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RESEARCH ARTICLE • FORSCHUNGSARTIKEL • ARAŞTIRMA MAKALESİ

FINANCIAL COMPETITIVENESS OF COMPANIES OPERATING IN THE AIR TRANSPORTATION SECTOR IN BORSA ISTANBUL

BORSA İSTANBUL'DA HAVA TAŞIMACILIĞI SEKTÖRÜNDE FAALİYET GÖSTEREN ŞİRKETLERİN FİNANSAL REKABET GÜCÜ

Hakan ALTIN*

Öz

Bu çalışmanın temel amacı, Borsa İstanbul'da hava taşımacılığı sektöründe faaliyet gösteren şirketlerin finansal rekabet güçlerinin değerlendirilmesidir. Borsa İstanbul'da hava taşımacılığı sektöründe faaliyet gösteren üç şirket vardır. Bu şirketlerin, finansal rekabet güçlerinin belirlenmesi hususunda genel kabul görmüş finansal oranlar kullanılmıştır. Üçer aylık bilanço dönemlerinin kullanıldığı çalışmada incelenen dönem 06/2019 ve 03/2023 yılları arasıdır. Dönem sayısı on altıdır. Buna karşılık, her bir şirketin zarar açıkladığı bilanço dönemleri analiz dışında bırakılmıştır. Çalışmanın uygulama süreci üç aşamadan oluşmaktadır. Birincisi, şirketlerin finansal rekabet güçlerinin belirlenmesi için OCRA yöntemi kullanılmıştır. İkincisi, elde edilen bulgular ARAS yöntemi ile karşılaştırılmıştır. Son olarak, iki yöntemden elde edilen sonuçların istatistiksel olarak anlamlılığı spearman sıra korelasyonu ile test edilmiştir. Ağırlıklandırma sürecinde her bir kriterin hem standart sapmasını hem de diğer kriterlerle ilişkisini temel alan CRITIC yöntem kullanılmıştır. Çalışmanın sonuçları havayolu şirketlerinin likiditesi, yönetimsel tutumları, karlılık ve piyasa değerleri hakkında önemli bilgiler sağlar. Bu bilgiler, yatırım kararlarını vermelerine yardımcı olabilecek tüm piyasa katılımcılarını ilgilendirir.

Anahtar Kelimeler: Borsa İstanbul, Hava Taşımacılığı, Finansal Rekabet Gücü, OCRA, ARAS
JEL Classification: G11, C02, C44

* Prof. Dr., Aksaray University, Economics and Administrative Sciences, Business Administration, hakanaltin@aksaray.edu.tr, ORCID: 0000-0002-0012-0016.

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Abstract

The main objective of this study is to evaluate the financial competitiveness of companies operating in the air transportation sector in Borsa, Istanbul. Three companies are operating in the air transportation sector in Borsa Istanbul. Generally accepted financial ratios were used to determine the financial competitiveness of these companies. The period analyzed in the study using quarterly balance sheet periods is between 06/2019 and 03/2023. The number of periods is sixteen. On the other hand, balance sheet periods in which each company announced a loss were excluded from the analysis. The implementation process of the study consists of three stages. First, the OCRA method is used to determine the financial competitiveness of companies. Second, the findings obtained are compared with the ARAS method. Finally, the statistical significance of the results obtained from the two methods is tested with Spearman rank correlation. The CRITIC method, which is based on the standard deviation of each criterion and its relationship with other criteria, was used in the weighting process. The study results provide important information about airlines' liquidity, managerial behavior, profitability and market capitalization. This information interests all market participants who can help them make investment decisions.

Keywords: Borsa Istanbul, Air Transportation, Financial Competitiveness, OCRA, ARAS
JEL Classification: G11, C02, C44

1. Introduction

Airline is one way to transport people and goods or services from one place to another for various purposes Baltaci et al. (2015, p. 89). Increasing demand for air transportation over time contributes to the economy's growth. Empirical results show that air transport, urbanization process and social globalization have positive and significant effects on economic growth Balsalobre-Lorente et al. (2021, p. 503). However, there are mixed results about the direction of the relationship. This is because the aviation industry creates worldwide passenger and cargo transportation by facilitating access to markets, employment, resources, labor, knowledge and technology that can lead to economic growth. In contrast, economic success creates demand for air transport in passenger and freight markets Zhang & Graham (2020, p. 507).

