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Financial Performance Analysis of Multi-Branch Banks with Integrated MPSI-MARA Model: The Case of Türkiye*

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Abstract

In this research, the financial data of multi-branch deposit banks operating in Türkiye were analyzed with MPSI-MARA integrated ranking model and seven different financial ratios were selected as performance criteria. According to the analysis made according to the MPSI weighting method, it was understood that the criterion that most affected the financial performance of the banks was "Number of Branches/Net Period Profit". The second most important criterion was determined to be the "Net Period Profit/Total Assets" criteria. The most important result of the research is the finding that Akbank is the bank with the highest financial performance according to the MARA ranking method integrated with the MPSI weight method. This successful bank was followed by Garanti Bankası and Yapı ve Kredi Bankası. It has been determined that state-owned banks are not successful in 2022.

Keywords:
Bank Performance,
Multi Criteria Decision Making Technics,
MPSI,
MARA

JEL Classification:
G41, G21, G10, G20

Bütünleşik MPSI-MARA Modeliyle Çok Şubeli Bankaların Finansal Performans Analizi: Türkiye Örneği

Öz

Bu araştırmada, Türkiye'de faaliyet gösteren çok şubeli mevduat bankalarının finansal verileri MPSI-MARA bütünleşik sıralama modeliyle analiz edilmiş ve yedi farklı finansal oran performans kriteri olarak seçilmiştir. MPSI ağırlıklandırma yöntemine göre yapılan analize göre, bankaların finansal performansını en çok etkileyen kriterin "Şube Sayısı/Net Dönem Karı" olduğu anlaşılmıştır. İkinci en önemli kriterin ise "Net Dönem Karı/Toplam Aktifler" kriterleri olduğu saptanmıştır. Araştırmanın en önemli sonucu, MPSI ağırlık yöntemi ile bütünleştirilen MARA sıralama yöntemine göre en yüksek finansal performansa sahip bankanın Akbank olduğu bulgusudur. Bu başarılı bankayı Garanti Bankası ve Yapı ve Kredi Bankası izlemiştir. Kamu sermayeli bankaların 2022 yılında başarılı olamadıkları saptanmıştır.

Anahtar Kelimeler:
Banka Performansı, Çok Kriterli Karar Verme Teknikleri, MPSI,
MARA

JEL Sınıflandırması:
G41, G21, G10, G20

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1. Introduction

The number of scientific studies measuring the financial performance of banks operating in the financial system by using the numerical values and comparing the performances of competing banks with each other in the light of these values is increasing day by day. This is because the number of individuals and institutions affected by the performance of the banking system is increasing as time passes. Today, there are almost no individuals or institutions left that are not affected by banking activities. Except for the years of economic recession, the number of both savers and borrowers is increasing continuously. The financial performance of banks as financial intermediaries and especially deposit banks collecting deposits is of close interest to many people. Not only in the developed Western countries that have managed to deepen their finances, but even in the developing countries that are trying to realize their economic growth with the increase in loans, the profitability of banking, the good functioning of the financial system, in short, its performance, have begun to be of vital importance. Banking activities have become the heart and engine of the economy, which provides vital blood flow. If it works, the economy recovers, normalizes, if it does not work, the economy becomes stagnated and faces with a crisis.

In this research, the financials of multi-branch deposit banks in Turkey for the year 2022 will be analyzed with MPSI (the Modified Preference Selection Index) and MARA (Magnitude of the Area for the Ranking of Alternatives) integrated model and the bank with the highest financial performance will be determined. This research is the only work made in banking using the integrated MPSI-MARA method.

In addition, the financial performance of the banks examined in the research will be converted into a numerical value and a ranking of success will be obtained. After the introduction and literature review, the theoretical explanation of the integrated method used in the research will be made in the following part and the findings of the analysis will be shared in the next part. In the last part, the results reached in the light of the findings obtained will be explained.

2. Literature

Measuring financial performance in the banking sector primarily serves as an indicator to the public about the situation of the financial sector, but more importantly, since banking functions as a financial intermediary, it is very closely related to all sectors in the economy. The number of studies conducted to compare the financial performance of competing banks has increased considerably in recent years. Multi Criteria Decision Making (MCDM) techniques have been among the frequently used applications in the performance analysis studies of the banking sector. There are many decision-making models applied for this purpose. Among these models, TOPSIS, VIKOR, MOORA, COPRAS, EDAS techniques were used very often in the literature. A few of the studies that evaluate financial performance in banking with frequently used multi-criteria decision-making techniques are presented below as examples.

Demireli (2010) investigated the financial performance of public banks in Turkey in the period 2001-2007 using the TOPSIS method. Among the findings of the study is that public banks, which have some predictions about the future, learn from past failures.

Şamiloğlu et al. (2013) compared the financial performance of participation banks and commercial banks in Turkey in the period 2003-2011 using the TOPSIS method. In the study, it was concluded that the financial performance of participation banks was higher than that of commercial banks.

Kandemir and Karataş (2016) compared the financial performances of commercial banks traded in BIST in the period 2004-2014. According to the GREY and TOPSIS methods, the bank with the highest financial performance was Vakıfbank, while according to the VIKOR method, it was Denizbank.

Dinçer and Görener (2011) evaluated the performance of public, private and foreign-owned banks in Turkey between 2005 and 2011 using VIKOR, TOPSIS methods and 31 financial criteria. Foreign banks have more successful performance than other banks.

Atukalp (2018) investigated the financial performance of private deposit banks operating in Turkey in the period 2015-2017 using Multi-MOORA method. Akbank was financially the best performing private-owned deposit bank operating in Turkey in the period of 2015-2017. Anadolubank in 2015 and İşbank in the period of 2016-2017 became the second best banks.

