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Measuring Bank Performance with Gray Relational Analysis: The Case of Turkey

Gri İlişkisel Analiz Yöntemi ile Banka Performansının Ölçülmesi: Türkiye Örneği

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ABSTRACT

Banking sector is one of the most important factors in development of economy. A strong and healthy banking sector is considered to be a prerequisite for sustainable economic growth. In this study, the aim is to apply Gray Relational Analysis (GRA) to measure and compare financial performances of 10 banks with common stock trading in Istanbul Stock Exchange (ISE) between the years of 2005–2011. Another aim of the study is to reduce the number of financial rates, which determine bank performance, and by doing so, identify which financial rate is more important in measuring performance. As a result of GRA method, "Akbank" was the first and "Yapı Kredi Bank" was the last in terms of financial performance. Another finding of the study was that a bank with high "Return on Assets" could also have a high financial performance.

Keywords: Gray relational analysis, financial performance, banking, Turkey, return on assets

ÖZET

Bankacılık sektörü ekonominin gelişmesi açısından en önemli etkenlerden biridir. Güçlü ve sağlıklı bankacılık sistemi, sürdürülebilir ekonomik büyüme için ön koşul olarak kabul edilmektedir. Bu çalışmada Gri İlişkisel Analiz (GİA) yöntemi uygulanarak 2005-2011 yılları arasında İstanbul Menkul Kıymetler Borsası'nda (İMKB) hisse senetleri işlem gören 10 bankanın finansal performansının ölçülmesi ve karşılaştırılması amaçlanmaktadır. Araştırmanın bir diğer amacı ise banka performansını belirleyen finansal oranların sayısını azaltmak ve bu sayede hangi finansal oranın performans ölçümünde daha önemli olduğunu tespit etmektir. GİA yöntemi sonucunda finansal performans bakımından ilk sırada "Akbank", son sırada ise "Yapı Kredi Bankası" yer almıştır. Araştırma sonucunda elde edilen bir diğer bulgu ise "Varlık Karlılığı" yüksek olan bir bankanın finansal performansının da yüksek olabileceği sonucuna ulaşılmıştır.

Anahtar Kelimeler: Gri ilişkisel analiz, finansal performans, bankacılık, Türkiye, varlık karlılığı

1. INTRODUCTION

The most important feature of corporations, which can withstand competitive environment, is to measure their performances periodically and to evaluate the results in order to develop appropriate reactions and proactive solutions. With regard to defined key performance criteria, the evaluation of actions and their results plays an important role in corporations' awareness of their positions in their own sectors and definition of the aspects they need to develop (Dinçer and Görener, 2011). Fierce competition in banking sector forces the banks to use their resources in the most effective way and being different from other economic sectors in its function of defining the resource distribution and playing the role of financial intermediation, the efficient and effective functioning of the banking sector is very significant in terms of national economy (Ertuğrul and Karakaşoğlu, 2008).

Banking sector is one of the most important actors in development of economy. Banks have important roles in economy with regard to accumulation of capital, growth of corporations and provision of economical wealth (Taşkın, 2011). The conditions of today's financial sector where the levels of terms of competition are high, force banks to make use of their resources in the most effective way. This creates a need for the bank managers who hold the position of decision makers in banking sector: to compare their bank's activities with other competing banks' activities (Budak, 2011).

Since financial performance of banks is affected by multiple factors, there are too many criteria to consider in measuring performance (Peker and Baki, 2011). The definition of criteria and weight to be used in determination of performance has a constitutive importance in the evaluation of multi-criteria decision-making process (Demireli, 2010). In literature, multi-criteria decision-making methods such as Analytical Hierarchy Process (AHP), Analytical Network Process (ANP), Data Envelopment Analy-

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sis (DEA), TOPSIS and Electre method are observed to be used in academic studies concerning measurement of financial performances of banks. In this study, however, Gray Relational Analysis (GRA) method has been used to sort banks according to their financial performances, making use of financial rates. GRA has been introduced by Julong Deng in 1982 (Deng, 1989). This study is going to fill an important gap in literature and become an alternative method in measuring bank performances.

In this study, the aim is to apply GRA to measure and compare financial performances of 10 banks with common stock trading in Istanbul Stock Exchange (ISE) between the years of 2005-2011. Another aim of the study is to reduce the number of financial rates, which determine bank performance, and by doing so, identify which financial rate is more important in measuring performance. Study consists of seven sections. The second section following introduction consists of an overview of general structure of banking sector in Turkey. Third section consists of summary of studies, which measure financial performances of corporations through GRA method. Forth section shows the calculation steps of GRA method and fifth section introduces financial ratios. Sixth section consists of application of GRA. And the results of study have been analyzed and a general evaluation has been put forth in the last section.

