Research Article

Comparison Of G-7 Countries' Macroeconomic Performance with SD and MABAC Methods

Yasemin TELLİ ÜÇLER[1]

[1] Dr.Öğr. Üyesi, Necmettin Erbakan Üniversitesi Uygulamalı Bilimler Fakültesi, yetlliucler@erbakan.edu.tr, ORCID: 0000-0002-7695-2003

Abstract: Countries determine their economic policies according to macroeconomic performance criteria. Macroeconomic performance criteria provide basic information on the level of development of countries. A reduction in unemployment, price stability and a balanced budget are important for achieving economic growth and competitiveness. The aim of this study is to analyse the macroeconomic performance of the G7 (Germany, the United States, the United Kingdom, Italy, France, Japan and Canada), a union of the seven countries with the highest level of development in the world, between 2018 and 2022. In the study, macroeconomic criteria (unemployment, inflation, external balance, and growth), which are called "magic diamonds" by OECD (Organization for Economic Cooperation and Development), were applied using SD (Standard Deviation) and MABAC (Multi-Attributive Border Approximation Area Comparison) methods. According to the results of the SD method, the inflation criterion has the greatest impact on macroeconomic performance in 2018 and 2019, the unemployment criterion in 2020 and 2022, and the growth criterion in 2021. According to the results of the MABAC method, Germany had the highest macroeconomic performance in 2020, and Japan had the highest macroeconomic performance in the other analyzed years.

Keywords: Macroeconomic Performance, MCDM, SD, MABAC, G7
Jel Codes: O11, C52, 057

G-7 Ülkelerinin Makroekonomik Performanslarının SD ve MABAC Yöntemleri ile Karşılaştırılması

Öz: Ülkeler ekonomi politikalarını makroekonomik performans kriterlerine göre belirlemektedirler. Makroekonomik performans kriterleri ülkelerin gelişmişlik seviyeleri ile ilgili temel bilgiler sunmaktadır. İşsizliğin azalması, fiyat istikrarının ve bütçe dengesinin oluşturulması ekonomik büyümenin ve rekabetin gerçekleşmesi açısından önem ifade etmektedir. Bu Çalışmanın amacı, dünyada gelişmişlik seviyesi en yüksek olan yedi ülkenin oluşturduğu bir birlik olan G7 (Almanya, Amerika Birleşik Devletleri, Birleşik Krallık, İtalya, Fransa, Japonya ve Kanada) 'nin 2018-2022 yılları arasındaki makroekonomik performanslarını incelemektir. Çalışmada OECD (Ekonomik Kalkınma ve İş Birliği Örgütü) tarafından "sihirli elmas "olarak adlandırılan (işsizlik, enflasyon, dış denge ve büyüme) makroekonomik kriterler ÇKKV (Çok kriterli karar verme) yöntemlerinden olan SD (Standart Sapma) ve MABAC (Multi- Attributive Border Approximation Area Comparison) yöntemleri kullanılarak uygulanmıştır. SD yönteminin sonuçlarına göre; enflasyon kriterinin 2018 ve 2019 yıllarında, işsizlik kriterinin 2020 ve 2022 yıllarında, büyüme kriterinin ise 2021 yılında makroekonomik performans üzerinde en büyük etkiye sahip olduğu görülmüştür. İlgili ülkeler arasında 2020 yılında en yüksek makroekonomik performansa sahip olan ülkenin Almanya, diğer incelenen yıllar arasında ise Japonya olduğu MABAC yönteminin sonuçlarına göre tespit edilmiştir.

Anahtar Kelimeler: Makroekonomik Performans, ÇKKV, SD, MABAC, G7
Jel Kodları: O11, C52, 057

Atıf: Telli Üçler Y. (2024). Comparison Of G-7 Countries' Macroeconomic Performance with SD and MABAC Methods. *Politik Ekonomik Kuram, 8*(1), 243-255. https://doi.org/10.30586/1411404

Geliş Tarihi: 28.12.2023
Kabul Tarihi: 14.03.2024

1. Introduction

A stable macroeconomic performance is not only important for the overall balance of a country but also an opportunity to increase its productivity and competitiveness (Veličković and Stanojević, 2022, p.587). Economies that lack productivity and competitiveness may experience both socio-economic and socio-cultural problems. Within the economic policies implemented by countries to realize economic development, there are many basic objectives, especially to increase production, minimize unemployment by expanding employment, observe the budget balance with public expenditures, and ensure the current balance (Arsić, 202, p.676). The indicator that countries use their financial, human, and physical capital efficiently and sustainably is determined by macroeconomic performance measurements (Belke, 2020, p.121).

