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## **Ranking of Turkish Banks According to Capital Adequacy and Profitability Ratios with the VIKOR Method**

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### ***Abstract:***

*The banking sector plays an important intermediary role in the economy; therefore, the stability and profitability of the sector is critical for the health of the whole economy. The relative position of each bank in the sector could be measured with alternative methods, such as ranking the banks according to the size of their assets, or the value of total deposits and/or credits in the sector. Another approach is to measure financial performance by ranking the banks according to various predetermined criteria. The aim of this study is to rank the largest 15 commercial banks in Turkey for the period of 2002-2012 according to their financial performance measured with capital adequacy and profitability ratios using the VIKOR method. It is determined that Akbank, one of the biggest private banks of Turkey, is the top performer in our list. Alternatifbank, on the other hand, a foreign private bank, is ranked 15<sup>th</sup> on our list. Three big public banks are listed as 4<sup>th</sup>, 6<sup>th</sup>, and 10<sup>th</sup> and therefore their performance could be labeled as above average.*

***Keywords:*** Banking sector, performance evaluation, the VIKOR method

### **1. Introduction**

The traditional role of banks in an economy is to provide much needed funds to finance new investment opportunities from the deposits primarily collected from households with surplus funds. It is generally accepted that the development of financial markets and financial institutions is critical for economic growth and development (Levine, 1997:689). As this financial development takes place, competition among firms intensifies. In general, there is either a monopolistic competition or an oligopolistic market structure exists in the banking sector. The degree of competition is expected to be quite intense in both market types.

Performance evaluation is crucial especially in competitive environments to understand the position of the company against its competitors and the industry benchmark. In order to improve the position of the company, it is necessary to determine the strengths and the weaknesses of the company. Various methods used in to obtain the necessary information for such evaluation purposes.

The degree of competition intensified in the Turkish banking sector in the 2000s after changes took place beginning in the mid-1990s. The establishment of the Turkish Competition Authority in 1997 (RK) and Banking Regulation and Supervision Agency in 2000 (BDDK) are among these changes that occurred. These steps were taken to create and maintain a competitive environment in the banking sector. Consequently, measurement and evaluation of performance gained more importance.

We used the VIKOR method to rank commercial banks in Turkey for the period of 2002-2012 based on capital adequacy and profitability ratios obtained as 11-year period averages for each bank. There are other studies ranking banks in Turkey for various years and with methods such as TOPSIS, GRA and AHP. The VIKOR method is not used very frequently in the banking sector except studies by Cetin & Cetin (2010) and Dinçer & Görener (2011). Our study is slightly different from these previous studies since the coverage is much broader both in the number of banks and also in the number of years included in our analysis.

The main responsibility of managers could be summarized as problem solving. Problem solving requires setting objectives, determining alternative ways to reach the objectives, evaluating alternatives from different perspectives and finally choosing the best alternative to solve the problem at the end. In a real world setting, problems are complicated and decision makers need all the help they can get.

Multi-criteria decision making (MCDM) provides a wide range of suitable methods to solve complex problems faced by present time managers and other decision makers. There are discrete alternatives evaluated with MCDM methods. Each alternative is defined with a set of criteria where criteria values could be in either cardinal or ordinal informational nature. These methods became increasingly

popular with today's decision makers due to the complexity of the problems and systems and multi-dimensional characteristics of objectives (Zavadskas & Turskis, 2011).

There are different methods of performance evaluation in the banking sector. One of the most often used performance evaluation method is data envelopment analysis (DEA). DEA is a non-parametric method used to obtain the best practice frontier among firms operating in the same industry (Mercan, Reisman, Yolalan, & Emel, 2003; Tsolas & Charles, 2015). On the other hand, there are a number of different approaches under the title of "multi criteria decision making methods" used in different settings. The technique for order performance by similarity to ideal solution (TOPSIS), the multi-criteria optimization and compromise solution (VIKOR), the analytic hierarchy process (AHP) and multi-objective optimization on the basis of ratio analysis (MOORA) are some of the methods of multi criteria decision making.

In this study, our aim is to apply the VIKOR method to evaluate the financial performance of the largest 15 commercial banks for the period of 2002-2012 based on their capital adequacy and profitability ratios. The capital adequacy is very important to show how the banks are resistant to any potential financial crisis. Higher capital adequacy ratios indicate lower risk for banks (Aktas, Acikalin, Bakin, & Celik, 2015).

