negative-Ideal A^- solutions

Positive-Ideal A*	**0.895**	**0.104**	**0.001**	**0.750**	**0.200**	**0.050**	**0.740**	**0.209**	**0.051**	**0.632**	**0.315**	**0.054**	**0.451**	**0.497**	**0.052**	**0.543**	**0.406**	**0.051**
Negative-Ideal A-	**0.378**	**0.530**	**0.092**	**0.294**	**0.604**	**0.102**	**0.325**	**0.571**	**0.104**	**0.253**	**0.657**	**0.090**	**0.451**	**0.497**	**0.052**	**0.245**	**0.659**	**0.096**

Source: author's calculation

In Table 7 the separation measures *S** are shown.

Table 7. Separation measures *S**

Separation Measures S*																		
	C1			C2			C3			C4			C5			C6		
A1	-0.224	0.132	0.092	-0.264	0.201	0.064	-0.177	0.107	0.070	-0.190	0.137	0.052	0.000	0.000	0.000	-0.173	0.120	0.053
A2	-0.319	0.228	0.091	-0.330	0.271	0.059	-0.256	0.193	0.063	-0.279	0.233	0.045	0.000	0.000	0.000	-0.100	0.096	0.004
A3	-0.126	0.090	0.037	-0.179	0.109	0.071	-0.151	0.082	0.069	-0.129	0.071	0.058	0.000	0.000	0.000	-0.100	0.087	0.013
A4	-0.310	0.220	0.090	-0.370	0.315	0.055	-0.181	0.112	0.069	-0.219	0.168	0.051	0.000	0.000	0.000	0.000	0.000	0.000
A5	-0.400	0.311	0.090	-0.411	0.358	0.053	-0.226	0.162	0.064	-0.286	0.241	0.045	0.000	0.000	0.000	-0.298	0.252	0.045
A6	0.000	0.000	0.000	0.000	0.000	0.000	-0.358	0.302	0.056	0.000	0.000	0.000	0.000	0.000	0.000	-0.225	0.182	0.043
A7	-0.516	0.426	0.091	-0.165	0.150	0.015	-0.362	0.306	0.056	-0.190	0.130	0.060	0.000	0.000	0.000	0.000	0.000	0.000
A8	0.000	0.000	0.000	-0.167	0.159	0.008	-0.259	0.197	0.063	-0.359	0.303	0.055	0.000	0.000	0.000	-0.153	0.114	0.039
A9	-0.387	0.291	0.096	-0.379	0.324	0.055	-0.179	0.174	0.005	-0.294	0.229	0.065	0.000	0.000	0.000	0.000	0.000	0.000
A10	0.000	0.000	0.000	-0.456	0.404	0.052	-0.331	0.267	0.065	0.000	0.000	0.000	0.000	0.000	0.000	-0.225	0.182	0.043
A11	-0.253	0.155	0.098	0.000	0.000	0.000	-0.405	0.353	0.052	-0.309	0.265	0.044	0.000	0.000	0.000	-0.248	0.210	0.038

Separation Measures S*																		
	C1			C2			C3			C4			C5			C6		
A12	0.000	0.000	0.000	-0.217	0.142	0.074	-0.209	0.137	0.072	-0.379	0.343	0.036	0.000	0.000	0.000	-0.276	0.227	0.048
A13	-0.350	0.256	0.093	-0.376	0.319	0.057	-0.331	0.264	0.067	-0.119	0.103	0.015	0.000	0.000	0.000	-0.238	0.185	0.053
A14	0.000	0.000	0.000	0.000	0.000	0.000	-0.396	0.343	0.053	0.000	0.000	0.000	0.000	0.000	0.000	-0.129	0.128	0.001
A15	-0.187	0.156	0.031	-0.278	0.226	0.052	-0.161	0.146	0.015	-0.093	0.069	0.025	0.000	0.000	0.000	-0.173	0.120	0.053
A16	0.000	0.000	0.000	0.000	0.000	0.000	-0.415	0.362	0.053	-0.182	0.122	0.061	0.000	0.000	0.000	-0.248	0.210	0.038
A17	-0.380	0.287	0.093	-0.182	0.171	0.011	0.000	0.000	0.000	-0.225	0.175	0.051	0.000	0.000	0.000	-0.190	0.133	0.056
A18	-0.290	0.187	0.103	-0.340	0.282	0.058	-0.310	0.246	0.064	0.000	0.000	0.000	0.000	0.000	0.000	-0.238	0.185	0.053
A19	0.000	0.000	0.000	-0.132	0.115	0.016	-0.212	0.139	0.073	-0.186	0.127	0.059	0.000	0.000	0.000	-0.185	0.130	0.055

Source: author's calculation

Table 8 shows the separation measures of S^-.