Yao & Yang (2012) show that air transportation positively correlates with economic growth, industrial structure, population density and openness. According to Hakim & Merkert (2016), economic growth and aviation activities have a unidirectional causality relationship. Baker et al. (2015) found a short and long-term bidirectional causality between regional aviation and economic growth. Nguyen (2023) confirms a bidirectional causality between air transportation (passenger and cargo) and economic growth. Chi & Baek (2013) find that market shocks have little impact on air transportation demand. Marazzo et al. (2010) found a long-run co-integrated relationship between air transport demand and economic growth. Adedoyin et al. (2020) state that the air transport industry, seen as the key to economic recovery and a critical factor in developing the tourism sector, makes significant direct and indirect contributions to national income. Ishutkina & Hansman (2008) argue that the general trend in air transport services and economic development is a correlation between air travel and economic growth. However, each economy's growth rates and mechanisms behind the interaction differ. Profillidis & Botzoris (2015) argue that there is a correlation between air passenger transportation and economic activity and that air passenger transportation activity affects growth rates. Njoya & Nikitas (2020) explain that air transportation significantly impacts

output, income and employment. Wong et al. (2022) argue that air transport increases regional development and positively impacts economic growth. Gudmundsson et al. (2021) show that the strength of economic shocks from various causes affects the linear growth of passenger and freight traffic and the industry's recovery over time in a predictable temporary manner. According to Law et al. (2022), developing civil air transport connectivity contributes to a country's economic growth by creating jobs, promoting trade and stimulating tourism. As a result, air transport is considered one of the most popular and rapidly growing sectors, offering a wide range of services and societal benefits Abdi & Càmara-Turull (2020). In contrast, airlines have experienced large fluctuations and extreme variations in their financial and operational performance, where inappropriate financial and operational management decisions can lead to high-risk situations by affecting internal costs and, if not properly addressed, can result in bankruptcy declaration or airline closure Pineda et al. (2018). This negatively affects all market participants.

Research has confirmed the impact of aviation on economic growth. According to a study by the International Air Transport Association (IATA), the aviation industry contributes $2.7 trillion to the global economy annually. This contribution is made through employment, tax revenue, and economic activities. In Turkey, the aviation industry is also an important driver of economic growth. According to statistics published by the Turkish Civil Aviation Authority (SHGM), the employment size of the aviation industry in Turkey reached 2.5 million people in 2022. This employment is created directly and indirectly. The aviation industry contributes approximately $20 billion to the Turkish economy annually.

There are 10 companies operating in the Transportation Sector on the Istanbul Stock Exchange. Of these, three companies operate in the air transportation sector. These three companies operate under high competition and cost pressure, both domestically and internationally. The determination of the financial performance of these companies is valuable in terms of having a strong financial structure, providing a competitive advantage, and being attractive to investors.

The main objective of this study is to assess the financial competitiveness of companies operating in the air transportation sector in Borsa, Istanbul. For this purpose, the Operational Competitiveness Ratings Analysis (OCRA) method was first used. Then, the findings are compared with the Additive Ratio Assessment (ARAS) method. The originality of the study is revealed in two ways. The first is the proposal of the OCRA method in evaluating the overall performance of companies. The second is the solution to the problem of which multi-criteria decision-making method should be selected.

2. Literature Review

This section of the study summarizes the studies examining the financial performance of airline companies. When Table 1 is examined, it is seen that although multi-criteria decision-making methods are used in a wide range of areas, they are limited in comparing the financial performance of airline companies. In addition, it is understood that only one study has compared different methods of measuring financial performance.

The common point of these studies can be summarized as evaluating the financial health and soundness of companies, having information about the competitive strength of the company, and making it easier for managers to make investment decisions. In this context, financial performance provides important information on the company's cash flow, profitability, and market value. In Table 1, other studies that responded to the purpose of the study are written in bold.

Table 1: Financial Performance of Airline Companies

Authors	Periods	Methods	Purpose of the study	Results
Behn & Riley (1999)	1988-1996	Regression model	To examine whether nonfinancial performance information is a useful indicator of financial performance in the airline industry.	Nonfinancial data positively affect financial performance.
Feng & Wang (2000)	Case study	**GRA, TOPSIS**	Establishing a performance evaluation process for airlines based on financial ratios.	The empirical result shows that airline performance evaluation is more comprehensive if financial ratios are considered.
Riley Jr (2003)	1988-1999	Panel data regression	To examine the relationship between nonfinancial performance variables, traditional accounting variables and other financial statement information in the airline industry.	The findings suggest that accounting earnings, changes in abnormal earnings and nonfinancial performance variables are significantly related to stock returns.
Flouris & Walker (2005)	1996-2003	Regression model	September 11, 2001, terrorist attacks and the stock and accounting performance of three major airlines in the United States.	Airline performance depends on lower operating costs, consumer confidence, product offering, organizational structure, workforce and operational processes,
Wang (2008)	2001-2005	**Fuzzy TOPSIS**	To analyze the financial performance of three domestic airlines in Taiwan.	The financial performance of these airlines can be easily evaluated with the Fuzzy TOPSIS method, whether the number of alternatives is high or not.
Guzhva (2008)	1974-2005	Regression model	September 11 terrorist attack on the performance of the US airline industry.	The analysis shows that not all airlines have been equally affected by the terrorist act, and investors are pricing quite rationally.

