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LONG-TERM PERFORMANCE EVALUATION OF DEPOSIT BANKS WITH MULTI-CRITERIA DECISION MAKING TOOLS: THE CASE OF TURKEY

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Abstract

In this study, it is aimed to measure the long term performance of deposit banks operating in Turkey with an integrated MCDM framework. The effect of stock market indicators is also considered when evaluating the performance of deposit banks. The arithmetic average of the selected ratios between 2014 and 2018 is calculated to obtain long term performance indicators. The weights of the criteria are set with the Best-Worst Method. Five different MCDM tools, namely ARAS, EDAS, MOORA, OCRA and TOPSIS, are used to evaluate the long-term performance of banks. The financial ratio, which has the highest importance, is liquid asset / total assets ratio, according to the expert evaluations. The average return on assets and shareholders' equity/total assets ratio is determined as highly correlated criteria with the final score.

Keywords: *Bank performance, Financial performance, Stock market indicators, Multi-criteria decision making, Best-worst method.*

JEL Codes: G21, C30, C60.

MEVDUAT BANKALARININ UZUN VADELİ PERFORMANSLARININ ÇOK KRİTERLİ KARAR VERME YÖNTEMLERİ İLE DEĞERLENDİRİLMESİ: TÜRKİYE ÖRNEĞİ

Öz

Bu çalışmada, entegre bir ÇKKV çerçevesi ile Türkiye'de faaliyet gösteren mevduat bankalarının uzun vadeli performanslarının ölçülmesi amaçlanmaktadır. Mevduat bankalarının performansı değerlendirilirken borsa göstergelerinin etkisi de dikkate alınmıştır. Uzun vadeli performans göstergeleri elde etmek için 2014-2018 yılları arasında seçilen oranların aritmetik ortalaması hesaplanmıştır. Kriterlerin ağırlıkları En İyi-En Kötü Yöntemi ile belirlenmiştir. Bankaların uzun vadeli performansını değerlendirmek için ARAS, EDAS, MOORA, OCRA ve TOPSIS olmak üzere beş farklı ÇKKV yöntemi kullanılmıştır. En büyük öneme sahip olan finansal oran, uzman değerlendirmelerine göre likit varlık/toplam varlık oranıdır. Ortalama aktif getirisi ve özsermaye/toplam aktifler oranı, nihai puanla yüksek oranda ilişkili kriterler olarak belirlenmiştir.

Anahtar Kelimeler: *Banka performansı, Finansal performans, Borsa göstergeleri, Çok kriterli karar verme, En iyi-En kötü yöntemi*

JEL Kodları: G21, C30, C60.

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1. INTRODUCTION

Some parties in the economy have more funds than they need, while some parties seek external funding to meet their needs. In this system, financial markets are markets in which funds are transferred from over-fund people to people with fund shortages (Mishkin & Eakins, 2015). There are many financial institutions and organizations that affect each other in these financial markets. Banks have an indispensable place among these institutions and organizations. Banks are institutions that are accepting deposits (liabilities) and making loans (assets) (Saunders & Millon Cornett, 2019). Due to their intermediary functions between savers and investors, banks are of great importance for all economies and are the building blocks of the economic systems of countries (Akgül, 2019). The efficiency of banks is of great importance, especially in developed countries, as it affects economic growth (Chan & Karim, 2010). In addition, while banks play an important role in the economy in terms of the growth of firms and economic prosperity, a strong banking system ensures financial stability and makes the economy more resistant to possible shocks (Taşkın, 2011).

Banks should take solid steps in the services they offer to meet the needs of their customers (Shaverdi et al., 2011). Due to the increasing competition between banks, banks have to target and achieve maximum performance (Beheshtinia & Omidi, 2017). Also considering the functions of the banking sector in the economy, it can be said that the financial performance of banks in the sector concerns a vast segment. Although banks are ranked according to different criteria by many organizations or publications (Fukuyama et al., 2018), evaluating the efficiency and financial performance of banks with the right criteria and methods is essential for decision-makers (Topak & Çanakçıoğlu, 2019). At this point, the performance evaluation process, which provides information on the current status of banks, is of great importance (Beheshtinia & Omidi, 2017). This situation reveals that an effective method must be found to evaluate the performance of the whole organization according to its goals (Shaverdi et al., 2011). There have been significant increases in the number of studies conducted to evaluate the performance of banks. In these studies, many different methods such as "Total production analysis", "Delphi analysis", "Balanced Scorecard", "Analytical Hierarchical Process (AHP)", "Data Envelopment Analysis (DEA)" were used (Wanke et al., 2016). Also, there has been an increasing trend towards the use of MCDM methods such as AHP and TOPSIS (Wanke et al., 2016). Multi-Criteria Decision Making methods are extremely useful in evaluating performance since they consider many criteria together (Topak & Çanakçıoğlu, 2019). MCDM tools help the Decision Maker evaluate several alternatives based on different criteria in order to make more accurate decisions (Chitnis & Vaidya, 2018). MCDM tools are used by bank managers to benchmark their relative performance within the sector.

MCDM tools were used to evaluate the performance of banks operating in different countries. This study also aims to measure the performance of banks; however, it differs from previous studies in a few ways:

- Previous studies are focused on short term (1-year) performance of measurement of banks (Kosmidou & Zopounidis, 2008; Uckun & Girginer, 2011; Albayrak & Erkut, 2005; Akkoç & Vatansever, 2013; Seçme et al., 2009; Bozdogan et al., 2013; Paksoy & Tıras, 2017). This study aims to measure the long term (5-year between 2014 and 2018) performance of banks operating in Turkey.

- It is possible to calculate various financial ratios using the financial statements of banks. To reduce the complexity, financial ratios that will be used for assessing the performance of banks are selected with a literature survey. Six ratio groups are determined, and the most frequent ratios are chosen to represent the ratio groups.
- Using a single source (in this case financial statement of banks) when measuring the performance will produce biased results. Stock market performance of banks has also impact on the performance. Stock market indicators are also added to the decision matrix to assess the performance of banks in a broader framework.
- In previous studies, equal weights among criteria are assumed (Ho, 2006; Demireli, 2010; Dogan, 2013; Gundogdu, 2015; Kandemir & Karataş, 2016; Oral, 2016). Also in some studies, ANP (Ozdemir & Demireli, 2013), AHP (Dincer & Gorener, 2011; Onder et al., 2013; Ozbek, 2015; Ghasempour & Salami, 2016; Beheshtinia & Omidi, 2017), fuzzy AHP (Seçme et al., 2009; Wu et al., 2009; Akkoç & Vatansever, 2013; Amile et al., 2013; Celen, 2014; Mandic et al., 2014; Rezaei & Ketabi, 2016; Sisman & Doğan, 2016) or DEMATEL (Yüksel et al., 2017) is employed. In this study, the weights of the criteria are determined with a novel MCDM tool named Best-Worst Method (Rezaei, 2015). BWM has some advantages such as it need a fewer comparison, final weights are highly reliable and deal with only integer numbers, which makes it much easier to use (Rezaei, 2015).
- Five different MCDM tools, namely “ARAS”, “EDAS”, “MOORA”, “OCRA”, and “TOPSIS”, were used to evaluate the performance of banks. The common point of the techniques is the similarities in the calculation steps. All of the methods are accepting decision matrix as input, and a weight vector then returns the scores for alternatives.

