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Analysis of Working Capital Efficiency with Index Method: An Application to BIST Aviation Companies

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Abstract

The primary aim of this study is to measure the working capital management efficiency levels of companies listed in the Borsa Istanbul (BIST) Transportation Index. To achieve this objective, the Index Method developed by Bhattacharya (1997) was utilized. Using annual data from 2014 to 2024, utilization index, performance index, and efficiency index values were calculated for Turkish Airlines (THYAO) and Pegasus Airlines (PGSUS), both publicly traded companies. According to the findings, the average index values for THYAO and PGSUS were found to be greater than 1, indicating that investments in current assets contributed to an increase in sales revenue. Additionally, a significant divergence among the indices was observed in 2020, the year when the global COVID-19 pandemic had a profound impact.

Keywords:
Working Capital Management,
Index Method,
Transportation Sector.

JEL Classification:
G10, G30, L93

Çalışma Sermayesinin Etkinliğinin İndeks Yöntemiyle Analizi: BİST Havacılık Şirketlerine Yönelik Bir Uygulama

Öz

Çalışmanın temel amacı, Borsa İstanbul (BİST) Ulaştırma endeksinde işlem gören şirketlerin çalışma sermayesi yönetimi etkinlik düzeyini ölçmektir. Bu amaca ulaşmak için Bhattacharya (1997) tarafından geliştirilen İndeks Yöntemi kullanılmıştır. Borsada işlem gören Türk Hava Yolları A.O. (THYAO) ve Pegasus Hava Taşımacılığı A.Ş.'nin (PGSUS) 2014 -2024 dönemi yıllık verileri kullanılarak kullanım indeksi, performans indeksi, etkinlik indeksi değerleri hesaplanmıştır. Çalışma bulgularına göre THYAO ve PGSUS şirketlerinin ortalama indeks değerlerinin 1'den büyük olduğu yani dönen varlıklara yapılan yatırımların satış hasılatını artırdığı tespit edilmiştir. Ayrıca, küresel COVID-19 pandemisinin etkili olduğu 2020 yılında endeksler arasında dikkat çekici bir ayrışma gözlenmiştir.

Anahtar Kelimeler:
Çalışma Sermayesi Yönetimi,
İndeks Yöntemi,
Ulaştırma Sektörü.

JEL Sınıflandırması:
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1. Introduction

Working capital management (WCM) is a critical area for financial health and operational sustainability, enabling a business to strategically balance its short-term assets and liabilities. Working capital management, defined in the literature as "the process of maintaining the balance between current assets and short-term liabilities", has a direct impact on liquidity management, profitability optimization and risk minimization (Copeland et al., 2005; Brigham and Houston, 2019). This process allows businesses to seize growth opportunities while meeting their financial commitments (Deloof, 2003). The combination and financing of working capital (current assets) required to sustain daily activities in an enterprise and to fulfill maturing obligations is one of the financial management functions that finance managers in enterprises spend the most time and effort on a daily basis (Karadeniz and İskenderoğlu, 2024). In finance theory, the importance of working capital management is associated with maintaining a firm's solvency, lowering its cost of capital and providing competitive advantage (Sharma and Kumar, 2011).

Working capital management is a financial strategy that aims to achieve a balance between liquidity and profitability by effectively managing the short-term assets and liabilities of businesses. The theoretical foundations of working capital management are based on three main strategies: conservative, aggressive and moderate approaches. The conservative strategy aims to increase liquidity and minimize financial risks by requiring businesses to hold high levels of current assets. This strategy encourages the business to cover its short-term liabilities with long-term financing; therefore, while financial stability is ensured, profitability potential may be limited due to high funding costs (Brigham, 2016). In contrast, aggressive strategies focus on minimizing working capital investments and maximizing profitability by relying more on short-term borrowing. However, this approach may increase liquidity risk and increase the likelihood of a cash crunch (Ross et al., 2016). On the other hand, moderate strategies strike a balance between conservative and aggressive approaches, in line with the classical risk-return trade-off theory. In this strategy, enterprises aim to achieve both financial flexibility and optimal profitability by using short and long-term financing in a balanced manner (Gitman, 2009). One of the most important measures of working capital management is the cash conversion period, which was introduced by Richards and Laughlin (1980) and measures the time required to convert inventories and receivables into cash. A shorter cash conversion period implies effective liquidity management and operational agility, while longer cycles can expose firms to financial instability and competitive disadvantages (Shin and Soenen, 1998). While this management is of strategic importance for businesses, it is influenced by a number of internal and external factors, creating a variety of challenges. Internal factors include, for example, company size, credit policies and inventory turnover, while external factors are particularly sensitive to economic fluctuations, changes in interest rates and disruptions in the global supply chain (Baños-Caballero et al., 2014). This complex environment makes it difficult to determine optimal working capital. Variables such as the sector structure in which the enterprise operates, competitive conditions, technological infrastructure and credit policies make it more difficult to determine the correct level. While insufficient working capital may cause liquidity problems, excess working capital may negatively affect

profitability. Therefore, it is of paramount importance for the financial health of businesses to accurately determine the most efficient level of working capital. (Aytürk and Yanık, 2015; Kandil Göker, 2018; Mazman İtik, 2021).