Wang & Kao (2009)	Case study	**Fuzzy multi-criteria group decision-making**	It evaluates the financial performance of three domestic airlines in Taiwan.	The FMCGDM method is used to solve the problem of assessing the financial performance of airlines.
Mahesh & Prasad (2012)	2005-2010	Paired sample t-test	It analyzes the profitability, leverage, liquidity and financial performance efficiency of Indian Airline Companies in the post-merger and post-acquisition period.	Overall, Airline M&A in India does not significantly affect post-merger financial performance.
Lin (2012)	Case study	Data envelopment analysis	It is an examination of the financial performance of several major international airlines from North America, Europe, Latin America, Asia and the Middle East.	Efficiency measures relate to strategically focused spending on operations and customer service.
Asatryan & Březinová (2014)	Case study	Regression model	To examine the extent to which corporate social responsibility (CSR) initiatives are related to the financial performance of airline companies.	The study found a significant positive relationship between CSR initiatives and financial performance measures.
Mellat-Parast et al. (2015)	1998-2009	Panel data regression	To examine the relationship between service quality and profitability in the airline industry.	Specifically, mishandled baggage and customer complaints negatively impact the profitability of airlines that focus on this issue more than airlines that do not.
Teker et al. (2016)	2011-2014	Harmonic index	It analyzes the financial performance of the top 20 airlines in the world.	A harmonic index is proposed to assess financial performance.
Hakim & Merkert (2016)	1973-2014	Pedroni/Johansen cointegration, Granger, Wald	To examine the causal relationship between air transportation and economic growth in the South Asian context.	The results confirm a long-run unidirectional Granger causality from GDP to air passenger traffic and air transport volumes.
Chen et al. (2017)	1994-2011	Panel regression	It is being investigated whether state ownership has significantly affected the performance of publicly listed Chinese airlines.	Chinese airlines with mixed ownership perform worse than their largely privately owned or majority state-owned counterparts.
Yang & Baasandorj (2017)	2006-2015	Panel regression	The impact of corporate social responsibility (CSR) on the financial performance of low-cost and full-service air carriers.	Air carriers influence their financial performance through corporate social responsibility activities.

Pineda et al. (2018)	Case study	**Analytic network process, VIKOR**	To propose an integrated model that combines data mining and multiple criteria decision-making to extract critical factors for airline performance improvement.	This integrated model is a method that can be used to evaluate each airline individually.
Dayı & Ulusoy (2018)	2008-2014	**Minimum Spanning Tree**	The financial performance of airlines around the world is to evaluate them in terms of their performance.	The MST approach can make this assessment. Fourier distribution confirms the findings.
Perçin & Aldalou (2018)	2012-2016	**Fuzzy AHP Fuzzy TOPSIS**	Evaluating the financial performance of companies working in the aviation sector.	A financial analysis model is proposed.
Kalemba & Campa Planas (2019)	2011-2015	Panel regression	The impact of safety on economic and financial indicators in the airline industry.	The results show that safety has a non-significant impact on airlines' profitability, while safety significantly impacts airlines' revenues.
Battal (2019)	2013-2018	**TOPSIS**	In Europe of the financial performance of the four major airlines is its measurement.	The results show that the performance scores of airlines changes over the analysis period.
Park et al. (2019)	1996-2014	Panel two-stage least squares	It is an examination of the role of various types of transportation infrastructure in OECD and non-OECD countries using a hybrid production approach that combines macroeconomic growth with transportation supply and demand.	The finding shows maritime transport is more important in economic growth than air and land transport. However, mostly in developing countries, air and land transport are unrelated to or negatively affect economic growth.
Abdi et al. (2020)	2013-2019	Panel data analysis	To examine how implementing environmental, social, and governance (ESG) disclosures affect airlines' firm value and financial performance.	An airline's effort to improve its ESG dimensions will lead to higher market capitalization and return on invested funds.
Huang (2021)	2016-2019	Malmquist productivity index and the conditional value-at-risk	It is an investigation of the financial performance of twenty-two Asia-Pacific-based airlines.	The study's findings provide recommendations for airlines to manage their capital structures and increase their financial stability.