The study is organized as follow: after this introduction section, the results of a detailed literature survey is presented in the second section. In the third section, the calculation steps of MCDM tools are presented. The fourth section is dedicated to analysis.

2. LITERATURE

Decision making is the study of determining and choosing alternatives by considering different factors and meeting the expectations of decision-makers in order to provide an optimum solution. All decisions are made in a decision environment expressed as a combination of information, alternatives, values and preferences available at the time of the decision (Mateo, 2012). Decision making has become a complex process in today's social and business environments. Decision-makers have to find the most effective option, considering the multiple criteria when choosing among alternatives (Çalışkan & Eren, 2016). Decision-makers determine the successful use and control of essential functions and tools of the enterprise such as profit, cost, production, labour force with performance measurements and evaluations. They may have to find the most suitable options that accomplish different goals, sometimes contradicting each other. In cases where there are multiple and generally incompatible criteria, multi-criteria decision-making techniques are used to solve a problem (Uygurtürk & Korkmaz, 2012).

Performance evaluation with MCDM tools involves several criteria (or attributes). In other words, if there is a single criterion, the highest preference rating alternative will be chosen. However, when the decision-maker evaluates the alternatives considering more than one criterion, many problems arise, such as the weights of the criteria, the dependency of preferences and the conflicts between the criteria, which complicates decision making. The solution is possible by using more sophisticated techniques (Tzeng & Huang, 2011). Alternatives

identified to evaluate performance include measurable and non-measurable criteria. These criteria are mutually exclusive, interrelated or independent (Ho, 2006). Strategic decisions made by many businesses typically involve considering more than one strategic goal. In order to achieve these strategic targets, it is recommended to use MCDM tools as an assessment tool for strategic decisions (Zopounidis & Pardalos, 2010).

MCDM tools are widely used in both public and private sector organizations to help make extremely complex decisions (Zopounidis & Pardalos, 2010). The banking sector is not an exception. A detailed literature survey is conducted, and the results are summarized in Table 1.30 studies are found that employed MCDM technique in the evaluation of bank performance. Nineteen of these studies are evaluated by the banks operating in Turkey. There are also other studies using the dataset from Greece (1), Iran (4), Saudi Arabia (1), Taiwan (2), Croatia (1), Serbia (1) and Montenegro (1). As clear from Table 1, various methods are used as weight determination process as well as the MCDM technique. Moreover, some of the studies used non-financial indicators in their decision matrix.

Table 1: Literature Summary of Studies

Study	Origin	Weight Determination	MCDM Technique	Feature Type	Number of Banks	Number of Criteria	Year
(Bozdogan et al., 2013)	Turkey	-	AHP	Ratios	6	2 main 19 sub	2010
(Ozdemir & Demireli, 2013)	Turkey	ANP	TOPSIS & VIKOR	Ratios	12	3 main 6 sub	2011-2012
(Kandemir & Karatas, 2016)	Turkey	Equal	GRA, TOPSIS & VIKOR	Ratios	12	18	2004-2014
(Paksoy & Tıras, 2017)	Turkey	Equal	PROMETHEE	Ratios	49	7 main 29 sub	2014
(Albayrak & Erkut, 2005)	Turkey	-	AHP	Ratios& non-financial indicators	5	11 main 26 sub	2002
(Dincer & Gorener, 2011)	Turkey	AHP	VIKOR	Ratios	3	8 main 31 sub	2002-2008
(Demireli, 2010)	Turkey	Equal weight	TOPSIS	Ratios	3	10	2001-2007
(Uckun & Girginer, 2011)	Turkey	-	GRA	Ratios	10	4 main 14 sub	2008
(Akkoç & Vatansever, 2013)	Turkey	Fuzzy AHP	Fuzzy TOPSIS	Ratios	12	7 main 17 sub	2010
(Kosmidou & Zopounidis, 2008)	Greece	-	PROMETHEE	Ratios	30	11	2003-2004
(Sisman & Doğan, 2016)	Turkey	Fuzzy AHP	Fuzzy MOORA	Ratios	10	5 main 10 sub	2008-2014
(Özbek, 2015)	Turkey	AHP	OCRA	Ratios	3	4	2005-2014

(Seçme et al., 2009)	Turkey	Fuzzy AHP	TOPSIS	Ratios& non-financial indicators	5	7 main 27 sub	2007
(Amile et al., 2013)	Iran	Fuzzy AHP	TOPSIS	Ratios and non-financial indicators	3	5 ratio 8 non fin.	-
(Beheshtinia & Omidi, 2017)	Iran	AHP & MDL	Fuzzy TOPSIS & Fuzzy VIKOR	Ratios and non-financial indicators	4	6 main 25 sub	-
(Celen, 2014)	Turkey	Fuzzy AHP	TOPSIS	Ratios	13	6 main 29 sub	2010
(Dogan, 2013)	Turkey	Equal	GRA	Ratios	10	4 main 10 sub	2005-2011
(Elsayed et al., 2017)	Saudi Arabia	Entropy	TOPSIS	Ratios& non-financial	12	5 main 25 sub	
(Ghasempour & Salami, 2016)	Iran	AHP	TOPSIS	Ratios	15	6 main 16 sub	2015
(Gundogdu, 2015)	Turkey	Equal	TOPSIS	Ratios	10	16	2003-2013
(Ho, 2006)	Taiwan	Equal	GRA	Ratios	3	17	1997
(Hunjak & Jakovčević, 2001)	Croatia	-	AHP	Ratios	10	7 main 26 sub	1999
(Mandic et al., 2014)	Serbia	Fuzzy AHP	TOPSIS	Financial indicators	35	8	2005-2010
(Oral, 2016)	Turkey	Equal	TOPSIS	Ratios	10	10	2012-2014
(Onder et al., 2013)	Turkey	AHP	TOPSIS	Ratios	17	10 main 57 sub	2002-2011
(Rakocevic & Dragasevic, 2009)	Montenegro	-	AHP	Ratios & non-financial indicators	11	5 main 17 sub	2008
(Rezaei & Ketabi, 2016)	Iran	Fuzzy AHP	TOPSIS	Ratios	21	8	2015
(Tunay & Akhisar, 2015)	Turkey	AHP	TOPSIS	Ratios	21	3	2009-2013
(Wu et al., 2009)	Taiwan	Fuzzy AHP	SAW, TOPSIS and VIKOR	Ratios and non-financial indicator	3	4 main 23 sub	-
(Yüksel et al., 2017)	Turkey	DEMATEL	GRA and MOORA	Ratios	23	4 main 13 sub	2015

When Table 1, which includes the studies in the literature, is examined, there is no study in which criterion weights are determined by using the best-worst method in the studies on bank performance. However, it is seen that the best-worst method is used in many different areas apart from determining the bank performance. For example, Ghaffar et al. (2021) evaluated the economic, environmental and social dimensions of shale development on a cost-benefit focus. Researchers who determined 12 cost and 12 benefit factors used MCDM methods and

determined the criteria weights according to the best-worst method. Biscaia et al. (2021) used a Trapezoidal Bipolar Fuzzy TOPSIS method in their study on project selection for automotive assembly structures and determined the criteria weights according to the best-worst method. Luo et al. (2020) used ANP and TOPSIS methods in their study on the selection of a waste-to-energy plant and determined the criteria weights by the best-worst method. Liu et al. (2021) determined the criteria weights according to the best-worst method in their study where they conducted environmental performance evaluation using the AHP method. Minaei et al. (2021) used GIS-based methodology in their study in which they conducted a spatial evaluation of solar photovoltaic suitability and determined the criteria weights by the best-worst method.