Countries that demonstrate that they have successfully carried out their economic development aim to come to the forefront against their competitors. In order to improve their economic performance, countries need to have information about their past and current economic situation as well as the past and current economic situation of the countries they compete with. On the other hand, the macroeconomic performance of countries provides information to investors. The ability of countries to attract foreign investors and have a say in financial markets may vary according to their macroeconomic performance, as well as their level of development, underground and aboveground natural resources, technology, qualified workforce, foreign trade volumes, and growth capacity (Belhoula et al., 2023, p.2; Eyüboğlu, 2017, p.332; Apan and Tiyek, 2023, p.46). In this context, macroeconomic performance is related to the extent to which countries achieve their goals. The development of a country is mostly measured by real GDP (Gross Domestic Product). Therefore, national economies aim to achieve a high real GDP rate (Veličković and Stanojević, 2022, p.587). A single variable is insufficient to measure a country's macroeconomic performance as a whole. Therefore, several different criteria are used to evaluate the macroeconomic performance of countries. These criteria should be explained by units that are completely independent of each other and should not have any interrelationship with each other on the variables (Al and Demirel, 2022, s.205). To comprehensively understand macroeconomic performance, countries may need to assess their economic welfare on four criteria. The criteria of "unemployment, inflation, external balance, and growth," which OECD (1987) calls the "magic diamond," are used to compare the macroeconomic performance of a country among different countries over a certain period (Yazgan,2022, p.79). In this context, when evaluating the economic growth rate and the inflation rate, it is observed that economic efficiency decreases in the case of high inflation and its volatility. It is observed that investing in low inflation leads to economic growth and increased economic productivity in economies. According to inflation rates, countries tend towards technology transfer, competitive advantage, and economies of scale in trade through economic growth. The volume of trade is analysed in terms of tariff and non-tariff barriers. It also shows the pattern of trade, which reflects both non-tariff barriers and economic growth. It is known that economic growth can be realised at low levels in an environment with high unemployment. The existence of an inverse relationship between economic growth and unemployment is supported by Okun's law (Veličković and Stanojević, 2022, p.592). The current account deficit is caused by the increase in demand resulting from economic growth. Therefore, the increase in economic growth together with the increase in GDP leads to an increase in demand, and the increase in demand leads to an increase in imports, thus causing current account deficits. Another perspective is that capital accumulation and technological progress in developing countries are associated with higher development potential. The existence of economic integration can lead to high current account deficits (Duman, 2017; p.13).

The economic performance of countries can be compared using a number of methods. According to the findings of these comparative studies, their economic levels in certain periods are evaluated; mathematical methods can be made according to many criteria depending on the economic performance of countries (Zlaugotne, 2020, p.454).

Multi-criteria decision-making (MCDM) methods are frequently used in such comparisons and have the ability to rank, select, and rank alternatives using the results. They are widely used in economic benchmarking and decision making where many alternatives and criteria are involved (Karahan et al., 2021, p.585; Gupta et al., 2021, p.274).

This study aims to evaluate the macroeconomic performance of G7 countries between 2018 and 2022. SD and MABAC methods, which are among the MCDM methods, were used. The study determines the macroeconomic performance criteria as "unemployment, inflation, external balance, and growth" criteria, which the OECD characterizes as the "magic diamond." Although many studies are in the literature to measure the macroeconomic performance of G7 countries, SD and MABAC methods are not available. Therefore, it aims to make a significant contribution to the literature with the model created to analyze the macroeconomic performance of G7 countries. The study consists of five sections: introduction, literature review, methodology, application and conclusion.

2. Literature Review

Şekiller eklendikten sonra stiller bölmesinden PEK_5.2 stili seçilmelidir. Şekillerin başlıkları şekillerin altında yer almalıdır ve PEK_5.1 stili seçilmelidir.

In the literature, there are many studies in which different models are applied to evaluate the macroeconomic performance of countries. A summary of the methodology and results of some recent studies is presented below:

Dovern and Weisser (2011) conducted a survey to analyze the accuracy, objectivity, and efficiency of macroeconomic forecasts for the period covering 1991-2005. The survey results for G7 countries and four different macroeconomic variables show large differences between countries and macroeconomic variables. While respondents were more positive about the GDP values, the same was not true for the other variables.

Neanidis and Savva (2013) evaluate the causal relationships between real and nominal macroeconomic uncertainty on inflation and output growth. Strong non-linear relationships were identified with the help of the bivariate EGARCH-M (Exponential GARCH-in-Mean) model for G7 countries between 1957 and 2009. Uncertainty in production and growth rates supported the destruction theory. It is found that growth rates decrease with the effect of high inflation. It is observed that real uncertainties have different effects on average inflation during inflationary periods, while the effect of nominal uncertainty is positive.

The relationship between macroeconomic performance and institutional change in OECD countries is analysed by Welsch and Kühling (2016). First, they analysed the impact of national income, unemployment and inflation on SWB (subjective well-being) in thirty OECD countries. The values found were used to construct a macroeconomic performance index for SWB. This index was applied between 1990 and 2009. Macroeconomic performance improved across the OECD and in most countries. OECD performance is positively associated with institutional change towards greater trade openness and better institutional quality. Both increased trade openness and improved institutional quality are associated with economic and political integration. International integration is found to enhance SWB by improving the national macroeconomic performance of OECD countries.

Giannellis and Koukouritakis (2019) investigated whether the gold price is affected by domestic and external macroeconomic performance, as reflected in exchange rate movements, using annual data for G7 countries between 1980 and 2016. They used cointegration techniques to analyse the impact of the effective exchange rate and interest rates on the gold price. To capture the non-linear dependence between the gold price and macroeconomic variables, a two-regime panel smooth transition regression model with a monotonic transition function was applied. The results show that investors tend to invest in gold as the misalignment rate of the real effective exchange rate increases. When the

interest rate increase is high, investors are less willing to sell gold for higher-yielding assets. Gold is the only way to hedge financial risk.