Fardnia et al. (2021)	1990-2009	OLS and Poisson regressions	To investigate whether an airline's financial factors are related to the safety performance of the airline carrier.	There is a mixed relationship between the financial factor and the airline's safety record.
Cocis et al. (2021)	2016-2018	**TOPSIS**	The relationship between corporate reputation and financial performance in the airline industry.	The rankings of companies in Fortune magazine and TOPSIS rankings yield similar results.
Ellibeş & Candan (2021)	2012-2018	**Fuzzy Analytical Hierarchy Process, GRA**	To evaluate the financial performance of selected airline companies from Turkey and the world.	The financial performance rankings of the firms were carried out with the Gray Relational Analysis (GRA) method.
Abdi et al. (2022)	2008-2019	Panel data analysis	To investigate the impact of environmental, social, and governance (ESG) scores on the value and financial performance of firms in the airline industry.	ESG scores affect firms' value and financial performance.
Batrancea et al. (2022)	2012-2021	**VIKOR**	The relationship between financial performance and sustainable corporate reputation in airlines.	Airline rankings in Fortune magazine and VIKOR rankings are similar.
Rahman et al. (2022)	2003-2017	Panel data analysis	The relationship between negative customer engagement (NCE) and financial performance in airlines.	The results show that the number of NCE incidents in airlines affects financial performance.
Kiracı et al. (2022)	2028-2020	**CRITIC, CODAS**	Analyzing the financial performance of global aircraft leasing companies.	The results prove that air charter companies have been affected by the Covid-19 pandemic.
Kuo et al. (2021)	2012-2016, 2013-2017	A multilevel quadratic growth model	To examine whether corporate social responsibility (CSR) practices increase costs and affect corporate financial performance in thirty airline companies.	The results show that environmental, social, and governance-based practices initially reduce airlines' Return on assets and then gradually increase it.
Law et al. (2022)	1995-2018	Panel autoregressive distributed lag	It examines the relationship between air transportation development, economic growth and inbound tourism in Cambodia, Laos, Myanmar and Vietnam.	A bidirectional causality exists between air passenger traffic and economic growth in the long run. Inbound tourism significantly impacts air transportation demand in the long run, but there is no significant relationship between the two in the short run.

3. Data and methodology

Three companies are operating in the air transportation sector in Borsa Istanbul. Generally accepted financial ratios produced by the accounting information system were used to determine the ability of these companies to continue their activities healthily and to survive. The period analyzed in the study using quarterly balance sheet periods is between 06/2019 and 03/2023. The number of periods is sixteen. On the other hand, the balance sheet periods in which each company announced a loss were excluded from the analysis. Therefore, the dimensions of the decision matrix, which should be created in the first stage of multi-criteria decision-making methods, are calculated differently for each company. The implementation process of the study consists of three stages. First, the OCRA method was used to determine the financial competitiveness of the companies. Second, the findings obtained are compared with the ARAS method. Finally, the statistical significance of the results obtained from the two methods is tested with Spearman rank correlation. The Criteria Importance Through Intercriteria Correlation (CRITIC) method, which is based on the standard deviation of each criterion and its relationship with other criteria, was used in the weighting process. The alternatives and criteria used in the study are presented in Table 2 and Table 3.

Table 2: Alternatives

Company Name	Code	Traded Market
Turkish Airlines Inc.	THAO	Star Market
Celebi Air Service Inc.	CLEBI	Star Market
Pegasus Air Transportation Inc.	PGSUS	Star Market

Table 3: Criteria

Criteria	Formula	Code	Criteria Direction
Price/Earnings (P/E)	Price per share / Earnings per share	C1	Max
Market/Book (M/B)	Market price per share / Book value per share	C2	Max
Current Ratio	Current assets / Current liabilities	C3	Max
Quick Ratio	(Current assets – Inventories) / Current liabilities	C4	Max
Times-interest-earned (TIE)	Earnings before interest and taxes (EBIT) / Interest charges	C5	Max
Profit margin	Net Income / Sales	C6	Max
Return on total assets (ROA)	Net income / Total assets	C7	Max
Return on common equity (ROE)	Net income / Common Equity	C8	Max
Inventory turnover	Sales / Inventories	C9	Max
Days sales outstanding (DSO)	Receivables / (Annual sales / 365)	C10	Min
Short-term debt to total debt	Short-term debt / Total debt	C11	Min
Total debt to total capital	Total debt / Total capital	C12	Min

4. Limitations of the Study

The number of periods in which the financial performance of the companies is analyzed is different depending on the profit status of each company. This situation necessitated matrix operations of different sizes. Historical (past) data were used in the study. Therefore, the financial competitiveness of companies is explained in a fixed period. As it is known, financial ratios that change over time change the performance of companies. This constraint applies to all multi-criteria decision-making methods that are not based on dynamic relationships. Multi-criteria decision-making methods consist of a large number of matrix operations. The result matrices of CRITIC and ARAS methods are included in the calculation process. Finally, in the process of comparing the results of the two methods used in the study, in the first stage, the correlation relationship between the scores was examined before any ranking process. Then, after the ranking process, the correlation relationship between the scores was examined.

5. Operational Competitiveness Ratings Analysis (OCRA)

OCRA, first introduced in the literature by Parkan, (1994) and Parkan, (1996), is a nonparametric technique used to evaluate alternatives' performance and efficiency analysis.

The mathematical representation of the method is explained below by Chatterjee & Chakraborty (2012, p.388):

Step 1: Calculate preference ratings based on nonbeneficial criteria.

In this step, the OCRA method is only interested in the scores of the various alternatives for the input criteria without considering the scores for the utility criterion. Preference is given to useless or low values of the input criteria. The overall performance of alternative I with respect to all input criteria is calculated using the following equation.

$$\overline{I_i} = \prod_{j=1}^{n} w_j \frac{\max\ (x_j^m) \square x_i^j}{\min\ (x_j^m)} \quad (i = 1,2,...,m; \quad j = 1,...,n; \quad i \square m) \tag{1}$$

where $\overline{I_i}$ i. is a measure of the relative performance of the alternative and is the performance score of alternative i. with respect to input criterion x_i^j j.