Topak and Çanakçıoğlu (2019) conducted a performance analysis of eleven banks with the largest assets and loans in Turkey in 2017 by using the integrated ENTROPY and COPRAS method. Capital, deposits, personnel expenses, number of personnel, number of branches, loans, net operating profit, return on assets and return on equity, asset profitability ratios were used as criteria. The highest-performing banks were Ziraat Bank, İşbank and Garanti BBVA respectively, while the lowest-performing banks were Şekerbank, TEB and QNB Finansbank respectively.

Işık and Ersoy (2020) conducted the financial performance analysis of private deposit banks in Turkey in the 2015-2018 period with the integrated EDAS - CRITIC method. According to the results of the research, Akbank emerged as the bank with the highest performing private bank.

Since they both are novel methods, there is only one study which employes the integrated method of MPSI (weighting method) and MARA (ranking method) in the literature even if it was not about bank performance. Gligorić et al. (2022) proposed the novel integrated method of MPSI + MARA to solve selection problem in underground mining sector. MPSI method was developed to modify the PSI method (Preference Selection Index). In the literature, a limited number of performance analysis studies using PSI technique have been found in Turkey. A summary of these and similar studies is given below.

Akyüz and Aka (2015) used PSI method to measure manufacturing performance. 3 different productions of a glass factory were compared. The obtained ranking results were compared with the ranking results found by AHP and TOPSIS methods. The results turned out to be very similar.

Tuş and Adalı (2018) used CRITIC, CODAS and PSI methods to recruit personnel for a textile company in Denizli. While the criterion weights were determined by CRITIC method, performance ranking was done by PSI and CODAS methods.

Kabakcı and Sarı (2019) ranked the performances of the ten largest deposit banks with the largest asset size operating in Turkey for the years 2008-2017 by PSI method. In the study, 15 financial ratios were selected as evaluation criteria. It was concluded that the capital adequacy ratio and the personnel per branch criteria were the criteria that affected the performance relatively most. As a result of the analysis, the most successful banks were Ziraat Bank and Akbank. The least successful banks were Yapı Kredi Bank and Denizbank. A great similarity was found between the rankings obtained by the PSI method and the rankings obtained by the TOPSIS method.

Akbulut (2020) used Grey Entropy, PSI and ARAS methods to analyze the performance of the top 10 deposit banks operating in Turkey in 2018. Criterion weights were made by Gray Entropy method and performance ranking was done by PSI and ARAS methods. In the study, 12 evaluation criteria were used; Bank Age, Total Assets, Total Loans, Total Deposits, Total Equity, Paid-Up Capital, Net Interest Income, Number of Branches, Number of Employees, Non-Performing Loans, Net Interest Expenses, Personnel Expenses. The performance ranking of both methods was very close to each other. The geometric average of the performance results of the two methods was taken and Ziraat Bank was the most successful and Denizbank was the least successful. According to the performance ranking formed according to the PSI method, from the most successful bank to the least successful bank; Ziraat Bank, Ekonomi Bank, Yapı Kredi Bank, Akbank, İşbank, Garanti BBVA, QNB Finansbank, Halk Bank, Vakıf Bank and Denizbank were found to be ranked.

Işık (2021) applied the PSI method while measuring the financial performance of Akbank, one of the domestic private banks, between 2009 and 2019. 10 financial indicators were used in the analysis. It was understood that the most important criterion in Akbank's performance was Total Deposits/Total Assets and the least important criterion was Frozen Receivables/Total Loans. As a result of the study, it was revealed that the year with the highest financial performance of Akbank was 2010 and the lowest year was 2019.

Demir (2022) measures the performance of Anadolu Sigorta, one of the non-life insurance companies, between 2013-2020 with PSI, SD and MABAC methods. In the study, 12 performance criteria were identified. Criterion weights were determined by SD and PSI methods, while performance ranking was done by MABAC method. SD and PSI weight coefficients were combined with the Bayesian approach. Accordingly, the most important performance criterion was the conservation rate. According to the MABAC method, the most successful year is 2013, while the most unsuccessful year is 2018.

3. Research Methodology

Detailed explanations about the MPSI method and MARA method used in the research are given in the following section.

3.1. MPSI Method

The method was introduced by Gligorić et al. in 2022. MPSI method is a modified type of PSI method. The PSI (Preference Selection Index = Preference Selection Index) method, which was first designed by Maniya and Bhatt (2010) to solve the problem of material selection, does not require the determination of the relative weights of the criteria, unlike other multi-criteria decision-making techniques (MCDM). Therefore, it is preferred in cases where it is difficult to determine relative criterion weights. Instead of the relative criterion weight value, the general preference value is calculated. The preference index value is determined for each alternative (Akyüz and Aka, 2015; Attri and Grover, 2015; Kabakçı and Sarı, 2019; Akbulut, 2020; Ulutaş and Topal, 2020; Ulutaş, 2020; Ulutaş et. al., 2021; Işık, 2021; Demir, 2022).

The MPSI method is based on the variation between normalized and mean value for each criterion by using Euclidean distance. It is an objective method to determine criteria weights. The method has five steps explained below (Gligorić et al., 2022:5):

Step 1. Building the decision matrix.

First, the decision matrix $X = \left[\mathrm{x_{ij}}\right]_{mxn}$ is built. Here (m) in the matrix shows the numbers of alternatives, (n) indicates the numbers of criteria. In the matrix, (x_{ij}) means the performance of alternative (i) according to criterion (j).

