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Izvorni znanstveni rad

ANALYSIS OF THE PERFORMANCE OF THE SERBIAN ECONOMY BASED ON THE MEREC-WASPAS METHOD

Abstract

It is a very challenging problem to analyze the performance of the economy of each country based on multi-criteria decision-making methods. Based on that, this paper analyzes the performance of the Serbian economy based on the MEREC-WASPAS method. According to the results of the WASPAS method, the best performance of the Serbian economy was in 2012. The following are: 2016, 2021, 2010, 2011, 2017, 2019, 2015, 2018, 2013, 2014, and 2020. The performance of the Serbian economy was influenced by real GDP growth, consumer prices , foreign exchange reserves, export of goods and services, import of goods and services, unemployment, earnings, consolidated financial result, public debt, exchange rate and GDP. Effective control of these and other factors can significantly influence the achievement of the target performance of the Serbian economy. By increasing liquidity, solvency, the degree of open economy, as well as by mitigating exposure to financial risk, it is also possible to influence the improvement of the performance of the Serbian economy. In addition, it should be emphasized that recently the performance of the Serbian economy has been affected to a certain extent by the global political climate, the Covid 19 pandemic and the energy crisis.

Keywords: performance, determinants, Serbian economy, MEREC-WASPAS method

1.INTRODUCTION

Whether the economy operates efficiently or not can be successfully assessed on the basis of the DEA approach. DEA analysis includes various input and output elements. This enables a realistic assessment of the performance of the economy. In the world, there is an increasingly rich literature devoted to the development and application of DEA models in economics (Andersen, & Petersen, 1993; Banker et al., 1984; Chen et al., 2021, Chang et al., 2020; Guo, & Cai, 2020; Lee et al., 2011; Lin et al., 2020; Pendharkar et al., 2021; Tone, 2002; Dobrović et al., 2021; Podinovski et al., 2021; Rostamzadeh et al., 2021; Fenyves, & Tarnóczi, 2020; Amini et al., 2019; Tsai et al., 2021; Mandić et al., 2017; Pamučar et al., 2021; Liao, & Wu, 2020; Demir, 2022; Liao & Wu, 2020; Ecer, 2020). This is also the case with literature in Serbia (Lukic et al., 2017, 2020; Lukic, 2018, 2021, 2022a,b; Lukic & Kozarevic, 2019; Lukic & Hadrovic Zekic, 2019; Vojteški Kljenak & Lukić, 2022). The performance of the economy from different angles can be successfully viewed on the basis of multi-criteria decision-making methods. They include several criteria as factors of economic performance. There is an increasingly rich literature devoted to the application of multi-criteria decision-making methods in economics (Ayçin & Arsu, 2021; Popović et al., 2022; Ecer & Aycin, 2022; Mishra et al., 2022; Nguyen et al., 2022; Rani et al., 2022; Toslak et al., 2022). The performance of the economy of each country can be successfully assessed on the basis of criteria-based decision-making methods. Bearing this in mind, this paper empirically investigates the performance of the Serbian economy using the MEREC-WASPAS method. improvements in the future by applying relevant measures, and this, among other things, reflects the scientific and professional contribution of this work. Knowing the real situation regarding the performance of the Serbian economy is a key assumption for improvement in the future by applying adequate measures. This is the primary research hypothesis of the problem treated in this paper. It can be successfully implemented using MEREC-WASPAS methods. The necessary empirical data for researching the performance of the Serbian economy using the given methodology were collected from the National Bank of Serbia. They are largely aligned with relevant international standards, so there are no limitations in terms of global comparability.

2. RESEARCH METHODOLOGY

In further presentations of the treated issues, we will briefly refer to the characteristics of the MEREC and WASPAS methods.

2. 1. MEREC method

As is known, the weight of criteria in multi-criteria decision -making (MCDM) problems is an important element that significantly affects the results. Consequently, several methods were developed for determining the weights of the criteria (AHP, DEMATEL, CRITIC, Entropy, and Standard Deviation). Weighting methods can be objective, subjective and integrated in nature. This paper discusses the method based on the removal effects of criteria (MEREC - MEthod based on the Removal Effects of Criteria) for determining their weights in decision problems with multiple criteria (Ayçin & Arsu, 2021; Popović et al., 2022; Ecer & Aycin , 2022; Mishra et al., 2022; Nguyen et al., 2022; Rani et al., 2022; Toslak et al., 2022). The MEREC method is in the category of objective criteria weighting methods, which uses the effect of removing each criterion on the performance of alternatives to determine the weight of the criteria (Shanmugasundar et al., 2022). Higher weights are assigned to criteria that have greater effects on the performance of alternatives. First, in the MEREC method, measures for the performance of the alternatives are defined. In doing so, a simple logarithmic measure is used with equal weights to calculate the performance of the alternative. In order to identify the effects of removing each criterion, the measure of absolute deviation is used, which reflects the differences between the overall performance of the alternative and its effect in removing the criteria. The following steps are used to calculate the objective weights of the criteria using the MEREC method (Keshavarz-Ghorabaee et al., 2021).

