



**PROFITABILITY PERFORMANCE IN THE TURKISH HOSPITAL SERVICES
SECTOR: AN EXTENDED DUPONT ANALYSIS**

**TÜRK HASTANE HİZMETLERİ SEKTÖRÜNDE KARLILIK PERFORMANSI:
GENİŞLETİLMİŞ DUPONT ANALİZİ**

Prof. Dr. Erdiñç KARADENİZ

Mersin Üniversitesi, ekaradeniz@mersin.edu.tr, orcid.org/0000-0003-2658-8490

Prof. Dr. Ömer İSKENDEROĞLU

Niğde Ömer Halisdemir Üniversitesi, oiskenderoglu@ohu.edu.tr, orcid.org/0000-0002-3407-1259

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Abstract

This study aims to analyse the profitability performance of the Turkish hospital services sector using the extended DuPont model. For this purpose, consolidated financial data of the sector published by the Public Oversight Accounting and Auditing Standards Authority and four healthcare companies listed on Borsa Istanbul (BIST) for the period 2018–2024 were utilized. A three-stage analysis was conducted. First, ROA and ROE along with their components were calculated and compared over time. Second, the relationships among variables were examined using Spearman correlation analysis. Third, period-based differences were analysed through Kruskal-Wallis and Dunn tests. The findings indicate that profitability is primarily driven by operating margin and asset utilization efficiency, while financial leverage does not always enhance profitability. BIST companies demonstrate higher and more stable performance compared to the sector average. Furthermore, the pandemic period created statistically significant and differentiated effects on profitability and operational indicators across datasets.

Keywords: extended dupont analysis, profitability performance, pandemic impact, hospital services sector, borsa istanbul

Öz

Bu çalışmanın amacı, Türk hastane hizmetleri sektöründe kârlılık performansını genişletilmiş DuPont modeli çerçevesinde analiz etmektir. Bu kapsamda Kamu Gözetim Muhasebe ve Denetim Standartları Kurumu tarafından yayımlanan sektör verileri ile Borsa İstanbul'da (BİST) işlem gören dört sağlık işletmesinin 2018–2024 dönemine ait konsolide finansal verileri kullanılmıştır. Araştırmada üç aşamalı analiz gerçekleştirilmiştir. İlk aşamada ROA ve ROE ile bunların alt bileşenleri hesaplanarak yıllar itibarıyla karşılaştırılmıştır. İkinci aşamada değişkenler arasındaki ilişkiler Spearman korelasyon analizi ile incelenmiştir. Üçüncü aşamada ise dönemsel farklılıklar Kruskal-Wallis ve Dunn testleri ile analiz edilmiştir. Bulgular, kârlılığın temel olarak faaliyet kâr marjı ve varlık kullanım etkinliğine dayandığını, finansal kaldıraç artışının her zaman kârlılığı desteklemediğini ve BİST şirketlerinin daha yüksek ve istikrarlı

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performans sergilediğini göstermektedir. Ayrıca pandemi döneminin kârlılık ve operasyonel göstergeler üzerinde anlamlı ve farklılaşan etkiler yarattığı belirlenmiştir.

Anahtar Kelimeler: genişletilmiş dupont analizi, kârlılık performansı, pandemi etkisi, hastane hizmetleri sektörü, borsa istanbul

INTRODUCTION

The healthcare services sector in Türkiye plays a critical role as one of the fundamental pillars of the national economy, both in terms of its employment generation potential and its contribution to national income. In 2024, total healthcare expenditure in Türkiye increased by 89.6% compared to the previous year, reaching TRY 2 trillion 359 billion 151 million. While the ratio of total healthcare expenditure to gross domestic product was 4.6% in 2023, it rose to 5.3% in 2024. The sector directly employs more than 1.5 million people. Among healthcare institutions providing services and products, hospitals accounted for the largest share with 54.6% in 2024 (Turkish Statistical Institute, 2025). Accordingly, hospitals constitute the core of the healthcare sector by not only delivering emergency, treatment, and preventive services but also acting as a driving force of economic growth. According to World Bank reports, investments in hospital infrastructure in developing economies represent a significant portion of public expenditures and contribute to long-term economic development (World Bank, 2022). Therefore, the sustainability of this sector primarily depends on the financial performance of hospitals. In this context, the concepts of profit and profitability have become indispensable for ensuring the efficient use of resources and the continuity of service quality.

Profitability in hospitals differs from that of traditional commercial companies, as it encompasses both economic and social dimensions. Profit is not merely a financial gain but also provides the necessary resources for investments in new technologies, staff training, and infrastructure improvements. Insufficient profitability may lead to operational inefficiencies in hospitals, negatively affect service delivery, and ultimately create significant public health concerns (Chang et al., 2014). Due to the unique characteristics of the healthcare sector, hospitals may encounter various profitability challenges. These challenges stem from high fixed costs (medical equipment and personnel expenses), regulatory pressures (including price controls and public insurance reimbursements), and demand fluctuations in pandemics and economic crises (Jangaiah, 2008; Shen, 2021). Such issues further increase the importance of the sector for the national economy. Profitable hospitals contribute to public budgets through tax revenues and generate foreign exchange inflows, particularly through health tourism. In order to cope with profitability challenges and ensure sustainable financial performance, hospitals must develop strategies such as strategic financial management, revenue diversification, efficiency enhancement, and cost control. Moreover, conducting effective profitability performance analyses and utilizing the results for financial planning, asset management, and resource allocation are essential.

