EVALUATION OF FINANCIAL PERFORMANCE OF TURKISH BANKS BEFORE AND AFTER COVID-19 USING INTEGRATED TOPSIS METHODS[1]

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ABSTRACT | The effects of the COVID-19 pandemic on the financial performance of 10 banks operating in Turkey, including five with domestic capital and five with foreign capital, were investigated in this study. 15 criteria obtained with various numerical data related to these 10 banks were determined. Entropy, CRITIC, and Mean Weight methods were used for criteria weighting. The performance rankings were obtained by these three weights scores using the TOPSIS method. A fourth ranking was obtained by taking arithmetic averages of the rankings obtained from these three methods. According to this ranking for 2019, Fibabank was the bank with the best performance. For 2020, Garanti was the bank with the best performance.

Keywords: *COVID-19, financial performance, entropy, CRITIC, TOPSIS*
JEL Codes: *D81, G20, L25*

Scope: *Bussiness administration*
Type: *Research*

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[1] Compliance with the ethical rules of the relevant study has been declared.

TÜRK BANKALARININ FİNANSAL PERFORMANSLARININ COVID-19 ÖNCESİ VE SONRASI ENTEGRE TOPSIS YÖNTEMLERİ İLE DEĞERLENDİRİLMESİ

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ÖZ | Bu çalışmada, COVID-19 salgınının Türkiye'de faaliyet gösteren beşi yerli sermayeli, beşi yabancı sermayeli 10 bankanın finansal performansı üzerindeki etkileri araştırılmıştır. Bu 10 bankaya ilişkin çeşitli sayısal verilerle elde edilen 15 kriter belirlenmiştir. Kriter ağırlıklandırmasında Entropi, CRITIC ve Eşit Ağırlık yöntemleri kullanılmıştır. TOPSIS yöntemi kullanılarak bu üç ağırlık puanına göre performans sıralamaları elde edilmiştir. Bu üç yöntemden elde edilen sıralamaların aritmetik ortalamaları alınarak dördüncü bir sıralama elde edilmiştir. Bu sıralamaya göre 2019 yılında en iyi performansa sahip banka Fibabank olmuştur. 2020 yılı için ise Garanti bankası en iyi performansa sahip banka olmuştur.

Anahtar Kelimeler: *COVID-19, finansal performans, entropi, CRITIC, TOPSIS*
JEL Kodları*: D81, G20, L25*

Alan: *İşletme*
Türü: *Araştırma*

1. INTRODUCTION

Having entered our lives through the use of tables called 'bancho' by merchants who traded money by lending money in open markets in Italy, the bank has become an indispensable part of economic life today (Kılıç, 2020). During its historical development, banks have interacted with money and this has always attracted the attention of investors, creditors, and other interested parties. Today, banks have an important role in the development of the country and the financial markets (Özkan, 2017).

Banks promote economic growth and work as locomotives of the financial system. In addition to the functions, they perform financially, banks constitute an important place in the financial system due to their potential volume. Like many sectors in the economy, performance evaluations are made to determine the competitiveness of banks in the market, whereas the results obtained from these evaluations are an important issue for the relevant parties. Businesses, banks, and other organizations that want to rid themselves of the negative effects of the competitive environment need to implement effective and efficient working conditions to minimize fluctuations in their earnings. This issue is also related to the performance analysis of enterprises. The financial performance of banks always attracts the attention of relevant parties, so banks should constantly analyze and inform their customers (Wanke et al., 2016).

How COVID-19, which entered our country in early 2020, and the various measures taken afterward, positively or negatively affected the performance of banks were examined in this study. An attempt to examine the performances of 10 banks, five with private capital traded in BIST and five with foreign capital established in Turkey, in 2019 and 2020 was conducted in this study. Some of the liquidity ratios, capital adequacy ratios, balance sheets, asset structure, and profitability ratios were obtained by using the 'Selected Ratios' section published on the official website of the BRSA. The TOPSIS method was used for performance rankings in the study. While weighting the criteria, objective weighting methods such as Entropy, CRITIC, and Mean Weight were used separately. With these three weighting methods, a fourth ranking was obtained by taking the averages of the rankings. While examining the performances of the banks for the years 2019 and 2020, findings were obtained regarding which objective weighting method would be most appropriate to incorporate while performing performance analysis for banks in the study.

2. LITERATURE REVIEW

In utilizing 2005 data, Keçek and Cinser (2008) emphasized that studies with multivariate statistical analysis techniques using some financial ratios would also be beneficial in performing performance analysis of commercial banks.

In utilizing the VIKOR method in their study to determine the performance of bank branches Ertuğrul and Karakaşoğlu (2009) stated this method could be used in performance appraisal.