2. GENERAL STRUCTURE OF BANKING SECTOR IN TURKEY

According to Central Bank of Turkey's Financial Stability Report, out of 49 banks, which are in operation in banking sector as of September 2010, first five in terms of size of assets have the share of 60.2% and first 10 have the share of 83.5%. Turkish financial sector, consisting of banking sector mainly, continues its healthy growth. Financial sector, which was continuing to grow in 2010 had a balance of 600 billion Dollars in June 2010 with an annual growth of 17.3%, and its rate to Gross Domestic Product (GDP), was 100%. The share of banks whish constitutes 88.8% of sector assets has increased by 0.7 when compared with the same period of previous year; the share of factoring corporations has increased by 0.2; and the share of pension funds has increased by 0.1. Total assets of banking sector, which constitutes the weight of financial sector, have increased by 11.2% nominal and 6.1% real in September 2010 compared to year-end and reached to 642.5 billions in USA Dollar with an increase of 14.6%. The balance sheet size to GDP rate, which was 87.6% at the year-end of 2009, has increased to 88.6% at the second quarter of 2010 (www.tcmb.gov.tr).

According to Financial Markets Report of Council of Bank Audit and Regulation, total profit of banking sector has reached to 13 billion Dollars as of the year-end of 2010. While interest incomes of sector have decreased by 9.3% compared to previous year, interest expenses have increase by 11%. The recession in interest rates has been determinant in the event in question. Central Bank of Turkey has contributed to this result by increasing the reserve requirements and ending interest payment for these requirements. Capital adequacy ratio (CAR) of banking sector is at the level of 19% as of December 2010. At the last quarter of the year, the increase at the rate of 8.1% in risk-weighted assets and relatively low increase at the rate of 5.9% in equities, have affected the decrease in sector's CAR. Parallel to the growth in credit volume of sector, the last quarter of the year has seen an increase of $25.7 billion especially in 100% risk weighted assets and the increase was more than the increase observed in previous periods. In this period equities have shown an increase of $4.3 billion, sector's principal capital has increased by $3.5 billion while paid in capital from the principal capital items has increase $0.74 billion stemming from cash capital increases. The largest increase in the items of equities has been in net profit for the year and accumulated profit item with $3.1 billion. Net profit for the year in banking sector has seen an increase at the rate of 9.7% in the year-end of 2010 compared to the previous year's end and reached the level of $13 billion. The increase rate of 9.7% in net profit for the year at the end of 2010 when compared to the increase rate of 50.9% at the end of 2009 indicates a tendency to decrease in the rate of increase in net profit for the year of banking sector (www.bddk.org.tr).

3. LITERATURE REVIEW

Gray relational analysis has been used in designing airway networks (Hsu and Wen, 2000), comparative studies concerning financial indicators of corporations (Feng and Wang, 2000), sales forecasting (Lin and Hsu, 2002) and many other sectors. This section summarizes the comparative studies of financial indicators using GRA.

Ho and Wu (2006) have compared performances 3 banks operating in Australia using 23 ratios in Gray Relational Analysis and with the help of ratios of liquidity, financial leverage and profitability. As a result of their study, they found that banks with high liquidity ratios could prove to have high performances as well.

Chang (2006) analyzed 15 commercial banks operating in Taiwan using GRA. In the study making use of data of the years 2000-2002, Chang has used 20 ratios consisting ratios of liquidity, capital structure and profitability. As a result of this study, Chang has found that the most important ratios affecting the performance of commercial banks are "Return on Assets" and "Return on Equities" in that order.

Yuan (2007) compared the performances of 6 corporations using ratios of liquidity and profitability. As a result of this study using 10 financial ratios and GRA, Yuan has found that the most important factor in measuring corporation performance is profitability ratios.

Wang (2009) measured financial performances of corporations operating in transportation sector in Taiwan using GRA. Similarly Lee et al. (2012) used GRA in order to compare financial performances of transportation corporations in Taiwan and Korea. The study defined degrees of importance of financial ratios and sorted transportation corporations according to their financial performances. Cheng et al. (2010) listed performance of the banks in Taiwan in a similar way using Analytic Hierarchy Process and GIA.

Peker and Baki (2011) have sorted three corporations operating in insurance sector according to their financial performances. In the study, performances have been measures through GRA using ratios of liquidity, leverage and profitability; and it is concluded that an insurance company with high ratios of liquidity could also have a high financial performance.

Uçkun and Girginer (2011) aimed at defining financial performances of state and private deposit banks using financial ratios through Gray Relational Analysis (GRA). The most important ratios in financial success were ratios concerning profitability in state banks and ratios concerning asset quality in private banks.

Girginer and Uçkun (2012) measured the impact of financial crisis on Turkish commercial banks by applying Gray Relational Analysis (GIA). In their study, they used data of the period 2005-2009 and took profitability, liquidity, asset quality and capital adequacy ratios of banks as performance indicators. GIA method resulted in a performance ranking as follows: state banks, foreign banks and private banks.