Step 2. Obtaining the normalized matrix.

Depending on the optimal target, a linear normalization is done to transform the initial values into the interval between [0, 1] values. For this, Equation 1 is employed for the benefit and Equation 2 is applied for cost criteria:

$$\mathrm{r_{ij}} = \frac{\mathrm{x_{ij}}}{\max \mathrm{x_{ij}}} \tag{1}$$

$$\mathrm{r_{ij}} = \frac{\min \mathrm{x_{ij}}}{\mathrm{x_{ij}}} \tag{2}$$

Here (r_{ij}) indicates the normalized value and it is located like that $0 < r_{ij} < 1$.

Step 3. Finding the mean value.

The mean value of criterion (v_j) is calculated by the help of Equation 3.

$$v_{\mathrm{j}} = \frac{1}{\mathrm{m}} \sum_{i=1}^{m} \mathrm{r_{ij}} \tag{3}$$

Step 4. Calculating the Preference Variation (p_j) by Equation 4.

$$p_j = \sum_{i=1}^{m} (r_{ij} - v_j)^2 \tag{4}$$

Step 5. Determining the criteria weights (w_j) by Equation 5.

$$w_j = \frac{p_j}{\sum_{j=1}^{n} p_j} \tag{5}$$

3.2. MARA Method

The method was first introduced by Gligorić et al. (2022). It is a method to determine the performance ranking between different alternatives based on certain criteria. To apply the method, decision maker forms an initial decision-making matrix to choose the best possible alternative. Thus, the initial decision matrix $X = [x_{ij}]_{mxn}$ is formed. In the matrix, (m) indicates the quantity of alternatives, (n) means the quantity of criteria and (x_{ij}) shows to the performance of the alternative (i) based on the criterion (j). The method has seven steps (Gligorić et al., 2022:6):

Step 1. Normalizing the initial decision matrix.

After building the initial decision matrix, the normalization of the matrix is done as described above in MPSI method.

Step 2. Obtaining the weighted normalized matrix (g_{ij}).

It is done by multiplying the criterion weights (w_j) with the corresponding normalized values (r_{ij}) as described below:

$$g_{ij} = w_j * r_{ij}, \qquad \forall i \in [1, 2, \ldots, m], \forall j \in [1, 2, \ldots, n] \tag{6}$$

After realizing the weighted normalization, the weighted normalized matrix (G) is obtained:

$$G = [g_{ij}]_{mxn} \tag{7}$$

Step 3. Calculating the Optimal Alternative (OP).

OP is calculated by Equation 8 below:

$$S_i = \max(g_{ij} | 1 \leq j \leq n), \qquad \forall i \in [1, 2, \ldots, m] \tag{8}$$

The final set of OP (S) is seen in Equation 9.

$$S = \{s_1, s_2, \ldots, s_j\}, \qquad j=1,2,\ldots n \tag{9}$$

Step 4. Decomposition of set S.

OA is divided into two subsets such as max and min in decomposition stage. The set S is sum of the two subsets:

$$S = S_{max} \cup S_{min} \tag{10}$$

If (k) shows the total number of benefit criteria, then (l = n – k) indicates the total number of cost criteria. Thus, OA is calculated as shown below:

$$S= \{s_1,s_2,...,s_k\} \cup \{s_1,s_2,...,s_l\}; \qquad k + 1 = j \tag{11}$$

Step 5. Decomposition of each alternative.

It is done by Equation 12 and 13 respectively.

$$T_i = T_{imax} \cup T_{imin}\,, \qquad \forall i \in [1, 2, . . . ,m] \tag{12}$$

$$T_i = \{t_{i1}, t_{i2},..., t_{ik}\} \cup \{ t_{i1}, t_{i2},..., t_{il}\}, \ \forall i \in [1, 2, . . . ,m] \tag{13}$$

Step 6. Calculating the element intensity of OA and each alternative.

For OA, the element intensity is calculated by Equation 14 and 15 respectively as shown below:

$$S_k= s_1+ s_2+...+ s_k \tag{14}$$

$$S_l= s_1+ s_2+...+ s_l \tag{15}$$

For each alternative, the element intensity is calculated by Equation 16 and 17 as indicated below:

$$T_{ik} = t_{i1}+ t_{i2}+...+ t_{ik}, \forall i \in [1, 2, . . . ,m] \tag{16}$$

$$T_{il} = t_{i1}+ t_{i2}+...+ t_{il}, \forall i \in [1, 2, . . . ,m] \tag{17}$$

Step 7. Finding the magnitude of the area for the ranking of alternatives.

MARA method is based on the two linear functions. The first pays the attention to OA. It is created by two points of $(0, S_k)$ and $(1, S_l)$. First function is formed as follows:

$$f_{opt}\,(S_k, S_l) = \frac{Sl - Sk}{1-0}(x - S_k)+ S_k = (S_l - S_k)x+ S_k \tag{18}$$

The second function regarding each alternative is formed by Equation 19:

$$f_{\mathrm{i}}\,(\mathrm{T}_{\mathrm{ik}}, \mathrm{T}_{\mathrm{il}}) = \frac{\mathrm{Til} - \mathrm{Tik}}{1-0}(x - \mathrm{T}_{\mathrm{ik}}) + \mathrm{T}_{\mathrm{ik}} = (\mathrm{T}_{\mathrm{il}} - \mathrm{T}_{\mathrm{ik}})x + T_{\mathrm{ik}} \tag{19}$$

Chart of main functions is represented by Figure 1 illustrated below:

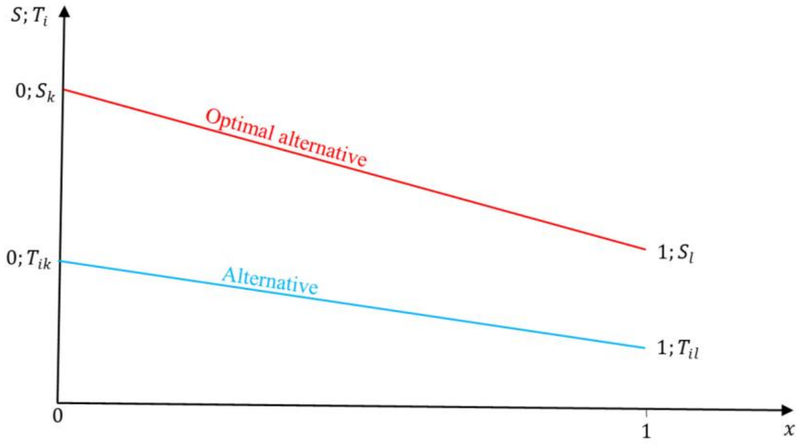

Figure 1. Function of the optimal and i^{th} alternative.
Source: Gligorić et al. (2022:7)

Area under OA is calculated by Equation 20:

$$F_{\mathrm{opt}} = \int_0^1 f_{\mathrm{opt}}(S_{\mathrm{k}}, S_{\mathrm{l}})dx = \int_0^1 \big((S_{\mathrm{l}} - S_{\mathrm{k}})x + S_{\mathrm{k}}\big)dx = \frac{\mathrm{S_l} - \mathrm{S_k}}{2} + S_{\mathrm{k}} \tag{20}$$

Area under the i^{th} alternative is calculated by Equation 21:

$$F_{\mathrm{i}} = \int_0^1 f_{\mathrm{i}}\,(T_{\mathrm{ik}}, T_{\mathrm{il}})dx = \int_0^1 \big((T_{\mathrm{il}} - T_{\mathrm{ik}})x + T_{\mathrm{ik}}\big)dx = \frac{T_{\mathrm{il}} - T_{\mathrm{ik}}}{2} + T_{\mathrm{ik}} \tag{21}$$

The magnitude of the area of the i^{th} alternative (MARA) is shown by Equation 22:

$$M_{\mathrm{i}} = \int_0^1 f_{\mathrm{opt}}\,(S_{\mathrm{k}}, S_{\mathrm{l}})dx - \int_0^1 f_{\mathrm{i}}\,(T_{\mathrm{ik}}, T_{\mathrm{il}})dx \tag{22}$$

The ranking of the alternatives is done by ascending order of M_i values.

4. Data and Implementation of Methodology

In this study, the data in the excel table of the Banks Association of Turkey (BAT) "December 2022-Bank Ranking by Asset Sizes" were interpreted (BAT, 2023). Deposit banks (multi-branch banks) with at least 15 branches from the banks included in the table were examined. Since their working principles and priorities are different, the financial ratios of banks with a single branch or less than 15 branches are excluded from the evaluation. The number of multi-branch deposit banks was determined as 19 for 2022.

In addition, some absolute quantities (Total Assets, Total Loans, Total Deposits, Total Equity, Paid-in Capital, Net Period Profit/Loss, Number of Branches, Number of Employees) in the table are used to use some basic financial ratios (T.Credits/T.Assets, T.Loans/T.Deposits, T.Equity/T.Assets, Net Period Profit/Total Assets, Net Period Profit/T.Equity, Number of Branches/Net Period Profit, Number of Employees/Net Period Profit). Thus, criteria that will be the basis for the financial performance of the banks whose performances will be compared have been determined. Below, information about the criteria used in the study and the banks within the scope of the study is shown as Table 1 and Table 2.

Table 1. Ranking of Deposit Banks in Turkey by Total Assets-2022

Asset Size Order	Banks	Codes
1	T.C. Ziraat Bankası	ZIR
2	T. Vakıflar Bankası	VAK
3	T. İş Bankası	ISB
4	T. Halk Bankası	HAL
5	T. Garanti Bankası	GAR
6	Yapı ve Kredi Bankası	YKB
7	Akbank	AKB
8	QNB Finansbank	QNB
9	Denizbank	DEN
10	Türk Ekonomi Bankası	EKO
11	ING Bank	ING
12	HSBC Bank	HSB
13	Fibabanka	FIB
14	Odea Bank	ODE
15	Şekerbank.	ŞEK
16	ICBC Turkey Bank	ICB
17	Burgan Bank	BUR
18	Alternatifbank	ALT
19	Anadolubank	ANA

From the Table 1, it is seen that Ziraat Bank is the bank with the largest total assets among the multi-branch deposit banks in Turkey at the end of 2022. The multi-branch deposit bank with the lowest total in terms of assets is Anadolubank at the end of 2022.

Table 2. Performance Criteria

No	Criteria	Code	Optimal
1	Total Loans / Total Assets	KA	max
2	Total Loans / Total Deposits	KM	max
3	Total Equity / Total Assets	OA	max
4	Net Period Profit / Total Assets	DKA	max
5	Net Period Profit / Total Equity	DKO	max
6	Number of Branches / Net Period Profit	SDK	min
7	Number of Employees / Net Period Profit	DK	min

From Table 2, it is seen that the total number of criteria used to evaluate performance in the research is seven. From the table it is possible to see information about the name, code and optimal direction of these criteria. The last two criteria are the minimum directional (cost) criteria. This means that the lower the numerical value for these criteria, the higher the performance. Therefore, when we keep the profit constant, the bank with fewer branches and fewer staff is considered more efficient and more successful. For other criteria (first 5 criteria), the opposite assessment is made. In other words, the higher the numerical value of the bank for these criteria, the higher its performance is considered. For example, if a bank extends as much of its assets as a loan as possible, the profitability and financial performance of that bank increases at that rate.