Ustasüleyman (2009) found that bank B had the highest service performance as a result of the study in which he evaluated the service performance of three commercial banks with the analytical Hierarchy Process TOPSIS method of the service quality of the banking sector.

In utilizing the TOPSIS method in his study, Demireli (2010) tested the performance of public banks operating in Turkey. As a result of this study, it was found that the banks were affected by the crises their performance fluctuated and there was not much improvement in the banking.

In their study, Dai and Wang (2011) stated that the TOPSIS method can evaluate the profitability of the company in an integrated way and can be used as a reference in increasing the profitability of the companies.

With the help of the TOPSIS method, Uygurtürk and Korkmaz (2012) analyzed the performance of 13 basic metal industry enterprises. As a result of the study, it was observed that the performance of the enterprises varied during the period in question.

In their study, Bağcı and Rençber (2014) compared the profitability performances of public and private banks utilizing the Promethee Method. In this study, it was seen that Halkbank from the public banks and Denizbank from the private banks were the most profitable, and when all banks were considered, public banks and Halkbank were the most profitable banks.

In their study, Mandic et al. (2014) conducted analyses using the Fuzzy Analytical Hierarchy Process (FAHP) and the Order Performance Technique by Similarity to Ideal Solution (TOPSIS) methods, whereas Banca Intesa obtained the best score in the ranking.

Saldanlı and Sırma (2014) emphasized that the TOPSIS method wouldn't aid investment decisions to be made regarding publicly traded enterprises, but it can be an important evaluation criterion in investment decisions as a result of the development of the method.

Çelen (2014a) suggested that the vector normalization procedure, which is generally used in the TOPSIS method by default, produces the most consistent results. Moreover, instead of relying on only one normalization procedure by

default, this study recommended applying a specific MADM method with different normalization procedures.

In a similar study, Çelen (2014b) argued that the 2001 financial crisis had a negative effect on the Turkish banking sector, but the effects were not devastating despite the ongoing global crisis.

In their study, Kandemir and Karataş (2016) used Gray relational analysis, TOPSIS, and VIKOR methods. As a result, Vakıfbank had the highest performance according to gray relational analysis and TOPSIS methods, while Şekerbank had the lowest performance. According to the VIKOR method, while Denizbank was the bank with the highest performance, Tekstil Bank was the bank with the lowest performance.

Wanke et al. (2016) attempted to determine the performance of Malaysian Islamic banks with the TOPSIS method and found that a slight decrease in equity leverage helped to achieve high efficiency, while variables related to the cost structure had a negative effect on productivity.

Yamaltdinova (2017) utilized the TOPSIS method in her study, whereas the results showed that the banks with the highest performance in Kyrgyzstan were Demir Kyrgyz International Bank and Optima Bank, while the banks with the lowest performance were Dos-Kredobank, FinanceCreditBank KAB, and Amanbank.

Yıldırım and Demirci (2017) revealed that the TOPSIS-Mahalanobis method was the most effective evaluation tool in bank performance evaluation and ranking.

In conducting a performance analysis of seven private and public banks using the TOPSIS method, Gökmen Özkan (2017) concluded that Garanti Bank had exhibited the highest performance and Akbank exhibited the lowest performance.

In their study of performance evaluation of four banks operating in Iran, Beheshtinia and Omidi (2017) observed that while the criteria of return on investment, debt ratio, and low energy consumption were important, brand value, increasing customer loyalty, and environmental awareness bore less importance.

In their study, Kalıntaş and Özarı (2019) examined the capital adequacy ratios of banks using the TOPSIS method, where they tried to emphasize the capital adequacy ratio of state-owned banks was found to be higher than that of private-capital banks.

Kendirli et al. (2019) analyzed the performances of 13 participating banks and commercial banks operating in Turkey with the TOPSIS method in three terms. Divided into periods such as pre-crisis (2005-2008), crisis (2008-

2011), and post-crisis (2011-2015), this study revealed that Turkey showed a good performance by taking the necessary precautions after the 2001 crisis.

Using 2018 annual data, Karakaya (2019) calculated the weights of 18 financial ratios that make up the Camels components by means of the Fuzzy Analytical Hierarchy Process (BAHS), whereupon banks were ranked according to their financial performance with the help of TOPSIS. As a result of said study, the banks were ranked as Kuveyt Türk, Ziraat Participation, Vakıf Katılım, Türkiye Finans Katılım and Albaraka Türk, according to their performance.

Tuba Özkan (2019) examined deposit banks traded on the BIST and found that QNB Finansbank demonstrated the highest performance during the specified term (2013-2017), followed by Türkiye Halk Bankası.

In his study, Yılmaz (2020) utilized the TOPSIS method and noticed that foreign capital deposit banks performed better.