Although cash conversion period is traditionally used to assess the effectiveness of working capital management, there are inconsistent results in the literature on the relationship between this metric and profitability. While some studies argue that there is a negative relationship between cash conversion period and profitability, others argue that there is a positive relationship; to overcome this uncertainty, the working capital efficiency index developed by Bhattacharya (1997) is a measure used to assess how efficiently businesses manage their current assets. This index is the product of two main components: the performance index and the utilization index. The performance index measures the average performance of current asset items and indicates how effective the company is in working capital management, while the utilization index indicates how successful the company is in generating sales from its current assets. This index is an important tool in assessing the financial health of businesses and is widely used in liquidity management and financial efficiency analysis (Bhattacharya, 1997).

In this framework, this study investigates the working capital efficiency of Türk Haya Yoları A.O. (THYAO) and Pegasus Hava Taşımacılığı A.Ş. (PGSUS), which are traded in the Transportation (XULAS) index in Borsa Istanbul, and an analysis is carried out with the data for the period 2014-2024 using the index method developed by Bhattacharya (1997). As can be seen from the related literature review, the fact that both national and international studies have not examined the working capital efficiency of transportation companies with Bhattacharya's (1997) index method has been the main motivation for this research.

The following stages of the research are organized as follows. In the next stage, a review of the national and international literature on index methodology is presented, followed by the data set, methodology and findings. In the last part, the research is completed with conclusion and evaluation.

2. Literature Review

Research on the effectiveness of working capital management at the international level reveals that financial data of different countries and sectors are analysed based on the index method developed by Bhattacharya (1997). Ramachandran and Janakiraman (2009), one of the examples of these studies, calculated performance, utilisation and efficiency indices based on data for the period 1997-2006 by taking paper enterprises operating in India as a sample; their findings showed that companies experienced fluctuations in the efficient use of their capital periodically, but achieved an average success in general. Afza and Nazir (2011), on the other hand, analysed the cement sector in Pakistan and evaluated the long-term data obtained for the period 1988-2008 according to Bhattacharya's model. In this study, thanks to the calculated performance, utilisation and efficiency indices, it is emphasised that firms across the sector have reached the targeted level of efficiency in working capital management; in particular, by examining the 18-year data of 22 firms, it is

emphasised that effective management is sustainable across the sector. Sharma and Kumar (2011) analysed the financial data of 263 companies in the Bombay Stock Exchange for the period 2000-2008 using multiple regression analysis and found that there is a negative relationship between debt repayment period and inventory holding period, and a positive relationship with receivable collection period and cash return period, and elaborated the effects of capital management on profitability. Valipour and Jamshidi (2012) analysed the financial statements of 72 firms from the pharmaceutical, chemical, basic metal and non-metal mining sectors operating in Tehran and revealed the relationship between working capital efficiency and profitability. In the index calculations applied, it is stated that measures such as performance, utilisation, efficiency and cash return period give more decisive results compared to traditional financial ratios; especially performance and utilisation indices show positive correlation with profitability. The study by Shehzad et al. (2012), which focuses on the companies operating in the textile sector of Pakistan, revealed the significant relationship between operating profit and working capital management by using Bhattacharya's index method over the data for the period 2004-2009, and concluded that firms across the industry maintain capital management effectively. Kaur and Singh (2013) calculate the performance, utilisation and efficiency indices of 14 manufacturing firms active in the Bombay Stock Exchange during the period 2000-2010 and emphasise that working capital indices of all firms were above 1 in 2004 and capital management was generally efficient. Praveena and Mahendran (2013), focusing on sugar factories in India, reported that the calculated efficiency indices of all the enterprises in the sample were above 1, indicating that effective use of existing assets and high efficiency in production processes were achieved in the sugar sector. The study conducted by Kaur (2014) on 13 healthcare companies operating in the Bombay Stock Exchange, based on the index method, revealed that the efficient use of capital contributes positively to sales performance; the findings of the study provide important clues for optimising financial strategies in the healthcare sector. In the same context, Kavitha and Shanmugam (2015) made a comparison between large and small-scale enterprises in the Indian pharmaceutical industry and found that small-scale firms apply more effective strategies in working capital management; they drew attention to the effect of scale size on capital management efficiency. Kasiran et al. (2016), covering 24 small and medium-sized enterprises operating in Malaysia, analysed the financial data for the period 2010-2013 according to the index method; the results showed that especially medium-sized enterprises exhibited lower working capital management performance than small-sized firms. Marie and Azhagaiah (2016) emphasised that 15 firms in the fast-moving consumer goods sector traded on the National Stock Exchange of India have achieved high efficiency in working capital management, which is consistent with the competitive nature of the sector and dynamic consumer demands. Sharma (2019), in his analysis of registered tea estates registered with the Tea Board of India in the Jorhat region of Assam for the period 2011-2016, applied Bhattacharya's model and found that firms in the tea sector generally adopt efficient capital management strategies.

Among the more recent international studies, Rahman et al. (2022) analysed the financial data of selected passenger car manufacturers in India and found that current asset

utilisation and working capital efficiency have a positive impact on sales performance. Yousaf (2022), in his research on Czech firms certified under the European Foundation for Quality Management (EFQM) Excellence Model, evaluated the manufacturing data for the period 2015-2020 and concluded that firms with quality certificates could not use their existing assets effectively enough and this situation could not provide the desired increase in sales performance. Yadav and Sur (2022), on the other hand, measured the working capital efficiency of state-owned enterprises operating in the petroleum sector of India using the index method and argued that full efficiency in capital management was not achieved in the pre- and post-economic liberalisation periods. Finally, Ergün and Kılınç Savrul (2024) compared the data of Posco from South Korea and Erdemir from Türkiye for the period 2011-2021 within the scope of five-year development plans, and showed that both firms performed effective working capital management based on utilisation, performance and efficiency indices calculated by Bhattacharya's index method; these results were shown to be in line with theoretical expectations by associating them with global economic events. While all these international studies reveal how widespread and reliable the index method is in measuring the effectiveness of working capital management in different countries and sectors, they also comprehensively reveal the impact of periodic, scale and sectoral differences on capital management performance.