This paper has four sections. The second section reviews the recent literature on the subject. The third section explains the main characteristics of the methodology used, the data, and the variables of the study. The fourth section exhibits the main findings of the VIKOR method and, finally, the conclusion is presented as the last section.

## 2. Literature Review

Different methods have been used in financial performance analysis of companies in various sectors. Intensified competition in the marketplace through a liberalized international business environment and pro-competitive regulations in local markets of developing economies increased the need and importance of performance analysis and evaluation of companies. This also increased the need for methods solving complex problems in the business world. MCDM methods are used quite frequently by decision makers to solve complex problems such as financial performance evaluation.

MCDM is a complex process with both managerial and engineering levels. The managerial level represents the decision makers. Decision makers determine the goals at the beginning and also decide on the optimal alternative at the end of the process. Alternatives are generated, evaluated and ranked on the engineering level according to a normative multi-criteria analysis. The final decision is made by the decision makers about the optimal alternative (Opricovic & Tzeng, 2004).

MCDM methods are frequently used in social sciences whenever the management has to make decisions about multi-dimensional problems. The importance of timely decision making has increased the value of these methods, especially in performance management. There are various methods used in MCDM approach. When the information used for the criteria in MCDM is cardinal various methods could be employed, such as; simple additive weighting (SAW), hierarchical additive weighting (HSAW), TOPSIS, ELECTRE, PROMETHEUS, ORESTE, COPRAS, ARAS, MOORA and VIKOR (Zavadskas & Turskis, 2011). In case of financial performance evaluation methods based on cardinal information is used in the literature.

The TOPSIS method was first developed by Hwang & Yoon (1981). In the TOPSIS method a positive ideal solution maximizes the benefit criteria and minimizes the cost criteria. In case of a positive ideal solution, the chosen alternative should have the shortest distance and in case of the negative ideal solution, the chosen alternative should have the farthest distance to the solution (Opricovic & Tzeng, 2004).

GRA is used in analyzing uncertainties to determine the relational degree between each factor in the grey system. Greyness refers to an incomplete set of information. It was first developed by Deng (1982).

The AHP is one of MCDM methods developed by Saaty (1990). In the AHP, the most important factors affecting the decision are determined and objectives, criteria, sub-criteria, and alternatives are used with a multi-level hierarchical structure.

VIKOR evaluates set of alternatives, selects compromise solutions and develops the ranking index by measuring the "closeness" of the alternative to the ideal solution (Opricovic & Tzeng, 2004).

MCDM methods are used in financial performance evaluation of both the real sector and also in financial services sector. Yurdakul & İç (2003) used MCDM in the Turkish automotive sector, (Soba, Akcanlı, Erem, & Eren, 2011) on firms processing stone and soil materials, which are listed on BIST (Istanbul Stock Exchange), Dumanoğlu (2010), Özden et al. (2012), Ertuğrul & Karakaşoğlu (2009) on the Turkish cement industry, Bülbül & Köse (2011) and Özer et al. (2010) on the Turkish food sector, Uygurtürk & Korkmaz (2012) and Bakırcı et al. (2014) in the basic metal industry, Dumanoğlu & Ergül (2010), Türkmen & Çağıl (2012) and Tayyar et al. (2014) in information technology, Bayrakdaroğlu & Yalçın (2012), Akbulut & Coşkun (2015) in the manufacturing industry, Çakır & Perçin (2013) in logistics, Ecer & Günay (2014) in the tourism sector, and Özgüven (2011) used MCDM methods in retailing to measure financial performances of firms in those listed sectors.

In the application of MCDM methods in performance analysis, all firms are ranked from the top performer as the first firm to the worst performer of the group as the last firm on a list. In case of financial performance analysis various financial ratios are used according to predetermined criteria to be employed in the study. The listed studies above are all on firms operating on the real side of the economy.