Elitaş et al. (2012) determined financial performances of insurance companies which are traded in ISE in the years 2010-2011 by using GIA. 10 financial ratios have been used in the study and performance measurement has been carried out with the help of liquidity, leverage and profitability ratios. As a result, Aksigorta was first in the list in terms of performance. In addition, it has been concluded that the most important ratio in financial performances of insurance companies is liquidity ratio.

Ecer and Dündar (2012) assessed performances of private capital deposit banks in Turkish banking sector. They used capital adequacy, liquidity and income-expense structure ratios related to 2010 and measured performances of 11 private capital deposit banks operating in Turkey by GIA. As a result, best performing private capital deposit banks were Adabank, Garanti Bank and Tekstil Bank respectively.

4. GRAY RELATIONAL ANALYSIS

Gray theory has been developed by Julong Deng in 1982 (Deng, 1989). The term "gray" here indicates the deficiency or total lack of information. In recent years, gray system theory has become an important analysis method used in various fields. Gray system theory is an alternative method in digitizing uncertainty. This theory is frequently used in analysis of relations between systems, modeling, and estimation and decision problems (Üstünışık, 2007). Gray Relational Analysis is one of the methods used in analyzing uncertainties in multi-criteria decision-making problems and provides an easier solution compared to mathematical analysis methods in cases of uncertainty. (Peker and Baki, 2011). GRA is a method used to determine the relational degree between each factor in a gray system and compared factor series (reference series). Every factor is defined as a sequence (row or column). The degree of inter-factorial influence is called as gray relational degree (Üstünışık, 2007).

The calculation steps of gray relational analysis method are shown below (Wen, 2004).

1. Step: The formation of decision matrix

$$x_i = \begin{bmatrix} x_1(1) & x_1(2) & \dots & x_1(n) \\ x_2(1) & x_2(2) & \dots & x_2(n) \\ \vdots & \vdots & \ddots & \vdots \\ x_n(1) & x_n(2) & \dots & x_n(n) \end{bmatrix} \quad (1)$$

2. Step: The formation of reference series

Reference series is stated as $x_0 = (x_0(1), x_0(2), ..., x_0(j), ..., x_0(n))$. The criterion of $x_0(j)$, $j.$ in the statement shows the biggest value within the criteria's normalized values.

3. Step: Operation of normalization

Data are normalized in this step. 3 different situations could be encountered. If a high criteria value is appropriate to result from the operation of normalization, the formula

$$x^*_i(j) = \frac{x_i(j) - \min_j x_i(j)}{\max_j x_i(j) - \min_j x_i(j)} \quad (2)$$

is used. If a low criteria value is appropriate to result from the operation of normalization, the formula

$$x^*_i(j) = \frac{\max_j x_i(j) - x_i(j)}{\max_j x_i(j) - \min_j x_i(j)} \quad (3)$$

is used. A third situation would be an average value being appropriate to result from the operation of normalization, in this case the formula

$$x^*_i(j) = \frac{\left|x_i(j) - x_{0b}(j)\right|}{\max_j x_i(j) - x_{0b}(j)} \quad (4)$$

is used. In the formula, number (4) $x_{0b}(j) j.$ is the target value of the criteria and it takes a value within the range of

$$\max_j x_i(j) \geq x_{0b}(j) j. \geq \min_j x_i(j)$$

After these operations, the decision matrix in number (1) becomes as shown below:

$$X^*_i = \begin{bmatrix} x^*_1(1) & x^*_1(1) & \cdots & x^*_1(n) \\ x^*_2(1) & x^*_2(2) & \cdots & x^*_2(n) \\ \vdots & \vdots & \ddots & \vdots \\ x^*_n(1) & x^*_n(2) & \cdots & x^*_n(n) \end{bmatrix} \quad (5)$$

4. Step: The formation of absolute value table

The absolute value $\Delta_{oi}(j)$ between x^*_0 and x^*_i is obtained as below:

$$\Delta_{oi}(j) = \left|x^*_{0i}(j) - x^*_i(j)\right| \quad (6)$$

$$= \begin{bmatrix} \Delta_{01}(1) & \Delta_{01}(1) & \cdots & \Delta_{01}(n) \\ \Delta_{02}(1) & \Delta_{02}(2) & \cdots & \Delta_{02}(n) \\ \vdots & \vdots & \ddots & \vdots \\ \Delta_{0m}(1) & \Delta_{0m}(2) & \cdots & \Delta_{0m}(n) \end{bmatrix}$$

5. Step: The formation of gray relational coefficient matrix

$$\gamma_{0i}(j) = \frac{\Delta\min + \zeta\Delta\max}{\Delta_{0i}(j) + \zeta\Delta\max} \quad (7)$$

formula is used to calculate this. In formula number (7) ζ is distinguishing coefficient and gets a value in the range of [0,1]. But it is recommended to take it as 0.5 in operations. Additionally it is calculated as $\Delta\max = \max_i \max_j \Delta_{oi}(j)$ and $\Delta\min = \min_i \min_j \Delta_{oi}(j)$.