3. METHODOLOGY

In this section, the calculation steps of "BWM", "ARAS", "EDAS", "MOORA", "OCRA" and "TOPSIS" techniques are explained.

3.1. ARAS Technique

Additive Ratio Assessment (ARAS) technique is developed by (Zavadskas et al., 2010). Steps of the ARAS can be mentioned as follow (Zavadskas et al., 2010).

Step 1: Creating decision matrix (1):

$$\mathrm{A} = \begin{bmatrix} \alpha_{01} & \dots & \alpha_{0q} \\ \alpha_{11} & \dots & \alpha_{1q} \\ \dots & \dots & \dots \\ \alpha_{p1} & \dots & \alpha_{pq} \end{bmatrix} \quad (1)$$

The first line of the decision matrix (A) consists of optimal values of criterion j. If the j is unknown, then

$\alpha_{0j} = \max_i \alpha_{ij}$, if $\max_i \alpha_{ij}$ is preferable and $\alpha_{0j} = \min_i \alpha_{ij}^*$, if $\min_i \alpha_{ij}^*$ is preferable.

Step 2. Normalize dataset using the following procedure.

Use Equation (2) to normalize decision matrix (preferable values are maxima):

$$n_{ij} = \frac{\alpha_{ij}}{\sum_{i=0}^{p} \alpha_{ij}} \quad (2)$$

Use Equation (3) to normalize decision matrix (preferable values are minima):

$$n_{ij} = \frac{\alpha_{ij}^*}{\sum_{i=0}^{p} \alpha_{ij}^*} \quad (3)$$

where

$$x_{ij}^* = \frac{1}{x_{ij}} \quad (4)$$

Step 3: Calculate normalized-weighted values with Equation (5)

$$\Upsilon_{ij} = n_{ij} \times w_j \quad (5)$$

Step 4: Calculate values of optimality function with Equation (6)

$$S_i = \sum_{j=1}^{q} v_{ij} \tag{6}$$

Step 5: Calculate utility degree:

$$K_i = \frac{S_i}{S_0} \tag{7}$$

Where $0 \leq K_i \leq 1$. Higher K values are preferred.

3.2. BWM Method

Best-Worst Method is developed by (Rezaei, 2015). Five steps should be followed before getting the relative weights of the criteria (Rezaei, 2015).

Step 1. Determining the criteria set. In this first step, criteria set $\{c_1, c_2, \dots, c_n\}$ is defined.

Step 2. Determining the best and the worst criteria.

Step 3. Compare the best criterion with all other criteria (1 to 9). The Best-to-Others vector would be:

$$A_B = (a_{B1}, a_{B2}, \dots a_{Bn}) \tag{8}$$

Step 4. Compare the worst criterion with all other criteria (1 to 9). The Others-to-Worst vector would be:

$$A_w = (a_{1w}, a_{2w}, \dots, a_{nw})^T \tag{9}$$

Step 5. Find the optimal weights $(w_1^*, w_2^*, \dots, w_n^*)$ with Equation (10)

$$\min \max_j \left\{ \left| \frac{w_B}{w_j} - a_{Bj} \right|, \left| \frac{w_j}{w_W} - a_{jW} \right| \right\} \tag{10}$$

s.t.

$$\sum w_j = 1$$
$$w_j \geq 0, for\ all\ j$$

Mathematical model (10) can be transferred to the following problem:

$$\min \xi$$

s.t.

$$\left| \frac{w_B}{w_j} - a_{Bj} \right| \leq \xi, for\ all\ j$$
$$\left| \frac{w_j}{w_W} - a_{jW} \right| \leq \xi, for\ all\ j \tag{11}$$
$$\sum w_j = 1$$
$$w_j \geq 0, for\ all\ j$$

Table 2: Consistency Index Table

a_{BW}	1	2	3	4	5	6	7	8	9
$\max \xi$	0.00	0.44	1.00	1.63	2.30	3.00	3.73	4.47	5.23

In the Best-Worst method, the consistency of the comparison matrix is checked to ensure overall consistency (Ren et al., 2017). Consistency ratio is calculated by Equation (12):

$$Consistency\ Ratio = \frac{\xi^*}{consistency\ index} \tag{12}$$

A value close to zero indicates high consistency, and a value close to 1 indicates low consistency.

3.3. EDAS Technique

Evaluation Based on Distance from Average Solution (EDAS) technique is developed by (Ghorabaee et al., 2015). Calculation steps can be mentioned as follow (Ghorabaee et al., 2015).

Step 1: Create a decision matrix with Equation (13):

$$\mathrm{A} = \begin{bmatrix} \alpha_{11} & \cdots & \alpha_{1q} \\ \cdots & \cdots & \cdots \\ \alpha_{p1} & \cdots & \alpha_{pq} \end{bmatrix} \tag{13}$$

Step 2: Determine the average solution with Equation (14)

$$AV_j = \frac{1}{p}\sum_{i=1}^{q} \alpha_{ij} \tag{14}$$

Step 3: Calculate the actual (PDA) and negative (NDA) distance from average solution.

If $the\ j$th criterion is beneficial to use Equation (15):

$$PDA_{ij} = \frac{\max\left(0, \left(\mathrm{A}_{ij} - AV_j\right)\right)}{AV_j}$$
$$NDA_{ij} = \frac{\max\left(0, \left(AV_j - \mathrm{A}_{ij}\right)\right)}{AV_j} \tag{15}$$

Moreover, if the jth criterion is non-beneficial (cost) use Equation (16).

$$PDA_{ij} = \frac{\max\left(0, \left(AV_j - \mathrm{A}_{ij}\right)\right)}{AV_j}$$
$$NDA_{ij} = \frac{\max\left(0, \left(\mathrm{A}_{ij} - AV_j\right)\right)}{AV_j} \tag{16}$$

Step 4: Determine the weighted sum of PDA and NDA with Equation (17).

$$SP_i = \sum_{j=1}^{q} w_j PDA_{ij}$$
$$SN_i = \sum_{j=1}^{q} w_j NDA_{ij} \quad (17)$$

Where w_j is the weight of the jth criterion.

Step 5. Normalize the values of SP and SN with Equation (18).

$$NSP_i = \frac{SP_i}{\max_i(SP_i)}$$
$$NSN_i = 1 - \frac{SN_i}{\max_i(SN_i)} \quad (18)$$

Step 6: Calculate the appraisal score (AS):

$$AS_i = \frac{1}{2}(NSP_i + NSN_i) \quad (19)$$

Where $0 \leq AS_i \leq 1$. The highest AS is the best choice.