In his study, Gülençer (2020) analyzed the financial performance of deposit banks by incorporating TOPSIS and VIKOR methods, resulting in private banks performing better than public banks between 2013-2017.

In his study, Daver (2020) proposed a performance measurement method by supporting the TOPSIS method with the Camels rating score method. As a result of said study, it was stated the performance ranking model presented wasn't suitable for investment decisions and that different performance measures need to be tried.

In their study, Kaygusuz et al. (2020) used the TOPSIS method with which they tried to examine the Camels valuation system components and bank performance. This study encompassed ten banks with ten years of data, with Denizbank to be the bank with the highest performance, and Halkbank as the bank with the lowest performance.

Gökmen Özkan and Deliktaş (2020) measured the performance of 10 banks operating in our country using the TOPSIS method. In this study, it was determined that Denizbank had the best performance, while Şekerbank was found to be the bank with the lowest performance.

In the study, Sarı (2020) stated that both TOPSIS and Promethee methods could be used in performance evaluation.

Tuba Özkan (2020) ranked the participation banks' performance with the TOPSIS method. As a result of said study, Türkiye Finans Katılım Bankası A.Ş emerged as the bank with the best performance.

In the study in which Unvan (2020) evaluated the performance of banks with TOPSIS and Fuzzy TOPSIS method in the period covering 2014-2018, it was observed that T.C. Ziraat Bankası, T.C. Iş Bankası and T.C. Garanti Bankası were the banks with the best performance.

Aydın (2020) used the CRITIC and MAIRCA methods in his study which aimed to evaluate the 2019 performance of state-owned participation, deposit, development, and investment banks in Turkey. As a result of said study, Ziraat Bankası (participation banks), Vakıflar Bankası (deposit banks), and Türk Eximbank (development and investment banks) were found to be the most successful performance-oriented banks.

In his study, Gül (2021), utilized the Entropy, Enhanced Entropy, and TOPSIS methods. In said study, Akbank demonstrated the highest performance and Turkish Bank the lowest.

Gülsün and Erdoğmuş (2021) attempted to compare bank performances with the help of Fuzzy TOPSIS and Fuzzy AHP methods, whereby it was determined that Ziraat Bankası had the highest and Finansbank had the lowest performance.

In his study, Baydaş (2022) made MCDM-based financial performance measurement of companies. The performance of WSA and FUCA methods was evaluated according to Spearman rho and entropy values, whereas he suggested that FUCA was the method with the highest capacity.

In his study, Türegün (2022) determined that the ranking results made with TOPSIS and VIKOR methods were similar in 2018 and 2019, and slightly different in 2020, using the 2018 data of tourism businesses traded on the BIST. As a result of Türegün's analysis, MARTI was the lowest-ranked alternative, whereas MERIT, KSTUR and PKENT were determined as floating companies.

Finally, in their study, Wanke et al. (2022) incorporated the CAMELS rating system to examine the performance of banks in ASEAN member countries, suggesting that the uncertain effect of ASEAN banking performance on financial difficulty could be addressed as a result.

3. MATERIAL AND METHOD

3.1. Material

In this study, it is necessary to look at how the performance of banks, either positively or negatively, has been affected by the COVID-19 pandemic that entered our country in early 2020, as well as the subsequent measures that were implemented continuously. In our study, we attempted to examine and compare the performance between the years 2019/2020 of 10 banks, five with private capital traded on the BIST and five with foreign capital established in Turkey. Some of the liquidity ratios, capital adequacy ratios, balance sheets, asset structure, and profitability ratios were obtained using the 'Selected Ratios' section published on the official website of the BRSA.

3.2. Method

An attempt is made to solve multi-criteria decision-making problems in a systematic way. As a priority, the information on the alternatives, if any, regarding the criteria is arranged and the initial decision matrix is created. If the alternatives don't have information about the criteria, the alternatives are compared according to the criteria using of various methods, and the scores of the alternatives are obtained according to the relevant criteria, whereby an initial decision matrix is formulated. After the initial decision matrix is created, the appropriate normalization method is determined, whereby a normalized decision matrix is obtained. Thereupon, the weight scores of the criteria are determined according to the objective or subjective weighting method to be used in the study. Unlike the previous studies found in the literature, i.e., Keçek and Cinser (2008), Ertuğrul and Karakaşoğlu (2009), Ustasüleyman (2009), Demireli (2010), Dai and Wang (2011), Uygurtürk and Korkmaz (2012), Bağcı and Rençber (2014)), Mandic et al. (2014), Çelen (2014a), Çelen (2014b), Saldanlı and Sırma (2014), Kandemir and Karataş (2016), Wanke et al. (2016), Beheshtinia and Omidi (2017), Yıldırım and Demirci (2017), Gökmen Özkan (2017), Yamaltdinova (2017), Kalıntaş and Özarı (2019), Arslan (2019), Kendirli et al. (2019), Karakaya (2019), Aydın (2020), Daver (2020), Kaygusuz et al. (2020), Gökmen Özkan and Deliktaş (2020), Gülençer (2020), Sarı (2020), Tuba Özkan (2020), Yılmaz (2020), Gül (2021), Gülsün and Erdoğmuş (2021), Türegün (2022) , Baydas (2022), Wanke et al. (2022), CRITIC-TOPSIS (CRT) was used in this study to calculate the performance scores of the banks, which are the subject of the research, in the pre-2019 and during 2020 year of COVID-19 and to obtain their ranking according to these scores, whereas Mean Weight-TOPSIS (MWT) and Entropy-TOPSIS (ENT) hybrid methods are applied separately.