Step 2: Calculate the linear preference rating for the input criteria.

$$\overline{\overline{I}} = \overline{I_i} \square \min\ (\overline{I_i}) \tag{2}$$

This linear scaling is done to assign a zero rating to the least preferred alternative. $\overline{\overline{I}}$ represents the total degree of preference for alternative i. according to the input criteria.

Step 3: Calculate preference ratings based on useful criteria.

Aggregate performance for alternative i. across all utility or output criteria is measured using the following expression.

$$\overline{O_i} = \prod_{h=1}^{H} w_h \frac{x_h^i \square \min\ (x_h^m)}{\min\ (x_h^m)} \tag{3}$$

where h = 1,2, ... H denotes the number of useful attributes or output criteria and the calibration constant w_h or weight importance of the h. output criterion. The higher the score of an alternative for an output criterion, the higher the preference for that alternative

Step 4: Calculate the linear degree of preference for the output criteria using the following equation.

$$\overline{\overline{O}} = \overline{O_i} \square \min\ (\overline{O_i}) \tag{4}$$

Step 5: Overall preference ratings are calculated.

The overall preference rating for each alternative is calculated by scaling the sum $(\overline{\overline{I_i}} + \overline{\overline{O_i}})$ such that the least preferred alternative receives a zero rating. The overall preference rating (Pi) is calculated as follows.

$$P_i = (\overline{\overline{I_i}} + \overline{\overline{O_i}}) \square \min\ (\overline{\overline{I_m}} + \overline{\overline{O_m}}) \tag{5}$$

Alternatives are ranked according to the values of the overall preference ranking. The alternative with the highest overall performance rating is ranked first.

6. Research Findings

6.1. THYAO OCRA

This section of the study presents the OCRA results for Turkish Airlines Inc. The OCRA method has an implementation process consisting of seven stages. In the first stage, the decision matrix is created. Table 4 shows the decision matrix. Then, a new normalized matrix is obtained using Equation (1) and Equation (3). Table 5 shows the calculation of the new normalized decision matrix. Then, a weighted normalized matrix is obtained using the w_h values. In other words, the values of $\overline{I_i}$ and $\overline{O_i}$ are obtained in their weighted form. Table 7 shows the calculation of the weighted normalized

matrix. This calculation is preceded by the determination of the importance weights (degrees) of the criteria. The results of the application using the CRITIC method are presented in Table 6. It is then $\overline{I_i}$ obtained using Equation (1) for the minimization-oriented criteria. Table 8 shows the criteria with a minimization direction. It is then $\overline{O_i}$ obtained using Equation (3) for the maximizing criteria. Table 9 shows the maximization-oriented criteria. Then, the minimum value of the series is found by taking the $(\overline{\overline{I_i}} + \overline{\overline{O_i}})$ sums, which are the Linear Degrees of Preference. Table 10 shows the linear degrees of preference. In the last stage, OCRA scores are found. For this, the minimum value of the series is subtracted from its sum $(\overline{\overline{I_i}} + \overline{\overline{O_i}})$. Then, the scores are ranked from largest to smallest. Table 11 shows the OCRA scores.

Table 4: Decision Matrix

Alternatives and Criteria	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Sep.19	10.28	0.49	0.74	0.69	2.37	0.05	0.02	0.07	35.34	20.83	0.33	0.78
Dec.19	5.35	0.55	0.80	0.75	2.89	0.06	0.03	0.11	43.60	6.32	0.33	0.83
Sep.21	10.53	0.40	0.76	0.72	2.90	0.10	0.03	0.11	25.34	50.24	0.34	0.76
Dec.21	5.15	0.52	0.73	0.69	1.77	0.08	0.02	0.09	27.97	46.19	0.34	0.74
Mar.22	5.51	0.50	0.73	0.69	1.22	0.05	0.01	0.02	10.18	124.44	0.38	0.74
Jun.22	6.81	0.65	0.79	0.75	3.83	0.10	0.02	0.08	22.84	61.03	0.43	0.72
Sep.22	5.45	0.79	0.89	0.85	7.57	0.17	0.07	0.21	39.96	34.89	0.40	0.68
Dec.22	5.01	1.12	0.88	0.84	4.40	0.15	0.08	0.26	50.22	21.84	0.39	0.69
Criteria Direction	Max	Max	Max	Max	Max	Max	Max	Max	Max	Min	Min	Min
Minimum Value	5.01	0.40	0.73	0.69	1.22	0.05	0.01	0.02	10.18	6.32	0.33	0.68
Maximum Value	10.53	1.12	0.89	0.85	7.57	0.17	0.08	0.26	50.22	124.44	0.43	0.83