Table 8. Separation measures S^-

Separation Measures S-																		
	C1			C2			C3			C4			C5			C6		
A1	0.292	-0.294	0.002	0.191	-0.203	0.012	0.238	-0.255	0.017	0.190	-0.206	0.016	0.000	0.000	0.000	0.125	-0.133	0.008
A2	0.197	-0.197	0.000	0.125	-0.133	0.008	0.159	-0.169	0.010	0.100	-0.109	0.009	0.000	0.000	0.000	0.198	-0.156	-0.042
A3	0.390	-0.336	-0.054	0.276	-0.295	0.019	0.263	-0.280	0.016	0.250	-0.271	0.022	0.000	0.000	0.000	0.198	-0.165	-0.033
A4	0.206	-0.206	0.000	0.085	-0.089	0.004	0.234	-0.250	0.017	0.160	-0.175	0.015	0.000	0.000	0.000	0.298	-0.252	-0.045
A5	0.116	-0.115	-0.001	0.045	-0.046	0.001	0.189	-0.200	0.011	0.093	-0.101	0.008	0.000	0.000	0.000	0.000	0.000	0.000
A6	0.516	-0.426	-0.091	0.456	-0.404	-0.052	0.056	-0.060	0.004	0.379	-0.343	-0.036	0.000	0.000	0.000	0.073	-0.070	-0.003
A7	0.000	0.000	0.000	0.291	-0.254	-0.037	0.053	-0.056	0.003	0.189	-0.212	0.024	0.000	0.000	0.000	0.298	-0.252	-0.045
A8	0.516	-0.426	-0.091	0.289	-0.245	-0.044	0.156	-0.165	0.010	0.020	-0.039	0.019	0.000	0.000	0.000	0.145	-0.138	-0.007
A9	0.130	-0.135	0.005	0.077	-0.080	0.003	0.236	-0.188	-0.048	0.085	-0.114	0.028	0.000	0.000	0.000	0.298	-0.252	-0.045
A10	0.516	-0.426	-0.091	0.000	0.000	0.000	0.084	-0.095	0.012	0.379	-0.343	-0.036	0.000	0.000	0.000	0.073	-0.070	-0.003
A11	0.264	-0.271	0.007	0.456	-0.404	-0.052	0.010	-0.009	-0.001	0.070	-0.078	0.008	0.000	0.000	0.000	0.050	-0.042	-0.008
A12	0.516	-0.426	-0.091	0.239	-0.262	0.023	0.206	-0.225	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.022	-0.025	0.003
A13	0.167	-0.170	0.003	0.079	-0.085	0.005	0.084	-0.098	0.014	0.260	-0.239	-0.021	0.000	0.000	0.000	0.059	-0.067	0.008
A14	0.516	-0.426	-0.091	0.456	-0.404	-0.052	0.019	-0.019	0.000	0.379	-0.343	-0.036	0.000	0.000	0.000	0.169	-0.124	-0.045
A15	0.330	-0.270	-0.060	0.178	-0.178	0.000	0.254	-0.216	-0.038	0.286	-0.274	-0.012	0.000	0.000	0.000	0.125	-0.133	0.008
A16	0.516	-0.426	-0.091	0.456	-0.404	-0.052	0.000	0.000	0.000	0.197	-0.221	0.024	0.000	0.000	0.000	0.050	-0.042	-0.008
A17	0.137	-0.139	0.002	0.274	-0.233	-0.040	0.415	-0.362	-0.053	0.154	-0.168	0.014	0.000	0.000	0.000	0.108	-0.119	0.011
A18	0.226	-0.239	0.012	0.116	-0.122	0.006	0.105	-0.116	0.011	0.379	-0.343	-0.036	0.000	0.000	0.000	0.059	-0.067	0.008
A19	0.516	-0.426	-0.091	0.324	-0.289	-0.035	0.203	-0.223	0.020	0.193	-0.216	0.023	0.000	0.000	0.000	0.112	-0.122	0.010

Source: author's calculation

Table 9 and Figure 1 shows the ranking of alternatives based on the IFTOPSIS method.

