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The effect of financial statements on financial review results. Statement of financial position or income statement?

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ABSTRACT

This study tests whether the evaluation results are affected by the changes in the financial statements in which the criteria are determined, in the case that the statement of financial position and income statement data in development and investment banks are determined as criteria in multi-criteria decision-making techniques. In this context, development and investment banks operating in the Turkish banking sector have been discussed for the period of 2015-2020. The possibility of affecting the result should be considered, when the statement of financial position and the income statement data are analysed separately. In accordance with this purpose, for criterion weighting Entropy method, for performance evaluation Topsis method and to determine the effect of financial statements on performance in the selection of criteria and the relationship between the bank's performance ranking considering each financial statement separately Spearman rank correlation coefficient have been used. According to the analysis results, when the statement of financial position or the income statement is taken into account, similar highly correlated results emerge in the financial evaluations of development and investment banks. None of these financial statements gives different results (positive or negative) than the other.

Finansal tabloların finansal inceleme sonuçları üzerindeki etkisi. Finansal durum tablosu mu gelir tablosu mu?

MAKALE BİLGİSİ

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ÖZ

Bu çalışma kalkınma ve yatırım bankalarında finansal durum tablosu ve gelir tablosu verilerinin çok kriterli karar verme tekniklerinde kriter olarak belirlenmesi durumunda, değerlendirme sonuçlarının, kriterlerin belirlendiği finansal tablolardaki değişikliklerden etkilenip etkilenmediğini test etmektedir. Bu kapsamda Türk bankacılık

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Anahtar Kelimeler: Finansal durum tablosu, gelir tablosu, mukayese, kalkınma ve yatırım bankası, çok kriterli karar verme.

sektöründe faaliyet gösteren kalkınma ve yatırım bankaları 2015-2020 dönemi için ele alınmıştır. Finansal durum tablosu ve gelir tablosu verileri ayrıştırılarak incelendiğinde sonuca etki etme olasılığı göz önünde bulundurulmalıdır. Bu amaca uygun olarak kriter ağırlıklandırma için Entropi yöntemi, performans değerlendirmesi için Topsis yöntemi, kriterlerin seçiminde finansal tabloların performans üzerindeki etkisini ve her bir finansal tablo ayrı ayrı ele alındığında bankanın performans sıralaması arasındaki ilişkiyi belirlemek için Spearman sıra korelasyon katsayısı kullanılmıştır. Analiz sonuçlarına göre kalkınma ve yatırım bankalarının finansal değerlendirmelerinde finansal durum tablosu veya gelir tablosu dikkate alındığında yüksek düzeyde ilişkili, benzer sonuçlar ortaya çıkmaktadır. Bu finansal tablolardan biri diğerine göre (olumlu veya olumsuz) farklı sonuçlar vermemektedir.

1. Introduction

Measuring and evaluating bank performance will increase the efficiency of the banking sector and contribute to the development of the sector. In addition to the fact that deposit banks are the prominent financial institutions in their financial systems in terms of banking activities, development and investment banks have an extremely important place in supporting economic growth and sustainable development.

While development banks support development with capital and technical support services in line with development goals in developing countries, investment banks transfer their savings to those who need resources through capital markets (Takan and Acar Boyacıoğlu, 2011, p. 59)

The duties of development banks can be summarized as providing medium and long-term loans to the industrial sector, mobilizing domestic resources and directing them to the industrial sector, pioneering new investment areas, and determining credit policies in line with development goals (Parasız, 2009, pp. 247-248).

The functions of investment banks can be listed as transferring funds to institutions or investments in need of funds, ensuring the distribution of securities to large masses and ensuring the development of the capital market (İslamoğlu, 2013, p. 118)

In the studies on banking, deposit banks are considered because they have an important role in the financial system, while development banks and investment banks should be examined due to the importance of the above-mentioned functions.

Multi-criteria decision making (MCDM) techniques are widely used in analysing the performance of the alternative, which is evaluated in finance and other academic fields. In this context, studies conducted with various MCDM techniques and also in objective and subjective techniques used in determining the importance of variables considered in determining the performance ranking are included in the literature.

In addition to choosing the appropriate method in performance analysis, the most important factor that will affect the analysis result in the MCDM is the selection of appropriate criteria. Achieving the appropriate and right result for the subject to be analysed is individually related to the correct selection of the criteria required for analysis. The statement of financial position and income statement are the data sources that the criteria have been taken in financial performance analysis. These financial statements are the tables which show different results of accounts for the same organization and focus on different points. The decision about which one should be preferred for the efficiency of financial analysis results can be determined by the relationship of the results to be obtained as a result of using these tables. In other words, the high relation of the results obtained as a result of using these financial statements will show that both tables are suitable at the same level. From this viewpoint, it should be examined which financial statement should be considered as a data source in performance analysis in financial institutions and whether both tables give the same result.

The aim of this study is to determine whether the evaluation results are affected by the changes in the financial statements in which criteria are determined, in case that statement of financial position and income statement data in development and investment banks are determined as criteria while evaluating with multi-criteria decision-making techniques. In this context, development and investment banks operating in the Turkish banking sector have been discussed for the period of 2015-2020. In the analysis, for criterion weighting Entropy method, for performance evaluation Topsis method (Technique for Order Preference by Similarity to Ideal Solution) and to determine the effect of financial statements on performance in the selection of criteria Spearman rank correlation coefficient have been used.

Although the statement of financial position and the income statement have been prepared for the same bank, they exhibit different financial results due to their date and period-oriented arrangements. In the analysis, financial data from both financial statements have been taken into account and the evaluation has been made accordingly. However, when the statement of financial position data arranged on the basis of history and the income statement data arranged on the basis of the period is considered separately in the analyses, the possibility of affecting the result should be considered.