6. Step: The calculation of degree of relation

$$\Gamma_{oi} = \frac{1}{n}\sum_{j=1}^{n} \gamma_{oi}(j) \quad (8)$$

In formula number (8) Γ_{ϕ} $i.$ shows the degree of gray relation of the element and is used when criteria are assumed to be equally important. If different weights of criteria are in question, the formula

$$\Gamma_{\phi} = \sum_{j=1}^{n} [W_i(j) x \gamma_{\phi}(j)] \quad (9)$$

is used.

5. DATA, VARIABLES AND METHODOLOGY

In this study, the aim is to measure and compare financial performances of 10 banks with common stock trading in Istanbul Stock Exchange (ISE) between the years of 2005–2011. Another aim of the study is to reduce the number of financial rates, which determine bank performance, and by doing so, identify which financial rate is more important in measuring performance. The data used in gray relational analysis have been obtained from databases in ISE's official web page[1] and The Banks Association of Turkey's web site[2] .Performances of 10 banks have been analyzed in the study with the help of ratios of liquidity, asset quality, leverage and profitability. The financial ratios belonging to banks are shown in Table 1.

Table 1: Financial Ratios

Type of Ratio	Ratio	Code
Liquidity	Liquid Assets / Short-Term Liabilities	A1
	Liquid Assets/Total Assets	A2
Asset Quality	Credits/Total Assets	A3
	Credits/Deposits	A4
	Deposits/Total Assets	A5
Leverage	Total Liabilities/Total Assets	A6
	Short-Term Liabilities/Total Liabilities	A7
	Equities/Total Assets	A8
Profitability	Net Profit/Total Assets	A9
	Net profit/Equities	A10

5.1. Ratios of Liquidity

Ratios of liquidity show whether or not corporation could pay its short-term liabilities in their due date, in other words they indicate the relation between cashable asset values and short-term liabilities. In a way, ratios of liquidity show solvency (Çetiner, 2005: 143). If the corporation is to continue its operations, its management has to evaluate solvency of the corporation. Additionally, ratios of liquidity are also used to determine whether or not the corporation has enough working capital.

A1: This ratio is obtained by dividing the total of current assets by the total of short-term liabili-

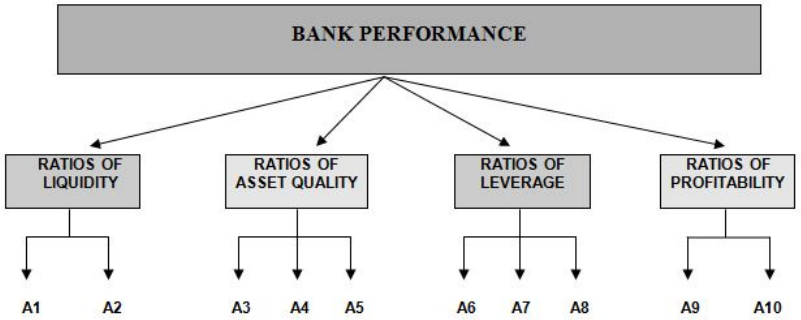

Figure 1: Hierarchical Structure of Bank Performance Assessment System

ties. The aim in calculating this ratio is to asses the corporation's solvency with regard to its short-term liabilities and to determine whether or not it has enough working capital (Akgüç, 2011).

A2: This ratio shows the rate of liquid assets to total assets of banks. The increase in this ratio increases solvency of short-term liabilities of banks. In the case of decrease in liquid asset ratio, on the other hand, the solvency of banks related to short-term liabilities would decrease.

5.2. Ratios of Asset Quality

Ratios of asset quality show the rate of resources of the banks' binded to fixed assets, the structure of credits and whether or not a problem exists in their repayment.

A3:This ratio shows the rate of credit to total assets. The highness and lowness of this ratio could create negative affects on profitability in various regards. A high ratio, which expresses a high credit level, means a high credit risk for the bank and disrupts the balance of risk-return (Poyraz, 2012).

A4: It indicates the conversion of collected deposits to credit. The increase in this ratio shows the branch's success in converting the collected resources to more profitable credit instead using them in branch current accounts. The increase in ratio through the decrease of branch deposits should be considered as negative while the increase in ratio stemming from newly issued credits should be considered as positive3.

A5: It indicates the rate of deposits to total assets. Though total deposits are considered in the debit items, they nevertheless are influential on asset quality and profitability of banks.