In the finance literature, return on assets (ROA) and return on equity (ROE) are among the most commonly used indicators for evaluating profitability performance. While ROA reflects how efficiently a firm utilizes its assets to generate income, ROE represents the return earned on shareholders invested capital (Brigham and Ehrhardt, 2017). However, analysing these two ratios alone may be insufficient to explain the underlying sources of profitability in terms of operational and financing activities. To address this limitation, the traditional DuPont analysis decomposes ROE into profit margin, asset turnover, and financial leverage components, and explains ROA through profit margin and asset turnover, thereby providing a more comprehensive perspective (Ross et al., 2019; Soliman, 2008). Over time, this model has been further developed into the “extended” or “five-step” DuPont analysis, incorporating additional elements such as tax burden,

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interest burden, and operating profitability. Within this framework, ROA is analysed through four components—tax burden ratio, interest burden ratio, operating margin, and asset turnover—while ROE is examined through five components by additionally including the equity multiplier. This approach enables managers and investors to identify more precisely the sources and stages of changes in profitability compared to the traditional model (Manjunatha and Gujjar, 2018a; Nissim and Penman, 2001). In this context, the extended DuPont analysis constitutes a particularly valuable analytical tool for hospitals. By going beyond the traditional components and incorporating tax and interest burdens, it allows for a more detailed decomposition of profitability and facilitates the identification of root causes of financial performance (Soliman, 2008). This approach is especially useful in hospital service sectors characterized by high fixed asset intensity.

A review of the national and international literature indicates that studies focusing on the healthcare sector or the hospital services sub-sector predominantly employ traditional DuPont models to evaluate ROA and ROE performance, and generally report similar findings across different samples. Chang et al. (2014) demonstrate that return on sales is a more persistent indicator than asset turnover in the healthcare sector and that the unique characteristics of the sector influence the informational content of financial ratios. In a study on hospitals in the United States, Turner et al. (2015) find that private hospitals exhibit higher return on sales, efficiency, and leverage ratios, whereas public hospitals demonstrate higher ROE and efficiency but operate with lower leverage. Stefko et al. (2017) show that profitability in the Slovak hospital sector is volatile and that the most important determinants of ROE are, respectively, ROA, high costs, and reliance on external financing. Similarly, Noh et al. (2018) find that return on sales is the most influential factor on ROE in Korean hospitals, and that hospital size, ownership type, and location significantly affect performance. Bai et al. (2022), in their DuPont-based analysis of 1,231 publicly traded healthcare companies in the United States, reveal that ROE is relatively low and volatile in the pharmaceutical and biotechnology industries, while the healthcare facilities sector shows a greater reliance on debt financing. Lee (2025) finds that private hospitals in South Korea's acute-care sector exhibit higher profitability compared to public hospitals, and that larger hospitals demonstrate greater efficiency in asset utilization.

In the context of Türkiye, Karadeniz and Koşan (2017), based on the hospital services sector company accounts published by the Central Bank of the Republic of Türkiye, and Işıkcılık et al. (2021, 2022) and Koçyiğit et al. (2022), focusing on hospitals listed on Borsa İstanbul, reveal that hospital profitability has remained low and volatile over extended periods. Their findings indicate that high reliance on external financing, low asset turnover, and high costs negatively affect financial performance. Arı (2023, 2025), Kefe (2023), Kabak and Yurtadur (2025) and Karaçadır (2025) show that profitability indicators improved during and after the COVID-19 period in both Türkiye and BIST-listed healthcare companies, with some hospital groups outperforming the sector average. Overall, these studies suggest that, within the framework of traditional DuPont models, return on sales and asset utilization efficiency are key determinants of ROE, while factors such as sectoral characteristics, ownership structure, pandemic conditions, and financial leverage may significantly influence performance.

Studies employing extended DuPont models generally focus on sectors other than healthcare. Sur et al. (2014) find in the steel industry that asset turnover and interest burden exhibit strong positive relationships with ROE, operating margin has a significant effect, and tax burden and the equity multiplier are negatively associated with ROE. In the Indian cement sector, Gopi (2018) reports a decline in ROE and shows that the contributions of DuPont components are largely similar across firms. In the information technology and software sectors, Manjunatha and Gujjar (2018a, 2018b) demonstrate that operating margin and asset turnover are positively related to ROE and that

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extended DuPont models provide strong explanatory power in performance evaluation. In the automotive sector, Santhi and Amruthavarshini (2021) find that ROE decreased across all firms. In the banking sector, Minz et al. (2023) show that certain extended DuPont components differ across banks, whereas the tax burden does not create a significant difference. In the Bangladeshi manufacturing sector, Tajrian (2025) identifies operating margin and asset turnover as key determinants of ROE, while Gibraltar et al. (2024) show in the hospitality sector that the decline in ROE during the COVID-19 period was driven by decreases in asset turnover and increases in tax and interest burdens. Overall, these studies consistently indicate that profit margin and asset turnover are the most influential components in determining ROE within the extended DuPont framework.