Belke (2020) analyzed the macroeconomic performance of G7 countries between 2010-2018. Real GDP per capita, foreign trade, current account balance, economic growth, budget balance, inflation rate public debt, unemployment rate, investment rate, and were used as performance evaluation criteria. In the study, the CRITIC (Criteria Importance Through Intercriteria Correlation) method was first used to determine which criteria have the highest importance weights by years. Then, the MAIRCA (Multi Atributive Ideal-Real Comparative Analysis) method was applied to rank the macroeconomic performance of the countries. The results show that Germany has the highest macroeconomic performance among the countries analyzed, while Italy has the lowest.

Predicting the long-run relationship between G7 stock prices and macroeconomic variables over the last 40 years, Humpe and McMillan (2020) conducted a panel ARDL (Autoregressive Distributed Lag) analysis. While a positive long-run relationship was found between stock prices, industrial production and consumer prices, a negative relationship was found with the 10-year real interest rate.

In the study conducted by Uludağ and Ümit (2020), the macroeconomic performances and value-added production performances of Kazakhstan, Azerbaijan, Uzbekistan, Turkmenistan, and Turkey between 2008 and 2016 were analyzed using DEMATEL (Decision Making Trial and Evaluation Laboratory Model) and COPRAS (Complex Proportional Assessment) methods. It is concluded that Kazakhstan, Azerbaijan, and Uzbekistan cannot use their income efficiently, while Turkmenistan and Turkey use their income from non-production activities more efficiently.

Karahan et al. (2021) used the Prometheus method, one of the MCDM methods, to analyse 10 EU countries, including Turkey, using five basic economic criteria. The data used in the study was obtained from the OECD database of 2018. Luxembourg has a more dominant and partial priority compared to other countries according to the partial results of Prometheus I. In the Prometheus II ranking, Luxembourg's weight is positive while Slovakia's is negative. Luxembourg is in the first place among the countries with the highest net value of Phi.

Koşaroğlu (2021) analyzed the macroeconomic performance of E7 countries for the years 2010-2019. The study using ENTROPI and ARAS (Additive Ratio Assessment) methods determined that the current account deficit is the most effective criterion for macroeconomic performance. The country with the best economic performance is China.

Tekinay (2021) analyzed the economic performance of G7 countries and Turkey in the second quarter of 2019 and the second quarter of 2020 regarding the COVID-19 pandemic based on selected economic indicators. The study used the TOPSIS (Technique for Order Preference by Similarity to Ideal Solutions) method. In the study analyzed according to the current account balance/GDP ratio, inflation rate, unemployment rate, and GDP economic indicators, Japan exhibited the highest performance in the 2nd quarter of 2019 and Germany in the 2nd quarter of 2020. It is concluded that Turkey is the worst-performing country in terms of inflation and unemployment rates in both quarters.

Arsic (2022) analysed the macroeconomic performance of European and Central Asian economies as a function of the adoption of inflation targeting. The study was applied to 26 countries and covered the periods 1997-2019 and 2008-2019. Dynamic panel modelling and propensity score matching analysis was carried out. The results show that the adoption of the target was efficient at reducing the rate, the volatility and the volatility of GDP. It is concluded that inflation targeting has an impact on the macroeconomic performance of developing countries.

In the study by Bai et al. (2022), it is observed that three different criteria are examined by considering a hierarchical downsizing approach for multi-country VAR models. In the study, real GDP growth, CPI inflation, and short-term interest rate variables between 1973 and 2019 for G7 countries are considered. It analyzes how GDP growth affects CPI (Consumer Price Index inflation) and short-term interest rate forecasting performance.

Hierarchical contraction is found to be much more useful in forecasting CPI inflation, especially when applied with the Horseshoe prior. As a production outcome, GDP growth and interest rates achieve the best density forecasting performance. The forecasting accuracy of multi-country models is generally higher than that of single-country models.

Veličković and Stanojević (2022) analyzed the countries in the process of transition from the productivity-oriented development phase of the EU to the innovation-oriented development phase between 1995 and 2016. The analysis of the macroeconomic performance of EU countries based on "magic diamond" indicators concluded that the relationship between the individual indicators of Greece, Portugal, Spain, Cyprus, Malta, and Slovenia contributed to economic growth.

In the study conducted by Yazgan (2022) for the BRICS-T countries, an analysis was conducted for the period 2017-2021, taking into account the macroeconomic performance criteria described by the OECD as the "magic diamond". In the study using the SD and MABAC methods, the criterion with the greatest impact on macroeconomic performance is growth. It was observed that India is the highest country in terms of macroeconomic performance in 2017-2018 and 2021. On the other hand, it has been observed that Turkey's macroeconomic performance between 2017, 2020 and 2021 is at a medium level.

Apan and Tiyek (2023) aimed to evaluate Turkey's macroeconomic performance for the 2008-2021 period using the CRITIC and MABAC approaches. The study was conducted by considering Turkey's macroeconomic performance, economic growth, investment rate, export rate, import rate, current account balance rate, unemployment rate, inflation rate, and interest rate. The export rate criterion was found to be the most important criterion. With the increase in exports, a balanced exchange rate policy is expected to be established, and the foreign trade deficit will be closed.