There are also other studies using MCDM methods in the performance analysis of firms operating in the financial sectors. Some of these studies are directed towards the banking sector; Hunjak & Jakovčević (2001), Albayrak & Erkut (2005), Kosmidou & Zopounidis (2008), Seçme et al. (2009), Demireli (2010), Çağıl (2011), Dinçer & Görener (2011), Ecer (2013), Sakarya & AYTEKİN (2013), Bağcı & Rençber (2014), Cetin & Cetin (2010), Rezaei & Gheibdoust (2014) and Doğan (2013). A relatively small number of

applications are made on insurance sector; Tsai et al. (2008), Peker & Baki (2011), Elitaş et al. (2012). There are few number of studies using MCDM methods on Islamic banking; Çetin & Bitirak (2010), Yayar & Baykara (2012), and Sakinç & Gülen (2014). Finally, there are application of MCDM methods on measuring the financial performance of sports clubs, such as; Atmaca (2012), Ecer & Boyukaslan (2014) and Sakinç (2014).

### 3. The Methodology, Data and Variables

The VIKOR method was developed by Opricovic (1998) as a multi-criteria optimization method used in complex systems. This method evaluates and ranks the alternatives in the presence of conflicting criteria. It introduces a multi-criteria ranking index after evaluating the closeness of each alternative to the ideal solution after normalizing the observations in each alternative (Opricovic, 1998).

The development of the VIKOR method started with the following L<sub>p</sub>-metric function which was introduced by Duckstein & Opricovic (1980).

$$L_{p,j} = \left\{ \sum_{i=1}^n [w_i (f_i^* - f_{ij}) / (f_i^i - f_i^-)]^p \right\}^{1/p}$$

$$1 \leq p \leq \infty; j = 1, 2, \dots, \dots, j$$

In the L<sub>p</sub>-metric function, L<sub>1,j</sub> and L<sub>∞,j</sub> are used to develop the ranking measure.

- Step 1 Determination of the best and the worst values for all criterion functions for i=1, 2, ... n

If the i<sup>th</sup> function represents a benefit;

$$f_i^* = \max_j f_{ij},$$

$$f_i^- = \min_j f_{ij},$$

if the i<sup>th</sup> function represents a cost

$$f_i^* = \min_j f_{ij},$$

$$f_i^- = \max_j f_{ij},$$

- Step 2 Normalization matrix and the weighted normalized matrix

Computation of the S<sub>j</sub> and R<sub>j</sub> j=1,2,...,J values

$$S_j = \sum_{i=1}^n w_i (f_i^* - f_{ij}) / (f_i^* - f_i^-),$$

$$R_j = \max_i [w_i (f_i^* - f_{ij}) / (f_i^* - f_i^-)],$$

where, w<sub>i</sub>'s are the weights of criteria

- Step 3 Computation of the Q<sub>j</sub>, j=1, 2... J values

$$Q_j = v(S_j - S^*) / (S^- - S^*) + (1 - v)(R_j - R^*) / (R^- - R^*)$$

where

$$S^* = \min_j S_j,$$

$$S^- = \max_j S_j,$$

$$R^* = \min_j R_j,$$

$$R^- = \max_j R_j,$$

vis introduced as weight of the strategy of maximum group utility. On the other hand, (1-v) is the weight of individual regret (Opricovic & Tzeng, 2007).

- Step 4 Ranking the alternatives, sorting by the values S, R and Q. The unit with the lowest Q<sub>j</sub> score is determined as the best alternative within the group.
- Step 5 Propose as a compromise solution the alternative (a') which is ranked the best by the measure Q (minimum) if the following two conditions are satisfied:
  - Condition 1 Acceptable Advantage  
Q(a'') - Q(a') ≥ DQ where a'' is the alternative DQ = 1 / (J - 1) where j is the number of alternatives.
  - Condition 2 Acceptable stability in decision making

The alternative a' must also be the best ranked by S or/and R. This compromise solution is stable within a decision making process, which could be "voting by majority rule" (v > 0.5 is needed), or "by consensus" (v ≈ 0.5), or "with veto" (v < 0.5). Here, v is the weight of the decision making strategy "the maximum group utility" (Opricovic & Tzeng, 2007).

The data is obtained from The Banks Association of Turkey (TBB). The sample consists of the 15 largest commercial banks in Turkey. Annual data for these 15 banks are obtained for the period of 2002-2012 from unconsolidated balance sheets and income statements.

The aim of this study is to rank the largest 15 commercial banks based on their financial performance for the 11-year period of 2002-2012. Capital adequacy and profitability ratios are used to evaluate the financial performance.