Finally, the weight scores and normalization decision matrix are used in ordering the alternatives to be used in the study or by using the optimal alternative selection method. The final ranking was found by taking the arithmetic mean (AVR) of the results of the rankings obtained by these three methods. In addition, the similarity of the rankings was interpreted by calculating the Spearman Rank Correlation coefficient for both years of the results of the rankings obtained with the three methods and the average. The definitions of all the methods mentioned in this study are provided in order.

3.2.1. Initial decision matrix

m: number of alternatives and *n*: number of criteria are provided as the initial decision matrix $\left[x_{ij} \right]_{mxn}$. x_{ij} indicates the *i*. alternative according to the *j*. criteria financial performance scores obtained.

3.2.2. Min-Max normalization method

Also referred to as the Weitendorf Linear Normalization Method, both the maximum and minimum values of the performance scores are taken into account in this method. Two different formulae are calculated for the criteria that affect financial performance positively or negatively (Ersoy, 2021; Gardziejczyk & Zabicki, 2017).

The normalization formula $x_{ij}^{*} = \text{mak}(x_{ij})$ and $x_{ij}^{-} = \min(x_{ij})$ provide the positively contributing criterion equation (1).

$$r_{ij} = \frac{x_{ij} - x_{ij}^{*}}{x_{ij}^{*} - x_{ij}^{-}} \qquad \text{i=1,...,m; j=1,...,n} \qquad \textbf{(1)}$$

The normalization formula for the negatively contributing criterion is given by equation (2).

$$r_{ij} = \frac{x_{ij}^{-} - x_{ij}}{x_{ij}^{*} - x_{ij}^{-}} \quad \text{i=1,...,m; j=1,...,n} \qquad \textbf{(2)}$$

With the help of this method, there are no negative values in the normalized decision matrix, and the criteria scores with negative effects are converted into positive criteria scores (Zardari, Ahmed, Shirazi, & Yusop, 2015).

3.2.3. Mean weight method

This method is an objective weighting method that takes the importance levels of all criteria equally relative to each other when there isn't enough information to reach a decision about the criteria (Odu, 2019). The weight values of the criteria are calculated with the following formula, where *n* is the total number of criteria.

$$w_j = \frac{1}{n} \qquad \text{j=1,...,n} \qquad \textbf{(3)}$$

3.2.4. CRITIC (criteria importance through intercriteria correlation) weighting method

Firstly, Diakoulaki et al. (1995), utilize an objective weighting method that measures the deviation in performance scores with the help of correlation

analysis while determining criteria weights (Zardari et al., 2015). An *nxn*-sized symmetric correlation matrix ($\left[l_{jk} \right]_{nxn}$) is obtained by calculating the binary correlations of the criteria in a normalized r_{ij} decision matrix. The value of the matrix l_{jk} is the correlation coefficient between the *j.* criteria and the *k.* criteria. σ_j is the standard deviation score of the *j.* criteria, whereas I_j is calculated by the information amount vector equation (4).

$$I_j = \sigma_j \sum_{k=1}^{n} \left(1 - l_{kj}\right) \quad \text{j=1,...,n} \tag{4}$$

The weights of the criteria are obtained using the formula (5).

$$w_j = \frac{I_j}{\sum_{j=1}^{n} I_j} \quad \text{j=1,...,n} \tag{5}$$

3.2.5. Entropy weighting method

Introduced to the literature by Shannon (1948), the Entropy method measures the uncertainty in the information formulated using the probability theory. Using the Entropy method, the information matrix p_{ij} is first normalized with the help of equation (6), then the Entropy information value E_j is calculated with equation (7), whereby the entropy weights w_j are finally obtained through equation (8) (Dai & Wang, 2011; Zardari et al., 2015).