Step 1: Constructing the decision matrix.

The decision matrix shows the scores or values of each alternative in relation to each criterion. The elements of this matrix are denoted by x_{ij} and should be greater than zero ($x_{ij} > 0$). If the values are negative, they should be transformed into positive values using the appropriate technique. Suppose there are n alternatives and m criteria, the form of the decision matrix is as follows:

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1j} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2j} & \cdots & x_{2m} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{i1} & x_{i2} & \cdots & x_{ij} & \cdots & x_{im} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nj} & \cdots & x_{nm} \end{bmatrix} \quad (1)$$

Step 2: Normalization of the decision matrix (*N*).

In this step, a simple linear normalization is used to scale the elements of the decision matrix. The elements of the normalized matrix are marked with n_{ij}^{x}. If $\mathcal{B}$it shows a set of useful criteria and $\mathcal{H}$ represents a set of non-useful criteria, the following normalization equation can be used:

$$n_{ij}^{x} = \begin{cases} \dfrac{\min_{k} x_{kj}}{x_{ij}} & if \quad j \in \mathcal{B} \\ \dfrac{x_{ij}}{\max_{k} x_{kj}} & if \quad j \in \mathcal{H} \end{cases} \quad (2)$$

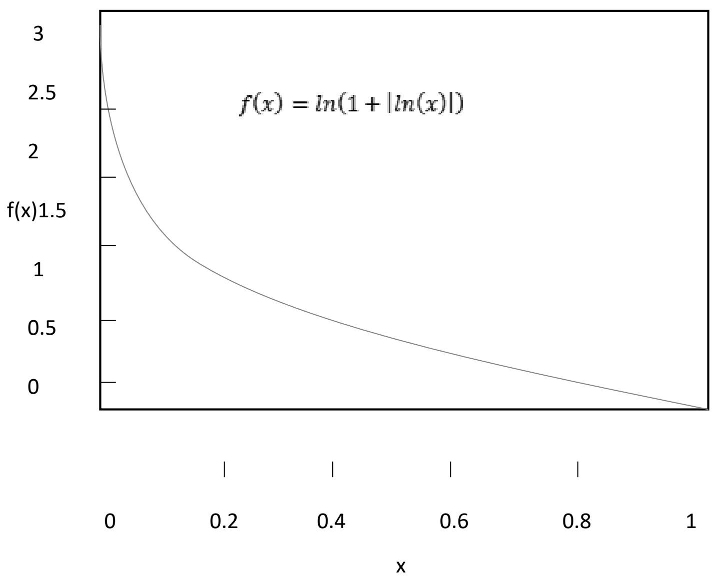
It should be noted here that the normalization process is similar but different from the process in methods such as WASPAS. The difference is in switching between useful and non-useful criteria formulas. Unlike other studies, here all criteria are transformed into normalized criteria types (Keshavarz-Ghorabaee et al., 2021).

Step 3: Calculation of the total performance of the alternatives (S_i).

In this phase, a logarithmic measure with equal criteria weights is applied to obtain the overall performance of the alternatives. This measure is based on the non-linear function shown in Figure 1. According to the normalized value obtained in the previous phase, it can be ensured that smaller values n_{ij}^x give higher performance values (S_i). The following equation is used for these calculations:

$$S_i = ln\left(1 + \left(\frac{1}{m}\sum_j \left|ln\left(n_{ij}^x\right)\right|\right)\right) \quad (3)$$

Figure 1. Weights of comparative analysis



S*tep 4*: Calculating the performance of the alternatives with the removal of each criterion.

In this phase, logarithmic measures are used in the same way as in the previous step. The difference between this step and step 3 is that the performance of the alternatives is determined by removing each criterion separately. Thus, *m* performance sets are associated with *m* criteria. Denote by S'_{ij} the total performance of the *i* -th alternative in connection with the removal of the *j* -th criterion. In this step, the following equation is used for the calculation:

$$S'_{ij} = ln\left(1 + \left(\frac{1}{m}\sum_{k,k\neq j} \left|ln\left(n_{ik}^x\right)\right|\right)\right) \quad (4)$$

Step 5: Calculation of the sum of absolute deviations.

In this step, calculation effect of removing the *j*-th criterion is calculated based on the values obtained in steps 3 and 4. Let's denote by E_j the effect of removing the *j*-th criterion. The calculation of the value of E_j is performed using the following equation:

$$E_j = \sum_i \left|S'_{ij} - S_i\right| \quad (5)$$

Step 6: Determination of the final weight of the criteria.