In the first step of the MPSI method, a decision matrix is created. In the decision matrix, the numerical values obtained by deposit banks with 15 or more branches operating in Turkey in 2022 according to the criteria shown in Table 2 are arranged in the form of a matrix. The columns of the prepared initial decision matrix show the performance criteria, and the rows show the banks. The generated matrix can be seen below:

Table 3. Financial Ratios of the Multi-Branch Deposit Banks in Turkey (2022)

Criterion	KA	KM	OA	DKA	DKO	SDK	CDK
Bank/Optimum	Max	Max	Max	Max	Max	Min	Min
ZIR	0.5478	0.7281	0.0876	0.0178	0.2029	0.0428	0.5958
VAK	0.5673	0.8457	0.0636	0.0143	0.2245	0.0395	0.7062
ISB	0.5556	0.8403	0.1359	0.0437	0.3216	0.0184	0.3788
HAL	0.6053	0.7942	0.0645	0.0106	0.1642	0.0704	1.4085
GAR	0.5810	0.8466	0.1325	0.0508	0.3832	0.0143	0.3169
YKB	0.5455	0.8984	0.1139	0.0476	0.4178	0.0152	0.2926
AKB	0.5212	0.8249	0.1429	0.0558	0.3908	0.0118	0.2119
QNB	0.6007	0.9168	0.0736	0.0286	0.3891	0.0253	0.6634
DEN	0.5721	0.8514	0.1036	0.0326	0.3150	0.0391	0.7652
EKO	0.5427	0.7452	0.0921	0.0407	0.4416	0.0400	0.7795
ING	0.6327	0.9294	0.1368	0.0266	0.1943	0.0564	1.1381
HSB	0.4423	0.5461	0.0843	0.0342	0.4064	0.0232	0.6126
FIB	0.5334	0.8436	0.0879	0.0360	0.4099	0.0165	0.7408
ODE	0.4716	0.6609	0.0731	0.0124	0.1693	0.0563	1.3010
ŞEK	0.5656	0.7648	0.0742	0.0238	0.3199	0.1584	2.2814
ICB	0.4436	1.1095	0.0474	0.0217	0.4579	0.0296	0.5734

Table 3. Continued

BUR	0.6363	0.9184	0.0881	0.0208	0.2359	0.0266	0.8488
ALT	0.5976	1.0592	0.0678	0.0179	0.2635	0.0321	0.8248
ANA	0.5463	0.7063	0.1757	0.0488	0.2781	0.0604	0.8705
Max	*0.6363*	*1.1095*	*0.1757*	*0.0558*	*0.4579*	*0.1584*	*2.2814*
Min	*0.4423*	*0.5461*	*0.0474*	*0.0106*	*0.1642*	*0.0118*	*0.2119*

Source: Banks Association of Turkey "December 2022-Bank Ranking by Asset Sizes" https://www.tbb.org.tr/tr/bankacilik/banka-ve-sektor-bilgileri/istatistiki-raporlar/59

From Table 3, it is seen that bank BUR in KA criterion, ICB in KM criterion, ANA in OA criterion, AKB in DKA criterion and ICB in DKO criterion have the highest numerical values among the top five criteria with maximum optimal. Of the last two criteria that require a minimum optimum, it is understood that the best bank (the one with the lowest value) in the SDK and CDK criteria is the AKB.

In the second step of the MPSI method, the normalization of the initial decision matrix was performed. Each numeric value in the initial matrix is normalized by applying Equation 1 or Equation 2. Thus, numeric values with different units are standardized by reducing them to the range of 0-1. The normalized decision matrix is shown Table 4.

Table 4. Normalized Matrix

Criterion	KA	KM	OA	DKA	DKO	SDK	CDK
Bank/Optimum	**Max**	**Max**	**Max**	**Max**	**Max**	**Min**	**Min**
ZIR	0.8609	0.6562	0.4986	0.3184	0.4433	0.2769	0.3556
VAK	0.8916	0.7622	0.3623	0.2559	0.4903	0.2998	0.3000
ISB	0.8731	0.7574	0.7735	0.7827	0.7023	0.6445	0.5593
HAL	0.9512	0.7158	0.3674	0.1898	0.3587	0.1684	0.1504
GAR	0.9131	0.7631	0.7544	0.9096	0.8370	0.8280	0.6685
YKB	0.8573	0.8098	0.6486	0.8526	0.9124	0.7800	0.7242
AKB	0.8191	0.7434	0.8132	1.0000	0.8535	1.0000	1.0000
QNB	0.9441	0.8263	0.4187	0.5127	0.8498	0.4679	0.3194
DEN	0.8990	0.7674	0.5896	0.5845	0.6881	0.3032	0.2769
EKO	0.8530	0.6716	0.5243	0.7285	0.9645	0.2959	0.2718
ING	0.9944	0.8377	0.7785	0.4759	0.4243	0.2102	0.1862
HSB	0.6951	0.4922	0.4797	0.6134	0.8876	0.5102	0.3459
FIB	0.8384	0.7604	0.5006	0.6457	0.8953	0.7192	0.2860
ODE	0.7412	0.5956	0.4159	0.2215	0.3697	0.2105	0.1629
ŞEK	0.8889	0.6893	0.4226	0.4255	0.6988	0.0748	0.0929
ICB	0.6971	1.0000	0.2700	0.3890	1.0000	0.4005	0.3695
BUR	1.0000	0.8278	0.5016	0.3724	0.5153	0.4448	0.2496
ALT	0.9392	0.9547	0.3862	0.3202	0.5755	0.3686	0.2569
ANA	0.8585	0.6366	1.0000	0.8750	0.6073	0.1960	0.2434