There are three ratios used in capital adequacy criteria:

- CA1: Shareholders' Equity / [(Capital to be Employed to credit + market + operational risk)\*12.5]\*100
- CA2: Shareholders' Equity / Total Assets
- CA3: Shareholders' Equity / (Deposits + Non-Deposit Funds)

There are two ratios used in profitability criteria:

- P1: Net Profit (Losses) / Total Shareholders' Equity
- P2: Income before Taxes / Total Assets

#### 4. Findings

The financial ratios in five criteria for the largest 15 commercial banks in the study are presented below in Table 1. Based on these ratios the best and the worst values are determined and presented at the bottom of the table.

Banks	Max	Max	Max	Max	Max
	CA1	CA2	CA3	P1	P2
ZiraatBankası	38.86044	9.307756	10.90104	24.53847	3.085115
Halkbank	39.88621	10.73757	12.92221	23.45731	3.274619
Vakıfbank	16.47231	10.39786	12.68983	19.0684	2.246038
Akbank	25.25376	14.44821	19.07306	16.30623	3.709865
Alternatifbank	14.17903	9.1343	11.53794	12.42036	1.204802
Anadolubank	16.41927	12.2112	16.06014	16.85376	2.657606
Şekerbank	15.38301	10.78102	13.37697	12.26224	1.964875
TürkEkonomiBankası (TEB)	15.02782	9.868707	12.5805	11.08329	1.632524
GarantiBankası	16.61367	11.23694	14.54904	17.07579	2.577637
İşBankası	21.2351	14.11412	18.80644	12.17142	2.24279
YapıveKrediBankası	15.07595	12.19756	17.11604	-2.82894	0.656646
Denizbank	16.53189	11.2591	14.45732	14.67619	2.15392
Finansbank	15.05339	12.26277	15.79575	19.044	3.094066
HSBC Bank	18.66759	16.51545	22.64296	10.8988	2.884799
ING Bank	15.50941	11.2424	13.85942	10.19348	1.42082
$f_i^*$	39.88621	16.51545	22.64296	24.53847	3.709865
$f_i^-$	14.17903	9.1343	10.90104	-2.82894	0.656646

Table 1: Financial Ratios

The normalization matrix is weighted with equal weights of  $w=0.2$  and the weighted normalized values is presented in Table 2 below. Moreover,  $v=0.5$  is used in the analysis.

Wi	0.2	0.2	0.2	0.2	0.2
BANKS	Max	Max	Max	Max	Max
	CA1	CA2	CA3	P1	P2
ZiraatBankası	0.00798	0.1953	0.2	0	0.040924
Halkbank	0	0.156558	0.165573	0.007901	0.028511
Vakıfbank	0.182159	0.165762	0.169532	0.039975	0.095887
Akbank	0.113839	0.056014	0.060806	0.060161	0
Alternatifbank	0.2	0.2	0.189152	0.088559	0.164093
Anadolubank	0.182571	0.116628	0.112125	0.05616	0.068928
Şekerbank	0.190633	0.15538	0.157827	0.089714	0.114305
TürkEkonomiBankası (TEB)	0.193397	0.1801	0.171394	0.09833	0.136075
GarantiBankası	0.181059	0.143027	0.137864	0.054537	0.074166
İşBankası	0.145104	0.065067	0.065347	0.090378	0.0961
YapıveKrediBankası	0.193022	0.116998	0.09414	0.2	0.2
Denizbank	0.181695	0.142426	0.139426	0.072073	0.101922
Finansbank	0.193198	0.115231	0.116628	0.040153	0.040338
HSBC Bank	0.165079	0	0	0.099678	0.054046
ING Bank	0.18965	0.142879	0.14961	0.104833	0.149943

Table 2: Weighted Normalized Matrix

As the final step of the VIKOR method, banks are ranked according to their S, R, and Q values and their ranking in each category is presented in Table 3.