$$p_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} \quad \text{i=1,...,m; j=1,...,n} \tag{6}$$

$$E_j = \begin{cases} -\dfrac{1}{\ln(m)} \left(\sum_{i=1}^{m} p_{ij} \ln\left(p_{ij}\right) \right) & \text{p}_{ij} \neq 0 \\ 0 & \text{p}_{ij} = 0 \end{cases} \quad \text{j=1,..,n} \tag{7}$$

$$w_j = \frac{1 - E_j}{\sum_{j=1}^{n} \left(1 - E_j\right)} \quad \textbf{(8)}$$

3.2.6. TOPSIS (technique for order of preference by similarity to ideal solution) method

With the TOPSIS method, which was first developed by Hwang & Yoon (1981), the positive and negative ideal values of the criteria are determined in the weighted normalized decision matrix, and the distances of the criteria scores from the positive and negative ideal values are calculated. The relative closeness of these values is then calculated, whereas the alternatives are ranked according to their values (Dai & Wang, 2011).

$Z = \left[z_{ij} \right]_{mxn}$ which is comprised of the weight vector w_j and the normalized decision matrix r_{ij} is calculated by the weighted normalized decision matrix equation (9).

$$z_{ij} = w_j * r_{ij} \qquad \text{i=1,...,m; j=1,...,n} \quad \textbf{(9)}$$

Positive and negative ideal values for criteria are calculated using the formulas

$$\begin{aligned} z_j^+ &= \max\left(z_{ij}\right) \\ z_j^- &= \min\left(z_{ij}\right) \end{aligned} \quad \text{i=1,...,m} \quad \textbf{(10)}$$

Since the criteria affecting the result negatively with the help of equation (2) are converted to positive, the criteria are not separated into negative or positive criteria. Afterward, the Euclidean distances of each alternative in the decision matrix weighted with positive and negative ideal values are calculated using the equations (11)-(12).

$$D_i^+ = \sqrt{\sum_{j=1}^{n} \left(z_{ij} - z_j^+\right)^2} \qquad \text{i=1,...,m} \quad \textbf{(11)}$$

$$D_i^- = \sqrt{\sum_{j=1}^{n}\left(z_{ij} - z_j^-\right)^2} \qquad \text{i=1,...,m} \qquad \textbf{(12)}$$

Finally, the relative proximities of the alternatives to the ideal values are calculated using equation (13), whereas the alternatives are ranked according to their C_i values.

$$C_i = \frac{D_i^-}{D_i^+ + D_i^-} \qquad 0 \le C_i \le 1 \qquad \textbf{(13)}$$

3.2.7. The spearman rank correlation coefficient

The Spearman Rank Correlation coefficient for non-repetitive or non-reciprocal x_i and y_i $\left(i = 1,..., N\right)$ values is obtained through equation (14) (Spearman 1904).

$$r_s = 1 - \frac{6\sum_{i=1}^{N}\left(x_i - y_i\right)^2}{N\left(N^2 - 1\right)} \qquad \textbf{(14)}$$

4. FINDINGS

15 criteria were determined as financial performance indicators for the 10 banks, five with private capital which are traded in the BIST, and five with foreign capital, which were selected for this study. The banks studied, their performance criteria and their abbreviations are provided in Table 1.

Table 1: Alternatives and Criteria

Alternatives	Abbreviation	Criteria	Abbreviation
Akbank	AKB	Equity/Total Assets	C1
İş Bankası	İSB	(Equity-Fixed Assets) /Total Assets	C2
Denizbank	DNB	Total Funds/Total Assets	C3
Garanti	GRB	Loans/Total Assets	C4
QNB Finansbank	QNB	Liquid Assets/Total Assets	C5
Yapı Kredi	YPK	Net Term Profit /Total Assets	C6
HSBC	HSB	Net Term Profit /Equity	C7
Şekerbank	SKB	Pre-Tax Profit /Total Assets	C8
ODEA	ODB	Total Liabilities/Total Equity	C9
Fibabank	FIB	Liquid Assets/(Deposits+Non-Deposit Resources)	C10
		Liquid Assets/Short-Term Liabilities	C11
		Financial Assets/Total Assets	C12
		Non-Performing Loans/Loans	C13
		Non-Performing Loans/Total Assets	C14
		Fixed Assets/Total Assets	C15

Initially, the initial decision matrix with values of each of the 10 alternatives belonging to the 15 criteria is created. The initial decision matrix $\left[x_{ij}\right]_{mxn}$ for annual 2019 and 2020 data, including the number of rows (alternative) m=10 and number of columns (criteria) n=15, is provided in Table 2. According to Table 2, while the first 11 criteria affect financial performance positively, the last four criteria affect financial performance negatively. That is, the highest values of the first 11 criteria are taken as maximum values and these criteria normalized by equation (1), while the highest value of the last 4 criteria is taken as the minimum and these criteria are normalized by equation (2). After this Min-Max normalization process is carried out, this situation will no longer matter as all criteria will be converted to maximum. With the help of equations (1) and (2), the initial decision matrix $\left[x_{ij}\right]_{mxn}$ is transformed into Min-Max normalized decision matrix.