In Table 4, the fact that any bank has a value of 1 in terms of any criterion indicates that that bank has achieved the best performance on the basis of that criterion. On the contrary, the fact that it has a degree very close to 0 or zero shows that it is extremely unsuccessful in terms of the relevant criterion. For example, while AKB bank was the most successful bank in this criterion by reaching a value of 1 in the DKA criterion, HAL bank was the most unsuccessful bank with a value of 0.1898 in the same criterion. According to the table, the AKB, which has a value of 1 in three different criteria, draws attention as the bank with a maximum value of 1.

In the next stage, the mean value and preference variation steps of the MPSI method were applied. Equation 3 is used when calculating mean value and Equation 4 is used when calculating preference variation. The Mean value and Preference variation values are shown in Table 5 below.

Table 5. Mean Value (v_j), Preference Variation (p_i)

Criterion	KA	KM	OA	DKA	DKO	SDK	CDK
v_j	0.8692	0.7509	0.5529	0.5512	0.6881	0.4315	0.3589
p_i	0.1341	0.2513	0.6651	1.1398	0.8104	1.1685	0.9236
Sum p_i	5.0928						

Sum p_i in Table 5 is obtained by horizontally summing the values in the p_i row. In the last step of the MPSI method, the weight coefficients of the criteria, or in other words, their importance levels in measuring performance, were calculated. Below are the criterion weights found with the help of Equation 5 shown in Table 6.

Table 6. Weights of Criteria by MPSI Method (wj)

Criterion	KA	KM	OA	DKA	DKO	SDK	CDK	
Weight no	w_1	w_2	w_3	w_4	w_5	w_6	w_7	Sum w_j
w_j	0.0263	0.0493	0.1306	0.2238	0.1591	0.2294	0.1814	1.0000

From the Table 6, the most important criteria are SDK (the criterion in the 6th place) and DKA (the criterion in the 4th place) criteria, respectively. The criterion with the lowest level of importance is the KA criterion, which has a coefficient of 0.0263. It should be noted that the sum of the criterion weights is equal to 1. Whichever weight method is applied, it is inevitable that the sum of the criterion weights (SUMw_j) will be 1.

After the criterion importance levels or in other words the criterion weights were determined by applying the MPSI method, it was time to apply the MARA method to make the performance ranking of the banks. The first 2 steps of the MARA method are the same as the first two steps of the MPSI method. That is, after the initial decision matrix is created, this matrix is normalized. Therefore, Table 3 and Table 4 are also arranged in the MARA method. Since they are the same here, these two steps will be skipped, and the third step will be explained.

In the third step of the MARA method, a weighted decision matrix is created. For this, criterion weights calculated by the MPSI method are used. To calculate the weighted decision matrix values, the criterion weights are multiplied by the normalized values with the help of Equation 6. Table 7 below shows the weighted decision matrix.

Table 7. Weighted Decision-Making Matrix

Criterion	KA	KM	OA	DKA	DKO	SDK	CDK
Bank/Optimum	**Max**	**Max**	**Max**	**Max**	**Max**	**Min**	**Min**
wj	*0.03*	*0.05*	*0.13*	*0.22*	*0.16*	*0.23*	*0.18*
ZIR	0.023	0.032	0.065	0.071	0.071	0.064	0.064
VAK	0.023	0.038	0.047	0.057	0.078	0.069	0.054
ISB	0.023	0.037	0.101	0.175	0.112	0.148	0.101
HAL	0.025	0.035	0.048	0.042	0.057	0.039	0.027
GAR	0.024	0.038	0.099	0.204	0.133	0.190	0.121
YKB	0.023	0.040	0.085	0.191	0.145	0.179	0.131
AKB	0.022	0.037	0.106	0.224	0.136	0.229	0.181
QNB	0.025	0.041	0.055	0.115	0.135	0.107	0.058
DEN	0.024	0.038	0.077	0.131	0.109	0.070	0.050
EKO	0.022	0.033	0.068	0.163	0.153	0.068	0.049
ING	0.026	0.041	0.102	0.107	0.068	0.048	0.034
HSB	0.018	0.024	0.063	0.137	0.141	0.117	0.063
FIB	0.022	0.038	0.065	0.145	0.142	0.165	0.052
ODE	0.020	0.029	0.054	0.050	0.059	0.048	0.030
ŞEK	0.023	0.034	0.055	0.095	0.111	0.017	0.017
ICB	0.018	0.049	0.035	0.087	0.159	0.092	0.067
BUR	0.026	0.041	0.066	0.083	0.082	0.102	0.045
ALT	0.025	0.047	0.050	0.072	0.092	0.085	0.047
ANA	0.023	0.031	0.131	0.196	0.097	0.045	0.044

The values in the row w_j in the table show the criterion severities, or in other words, the criterion weights, calculated earlier by the MPSI method.

In the fourth step of the MARA method, the optimal alternative determination process is performed. To find S values, Equation 8 and Equation 9 are applied. The S values found after the optimal alternative determination process are shown in Table 8 below.