BANKS	Si	Rank Si	Ri	Rank Ri	Qi	Rank Qi
ZiraatBankası	0.444204	4	0.2	13	0,639191	6
Halkbank	0.358543	3	0.165573	4	0.361675	4
Vakıfbank	0.653315	10	0.182159	7	0.725416	10
Akbank	0.290821	1	0.113839	1	0	1
Alternatifbank	0.841804	15	0.2	13	1	15
Anadolubank	0.536412	7	0.182571	8	0.621724	5
Şekerbank	0.70786	11	0.190633	10	0.824093	11
TürkEkonomiBankası (TEB)	0.779296	13	0.193397	12	0.904956	13
GarantiBankası	0.590652	8	0.181059	5	0.66217	8
İşBankası	0.461997	5	0.145104	2	0.336771	3
YapıveKrediBankası	0.80416	14	0.2	13	0.965839	14
Denizbank	0.637542	9	0.181695	6	0.708413	9
Finansbank	0.505548	6	0.193198	11	0.655383	7
HSBC Bank	0.318803	2	0.165079	3	0.322745	2
ING Bank	0.736915	12	0.18965	9	0.844753	12

Table 3: S, R, and Q scores and the Ranking according to the VIKOR Method

According to the results outlined in Table 3, Akbank has the best financial performance among the 15 largest commercial banks for the period of 2002-2012. Akbank is one of the biggest private banks of Turkey and it was established in 1948. The second ranking in the listing is HSBC Bank. HSBC was established as the first British bank operating in Turkey in 1990 as the Midland Bank. Later in 1997, Midland Bank changed its name to HSBC Bank and using this name since that date. HSBC Bank is ranked 11<sup>th</sup> in terms of total assets in 2012. Alternatifbank is located at the bottom of the list, which is a small foreign private bank established in 1991. Even though Alternatifbank has been operating for 24 years in Turkey, Commercial Bank of Qatar purchased the majority of its shares in 2013 and therefore it is now classified as a foreign bank. When we look at the top three on the list, we see that all three are privately owned banks. The ranking obtained in this study is consistent with Doğan (2013), who ranked the banks with the GRA method. There are three public banks on the list; Halkbank, ranked 4<sup>th</sup>, ZiraatBankası, ranked 6<sup>th</sup>, and Vakıfbank, ranked 10<sup>th</sup>. In terms of total assets ZiraatBankası is ranked number 2, Halkbank is ranked number six and Vakıfbank is ranked number 7. It is possible to say that overall performance of public banks is consistent with their ranking according to relative size of their total assets in the Turkish banking sector.

In order to control the validity of the ranking, it is necessary to check two conditions outlined earlier. The first one is called “the acceptable advantage” condition. The number of alternative in our case is 15 and therefore DQ is equal to 0.07 and the difference between the Q values of number 2 and number 1 units is equal to 0.32 and since  $0.32 > 0.07$ , the first condition is satisfied. The second condition is called “acceptable stability in decision making” (Chen & Wang, 2009). In our case the number one ranking Akbank is also ranked first in both S and R rankings. It means that the ranking of Akbank is also stable.

## 5. Conclusion

The banking sector plays a crucial role in economic growth through its intermediary role as financing new investment opportunities by giving credits from the funds collected as deposits. Due to this crucial role, the financial performance and the capital structure of banks are important for all parties of the financial markets, such as; depositors, shareholders, creditors and the central bank as the main regulatory authority in many countries. The evaluation and ranking of banks based on various criteria provides useful information from this perspective.

In this study, we used the VIKOR method and obtained a ranking for the largest 15 commercial banks operating in Turkey for the period of 2002-2012 based on profitability and capital adequacy ratios together. There are three public banks, seven Turkish private, and five foreign private banks in our list. We started the analysis from the year 2002 due to the fact that Turkish banking sector went through a series of regulations and restructuring before 2002. For example, TMSF (Saving Deposit Insurance Fund) took control of 18 private commercial banks between 1997 and 2001 and the BDDK was established in 2000. Therefore, an analysis of the banking sector in the 2000s provides information about the new situation of the banking sector in Turkey.

Our results showed that the top three performers are all large private banks while the third one is a foreign bank. The performance of public banks is noteworthy as they ranked among the top 10 banks. The position of public banks showed an improvement after the new regulations of late 1990s and 2000. The overall ranking of foreign banks is another interesting point of the study. Out of five foreign banks, four of them are ranked from 11<sup>th</sup> to 15<sup>th</sup> at the bottom of the list. The presence of foreign banks in Turkey is relatively new and their performance should be monitored in the near future.

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