3.4. MOORA Method

Multi-Objective Optimization based on Ratio Analysis (MOORA) technique is developed by (Brauers & Zavadskas, 2006). Calculation steps can be mentioned as follow:

Step 1: Create a decision matrix:

$$\mathrm{A} = \begin{bmatrix} \alpha_{11} & \dots & \alpha_{1q} \\ \dots & \dots & \dots \\ \alpha_{p1} & \dots & \alpha_{pq} \end{bmatrix} \quad (20)$$

Step 2: Normalize dataset:

$$n_{ij} = \frac{\alpha_{ij}}{\sqrt{\sum_{j=1}^{p} \alpha_{ij}^2}} \quad (21)$$

Step 3: Weight the normalized dataset with Equation (22).

$$\Upsilon_{ij} = n_{ij} * w_j \quad (22)$$

Step 4: Calculate coefficients:

$$y_i = \sum_{j=1}^{g} v_{ij} - \sum_{j=g+1}^{q} v_{ij}\,, i = 1,2,\dots,p \quad (23)$$

3.5. OCRA Technique

Operational Competitiveness Rating (OCRA) technique is developed by (Parkan, 1994). Calculation steps can be mentioned below (Kundakci, 2017):

Step 1: Create a decision matrix:

$$\mathrm{A} = \begin{bmatrix} \alpha_{11} & \dots & \alpha_{1q} \\ \dots & \dots & \dots \\ \alpha_{p1} & \dots & \alpha_{pq} \end{bmatrix} \quad (24)$$

Step 2: Calculate the total performance of the alternative:

$$\overline{I_\iota} = \sum_{j=1}^{g} w_j \frac{\max(\alpha_{ij}) - \alpha_{ij}}{\min(\alpha_{ij})}, i = 1,2, \dots, p \; and \; j = 1,2, \dots g \quad (25)$$

$\overline{I_\iota}$ indicates the relative performance of alternative i and x_{ij}:

$$\overline{\overline{I_\iota}} = \overline{I_\iota} - \min(\overline{I_\iota}) \quad (26)$$

Step 3: Calculate the ratings with Equation (27).

$$\overline{O_\iota} = \sum_{j=g+1}^{q} w_j \frac{\alpha_{ij} - \min(\alpha_{ij})}{\min(\alpha_{ij})}, i = 1,2, \dots, p \; and \; j = g+1, g+2, \dots, q \quad (27)$$

Step 4: Calculate the linear preference rating with Equation (28).

$$\overline{\overline{O_\iota}} = \overline{O_\iota} - \min(O_i) \quad (28)$$

Step 5: Calculate the total preference value for each alternative with Equation (29):

$$\rho_i = \left(\overline{\overline{I_\iota}} + \overline{\overline{O_\iota}}\right) - \min\left(\bar{\bar{I}} + \bar{\bar{O}}\right), i = 1,2, \dots, p \quad (29)$$

3.6. TOPSIS Method

The TOPSIS method is developed by (Hwang & Yoon, 1981). Calculation steps can be mentioned below (Mateo, 2015):

Step 1: Construct a decision matrix:

$$\mathrm{A} = \begin{bmatrix} \alpha_{11} & \dots & \alpha_{1q} \\ \dots & \dots & \dots \\ \alpha_{p1} & \dots & \alpha_{pq} \end{bmatrix} \quad (30)$$

Step 2 : Calculate the normalized decision matrix:

$$n_{ij} = \frac{\alpha_{ij}}{\sqrt{\sum_{j=1}^{m} \alpha_{ij}^2}} \; j = 1,2, \dots q, i = 1,2, \dots, p \quad (31)$$

Step 3: Calculate the weighted normalized decision matrix:

$$\Upsilon_{ij} = n_{ij} w_j \quad (32)$$

Step 4: Determine the ideal (X^+) and negative-ideal (X^-) solutions:

$$X^+ = \{v_1^+, v_2^+, \dots, v_q^+\} = \left\{\left(\max_i v_{ij} \,\middle|\, j \in J\right), \left(\min_i v_{ij} \,\middle|\, j \in J'\right)\right\}$$
$$X^- = \{v_1^-, v_2^-, \dots, v_q^-\} = \left\{\left(\min_i v_{ij} \,\middle|\, j \in J\right), \left(\max_i v_{ij} \,\middle|\, j \in J'\right)\right\} \quad (33)$$

Step 5: Calculate the separation measures:

$$S_i^* = \sqrt{\sum_{j=1}^{q} \left(v_{ij} - v_j^+\right)^2}, i = 1,2,\dots,p$$
$$S_i^- = \sqrt{\sum_{j=1}^{q} \left(v_{ij} - v_j^-\right)^2}, i = 1,2,\dots,p \quad (34)$$

Step 6: Calculate relative closeness to the ideal solution:

$$C_i = \frac{S_i^-}{S_i^- + S_i^+}, i = 1,2,\dots,p \quad (35)$$

4. Results

4.1. Proposed System

Steps of the study are visualized in Figure 1 and can be summarized as follow:

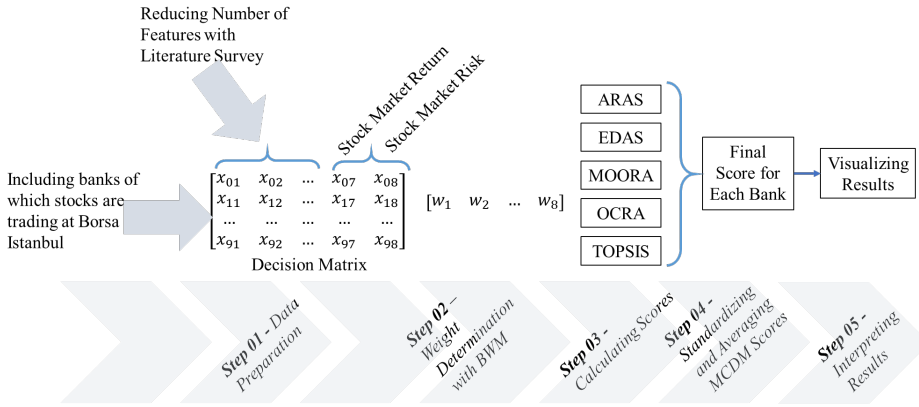

Figure 1: The Flow of the Study

Step 01 – Data Preparation Phase: In this phase, the long-term dataset is obtained from two different data sources. The dataset includes financial ratios as well as stock market indicators. Financial ratios are selected based on the frequency in the literature.

Step 02 – Weight Determination with BWM: In this phase, the relative weights of the criteria are determined with the Best-Worst Method. Three expert opinions are used.

Step 03 – Calculating scores: In this phase, five different MCDM tools are applied to the weighted decision matrix. Tools are selected based on their calculation steps. These five tools applies similar steps in calculating the scores. No extra parameters needed to apply the scores of alternatives with these tools.

Step 04 – Standardizing and Averaging MCDM Scores. In the previous step, five score set is obtained. Interpreting five different score set will be complicated; that is why all of the score sets are standardized and averaged. As a result of this process, a final performance score set where all the elements are in the range of [0, 1] is obtained.

Step 05 – Interpreting results. In this step, the characteristics of banks (state-owned, private or foreign) and scores are interpreted. Also, Spearman Correlation analysis is conducted to analyze the relationship between each of the single-criteria and final performance.

4.2. Dataset

Dataset is compiled from two different data sources. Financial ratios of banks are obtained from The Banks Association of Turkey (tbb.org.tr). Daily return and standard deviation of returns are obtained from investing.com, which provides daily historical stock market data.

There are three types of deposit banks operating in Turkey. These banks are state-owned (3 banks) privately-owned (9) and foreign banks. Foreign banks are further divided into two groups as Founded in Turkey (16) and Having Branches in Turkey (5).