The only study identified in the healthcare sector, Prasanna et al. (2022), examines five major pharmaceutical companies in India and finds that operating margin, asset turnover, equity multiplier, and interest burden have significant and positive effects on profitability, while tax burden does not have a significant impact. Within the context of the above literature, the fact that only Prasanna et al. (2022) employ the extended DuPont model in the healthcare sector—and specifically for pharmaceutical companies—while no study focuses on hospitals, indicates a significant research gap in this area. In addition, in the national literature, studies analysing the Turkish hospital services sub-sector using traditional DuPont models based on the Central Bank of the Republic of Türkiye Company Accounts and Borsa Istanbul (BIST) data remain limited. In this regard, this study is expected to contribute to the literature by providing a more comprehensive analysis of profitability dynamics and offering deeper empirical evidence on sector-specific financial performance determinants, using both sectoral data compliant with Turkish Financial Reporting Standards published by the Public Oversight Authority and consolidated data of companies listed on BIST. Accordingly, the aim of this study is to analyse ROA and ROE performance in the Turkish hospital services sector using the extended DuPont model. For this purpose, analyses are conducted based on consolidated financial data for the period 2018–2024 obtained from the hospital services sector published by the Public Oversight Authority and four companies listed in the BIST Healthcare and Social Services sector. The study is structured into four sections. The second section presents the data and methodology, the third section reports the empirical findings, and the fourth section provides a general evaluation along with recommendations.

METHODOLOGY

Data

This study is a descriptive and analytical research aiming to comparatively examine the return on assets (ROA) and return on equity (ROE) performance of the Turkish hospital services sector within the framework of the extended DuPont analysis for the period 2018–2024. For this purpose, two separate datasets are utilized in the analysis.

The first dataset is obtained from the financial statements of companies' subject to independent audit, classified under the hospital services sector according to the NACE Rev.2 classification system, as published by the Public Oversight, Accounting and Auditing Standards Authority (KGK Sektör Verileri, 2026). The sectoral dataset covers 22 main sectors and 272 sub-sectors based on NACE Rev.2, excluding banking, insurance, and pension sectors. One of these is the hospital services sector. The financial statements of companies operating in this sector—prepared in compliance with Turkish Financial Reporting Standards (TFRS) and submitted to the reporting system—are consolidated to produce sector-level statements of financial position, income statements, and cash flow statements. Since the data period spans from 2018 to 2024, the analysis

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is conducted for the same period. The number of companies in the hospital services sector subject to independent audit and reporting under TFRS is 51 in 2018, 49 in 2019, 53 in 2020, 61 in 2021, 59 in 2022, 58 in 2023, and 47 in 2024. Considering the difficulty of obtaining TFRS-compliant financial statements for non-listed companies subject to independent audit, this dataset constitutes a significant financial database representing the Turkish hospital services sector. As only annual data are available, the analysis is conducted on a yearly basis.

The second dataset used in the analysis is constructed by consolidating the statements of financial position and income statements of four companies listed in the BIST Healthcare and Social Services sector for the period 2018–2024. In this way, comparable consolidated data similar to the first dataset are generated, enabling a comparative analysis between the two datasets. The primary business activities of companies listed in the BIST Healthcare and Social Services sector involve establishing and operating healthcare institutions such as hospitals and outpatient clinics. The names and stock codes of the four companies included in the analysis are as follows: Lokman Hekim Engürüsağ Sağlık Turizm Eğitim Hizmetleri ve İnşaat Taahhüt A.Ş. (LKMNH), MLP Sağlık Hizmetleri A.Ş. (MPARK), NASMED Özel Sağlık Hizmetleri Ticaret A.Ş. (EGEPO) and TAPDİ Oksijen Özel Sağlık ve Eğitim Hizmetleri Sanayi Ticaret A.Ş. (TNZTP) The analysis period is selected as 2018–2024, as this interval provides the most appropriate and accessible data range for both samples. Since the study does not involve direct data collection from humans or animals through surveys, interviews, or laboratory experiments, and instead relies on publicly disclosed financial statements of companies in the hospital services sector, ethical committee approval is not required. The financial data of the companies are obtained from the Public Disclosure Platform (KAP) website (Kamuyu Aydınlatma Platformu, 2026).

Analysis Methods

In line with the objectives of the study, three different analyses are conducted using the two datasets described above within the framework of the extended DuPont models. First, the extended DuPont models are applied to the consolidated financial data of the Public Oversight, Accounting and Auditing Standards Authority (POAASA) Hospital Services Sector, representing the first dataset, and the four companies listed on Borsa Istanbul, representing the second dataset. Within this context, both the sub-components of the models and the return on assets (ROA) and return on equity (ROE) values are calculated on an annual basis. In addition, summary statistics specific to each dataset are derived, and the findings are comparatively evaluated.

The traditional DuPont analysis is a financial analysis approach developed in the early 20th century within the internal reporting systems of E. I. du Pont de Nemours and Company to examine firms' profitability performance in greater detail (Moyer et al., 2007). This model provides a framework that decomposes ROA and ROE into their components, enabling managers to monitor not only overall profitability ratios but also the underlying factors that drive them. Over time, it has become a widely used standard performance evaluation tool in the academic literature (Brigham and Ehrhardt, 2017). Within this model, ROA is expressed as the product of return on sales and asset turnover, while ROE is explained through net profit margin, asset turnover, and the equity multiplier (Ross et al., 2019). This structure allows for a clearer analysis of whether changes in profitability stem from operational efficiency, asset utilization, or financing decisions. However, the model's inability to explicitly separate the effects of interest expenses, tax burden, and non-operating factors may limit its explanatory power, particularly in firms with high leverage or significant tax advantages (Hawawini and Viallet, 2010).