In the study conducted by Arsu et al. (2023) with CRITIC and COPRAS methods, the economic advantages between BRICS (Brazil, Russia, India, China and South Africa) and MINT (Mexico, Indonesia, Nigeria, and Turkey) countries were measured using their macroeconomic indicators. The study was conducted according to three different scenarios using macroeconomic performance and human development level data. Then, macroeconomic performance and human development level data were evaluated separately. According to the results of the CRITIC method, the most important factors in the first and third scenarios are defined as economic growth, unemployment rate, and inflation rate, respectively. In scenario 2, the most important factors were found to be years of schooling, life expectancy at birth, and GNP per capita. When the results of the COPRAS method are analyzed, China, Russia, and Indonesia are found to be the most important factors in scenarios 1 and 3, respectively. According to Scenario 2, Russia, Turkey, and Mexico are the most successful countries.

Belhoula et al. (2023) examine the effect of macroeconomic indicators, microstructural factors, uncertainty indices, investor sentiment and global shocks on the dynamic efficiency of G7 stock markets by considering data from G7 countries between 2005 and 2022. A non-Bayesian generalised least squares time-varying model and a time-varying adjusted market efficiency method are applied. We find a strong relationship between stock market efficiency and oil prices. A heterogeneous panel causality test shows unidirectional evidence for all stock market efficiency factors except the consumer confidence index variable. Between time-varying market efficiency and interest rates, exchange rates, market volatility and economic growth, significant bidirectional causality was found.

The CRITIC and MABAC methodologies were analysed using data on macroeconomic variables of OECD countries between 2015 and 2021 in the study by Kahreman (2023). In the study, a performance comparison was made using GDP per capita, the total share of exports and imports in the volume of foreign trade and GDP, net exports, the unemployment rate, inflation and the exchange rate as the criteria for assessing performance. According to the results of the CRITIC method, it can be seen that the GDP is the most effective criterion for the evaluation of economic performance. The

three countries with the best economic performance are Luxembourg, Ireland and Germany according to the results of the MABAC method.

3. Methodology

This study aims to determine the macroeconomic performance of G7 countries between 2018 and 2022 using SD and MABAC methods. For this purpose, in this section of the study, the SD and MABAC methods used among the MCDM methods are explained in detail.

3.1. SD (Standard Deviation) Method

The method developed by Diakoulaki et al. in 1995 is an objective weighting method that considers how much the series deviates from their mean (Diakoulaki, 1995, p. 764). In this method, which is similar to the entropy method, low importance weight is given to criteria with similar values, and high importance weight is given to criteria with distant values. In addition, the disadvantage of the method is eliminated by performing normalization for criteria belonging to different units. The application steps of the method are summarized as follows (Diakoulaki, 1995, p. 764-765; Uludağ and Doğan, 2021, p. 409-411).

Step 1: In this step, the decision matrix consisting of the criteria and alternatives related to the decision problem is obtained from Equation (1).

$$X = \left[x_{ij}\right]_{m*n} \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \quad (1)$$

Step 2: Normalization is performed to standardize the criteria for different units in the decision matrix. Here, Equation (2) is used for benefit-oriented criteria, and Equation (3) for cost-oriented criteria.

$$X_{ij}^{*} = \frac{X_{iJ} - X_j^{min}}{X_J^{max} - X_j^{min}}; i = 1,2, \dots \dots . m; j = 1,2, \dots n \quad (2)$$

$$X_{ij}^{*} = \frac{X_j^{max} - X_{iJ}}{X_J^{max} - X_j^{min}}; i = 1,2, \dots \dots . m; j = 1,2, \dots n \quad (3)$$

Step 3: In the last step of the method, the standard deviation (σj) of each criterion is calculated using Equation (4), and the weight values (wj) of these criteria are calculated using Equation (5).

$$\sigma_j = \sqrt{\frac{\sum_{i=1}^{m} (X_{ij} - \bar{x}_j)^2}{m}}; j = 1,2, \dots n \quad (4)$$

$$W_j = \frac{\sigma_j}{\sum_{j=1}^{n} \sigma_j}; j = 1,2, \dots m \quad (5)$$

3.2. MABAC (Multi-Attributive Border Approximation Area Comparison) Method

The MABAC method developed by Pamučar and Ćirović in 2015 is a method that evaluates the alternatives with the distances of the criteria functions of the alternatives to

the boundary proximity area. The application steps of this method are as follows (Pamučar and Ćirović, 2015, pp.3016-3028; Ayçin and Çakın, 2019, pp.9-12):

Step 1: The decision matrix, which consists of the criteria and alternatives in the decision problem, is created with the help of Equation (6).

$$X=\begin{array}{c} \\ A_1 \\ A_2 \\ \dots \\ A_m \end{array}\begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \dots & C_n \end{array} \\ \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \end{array} \quad (6)$$

Step 2: Based on Equation (7), normalization is performed to standardize the criteria for different units in the matrix. In this process, Equation (8) is used for benefit-oriented criteria and Equation (9) for cost-oriented criteria.