Some banks have a small number of branches throughout the country. Evaluating banks with fewer branches and banks with more branches together may lead to misleading results. Banks with less than 50 branches are excluded from the study to obtain a homogenous dataset. As a result, the dataset contains two state-owned, four privately-owned and four foreign banks. The share of selected banks in total assets of the sector is 88.81%.

4.3. Feature Selection

The Banks Association of Turkey issues more than 40 ratios in 6 main categories for each bank. Using all of the ratios will make the decision-making process complicated. Moreover, some of the ratios may include the same information with another ratio in the dataset. Thus an elimination process is needed to reduce the number of features.

Of the studies reviewed, 21 use similar financial ratios in the data set. Therefore, these 21 studies have been examined in detail to determine the most frequently used financial ratios in the literature. The financial ratios used in 21 studies are categorized, and the frequency of the ratios are presented in Table 3. The most frequent ratio used in the main categories is selected to represent that category. As a result, six financial ratios are selected out of 40 ratios.

Table 3: The Financial Ratios Used in Studies

	(Yüksel et al., 2017)	(Celen, 2014)	(Ghasempour & Salami, 2016)	(Gundogdu, 2015)	(Akkoç & Vatansever, 2013)	(Kosmidou & Zopounidis, 2008)	(Sisman & Doğan, 2016)	(Seçme et al., 2009)	(Bozdogan et al., 2013)	(Demireli, 2010)	(Kandemir & Karatas, 2016)
Capital Ratios											
"Capital Adequacy Ratio"	✓	✓	✓	✓	✓			✓			
"Shareholders' Equity / Total Assets"		✓		✓	✓	✓	✓	✓	✓		✓
"(Shareholders' Equity-Permanent Assets) / Total Assets"		✓		✓				✓	✓		
"Shareholders' Equity / (Deposits + Non-Deposit Funds)"											
"On Balance-sheet FC Position / Shareholders' Equity"	✓										
"Net on Balance-sheet Position / Total Shareholders' Equity"		✓									
"N(on+off) Balance-sheet Position / Total Shareholders' Equity"		✓							✓		
Balance-Sheet Ratios											
"TC Assets / Total Assets"		✓						✓			
"FC Assets / Total Assets"								✓			
"TC Liabilities / Total Liabilities"		✓						✓			
"FC Liabilities / Total Liabilities"								✓			
"FC Assets / FC Liabilities"		✓									
"TC Deposits / Total Deposits"		✓									
"TC Loans and Receivables* / Total Loans and Receivables*"				✓							
"Total Deposits / Total Assets"		✓					✓	✓			
"Funds Borrowed / Total Assets"		✓									
Assets Quality											
"Financial Assets (Net) / Total Assets"	✓	✓				✓					✓
"Total Loans / Total Assets"		✓	✓	✓			✓		✓	✓	
"Total Loans / Total Deposits"		✓	✓		✓	✓	✓			✓	
"Loans under follow-up (gross) / Total Loans"	✓	✓	✓	✓	✓				✓		

"Permanent Assets / Total Assets"	✓	✓						✓	✓		
"Consumer Loans / Total Loans"											
Liquidity											
"Liquid Assets / Total Assets"	✓	✓		✓		✓		✓	✓		✓
"Liquid Assets / Short-term Liabilities"		✓	✓		✓	✓		✓	✓		
"TC Liquid Assets / Total Assets"		✓									
"Liquid Assets / (Deposits + Non-Deposit Funds)"				✓							
"FC Liquid Assets / FC Liabilities"				✓							
Profitability											
"Average Return on Assets"	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
"Average Return on Shareholders' Equity"	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
"Income Before Taxes / Total Assets"		✓				✓					
"Net Profit (Losses) / Paid-in Capital"				✓							
Income-Expenditure Structure											
"Net Interest Income After Specific Provisions / Total Assets"	✓	✓		✓	✓			✓	✓	✓	
"Net Interest Income Af Spec Prov / Total Operating Income"		✓						✓	✓		
"Non-Interest Income (Net) / Total Assets"	✓	✓			✓			✓	✓	✓	
"Non-Interest Income (Net) / Other Operating Expenses"											
"Other Operating Expenses / Total Operating Income"	✓							✓	✓		
"Provision For Loan or Other Receivables Losses / Total Assets"					✓	✓		✓			
"Interest Income / Interest Expense"				✓	✓				✓		✓
"Total Income / Total Expense"					✓						
"Interest Income / Total Assets"							✓				
"Interest Expense / Total Assets"	✓						✓				

Table 3 cont.

	(Paksoy & Tıras, 2017)	(Albayrak & Erkut, 2005)	(Dogan, 2013)	(Dincer & Gorener, 2011)	(Ho, 2006)	(Hunjak & Jakovčević, 2001)	(Oral, 2016)	(Onder et al., 2013)	(Rakocevic & Dragasevic, 2009)	(Tunay & Akbisar, 2015)
Capital Ratios										
"Capital Adequacy Ratio"		✓		✓		✓		✓	✓	✓
"Shareholders' Equity / Total Assets"		✓		✓			✓	✓		✓
"(Shareholders' Equity-Permanent Assets) / Total Assets"		✓						✓		✓
"Shareholders' Equity / (Deposits + Non-Deposit Funds)"				✓	✓			✓		
"On Balance-sheet FC Position / Shareholders' Equity"								✓		
"Net on Balance-sheet Position / Total Shareholders' Equity"				✓				✓		
"N(on+off) Balance-sheet Position / Total Shareholders' Equity"		✓								
Balance-Sheet Ratios										
"TC Assets / Total Assets"								✓		
"FC Assets / Total Assets"								✓		
"TC Liabilities / Total Liabilities"								✓		
"FC Liabilities / Total Liabilities"								✓		
"FC Assets / FC Liabilities"								✓		
"TC Deposits / Total Deposits"								✓		
"TC Loans and Receivables* / Total Loans and Receivables*"								✓		
"Total Deposits / Total Assets"				✓				✓		
"Funds Borrowed / Total Assets"								✓		
Assets Quality										
"Financial Assets (Net) / Total Assets"				✓			✓	✓		
"Total Loans / Total Assets"	✓	✓	✓	✓	✓			✓		
"Total Loans / Total Deposits"			✓			✓		✓	✓	
"Loans under follow-up (gross) / Total Loans"	✓	✓		✓						
"Permanent Assets / Total Assets"	✓	✓		✓						
"Consumer Loans / Total Loans"								✓		
Liquidity										
"Liquid Assets / Total Assets"	✓	✓	✓	✓			✓	✓	✓	
"Liquid Assets / Short-term		✓	✓	✓			✓	✓		

Liabilities"										
"TC Liquid Assets / Total Assets"								✓		
"Liquid Assets / (Deposits + Non-Deposit Funds)"	✓			✓				✓		
"FC Liquid Assets / FC Liabilities"	✓							✓		
Profitability										
"Average Return on Assets"	✓	✓	✓	✓	✓		✓	✓	✓	
"Average Return on Shareholders' Equity"	✓	✓	✓	✓	✓		✓	✓	✓	
"Income Before Taxes / Total Assets"	✓							✓		
"Net Profit (Losses) / Paid-in Capital"								✓		
Income-Expenditure Structure										
"Net Interest Income After Specific Provisions / Total Assets"		✓		✓			✓	✓		
"Net Interest Income Af Spec Prov / Total Operating Income"	✓	✓					✓	✓		
"Non-Interest Income (Net) / Total Assets"		✓		✓	✓			✓		
"Non-Interest Income (Net) / Other Operating Expenses"	✓	✓						✓		
"Other Operating Expenses / Total Operating Income"					✓	✓			✓	
"Provision For Loan or Other Receivables Losses / Total Assets"										
"Interest Income / Interest Expense"	✓			✓				✓		
"Total Income / Total Expense"	✓							✓		
"Interest Income / Total Assets"								✓		
"Interest Expense / Total Assets"										
"Interest Income / Total Expenses"								✓		
"Interest Expense / Total Expenses"				✓				✓		

Aim of this study is to measure the long term performance. The arithmetic average of the selected ratios between 2014 and 2018 is calculated to obtain long term performance indicators. Column 2 to column 7 of Table 4 represents the average of selected financial ratios.