Table 5: New Normalized Decision Matrix

Alternatives and Criteria	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Sep.19	1.05	0.23	0.02	0.01	0.94	0.00	2.43	2.27	2.47	0.27	0.27	0.06
Dec.19	0.07	0.38	0.10	0.09	1.36	0.31	4.55	4.27	3.28	0.27	0.27	0.00
Sep.21	1.10	0.00	0.04	0.04	1.37	1.24	3.65	4.13	1.49	0.25	0.25	0.10
Dec.21	0.03	0.30	0.00	0.00	0.45	0.83	3.18	3.29	1.75	0.24	0.24	0.12
Mar.22	0.10	0.25	0.00	0.01	0.00	0.13	0.00	0.00	0.00	0.13	0.13	0.13
Jun.22	0.36	0.63	0.08	0.09	2.13	1.15	3.18	2.99	1.24	0.00	0.00	0.15
Sep.22	0.09	0.98	0.22	0.24	5.19	2.74	11.27	9.05	2.92	0.07	0.07	0.22
Dec.22	0.00	1.80	0.21	0.21	2.61	2.31	13.74	11.39	3.93	0.11	0.11	0.21

Table 6: Criteria Weights Calculated by Critic Method

Criteria	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
w_j	0.17	0.06	0.07	0.07	0.06	0.06	0.08	0.08	0.07	0.07	0.15	0.08

According to Table 6, the most important criterion is Price/Earnings (P/E) (C1: 0,17). This criterion is followed by Short term debt to total debt (C11: 0,15), Total debt to total capital (C12: 0,08), Return

on total assets (ROA) (C:0.08), Return on common equity (ROE) (C9: 0,08), Current Ratio (C3 :0,07), Quick Ratio (C4:0,07), Inventory turnover (C9: 0,07), Days sales outstanding (DSO) (C10: 0,07), Times-interest-earned (TIE) (C5:0,06), Profit margin (C6: 0,06) and Market/Book (M/B) (C2: 0,06) criteria respectively.

Table 7: Weighted Normalized Matrix

Alternatives and Criteria	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Sep.19	0.17	0.01	0.00	0.00	0.05	0.00	0.00	0.17	0.16	0.02	0.04	0.00
Dec.19	0.01	0.02	0.01	0.01	0.08	0.00	0.00	0.32	0.21	0.02	0.04	0.00
Sep.21	0.18	0.00	0.00	0.00	0.08	0.01	0.00	0.31	0.10	0.02	0.04	0.01
Dec.21	0.00	0.02	0.00	0.00	0.03	0.01	0.00	0.25	0.11	0.02	0.04	0.01
Mar.22	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01
Jun.22	0.06	0.04	0.01	0.01	0.12	0.01	0.00	0.23	0.08	0.00	0.00	0.01
Sep.22	0.01	0.06	0.01	0.02	0.30	0.01	0.01	0.68	0.19	0.01	0.01	0.02
Dec.22	0.00	0.11	0.01	0.01	0.15	0.01	0.01	0.86	0.26	0.01	0.02	0.02

Table 8: Minimization Directional Criteria

Alternatives and Criteria	I line	Min I line	I double line
Sep.19	0.28	0.00	0.28
Dec.19	0.24	0.00	0.24
Sep.21	0.19	0.00	0.19
Dec.21	0.15	0.00	0.15
Mar.22	0.10	0.00	0.10
Jun.22	0.07	0.00	0.07
Sep.22	0.06	0.01	0.05
Dec.22	0.03	0.02	0.02

Table 9: Maximization Directional Criteria

Alternatives and Criteria	Qi line	Min Qi line	Q double line
Sep.19	0.42	0.00	0.42
Dec.19	0.45	0.00	0.45
Sep.21	0.59	0.00	0.59
Dec.21	0.30	0.00	0.30
Mar.22	0.04	0.00	0.04
Jun.22	0.46	0.00	0.46
Sep.22	1.10	0.01	1.09
Dec.22	1.16	0.00	1.16

Table 10: Linear Preference Ratings

Alternatives and Criteria	I double line + Q double line
Sep.19	0.70
Dec.19	0.69
Sep.21	0.78

Table 10: Continues

Dec.21	0.45
Mar.22	0.14
Jun.22	0.54
Sep.22	1.14
Dec.22	1.18
Min	0.14

Table 11: OCRA Scores

Alternatives and Criteria	Pi	Rank
Sep.19	0.562	4
Dec.19	0.547	5
Sep.21	0.641	3
Dec.21	0.314	7
Mar.22	0.000	8
Jun.22	0.396	6
Sep.22	1.004	2
Dec.22	1.040	1

According to the results of the application of the OCRA method to assess the financial competitiveness of Turkish Airlines Inc., the ranking of the eight periods is presented in Table 11. Accordingly, the period with the highest financial performance of the company is the December 22 balance sheet period. December 22 balance sheet period is followed by September 2022, September 2021, September 2019, December 2019, June 2022, December 2021 and March 2022 balance sheet periods, respectively.

6.2. THYAO ARAS

In this section of the study, the financial competitiveness of THYAO was calculated according to the ARAS method. Table 12 shows these calculations.