As a result of the analysis, the performance evaluation results of the banks during the period have been tabulated in the study, and if the evaluation has been made on the basis of the statement of financial position or the income statement, a high degree of positive relationship has been determined between the examination results. Accordingly, handling the statement of financial position or the income statement in financial evaluations for development and investment banks yields similar results at a high level of relationship.

The layout of this paper is as follows: Section 2 consist literature review. Section 3 presents Entropy, Topsis and Spearman Correlation analysis models and also data set has been descripted in Section 3. Section 4 presents empirical findings of performance analysis of development and investment banks in Turkey for the period of 2015-2020 and this section also analyses the relationship between statement of financial position or income statement oriented financial performance results of these banks. In the conclusion section, there is a general assessment of the analysis.

2. Literature review

The literature review based on the format of the financial statements and includes studies focused on banks at the point of financial performance measurement with multi-criteria decision-making techniques, is included in this section.

Ding, Jeanjean and Stolowy (2005), who have said that the format of financial statements has been historically differed from one country to another, have analysed the statement of financial position and income statement formats separately in their study. According to the results of the analysis, the firm's degree of internationalization, both financial and commercial, was identified as the main driving factor behind the adoption of alternative formats. Financial factors have been defined as foreign listing, auditor type and the decision to apply alternative accounting standards and commercial factors are internationalization of sales and company size.

According to Malíková and Brabec (2012) results of financial ratios are mainly influenced by the presumptions (the financial statements have been prepared according to these presumptions). The authors have examined whether and how strong different accounting systems had an impact on the results of the selected financial ratios. As a result of the analysis dissimilarities in input data have caused different results of selected financial ratios.

Çelen (2014) has evaluated the effects of the normalization procedures on decision outcomes of a given multi-attribute decision making method. For this aim, Çelen (2014) has used Topsis method to evaluate the financial performances of 13 Turkish deposit banks by using the weights calculated from Fuzzy Analytic Hierarchy Process (FAHP) method. Study has revealed that vector normalization procedure has generated the most consistent results.

Wu, Li, Fan, Wang and Wu (2018) have proposed a cross-efficiency interval with a Vikor aggregate model to measure the universal productive efficiency of major Chinese commercial banks of China.

According to the results, the cross-efficiency interval can provide more information than the traditional DEA model.

Aras, Tezcan and Kutlu Furtuna (2018) have evaluated multidimensional corporate sustainability performance of Turkish banks and whether sustainability efforts of banks are value-related. According to the study results which is entropy based Topsis techniques have been used, positive and significant relationship has been found between the market value and the financial sustainability performance in the long run.

Sarı and Kayral (2019) have offered a robust model for measuring Turkish bank performance by using the Topsis methodology and stepwise regression analysis. The aim of this study is to introduce an easy-to-calculate and a robust mathematical model for the assessment of the financial performance of banks.

With the paper of Guru and Mahalik (2019), efficiency calculation of different public sector banks in India has been analysed. Topsis and Grey Relational Analysis and AHP weighting have been used together to rank the bank performances. According to the study, the comparative result shows that both models have almost the same interpretation.

Marjanović and Marković (2020) have assessed the performance of the European Union countries' financial sectors by applying the methods of multi-criteria analysis. For the analysis which indicated that Luxembourg has the most developed financial sector among European economies, it has been used Topsis method weighted with Entropy, to assess the financial development of EU countries.

In Işık (2020)'s study, it has been evaluated that state owned development and investment banks' operating in the Turkish banking sector performance with SD, Mabac and Waspas method. According to the results of the study, it has been determined that banks operating on a large scale gain a competitive advantage in the sector and can benefit from economies of scale and increase their performance.

While the financial system-oriented studies in the literature deal with banks in terms of their performance, this study examines the effect of financial statements on financial analysis results in particular for financial institutions.

3. Research methodology

In this study, Entropy and Topsis methods have been used for performance evaluation. Criterion weights have been obtained by the Entropy method, and the Topsis method has been used to arrange the alternatives. Spearman rank correlation coefficient has been used to determine the relationship between statement of financial position and the income statement on financial evaluations.

3.1. Entropy method

In addition to the fact that the concept of entropy has been originally defined by Rudolph Clausius (1985), the concept of information entropy has been proposed firstly by Shannon (1948) (Zhang, Gu, Gu and Zhang, 2011, p.444). The process steps to be performed in order to reach the weight value in the Entropy method can be listed as follows and the application steps of the Entropy method is listed in the Table 1 (Zhang et. al., 2011, pp. 444-445).

1. Creating the decision matrix (consists of m alternatives and n evaluation criterias)
2. Creating of normalized decision matrix by Equation (2)
3. Finding the Entropy (e_j) values for the criteria by Equation (3)
4. Determining of differentiation degrees (d_j) by Equation (4)
5. Determining the weight values (w_j) related to the criteria by Equation (5). When the values obtained in the Entropy method are considered, the w_j value of the criterion is directly proportional to the importance of the criterion.