In this step, the actual weight of the criterion is calculated using the removal effect (E_j) in step 5. Let us denote w_j the weight of the *j*-th criterion. The following equation is used to calculate w_j:

$$W_j = \frac{E_j}{\sum_k E_k} \quad (6)$$

2.2. WASPAS method

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 et al., 2013a,b). An advanced fuzzy WASPAS method was developed for solving complex problems under uncertainty. The WASPAS method procedure consists of the following steps (Urosevic et al., 2017):

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

The optimal performance rating is calculated as follows:

$$x_{0j} = \begin{cases} \max\limits_i x_{ij}; & j \in \Omega_{max} \\ \min\limits_i x_{ij}; & j \in \Omega_{min} \end{cases}, \quad (7)$$

where: x_{0j} denotes the optimal performance rating of the *i* -th 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:

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{x_{0j}}; & j \in \Omega_{max} \\ \dfrac{x_{0j}}{x_{ij}}; & j \in \Omega_{min} \end{cases}, \quad (8)$$

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

$$Q_i^{(1)} = \sum_{j=1}^{n} w_j r_{ij}, \quad (9)$$

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 *i*-th alternative, based on the WP method, is calculated as follows:

$$Q_i^{(2)} = \prod_{j=1}^{n} r_{ij}^{w_j}, \quad (10)$$

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 et al., 2012) is calculated as follows:

$$Q_i = \lambda Q_i^{(1)} + (1-\lambda) Q_i^{(2)} = \lambda \sum_{j=1}^{n} w_j r_{ij} + (1-\lambda) \prod_{j=1}^{n} r_{ij}^{w_j} \quad (11)$$

where: λ is the coefficient and $\lambda \in [0, 1]$.

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

$$Q_i = 0.5Q_i^{(1)} + 0.5Q_i^{(2)} = 0.5\sum_{j=1}^{n} w_j r_{ij} + 0.5\prod_{j=1}^{n} r_{ij}^{w_j} \quad (12)$$

4. RESULTS AND DISCUSSION

When analyzing the performance of the Serbian economy based on the MEREC-WASPAS method, key indicators were taken as criteria. Alternatives were observed for individual years in the period 2010 - 2021. Criteria, alternatives and relevant initial data are shown in Table 1.

Table 1. Performance indicators of the Serbian economy

		Real GDP growth (in %)	Consumer prices (in % compared to the same month of the previous year)	NBS foreign exchange reserves (in millions oh euros)	Export of goods and services (in millions oh euros)	Import of goods and services (in millions oh euros)	The current account of the balance of payments (in millions oh euros)	Unemployed nity according to the Survey (in %)	Earnings (average for period of time, In euros)	Consolidated external financial result (in % of GDP)	Public debt of the Republic of Serbia (central level of the state, in % of GDP)	Exchange rate of the dinar against the dollar (average in the period)	Exchange rate of the dinar against the euro (average in the period)	GDP (in millions of euros)
		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
A1	2010	0.7	10.3	10.002	9.515	14.244	-2.037	20.9	331.8	-4.3	39.5	77.91	103.04	31.546
A2	2011	2	7	12.058	11.145	16.487	-3.656	24.9	372.5	-4.5	42.8	73.34	101.95	35.432
A3	2012	-0.7	12.2	10.915	11.469	16.992	-3.671	25.9	366.1	-6.4	52.9	88.12	113.13	33.679
A4	2013	2.9	2.2	11.189	13.937	17.782	-2.098	24	388.5	-5.1	56	85.17	113.14	36.427
A5	2014	-1.6	1.7	9.907	14.451	18.096	-1.985	20.6	379.8	-6.2	66.2	88.54	117.31	35.467
A6	2015	1.8	1.5	10.378	15.728	18.643	-1.234	18.9	367.9	-3.5	70	108.85	120.73	35.740
A7	2016	3.3	1.6	10.205	17.385	19.597	-1.075	16.4	374.5	-1.2	67.7	111.29	123.12	36.779
A8	2017	2.1	3	9.962	19.312	22.343	-2.051	14.5	394.5	1.1	57.8	107.5	121.34	39.235
A9	2018	4.5	2	11.262	21.166	25.257	-2.076	13.7	419.8	0.6	53.6	100.28	118.27	42.892
A10	2019	4.3	1.9	13.378	23.349	27.960	-3.161	11.2	466	-0.2	51.9	105.28	117.85	46.005
A11	2020	-0.9	1.3	13.492	22.271	26.370	-1.929	9.7	510.9	-8	57	103.03	117.58	46.815
A12	2021	7.5	7.9	16.455	28.583	33.109	-2.296	11	560.2	-4.1	56.5	99.49	117.57	53.329
Statistics														
Mean		2.1583	4.3833	861.1665	17.3593	21.4067	-2.2724	17.6417	411.0417	-3.4833	55.9917	95.7333	115.4192	39.4455
Median		2.0500	2.1000	11.2255	16.5565	19.1200	-2.0635	17.6500	384.1500	-4.2000	56.2500	99.8850	117.5750	36.6030
Std. Deviation		2.60051	3.89191	2942.54506	5.73629	5.64265	.82828	5.70398	67.45758	2.93345	9.14574	12.69252	6.70528	6.46356
The minimum		-1.60	1.30	9.91	9.52	14.24	-3.67	9.70	331.80	-8.00	39.50	73.34	101.95	31.55
Maximum		7.50	12.20	10205.00	28.58	33.11	-1.08	25.90	560.20	1.10	70.00	111.29	123.12	53.33

Source: National Bank of Serbia

In this paper, we will determine the weighting coefficients of the selection criteria using the MEREC method. (All calculations and results in this paper are the author's) Tables 2 - 6 show the calculations and results of the MEREC method.