Focusing on Türkiye and Borsa Istanbul samples, the studies provide detailed analyses on sectoral and sample basis in the evaluation of working capital management using the index method. Kandil Göker (2018), one of the leading studies in the food sector, evaluated the financial statements of 24 food companies traded in BIST in the period 2010-2017 with Bhattacharya's index method and revealed that firms manage their working capital effectively. Güler and Konuk (2019), on the other hand, analysed the quarterly data of 21 firms in the BIST for the period 2009-2016 and found that generally successful results were obtained in managing current assets. Furthermore, the study conducted by Kandil Göker (2020) measured the current asset utilisation of 19 companies in the BIST Sustainability Index in the period 2015-2018 and reported the observed declines in capital utilisation after the companies entered the sustainability criteria, which had significant effects on financial performance reflected in sales revenues. In the retail sector, Erem Ceylan (2020), based on the financial data of BIST retail companies for the period 2010-2019, based on Bhattacharya's index method, revealed that retail firms generally implement effective working capital management.

Türkiye-specific practices are also noteworthy in tourism, service and technology sectors. Günay (2021) analysed the data of food and beverage, accommodation and airline transportation sectors traded on BIST in the period 2009-2019 and stated that airline enterprises exhibited a more balanced and stable capital management, while fluctuating performance was observed in food and beverage and accommodation sectors. Mazman İtik (2021) study, which analysed the quarterly financial data of 12 companies operating in the BIST technology sector, showed that the index values of all firms were above 1 as a result of the application of Bhattacharya's index method and that capital investments positively affected sales revenue.

In the manufacturing sector, Sakınç (2021a) reports that companies generally adopt efficient capital management strategies with the index method applied on the financial statements of 15 firms in the BIST retail sector for the period 2011-2018. In addition, the study conducted by Sakınç (2021b) on 17 manufacturing companies in the BIST Participation 30 index evaluated the data for the period 2013-2018 and found that the performance, utilisation and efficiency indices were above 1, indicating successful working capital management in the manufacturing sector. Kaya et al. (2022), in their analysis of 127 manufacturing enterprises traded in BIST in the period 2009-2018, drew attention to the heterogeneous performance distribution in the manufacturing sector by stating that 45% of the firms outperformed the sector in general, 4% were in parallel and 51% lagged behind. In the health sector, Karadeniz and İskenderoğlu (2024) calculated utilisation, performance and efficiency indices based on the financial statements of 4 health companies traded in the BIST Human Health and Social Services sector in the period 2019-2022 and found a general stability in the utilisation index, while the performance and efficiency indices fluctuated.

In parallel with the approaches in the international literature, these studies in the Turkish sample reach similar conclusions on the efficient use of existing assets, optimising capital management and increasing profitability of firms; however, various differences are also revealed depending on country and sector dynamics. In this context, the fact that there are few studies on the working capital efficiency of companies in the transportation sector stands out as the main motivation.

3. Data Set and Method

This study analyses the working capital efficiency of Türk Hava Yolları and Pegasus operating in the aviation sector. A data set was created using financial statements for the years 2014-2024. Financial statement data are obtained from Public Disclosure Platform, turkishairlines.com and flypgs.com websites (PDP, 2025; Türk Hava Yolları, 2025; Pegasus, 2024). The reason for choosing the relevant sector is that the impact of the pandemic can be clearly seen. This is how the impact of the pandemic, which negatively affected almost all sectors, was measured on aviation companies. Another reason why the aviation sector is preferred is that it plays a critical role in the growth of economies and global trade. Changes and developments in the aviation sector, especially before and after the pandemic, are of great importance in terms of their impact on working capital. In this context, the aviation sector was preferred for the analysis of working capital.

In addition, two passenger transport companies operating in the sector were analysed. This is due to the similarities in the business lines and financial structures of the companies concerned. THYAO and PGSUS are among the largest and best-known airlines in Türkiye. Moreover, in order to observe the impact of the pandemic more clearly, only passenger transport companies were preferred among the companies in the BIST Transport (XULAS) sector.

Table 1 shows the companies in the BIST Transport (XULAS) index, which includes the companies sampled in this study.

Table 1. BIST Transport Index Companies (XULAS)

Queue	Code	Company Title
1	BEYAZ	Beyaz Filo Oto Kiralama A.Ş.
2	CLEBI	Çelebi Hava Servisi A.Ş.
3	GSDDE	GSD Denizcilik Gayrimenkul İnşaat Sanayi ve Ticaret A.Ş.
4	GRSEL	Gür-Sel Turizm Taşımacılık ve Servis Ticaret A.Ş.
5	HRKET	Hareket Proje Taşımacılığı ve Yük Mühendisliği A.Ş.
6	HOROZ	Horoz Lojistik Kargo Hizmetleri ve Ticaret A.Ş.
7	PASEU	Pasifik Eurasia Lojistik Dış Ticaret A.Ş.
8	PGSUS	Pegasus Hava Taşımacılığı A.Ş.
9	RYSAS	Reysaş Taşımacılık ve Lojistik Ticaret A.Ş.
10	TLMAN	Trabzon Liman İşletmeciliği A.Ş.
11	TUREX	Tureks Turizm Taşımacılık A.Ş.
12	THYAO	Türk Hava Yollari A.O.