Table 2: Initial Decision Matrix

Term	Criteria	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
	Criteria	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	min.	min.	min.	min.
	Direction / Alternatives															
2019	AKB	0.1509	0.0993	0.0870	0.5654	0.1490	0.0150	0.0996	0.0189	5,6290	0.1928	0.2398	0.3739	0.0729	0.0412	0.0516
	İSB	0.1258	0.0511	0.0860	0.6180	0.1486	0.0256	0.2034	0.0147	6,9503	0.1887	0.2350	0.2680	0.0157	0.0097	0.0747
	DNB	0.1132	-0.0063	0.0918	0.6761	0.1394	0.0085	0.0754	0.0094	8.8307	0.1855	0.2175	0.2080	0.0225	0.0152	0.1195
	GRB	0.1375	0.0471	0.0642	0.6421	0.1755	0.0157	0.1145	0.0200	7.2751	0.2361	0.2760	0.2460	0.0689	0.0442	0.0904
	QNB	0.0918	0.0277	0.0843	0.6548	0.1265	0.0147	0.1596	0.0175	10.8888	0.1606	0.2175	0.2382	0.3155	0.2066	0.0641
	YPK	0.1063	0.0316	0.0984	0.6206	0.1936	0.0086	0.0810	0.0103	9.4081	0.2630	0.3368	0.2748	1.3268	0.8233	0.0747
	HSB	0.0881	0.0530	0.0009	0.5027	0.4179	0.0134	0.1526	0.0172	11.3476	0.5247	0.5253	0.4988	0.0403	0.0202	0.0351
	SKB	0.0646	-0.0398	0.0300	0.7132	0.1316	-0.0224	-0.3461	-0.0285	15.4793	0.1543	0.1640	0.1513	0.1305	0.0931	0.1044
	ODB	0.1010	0.0253	0.0570	0.5911	0.2522	0.0022	0.0216	0.0028	9.9005	0.3310	0.3729	0.3299	0.1391	0.0822	0.0757
	FIB	0.0761	0.0084	0.0393	0.6615	0.2406	0.0097	0.1273	0.0114	13.1383	0.3120	0.3882	0.3115	0.0636	0.0421	0.0677
2020	AKB	0.1410	0.0849	0.0813	0.5679	0.1494	0.0140	0.0996	0.0178	6.0901	0.2008	0.2481	0.3191	0.0683	0.0388	0.0562
	İSB	0.1141	0.0251	0.0681	0.6155	0.1492	0.0220	0.1930	0.0149	7.7620	0.1913	0.2402	0.2680	0.0067	0.0041	0.0891
	DNB	0.1149	-0.0234	0.1173	0.6776	0.1386	0.0090	0.0783	0.0105	8.7054	0.1794	0.2238	0.2185	0.0386	0.0261	0.1383
	GRB	0.1260	0.0736	0.0516	0.6394	0.1731	0.0127	0.1005	0.0175	7.9379	0.2331	0.2653	0.2457	0.0456	0.0292	0.0524
	QNB	0.0846	0.0159	0.0889	0.6572	0.1310	0.0109	0.1294	0.0132	11.8223	0.1666	0.2280	0.2390	0.3022	0.1986	0.0687
	YPK	0.0997	0.0110	0.0890	0.6273	0.1541	0.0092	0.0923	0.0114	10.0298	0.1953	0.2735	0.2305	1.2974	0.8139	0.0887
	HSB	0.0804	0.0592	0.0444	0.6041	0.2484	0.0099	0.1231	0.0135	12.4326	0.3076	0.3485	0.4102	0.0237	0.0143	0.0213
	SKB	0.0703	-0.0261	0.0174	0.6913	0.1424	0.0014	0.0200	0.0020	14.2274	0.1674	0.1737	0.1623	0.0991	0.0685	0.0964
	ODB	0.0863	-0.0047	0.0351	0.5310	0.1651	0.0034	0.0388	0.0042	11.5850	0.2121	0.2577	0.3981	0.1015	0.0539	0.0910
	FIB	0.0688	0.0269	0.0424	0.7170	0.1592	0.0084	0.1227	0.0116	14.5285	0.1265	0.2453	0.2233	0.0317	0.0228	0.0419

4.1. CRITIC-TOPSIS (CRT), Entropy-TOPSIS (ENT), and Mean Weight-TOPSIS (MWT) Methods

In this section, weight calculations for the criteria provided in Table 1 are tabulated using the CRITIC, Entropy, and Mean Weight methods for the annual 2019 and 2020 data.