Table 8. Optimal Alternative Determination

Criterion	KA	KM	OA	DKA	DKO	SDK	CDK
Optimum	**Max**	**Max**	**Max**	**Max**	**Max**	**Min**	**Min**
	S_1	S_2	S_3	S_4	S_5	S_6	S_7
S	0.0263	0.0493	0.1306	0.2238	0.1591	0.2294	0.1814

In the fifth step of the MARA method, after finding the S values, the decomposition of the optimal alternative is performed. For this, Equation 10 and Equation 11 are applied. The following table shows the results of this process.

Table 9. Decomposition of the Optimal Alternative

Criterion	KA	KM	OA	DKA	DKO	SDK	CDK
Optimum	**Max**	**Max**	**Max**	**Max**	**Max**	**Min**	**Min**
	s_1	s_2	s_3	s_4	s_5	s_6	s_7
S_{max}	0.0263	0.0493	0.1306	0.2238	0.1591		
S_{min}						0.2294	0.1814

In the next step, the decomposition of the alternatives is done. Equation 12 and Equation 13 are applied to this process. The results of the process are shown in Table 10 below.

Table 10. Decomposition of the Alternatives

Criterion		KA	KM	OA	DKA	DKO	SDK	CDK
Bank/Optimum		**Max**	**Max**	**Max**	**Max**	**Max**	**Min**	**Min**
		t_1	t_2	t_3	t_4	t_5	t_6	t_7
ZIR	T_1^{max}	0.023	0.032	0.065	0.071	0.071		
	T_1^{min}						0.064	0.064
VAK	T_1^{max}	0.023	0.038	0.047	0.057	0.078		
	T_1^{min}						0.069	0.054
ISB	T_1^{max}	0.023	0.037	0.101	0.175	0.112		
	T_1^{min}						0.148	0.101
HAL	T_1^{max}	0.025	0.035	0.048	0.042	0.057		
	T_1^{min}						0.039	0.027
GAR	T_1^{max}	0.024	0.038	0.099	0.204	0.133		
	T_1^{min}						0.190	0.121
YKB	T_1^{max}	0.023	0.040	0.085	0.191	0.145		
	T_1^{min}						0.179	0.131
AKB	T_1^{max}	0.022	0.037	0.106	0.224	0.136		
	T_1^{min}						0.229	0.181
QNB	T_1^{max}	0.025	0.041	0.055	0.115	0.135		
	T_1^{min}						0.107	0.058
DEN	T_1^{max}	0.024	0.038	0.077	0.131	0.109		
	T_1^{min}						0.070	0.050
EKO	T_1^{max}	0.022	0.033	0.068	0.163	0.153		
	T_1^{min}						0.068	0.049
ING	T_1^{max}	0.026	0.041	0.102	0.107	0.068		
	T_1^{min}						0.048	0.034
HSB	T_1^{max}	0.018	0.024	0.063	0.137	0.141		
	T_1^{min}						0.117	0.063
FIB	T_1^{max}	0.022	0.038	0.065	0.145	0.142		
	T_1^{min}						0.165	0.052
ODE	T_1^{max}	0.020	0.029	0.054	0.050	0.059		
	T_1^{min}						0.048	0.030

Table 10. Continued

ŞEK	T_1^{max}	0.023	0.034	0.055	0.095	0.111		
	T_1^{min}						0.017	0.017
ICB	T_1^{max}	0.018	0.049	0.035	0.087	0.159		
	T_1^{min}						0.092	0.067
BUR	T_1^{max}	0.026	0.041	0.066	0.083	0.082		
	T_1^{min}						0.102	0.045
ALT	T_1^{max}	0.025	0.047	0.050	0.072	0.092		
	T_1^{min}						0.085	0.047
ANA	T_1^{max}	0.023	0.031	0.131	0.196	0.097		
	T_1^{min}						0.045	0.044

In the seventh step of the MARA method, the intesity of the optimal alternative and alternatives is performed. Equation 14, Equation 15, and Equation 16 are used for this process. The results of the procedure are shown in Table 11 below.

Table 11. The Intensity of the Optimal Alternative/s

Optimum	**max**	**min**
Alternative	S_k	S_l
	T_{ik}	T_{il}
S	0.5892	0.4108
ZIR	0.2620	0.1280
VAK	0.2437	0.1232
ISB	0.4483	0.2493
HAL	0.2079	0.0659
GAR	0.4970	0.3112
YKB	0.4832	0.3103
AKB	0.5241	0.4108
QNB	0.3703	0.1653
DEN	0.3788	0.1198
EKO	0.4406	0.1172
ING	0.3432	0.0820
HSB	0.3838	0.1798
FIB	0.4119	0.2169
ODE	0.2116	0.0778
ŞEK	0.3190	0.0340
ICB	0.3491	0.1589
BUR	0.2980	0.1473
ALT	0.2855	0.1312
ANA	0.4771	0.0891

In the eighth step of the MARA method, the area under OA and alternatives is calculated. Equations 18-21 are used for this operation. The results of the procedure are shown in Table 12 below.

Table 12. The Area Under Optimal Alternative/s

	Area	Values
	F_{opt}	0.5000
ZIR	F_1	0.1950
VAK	F_2	0.1834
ISB	F_3	0.3488
HAL	F_4	0.1369
GAR	F_5	0.4041
YKB	F_6	0.3968
AKB	F_7	0.4674
QNB	F_8	0.2678
DEN	F_9	0.2493
EKO	F_{10}	0.2789
ING	F_{11}	0.2126
HSB	F_{12}	0.2818
FIB	F_{13}	0.3144
ODE	F_{14}	0.1447
ŞEK	F_{15}	0.1765
ICB	F_{16}	0.2540
BUR	F_{17}	0.2227
ALT	F_{18}	0.2083
ANA	F_{19}	0.2831

In the ninth step of the MARA method, the magnitude of the area of alternatives and the final ranking of the alternatives are calculated. Equation 22 is used for this calculation. The result of the calculation is shown in Table 13 below.