Source: Public Disclosure Platform (2025)

3.1. Analysis Method

In the analysis, calculations were made by applying the working capital efficiency index method on the balance sheets and income statements of THYAO and PGSUS companies whose shares were traded on BIST between 2014-2024. The working capital efficiency index, developed in Bhattacharya (1997), is a financial analysis method that measures the efficiency of managing working capital in enterprises (Karadeniz ve İskenderoğlu, 2024: 299). In the method, three variables, namely utilisation index, performance index and efficiency index, are calculated to measure the efficiency of working capital.

Utilisation index is denoted by the symbol UI. Utilisation index measures the ability of the company to generate sales by using its current assets. In other words, it can also be defined as an indicator of the degree of utilisation of current assets (Güler and Konuk, 2019: 41). This value is desired to be higher than 1. When the UI value is greater than 1, it indicates that the working capital (current assets) is used effectively in terms of the ability to generate sales as a whole, whereas when it is less than 1, it indicates that the working capital is not used effectively.

The UI value is calculated using Equation (1). In the equation, t-1 refers to the previous period and t refers to the current period (Kandil Göker, 2018).

$$UI_{WCM} = \frac{A_{t-1}}{A_t}, A = \text{Current Assets/Sales} \quad (1)$$

The performance index is denoted by the symbol PI. It is defined as the average performance of various account items within the current assets of each company (Güler and Konuk, 2019: 41). Numerically, an enterprise's performance index greater than 1 indicates

that the enterprise manages its working capital effectively. This means that the proportional increase in sales is greater than the proportional increase in current assets (Sharma, 2019).

PI value is calculated using Equation (2). In the formula; I_S is the ratio of the net sales revenue of the current period to the net sales revenue of the previous period. W_{it} is the current asset sub-account group amount in period t, W_{it-1} is the current asset sub-account group amount in the previous period t. N is the number of current asset sub-account groups (Güler and Konuk, 2019).

$$PI_{WCM} = I_S \sum_{i=1}^{n} (W_{it-1}/W_{it})\,/N \tag{2}$$

The working capital management efficiency index (EI) is a product of the performance index and utilisation index, which helps to measure the ultimate effectiveness of enterprises in working capital management (Rahman et. al., 2022). This index value is calculated by multiplying the performance index value by the utilisation index value (Rajinikanth, 2018). An EI value greater than 1 indicates that working capital investments and management are managed effectively, while a value less than 1 indicates that working capital investments and management are not effective. The EI value is calculated using Equation (3) below (Mazman İtik, 2021).

$$EI_{WCM} = PI_{WCM} * UI_{WCM} \tag{3}$$

3.2. Findings

In line with the objectives of the research, the utilisation, performance and efficiency indices of the transport companies traded on BIST for the years 2014-2024 were calculated by applying the formulas described above in Microsoft Excel 2016 environment and the findings obtained are presented below respectively. Then, summary statistics of the calculated index values are presented and interpreted in order to make a company-based comparison. In the presentation of the findings, the companies are coded as THYAO and PGSUS and presented with stock exchange abbreviations. An example of how the utilisation index (UI), performance index (PI) and efficiency index (EI) values of THYAO for the years 2022-2024 are calculated is shown in Table 2.

Table 2. THYAO Company Index Values Calculation Example (Million TRY)

1	(A)	(B)	(C)	(D)	(E)
2	**Account Names**	**2021**	**2022**	**2023**	**2024**
3	Current Assets	65,797	135,095	253,043	341,910
4	Cash and Equivalents	35,679	76,192	20,115	95,992
5	Financial Investments	69	11,705	157,311	118,030
6	Trade Receivables	12,323	18,618	25,192	31,908
7	Other Receivables	10,617	16,387	26,196	48,265
8	Derivative Instruments	782	819	531	4,213
9	Stocks	3,481	6,196	12,311	23,661
10	Prepaid Expenses	1,526	3,293	6,975	10,641
11	Current Period Tax Related Assets	260	650	1,210	1,014
12	Other Current Assets	1,060	1,235	3,202	8,186
13	Net Sales	97,378	311,169	504,398	745,430
14	Calculation of Utilisation Index (UI)		(B3/B13)/(C3/C13)	(C3/C13)/(D3/D13)	(D3/D13)/(E3/E13)
15	Calculation of Performance Index (PI)		(C13/B13)*((B4/C4)+(B5/C5)+(B6/C6)+(B7/C7)+(B8/C8)+(B9/C9)+(B10/C10)+(B11/C11)+(B12/C12))/9	(D13/C13)*((C4/D4)+(C5/D5)+(C6/D6)+(C7/D7)+(C8/D8)+(C9/D9)+(C10/D10)+(C11/D11)+(C12/D12))/9	(E13/D13)*((D4/E4)+(D5/E5)+(D6/E6)+(D7/E7)+(D8/E8)+(D9/E9)+(D10/E10)+(D11/E11)+(D12/E12))/9
16	Calculation of Efficiency Index (EI)		C14*C15	D14*D15	E14*E15
17	Utilisation Index (UI)		1.56	0.87	1.09
18	Performance Index (PI)		1.78	1.56	0.95
19	Efficiency Index (EI)		2.78	1.35	1.03

Based on the reference values in Table 2, for the Utilisation Index (UI) values, it can be said that the enterprise in question increased its total current assets by 105% in 2022 compared to 2021, while net sales increased by 220% in 2022 compared to 2021. In 2023, current assets increased by 87% compared to the previous year, while sales increased by 62%. Explanations can be made for other periods with the same logic.