Table 2. Initial matrix

Initial Matrix													
kind of criteria	1	1	1	1	1	1	1	-1	1	1	1	1	1
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
A1	0.7	10.3	10.002	9.515	14.244	-2.037	20.9	331.8	-4.3	39.5	77.91	103.04	31.546
A2	2	7	12.058	11.145	16.487	-3.656	24.9	372.5	-4.5	42.8	73.34	101.95	35.432
A3	-0.7	12.2	10.915	11.469	16.992	-3.671	25.9	366.1	-6.4	52.9	88.12	113.13	33.679
A4	2.9	2.2	11.189	13.937	17.782	-2.098	24	388.5	-5.1	56	85.17	113.14	36.427
A5	-1.6	1.7	9.907	14.451	18.096	-1.985	20.6	379.8	-6.2	66.2	88.54	117.31	35.467
A6	1.8	1.5	10.378	15.728	18.643	-1.234	18.9	367.9	-3.5	70	108.85	120.73	35.74
A7	3.3	1.6	10.205	17.385	19.597	-1.075	16.4	374.5	-1.2	67.7	111.29	123.12	36.779
A8	2.1	3	9.962	19.312	22.343	-2.051	14.5	394.5	1.1	57.8	107.5	121.34	39.235
A9	4.5	2	11.262	21.166	25.257	-2.076	13.7	419.8	0.6	53.6	100.28	118.27	42.892
A10	4.3	1.9	13.378	23.349	27.96	-3.161	11.2	466	-0.2	51.9	105.28	117.85	46.005
A11	-0.9	1.3	13.492	22.271	26.37	-1.929	9.7	510.9	-8	57	103.03	117.58	46.815
A12	7.5	7.9	16.455	28.583	33.109	-2.296	11	560.2	-4.1	56.5	99.49	117.57	53.329
MAX	7.5	12.2	10.205	28.583	33.109	-1.075	25.9	560.2	1.1	70	111.29	123.12	53.329
MIN	-1.6	1.3	9.907	9.515	14.244	-3.671	9.7	331.8	-8	39.5	73.34	101.95	31.546

Table 3. Normalized matrix

Normalized Matrix	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
A1	-2.286	0.126	0.991	1.000	1.000	0.000	0.464	0.592	0.000	1.000	0.941	0.989	1.000
A2	-0.800	0.186	0.822	0.854	0.864	0.000	0.390	0.665	0.000	0.923	1.000	1.000	0.890
A3	0.000	0.107	0.908	0.830	0.838	0.000	0.375	0.654	0.000	0.747	0.832	0.901	0.937
A4	-0.552	0.591	0.885	0.683	0.801	0.000	0.404	0.694	0.000	0.705	0.861	0.901	0.866
A5	0.000	0.765	1.000	0.658	0.787	0.000	0.471	0.678	0.000	0.597	0.828	0.869	0.889
A6	-0.889	0.867	0.955	0.605	0.764	0.000	0.513	0.657	0.000	0.564	0.674	0.844	0.883
A7	-0.485	0.813	0.001	0.547	0.727	0.000	0.591	0.669	0.000	0.583	0.659	0.828	0.858
A8	-0.762	0.433	0.994	0.493	0.638	0.000	0.669	0.704	-7.273	0.683	0.682	0.840	0.804
A9	-0.356	0.650	0.880	0.450	0.564	0.000	0.708	0.749	-13.333	0.737	0.731	0.862	0.735
A10	-0.372	0.684	0.741	0.408	0.509	0.000	0.866	0.832	0.000	0.761	0.697	0.865	0.686
A11	0.000	1.000	0.734	0.427	0.540	0.000	1.000	0.912	0.000	0.693	0.712	0.867	0.674
A12	-0.213	0.165	0.602	0.333	0.430	0.000	0.882	1.000	0.000	0.699	0.737	0.867	0.592

Table 4. Ln(x)