Table 9. Ranking of alternatives based on the IFTOPSIS method

	Relative Closeness Coefficient Ci*					
		S*	**S-**	**Ci***	**Ci***	**Ranking**
2002	**A1**	0.169	0.201	0.543	**0.543**	**8**
2003	**A2**	0.225	0.145	0.392	**0.392**	**17**
2004	**A3**	0.112	0.256	0.694	**0.694**	**1**
2005	**A4**	0.208	0.189	0.476	**0.476**	**12**
2006	**A5**	0.280	0.102	0.268	**0.268**	**19**
2007	**A6**	0.160	0.304	0.655	**0.655**	**4**
2008	**A7**	0.257	0.181	0.413	**0.413**	**15**
2009	**A8**	0.188	0.241	0.561	**0.561**	**7**

	Relative Closeness Coefficient Ci*					
2010	**A9**	0.241	0.162	0.402	**0.402**	**16**
2011	**A10**	0.232	0.249	0.518	**0.518**	**11**
2012	**A11**	0.235	0.211	0.472	**0.472**	**13**
2013	**A12**	0.211	0.238	0.530	**0.530**	**9**
2014	**A13**	0.249	0.136	0.352	**0.352**	**18**
2015	**A14**	0.161	0.308	0.657	**0.657**	**3**
2016	**A15**	0.158	0.214	0.576	**0.576**	**6**
2017	**A16**	0.197	0.277	0.585	**0.585**	**5**
2018	**A17**	0.191	0.215	0.529	**0.529**	**10**
2019	**A18**	0.220	0.190	0.462	**0.462**	**14**
2020	**A19**	0.132	0.266	0.668	**0.668**	**2**

Source: author's calculation

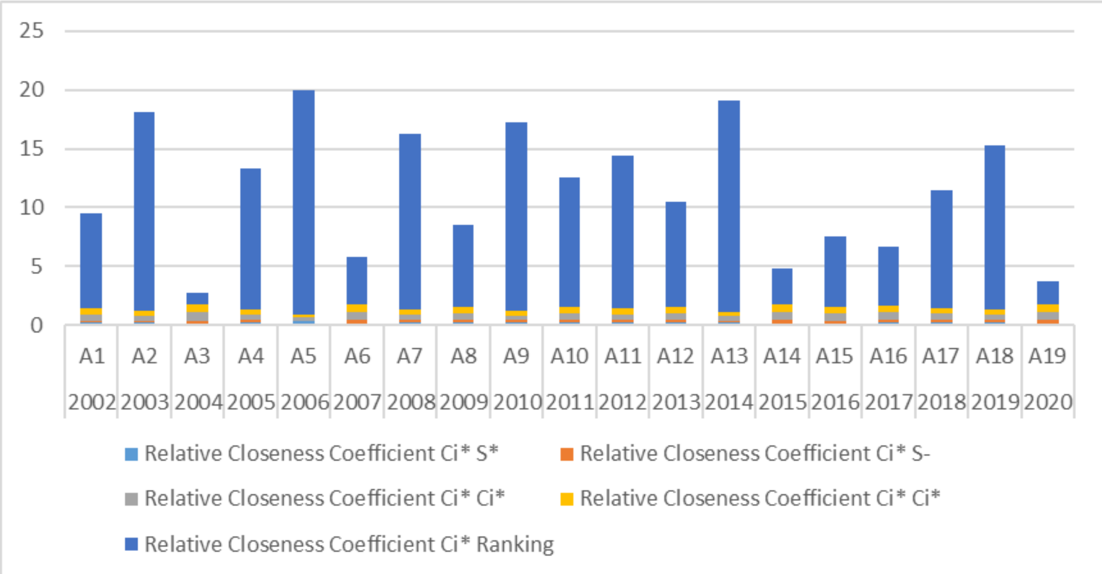

Figure 1. Ranking of alternatives according to the IFTOPSIS method

Source: author's conception

According to the empirical results obtained by applying the IFTOPSIS method, the top five years in order are: 2004, 2020, 2015, 2007 and 2017. The worst year is 2006. Financial performance and trade efficiency in Serbia have improved recently.

6.2 Ranking of alternatives based on the TOPSIS method

We will determine the weighting coefficients for the ranking of alternatives based on the TOPSIS method using the AHP method (Saaty, 2008). Table 10 shows the weighting coefficients of the criteria determined using the given method.