The utilisation index is an indicator that takes into account whether the increase in current assets of an enterprise is accompanied by an increase in net sales, or if both elements increase or decrease, which element increases or decreases at a higher rate (Güler and Konuk, 2019: 43). A utilisation index value greater than one means that if companies invest in their current assets as a whole, they increase their sales revenue (Mazman İtik, 2021: 3543).

The feature that distinguishes the performance index value from the utilisation index is that while the utilisation index value deals with the investments made in current assets as a whole, the performance index value is the index value that measures whether the investments made in current asset sub-headings are efficient within themselves. The performance index, on the other hand, is more specific and tries to determine whether the current asset sub-account groups are used effectively individually (Güler and Konuk, 2019: 43). Looking at the averages of the performance index values as a whole, when the average value of all companies is greater than one, it means that all companies have invested in current asset subgroups at the right rate and the investments made have increased sales revenue (Mazman İtik, 2021: 3544).

The efficiency index value is a final index value obtained from the results of the other two indices. The efficiency index value expresses whether current assets are used effectively and efficiently both in total and each item in the current asset group separately. When we evaluate the efficiency index value as a whole, the fact that the average index values of the companies have a value greater than or equal to 1 means that they fulfil the condition required by the Index Method developed by Bhattacharya (1997). It means that the companies have made the right investments in current assets both as a whole and on an item basis and that the investments made are reflected positively on sales (Mazman İtik, 2021: 3544)

Table 3 presents the descriptive statistics of the utilisation, performance and efficiency index values of the companies between 2014 and 2024.

Table 3. Descriptive Statistics

	Minimum	Maximum	Average	Standard Deviation
THYAO				
Utilisation Index (UI)	0.57	1.56	0.97	0.26
Performance Index (PI)	0.71	3.18	1.39	0.68
Efficiency Index (EI)	0.52	2.78	1.32	0.62
PGSUS				
Utilisation Index (UI)	0.50	2.45	1.07	0.51
Performance Index (PI)	0.45	18.03	3.38	5.00
Efficiency Index (EI)	0.22	17.36	3.51	4.79

When Table 3 is analysed, it is observed that UI average values are above 1 for PGSUS and below 1 for THYAO. Therefore, it is determined that PGSUS is the most successful company in terms of UI performance among airline companies. When the maximum values of UI values are analysed, it is found that PGSUS has the highest value and PGSUS has the lowest value in terms of minimum values. It was determined that PGSUS was the company with the highest standard deviation of UI values and the most fluctuating UI performance.

When the descriptive statistics of PI values are analysed, it is observed that the average values are above 1 in THYAO and PGSUS. PGSUS has the highest average and maximum value of PI, whereas THYAO has the lowest average value. It was determined that PGSUS was the company with the lowest minimum value. When the standard deviation values were analysed, it was observed that the largest fluctuation in PI values was observed in PGSUS and the smallest fluctuation was observed in THYAO.

When the descriptive statistics of EI values are analysed, it is observed that the average values are above 1 in THYAO and PGSUS. It is observed that the average value of EI is the highest in PGSUS. When the minimum values of EI values were analysed, it was determined that the lowest values occurred in PGSUS), while the highest EI value in terms of maximum values occurred in PGSUS. In terms of standard deviation values, the highest fluctuation was observed in PGSUS and the lowest fluctuation was observed in THYAO.

In the variables and calculations of the study, the annual reports of THYAO and PGSUS were utilised and the findings obtained were presented and evaluated separately. Although they are obtained as a result of proportional calculations, it is preferred to present the results in separate tables since they do not provide information about a direct competitive relationship. The results of the working capital efficiency index for THYAO covering the period 2014-2024 are presented in Table 4.

Table 4. THYAO WCM Values

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
UI	0.89	0.85	0.74	1.25	0.91	1.00	0.57	0.98	1.56	0.87	1.09
PI	0.92	0.97	0.71	1.37	1.19	1.10	3.18	1.56	1.78	1.56	0.95
EI	0.82	0.83	0.52	1.71	1.09	1.10	1.82	1.52	2.78	1.35	1.03

Analysing Table 4, it is seen that for the period 2014-2024, the lowest UI value of THYAO company was realised in 2020 (0.57) and the highest UI value was realised in 2022 (1.56). It is seen that the lowest PI value of the THYAO company was realised in 2016 (0.71) and the highest PI value was realised in 2020 (3.18). It is seen that the lowest EI value of THYAO company was realised in 2016 (0.52) and the highest EI value was realised in 2022 (2.78).

The results of the working capital efficiency index for PGSUS covering the period 2014-2024 are presented in Table 5.

Table 5. PGSUS WCM Values

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
UI	1.05	0.93	1.34	0.68	1.09	0.96	0.50	0.94	2.45	0.71	1.09
PI	2.28	1.15	2.16	0.87	2.96	18.03	0.45	1.24	1.93	4.73	1.42
EI	2.38	1.07	2.88	0.59	3.22	17.36	0.22	1.16	4.73	3.37	1.56

Results obtained in Table 5 are analysed, it is seen that for the period 2014-2024, the lowest UI value of PGSUS was realised in 2020 (0.50) and the highest UI value was realised in 2022 (2.45). It is seen that the lowest PI value of PGSUS company was realised in 2020 (0.45) and the highest PI value was realised in 2023 (4.73). It is seen that the lowest EI value of PGSUS company was realised in 2020 (0.22) and the highest EI value was realised in 2022 (4.73).

The trend of the findings of THYAO between 2014 and 2024 is also presented in Figure 1.