Table 4: Decision Matrix

	Shareholders' equity/total assets (Ratio 1)	Total deposits/total assets (Ratio 2)	Total loans/total assets (Ratio 3)	Liquid assets/total assets (Ratio 4)	The average return on assets (Ratio 5)	Net interest income after specific provisions /total assets (Ratio 6)	Mean of return (Ratio 7)	The standard deviation of return (Ratio 8)
HALKB	9.24	65.15	102.66	18.77	1.24	2.26	-0.01	3.70
VAKBN	8.94	57.58	117.57	21.05	1.32	2.24	-0.06	3.61
AKBNK	12.21	57.80	103.26	28.18	1.72	2.52	-0.05	3.54
SKBNK	9.70	65.84	104.71	17.18	0.56	2.90	-0.04	3.90
ISCTR	11.86	56.80	114.31	23.69	1.52	2.80	-0.06	3.46
YKBNK	10.53	58.34	112.93	22.60	1.21	2.21	0.01	3.79
DENIZ	10.01	60.38	102.56	24.42	1.35	2.60	-0.18	4.90
ICBCT	9.73	44.53	152.80	30.12	0.21	2.55	-0.02	4.09
QNBFB	10.16	54.96	116.81	20.29	1.30	3.36	-0.07	3.00
GARAN	12.45	56.69	111.59	21.95	1.78	3.10	-0.07	3.57

4.4. Return and Risk Values as Performance Measurement Criteria

Literature survey revealed that all of the examined studies (summarized in Table 3) employed financial ratios or non-financial (quantitative) indicators to assess the performance of banks. In this study, stock market indicators (mean of the returns and standard deviation of returns) are also added as two new criteria to the decision matrix to evaluate the performance of banks in a broad framework.

Stock market performance of a bank cannot be separated from the performance of banks. It is possible to assert that the stock market price of banks also has an impact on the performance of banks. Investors consider not only financial ratios, but also the value of banks in the stock market. Since this study aims to measure the long term performance of the banks, stock market performance is also added to the decision matrix.

Daily stock return is calculated using Equation (36).

$$r_t = \frac{p_t - p_{t-1}}{p_{t-1}} \times 100 \qquad (36)$$

Where r_t is the daily return of stock for day t, p_t and p_{t-1} are closing price for day t and $t-1$, respectively.

Column 7 to column 8 of Table 4 represent the average return and standard deviation of daily returns.

Table 5: Descriptive Statistics of Daily Returns

Stock Quote	Mean	Standard Deviation	Skewness	Kurtosis
HALKB	-0.010	3.698	-15.547	426.078
VAKBN	-0.056	3.614	-16.697	466.027
AKBNK	-0.047	3.539	-17.693	507.230
SKBNK	-0.040	3.905	-16.741	419.620
ISCTR	-0.058	3.457	-19.045	555.710
YKBNK	0.012	3.787	-12.163	422.021
DENIZ	-0.183	4.902	-5.157	189.946
ICBCT	-0.017	4.089	3.377	44.248
QNBFB	-0.070	2.996	-1.801	14.755
GARAN	-0.068	3.568	-17.354	490.196

Time-series properties are presented in Table 5.

Figure 2: Natural Logarithm of the Closing Price for Each Bank

Natural logarithm of the close price for each bank between 1 January 2014 and 31 December 2018 is presented in Figure 2. Note that the times they started to trade on Borsa Istanbul is different from each other.

4.5. Weight Determination Process

Ratios in measuring the performance of banks may have different degrees of importance. Some ratios may be a good indicator of bank performance, while others may have secondary importance in performance measurement. The relative weights of the ratios can be determined by experts working in the banking sector. With the help of the experience and field knowledge, experts can quantify the impact of each ratio on performance evaluation compared to other ratios.

However, the results may be biased, as experts assess according to subjective judgements. The opinions of three different experts were used in this study to provide an objective

evaluation. Two of them are currently working in the Banking Regulation, and Supervision Agency of Turkey (BRSA) and each one has at least 15 years of experience in Turkey's financial sector. Moreover, an academician studying in the finance department of a university in Turkey also evaluated the criteria. As a result, three different weight sets were obtained using expert evaluations. The consensus among the expert opinions was obtained by taking the arithmetic average of weights.

Table 6: Best Criterion Over Other Criteria Preferences

	A	B	C
Ratio 1	7	1	4
Ratio 2	5	7	5
Ratio 3	6	2	8
Ratio 4	8	4	9
Ratio 5	2	5	2
Ratio 6	4	6	1
Ratio 7	1	8	3
Ratio 8	3	9	7

Three experts are employed as decision-makers to evaluate the criteria weights. Each expert was asked to perform pairwise comparisons. Tables (6-7) are representing the results of the interviews. These tables demonstrate the preference of the best criterion over other criteria, and the preference of other criteria over the worst criterion respectively for every three experts.

Table 7: Other Criteria Over Worst Preferences

	A	B	C
Ratio 1	2	9	5
Ratio 2	4	3	4
Ratio 3	3	8	2
Ratio 4	1	7	1
Ratio 5	7	5	8
Ratio 6	5	4	9
Ratio 7	8	2	6
Ratio 8	6	1	3

The weights are determined with BWM technique. The minimizing problem mentioned in Equation (11) can be formulated for each expert, and by solving these problems, it is possible to obtain optimal weights of each criterion for each expert in addition to the values of ξ. As a result, three sets of weights are obtained, and an average of them is calculated and presented in Table 8.

Table 8. Criteria Weights

	Mean Weights	A	B	C
Ratio 1	0.2241	0.2196	0.0803	0.3723
Ratio 2	0.0541	0.0314	0.0688	0.0620
Ratio 3	0.0632	0.0549	0.0602	0.0745
Ratio 4	0.2358	0.3607	0.1605	0.1861
Ratio 5	0.2053	0.1098	0.3821	0.1241
Ratio 6	0.0624	0.0627	0.0314	0.0931
Ratio 7	0.0849	0.0878	0.1204	0.0465
Ratio 8	0.0703	0.0732	0.0963	0.0414
ξ		0.0784	0.0995	0.000

ξ values are used to check the consistency of pairwise comparisons (Table 8). Since the value of ξ presented in Table 8 is below 0.10 for all decision-makers (or experts), it is possible to conclude that pairwise comparisons are consistent.