Table 1

Steps' equations of Entropy method

Step	Equation		
1	$X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix}$	i = 1, … , m ; j = 1, … , n	(1)
2	$x^{*}_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}}$	i = 1, … , m ; j = 1, … , n	(2)
3	$e_{ij} = -k \cdot \sum_{j=1}^{n} x^{*}_{ij} \cdot \ln(x^{*}_{ij})$ $k = (\ln(m))^{-1}$	i = 1, … , m ; j = 1, … , n	(3)
4	$d_j = 1 - e_j$	j = 1, … , n	(4)
5	$w_j = \frac{d_j}{\sum_{j=1}^{n} d_j}$	j = 1, … , n	(5)

The natural logarithm (ln) calculation performed in the 3rd step of the Entropy method cannot be performed if the values in the normalized decision matrix are 0 or negative. For this reason, before starting Entropy method step applications, it is necessary to transform the data in the decision matrix by using the Z-score standardization method shown in Equation (6) and (7) (Zhang, Wang, Li and Xu, 2014, p.3). At the end of this, instead of x_{ij} data regarding the variables used in Equation (2), the z'_{ij} data in Equation (7) is included in the evaluation.

$$z_{ij} = \frac{x_{ij} - \overline{X}_j}{\sigma_j} \tag{6}$$

$$z'_{ij} = z_{ij} + A \qquad A > \left|\min\ z_{ij}\right| \tag{7}$$

3.2. Topsis method

The concept that the chosen alternative should have be the farthest distance from the negative ideal solution and shorter than the positive ideal solution is the point on which the Topsis method is based. The Topsis method was developed by Hwang and Yoon (1981) (Jahanshahloo, Hosseinzadeh and Izadikhah, 2006, p.1377).

The steps and to be taken for each of steps have been listed below and the application steps of the Topsis method have been listed in the Table 2. (Cheng-Min and Rong-Tsu, 2001, pp. 465-466; Amiri, Zandieh, Vahdani, Soltani and Roshanaei, 2010, pp. 513-514; ; Chamodrakas, Leftheriotis and Martakos, 2011, p. 901-902; Jahanshahloo et. al., 2006, p. 1378):

1. Creating the decision matrix (consists of m alternatives and n evaluation criterias)
2. Creating of normalized decision matrix by Equation (9)

3. Calculating the weighted normalized decision matrix, the weighted normalized value v_{ij} is calculated by Equation (10).
4. Determining the positive ideal and negative ideal solution: The positive ideal and negative ideal solution are determined as Equation (11). Where J is the index set of benefit criteria and J' is the index set of cost criteria.
5. Identificating of the alternatives' separation from the positive ideal solutions (S_i^+) and negative ideal solutions (S_i^-). (S_i^+) and (S_i^-) are measured by Equation (12), for the definition of the separation of alternatives from the positive and negative ideal solutions,
6. Calculating of the relative closeness (C_i^*) of each decision point to the ideal solution. In the last step the relative closeness (C_i^*) of each decision point to the ideal solution is calculated by Equation (13). It is the case that the best performing alternative has the highest closeness value (C_i^*).

Table 2

Steps' equations of Topsis method

Step	Equation		
1	$X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix}$	i = 1, … , m ; j = 1, … , n	(8)
2	$x^*_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x^2_{ij}}}$	i = 1, … ,m ; j = 1, … ,n	(9)
3	$v_{ij} = x^*_{ij} \cdot w_{ij}$	i = 1, … ,m ; j = 1, … ,n	(10)
4	$A^+ = \{(\max V_{ij} \mid j \in J), (\min V_{ij} \mid j \in J')\}$ $A^- = \{(\min V_{ij} \mid j \in J), (\max V_{ij} \mid j \in J')\}$	i = 1, … , m	(11)
5	$S_i^+ = \sqrt{\sum_{j=1}^{n} (v_{ij} - A_j^+)^2}$ $S_i^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - A_j^-)^2}$	i = 1, … ,m	(12)
6	$C^*_i = \frac{S_i^-}{S_i^- + S_i^+}$	i = 1, … ,m $0 < C^*_i < 1$	(13)

3.3. Spearman rank correlation coefficient

Correlation analysis is used to examine the relationship between variables. Pearson and Spearman rank correlation analysis are the main methods used in this regard. If the assumption that the two samples are normally distributed is valid, Pearson's correlation coefficient should be calculated. If the normality

assumption is not valid for the data, Spearman's rank correlation should be used as the best correlation coefficient option. In the calculation of Spearman rank correlation, variables are considered as rows, and equation (14) can be used for the coefficient calculation. d_i represents the difference in the ranks and n is the sample size. (Göktaş and İşçi, 2011, p. 21).

$$r_s = 1 - \frac{6 \cdot \sum_{i=1}^{n} d_i^2}{n(n^2 - 1)} \tag{14}$$

3.4. Data set

The criteria taken into consideration can be classified as statement of financial position and income statement ratios. These criteria (rates) are as shown below.

Criteria selected from the statement of financial position;

EqTa : the ratio of equity to total assets

LoTa : the ratio of total loan to total assets

LqTa : the ratio of liquid assets to total assets

Criteria selected from the income statement;

IntIn : the ratio of interest income to total income

IntEx : the ratio of interest expenses to total expenses

InEx : the ratio of total income to total expenses

The values in the variables were determined as shown below (BAT, 2021):

- Total loan: loans + loans under follow-up (gross) - specific provisions
- Liquid assets: cash and balances with the central bank of turkey + financial assets where fair value change is reflected to income statement (net) + banks and other financial institutions + money market placements + financial assets available for sale (net)
- Total income: interest income + net fees and commissions income + dividend income + trading profit / loss + other operating income
- Total expenses = interest expenses + other operating expenses

3.5. Sample

The development and investment banks in Turkey have been included in the analysis. These banks have been shown in Table 3.