For the CRITIC method, based on the Min-Max normalized decision matrix, the correlation values $\left[l_{jk} \right]_{nxn}$ and standard deviation scores σ_j of the criteria were calculated for the data of both years. Then the weights of the criteria were obtained by the CRITIC method with equations (4) and (5). According to these results, the most important criteria for both 2019 and 2020 is 'Total Debts/Total Equity' and the least important criteria for 2019 is 'Net Profit for the Year/Total Assets', and for 2020 is 'Liquid Assets/Short-Term Liabilities'.

For the Entropy method, the normalization matrix elements obtained by the Min-Max normalization method were re-normalized with the help of equation (6). Entropy values were calculated by applying equation (7) to the elements of the new normalized decision matrix obtained. The point to be noted here is that the entropy values $\left[0,1\right]$ are the elements of the set. The weight of each criterion was calculated by substituting the entropy values found in equation (8). The criteria with the highest level of importance for both the years 2019 and 2020 was 'Liquid Assets/Total Assets', with the lowest level of importance being 'Non-Performing Loans/Loans'.

For the Mean Weight method, it is accepted that the importance levels of the criteria equal each other. Thus, the weight value of each criterion was taken as $w_j \cong 0.0667$ (j=1,...,15) for $n = 15$ from equation (3).

The criteria weights obtained by CRITIC, Entropy, and Mean Weight methods were substituted in equation (9) respectively and normalized decision matrices for each method and both years are obtained. These normalized decision matrices were substituted in the TOPSIS method and rankings for each weighting method were obtained with the help of equations (10), (11), (12), and (13). The ranking is given in Table 3.

It is seen that the rankings obtained by CRT, ENT, and MWT methods vary. Multi-criteria decision-making methods can render different results when various weighting methods are used. As with many other fields of application, there is no standard approach to ranking banks according to their financial performance scores. In this study, while the TOPSIS method was chosen to rank the alternatives, three different objective weighting methods were used to calculate the weights of the criteria. According to their financial performance scores, the final rankings of the 10 banks in question are calculated by taking the

arithmetic average of the rankings obtained from these three methods. The new rankings obtained by taking the arithmetic mean of the rankings (AVR) are provided in Table 3 with the other ranking scores. Accordingly, in the performance ranking, Fibabank ranked 1st in 2019 while Garanti Bank ranked 1st in 2020. HSBC was ranked 2nd in both years. Şekerbank, which was in the 10th rank in 2019, rose to the 9th rank in 2020, and ODEA bank, which ranked 4th in 2019, regressed to the 10th spot in 2020.

Table 3: Performance Rankings of Banks for 2019 / 2020

2019					2020				
Alternatives	CRT	ENT	MWT	**AVR**	Alternatives	CRT	ENT	MWT	**AVR**
Fibabank	1	3	2	**1**	*Garanti B.*	1	2	1	**1**
HSBC	7	1	1	**2**	HSBC	3	1	2	**2**
Garanti	2	5	3	**3**	Fibabank**	2	5	5	**3**
ODEA	6	2	6	**4**	İş Bankası**	5	4	3	**4**
İş Bankası	4	7	4	**5**	Akbank	7	3	4	**5**
Akbank	8	6	5	**6**	QNB Finans.	4	9	6	**6**
QNB Finans.	3	10	7	**7**	Denizbank	6	7	7	**7**
Denizbank*	5	9	8	**8**	Yapı Kredi	9	6	8	**8**
Yapı Kredi*	9	4	9	**9**	Şekerbank	8	10	9	**9**
Şekerbank	10	8	10	**10**	ODEA	10	8	10	**10**

* Banks with equal score for Average ranking in 2019. ** Banks with equal score for Average ranking in 2020.

According to Table 3, while the bank with the best financial performance in 2019 was Fibabank, the one with the worst performance was Şekerbank for AVR. The average scores of Denizbank and Yapı Kredi were found to be equal; they were placed in 8th and 9th place in alphabetical order. While the bank demonstrating the best performance in 2020 is Garanti, the worst-performance bank is ODEA. While Fibabank and İşbank have equal scores and are ranked 3rd and 4th in alphabetical order, HSBC ranked 2nd for both years.