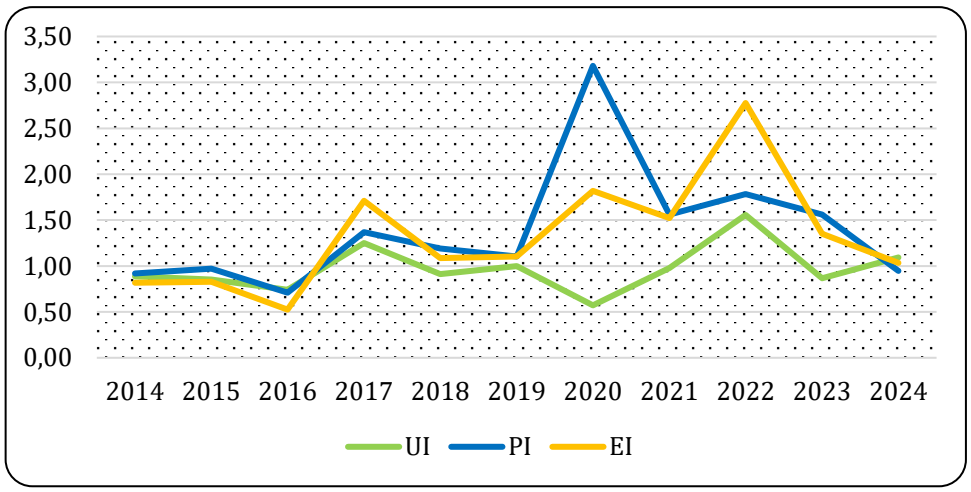

Figure 1. Trends in Index Values of THYAO

When analyzing the data in Table 4 and the graph in Figure 1, it was determined that the company's utilization index (UI) values were above 1 in 2017, 2022, and 2024. Working capital investments in these years contributed positively to the company's sales performance. On the other hand, it was determined that the KI value was below 1 in 2014-2016, 2018-2021 and 2023 and working capital investments were not realised effectively in these years. It is seen that the PI values of the company are below 1 in 2014-2016 and 2024, and in these years, the company has not made optimal investments in current asset sub-account items and has an ineffective investment policy in the context of sub-account items. When we look at the EI values, which show whether the working capital is used effectively both as a whole and separately for each sub-account item, it is possible to say that the company used its working capital effectively since the company's EI value was above 1 in 2017-2024, and although there was a failure in this year, especially in terms of

sub-items (UI), the success of current asset investments as a whole (PI) was high. On the other hand, in 2014-2016, it was observed that the company was not effective in working capital management in terms of EI value. During the analysis period, it was determined that the lowest year of the company's EI value was 2016 and the highest year was 2022.

Figure 2 presents the calculated index values of the analyzed PGSUS company between 2014 and 2024, as well as a graph showing the trend of these values.

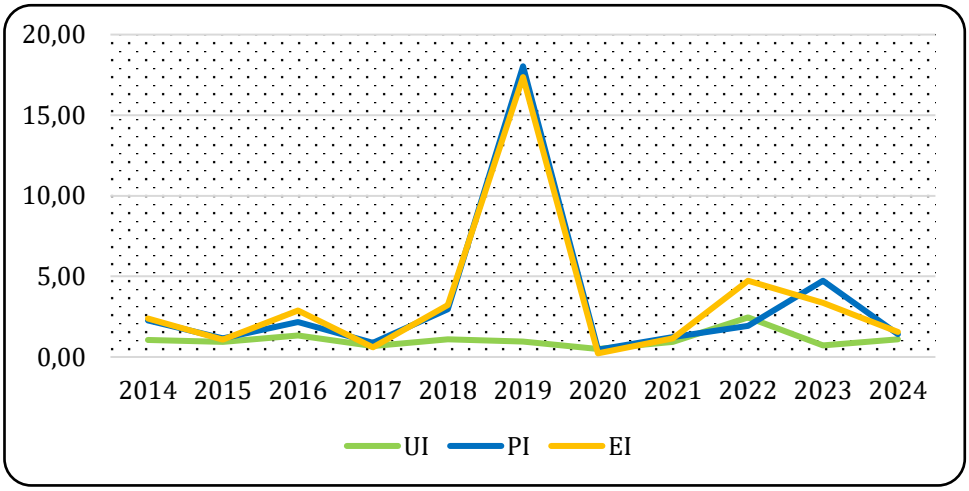

Figure 2. Trends in Index Values of PGSUS

Figure 2 shows that the PGSUS company's UI values were above 1 in 2014, 2016, 2018, 2022, and 2024. Working capital investments in these years contributed positively to the company's sales performance. On the other hand, it was determined that the UI value was below 1 in 2015, 2017, 2019, 2020, 2021 and 2023 and working capital investments were not effective in these years. The company's PI values were below 1 in 2017 and 2020, and it is seen that the company did not make optimal investments in the current asset sub-account items in these years and had an ineffective investment policy in the context of the sub-account item. Looking at the EI values of the company, it was determined that the company's EI values were above 1 in 2014-2016, 2018-2019 and 2021-2024 and that the company was successful in these years. It has been determined that the company has the highest EI value, especially in 2019, as the PI value is higher than 1. In 2014, 2016, 2018, 2022 and 2024, it was observed that the company carried out an effective working capital management both as a whole and in terms of sub-items, and in 2015, 2019, 2021 and 2023, the EI value was higher than 1, especially in terms of higher PI value. During the analysis period, the company's EI value was the highest in 2019 and the lowest in 2020.

Figure 3 presents the performance trends of the two analyzed companies in the period 2014-2024, with UI values compared in terms of years.