Table 3

Banks covered in the analysis

	Names of the Banks	**Abbreviation**
1	İlbank Inc.	İlbank
2	Türk Eximbank (The Export Credit Bank of Turkey, Inc.)	Eximbank
3	The Development Bank of Turkey	Development Bank of Turkey
4	Aktif Investment Bank	Aktif
5	Diler Investment Bank	Diler
6	GSD Investment Bank	GSD
7	Nurol Investment Bank	Nurol
8	The Industrial Development Bank of Turkey	Industrial Development Bank
9	BankPozitif Credit and Development Bank	BankPozitif
10	Bank of America Investment Bank Inc.	Bank of America
11	Pasha Investment Bank	Pasha
12	Standard Chartered Investment Bank Türk	Standard Chartered

4. Empirical results

In the first step of the Entropy method, a decision matrix has been created for the period of 2015-2020 and it is shown in Table 7 given in the Appendix. This matrix is consisted of 12 alternatives represented by banks and 6 evaluation criteria represented by ratios. Normalized decision matrix, calculation of the (e_j) values of the criteria, determining of differentiation degrees (d_j) and determining the weight values (w_j) related to the criteria (2020) are shown in Table 8 and Table 9 given in the Appendix.

The weight values (w_j) found as a result of the analysis for the whole period are given in Table 4. The ratio with the largest w_j value is the most important ratio. According to the analysis findings for statement of financial position "the ratio of liquid assets to total assets", except 2016 and 2019 and for income statement "the ratio of interest expenses to total expenses" are the most important indicators for banks performance

Table 4

Weight values of criteria according to the Entropy method by years (w_j)

Year	**Statement of Financial Position**			**Income Statement**		
	EqTa	**LoTa**	**LqTa**	**IntIn**	**IntEx**	**InEx**
2015	0.3539	0.2102	0.4359	0.1421	0.7368	0.1210
2016	0.4269	0.2133	0.3598	0.1301	0.6919	0.1780
2017	0.3758	0.2180	0.4062	0.1756	0.6889	0.1355
2018	0.3917	0.2135	0.3948	0.1772	0.5116	0.3112
2019	0.4235	0.2469	0.3296	0.1105	0.4849	0.4045
2020	0.3056	0.2273	0.4671	0.1759	0.5737	0.2505

In the first step of the Topsis method, a decision matrix has been created for analysis period and then decision matrix has been normalized. Decision matrix has been created for the period of 2015-2020 and it is shown in Table 7 in the Appendix (expect Column LoTa (z'_{ij}) and Column IntEx (z'_{ij})) and

normalized decision matrix (2020) is shown in Tables 10 in the Appendix. In the step 3, v_{ij} values have been calculated. The positive and negative ideal solutions have been determined for criteria in step 4 and in the step 5 the separation of banks from the positive ideal (S_i^+) and negative ideal (S_i^-) solutions are measured.

Calculation of the v_{ij} values and determination of positive ideal and negative ideal solutions ($A_j^+ - A_j^-$) have been given in Table 11 in the Appendix. Determining the separation of banks from the positive ideal (S_i^+) and negative ideal (S_i^-) (2020) for statement of financial position and income statement have been given Table 12 in the Appendix.

In the last step C_i^* has been calculated and is shown in Table 5 for statement of financial position results and income statement results. Considering that 2019 is a partially and 2020 is a full pandemic year in Turkey, the findings should be approached with caution within the framework of this limitation. The better ranking alternative is the one with the higher C_i^* value.

Table 5

C_i^* of each decision point to the ideal solution

	2015		2016		2017		2018		2019		2020	
STATEMENT OF FINANCIAL POSITION	***R***	C_i^*	***R***	C_i^*	***R***	C_i^*	***R***	C_i^*	***R***	C_i^*	***R***	C_i^*
İlbank	4	0.448	4	0.498	4	0.387	5	0.398	5	0.484	4	0.380
Eximbank	12	0.212	12	0.221	12	0.216	11	0.230	11	0.271	9	0.203
Development Bank of Turkey	10	0.244	9	0.254	10	0.265	10	0.248	10	0.284	7	0.224
Aktif	8	0.286	7	0.280	9	0.280	9	0.256	8	0.321	12	0.157
Diler	3	0.454	3	0.560	3	0.497	3	0.721	1	0.756	3	0.493
GSD	11	0.222	6	0.315	6	0.301	4	0.529	4	0.539	5	0.309
Nurol	6	0.393	10	0.246	8	0.291	7	0.305	9	0.295	10	0.196
Industrial Development Bank	7	0.303	11	0.238	11	0.224	12	0.202	12	0.247	11	0.184
BankPozitif	9	0.262	8	0.260	5	0.321	8	0.276	6	0.349	6	0.235
Bank of America	1	0.747	2	0.766	2	0.746	1	0.777	3	0.669	2	0.719
Pasha	5	0.429	5	0.406	7	0.296	6	0.312	7	0.345	8	0.210
Standard Chartered	2	0.746	1	0.776	1	0.766	2	0.748	2	0.735	1	0.725
INCOME STATEMENT	***R***	C_i^*	***R***	C_i^*	***R***	C_i^*	***R***	C_i^*	***R***	C_i^*	***R***	C_i^*
İlbank	1	0.978	1	0.951	2	0.923	5	0.511	5	0.325	5	0.604
Eximbank	11	0.168	11	0.142	11	0.159	12	0.157	12	0.071	12	0.139
Development Bank of Turkey	6	0.586	6	0.529	6	0.417	7	0.222	7	0.126	11	0.174
Aktif	8	0.324	8	0.307	8	0.323	10	0.196	11	0.100	9	0.195
Diler	2	0.972	2	0.939	1	0.965	1	0.992	2	0.679	1	0.754
GSD	5	0.599	5	0.548	5	0.534	4	0.598	1	0.823	4	0.658
Nurol	10	0.228	10	0.204	10	0.193	8	0.205	9	0.111	7	0.228
Industrial Development Bank	12	0.113	12	0.121	12	0.144	9	0.197	8	0.112	10	0.180
BankPozitif	7	0.542	7	0.363	7	0.340	6	0.277	6	0.242	6	0.437
Bank of America	4	0.858	4	0.710	4	0.806	3	0.714	3	0.541	2	0.711
Pasha	9	0.245	9	0.226	9	0.223	11	0.189	10	0.106	8	0.221
Standard Chartered	3	0.879	3	0.831	3	0.842	2	0.737	4	0.474	3	0.668

Normality test is required to determine the correlation analysis method. The normality test results are presented in Table 6.