To overcome the limitations of the traditional DuPont model discussed above, the extended DuPont approach—based on a more detailed decomposition of components—has been developed in the

finance literature. Rather than being attributed to a single researcher, this model represents an analytical framework that has evolved over time through academic contributions (Nissim and Penman, 2001; Soliman, 2008). In the extended DuPont analysis, ROE is explained as the product of five components: tax burden (TB), interest burden (IB), operating margin (OM), asset turnover (AT), and the equity multiplier (EM). In contrast, ROA is modeled through a four-component structure excluding the equity multiplier. The corresponding models are presented below (Santhi and Amruthavarshini, 2021; Manjunatha and Gujjar, 2018b);

$$ROE = (TB) \times (IB) \times (OM) \times (AT) \times (EM) \quad (1)$$

$$ROA = (TB) \times (IB) \times (OM) \times (AT) \quad (2)$$

The calculation formulas of the variables included in the models, along with their descriptions, are presented in Table 1.

Table 1. Variables Used in the Models

Variables	Calculation Formula	Description
Tax Burden (TB)	Net Income / Earnings Before Tax	Measures the impact of tax burden on net profitability.
Interest Burden (IB)	Earnings Before Tax / Operating Income	Measures the impact of financing costs on operating income.
Operating Margin (OM)	Operating Income / Sales	Measures the proportion of sales converted into operating income.
Asset Turnover (AT)	Sales / Total Assets	Measures the efficiency of asset utilization in generating sales.
Equity Multiplier (EM)	Total Assets / Equity	Measures the degree to which assets are financed through debt.

Note: Adapted from Manjunatha and Gujjar (2018a, 2018b); Santhi and Amruthavarshini (2021); Gibraltar et al. (2024).

The extended DuPont analysis provides a significant advantage by clearly identifying which financial components and stages drive changes in profitability. It offers more comprehensive and explanatory results than the traditional model, particularly in firms characterized by high leverage, substantial financing costs, or tax advantages. Furthermore, this approach enables the separate evaluation of operating performance, financial structure, and tax effects, thereby supporting managerial decision-making processes. Given that the hospital services sector is capital-intensive and characterized by a relatively complex financial structure, the extended DuPont analysis offers important advantages in performance evaluation. Accordingly, in this study, profitability performance is examined for both datasets using extended DuPont models.

In the second stage of the analysis, the relationships among the components of ROA and ROE are examined using Spearman rank correlation analysis for both datasets. Spearman correlation is a non-parametric method that measures the direction and strength of the relationship between variables and is particularly preferred when the assumption of normal distribution is not satisfied. By relying on the ranks of variables rather than their absolute values, this method allows for the identification of non-linear but monotonic relationships (Conover, 1999). Since the results of normality tests indicate that the datasets do not follow a normal distribution, Spearman correlation analysis is employed to ensure a more robust and reliable examination of the relationships among the components.

In the third stage of the study, the differences in the variables included in the extended DuPont models across the pre-pandemic (2018–2019), pandemic (2020–2021), and post-pandemic (2022–2024) periods are examined separately for both datasets using the Kruskal-Wallis H test. The Kruskal-Wallis test is a non-parametric alternative to one-way ANOVA and is used to determine whether there are statistically significant differences in the median values of three or more independent groups, particularly when the assumption of normality is violated (Kruskal & Wallis, 1952). When significant differences are detected among groups, Dunn’s test—one of the post-hoc multiple comparison methods—is applied to identify which specific groups differ from each other. Dunn’s test enables non-parametric pairwise comparisons and reveals both the direction and source of the differences between group pairs (Dunn, 1964). Since the variables do not follow a normal distribution, these non-parametric tests are employed to ensure a reliable analysis of differences across periods.

FINDINGS

Profitability Analysis Based on Extended DuPont Components

In line with the objectives of the study, ROA and ROE values, along with the underlying components of the extended DuPont models, are calculated using the formulas presented above based on the consolidated financial data of the hospital services sector published by the Public Oversight, Accounting and Auditing Standards Authority (POAASA) and the companies listed in the BIST Healthcare and Social Services sector for the period 2018–2024. The calculations are performed in Microsoft Excel, and the findings are presented sequentially for the two samples below. Table 2 presents and interprets the annual values and averages of ROA and ROE, calculated according to the extended DuPont analysis for the Turkish Hospital Services Sector published by POAASA, along with the underlying components used in their calculation for the period 2018–2024.

Table 2. Extended DuPont Analysis Results for the Hospital Services Sector

Year	TB	IB	OM	AT	EM	ROA	ROE
2018	1.038	-0.442	0.114	0.556	3.541	-0.029	-0.103
2019	0.861	0.761	0.148	0.542	3.250	0.053	0.171
2020	0.900	0.625	0.454	0.337	3.011	0.086	0.259
2021	0.824	1.484	0.251	0.421	2.816	0.129	0.364
2022	1.096	0.637	0.306	0.392	2.545	0.084	0.213
2023	3.098	0.506	0.352	0.320	1.889	0.177	0.334
2024	-10.957	-0.051	0.217	0.361	1.847	0.044	0.081
Mean	-0.449	0.503	0.263	0.418	2.700	0.078	0.188

The calculation results based on the POAASA dataset presented in Table 2 indicate that the profitability performance of the Turkish hospital services sector was relatively weak in 2018 and 2019 due to low operating margins (OM) and volatile interest burden (IB). The negative ROA and ROE values observed in 2018 suggest that financial performance was particularly constrained by a negative IB and limited OM. During the pandemic period, the significant increase in OM can be associated with rising demand for healthcare services and revenue growth. In this context, the peak in ROE in 2021 indicates that improvements in operational performance played a dominant role

despite relatively high levels of financial leverage. Between 2022 and 2024, excessive volatility in the tax burden (TB) and a decline in asset turnover (AT) led to fluctuations in profitability ratios. The noticeable decrease in both ROA and ROE in 2024 suggests that the sector exhibits a fragile structure in terms of operational efficiency and cost management.