Table 12: ARAS Scores

Alternatives and Criteria	Si	Ki	Rank
Sep.19	0.101	0.581	5
Dec.19	0.115	0.659	3
Sep.21	0.103	0.592	4
Dec.21	0.086	0.495	7
Mar.22	0.068	0.393	8
Jun.22	0.092	0.528	6
Sep.22	0.127	0.731	2
Dec.22	0.134	0.768	1
Optimal Values	0.174	1.000	

According to the results of the application of the ARAS method to evaluate the financial competitiveness of Turkish Airlines Inc., the ranking of the eight periods is presented in Table 12. Accordingly, the period with the highest financial performance of the company is the December 22 balance sheet period. The balance sheet period of December 22 is followed by September 2022, December 2019, September 2021, September 2019, June 2022, December 2021 and March 2022, respectively.

6.3. Statistical Significance of OCRA and ARAS Methods for THYAO

In this part of the study, the statistical significance of OCRA and ARAS results for Turkish Airlines Inc. is analyzed by Spearman Rank Correlation.

Table 13: Spearman Rank Correlation

		Correlations		
			OCRA	**ARAS**
Spearman's rho	**OCRA**	Correlation Coefficient	1	.929**
		Sig. (2-tailed)	.	0.001
		N	8	8
	ARAS	Correlation Coefficient	.929**	1
		Sig. (2-tailed)	0.001	.
		N	8	8

**Correlation is significant at the 0.01 level (2-tailed).

According to Table 13, there is a strong positive correlation between the ranking results of the two methods, statistically significant at the 92.90 percent level.

6.4. CLEBI OCRA

In this section of the study, the financial competitiveness of CLEBI was calculated according to the OCRA method. Table 14 shows these calculations.

Table 14: CLEBI OCRA

Alternatives and Criteria	**Pi**	**Rank**
Jun.19	0.000	9
Sep.19	0.401	4
Dec.19	0.333	6
Sep.21	0.219	7
Dec.21	0.701	1
Mar.22	0.189	8

Table 14: Continues

Jun.22	0.345	5
Sep.22	0.646	3
Dec.22	0.672	2

According to the results of the application of the OCRA method to evaluate the financial competitiveness of Celebi Air Service Inc., the ranking of the nine periods is presented in Table 14. Accordingly, the period with the highest financial performance of the company is the December 21 balance sheet period. The balance sheet period of December 2021 is followed by the balance sheet periods of December 2022, September 2022, September 2019, June 2022, December 2019, September 2021, March 2022, and June 2019, respectively.

6.5. CLEBI ARAS

In this section of the study, the financial competitiveness of CLEBI was calculated according to the ARAS method. Table 15 shows these calculations.

Table 15: CLEBI ARAS

Alternatives and Criteria	Si	Ki	Rank
Jun.19	0.064	0.442	9
Sep.19	0.092	0.636	5
Dec.19	0.098	0.680	4
Sep.21	0.083	0.573	7
Dec.21	0.112	0.775	3
Mar.22	0.073	0.504	8
Jun.22	0.090	0.624	6
Sep.22	0.118	0.817	2
Dec.22	0.128	0.886	1
Optimal Values	0.144	1.000	

According to the results of the application of the ARAS method to assess the financial competitiveness of Celebi Air Service Inc., the ranking of the nine periods is presented in Table 15. Accordingly, the period with the highest financial performance of the company is the December 22 balance sheet period. The balance sheet period of December 2022 is followed by the balance sheet periods of September 2022, December 2021, December 2019, September 2019, June 2022, September 2021, March 2022 and June 2019, respectively.

6.6. Statistical Significance of OCRA and ARAS Methods for CLEBI

In this section of the study, the statistical significance of Celebi Air Service Inc. OCRA and ARAS results are analyzed by Spearman Rank Correlation.

Table 16: Spearman Rank Correlation

		Correlations		
			OCRA	**ARAS**
Spearman's rho	**OCRA**	Correlation Coefficient	1	.900**
		Sig. (2-tailed)	.	0.001
		N	9	9
	ARAS	Correlation Coefficient	.900**	1
		Sig. (2-tailed)	0.001	.
		N	9	9

**Correlation is significant at the 0.01 level (2-tailed).

Table 16 shows a strong positive correlation between the results of the two methods, statistically significant at the 90 percent level.

6.7. PGSUS OCRA

In this section of the study, the financial competitiveness of PGSUS was calculated according to the OCRA method. Table 17 shows these calculations.

Table 17: PGSUS OCRA

Alternatives and Criteria	Pi	Rank
Jun.19	0.116	3
Sep.19	0.000	5
Dec.19	0.019	4
Sep.22	0.379	2
Dec.22	0.866	1

According to the results of the application of the OCRA method to evaluate the financial competitiveness of Pegasus Air Transportation Inc., the ranking of the five periods is presented in Table 17. Accordingly, the period with the highest financial performance of the company is the December 22 balance sheet period. The December 2022 balance sheet period is followed by the September 2022, June 2019, December 2019 and September 2019 balance sheet periods, respectively.