Table 6

Tests of normality outputs

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Statement of financial position	.219	72	.000
Income Statement	.183	72	.000

[a] Lilliefors Significance Correction

H_0 hypothesis has been rejected because the significance value is less than 0.05. Accordingly, financial evaluation results which have been determined with statement of financial position or the income statement do not have a normal distribution. Since normality cannot be achieved, non-parametric tests should be applied to test the relationship between statement of financial position and income statement results.

Analysis results can be expressed as r_s=0.767, p=0.000, N=72. The Spearman rank correlation coefficient shows the magnitude of the relationship between the evaluation results determined with statement of financial position data or income statement data. The Spearman rank correlation coefficient is 0.767 and since p value is 0.000 the coefficient is significant. According to the findings, there is a positive correlation between financial evaluation results which determined with statement of financial position or the income statement as measured by Entropy weighted Topsis of development and investment banks in Turkey. In other words, considering the statement of financial position or the income statement in financial evaluations for development and investment banks yields similar results at a high level of relationship.

5. Conclusion

This study is on the consideration that the statement of financial position or the income statement in financial evaluations for development and investment banks created by evaluating with multi-criteria decision-making techniques in the banks. In this regard, the financial performance of development and investment banks operating in Turkey have been analysed for the period of 2015-2020 by Topsis method weighted with Entropy. Statement of financial position and income statement of the banks have been selected as the sources of the data set. For performance analysis, the ratio of equity to total assets, the ratio of total loan to total assets, the ratio of liquid assets to total assets have been selected as data in the statement of financial position and the ratio of interest income to total income, the ratio of interest expenses to total expenses, the ratio of total income to total expenses have been selected as data in the income statement. Performance analysis has been conducted twice for the same banks with the criteria selected from each financial statement.

The original value of this study is not only to analyse financial performance, but also to reveal the effect of financial statements on financial performance in development and investment banks.

As expected, the results of the analysis based on the data of both financial statements are not identical. At this point, the relationship of the results with each other in the context of financial statements has been analysed. Spearman rank correlation coefficient analysis has been made for this aim. According to the results, a high degree of correlation has been found between financial analysis results found by considering both financial statements.

Based on the findings, it can be said that handling any financial statements of the development and investment bank analysed will yield similar results for financial analysts. Although they are prepared to show different accounts and results, both the statement of financial position and the income statement give meaningfully similar results in the financial performance analysis of banks.

Author statement

Research and publication ethics statement

This study has been prepared in accordance with the ethical principles of scientific research and publication.

Approval of ethics board

Ethics committee approval is not required for this study.

Conflict of interest

There is no conflict of interest arising from the study for the authors or third parties.

Declaration of support

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Appendix

Table 7

*Decision matrix * (2015-2020)*

Year / Banks	Statement of Financial Position				Income Statement			
2015	**EqTa**	**LoTa**	**LoTa (z'_{ij})**	**LqTa**	**IntIn**	**IntEx**	**IntEx (z'_{ij})**	**InEx**
İlbank	68.1	69.9	2.364	26.6	84.1	0.0	0.003	286.5
Eximbank	10.8	97.1	3.282	0.4	100.5	71.6	2.364	176.3
Development Bank of Turkey	14.7	82.0	2.771	15.2	89.5	34.0	1.123	174.7
Aktif	12.4	62.5	2.114	25.3	82.2	55.9	1.845	123.0
Diler	85.2	79.1	2.675	19.4	79.7	0.3	0.011	280.5
GSD	31.1	84.5	2.855	1.0	81.2	32.8	1.084	170.0
Nurol	17.1	58.4	1.977	38.0	94.2	64.8	2.140	145.1
Industrial Development Bank	12.0	66.0	2.231	27.0	92.7	81.8	2.699	209.4
BankPozitif	18.5	69.6	2.352	19.9	95.1	37.1	1.226	62.6
Bank of America	58.8	6.8	0.234	83.1	18.5	5.5	0.183	130.6
Pasha	71.5	76.2	2.577	21.8	87.3	63.0	2.081	138.1
Standard Chartered	88.2	0.0	0.006	70.2	20.2	0.0	0.002	127.0