$$N=\begin{array}{c} \\ A_1 \\ A_2 \\ \dots \\ A_m \end{array}\begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \dots & C_n \end{array} \\ \begin{bmatrix} n_{11} & n_{12} & \dots & n_{1n} \\ n_{21} & n_{22} & \cdots & n_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ n_{m1} & n_{m2} & \cdots & n_{mn} \end{bmatrix} \end{array} \quad (7)$$

$$n_{ij} = \frac{x_{ij}-x_i^-}{x_i^+-x_i^-} \quad (8)$$

$$n_{ij} = \frac{x_{ij}-x_i^+}{x_i^--x_i^+} \quad (9)$$

Step 3: In this step, the weight values of the criteria are included in the calculation using Equation (10).

$$v_{ij} = w_i.(n_{ij}+1) \quad (10)$$

Step 4: Based on Equation (11), boundary proximity area values (gi) for the criteria are determined. Calculating this value for each criterion, the boundary proximity area matrix (G) is obtained with the help of Equation (12).

$$g_i = \left(\prod_{j=1}^{m} v_{ij}\right)^{\frac{1}{m}} \quad (11)$$

$$G=\begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \dots & C_n \end{array} \\ \begin{bmatrix} g_1 & g_2 & \dots & g_n \end{bmatrix} \end{array} \quad (12)$$

Step 5: In this step, the Q matrix is obtained by calculating the distances of the values in the decision matrix from the boundary proximity area based on Equation (13). The values in the matrix (qji) are obtained as illustrated in Equation (14).

$$Q = \begin{bmatrix} q_{11} & q_{12} & \dots & q_{1n} \\ q_{21} & q_{22} & \cdots & q_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ q_{m1} & q_{m2} & \cdots & q_{mn} \end{bmatrix} \quad (13)$$

$$Q = V - G = \begin{bmatrix} v_{11}-g_1 & v_{12}-g_2 & \dots & v_{1n}-g_n \\ v_{21}-g_1 & v_{22}-g_2 & \cdots & v_{2n}-g_n \\ \vdots & \vdots & \ddots & \vdots \\ v_{m1}-g_1 & v_{m1}-g_2 & \cdots & v_{mn}-g_n \end{bmatrix} \quad (14)$$

Step 6: In this step, the status of each decision alternative is determined based on Equation (15) according to the values of (q_{ji}).

$$A_i \in \begin{cases} G^+ \text{ eğer } q_{ij} > 0 \\ G \text{ eğer } q_{ij} = 0 \\ G^- \text{ eğer } q_{ij} < 0 \end{cases} \quad (15)$$

For each of the decision alternatives to be the best alternative, a large proportion of the values of the criteria must be in the upper proximity range (G^+).

- $q_{ij} > 0$ indicates the closeness of alternative Ai to the ideal alternative;
- $q_{ij} < 0$ indicates the closeness of Ai to the negative-ideal alternative.

Step 7: In the last step of the method, the criterion functions of each of the alternatives are calculated based on Equation (16). After the calculation, it is concluded that the alternative with the highest value is the best.

$$S_i = \sum_{j=1}^{n} q_{ij}, \;\; j = 1,2,\dots,n, \;\; i = 1,2,\dots,m \quad (16)$$

4. Application

In this study, the macroeconomic performances of G7 countries between 2018 and 2022 are evaluated by using SD and MABAC methods in an integrated manner. First, the weights of the criteria that the OECD characterizes as "magic diamonds" are calculated using the SD method; then, the macroeconomic performances of the seven countries are ranked using the MABAC method. Information on the criteria used in the study is given in Table 1.

Table 1. Information on the criteria used in the study

Criterion	Criterion Code	Criterion Focus
Unemployment	C_1	Cost
Inflation	C_2	Cost
Growth	C_3	Benefit
External Balance	C_4	Benefit

In the first part of the application, a decision matrix containing data on the macroeconomic performance of G7 countries between 2018 and 2022 was constructed using the SD method, and this information is presented in Table 2. Since the study covers multiple periods, only the findings for 2018 are presented as an example in the tables in this section.

Table 2. Decision matrix (2018)

	C_1	C_2	C_3	C_4
Germany	3.208	1.730	0.981	8.010
USA	3.900	2.440	2.945	-2.130
United Kingdom	4.100	2.300	1.705	-3.930
Italy	10.600	1.140	0.926	2.590
France	9.025	1.850	1.865	-0.720
Japan	2.442	0.990	0.643	3.510
Canada	5.842	2.270	2.777	-2.380

In the second step of the method, the benefit-oriented criteria based on Equation (2) and the cost-oriented criteria based on Equation (3) were normalized, and the new matrix is presented in table 3.

Table 3. Normalized decision matrix (2018)

	C_1	**C_2**	**C_3**	**C_4**
Germany	0.906	0.490	0.147	1.000
USA	0.821	0.000	1.000	0.151
United Kingdom	0.797	0.097	0.461	0.000
Italy	0.000	0.897	0.123	0.546
France	0.193	0.407	0.531	0.269
Japan	1.000	1.000	0.000	0.623
Canada	0.583	0.117	0.927	0.130

In the last step of the method, the standard deviation (σj) for each criterion and the weight values (wj) of these criteria were calculated based on Equation (4) and Equation (5), and the values obtained are shown in the table below.