6.8. PGSUS ARAS

In this section of the study, the financial competitiveness of PGSUS was calculated according to the ARAS method. Table 18 shows these calculations.

Table 18: PGSUS ARAS

Alternatives and Criteria	Si	Ki	Rank
Jun.19	0.130	0.536	5
Sep.19	0.138	0.570	4
Dec.19	0.150	0.622	2
Sep.22	0.148	0.615	3
Dec.22	0.192	0.796	1
Optimal Values	0.242	1.000	

According to the results of the application of the ARAS method to evaluate the financial competitiveness of Pegasus Air Transportation Inc., the ranking of the five periods is presented in Table 18. Accordingly, the period with the highest financial performance of the company is the December 22 balance sheet period. December 2022 balance sheet period is followed by December 2019, September 2022, September 2019 and June 2019 balance sheet periods, respectively.

6.9. Statistical Significance of OCRA and ARAS Methods for PGSUS

In this section of the study, the statistical significance of the OCRA and ARAS results of Pegasus Air Transportation Inc. is analyzed by Spearman Rank Correlation.

Table 19: Spearman Rank Correlation

		Correlations		
			OCRA	**ARAS**
Spearman's rho	**OCRA**	Correlation Coefficient	1	1.000**
		Sig. (2-tailed)	.	.
		N	5	5
	ARAS	Correlation Coefficient	1.000**	1
		Sig. (2-tailed)	.	.
		N	5	5

** Correlation is significant at the 0.01 level (2-tailed).

Table 19 shows a statistically significant positive correlation between the results of the two methods in absolute terms.

7. Conclusion and Discussion

According to a generally accepted definition, economic growth is "the increase in income generated in a country compared to the previous year." Each sector contributes to economic growth at different levels. The contribution of the aviation sector to economic growth has been a subject of extensive research. Early research focused on the operational performance of the airline sector. Later, the correlation between operational performance and financial performance led to new research on financial performance.

The performance evaluation of companies operating in the aviation sector is important for several reasons. First, investors use financial performance to make decisions. Second, creditors are concerned with the repayment of debt. Third, managers evaluate the performance of the company. Fourth, it shows the company's position in the industry. A company with high performance attracts investors. It provides a competitive advantage. It has a stronger financial structure. This is achieved by making the right decisions. One way to make the right decision is to use multi-criteria decision-making methods. Multi-criteria decision-making methods make it easier to make decisions when there are multiple alternatives and criteria.

The first originality of this study is the proposal of the OCRA method to determine the financial performance of companies operating in the aviation sector. The second originality is to use the ARAS method to control the robustness and reliability of the findings. The third originality is the use of the CRITIC method to determine the importance level of the criteria. In this context, the mathematics used in the study is easy to understand and comparable. It eliminates the problem of which method to choose for managers. This result is consistent with the studies of Feng & Wang (2000), Wang (2008), Wang & Kao (2009), Pineda et al. (2018), Dayı & Ulusoy (2018), Perçin & Aldalou (2018), Battal (2019), Cocis et al. (2021), Ellibeş & Candan (2021), Batrancea et al. (2022), and Kiracı et al. (2022).

Airline managers need an objective approach to determine the operational and financial performance of the airline without subjective evaluation. This objective approach is critical in ensuring that the company continues to operate healthily because an airline company's business performance and financial efficiency are realized through correct decision-making.

The main objective of this study is to evaluate the financial competitiveness of companies operating in the air transportation sector in Borsa, Istanbul. For this purpose, Operational Competitiveness Ratings Analysis (OCRA) method is first used. Then, the findings are compared with the Additive Ratio Assessment (ARAS) method. The findings are as follows. First, the OCRA method can be used for financial performance evaluation purposes. Second, OCRA and ARAS methods give very similar results. Third, the findings are statistically significant.

In this process, Turkish Airlines Inc. posted a profit in eight of the sixteen balance sheet periods analyzed, while Celebi Air Service Inc. posted a profit in nine balance sheet periods. This correlation between the two companies is a signal that the increase in demand in the market has a positive impact on all stakeholders. However, Pegasus Air Transportation Inc. profited in five balance sheet periods. It is understood that the unpredictable COVID-19 pandemic is the most important systematic risk factor of the balance sheet periods in which the companies announced losses.

The results of the study provide important information about airline companies' liquidity, managerial behavior, profitability and market capitalization. This information interests all market participants, which can help them make investment decisions. My suggestion for future research would be the impact of oil price fluctuations on airline profitability.

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Resume

Hakan ALTIN (Prof. Dr.), Aksaray University, Faculty of Economics and Administrative Sciences, Department of Business Administration, is a Finance Professor. His research areas include Financial Theory, Portfolio Management, and Behavioral Finance. His research has been published in journals such as Cogent Economics & Finance, International Journal of Risk and Contingency Management, International Journal of Applied Management Sciences and Engineering, and International Journal of Operations Research and Information Systems.