2016	**EqTa**	**LoTa**	**LoTa (z'_{ij})**	**LqTa**	**IntIn**	**IntEx**	**IntEx (z'_{ij})**	**InEx**
İlbank	64.6	74.3	2.675	21.7	74.4	0.1	0.006	350.7
Eximbank	7.6	90.2	3.249	5.0	112.5	77.4	2.537	144.2
Development Bank of Turkey	11.0	77.0	2.774	20.9	87.5	39.2	1.284	182.0
Aktif	11.0	61.7	2.223	29.1	84.3	58.3	1.912	125.7
Diler	80.8	78.8	2.836	21.0	87.4	4.3	0.144	335.1
GSD	41.6	68.3	2.459	8.2	92.4	38.3	1.257	239.4
Nurol	13.5	62.2	2.241	22.9	104.3	69.6	2.280	165.2
Industrial Development Bank	12.2	72.2	2.598	18.9	100.3	83.8	2.747	191.9
BankPozitif	20.5	74.8	2.693	17.6	75.7	53.2	1.745	132.9
Bank of America	74.4	11.1	0.400	72.8	37.8	18.2	0.599	80.9
Pasha	47.9	79.1	2.850	19.5	85.9	66.1	2.167	146.8
Standard Chartered	89.3	0.0	0.001	70.8	21.0	0.0	0.002	144.2
2017	**EqTa**	**LoTa**	**LoTa (z'_{ij})**	**LqTa**	**IntIn**	**IntEx**	**IntEx (z'_{ij})**	**InEx**
İlbank	64.1	89.7	2.974	7.1	78.9	5.5	0.177	340.7
Eximbank	6.8	94.0	3.117	4.2	103.4	80.6	2.504	142.5
Development Bank of Turkey	14.0	77.1	2.559	21.4	96.0	51.4	1.598	210.1
Aktif	11.1	62.2	2.065	27.2	82.1	59.2	1.839	153.6
Diler	83.3	80.4	2.668	19.0	95.1	2.5	0.084	316.1
GSD	46.0	75.1	2.492	5.8	91.2	41.0	1.277	296.3
Nurol	13.0	62.4	2.073	28.1	96.8	73.9	2.297	156.0
Industrial Development Bank	12.2	76.9	2.551	14.8	98.8	85.6	2.658	201.0
BankPozitif	24.8	64.5	2.142	27.5	90.4	57.8	1.795	107.0
Bank of America	66.3	4.6	0.159	77.6	15.4	9.0	0.284	195.1
Pasha	29.1	75.7	2.512	19.8	89.7	69.5	2.161	144.7
Standard Chartered	88.8	0.0	0.009	70.3	24.1	5.5	0.006	151.4
2018	**EqTa**	**LoTa**	**LoTa (z'_{ij})**	**LqTa**	**IntIn**	**IntEx**	**IntEx (z'_{ij})**	**InEx**
İlbank	57.7	87.8	2.958	8.8	84.5	49.7	1.356	416.2
Eximbank	5.5	92.9	3.129	3.0	91.0	96.1	2.623	141.5
Development Bank of Turkey	9.0	86.8	2.924	10.4	94.6	88.1	2.404	276.1
Aktif	11.2	53.4	1.799	19.1	79.3	79.7	2.176	150.0
Diler	87.0	54.0	1.820	39.7	103.1	0.7	0.020	646.9
GSD	67.4	70.9	2.388	24.0	59.3	48.7	1.330	639.7
Nurol	9.4	62.4	2.102	23.4	104.9	86.7	2.366	153.2
Industrial Development Bank	12.3	72.4	2.438	5.1	105.2	95.8	2.615	215.7
BankPozitif	31.8	74.5	2.512	8.0	65.5	65.5	1.788	154.3
Bank of America	83.6	5.5	0.189	60.8	19.2	11.8	0.324	439.1
Pasha	37.5	62.3	2.098	13.2	91.1	84.9	2.316	155.5
Standard Chartered	86.3	0.0	0.003	54.2	19.9	0.0	0.002	416.7

2019	**EqTa**	**LoTa**	**LoTa (z'_{ij})**	**LqTa**	**IntIn**	**IntEx**	**IntEx (z'_{ij})**	**InEx**
İlbank	58.1	78.7	2.672	15.8	93.0	54.8	---	373.9
Eximbank	5.6	88.0	2.987	6.1	85.7	96.5	---	146.2
Development Bank of Turkey	12.2	78.1	2.650	12.8	93.6	91.9	---	261.4
Aktif	11.0	45.7	1.552	27.8	79.9	84.0	---	148.8
Diler	87.6	43.3	1.472	41.6	85.6	0.5	---	677.3
GSD	78.5	85.2	2.891	11.5	63.8	28.9	---	1.113.9
Nurol	13.2	66.4	2.253	18.8	101.2	85.4	---	154.3
Industrial Development Bank	13.5	74.5	2.529	3.4	113.1	94.6	---	205.9
BankPozitif	33.3	73.1	2.483	13.4	74.4	55.7	---	175.5
Bank of America	86.0	5.1	0.177	40.5	28.5	4.3	---	458.9
Pasha	30.8	61.5	2.087	18.2	91.1	84.8	---	153.6
Standard Chartered	89.7	0.0	0.006	57.9	21.9	0.1	---	272.8
2020	**EqTa**	**LoTa**	**LoTa (z'_{ij})**	**LqTa**	**IntIn**	**IntEx**	**IntEx (z'_{ij})**	**InEx**
İlbank	51.5	63.1	2.050	30.7	91.7	39.4	---	539.4
Eximbank	5.6	87.7	2.845	5.7	82.2	96.2	---	154.7
Development Bank of Turkey	12.8	72.7	2.360	18.0	85.1	91.3	---	272.3
Aktif	11.1	50.9	1.654	13.4	85.0	82.1	---	176.8
Diler	77.5	36.5	1.187	39.5	76.5	1.2	---	392.6
GSD	57.1	88.8	2.882	8.9	48.3	38.2	---	796.9
Nurol	14.0	72.4	2.351	11.8	84.6	77.3	---	211.5
Industrial Development Bank	11.9	75.6	2.455	5.2	97.0	94.2	---	250.2
BankPozitif	30.8	83.1	2.698	8.2	92.8	48.0	---	191.6
Bank of America	47.1	0.0	0.007	91.7	17.5	1.6	---	372.5
Pasha	25.8	63.5	2.064	13.7	89.5	78.6	---	179.1
Standard Chartered	91.1	0.0	0.007	73.2	14.2	0.1	---	246.7

* The value of LoTa (z'_{ij}) is expressed as LoTa and the value of IntEx (z'_{ij}) is expressed as IntEx in Table 8 and Table 9.