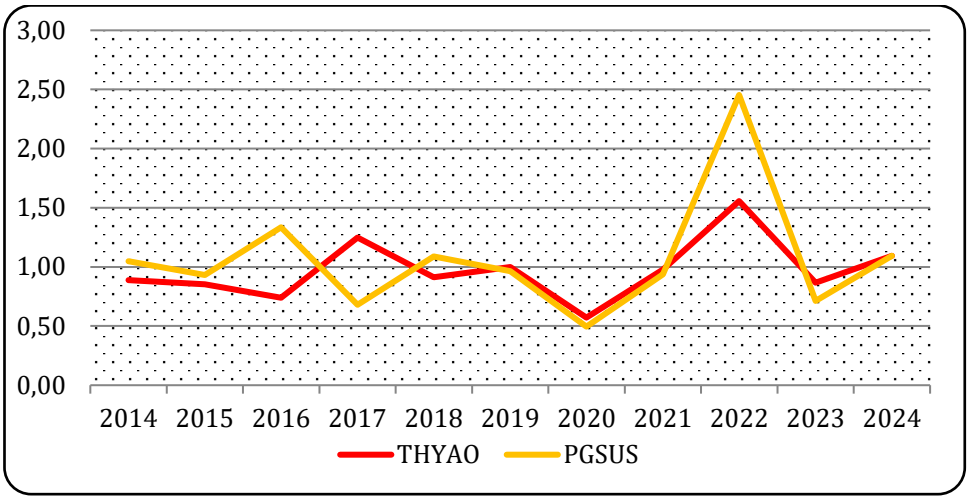

Figure 3. Comparison of Utilisation Index (UI) of Companies

Figure 3 shows that PGSUS outperformed THY in terms of UI, especially in 2014, 2016 and 2022. THYAO achieved better UI values than PGSUS in 2017 and 2021. By 2024, both companies have an equal UI value (1.09), indicating a similar level of efficient capital utilisation in terms of expertise.

The performance trends of the two analysed companies in the 2014-2024 period are presented in Figure 4 when PI values are compared in terms of years.

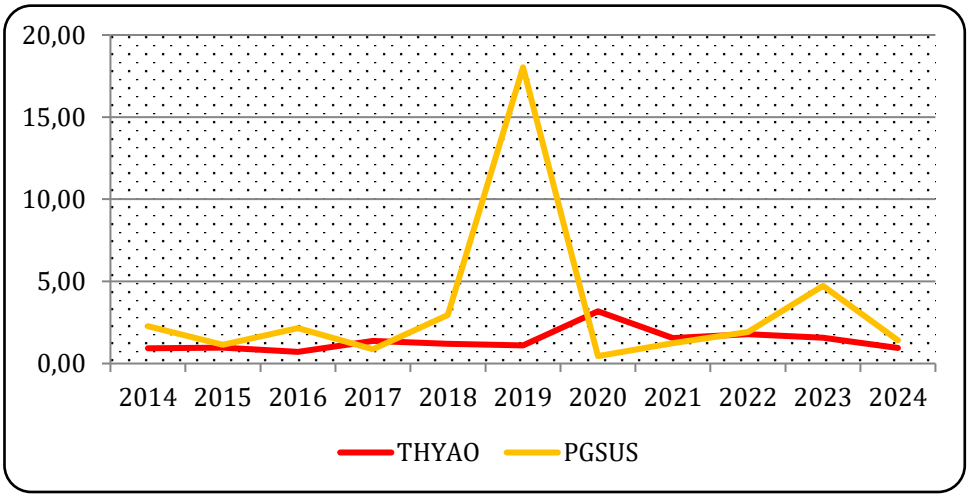

Figure 4. Performance Index (PI) Comparison of Companies

When Figure 4 is analysed, PGSUS has shown much higher fluctuations in terms of performance index than THYAO. This suggests that it follows a more aggressive financial strategy or is more affected by external factors. 2019 and 2023 are the years when PGSUS is clearly ahead of THY. THYAO has generally shown more stable and sustainable PI values,

except for 2020. In 2024, PGSUS has a higher PI value (1.42) than THYAO (0.95). This indicates that Pegasus has shown a stronger performance index at the end of the year.

The performance trends of the two analysed companies in the 2014-2024 period are presented in Figure 5 when EI values are compared by year.