Ln(x)	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	Sum	Si
A1	0.000	2.070	0.010	0.000	0.000	0.000	0.768	0.524	0.000	0.000	0.060	0.011	0.000	3.442	0.235
A2	0.000	1.684	0.196	0.158	0.146	0.000	0.943	0.408	0.000	0.080	0.000	0.000	0.116	3.732	0.252
A3	0.000	2.239	0.097	0.187	0.176	0.000	0.982	0.425	0.000	0.292	0.184	0.104	0.065	4.752	0.312
A4	0.000	0.526	0.122	0.382	0.222	0.000	0.906	0.366	0.000	0.349	0.150	0.104	0.144	3.270	0.224
A5	0.000	0.268	0.000	0.418	0.239	0.000	0.753	0.389	0.000	0.516	0.188	0.140	0.117	3.030	0.209
A6	0.000	0.143	0.046	0.503	0.269	0.000	0.667	0.420	0.000	0.572	0.395	0.169	0.125	3.310	0.227
A7	0.000	0.208	6.937	0.603	0.319	0.000	0.525	0.403	0.000	0.539	0.417	0.189	0.153	10.293	0.583
A8	0.000	0.836	0.006	0.708	0.450	0.000	0.402	0.351	0.000	0.381	0.382	0.174	0.218	3.908	0.263
A9	0.000	0.431	0.128	0.800	0.573	0.000	0.345	0.289	0.000	0.305	0.313	0.148	0.307	3.639	0.247
A10	0.000	0.379	0.300	0.898	0.674	0.000	0.144	0.184	0.000	0.273	0.362	0.145	0.377	3.737	0.253
A11	0.000	0.000	0.309	0.850	0.616	0.000	0.000	0.092	0.000	0.367	0.340	0.143	0.395	3.111	0.215
A12	0.000	1.804	0.507	1.100	0.843	0.000	0.126	0.000	0.000	0.358	0.305	0.143	0.525	5.712	0.364

Table 5. S'ij

S'ij	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
A1	0.235	0.100	0.234	0.235	0.235	0.000	0.187	0.203	0.000	0.235	0.231	0.234	0.235
A2	0.252	0.146	0.241	0.243	0.244	0.000	0.194	0.228	0.000	0.248	0.252	0.252	0.245
A3	0.000	0.177	0.306	0.301	0.302	0.000	0.255	0.287	0.000	0.295	0.301	0.306	0.308
A4	0.224	0.191	0.217	0.201	0.211	0.000	0.167	0.202	0.000	0.203	0.215	0.218	0.215
A5	0.000	0.193	0.209	0.183	0.194	0.000	0.161	0.185	0.000	0.177	0.198	0.201	0.202
A6	0.227	0.218	0.224	0.196	0.210	0.000	0.185	0.201	0.000	0.191	0.202	0.216	0.219
A7	0.583	0.574	0.230	0.557	0.569	0.000	0.560	0.566	0.000	0.560	0.565	0.575	0.577
A8	0.263	0.212	0.262	0.220	0.236	0.000	0.239	0.242	0.263	0.240	0.240	0.252	0.250
A9	0.247	0.221	0.239	0.198	0.212	0.000	0.226	0.229	0.247	0.228	0.228	0.238	0.228
A10	0.253	0.230	0.235	0.198	0.212	0.000	0.244	0.242	0.000	0.236	0.231	0.244	0.230
A11	0.000	0.215	0.195	0.160	0.176	0.000	0.215	0.209	0.000	0.192	0.193	0.206	0.190
A12	0.364	0.263	0.337	0.304	0.318	0.000	0.357	0.364	0.000	0.345	0.348	0.357	0.336

Table 6. Ej

Ej	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13		
A1	0.000	0.135	0.001	0.000	0.000	0.000	0.048	0.032	0.000	0.000	0.004	0.001	0.000		
A2	0.000	0.106	0.012	0.009	0.009	0.000	0.058	0.025	0.000	0.005	0.000	0.000	0.007		
A3	0.000	0.135	0.005	0.011	0.010	0.000	0.057	0.024	0.000	0.017	0.010	0.006	0.004		
A4	0.000	0.033	0.008	0.024	0.014	0.000	0.057	0.023	0.000	0.022	0.009	0.006	0.009		
A5	0.000	0.017	0.000	0.026	0.015	0.000	0.048	0.025	0.000	0.033	0.012	0.009	0.007		
A6	0.000	0.009	0.003	0.031	0.017	0.000	0.042	0.026	0.000	0.036	0.025	0.010	0.008		
A7	0.000	0.009	0.354	0.026	0.014	0.000	0.023	0.017	0.000	0.023	0.018	0.008	0.007		
A8	0.000	0.051	0.000	0.043	0.027	0.000	0.024	0.021	0.000	0.023	0.023	0.010	0.013		
A9	0.000	0.026	0.008	0.049	0.035	0.000	0.021	0.017	0.000	0.019	0.019	0.009	0.019		
A10	0.000	0.023	0.018	0.055	0.041	0.000	0.009	0.011	0.000	0.016	0.022	0.009	0.023		
A11	0.000	0.000	0.019	0.054	0.039	0.000	0.000	0.006	0.000	0.023	0.021	0.009	0.025		
A12	0.000	0.101	0.027	0.061	0.046	0.000	0.007	0.000	0.000	0.019	0.016	0.008	0.028		
SUM	0.000	0.644	0.455	0.390	0.266	0.000	0.393	0.227	0.000	0.235	0.179	0.085	0.149	3.023	Total Sum
Weights	0.0000	0.2131	0.1504	0.1289	0.0881	0.0000	0.1300	0.0752	0.0000	0.0777	0.0593	0.0281	0.0492	1.000	