Table 8

Normalized decision matrix (x^*_{ij}) for Entropy method (2020)

x^*_{ij}	**Statement of Financial Position**			**Income Statement**		
Banks	**EqTa**	**LoTa**	**LqTa**	**IntIn**	**IntEx**	**InEx**
İlbank	0.118	0.091	0.096	0.106	0.061	0.143
Eximbank	0.013	0.126	0.018	0.095	0.148	0.041
Development Bank of Turkey	0.029	0.105	0.056	0.098	0.141	0.072
Aktif	0.026	0.073	0.042	0.098	0.127	0.047
Diler	0.178	0.053	0.123	0.088	0.002	0.104
GSD	0.131	0.128	0.028	0.056	0.059	0.211
Nurol	0.032	0.104	0.037	0.098	0.119	0.056
Industrial Development Bank	0.027	0.109	0.016	0.112	0.145	0.066
BankPozitif	0.071	0.120	0.026	0.107	0.074	0.051
Bank of America	0.108	0.000	0.287	0.020	0.002	0.098
Pasha	0.059	0.091	0.043	0.104	0.121	0.047
Standard Chartered	0.209	0.000	0.229	0.016	0.000	0.065

Table 9

Finding the e_j - d_j - w_j values for the criteria (2020)

Statement of Financial Position		$\ln(x_{ij}^*)$			$x_{ij}^* \ln(x_{ij}^*)$	
Banks	**EqTa**	**LoTa**	**LqTa**	**EqTa**	**LoTa**	**LqTa**
İlbank	-2.137	-2.398	-2.345	-0.252	-0.218	-0.225
Eximbank	-4.358	-2.071	-4.024	-0.056	-0.261	-0.072
Development Bank of Turkey	-3.531	-2.258	-2.875	-0.103	-0.236	-0.162
Aktif	-3.668	-2.613	-3.177	-0.094	-0.192	-0.133
Diler	-1.728	-2.944	-2.092	-0.307	-0.155	-0.258
GSD	-2.034	-2.058	-3.587	-0.266	-0.263	-0.099
Nurol	-3.436	-2.261	-3.302	-0.111	-0.236	-0.122
Industrial Development Bank	-3.605	-2.218	-4.121	-0.098	-0.241	-0.067
BankPozitif	-2.651	-2.124	-3.659	-0.187	-0.254	-0.094
Bank of America	-2.226	-8.116	-1.250	-0.240	-0.002	-0.358
Pasha	-2.827	-2.392	-3.147	-0.167	-0.219	-0.135
Standard Chartered	-1.566	-8.116	-1.475	-0.327	-0.002	-0.337
$\sum_{j=1}^{n} x_{ij}^* . \ln(x_{ij}^*)$				-2.208	-2.279	-2.062
$-k = -(\ln(m))^{-1}$				-0.4	-0.4	-0.4
e_{ij}				0.8888	0.9172	0.8299
d_j				0.1112	0.0828	0.1701
w_j				0.3056	0.2273	0.4671
Income Statement		$\ln(x_{ij}^*)$			$x_{ij}^* \ln(x_{ij}^*)$	
Banks	**IntIn**	**IntEx**	**InEx**	**IntIn**	**IntEx**	**InEx**
İlbank	-2.244	-2.801	-1.948	-0.238	-0.170	-0.278
Eximbank	-2.353	-1.908	-3.197	-0.224	-0.283	-0.131
Development Bank of Turkey	-2.318	-1.960	-2.632	-0.228	-0.276	-0.189
Aktif	-2.320	-2.066	-3.064	-0.228	-0.262	-0.143
Diler	-2.425	-6.297	-2.266	-0.215	-0.012	-0.235
GSD	-2.885	-2.832	-1.558	-0.161	-0.167	-0.328
Nurol	-2.324	-2.126	-2.884	-0.227	-0.254	-0.161
Industrial Development Bank	-2.187	-1.929	-2.716	-0.245	-0.280	-0.180
BankPozitif	-2.231	-2.603	-2.983	-0.240	-0.193	-0.151
Bank of America	-3.898	-6.001	-2.318	-0.079	-0.015	-0.228
Pasha	-2.268	-2.109	-3.051	-0.235	-0.256	-0.144
Standard Chartered	-4.106	-9.379	-2.730	-0.068	-0.001	-0.178
$\sum_{j=1}^{n} x_{ij}^* \cdot \ln(x_{ij}^*)$				-2.388	-2.168	-2.346
$-k = -(\ln(m))^{-1}$				-0.4	-0.4	-0.4
e_{ij}				0.9609	0.8724	0.9443
d_j				0.0391	0.1276	0.0557
w_j				0.1759	0.5737	0.2505

Table 10

Normalized decision matrix (x^{*}_{ij}) for Topsis method (2020)

	Statement of Financial Position			**Income Statement**		
Banks	**EqTa**	**LoTa**	**LqTa**	**IntIn**	**IntEx**	**InEx**
İlbank	0.327	0.280	0.233	0.343	0.175	0.428
Eximbank	0.036	0.389	0.043	0.307	0.427	0.123
Development Bank of Turkey	0.081	0.323	0.137	0.318	0.406	0.216
Aktif	0.071	0.226	0.102	0.318	0.365	0.140
Diler	0.493	0.162	0.300	0.286	0.005	0.312
GSD	0.363	0.395	0.067	0.180	0.170	0.633
Nurol	0.089	0.322	0.090	0.316	0.343	0.168
Industrial Development Bank	0.075	0.336	0.039	0.363	0.418	0.199
BankPozitif	0.196	0.369	0.063	0.347	0.213	0.152
Bank of America	0.300	0.000	0.697	0.066	0.007	0.296
Pasha	0.164	0.282	0.105	0.335	0.349	0.142
Standard Chartered	0.580	0.000	0.556	0.053	0.000	0.196