4.6. MCDM Analysis Results

The decision matrix and criteria weight set are used to rank the banks based on five different MCDM techniques. The results of MCDM computations are presented in Table 9. As the figures in the table presents, various MCDM tools produced scores on different ranges. To obtain an average of five MCDM techniques, Table 9 has undergone a standardization process by using the following Equation (37).

$$z_i = \frac{x_i - \min(x)}{\max(x) - \min(x)} \tag{37}$$

Where z_i represents the normalized value and x_i represents the value before normalization of ith observation. $\mathrm{Min}(x)$ and $\max(x)$ represent the minimum and maximum value of feature x. This normalization technique can reduce the influence of differences in the magnitudes of the input feature (Angelov & Gu, 2019).

Table 9: MCDM Scores

	ARAS	EDAS	MOORA	OCRA	TOPSIS
HALKB	0.0773	0.1825	0.1766	0.9172	0.6154
VAKBN	0.0861	0.4254	0.1650	1.0302	0.5922
AKBNK	0.1047	0.9931	0.2381	1.6215	0.8092
SKBNK	0.0725	0.0793	0.1330	0.2532	0.4198
ISCTR	0.0990	0.7944	0.2077	1.3633	0.7051
YKBNK	0.0779	0.1779	0.1995	0.9448	0.6886
DENIZ	0.1122	1.0057	0.1362	1.1796	0.4414
ICBCT	0.0708	0.0505	0.1476	0.0000	0.4740
QNBFB	0.0932	0.6030	0.1757	1.0810	0.5783
GARAN	0.1043	0.9573	0.2170	1.6175	0.7039

Standardized scores and the mean of standardized scores are depicted in Table 10.

Table 10: Standardized Scores of MCDM Tools

	Final Scores	ARAS	EDAS	MOORA	OCRA	TOPSIS
HALKB	0.3555	0.1565	0.1382	0.4148	0.5657	0.5023
VAKBN	0.4288	0.3690	0.3925	0.3047	0.6353	0.4426
AKBNK	0.9612	0.8192	0.9868	1.0000	1.0000	1.0000
SKBNK	0.0457	0.0420	0.0302	0.0000	0.1562	0.0000
ISCTR	0.7488	0.6810	0.7788	0.7111	0.8408	0.7325
YKBNK	0.4422	0.1722	0.1333	0.6326	0.5826	0.6903
DENIZ	0.5626	1.0000	1.0000	0.0302	0.7275	0.0554
ICBCT	0.0556	0.0000	0.0000	0.1388	0.0000	0.1392
QNBFB	0.5201	0.5423	0.5784	0.4062	0.6666	0.4071
GARAN	0.8571	0.8100	0.9494	0.7991	0.9975	0.7294

Final scores for each bank, as well as bank characteristics, are visualized in Figure 3. State-owned banks are presented with red, private-owned banks are with green and foreign banks are presented with blue colour.

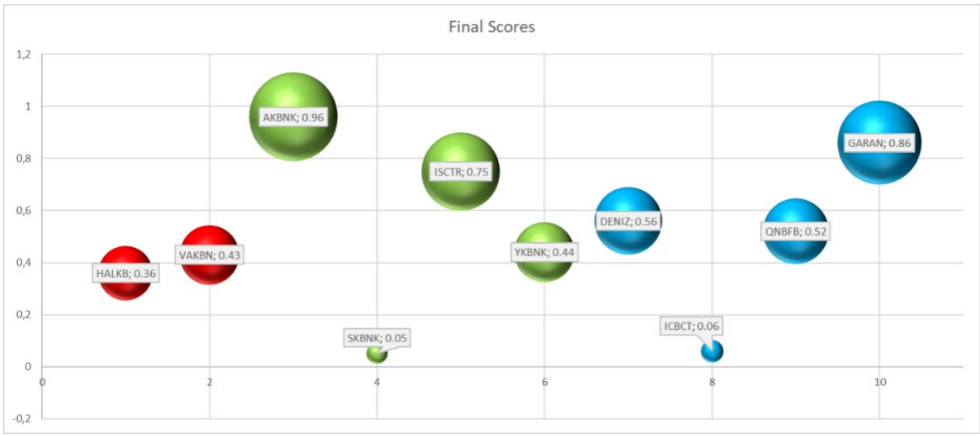

Figure 3. Visualization of Final Scores

As Figure 3 indicates, state-owned banks have similar final performance scores (Turkiye Halk Bankası 0.36 and Turkiye Vakiflar Bankası 0.43). Highest score in privately owned banks belongs to Akbank (0.96). The highest score belongs to foreign banks belong to Turkiye Garanti Bankasi (0.86).

4.7. Correlation Analysis

A Spearman Correlation analysis is carried out to analyze the correlation between each of the single-criteria and final performance (Table 11).

Table 11: Correlation Analysis

	Overall	p	ARAS	p	EDAS	p	MOORA	p	OCRA	p	TOPSIS	p
Ratio 1	0.83	0.01	0.6	0.07	0.54	0.11	0.75	0.02	0.75	0.02	0.66	0.04
Ratio 2	-0.26	0.47	-0.04	0.92	-0.02	0.97	-0.26	0.47	-0.18	0.63	-0.21	0.56
Ratio 3	-0.25	0.49	-0.43	0.22	-0.48	0.17	-0.07	0.86	-0.28	0.43	-0.03	0.95
Ratio 4	0.43	0.22	0.33	0.35	0.28	0.43	0.25	0.49	0.3	0.41	0.28	0.43
Ratio 5	0.92	0	0.89	0	0.9	0	0.66	0.04	0.96	0	0.65	0.05
Ratio 6	0.2	0.58	0.22	0.54	0.25	0.49	-0.09	0.81	0.25	0.49	-0.21	0.56
Ratio 7	-0.54	0.11	-0.73	0.02	-0.75	0.02	0.04	0.92	-0.61	0.07	0.09	0.81
Ratio 8	-0.55	0.1	-0.33	0.35	-0.35	0.33	-0.67	0.04	-0.59	0.08	-0.65	0.05

The variables with the highest correlation coefficient are the average return on assets (0.92) and shareholders' equity/total assets ratio (0.83). All of the other variables have less statistically significant coefficients (p). Moreover, these criteria also have the highest correlation coefficient with single MCDM tools.

5. DISCUSSION

This study aimed to evaluate the long-term performance of the ten deposit banks operating in Turkey using five different methods of MCDM (i.e. ARAS, EDAS, MOORA, OCRA and TOPSIS). The weights of the criteria are set with the Best-Worst Method. According to the results of the analysis, some significant findings were discussed below.

As can be seen in Table 10 and Figure 3, the financial performances of private banks and foreign banks are higher than those of state-owned banks. Akbank is a privately owned bank with the highest financial performance. Also, Turkiye Garanti Bankasi is a foreign bank with the highest financial performance. These findings are similar to the findings of some studies in the literature. Dincer et al. (2016) have measured the performance of banks operating in Turkey using fuzzy DEMATEL fuzzy TOPSIS methods. As a result of their work, they found that the performances of private-owned banks were higher than those of state-owned banks. Bayyurt (2013) has measured the performance of banks operating in Turkey using TOPSIS, DEA and Electra III methods. As a result, it has been found that the performances of private-owned banks are higher than others. Cetin & Cetin (2010) have measured the performance of banks using the VIKOR method. As a result of their work, they found that the performances of private-owned banks were higher than those of state-owned banks. Also, this finding differs from the findings of some studies in the literature. Yuksel et al. (2017) have measured the performance of banks using DEMATEL, GRA and MOORA methods. They found that the performances of foreign banks were higher than the performances of other banks (both state and private banks).