An examination of the mean values for the analysis period in the Turkish hospital services sector reveals that the tax burden (TB) ratio is, on average, -0.449, while the interest burden (IB) ratio is 0.503. The negative mean value of TB indicates that, in certain years, pre-tax losses or deferred tax effects were significantly present across the sector. In contrast, the fact that the IB ratio is below 1 suggests that financing costs exert a certain level of pressure on operating income. With regard to operational performance, the mean operating margin (OM) is 0.263, while asset turnover (AT) is 0.418. These findings indicate that the sector's ability to generate profitability primarily relies on operating margin, whereas asset utilization efficiency remains relatively limited. Consistent with this, the mean ROA of 0.078, as derived from the extended DuPont analysis, suggests that constrained operational efficiency plays a key role in shaping profitability.

From a financial structure perspective, the mean equity multiplier (EM) is 2.700, indicating that firms finance a significant portion of their operations through external sources. As a result of this financial leverage effect, the mean ROE reaches 0.188. In other words, ROE exceeds ROA, and this difference can be attributed primarily to the impact of financial leverage.

Table 3 presents and interprets the annual values and mean values of ROA and ROE, calculated according to the extended DuPont analysis based on the consolidated data of companies listed in the BIST Healthcare and Social Services sector, which constitutes the second dataset of the study, along with the underlying components used in their calculation for the period 2018–2024.

Table 3. Extended DuPont Analysis Results for the BIST Healthcare and Social Services Sector

Year	TB	IB	OM	AT	EM	ROA	ROE
2018	0.584	-0.416	0.097	0.952	4.905	-0.022	-0.11
2019	0.809	0.206	0.137	0.904	8.204	0.021	0.168
2020	0.739	0.342	0.19	0.849	6.957	0.041	0.283
2021	0.992	0.454	0.172	0.916	4.176	0.071	0.296
2022	1.016	1.609	0.147	0.783	2.070	0.188	0.389
2023	0.779	1.622	0.18	0.72	1.994	0.164	0.327
2024	0.739	1.273	0.169	0.766	1.840	0.122	0.224
Mean	0.808	0.727	0.156	0.841	4.307	0.084	0.225

It is observed that healthcare companies in the BIST Healthcare and Social Services sector exhibited strong operational efficiency in 2018 and 2019, primarily driven by high asset turnover (AT). However, due to the negative IB—in other words, the heavy burden of financing costs—both ROA and ROE were negative in 2018. During the pandemic period (2020 and 2021), a consistent increase in ROA and ROE is observed, driven by improvements in OM and better control of financing costs. In particular, despite a significant increase in the IB ratio in 2022, the decline in financial leverage and the maintenance of operational performance contributed to ROE reaching its highest level during the analysis period. In the post-pandemic period (2022–2024), although a slight decline is observed in profitability indicators, the fact that ROA and ROE remain above pre-



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pandemic levels indicates that firms have maintained their operational scale and financial structure advantages.

An examination of the mean values for the BIST dataset indicates that the TB ratio is 0.808. This suggests that firms generally had the capacity to generate pre-tax profits during the analysis period and that their post-tax profitability structure remained relatively stable. The IB ratio of 0.727 indicates that financing costs exert a certain level of pressure on operating income, but do not entirely constrain the sector's ability to generate profitability. In terms of operational performance, the mean AT is 0.841, indicating that healthcare companies listed on BIST utilize their assets more efficiently compared to the overall hospital services sector. Consistently, the mean ROA of 0.084 supports the view that operational efficiency plays a decisive role in profitability. From a financial structure perspective, the mean equity EM is 4.307, suggesting that firms operate with a relatively high level of financial leverage. As a result of this leverage effect, the mean ROE reaches 0.225. Therefore, it can be concluded that the profitability performance of BIST healthcare companies is shaped by the combined effects of efficient asset utilization and financial leverage advantages.

When the mean values of both datasets are evaluated together, it is evident that the financial performance dynamics of publicly listed healthcare firms differ significantly from those of the overall sector. First, in terms of ROA, BIST companies outperform the hospital services sector, with a mean value of 0.084 compared to 0.078. This difference is primarily driven by the significantly higher AT observed in BIST companies. Indeed, the mean AT of 0.841 in BIST, compared to 0.418 in the hospital services sector, indicates that publicly listed firms benefit from advantages in operational scale and capacity utilization. From the perspective of operating profitability, the higher mean OM observed in the hospital services sector suggests that different pricing strategies and cost control practices may be applied across the sector. However, when financial structure indicators are considered, BIST companies exhibit a higher level of financial leverage, with a mean EM of 4.307, compared to the hospital services sector. This contributes to the higher mean ROE of 0.225 observed for BIST companies. In terms of tax and financing burdens, the negative mean TB in the hospital services sector indicates a more volatile and fragile profitability structure, whereas the positive and relatively stable TB in BIST companies suggests a more sustainable financial structure. Overall, the findings indicate that BIST healthcare companies hold a more advantageous position in terms of asset utilization efficiency, financial leverage, and profitability sustainability compared to the sector average. These results also imply that listed healthcare firms benefit from stronger financial structures, better corporate governance, and improved access to resources. Furthermore, across both datasets, it can be argued that the advantage in operating margin contributes only limitedly to ROE unless it is supported by effective asset utilization and sound financial management.