5.3. Ratios of Leverage

Ratios of leverage are ratios, which show the degree of foreign assets used in financing of corporation. These ratios, which show the relation between foreign assets and equities, answer the questions related to positive financing of the business and adequacy of safety margin of creditors (Gücenme, 2005).

A6:This ratio shows the rate of foreign asset financing of total assets of banks. If the ratio is higher than 0.5, it indicates that too much foreign asset is being used in financing of the banks. If the ratio is lower than 0.5, it means that equity takes a bigger place in the total assets.

A7: This ratio shows the weight of short-term liabilities within the total liabilities. Increase in this ratio increases short-term liability load of the bank while it decreases its solvency.

A8: This ratio is obtained by dividing equities of banks by their total assets. In other words, it shows the rate of financing their assets with their own equities.

5.4. Ratios of Profitability

The ratios of profitability are used to measure the success of the business as a result of its activities and to assess whether or not a balanced and adequate profitability is attained (Aydın et al. 2008). Even when the business seems to have a minimal profit with regard to its amount, the profit of the mentioned business is considered to be satisfying if the profitability ratio is higher than other businesses operating in the same field of industry (Akgüç, 2011).

A9: This ratio is obtained by dividing net profit by total assets and is used to measure how efficient the assets are being used. The ratio would be lower in the businesses with a debt burden compared to the businesses using high levels of equity capital (Büker et al. 2008.).

A10: It is calculated by dividing net profit by equity capital. It is a ratio, which shows the profit rate of the business regarding its own assets (Karan, 2004).

It presents the profit rate per one unit of capital provided by company's owner or owners.

6. IMPLEMENTATION

The aim of this study is to define financial performances of 10 banks being traded in ISE by using GRA method. With this purpose, a sample has been constituted by taking averages of financial data between the years of 2005-2011.

6.1. The Formation of Decision Matrix

Decision matrix calculated by using the data obtained from financial statements of the banks and taking the averages of 7 years financial ratios is shown in Table 1.

As seen in Table 1, analysis of liquidity ratios of the banks operating in ISE shows that Vakıflar Bank has the highest solvency concerning short-term liabilities (A1) and Yapı Kredi Bank has the lowest rate. The highest liquid asset ratio within the total assets (A2) belongs to Türkiye İş Bank, and the lowest belongs to Yapı Kredi Bank. In other words, it could be said that Türkiye İş Bank has more cashable assets than other banks.

When asset quality of the banks is analyzed, the lowest credit ratio in total assets (A3) belongs to Türkiye İş Bank and the highest belongs to Finans Bank. The highest ratio of conversion of collected deposits to credit (A4) belongs to Deniz Bank, and the lowest belongs to Halk Bank. The highest ratio of deposits in total assets or liabilities (A5) belongs to Halk Bank, and the lowest belongs to Denizbank.

Table 2: Decision Matrix of the Banks

	Ratios of Liquidity		Asset Quality			Ratios of Leverage			Ratios of Profitability	
BANKS	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
Vakıflar Bank	0,896	0,370	0,539	0,791	0,678	0,880	0,630	0,113	0,019	0,152
Akbank	0,699	0,411	0,484	0,814	0,591	0,840	0,670	0,141	0,025	0,183
Şekerbank	0,448	0,314	0,544	0,769	0,691	0,879	0,700	0,121	0,015	0,120
TEB	0,491	0,337	0,598	0,966	0,618	0,900	0,700	0,099	0,012	0,137
Garanti Bank	0,583	0,364	0,527	0,886	0,587	0,870	0,700	0,117	0,024	0,217
T. İş Bank	0,748	0,416	0,445	0,711	0,633	0,870	0,690	0,118	0,018	0,148
Y. Kredi Bank	0,245	0,157	0,563	0,886	0,623	0,880	0,700	0,108	-0,003	-0,116
Denizbank	0,525	0,297	0,629	1,104	0,567	0,890	0,450	0,111	0,020	0,181
Finans Bank	0,555	0,284	0,643	1,050	0,639	0,860	0,630	0,124	0,025	0,205
Halk Bank	0,377	0,219	0,469	0,622	0,748	0,900	0,720	0,098	0,024	0,240

Analysis of ratios of leverage of the banks shows that the highest liability rate in assets (A6) or the lowest equity capital rate in assets (A8) belongs to Halk Bank. On the other hand, the bank with the lowest liability rate or highest equity capital rate is Akbank. In other words, the credit institutions would be preferring Akbank since it has a more solid debt/equity structure. On the other hand, bank shareholders would prefer Halk Bank since more foreign assets are used compared to equity capital and the business profitability would increase with the leverage of financing and the shareholders would obtain more share of profit. The lowest short-term liability rate within total liabilities (A7) belongs to Denizbank, and the highest belongs to Halk Bank.