Table 4: Spearman Rank Correlation Coefficients

	2019					2020			
	CRT	**ENT**	**MWT**	**AVR**		**CRT**	**ENT**	**MWT**	**AVR**
CRT	1	-.04	.56	.64	**CRT**	1	.55	.82	.92
ENT	-.04	1	.58	.66	**ENT**	.55	1	.87	.83
MWT	.56	.58	1	.95	**MWT**	.82	.87	1	.96
AVR	.64	.66	.95	1	**AVR**	.92	.83	.96	1

Spearman Rank Correlation coefficients of the 2019 and 2020 rankings are provided in Table 4. According to the Table, while it can be said there is a very high similarity between the rankings obtained by the Mean Weight-TOPSIS method (MWT) and the average of the rankings (AVR) in 2019, it is also observed that the rankings obtained through CRT and ENT methods show almost no similarity. Also, while there is a moderate similarity between the rankings obtained through CRT and ENT methods in 2020, it is seen there is a high similarity between the CRT-AVR, CRT-MWT, ENT-MWT, and ENT-AVR rankings.

5. CONCLUSION

After the first COVID-19 virus case was seen in Turkey in March 2020, many people's habits changed with the curfews in the country. During this period, people started to do almost everything at home via the Internet. It is thought that the performance of banks, like many businesses, was affected by restrictions brought about by the COVID-19 pandemic and by the continually implemented measures. For this reason, the performance rankings of the banks for the years 2019 / 2020 were calculated, whereas the impact of the pandemic process on performance rankings was examined.

According to the results obtained with the help of the CRITIC-TOPSIS (CRT) method with the data of 2019, the bank with the highest financial performance score, Fibabank could not maintain its position during the pandemic process and fell to 2nd place in 2020. Garanti, which ranked second in 2019, increased its performance in this process compared to other banks and rose to first place in 2020. According to this method, Garanti was the institution that increased its financial performance the most during the pandemic process, while ODEA was the bank that decreased it the most. ODEA fell from 6th to 10th during the pandemic process.

In the financial performance ranking calculated with the Entropy-

TOPSIS (ENT) method in both 2019 and 2020, HSBC was not affected by the pandemic process and became the bank with the best performance. According to this method, ODEA Bank was the bank most affected by the pandemic. While ODEA was in 2nd spot in 2019 before the pandemic, it fell to 8th place during the pandemic. While Garanti Bank, Işbank, Akbank, QNB Finansbank, and Denizbank rose to the top by increasing their performance during the pandemic process, the rankings of the other institutions decreased.

As the first place in the pre-pandemic financial performance rankings according to the Mean Weight TOPSIS (MWT) method, HSBC left its place to Garanti during the pandemic. According to this method, while Garanti was the bank that best evaluated the pandemic process, the worst-rated bank was ODEA, which fell from 6th place to 10th.

It is seen that the rankings obtained by CRT, ENT, and MWT methods vary from one another. Multi-criteria decision-making methods can give different results when different weighting methods are used. As with many other fields of application, there is no standard approach to ranking banks according to their financial performance scores. Therefore, the final ranking was calculated by taking the arithmetic mean of rankings obtained from these three methods. According to the final ranking, the bank that was positively affected by the pandemic process in terms of financial performance and turned this process into an advantage was Garanti, which rose two places to the top. HSBC has not been affected positively or negatively by the pandemic process as it held 2nd place for both years. ODEA Bank was the institution most negatively affected by the pandemic process. The bank, which was in 4th place in the financial performance ranking prior to the pandemic, fell to 10th place during the pandemic. Another bank adversely affected by the pandemic process was Fibabank, which fell two rows at once. Other banks, on the other hand, rose one place each compared to 2019 and were positively affected by this process.

From the result of the study, as a result of various measures, it is seen that the Covid 19 pandemic has a positive or negative effect on the financial performance rankings of banks. Of course, different factors that impact upon the financial performance of banks. Results obtained in this study can also be utilized as a source when measuring the effects of other factors. These results can be compared with those obtained for different criteria or multi-criteria decision-making methods. Moreover, in evaluating the results obtained in the study, it is seen that the closest rankings to the final ranking are obtained with the Mean Weight TOPSIS method. For this reason, when comparing the financial performance of banks, if the TOPSIS method is to be applied, it is recommended that criteria weights be taken equally.

6. CONFLICT OF INTEREST STATEMENT

There is no conflict of interest between the authors.

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No funding or support was used in this study.

8. AUTHOR CONTRIBUTIONS

MH: Idea
ÖA: Design
Ö.A: Supervision
MH: Collecting and processing resources
ÖA: Analysis and interpretation
ÖA, MH: Literature review
ÖA, MH: Writer
ÖA, MH: Critical Review

9. ETHICS COMMITTEE STATEMENT AND INTELLECTUAL PROPERTY COPYRIGHTS

While conducting the present study, all the rules within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive" were obeyed and none of the "Actions Contrary to Scientific Research and Publication Ethics" were performed. Ethics committee principles were paid great attention in the study and necessary permissions were taken in accordance with the principles of intellectual property and copyright.

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