Table 10. Weight Coefficients of Criteria

AHP With Arithmetic Mean Method						
Initial Comparisons Matrix						
	C1	**C2**	**C3**	**C4**	**C5**	**C6**
C1	1	1	1	2	1	2
C2	1	1	6	1.25	1	2
C3	1	0.166667	1	0.5	1	1
C4	0.5	0.8	2	1	1	1

AHP With Arithmetic Mean Method						
Initial Comparisons Matrix						
	C1	**C2**	**C3**	**C4**	**C5**	**C6**
C5	1	1	1	1	1	1
C6	0.5	0.5	1	1	1	1
SUM	5	4.46667	12	6.75	6	8

Normalised Matrix							
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**Weights of Criteria**
C1	0.2000	0.2239	0.0833	0.2963	0.1667	0.2500	0.2034
C2	0.2000	0.2239	0.5000	0.1852	0.1667	0.2500	0.2543
C3	0.2000	0.0373	0.0833	0.0741	0.1667	0.1250	0.1144
C4	0.1000	0.1791	0.1667	0.1481	0.1667	0.1250	0.1476
C5	0.2000	0.2239	0.0833	0.1481	0.1667	0.1250	0.1578
C6	0.1000	0.1119	0.0833	0.1481	0.1667	0.1250	0.1225
						SUM	**1**
Consistency Ratio	**0.0657**	**COMPARE WITH 0.1; IT SHOULD BE LESS THAN 0.1.**					

Source: author's calculation

Table 11 shows the initial matrix, while Table 12 shows the normalised matrix, and Table 13 shows the normalised weighted matrix.

Table 11. Initial Matrix

weights of criteria	0.2034	0.2543	0.1144	0.1476	0.1578	0.1225
kind of criteria	1	1	1	1	1	1
INITIAL MATRIX	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
A1	4.7	1.78	1.35	1.31721	2.63355	45.60267
A2	7.06	2.43	1.83	1.32747	2.89993	71.67583
A3	10.99	3.18	2.46	1.29392	3.45247	135.6546
A4	7.78	3.58	3.71	0.96272	2.1755	251.8691
A5	10.47	4.92	4.63	1.06301	2.12799	378.97
A6	11.43	4.93	4.58	1.07585	2.31926	439.9337
A7	10.67	4.04	3.59	1.12552	2.63724	394.3352
A8	9.24	3.36	3.31	1.01667	2.74718	355,718
A9	13.54	3.88	3.23	1.19963	3.49027	398.3957
A10	13.78	4.26	3.41	1.24904	3.23767	458,832
A11	13.07	3.14	3.14	1	4.15847	483.0372
A12	12.01	4.15	3.1	1.33837	2.89223	464.417
A13	11.42	4.03	3.35	1.20256	2.83403	453.7864
A14	11.83	4.33	3.49	1.24299	2.73032	596.82
A15	12.24	4.53	3.5	1.29456	2.7041	510,636
A16	13.33	5.17	3.87	1.33558	2.57906	589.9769
A17	12.09	4.82	3.62	1.33118	2.50493	555.2917
A18	12.99	5.2	3.86	1.34492	2.50027	627.8299
A19	14.46	6.03	4.67	1.29141	2.39859	751.3026

Information For Normalisation	Sum of Squares	2502.891	337.2816	233.2176	28.17598	152.4585	3964419.7
	SQRT	50.0289	18.3652	15.2715	5.3081	12.3474	1991.0850

Source: author's Author's calculation

Table 12. Normalised Matrix

weights of criteria	0.2034	0.2543	0.1144	0.1476	0.1578	0.1225
kind of criteria	1	1	1	1	1	1
NORMALISED MATRIX	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
A1	0.0939	0.0969	0.0884	0.2482	0.2133	0.0229
A2	0.1411	0.1323	0.1198	0.2501	0.2349	0.0360
A3	0.2197	0.1732	0.1611	0.2438	0.2796	0.0681
A4	0.1555	0.1949	0.2429	0.1814	0.1762	0.1265
A5	0.2093	0.2679	0.3032	0.2003	0.1723	0.1903
A6	0.2285	0.2684	0.2999	0.2027	0.1878	0.2210
A7	0.2133	0.2200	0.2351	0.2120	0.2136	0.1981
A8	0.1847	0.1830	0.2167	0.1915	0.2225	0.1787
A9	0.2706	0.2113	0.2115	0.2260	0.2827	0.2001
A10	0.2754	0.2320	0.2233	0.2353	0.2622	0.2304
A11	0.2612	0.1710	0.2056	0.1884	0.3368	0.2426
A12	0.2401	0.2260	0.2030	0.2521	0.2342	0.2332
A13	0.2283	0.2194	0.2194	0.2266	0.2295	0.2279
A14	0.2365	0.2358	0.2285	0.2342	0.2211	0.2997
A15	0.2447	0.2467	0.2292	0.2439	0.2190	0.2565
A16	0.2664	0.2815	0.2534	0.2516	0.2089	0.2963
A17	0.2417	0.2625	0.2370	0.2508	0.2029	0.2789
A18	0.2596	0.2831	0.2528	0.2534	0.2025	0.3153
A19	0.2890	0.3283	0.3058	0.2433	0.1943	0.3773