Analysis of ratios of profitability of banks shows that the highest return on assets (A9) belongs to Akbank and the lowest belongs to Yapı Kredi Bank. The highest return on equities (A10) belongs to Halk Bank, and the lowest belongs to Yapı Kredi Bank. In other words, Yapı Kredi Bank is in a worse position than every other bank in terms of profitability. For Halk Bank, the usage of more foreign assets than equity capital has affected equity capital gain in a positive way.

6.2. The Formation of Reference Series

A fictional reference corporation's values have been added in Table 3. In this step, the indicated reference series is formed by taking the highest values in every criterion.

6.3. Formation of Comparison Series

Company managers and shareholders desire high company profitability and short-term liability solvency at all times. Therefore formula number (2) has been used in ratios of liquidity and profitability. Ratios of leverage are desired to be low especially from the perspective of creditors since it shows the debt load of the company. Therefore, formula number (3) has been used to calculate ratios of leverage. But, since equity rate in assets (A8) is desired to be high, formula number (2) has been used. The high ratios regarding asset quality indicates a high credit level, and means a high risk of credit from the perspective of the bank. Low levels of these ratios, on the other hand, affect asset quality of the banks negatively. Therefore, these ratios have to get an optimal value and are calculated by formula number (4).

Table 3: Decision Matrix of Banks with Formed Reference Series

	Ratios of Liquidity		Asset Quality			Ratios of Leverage			Ratios of Profitability	
BANKS	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
X Corporation	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Vakıflar Bank	0,896	0,370	0,539	0,791	0,678	0,880	0,630	0,113	0,019	0,152
Akbank	0,699	0,411	0,484	0,814	0,591	0,840	0,670	0,141	0,025	0,183
Şekerbank	0,448	0,314	0,544	0,769	0,691	0,879	0,700	0,121	0,015	0,120
TEB	0,491	0,337	0,598	0,966	0,618	0,900	0,700	0,099	0,012	0,137
Garanti Bank	0,583	0,364	0,527	0,886	0,587	0,870	0,700	0,117	0,024	0,217
T. İş Bank	0,748	0,416	0,445	0,711	0,633	0,870	0,690	0,118	0,018	0,148
Y. Kredi Bank	0,245	0,157	0,563	0,886	0,623	0,880	0,700	0,108	-0,003	-0,116
Denizbank	0,525	0,297	0,629	1,104	0,567	0,890	0,450	0,111	0,020	0,181
Finans Bank	0,555	0,284	0,643	1,050	0,639	0,860	0,630	0,124	0,025	0,205
Halk Bank	0,377	0,219	0,469	0,622	0,748	0,900	0,720	0,098	0,024	0,240

Table 4: Table of Comparison Series of Banks

	Ratios of Liquidity		Asset Quality			Ratios of Leverage			Ratios of Profitability	
BANKS	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
X Corporation	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Vakıflar Bank	1,00	0,82	0,52	0,65	0,61	0,33	0,33	0,35	0,76	0,75
Akbank	0,70	0,98	0,80	0,60	0,13	1,00	0,19	1,00	1,00	0,84
Şekerbank	0,31	0,61	0,50	0,70	0,69	0,35	0,07	0,53	0,63	0,66
TEB	0,38	0,69	0,23	0,29	0,28	0,00	0,07	0,02	0,54	0,71
Garanti Bank	0,52	0,80	0,59	0,45	0,11	0,50	0,07	0,45	0,96	0,94
T. İş Bank	0,77	1,00	1,00	0,81	0,36	0,50	0,11	0,47	0,75	0,74
Y. Kredi Ban	0,00	0,00	0,40	0,45	0,31	0,33	0,07	0,23	0,00	0,00
Denizbank	0,43	0,54	0,07	0,00	0,00	0,17	1,00	0,30	0,82	0,83
Finans Bank	0,48	0,49	0,00	0,11	0,40	0,67	0,33	0,60	0,99	0,90
Halk Bank	0,20	0,24	0,88	1,00	1,00	0,00	0,00	0,00	0,97	1,00

6.4. The Formation of Absolute Value Table

In this step, the absolute value table has been formed by finding out the distances between the highest values and values in other criteria with the help of formula number (6). In other words, this step consists of calculation of distances between normalized values and reference series.

6.5. Formation of Gray Relational Coefficient Matrix Table

Table 6 is produced through conversion of all financial ratios to gray relational coefficient by taking δ=0.5 and using formula number (7).