Table 13. The Magnitude of the Area of Alternatives and Final Ranking of the Alternatives

Alternative	Magnitude of the Area of Alternative M_i	Values	Rank
ZIR	M_1	0.3050	15
VAK	M_2	0.3166	16
ISB	M_3	0.1512	4
HAL	M_4	0.3631	19
GAR	M_5	0.0959	2
YKB	M_6	0.1032	3
AKB	M_7	0.0326	1
QNB	M_8	0.2322	9
DEN	M_9	0.2507	11
EKO	M_{10}	0.2211	8
ING	M_{11}	0.2874	13
HSB	M_{12}	0.2182	7

Table 13. Continued

FIB	M_{13}	0.1856	5
ODE	M_{14}	0.3553	18
ŞEK	M_{15}	0.3235	17
ICB	M_{16}	0.2460	10
BUR	M_{17}	0.2773	12
ALT	M_{18}	0.2917	14
ANA	M_{19}	0.2169	6

According to the table above, the final rankings of the banks are revealed. According to the financial performance ranking, the bank with the lowest numerical value is the bank with the highest performance. According to this table, the highest performance was achieved by AKB bank, which ranked 1st. In the last place is HAL bank, which has the 19th place. When we open the names of the banks and sort them according to the order of success, we obtain the following table.

Table 14. Financial Success Ranking of the Banks in 2022

Bank Name	Codes	Rank
Akbank	AKB	1
T.Garanti Bankası (Garanti BBVA)	GAR	2
Yapı ve Kredi Bankası	YKB	3
T.İş Bankası	ISB	4
Fibabanka	FIB	5
Anadolubank	ANA	6
HSBC Bank	HSB	7
T.Ekonomi Bankası	EKO	8
QNB Finansbank	QNB	9
ICBC Turkey Bank	ICB	10
Denizbank	DEN	11
Burgan Bank	BUR	12
ING Bank	ING	13
Alternatifbank	ALT	14
T.C. Ziraat Bankası	ZIR	15
T. Vakıflar Bankası	VAK	16
Şekerbank	ŞEK	17
Odea Bank	ODE	18
T. Halk Bankası	HAL	19

According to Table 14, seven different criteria selected in the research, when we take into account the criterion weights obtained by the MPSI weighting method and apply the MARA method, the top three banks with the highest financial performance in Turkey in 2022 were Akbank, Türkiye Garanti Bankası and Yapı ve Kredi Bankası, respectively. The last three places were taken by T.Halk Bank, Odeabank and Şekerbank from the last to the beginning.

One of the interesting results that emerges from the table is that public banks are far behind in the ranking of success. Even Ziraat Bank, the most successful public bank, could not enter the top 10 successful banks; however, it was able to find a place in the 15.th place. Halkbank ranked last. We think that this result will be useful for the managers of public banks to have a signal effect.

Another interesting result that emerges from the table is that there is no positive relationship between financial performance success and asset size. It may even be partly possible to say that this relationship can be negative, as public banks with large total assets remain at the bottom of the list.

5. Conclusion

The number of academic studies involving measuring the financial performance of banks operating in the financial system with numerical values and comparing the performances of competing banks with each other in the light of these values is increasing as time passes.

This is due to the fact that the number of individuals and institutions affected by the performance of the banking system is increasing in time. In this research, which was conducted based on the statistics of BAT (the Banks Association of Turkey), the financials of multi-branch deposit banks operating in Turkey for the year 2022 were analyzed with MPSI and MARA integrated ranking model. The goal of the study is to find the bank with the highest financial performance.

In the research, 19 banks with multiple branches were examined. From the financial ratios of the banks, 7 different ratios were selected as criteria in the performance evaluation as "T.Loans/T.Assets", "T.Loans/T.Deposits", "T.Equity/T.Assets", "Net Period Profit/Total Assets", "Net Period Profit/T.Equity", "Number of Branches/Net Period Profit", "Number of Employees/Net Period Profit".

According to the analysis made according to the MPSI weighting method, it was understood that the criterion that most affected the financial performance of banks was SDK (Number of Branches/Net Period Profit). The second most important criterion was determined to be DKA (Net Period Profit/Total Assets) criteria. The criterion with the lowest level of importance is the KA (T.Credits/T.Assets) criterion.

The most important result of the research is the finding that Akbank is the bank with the highest financial performance according to the MARA ranking method integrated with the MPSI weight method. This successful bank was followed by Garanti Bank and Yapı Kredi Bank. It has been determined that state-owned banks are not successful in 2022.

We believe that the findings of this study can offer valuable insights to public bank managers, potentially serving as a signal for decision-making. Nevertheless, it is essential to recognize that the outcomes of this research may be influenced by the chosen criteria, their respective weights, and the methodologies employed in result evaluation.

Therefore, we suggest that future researchers explore the same sample utilizing alternative multi-criteria decision-making approaches. This approach would contribute to a more comprehensive understanding and interpretation of the results, fostering a well-rounded perspective on the subject matter.

Research and Publication Ethics Statement

In this study, which did not require ethics committee approval and/or legal/special permission, research and publication ethics were followed.

Researcher's Contribution Rate Statement

I am a single author of this paper. My contribution is 100%.

Researcher's Conflict of Interest Statement

There are no potential conflicts of interest in this study.

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