In the specific case, according to the results of the MEREC method, the following criteria are excluded: C1 - Real GDP growth (in %) , C6 - Current account of the balance of payments (in millions of euros) and C9 - Consolidated financial result (in % of GDP) . The most important criterion is C2 - NBS foreign exchange reserves (in millions of euros). Criterion C12 - The exchange rate of the dinar against the euro (average during the period) is of the least importance. The performance of the Serbian economy can therefore be significantly improved with the efficient management of foreign exchange reserves. Tables 7 - 11 show the calculations and results of the WASPAS method.

Table 7. Initial matrix

Initial Matrix													
weights of criteria	0	0.2131	0.1504	0.1289	0.0881	0	0.13	0.0752	0	0.0777	0.0593	0.0281	0.0492
kind of criteria	1	1	1	1	1	1	1	-1	1	1	1	1	1
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
A1	0.7	10.3	10.002	9.515	14.244	-2.037	20.9	331.8	-4.3	39.5	77.91	103.04	31.546
A2	2	7	12.058	11.145	16.487	-3.656	24.9	372.5	-4.5	42.8	73.34	101.95	35.432
A3	-0.7	12.2	10.915	11.469	16.992	-3.671	25.9	366.1	-6.4	52.9	88.12	113.13	33.679
A4	2.9	2.2	11.189	13.937	17.782	-2.098	24	388.5	-5.1	56	85.17	113.14	36.427
A5	-1.6	1.7	9.907	14.451	18.096	-1.985	20.6	379.8	-6.2	66.2	88.54	117.31	35.467
A6	1.8	1.5	10.378	15.728	18.643	-1.234	18.9	367.9	-3.5	70	108.85	120.73	35.74
A7	3.3	1.6	10.205	17.385	19.597	-1.075	16.4	374.5	-1.2	67.7	111.29	123.12	36.779
A8	2.1	3	9.962	19.312	22.343	-2.051	14.5	394.5	1.1	57.8	107.5	121.34	39.235
A9	4.5	2	11.262	21.166	25.257	-2.076	13.7	419.8	0.6	53.6	100.28	118.27	42.892
A10	4.3	1.9	13.378	23.349	27.96	-3.161	11.2	466	-0.2	51.9	105.28	117.85	46.005
A11	-0.9	1.3	13.492	22.271	26.37	-1.929	9.7	510.9	-8	57	103.03	117.58	46.815
A12	7.5	7.9	16.455	28.583	33.109	-2.296	11	560.2	-4.1	56.5	99.49	117.57	53.329
MAX	7.5	12.2	10.205	28.583	33.109	-1.075	25.9	560.2	1.1	70	111.29	123.12	53.329
MIN	-1.6	1.3	9.907	9.515	14.244	-3.671	9.7	331.8	-8	39.5	73.34	101.95	31.546

Table 8. Normalized matrix

Normalized Matrix													
weights of criteria	0	0.2131	0.1504	0.1289	0.0881	0	0.13	0.0752	0	0.0777	0.0593	0.0281	0.0492
kind of criteria	1	1	1	1	1	1	1	-1	1	1	1	1	1
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
A1	0.0933	0.8443	0.0010	0.3329	0.4302	0.0000	0.8069	1.0000	0.0000	0.5643	0.7001	0.8369	0.5915
A2	0.2667	0.5738	0.0012	0.3899	0.4980	0.0000	0.9614	0.8907	0.0000	0.6114	0.6590	0.8281	0.6644
A3	0.0000	1.0000	0.0011	0.4013	0.5132	0.0000	1.0000	0.9063	0.0000	0.7557	0.7918	0.9189	0.6315
A4	0.3867	0.1803	0.0011	0.4876	0.5371	0.0000	0.9266	0.8541	0.0000	0.8000	0.7653	0.9189	0.6831
A5	0.0000	0.1393	0.0010	0.5056	0.5466	0.0000	0.7954	0.8736	0.0000	0.9457	0.7956	0.9528	0.6651
A6	0.2400	0.1230	0.0010	0.5503	0.5631	0.0000	0.7297	0.9019	0.0000	1.0000	0.9781	0.9806	0.6702
A7	0.4400	0.1311	1.0000	0.6082	0.5919	0.0000	0.6332	0.8860	0.0000	0.9671	1.0000	1.0000	0.6897
A8	0.2800	0.2459	0.0010	0.6756	0.6748	0.0000	0.5598	0.8411	1.0000	0.8257	0.9659	0.9855	0.7357
A9	0.6000	0.1639	0.0011	0.7405	0.7628	0.0000	0.5290	0.7904	0.5455	0.7657	0.9011	0.9606	0.8043
A10	0.5733	0.1557	0.0013	0.8169	0.8445	0.0000	0.4324	0.7120	0.0000	0.7414	0.9460	0.9572	0.8627
A11	0.0000	0.1066	0.0013	0.7792	0.7965	0.0000	0.3745	0.6494	0.0000	0.8143	0.9258	0.9550	0.8779
A12	1.0000	0.6475	0.0016	1.0000	1.0000	0.0000	0.4247	0.5923	0.0000	0.8071	0.8940	0.9549	1.0000