Table 5: Absolute Value Table of Banks

	Ratios of Liquidity		Asset Quality			Ratios of Leverage			Ratios of Profitability	
BANKS	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
X Corporation	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Vakıflar Bank	0,00	0,18	0,48	0,35	0,39	0,67	0,67	0,65	0,24	0,25
Akbank	0,30	0,02	0,20	0,40	0,87	0,00	0,81	0,00	0,00	0,16
Şekerbank	0,69	0,39	0,50	0,30	0,31	0,65	0,93	0,47	0,37	0,34
TEB	0,62	0,31	0,77	0,71	0,72	1,00	0,93	0,98	0,46	0,29
Garanti Bank	0,48	0,20	0,41	0,55	0,89	0,50	0,93	0,55	0,04	0,06
T. İş Bank	0,23	0,00	0,00	0,19	0,64	0,50	0,89	0,53	0,25	0,26
Y. Kredi Bank	1,00	1,00	0,60	0,55	0,69	0,67	0,93	0,77	1,00	1,00
Denizbank	0,57	0,46	0,93	1,00	1,00	0,83	0,00	0,70	0,18	0,17
Finans Bank	0,52	0,51	1,00	0,89	0,60	0,33	0,67	0,40	0,01	0,10
Halk Bank	0,80	0,76	0,12	0,00	0,00	1,00	1,00	1,00	0,03	0,00

Table 6: Gray Relational Coefficient Matrix Table

	Ratios of Liquidity		Asset Quality			Ratios of Leverage			Ratios of Profitability	
BANKS	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
Vakıflar Bank	1,000	0,849	0,677	0,740	0,722	0,600	0,600	0,605	0,809	0,802
Akbank	0,768	0,983	0,835	0,715	0,536	1,000	0,551	1,000	1,000	0,863
Şekerbank	0,592	0,717	0,668	0,766	0,762	0,605	0,519	0,680	0,731	0,748
TEB	0,616	0,766	0,564	0,583	0,582	0,500	0,519	0,505	0,684	0,776
Garanti Bank	0,676	0,833	0,708	0,646	0,529	0,667	0,519	0,644	0,964	0,939
T. İş Bank	0,815	1,000	1,000	0,844	0,611	0,667	0,529	0,652	0,799	0,795
Y. Kredi Bank	0,500	0,500	0,627	0,646	0,593	0,600	0,519	0,566	0,500	0,500
Denizbank	0,637	0,685	0,519	0,500	0,500	0,545	1,000	0,587	0,845	0,858
Finans Bank	0,656	0,663	0,500	0,529	0,624	0,750	0,600	0,712	0,991	0,911
Halk Bank	0,556	0,568	0,892	1,000	1,000	0,500	0,500	0,500	0,968	1,000

There are weights of determinant factors of performance of banks in the gray relational coefficient matrix table. Criteria are assumed to be equal in importance and every criterion's weight has been taken as 0.10. The degree of relation of these factors has been defined in Table 7 with the help of formula number (8) and banks have been sorted according to their performance in Table 9.

Table 7: Gray Relational Coefficient Matrix Assessment Table

	Ratios of Liquidity		Asset Quality			Ratios of Leverage			Ratios of Profitability	
BANKS	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
Vakıflar Bank	1,000	0,849 (3)	0,677 (5)	0,740 (4)	0,722 (3)	0,600 (6)	0,600 (2)	0,605 (6)	0,809 (6)	0,802 (6)
Akbank	0,768 (3)	0,983 (2)	0,835 (3)	0,715 (5)	0,536 (8)	1,000 (1)	0,551 (4)	1,000 (1)	1,000 (1)	0,863 (4)
Şekerbank	0,592 (8)	0,717 (6)	0,668 (6)	0,766 (3)	0,762 (2)	0,605 (5)	0,519 (8)	0,680 (5)	0,731 (8)	0,748 (9)
TEB	0,616 (7)	0,766 (5)	0,564 (8)	0,583 (8)	0,582 (7)	0,500 (9)	0,519 (7)	0,505 (9)	0,684 (9)	0,776 (8)
Garanti Bank	0,676 (4)	0,833 (4)	0,708 (4)	0,646 (6)	0,529 (9)	0,667 (4)	0,519 (6)	0,644 (4)	0,964 (4)	0,939 (2)
T. İş Bank	0,815 (2)	1,000 (1)	1,000 (1)	0,844 (2)	0,611 (5)	0,667 (3)	0,529 (5)	0,652 (3)	0,799 (7)	0,795 (7)
Y. Kredi Bank	0,500	0,500	0,627 (7)	0,646 (7)	0,593 (6)	0,600 (7)	0,519 (9)	0,566 (7)	0,500	0,500 (10)
Denizbank	0,637 (6)	0,685 (7)	0,519 (9)	0,500	0,500	0,545 (8)	1,000 (1)	0,587 (8)	0,845 (5)	0,858 (5)
Finans Bank	0,656 (5)	0,663 (8)	0,500 (10)	0,529 (9)	0,624 (4)	0,750 (2)	0,600 (3)	0,712 (2)	0,991 (2)	0,911 (3)
Halk Bank	0,556 (9)	0,568 (9)	0,892 (2)	1,000 (1)	1,000 (1)	0,500 (10)	0,500 (10)	0,500 (10)	0,968 (3)	1,000 (1)

(**Not:*** The numbers in parentheses show the order of sorting for each financial ratio.)