Table 4. σ_j and $\mathbf{w}_j$ values of criteria (2018)

	C_1	C_2	C_3	C_4
σ_j	0.380	0.396	0.395	0.352
w_j	0.249	0.260	0.260	0.231

As seen in Table 4, for 2018, according to the results of the SD method, the two criteria that have the highest impact on macroeconomic performance are inflation and growth.

According to the results of the SD method, the weight values (w_j) of the criteria on the basis of the years analyzed are summarized in Table 5.

Table 5. w_j values of the criteria

	2018	2019	2020	2021	2022
C_1	0.249	0.256	0.263	0.263	0.267
C_2	0.260	0.266	0.244	0.225	0.244
C_3	0.260	0.234	0.238	0.282	0.247
C_4	0.231	0.244	0.255	0.230	0.241

Based on the table above, when the weights of the criteria considered in terms of the analyzed years are analyzed, the inflation criterion has the highest impact on macroeconomic performance in 2018 and 2019, the unemployment criterion in 2020 and 2022, and finally, in 2021.

In the second part of the application, the macroeconomic performance of G7 countries is evaluated using the MABAC method. In the first step of the method, based on the decision matrix, benefit-side criteria are normalized using Equation (8), and cost-side criteria are normalized using Equation (9) and presented in the table below.

Table 6. Normalized decision matrix (2018)

	C_1	C_2	C_3	C_4
Germany	0.906	0.490	0.147	1.000
USA	0.821	0.000	1.000	0.151
United Kingdom	0.797	0.097	0.461	0.000
Italy	0.000	0.897	0.123	0.546
France	0.193	0.407	0.531	0.269
Japan	1.000	1.000	0.000	0.623
Canada	0.583	0.117	0.927	0.130

In the second step, the weighted normalized decision matrix was obtained by including the criteria weights shown in Table 3 in the calculation with the SD method with the help of Equation (10), and the values are summarized in the table below.

Table 7. Weighted normalized decision matrix (2018)

	C_1	C_2	C_3	C_4
Germany	0.475	0.387	-0.321	0.658
USA	0.454	0.260	-0.559	0.379
United Kingdom	0.448	0.285	-0.408	0.329
Italy	0.249	0.493	-0.314	0.509
France	0.298	0.366	-0.428	0.418
Japan	0.499	0.520	-0.279	0.534
Canada	0.395	0.290	-0.539	0.372

Then, based on the weighted normalized decision matrix, the border proximity area values (g_i) were calculated with the help of Equation (11), and the border proximity area matrix developed with these values and the distance matrix (q_{ij}) of each country to the border proximity area are presented in Tables 8 and 9.

Table 8. g_i Values of the criteria (2018)

	C_1	C_2	C_3	C_4
g_i	0.392	0.360	-0.394	0.445

Table 9. q_{ij} Values of the countries (2018)

	C_1	C_2	C_3	C_4
Germany	0.084	0.027	0.074	0.213
USA	0.063	-0.100	-0.165	-0.066
United Kingdom	0.056	-0.075	-0.014	-0.116
Italy	-0.142	0.133	0.080	0.064
France	-0.094	0.006	-0.034	-0.028
Japan	0.107	0.160	0.115	0.089
Canada	0.003	-0.069	-0.144	-0.073

In the final stage of the MABAC method, using the values in Table 8, the criterion functions of the countries are calculated using Equation (16), and these values and the ranking of the countries based on their macroeconomic performance are summarized in the table below.

Table 10. Ranking of countries based on MABAC method results (2018)

	S_i	Ranking
Germany	0.398	2
USA	-0.269	6
United Kingdom	-0.149	4
Italy	0.135	3
France	-0.149	5
Japan	0.471	1
Canada	-0.284	7

As seen in Table 10, the three countries with the highest macroeconomic performance in 2018 are Japan, Germany, and Italy, respectively.

Based on the results of the MABAC method, the ranking of countries based on the years analyzed is summarized in Table 11.

Table 11. Ranking of countries by macroeconomic performance

	2018	2019	2020	2021	2022
Germany	2	2	1	2	2
USA	6	5	3	7	4
United Kingdom	4	6	7	4	6
Italy	3	3	5	6	7
France	5	4	6	5	5
Japan	1	1	2	1	1
Canada	7	7	4	3	3

5. Conclusion

In this study, SD and MABAC methods are integrated to evaluate the macroeconomic performance of G7 countries between 2018 and 2022. In the study, the criteria affecting macroeconomic performance are determined as "unemployment, inflation, external balance, and growth" criteria, which the OECD characterizes as the "magic diamond."