Table 9. Weighted normalized matrix

Weighted Normalized Matrix	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	Qi1
A1	0.0000	0.1799	0.0001	0.0429	0.0379	0.0000	0.1049	0.0752	0.0000	0.0438	0.0415	0.0235	0.0291	0.5790
A2	0.0000	0.1223	0.0002	0.0503	0.0439	0.0000	0.1250	0.0670	0.0000	0.0475	0.0391	0.0233	0.0327	0.5511
A3	0.0000	0.2131	0.0002	0.0517	0.0452	0.0000	0.1300	0.0682	0.0000	0.0587	0.0470	0.0258	0.0311	0.6709
A4	0.0000	0.0384	0.0002	0.0629	0.0473	0.0000	0.1205	0.0642	0.0000	0.0622	0.0454	0.0258	0.0336	0.5004
A5	0.0000	0.0297	0.0001	0.0652	0.0482	0.0000	0.1034	0.0657	0.0000	0.0735	0.0472	0.0268	0.0327	0.4924
A6	0.0000	0.0262	0.0002	0.0709	0.0496	0.0000	0.0949	0.0678	0.0000	0.0777	0.0580	0.0276	0.0330	0.5058
A7	0.0000	0.0279	0.1504	0.0784	0.0521	0.0000	0.0823	0.0666	0.0000	0.0751	0.0593	0.0281	0.0339	0.6543
A8	0.0000	0.0524	0.0001	0.0871	0.0595	0.0000	0.0728	0.0632	0.0000	0.0642	0.0573	0.0277	0.0362	0.5204
A9	0.0000	0.0349	0.0002	0.0955	0.0672	0.0000	0.0688	0.0594	0.0000	0.0595	0.0534	0.0270	0.0396	0.5055
A10	0.0000	0.0332	0.0002	0.1053	0.0744	0.0000	0.0562	0.0535	0.0000	0.0576	0.0561	0.0269	0.0424	0.5059
A11	0.0000	0.0227	0.0002	0.1004	0.0702	0.0000	0.0487	0.0488	0.0000	0.0633	0.0549	0.0268	0.0432	0.4792
A12	0.0000	0.1380	0.0002	0.1289	0.0881	0.0000	0.0552	0.0445	0.0000	0.0627	0.0530	0.0268	0.0492	0.6467

Table 10. Exponentially weighted matrix

Exponentially weighted Matrix	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	Qi2
A1	1.0000	0.9646	0.3528	0.8678	0.9284	0.0000	0.9725	1.0000	0.0000	0.9565	0.9791	0.9950	0.9745	0.0000
A2	1.0000	0.8884	0.3628	0.8857	0.9404	0.0000	0.9949	0.9913	0.0000	0.9625	0.9756	0.9947	0.9801	0.0000
A3	0.0000	1.0000	0.3574	0.8890	0.9429	0.0000	1.0000	0.9926	0.0000	0.9785	0.9863	0.9976	0.9776	0.0000
A4	1.0000	0.6942	0.3588	0.9116	0.9467	0.0000	0.9901	0.9882	0.0000	0.9828	0.9843	0.9976	0.9814	0.0000
A5	0.0000	0.6571	0.3523	0.9158	0.9482	0.0000	0.9707	0.9899	0.0000	0.9957	0.9865	0.9986	0.9801	0.0000
A6	1.0000	0.6398	0.3547	0.9259	0.9507	0.0000	0.9599	0.9923	0.0000	1.0000	0.9987	0.9994	0.9805	0.0000
A7	1.0000	0.6486	1.0000	0.9379	0.9548	0.0000	0.9423	0.9909	0.0000	0.9974	1.0000	1.0000	0.9819	0.0000
A8	1.0000	0.7416	0.3526	0.9507	0.9659	0.0000	0.9274	0.9871	1.0000	0.9852	0.9979	0.9996	0.9850	0.0000
A9	1.0000	0.6802	0.3591	0.9620	0.9764	0.0000	0.9205	0.9825	1.0000	0.9795	0.9938	0.9989	0.9893	0.0000
A10	1.0000	0.6728	0.3685	0.9743	0.9852	0.0000	0.8967	0.9748	0.0000	0.9770	0.9967	0.9988	0.9928	0.0000
A11	0.0000	0.6206	0.3690	0.9683	0.9802	0.0000	0.8801	0.9681	0.0000	0.9842	0.9954	0.9987	0.9936	0.0000
A12	1.0000	0.9116	0.3802	1.0000	1.0000	0.0000	0.8946	0.9614	0.0000	0.9835	0.9934	0.9987	1.0000	0.0000