Table 8: The Results of Performance Measurement and Sorts

BANKS	Degree of Relation	Sort
Akbank	0,825	1
T. İş Bank	0,771	2
Halk Bank	0,748	3
Vakıflar Bank	0,740	4
Garanti Bank	0,713	5
Finans Bank	0,694	6
Şekerbank	0,679	7
Denizbank	0,668	8
TEB	0,610	9
Y. Kredi Bank	0,555	10

As seen in Table 7, analysis of the liquidity ratios (A1 and A2) of banks operating in ISE shows that the highest ratios belong to Vakıflar Bank and Türkiye İş Bank respectively. The lowest ratio of liquidity, on the other hand, belongs to Yapı Kredi Bank. Analysis of asset quality of the banks shows that the lowest credit ratio within the total assets (A3) belongs to Türkiye İş Bank; the highest ratio of conversion of collected deposits to credit (A4) belongs to Deniz Bank; and the highest ratio of deposits within the total assets or liabilities (A5) belongs to Halk Bank. When ratios of leverage of the banks are analyzed, the lowest liability rate is observed in Akbank and the highest is observed in Halk Bank. Analysis of ratios of profitability of banks show that the highest return on assets (A9) belongs to Akbank and highest equity capital gain (A10) belongs to Halk Bank. This sorting matches with the sorting listed before the implementation of Gray Relational Analysis method or after Table 2.

When all the performance criteria are assessed together and a general sorting has been made within the banks, bank with highest performance or gray relational degree is observed to be Akbank. The lowest performance, on the other hand, belongs to Yapı Kredi Bank. When we analyze Akbank, which has the highest performance, the fundamental criterion to differentiate it from other banks is observed to be ratios of profitability. In other words, Akbank

has higher Return on Assets (A9) than other banks. Additionally, Yapı Kredi Bank which has the lowest performance is observed to have the lowest Return on Assets (A9) in the sorting of that criterion as well. In addition to this, Akbank has the lowest foreign asset usage (A6) and highest equity capital usage (A8) when compared to other banks. It is concluded that a bank with high "Return on Assets" could have a high performance as well. In other words, it is established that the most important indicator in financial success of the banks is ratios of profitability.

Akbank is ranked as 4th in terms of Return on Equities. Akbank has increased its equity rate in debit items by using less foreign assets than all of the other banks. This condition decreased the profit rate per one unit of capital provided by Akbank's owner or owners. On the other hand, Halk Bank with the highest ratio of leverage having the highest Return on Equities could again be explained by the decrease of equity item within the debit items.

7. GENERAL ASSESSMENT

Banking sector is one of the most important factors in development of economy. A strong and healthy banking sector is considered to be a prerequisite for sustainable economic growth. Fierce competition in financing sector forces the banks to use their resources in the most effective way. This resulted with the bank managers' need of comparing their bank's activities with other competing banks.

In this study, performances of 10 banks operating in ISE have been compared for the period of 2005-2011 using the method of GRA. Additionally, the numbers of financial ratios determining bank performance have been reduced and the ratio with more importance in performance measurement has been defined. Akbank, with the highest performance within the banks covered in the scope of this study, differentiates itself in terms of "Return on Assets." In other words, it is concluded that a bank with a high "Return on Assets" could have a high performance as well.

To date, the majority of the studies measuring bank performances have used "Return on Assets" and "Return on Equities" as performance indicators based on accounting. With this study, it could be argued that Return on Assets has partially more influence on bank performance than Return on Equities. In other words, it could be argued that the most important indicator of financial success of banks is "Return on Assets." The importance of this study has increased by its content, which enables measurement of bank performance by fewer ratios, rather than many financial ratios. Additionally, this study is important for informing bank managers by determining the performances of banks in the sector.

When studies measuring company performances through the use of GRA method have been analyzed, it is observed that Chang (2006), Yuan (2007), Uçkun and Girginer (2011) have concluded in the same direction; while Ho and Wu (2006), Peker and Baki (2011) have concluded in a different direction.

GRA is an important method in measuring financial performances of the banks and enabling investors to establish more objective and correct purposes for themselves. The limits of this study consist of the usage of the data for the period of 2005-2011 concerning the banks operating in ISE and the utilization of 10 financial ratios. In future studies, comparisons could be made between the findings of this study and implementation of other multi-criteria decision-making models such as AHP, TOPSIS, ANP and ELECTRE on banks.

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[1] www.imkb.gov.tr

[2] www.tbb.org.tr

[3] http://www.turklider.org/TR/EditModule.aspx?TabId=1043&mid=8418&ItemId=3026

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