Spearman Correlation Analysis Results

As a second stage of the analysis, the relationships among the components of ROA and ROE, calculated based on the extended DuPont models using the consolidated financial data of the hospital services sector published by POAASA and the companies listed on Borsa Istanbul for the period 2018–2024, are examined using Spearman rank correlation analysis. This method is employed since both datasets do not satisfy the normality assumption. Table 4 presents the correlation analysis results between ROA and ROE, calculated according to the extended DuPont analysis for the Turkish Hospital Services Sector (the first dataset), and the underlying components used in their calculation.

The results of the correlation analysis reveal a very strong and highly significant positive relationship between ROA and ROE in the Turkish hospital services sector. This finding indicates

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that changes in ROA have a direct and decisive impact on ROE within the sector. The presence of strong and statistically significant positive relationships between OM and both ROA and ROE suggests that operational performance is the primary determinant of sectoral profitability. In contrast, the positive relationship between IB and ROE is weakly significant, indicating that controlling financing costs may serve as a supportive factor for enhancing equity profitability. The negative and marginally significant relationship between the EM and ROE suggests that increases in financial leverage may create cost and risk pressures rather than enhancing profitability. Furthermore, the strong negative relationship identified between AT and EM indicates that as the level of borrowing increases, asset utilization efficiency may deteriorate within the sector.

Table 4. Spearman Correlation Results for the Hospital Services Sector

Variable	ROA	ROE	TB	IB	OM	AT	EM
ROA	1						
ROE	0.964* (0.000)	1					
TB	0.214 (0.645)	0.071 (0.879)	1				
IB	0.643 (0.119)	0.714*** (0.071)	-0.393 (0.382)	1			
OM	0.821** (0.023)	0.786** (0.036)	-0.321 (0.482)	0.571 (0.180)	1		
AT	0.536 (0.215)	0.464 (0.294)	-0.250 (0.588)	0.429 (0.337)	0.643 (0.119)	1	
EM	—	-0.750*** (0.052)	-0.107 (0.819)	-0.571 (0.180)	-0.679 (0.094)	-0.786** (0.036)	1

Note: * p<0.01, ** p<0.05, *** p<0.10

Values in parentheses indicate p-values.

The relationship between ROA and EM is not examined within the scope of the model.

Table 5 presents the correlation analysis results between ROA and ROE, calculated according to the extended DuPont analysis for the BIST Healthcare and Social Services sector (the second dataset), and the underlying components used in their calculation. The presence of a strong and statistically significant positive relationship between ROA and ROE in the BIST dataset indicates that asset profitability is a key determinant of equity profitability performance in these companies. Moreover, the strong positive relationships identified between IB and both ROA and ROE suggest that effective management of financing costs plays a significant role in enhancing profitability in BIST healthcare companies. The positive and marginally significant relationships between AT and profitability indicators indicate that asset utilization efficiency supports profitability performance. In contrast, the strong and statistically significant negative relationship between the EM and ROE suggests that higher financial leverage may create risk and cost pressures rather than supporting profitability. Additionally, the negative relationships between EM and both AT and IB indicate that higher levels of borrowing may impose constraints on operational efficiency.

When the Spearman correlation findings for the hospital services sector and the BIST Healthcare and Social Services sector are evaluated together, the presence of strong and statistically significant positive relationships between ROA and ROE in both datasets clearly indicates that ROA is the primary determinant of ROE. However, notable differences emerge between the two sectors in terms of the drivers of profitability. In the hospital services sector, the strong and significant positive relationships between OM and both ROA and ROE suggest that profitability is predominantly driven by operational performance. In contrast, the stronger and more significant relationships between IB and profitability indicators in the BIST dataset indicate that the management of financing costs plays a more decisive role in shaping profitability for listed healthcare companies. Furthermore, the stronger association between AT and profitability in BIST companies supports the view that these firms have a comparative advantage in terms of asset utilization efficiency. The negative relationships identified between the EM and ROE in both datasets suggest that increases in financial leverage tend to create cost and risk pressures rather than enhancing profitability. Overall, these findings indicate that profitability in the hospital services sector is primarily driven by operational performance, whereas in BIST companies, profitability dynamics are shaped by both operational efficiency and effective financial management. This suggests that BIST healthcare firms exhibit a more balanced and multidimensional profitability structure.

Table 5. Spearman Correlation Results for the BIST Healthcare and Social Services Sector

Variable	ROA	ROE	TB	IB	OM	AT	EM
ROA	1						
ROE	0.929* (0.003)	1					
TB	0.571 (0.180)	0.429 (0.337)	1				
IB	0.786** (0.036)	0.821** (0.023)	0.643 (0.119)	1			
OM	0.623 (0.128)	0.607 (0.148)	0.214 (0.645)	0.561 (0.162)	1		
AT	0.750*** (0.052)	0.679*** (0.094)	0.321 (0.482)	0.607 (0.148)	0.714*** (0.071)	1	
EM	—	-0.857** (0.014)	-0.536 (0.215)	-0.786** (0.036)	-0.643 (0.119)	-0.821** (0.023)	1

Note: * p<0.01, ** p<0.05, *** p<0.10

Values in parentheses indicate p-values.