As can be seen in Table 8, the criteria with the highest weight were Liquid Assets / Total Assets. This finding differs from the findings of some studies in the literature. Cetin & Cetin (2010) have measured the performance of banks using the VIKOR method. In their study, they determined that the weight of the Liquid Assets / Total Assets criterion was the lowest in liquidity ratios. Dincer & Gorener (2011) have measured the performance of banks operating in Turkey using AHP and VIKOR methods. They determined that the weight of the Liquid Assets / Total Assets criterion was the third-highest weight among all criteria (31 criteria). Onder et al. (2013)

have measured the performance of banks operating in Turkey using AHP and TOPSIS methods. They determined that the weight of the Liquid Assets / Total Assets criterion was the sixth-highest weight among all criteria, although it is the first among the liquidity ratios. Yüksel et al. (2017) determined that the weight of the Liquid Assets / Total Assets criterion ranked the 12th out of 13 criteria.

Table 8 shows that the weight of 3 of the eight criteria used in calculating the performances of banks is higher than the other five criteria and that the weight of these three criteria is close to each other. However, the difference between the three most weighted criteria and the remaining five criteria is quite high. Therefore, this indicates that "Liquid Assets/Total Assets", "Shareholders' Equity/Total Assets" and "Average Return on Assets" criteria are largely determinative when evaluating banks' performances. In other words, the criteria that put forward the Akbank and Turkiye Garanti Bankasi in terms of performance reveal the current functional status of these banks regarding these three criteria. When evaluated in terms of criteria, it is possible to say that these two banks have high ability to convert their assets to liquidity in the period, including 2014-2018. Although liquid assets/total assets ratio is evaluated considering alternative costs and the cash producing capacity of the sector in which the enterprise is located, the high ratio increases the company's manoeuvrability in unexpected situations. This situation reveals that both banks had assets with high liquidity in this period, notably cash, checks, government bonds, corporate bonds, etc. At the same time, when looking at the ratio that shows how much of the assets of the two banks is financed by shareholders' equity, it is possible to state that this ratio is high in both banks. Because this ratio is over 75% means that the bank does not have much debt, follows a conservative borrowing model and takes a little risk. This situation shows that the two banks can meet their financial obligations in the analyzed period and are unlikely to experience financial problems. Considering the ratio showing how productive the bank assets are in generating profit, it shows that the assets of the two banks were successfully used in generating profit in the relevant period. This situation indicates that the asset profitability ratio of the two banks in the relevant period is relatively high, or an increase in the return on assets is observed.

To summarize the discussion section, it is seen that the findings of this study related to bank performance and the findings of the majority of the studies related to bank performance in the literature are similar. In the literature, the criteria with relatively high weight differ in the studies for determining bank performance. Although the criteria have different weights, the final results reveal that, as in this study, the performances of privately-owned banks are higher than those of state-owned banks. Especially since 2010, it is possible to say that privately-owned or foreign banks operating in Turkey are in better condition in terms of factors determining bank performance such as financial ratios and the effects of stock market indicators.

5.1. Managerial Implications

One of the most relevant results of the study, in other words, the most critical feature that separates the banks in terms of performance is related to the liquid assets of the banks. When we look at the weights of the criteria such as financial rates and stock market indicators, it would not be wrong to express this. The finding obtained on the importance of liquidity reveals that managers operating in the sector should take care of the liquidity of this asset when it comes to asset acquisition. Also, this finding shows that liquidity has vital importance on bank performance. It is also of great importance that bank managers keep the ratio of liquid assets within total assets to a certain level. It is crucial to maintain high liquidity assets such as cash,

government bonds and corporate bonds within the bank in order to keep the possible adverse effects to a minimum in the extraordinary situations that banks may encounter. At the same time, thanks to the availability of liquid assets, managers may have the option to operate on different assets in extraordinary situations they encounter, in other words, they will be able to obtain mobility for the use of assets.

The second most important feature that distinguishes banks in terms of performance is related to the borrowing status of banks. For managers, borrowing is not the only way to finance bank assets, and assets can be financed through shareholder's equity. Managers need to prefer shareholder's equity rather than short and long term liabilities in asset financing to keep the risk to a minimum. Even if short and long term liabilities are preferred, at least shareholder's equity should be used in asset financing at a specific rate and not too low. As for financing, the vast majority of total assets with foreign assets will bring high levels of borrowing and high risk. This situation can restrict managers in terms of investment decisions or effective use of assets. Managers who can finance their total assets with a reasonable rate of shareholder's equity will be able to fulfil their financial obligations and not encounter unexpected financial problems. Also, managers may prefer methods such as the use of undistributed profits and the addition of internal resources to capital in asset financing.

The third most important feature that causes a difference between the performances of the banks is related to the profitability of the assets. We have mentioned before that managers prefer liquid assets. In addition to attaching importance to assets with high liquidity, managers should also prefer assets that can contribute to bank profitability. Managers should be in search of increasing the profitability rates of existing assets. Since the rate of return on assets provides investors with an investment idea for the assets of the bank, this high rate indicates that the bank earns more with less investment. So, managers should pay attention to the profitability of the assets in order to attract more investors. Finally, it is possible to state that Akbank and Türkiye Garanti Bankası executives performed successfully in terms of the criteria mentioned above, which are prominent in this study. Besides, it is thought that it will be beneficial for the managers of state-owned banks (Türkiye Vakıflar Bankası and Türkiye Halk Bankası) with low performance to prefer assets with high liquidity and high profitability for the coming periods. Moreover, the managers of state-owned banks need to finance their bank assets, mostly using shareholder's equity. Managers must not use foreign assets unless required. Even if they use foreign assets, they must keep it at a reasonable rate in terms of borrowing and risk.

6. CONCLUSION

Banks, one of the essential institution of the financial sector, directly or indirectly affect the general economic situation. In the banking sector, where the competition is at high levels, banks must create superiority over their competitors by controlling and measuring their performance in the sector. Intangible nature of the products and services of the banking industry makes it challenging to measure banking performance. In this study, financial performances of the state-owned, privately-owned and foreign deposit banks (10 banks at total) operating in Turkey from 2014 to 2018 were analyzed. The proposed model includes the use of the Best-Worth method to determine criteria weights and the use of ARAS, EDAS, MOORA, OCRA, and TOPSIS methods to evaluate banks' long-term performance.

According to the expert evaluations, the financial ratio, which has the highest importance, is determined as liquid assets/total assets. The second highest weight belongs to Shareholders' equity/total assets ratio. It is possible to state that stock market indicators did not surpass

traditional indicators. Results indicate that the highest performing bank is AKBNK which is a privately-owned deposit bank. The bank which has the second-highest performance score is determined as GARAN, which is a foreign deposit bank. State-owned banks present a moderate performance. Correlation analysis revealed that the ratio which has the highest coefficient is determined as return on assets. It is possible to comment that the return on asset is the most important feature that affects the final performance evaluation score.

One of the limitations of this study is that only deposit banks of which stocks are traded in Borsa Istanbul are considered. Thirty-three deposit banks are operating in Turkey. However, only ten banks are listed on the stock exchange. In this study, banks' performances were evaluated based on eight criteria. Researchers may consider different criteria for future studies. Also different criteria weight determination process can be employed and the effects of different weights may be examined. The proposed methodology can be applied to the banking sector of other countries or other industries.

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