In the study, the SD method, which is one of the objective criteria weighting methods, was used to determine the criterion weights of each criterion. The results of this method indicate that the inflation criterion has the highest impact on macroeconomic performance in 2018 and 2019, the unemployment criterion in 2020 and 2022, and finally, the growth criterion in 2021. In 2018 and 2019, G7 countries also struggled with inflation. The significant increase in food and energy prices, the change in consumer behavior worldwide, the economic crisis in 2018, the effects of which are still felt today, and the delays in the global supply chain are reflected as the effects of inflation. In 2020 and 2022, unemployment affected the G7 countries as it did the whole world. The COVID-19 pandemic, which spread worldwide from Wuhan, China, forced countries to take a series of measures to control the disease. Measures such as social isolation, curfews, closure of workplaces, and travel barriers have affected all interrelated sectors and caused an increase in unemployment. In 2021, it was observed that economic growth in G7 countries was at the highest level compared to the relevant years. After 2018, the rise in stimulus policies in the economies of G7 countries, the rapid and effective implementation of vaccination in the fight against the pandemic, the lifting of bans, and the resumption of the recovery in demand led to an increase in economic growth.

After weighing the criteria considered in the study, the MABAC method was used to rank the countries according to their macroeconomic performance. Based on the analysis results of this method, it was observed that Japan had the highest macroeconomic performance in 2018, 2019, 2021, and 2022. It was determined that the same country ranked 2nd in 2020 in terms of macroeconomic performance. Japan, especially after the Second World War, has sought to develop its manufacturing industry. It tried to revitalize the economy with reforms aimed at making it competitive. Production in the steel sector has accelerated the economy by increasing automotive, automotive parts, and electronics production. In particular, Honda, Nissan, and Denso companies in the automotive sector and Hitachi, Sony, and Panasonic brands in the electronics sector have gained an important place on the world platform. Over the years, Japan has become one of the fastest-growing economies in the world with its cheap labor force and low-cost mass production. By focusing on heavy industry, it has become one of the developed countries. The reason why Japan's macroeconomic performance has been the highest among the related countries in almost all years is the country's current account surplus for years. Although imports have slightly outpaced exports in recent years, Japan's economic success has led to a large accumulation of foreign reserves and foreign assets, making it one of the largest creditor countries. Strong in areas such as electronics and advanced engineering, Japan also has well-developed high-tech manufacturing and service sectors.

Following Japan, Germany has shown the highest macroeconomic performance. Germany is among the countries with the highest R&D expenditures in the world. The amount the country spends on R&D reaches 3 percent of GDP. High savings in the public and private sectors, efficient domestic investments in terms of periods, and long-term

industrial strategy are known as the reasons for the current account surplus of the German economy. Germany's most important sector is advanced engineering. Robotics, automation, machine vision software, and artificial intelligence are prominent sub-sectors in this sector, which aims for full automation. Germany is the world's leading steel, machinery, automobiles, electronics, and chemicals producer. Public finance in Germany is highly disciplined and has a strong stance. Even during the COVID-19 crisis, this provided ample financial space to deal with the economic devastation in the country. Germany continued to maintain its position in the world in macroeconomic performance criteria.

Since there is no literature review on the integrated use of SD and MABAC methods in evaluating the macroeconomic performance of G7 countries, this study is expected to contribute to the literature in this respect. The selection of four criteria in the application and the inclusion of only G7 countries constitute the limitations of this study. In future studies, different MCDM methods, criteria, and countries and cities can be used to evaluate macroeconomic performances, and the issue can be investigated in depth.

References

Al, İ.; Demirel, S. K. (2022). Türkiye'nin Makroekonomik Performansının TOPSIS Yöntemiyle Değerlendirilmesi: 2002-2019 Dönemi, *Mehmet Akif Ersoy Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 9*(1), 202-222.

Apan, M.;Tiyek, R. (2023). Makroekonomik Performans ve Entegre CRITIC Tabanlı MABAC Karar Verme Yaklaşımı: Türkiye Ekonomisinin 2008-2021 Dönem Verisinden Kanıtlar, *Süleyman Demirel Üniversitesi Vizyoner Dergisi*, *14*(100. Yıl Özel Sayısı), 44-65.

Arsić, M.; Mladenović, Z. ; Nojković, A. (2022). Macroeconomic Performance of Inflation Targeting in European and Asian Emerging Economies, *Journal of Policy Modeling, 44*(3), 675-700.

Arsu, T. (2022). Assessment of Macroeconomic Performances and Human Development Levels of BRICS and MINT Countries Using CRITIC and COPRAS Methods, *Pacific Business Review (International)*, *14*(10), 1-19.

Ayçin, E.; Çakın, E. (2019). Ülkelerin İnovasyon Performanslarının Ölçümünde Entropi ve MABAC Çok Kriterli Karar Verme Yöntemlerinin Bütünleşik Olarak Kullanılması, *Akdeniz İİBF Dergisi*, *19* (2), 326-351.

Bai, Y., Carriero, A.; Clark, T. E.; Marcellino, M. (2022). Macroeconomic Forecasting in A Multi-Country Context, *Journal of Applied Econometrics*, *37*(6), 1230-1255.

Belhoula, M. M.; Mensi, W.; Naoui, K. (2023). Impacts of Investor's Sentiment, Uncertainty Indexes, and Macroeconomic Factors on The Dynamic Efficiency of G7 Stock Markets, *Quality & Quantity*, 1-32.

Belke, M. (2020). CRITIC ve MAIRCA Yöntemleriyle G7 Ülkelerinin Makroekonomik Performansının Değerlendirilmesi, *İstanbul Ticaret Üniversitesi Sosyal Bilimler Dergisi*, *19*(Özel ek), 120-139.