Table 11. Ranking

					λ	0.5	
	Ranking						
	Alternatives	Qi1	Qi2	Qi		Qi	Ranking
2010	A1	0.5790	0.5790	0.5790	0.5790		4
2011	A2	0.5511	0.5511	0.5511	0.5511		5
2012	A3	0.6709	0.6709	0.6709	**0.6709**		1
2013	A4	0.5004	0.5004	0.5004	0.5004		10
2014	A5	0.4924	0.4924	0.4924	0.4924		11
2015	A6	0.5058	0.5058	0.5058	0.5058		8
2016	A7	0.6543	0.6543	0.6543	0.6543		2
2017	A8	0.5204	0.5204	0.5204	0.5204		6
2018	A9	0.5055	0.5055	0.5055	0.5055		9
2019	A10	0.5059	0.5059	0.5059	0.5059		7
2020	A11	0.4792	0.4792	0.4792	0.4792		12
2021	A12	0.6467	0.6467	0.6467	0.6467		3

Therefore, according to the results of the WASPAS method, the best performance of the Serbian economy was in 2012. The following are: 2016, 2021, 2010, 2011, 2017, 2019, 2015, 2018, 2013, 2014, and 2020. The performance of the Serbian economy was influenced by real GDP growth, consumer prices, foreign exchange reserves, export of goods and services, import of goods and services, unemployment, earnings, consolidated financial result, public debt, exchange rate and GDP. Lately, the performance of the Serbian economy has been affected to some extent by the global political climate, the Covid 19 pandemic and the energy crisis. With the increase in the reference interest rate, the increase in inflation and thus the effects on the performance of the Serbian economy are controlled to a certain extent. Effective control of these and other factors can significantly influence the achievement of the target performance of the Serbian economy.

5. CONCLUSION

The following can be concluded based on the results of the empirical research on the performance of the Serbian economy using the given methodology: In the specific case, by applying the MEREC method, the following criteria were excluded from the analysis: C1 - Real GDP growth (in %) , C6 - Current account of the balance of payments (in millions of euros) and C9 - Consolidated financial result (in % of GDP) . The most important criterion is C2 - NBS foreign exchange reserves (in millions of euros). Criterion C12 - The exchange rate of the dinar against the euro (average during the period) belongs to the least significant criteria. This means that the performance of the Serbian economy can be significantly improved with efficient management of foreign exchange reserves. According to the results of the WASPAS method, the best performance of the Serbian economy was in 2012. The following are: 2016, 2021, 2010, 2011, 2017, 2019, 2015, 2018, 2013, 2014, and 2020. The performance of the Serbian economy was influenced by real GDP growth, consumer prices, foreign exchange reserves, export of goods and services, import of goods and services, unemployment, earnings, consolidated financial result, public debt, exchange rate and GDP. It should be mentioned in particular that recently the performance of the Serbian economy has been affected to a certain extent by the global political climate, the Covid 19 pandemic and the energy crisis. With the increase in the reference interest rate, the increase in inflation and thus the effects on the performance of the Serbian economy are controlled to a certain extent. Effective control of these and other factors can significantly influence the achievement of the target performance of the Serbian economy.

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ANALIZA POSLOVANJA PRIVREDE SRBIJE NA OSNOVU MEREC-WASPAS METODE

Sažetak

Vrlo je izazovan problem analizirati učinak gospodarstva svake zemlje na temelju višekriterijskih metoda odlučivanja. Na osnovu toga, ovaj rad analizira performanse privrede Srbije na osnovu MEREC-WASPAS metode. Prema rezultatima WASPAS metode, najbolje rezultate srbijansko gospodarstvo imalo je 2012. godine. Nakon toga slijede: 2016., 2021., 2010., 2011., 2017., 2019., 2015., 2018., 2013., 2014. i 2020. godina. Na srpsko gospodarstvo utjecali su rast realnog BDP-a, potrošačke cijene, devizne rezerve, izvoz roba i usluga, uvoz roba i usluga, nezaposlenost, zarade, konsolidirani financijski rezultat, javni dug, tečaj i BDP. Učinkovita kontrola ovih i drugih čimbenika može značajno utjecati na postizanje ciljanog učinka gospodarstva Srbije. Povećanjem likvidnosti, solventnosti, stupnja otvorenosti privrede, kao i ublažavanjem izloženosti financijskom riziku, moguće je utjecati i na poboljšanje performansi privrede Srbije. Osim toga, treba naglasiti da je u posljednje vrijeme na performanse srpskog gospodarstva u određenoj mjeri utjecala globalna politička klima, pandemija Covida 19 i energetska kriza.

Ključne riječi: performanse, determinante, srpsko gospodarstvo, MEREC-WASPAS metoda