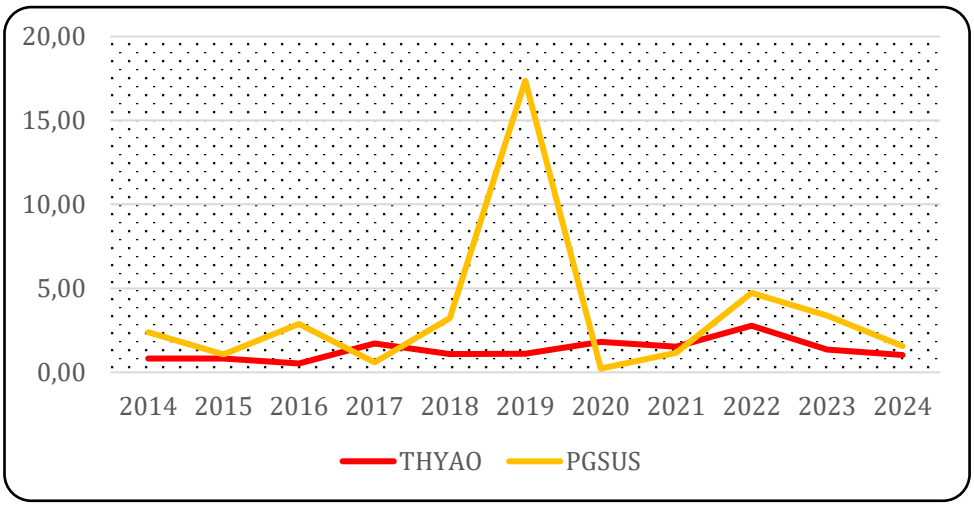

Figure 5. Efficiency Index (EI) Comparison of Companies

Figure 5 shows that PGSUS has the highest performance, especially in 2019, when working capital was managed more effectively than THYAO. PGSUS is also more successful in terms of the number of years. It is seen that the PI values of PGSUS are above 1 except for the years 2017 and 2020. In the context of the number of years in which working capital is managed effectively, it is seen that the PI values of THYAO company are above 1 except for the 2014-2016 period and follow a stable course in the 2017-2024 period.

4. Conclusion

In this study, working capital efficiency in the transport sector is calculated and analysed for publicly traded aviation companies. For this purpose, the working capital efficiency index method was applied on the financial statements of two companies whose shares were traded in the Borsa Istanbul Transport Sector in 2014-2024. In the analysis process, firstly, the utilisation (UI), performance (PI) and efficiency index (EI) values of the companies were calculated in the context of the analysis period and evaluated on a yearly and comparative basis. In addition, descriptive statistics of these index values were calculated and evaluated by comparing whether the companies manage their working capital effectively as a whole, in terms of sub-items or both.

When THYAO and PGSUS are evaluated comparatively; PGSUS has reached much higher levels in PI and EI values compared to THYAO, especially in 2014-2016 and 2018-2019 periods. This shows that PGSUS used its working capital more aggressively and

efficiently in some years. In 2017, THYAO's UI (1.25), PI (1.37) and EI (1.71) were above 1, while PGSUS was below 1 in all indices. This year has been a strong period for THYAO and a weak period for PGSUS. During 2020, the beginning of the pandemic, both companies experienced a decline, but PGSUS's EI value was only 0.22, while THYAO was able to maintain this value at 1.82. This shows that THYAO is relatively more resilient in crisis management. In 2021, both companies started to mitigate the effects of the pandemic with positive index values. However, THYAO performed more effectively with higher PI and EI values than PGSUS. In 2022, PGSUS reached very high values such as UI (2.45) and EI (4.73). THYAO also performed strongly this year with EI (2.78), but PGSUS stands out with higher index values. 2024 was a balanced and stable year for both companies. All indicators are above 1 and very close to each other.

The findings of this study are largely consistent with the working capital management analyses conducted at national and international level with the index method developed by Bhattacharya (1997). In the international literature, studies such as Ramachandran and Janakiraman (2009), Afza and Nazir (2011), Sharma and Kumar (2011), Valipour and Jamshidi (2012) reveal that companies manage working capital effectively in general, although they experience periodic fluctuations. In this context, the fact that the index values of THYAO and PGSUS companies are generally above 1 in the 2014-2024 period is in line with the findings in the literature. Studies such as Kandil Göker (2018, 2020), Güler and Konuk (2019), Erem Ceylan (2020), Günay (2021) and Mazman İtik (2021) have revealed that sectors operating in Borsa Istanbul generally achieve working capital efficiency. In these studies, it is stated that firms reach high levels especially in performance and efficiency indices, but periodic crises can temporarily disrupt these balances. These findings are in line with the fact that both THYAO and PGSUS experienced serious declines in all indices in 2020, the year of the COVID-19 pandemic. In Günay's (2021) study, it was emphasised that the airline sector exhibits a more stable and balanced structure during crisis periods, and this statement is supported by the fact that THYAO showed less fluctuations during the pandemic. On the other hand, studies such as Kaya et al. (2022) and Karadeniz and İskenderoğlu (2024) have shown that there can be significant differences in efficiency levels even among firms in the same sector. This is an important indicator that explains the fact that THYAO and PGSUS reach different index levels periodically despite operating in the same sector. Kasiran et al. (2016) and Kavitha & Shanmugam (2015) draw attention to the effects of scale differences on capital management and state that small-scale firms achieve more efficient results. The fact that PGSUS developed more flexible strategies due to its private sector structure and recovered faster in the post-crisis recovery process is similar to these findings. On the other hand, the fact that THYAO's publicly supported structure allows it to display a more balanced picture in asset utilisation during crisis periods is in line with the evaluations in the literature on the advantages of public structures.

In conclusion, the findings of this study are largely consistent with the main approaches in both international and Türkiye-specific literature, and once again demonstrate that Bhattacharya's index method can be used as a powerful analytical tool to explain sectoral, periodic and structural differences. The performances of THYAO and

PGSUS during the period analysed confirm that efficient capital management is closely related to sectoral structure, scale, corporate strategy and external environmental conditions, as indicated by numerous studies in the literature.

The study is one of the few and up-to-date studies in which the index method calculation is used both in the aviation sector and at the level of international competition. The findings and theoretical explanations are expected to contribute to the literature, managers and investors in the sector. While evaluating the findings, it is thought that the previously explained limitations of the analysis method applied should be taken into consideration. In future studies, it is thought that it would be useful to calculate index values for different sectors or sub-sectors by taking longer periods into consideration.

Statement of Research and Publication Ethics

This study did not require ethics committee approval and/or any legal or special permission. The principles of research and publication ethics were fully complied with.

Declaration of Contribution of the Researchers

The authors declare that they have contributed equally to the article.

Researchers' Conflict of Interest Statement

There is no conflict of interest related to this study.

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