Table 11

Finding the v_{ij} - A_j^+ - A_j^- values for the criteria (2020)

	Statement of Financial Position			**Income Statement**		
	EqTa	**LoTa**	**LqTa**	**IntIn**	**IntEx**	**InEx**
	Mak	Mak	Mak	Mak	Min	Mak
w_j	0.3056	0.2273	0.4671	0.1759	0.5737	0.2505
			v_{ij} values			
İlbank	0.100	0.064	0.109	0.060	0.100	0.107
Eximbank	0.011	0.089	0.020	0.054	0.245	0.031
Development Bank of Turkey	0.025	0.073	0.064	0.056	0.233	0.054
Aktif	0.022	0.051	0.047	0.056	0.209	0.035
Diler	0.151	0.037	0.140	0.050	0.003	0.078
GSD	0.111	0.090	0.031	0.032	0.097	0.159
Nurol	0.027	0.073	0.042	0.056	0.197	0.042
Industrial Development Bank	0.023	0.076	0.018	0.064	0.240	0.050
BankPozitif	0.060	0.084	0.029	0.061	0.122	0.038
Bank of America	0.092	0.000	0.326	0.012	0.004	0.074
Pasha	0.050	0.064	0.049	0.059	0.200	0.036
Standard Chartered	0.177	0.000	0.260	0.009	0.000	0.049
A_j^+	0.177	0.090	0.326	0.064	0.000	0.159
A_j^-	0.011	0.000	0.018	0.009	0.245	0.031

Table 12

Finding the S_i^+ - S_i^- values for the criteria (2020)

Statement of Financial Position	$v_{ij} - A_j^+$			$\sum_{j=1}^{n}(v_{ij}-A_j^+)^2$	S_i^+	$v_{ij} - A_j^-$			$\sum_{j=1}^{n}(v_{ij}-A_j^-)^2$	S_i^-
	EqTa	**LoTa**	**LqTa**			**EqTa**	**LoTa**	**LqTa**		
İlbank	0.006	0.001	0.047	0.054	0.231	0.008	0.004	0.008	0.020	0.142
Eximbank	0.028	0.000	0.093	0.121	0.348	0.000	0.008	0.000	0.008	0.089
Development Bank	0.023	0.000	0.068	0.092	0.303	0.000	0.005	0.002	0.008	0.088
Aktif	0.024	0.001	0.077	0.103	0.321	0.000	0.003	0.001	0.004	0.060
Diler	0.001	0.003	0.034	0.038	0.195	0.020	0.001	0.015	0.036	0.189
GSD	0.004	0.000	0.087	0.091	0.302	0.010	0.008	0.000	0.018	0.135
Nurol	0.022	0.000	0.081	0.103	0.321	0.000	0.005	0.001	0.006	0.079
Industrial Development Bank	0.024	0.000	0.094	0.118	0.344	0.000	0.006	0.000	0.006	0.077
BankPozitif	0.014	0.000	0.088	0.102	0.319	0.002	0.007	0.000	0.010	0.098
Bank of America	0.007	0.008	0.000	0.015	0.124	0.007	0.000	0.094	0.101	0.318
Pasha	0.016	0.001	0.077	0.093	0.306	0.002	0.004	0.001	0.007	0.081
Standard Chartered	0.000	0.008	0.004	0.012	0.111	0.028	0.000	0.058	0.086	0.293
Income Statement	$v_{ij} - A_j^+$			$\sum_{j=1}^{n}(v_{ij}-A_j^+)^2$	S_i^+	$v_{ij} - A_j^-$			$\sum_{j=1}^{n}(v_{ij}-A_j^-)^2$	S_i^-
	IntIn	**IntEx**	**InEx**			**IntIn**	**IntEx**	**InEx**		
İlbank	0.000	0.010	0.003	0.013	0.113	0.003	0.021	0.006	0.029	0.172
Eximbank	0.000	0.060	0.016	0.076	0.276	0.002	0.000	0.000	0.002	0.045
Development Bank	0.000	0.054	0.011	0.065	0.255	0.002	0.000	0.001	0.003	0.054
Aktif	0.000	0.044	0.015	0.059	0.243	0.002	0.001	0.000	0.003	0.059
Diler	0.000	0.000	0.006	0.007	0.082	0.002	0.059	0.002	0.063	0.250
GSD	0.001	0.009	0.000	0.010	0.102	0.001	0.022	0.016	0.039	0.197
Nurol	0.000	0.039	0.014	0.052	0.229	0.002	0.002	0.000	0.005	0.068
Industrial Development Bank	0.000	0.058	0.012	0.069	0.263	0.003	0.000	0.000	0.003	0.058
BankPozitif	0.000	0.015	0.015	0.029	0.172	0.003	0.015	0.000	0.018	0.133
Bank of America	0.003	0.000	0.007	0.010	0.099	0.000	0.058	0.002	0.060	0.245
Pasha	0.000	0.040	0.015	0.055	0.235	0.002	0.002	0.000	0.004	0.067
Standard Chartered	0.003	0.000	0.012	0.015	0.122	0.000	0.060	0.000	0.060	0.246