Source: author's calculation

Table 13. Normalised Weighted Matrix

NORMALISED WEIGHTED MATRIX	C1	C2	C3	C4	C5	C6
A1	0.0191	0.0246	0.0101	0.0366	0.0337	0.0028
A2	0.0287	0.0336	0.0137	0.0369	0.0371	0.0044
A3	0.0447	0.0440	0.0184	0.0360	0.0441	0.0083
A4	0.0316	0.0496	0.0278	0.0268	0.0278	0.0155
A5	0.0426	0.0681	0.0347	0.0296	0.0272	0.0233
A6	0.0465	0.0683	0.0343	0.0299	0.0296	0.0271
A7	0.0434	0.0559	0.0269	0.0313	0.0337	0.0243
A8	0.0376	0.0465	0.0248	0.0283	0.0351	0.0219
A9	0.0550	0.0537	0.0242	0.0334	0.0446	0.0245
A10	0.0560	0.0590	0.0255	0.0347	0.0414	0.0282
A11	0.0531	0.0435	0.0235	0.0278	0.0531	0.0297
A12	0.0488	0.0575	0.0232	0.0372	0.0370	0.0286
A13	0.0464	0.0558	0.0251	0.0334	0.0362	0.0279
A14	0.0481	0.0600	0.0261	0.0346	0.0349	0.0367
A15	0.0498	0.0627	0.0262	0.0360	0.0346	0.0314
A16	0.0542	0.0716	0.0290	0.0371	0.0330	0.0363
A17	0.0492	0.0667	0.0271	0.0370	0.0320	0.0342
A18	0.0528	0.0720	0.0289	0.0374	0.0320	0.0386
A19	0.0588	0.0835	0.0350	0.0359	0.0307	0.0462

NORMALISED WEIGHTED MATRIX	C1	C2	C3	C4	C5	C6
MIN	0.0191	0.0246	0.0101	0.0268	0.0272	0.0028
MAX	0.0588	0.0835	0.0350	0.0374	0.0531	0.0462
A+	0.0588	0.0835	0.0350	0.0374	0.0531	0.0462
A-	0.0191	0.0246	0.0101	0.0268	0.0272	0.0028

Source: author's calculation

Table 14 and Figure 2 show the ranking of alternatives based on the TOPSIS method.

Table 14. Ranking of alternatives based on the TOPSIS method

	Alternatives	Si+	Si-	Ci	Ci	Ranking
2002	**A1**	0.0890	0.0118	0.1169	0.117	**19**
2003	**A2**	0.0765	0.0197	0.2050	0.205	**18**
2004	**A3**	0.0596	0.0387	0.3941	0.394	**16**
2005	**A4**	0.0603	0.0354	0.3697	0.370	**17**
2006	**A5**	0.0419	0.0589	0.5842	0.584	**11**
2007	**A6**	0.0369	0.0620	0.6270	0.627	**8**
2008	**A7**	0.0443	0.0487	0.5239	0.524	**14**
2009	**A8**	0.0541	0.0383	0.4144	0.414	**15**
2010	**A9**	0.0397	0.0562	0.5857	0.586	**10**
2011	**A10**	0.0342	0.0608	0.6401	0.640	**5**
2012	**A11**	0.0461	0.0556	0.5465	0.546	**13**
2013	**A12**	0.0386	0.0548	0.5867	0.587	**9**
2014	**A13**	0.0407	0.0519	0.5608	0.561	**12**
2015	**A14**	0.0343	0.0601	0.6366	0.637	**7**
2016	**A15**	0.0340	0.0601	0.6385	0.638	**6**
2017	**A16**	0.0265	0.0711	0.7281	0.728	**3**
2018	**A17**	0.0321	0.0638	0.6657	0.666	**4**
2019	**A18**	0.0267	0.0718	0.7291	0.729	**2**
2020	**A19**	0.0225	0.0874	0.7950	0.795	**1**