Diakoulaki, D. ; Mavrotas, G. ; Papayannakis, L. (1995). Determining objective weights in multiple criteria problems: The critic method, *Computers & Operations Research*, *22*(7), 763-770.

Dovern, J.; Weisser, J. (2011). Accuracy, unbiasedness, and efficiency of professional macroeconomic forecasts: An empirical comparison for the G7, *International Journal of Forecasting*, *27*(2), 452-465.

Duman, Y. K. (2017). Türkiye'de Cari Işlemler Dengesi ve Ekonomik Büyüme Arasındaki İlişki, *Sakarya İktisat Dergisi*, *6*(4), 12-28.

Eyüboğlu, K. (2017). Türk Dünyasında Yer Alan Ülkelerin Makro Performanslarının Karşılaştırılması, *Bilig*, *83*, 331-350.

Giannellis, N.; Koukouritakis, M. (2019). Gold Price and Exchange Rates: A Panel Smooth Transition Regression Model for the G7 Countries, *The North American Journal of Economics and Finance*, *49*, 27-46.

Gupta, D.; Parikh, A.; Datta, T. K. (2021). A Multi-Criteria Decision-Making Approach to Rank the Sectoral Stock Indices of National Stock Exchange of India Based on their Performances, *National Accounting Review*, *3*(3), 272-292.

Humpe, A.; McMillan, D. G. (2020). Macroeconomic Variables and Long-Term Stock Market Performance: A Panel ARDL Cointegration Approach for G7 Countries, *Cogent Economics & Finance*, *8*(1), 1816257.

Kahreman,Y. (2023). OECD Ülkelerinin Ekonomik Performanslarının CRITIC-MABAC Yöntemi ile Ölçülmesi, *Uluslararası Bankacılık Ekonomi ve Yönetim Araştırmaları Dergisi*, *6*(1), 96-122.

Karahan, M.; Çetintaş, F., Karahan, M. S. (2021). Turkey and Some EU Countries' Economic Performance Analysis with Multi-Criteria Decision-Making Methods: Promethee GAIA Application in, *Digital Conversion on the Way to Industry 4.0* içinde, Ed., Durakbasa N. M. and Gençyılmaz M. G., Springer, Newyork, pp. 584-597.

Koşaroğlu, Ş. M. (2021). E7 Ülkelerinin Makroekonomik Performanslarının ENTROPİ ve ARAS Yöntemleriyle Karşılaştırılması, *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi*, *68*, 203-221.

Neanidis, K. C.; Savva, C. S. (2013). Macroeconomic Uncertainty, Inflation, and Growth: Regime-Dependent Effects in The G7, *Journal of Macroeconomics*, *35*, 81-92.

Pamučar, D.; Ćirović, G. (2015). The Selection of Transport and Handling Resources in Logistics Centers Using Multi-Attributive Border Approximation Area Comparison (MABAC), *Expert Systems with Applications*, *42*(6), 3016-3028.

Tekinay, O. N. (2022). Covid-19 Salgın Dönemi G7 Ülkeleri ve Türkiye'nin Ekonomik Performans Sıralaması ve Karşılaştırılması, *Yalova Sosyal Bilimler Dergisi*, *12*(1), 1-25.

Uludağ, A. S.; Ümit, A. Ö. (2020). Türk Dünyası Ülkelerinin Katma Değerli Üretim ve Makroekonomik Performanslarının DEMATEL ve COPRAS Yöntemleriyle Analizi, *Sosyoekonomi*, *28*(45), 139-164.

Uludağ, A.S.; Doğan, H. (2021). *Üretim Yönetiminde Çok Kriterli Karar Verme Yöntemleri: Literatür, Teori ve Uygulama*, Ankara: Nobel Akademik Yayıncılık.

Veličković, G.; Stanojević, J. (2022). "Magic Diamond" in a Macroeconomic Performance: An Empirical Assessment of Selected EU Countries. *Economic Alternatives*, *4*, 587-605.

Welsch, H.; Kühling, J. (2016). Macroeconomic Performance and Institutional Change:Evidence from Subjective Well-Being Data, *Journal of Applied Economics*, *19*(2), 193-217.

Yazgan, A. E. (2022). Bütünleşik SD ve MABAC Yöntemleri Ile BRICS-T Ülkelerinin Makro Ekonomik Performanslarının Incelenmesi. *Ekonomik Büyüme Alanında Güncel Çalışmalar* içinde. Ed. Üçler Telli, Y., Eğitim Yayınevi: Konya, pp.79-91.

Zlaugotne, B.; Zihare, L.; Balode, L.; Kalnbalkite, A.; Khabdullin, A.; Blumberga, D. (2020). Multi-criteria Decision Analysis Methods Comparison.,*Environmental and Climate Technologies*, *24*(1), 454-471.

Çıkar Çatışması: Yoktur.

Finansal Destek: Yoktur.

Etik Onay: Yoktur.

Yazar Katkısı: Yasemin Telli Üçler(%100)

Conflict of Interest: None.

Funding: None.

Ethical Approval: None.

Author Contributions: Yasemin Telli Üçler (100%)