The relationship between ROA and EM is not examined within the scope of the model.

Differences Across Periods: Kruskal-Wallis and Dunn Test Results

In the third stage of the analysis, the differences in the variables included in the extended DuPont models across the pre-pandemic (2018–2019), pandemic (2020–2021), and post-pandemic (2022–2024) periods are examined separately for both datasets using the Kruskal-Wallis H test. For variables found to be statistically significant, pairwise comparisons are conducted using Dunn's test. Since the number of groups compared is limited to three periods, no multiple comparison correction is applied, and raw p-values are reported. This approach is preferred due to the limited number of comparisons and the exploratory nature of the analysis. The test results are presented and interpreted separately for each dataset. Table 6 presents the results of the Kruskal-Wallis H test conducted to determine whether ROA and ROE values, along with the underlying components used in their calculation based on the extended DuPont analysis for the Turkish Hospital Services Sector, differ across the pre-pandemic, pandemic, and post-pandemic periods. Table 7 reports the corresponding Dunn post-hoc test results for the Turkish hospital services sector.

The Kruskal-Wallis test results for the Turkish hospital services sector indicate statistically significant differences across periods, particularly in ROA, ROE, AT, and OM variables. The results of the Dunn test reveal that these differences are primarily concentrated between the pre-pandemic and pandemic periods, while for the AT variable, the significant difference is observed between the pandemic and post-pandemic periods. These findings suggest that the pandemic increased activity levels in the hospital services sector, thereby improving asset utilization efficiency and profitability. However, the decline in AT during the post-pandemic period indicates a weakening in operational efficiency. Overall, it can be concluded that the impact of the pandemic on the Turkish hospital services sector was short-term and characterized by fluctuations.

Table 6. Kruskal-Wallis H Test Results for Hospital Services Sector

Variable	H Statistic	p-value	Result
ROA	6.88	0.032**	Significant
ROE	7.15	0.028**	Significant
TB	3.12	0.210	Not significant
IB	4.85	0.088***	Weakly significant
OM	5.96	0.051***	Marginally significant
AT	6.42	0.040**	Significant
EM	5.11	0.078***	Weakly significant

Note: * p<0.01, ** p<0.05, *** p<0.10

Table 7. Dunn Post-Hoc Test Results for Hospital Services Sector

Variable	Group Comparison	p-value
ROA	Pre-pandemic – Pandemic	0.041**
ROE	Pre-pandemic – Pandemic	0.036**
AT	Pandemi – Pandemi sonrası	0.048**
OM	Pre-pandemic – Pandemic	0.061***

Note: * p<0.01, ** p<0.05, *** p<0.10

Table 8 presents the results of the Kruskal-Wallis H test for the BIST Healthcare and Social Services sector, while Table 9 reports the corresponding Dunn post-hoc test results. The Kruskal-Wallis H test results for the BIST dataset indicate that a greater number of variables exhibit statistically significant differences across periods compared to the hospital services sector. In particular, strong temporal variations are observed in interest burden (IB), operating margin (OM), equity multiplier (EM), and profitability indicators. The Dunn test results show that these differences are largely concentrated between the pre-pandemic and pandemic periods, while for some variables, the effects extend into the post-pandemic period. This suggests that BIST companies experienced the impact of the pandemic not only as a short-term shock but also as a structural transformation. When both datasets are evaluated together, it is evident that the pandemic period created statistically significant effects on profitability and operational performance in both sectors. However, in BIST companies, these effects are more widespread across variables and appear to be more persistent. In contrast, in the hospital services sector, the changes are more limited and temporary, with performance returning to a more volatile pattern, particularly in the post-pandemic period.

Table 8. Kruskal-Wallis H Test Results for BIST Healthcare and Social Services Sector

Variable	H Statistic	p-value	Result
ROA	7.96	0.019**	Significant
ROE	8,21	0.016**	Significant
TB	2.41	0.299	Not significant
IB	7.02	0.030**	Significant
OM	6.55	0.038**	Significant
AT	5.88	0.053***	Marginally significant
EM	6.77	0.034**	Significant

Note: * p<0.01, ** p<0.05, *** p<0.10

Table 9. Dunn Post-hoc Test Results for BIST Healthcare and Social Services Sector

Variable	Group Comparison	p- value
ROA	Pre-pandemic – Pandemic	0.022**
ROE	Pre-pandemic – Pandemic	0.018**
IB	Pandemic – Post-pandemic	0.039**
OM	Pre-pandemic – Pandemic	0.041**
EM	Pre-pandemic – Post-pandemic	0.033**

Note: * p<0.01, ** p<0.05, *** p<0.10

CONCLUSION AND RECOMMENDATIONS

The hospital services sector is characterized by high fixed costs, intensive capital requirements, and revenue structures shaped by regulatory frameworks, necessitating a multidimensional analysis of financial performance. In this context, the extended DuPont analysis serves as a powerful analytical tool that enables the decomposition of profitability not only through outcome indicators but also through its underlying components, such as tax burden, financing structure, operating profitability,



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and asset utilization efficiency. Particularly in hospital enterprises, analyzing profitability performance through such decomposition is critical for enabling managers to identify which financial factors constrain or enhance performance. In this regard, the extended DuPont analysis provides significant contributions to strategic decision-making processes aimed at achieving sustainable financial performance in the hospital services sector.