Source: author's calculation

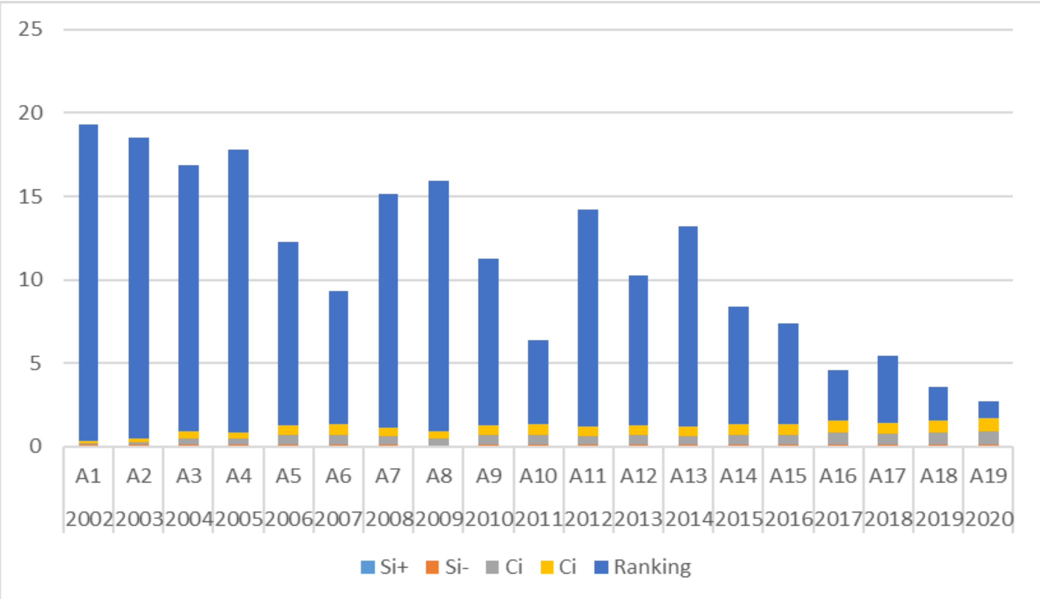

Figure 2. Ranking of alternatives according to the TOPSIS method

Source: author's conception

According to the results of the empirical research using the TOPSIS method, the top five years in order are: 2020, 2019, 2017, 2018 and 2011. The worst year is 2002. Recently, according to the TOPSIS method, the financial performance and efficiency of trade have improved in Serbia. The improvement of financial performance and trade efficiency in Serbia was influenced by numerous macro and micro factors, such as: economic climate, inflation, exchange rate, inflow of foreign direct investments, management of human resources, assets, capital, sales, and profit. Likewise, the implementation of new business models (multichannel sales, sales of organic products, private label), cost management (for example, costing by activity), customers and product categories. Digitisation of the entire business also plays a significant role in this. The impact of the COVID-19 pandemic has been mitigated with e-commerce. Adequate control of these and other factors can significantly influence the achievement of the target financial performance and trade efficiency in Serbia. In order to fully understand the dynamics of financial performance and efficiency of trade in Serbia, in addition to the applied methods, other methods of multi-criteria decision-making should be used in comparison. Also, for the sake of international comparison, it would be desirable to conduct similar research in other countries.

7. CONCLUSIONS

Based on the obtained results of empirical research, the following can be concluded: 1. According to the empirical results obtained using the IFTOPSIS method, the top five years in order are: 2004, 2020, 2015, 2007 and 2017. The worst year is 2006. Recently, financial performance and trade efficiency in Serbia have improved. 2. According to the results of empirical research based on the TOPSIS method, the top five years in order are: 2020, 2019, 2017, 2018 and 2011. The worst year is 2002. Recently, according to the TOPSIS method, financial performance and trade efficiency have improved in Serbia. The factors for improving the financial performance and efficiency of trade in Serbia are: economic climate, inflation, exchange rate, inflow of foreign direct investments (retail chains), management of human resources, assets, capital, sales, and profit, application of new business models (multichannel sales, sales of organic product, private label), cost management (for example, activity costing), customers, and product categories. The digitalisation of the entire business plays a significant role in this. The impact of the COVID-19 pandemic has been mitigated with e-commerce. Adequate control of these and other factors can greatly influence the achievement of target financial performance and trade efficiency in Serbia.

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