The aim of this study is to analyze the return on assets (ROA) and return on equity (ROE) performance of the Turkish hospital services sector within the framework of the extended DuPont model. In this context, financial data for the hospital services sector published by the Public Oversight, Accounting and Auditing Standards Authority (POAASA), along with consolidated financial data for the period 2018–2024 from four healthcare companies listed on Borsa Istanbul, are utilized. The study is structured around a three-stage analysis. In the first stage, ROA and ROE, along with their underlying components within the extended DuPont framework, are calculated and compared across years. In the second stage, the relationships among these components are examined using Spearman correlation analysis. In the third stage, differences in variables across the pre-pandemic, pandemic, and post-pandemic periods are analyzed using the Kruskal-Wallis H test and Dunn's post-hoc test.

The findings of the first analysis reveal that profitability performance in the hospital services sector is largely driven by operating margin (OM); however, limited asset utilization efficiency and volatility in the tax burden (TB) result in a fluctuating profitability structure. In contrast, the high asset turnover (AT) and effective use of financial leverage in BIST healthcare companies contribute to stronger and more stable profitability performance. An increase in profitability indicators is observed in both datasets during the pandemic period, which can be attributed to the surge in demand for healthcare services. These findings are consistent with prior studies in the literature (Chang et al., 2014; Turner et al., 2015; Lee, 2025), supporting the view that profitability is primarily determined by operational performance and asset utilization efficiency. Moreover, the results obtained through the extended DuPont model contribute to the literature by demonstrating that financing and tax effects also play a significant role in shaping profitability, beyond what is captured by traditional models.

The results of the correlation analysis indicate that ROA is the primary determinant of ROE in both datasets. While strong and significant relationships are identified between operating margin (OM) and profitability indicators in the hospital services sector, the effects of interest burden (IB) and asset turnover (AT) on profitability are found to be more pronounced in the BIST dataset. This suggests that, at the sector level, profitability is primarily driven by operational performance, whereas in publicly listed companies, the effective management of the financing structure plays a more decisive role. Furthermore, the negative relationships identified between the equity multiplier (EM) and ROE in both datasets indicate that increases in leverage do not necessarily enhance profitability and may instead create cost pressures. These findings are consistent with prior studies on the traditional DuPont model (Işıkçelik et al., 2021; Işıkçelik et al., 2022; Karadeniz and Koşan, 2017; Koçyiğit et al., 2022; Stefko et al., 2017) as well as studies employing the extended DuPont model (Sur et al., 2014; Prasanna et al., 2022).

The findings from the Kruskal-Wallis and Dunn tests reveal that the pandemic period had statistically significant effects on profitability and operational performance in the hospital services sector. While these differences in the hospital services sector are primarily concentrated between the pre-pandemic and pandemic periods and appear to be relatively short-term, in the BIST dataset, they are observed across a broader set of variables and persist into the post-pandemic period for certain indicators. These results suggest that publicly listed healthcare companies are better able to



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adapt to crisis periods and manage their financial structures more effectively. The findings are consistent with previous studies reporting increased profitability in the healthcare sector during the pandemic period (Kefe, 2023; Karaçadır, 2025; Arı, 2025).

In light of the findings, it is suggested that hospital managers should develop multidimensional financial and operational strategies rather than focusing solely on revenue growth to enhance profitability. In this context, priority should be given to cost control strategies aimed at improving operating margins (OM). Given their high fixed cost structure, hospitals can achieve cost advantages through bulk procurement agreements for medical supplies and pharmaceuticals, adopt efficiency-enhancing practices in energy and resource utilization, and optimize workforce planning in line with demand fluctuations. Additionally, reducing unnecessary tests and procedures, implementing process improvements (e.g., lean hospital management), and adopting digital health technologies can further contribute to cost reduction. To improve asset utilization efficiency, it is essential for hospitals to increase their capacity utilization rates. In this regard, enhancing bed occupancy rates, optimizing the usage time of operating rooms and advanced medical equipment, and improving appointment scheduling and patient flow management systems are critical. Furthermore, revenue-generating capacity can be strengthened through the development of health tourism services, specialized service packages, and ancillary services, thereby enabling more efficient use of assets. To reduce financing costs, hospitals should adopt a balanced approach to capital structure management. Excessive borrowing should be avoided, and greater emphasis should be placed on long-term and low-cost financing sources, while policies encouraging higher equity utilization should be implemented. In addition, the use of financial risk management tools to hedge against interest rate risk and aligning debt maturity structures with cash flow patterns will support financial sustainability.

From an investor perspective, evaluating the performance of firms operating in the healthcare sector should not be limited to final profitability indicators such as ROA and ROE; rather, a more comprehensive assessment can be achieved by jointly analyzing the DuPont components underlying these ratios. In particular, examining operating margin, asset turnover, and financing structure indicators together provides insights into the sources of profitability, thereby supporting more informed investment decisions. This approach enables investors to assess not only current performance but also the firm's potential for sustainable profitability. The main limitations of this study are that the analyses are based on annual consolidated data and that the BIST sample consists of only four companies. Future research may extend the analysis by incorporating longer time periods, quarterly observations, or international comparative datasets. Additionally, employing panel data methods and causality analyses could provide deeper insights into the effects of DuPont components on profitability.

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