Research Article

Evaluation Of The Financial Performances Of The Medical Device Companies among Fortune 500 Companies Before, During And After The COVID-19 Pandemic

Tolga Tümer[1], *Dilaver Tengilimoğlu*[2], *Eşref Uğur Çelik*[3], *Emine Kübra Dindar Demiray*[4]

Abstract

Purpose: *The purpose of this study was to evaluate the financial performances of the six medical device companies among Fortune 500 companies before, during and after the COVID-19 pandemic.*

Methodology: *We first conducted ratio analysis by using liquidity, turnover, leverage and profitability ratios; then we conducted Wilcoxon signed-rank tests by using the calculated values of the financial ratios. We obtained the required data from the annual financial statements of the medical device companies among Fortune 500 companies. In the analyses, we took 2019 as the year before the COVID-19 pandemic, 2020 and 2021 as the year of the COVID-19 pandemic and 2022 as the year after the COVID-19 pandemic.*

Results: *The results of the study showed that the medical device companies among Fortune 500 companies were able to keep their financial performances steady when the COVID-19 pandemic began; they were able to increase their profits in the second year of the COVID-19 pandemic; and they were able to start using their assets more efficiently after the COVID-19 pandemic.*

Discussion: *The findings of the study suggests that the overall financial performances of the medical device companies among Fortune 500 companies were strong before, during and after the COVID-19 pandemic. The evaluation of the financial performances of the medical device companies among Fortune 500 companies before, during and after the COVID-19 pandemic may be beneficial for managers and policy makers in the medical device industry to determine the areas that requires to be strengthened in order to be better prepared for possible future pandemics and crisis periods.*

Keywords*: Medical device industry, Fortune 500, financial performance, COVID-19.*

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Araştırma Makalesi

Fortune 500 Şirketleri Arasında Yer Alan Tıbbi Cihaz Şirketlerinin COVID-19 Pandemisi Öncesindeki, Sırasındaki ve Sonrasındaki Finansal Performanslarının Değerlendirilmesi

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Öz

Amaç: Bu çalışmanın amacı, Fortune 500'de yer alan altı tıbbi cihaz şirketinin COVID-19 pandemisi öncesindeki, sırasındaki ve sonrasındaki finansal performanslarının değerlendirilmesidir.

Yöntem: Çalışmada öncelikle likidite, devir hızı, kaldıraç ve kârlılık oranları kullanılarak rasyo analizi yapılmıştır; daha sonra ise hesaplanan finansal rasyoların değerleri kullanılarak Wilcoxon işaretli sıralar testleri uygulanmıştır. İhtiyaç duyulan veriler Fortune 500 şirketleri arasında yer alan tıbbi cihaz şirketlerinin yıllık finansal tablolarından elde edilmiştir. Analizlerde, COVID-19 pandemisi öncesi yıl olarak 2019, pandemi süreci olarak 2020 ve 2021, pandemi sonrası yıl olarak ise 2022 alınmıştır.

Sonuçlar: Araştırmanın bulgularına göre Fortune 500 şirketleri arasında yer alan tıbbi cihaz şirketleri; COVID-19 pandemisi başladığında finansal performanslarını istikrarlı tutmayı başarmış, COVID-19 pandemisinin ikinci yılında kârlarını artırmış, COVID-19 pandemisinden sonra ise varlıklarını daha verimli kullanmaya başlamışlardır.

Tartışma: Çalışmanın bulguları, Fortune 500'de yer alan tıbbi cihaz şirketlerinin COVID-19 pandemisi öncesinde, sırasında ve sonrasındaki finansal performanslarının güçlü olduğunu göstermektedir. Fortune 500 şirketleri arasında yer alan tıbbi cihaz şirketlerinin COVID-19 pandemisi öncesinde, sırasında ve sonrasındaki finansal performanslarının değerlendirilmesi; küresel çapta tıbbi cihaz sektöründeki yöneticiler ve politika yapıcılar açısından gelecekteki olası pandemilere ve kriz dönemlerine karşı daha da hazırlıklı olabilmek adına güçlendirilmesi gereken alanların belirlenmesi bakımından faydalı olabilir.

Anahtar Kelimeler: Tıbbi cihaz sektörü, Fortune 500, finansal performans, COVID-19.

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1. Introduction

The COVID-19 pandemic, which directly and/or indirectly affected every sector globally (Kaye et al., 2021; Renda & Castro, 2020; Sun & Li, 2021), affected some sectors like healthcare and tourism more than others (Özkan et al., 2022; Tümer & Tengilimoğlu, 2023). According to the World Health Organization (WHO), nearly seven million people died because of the COVID-19 pandemic (WHO, 2023). The global human capital was negatively affected by the COVID-19 pandemic and therefore many countries' economic growth decreased, as human capital is known to be one of the driving forces of economic growth (Aknur & Dugan, 2023; Celik et al., 2023).

Healthcare sector was on the frontline during the COVID-19 pandemic (Bartenschlager et al., 2023). Moreover, healthcare sector was responsible for finding a treatment to COVID-19. Consequently, medical device sector, which is a very important sub-sector of healthcare sector (Tengilimoğlu & Yiğit, 2021), was also especially important during the COVID-19 pandemic for both combating COVID-19 and finding an effective and efficient treatment to COVID-19. The COVID-19 pandemic disrupted the global healthcare supply chain (Hasan et al., 2023; Spieske et al., 2022) and it was very challenging for hospitals to have enough of the needed medical devices during the COVID-19 pandemic (Garzotto et al., 2020).

On the other hand, businesses need to have a strong financial performance in order to remain competitive and secure their continuity. This need greatly increases and becomes even more critical during crisis periods such as pandemics. Additionaly, the COVID-19 pandemic crisis was harder to combat than a typical crisis, as it was complex and disrupted the global economy. Because of this, the COVID-19 pandemic is considered to be a sticky crisis in the literature (Coombs et al., 2020; Ratten, 2021; Taneja & Bharti, 2023). As explained, medical device sector was deeply affected by the COVID-19 pandemic and thus, it became harder for medical device companies to keep their financial performances strong and steady during the COVID-19 pandemic.

There are studies in the literature about the impact of the COVID-19 pandemic on the financial performances of companies in the healthcare sector and its sub-sectors. Tengilimoğlu et al. (2023) found that the COVID-19 pandemic did not have a negative impact on the liqudity, turnover, leverage and profitability ratios and thus the financial performances of the publicly held healthcare companies in Türkiye. On the other hand, Mahssouni et al. (2022) found that the COVID-19 pandemic had a negative impact on the financial performances of Belgian pharmaceutical companies. He et al. (2023) states that the COVID-19 pandemic did not have a negative impact on the total margin of California hospitals. Accordingly, Gidwani & Damberg (2023) states that the financial performances of the majority of US hospitals were strong during the COVID-19 pandemic. Moreover, Zheng et al. (2023) states that the impact of the COVID-19 pandemic was in fact positive for the medicine sector in China.

In this context, we aimed to evaluate the financial performances of the medical device companies among Fortune 500 companies before, during and after the COVID-19 pandemic. The evaluation of the financial performances of the medical device companies among Fortune 500 companies before, during and after the COVID-19 pandemic may help managers and policymakers in the medical device sector to identify the areas that needs to be strengthened in order to be better prepared for possible future pandemics and crisis periods. Therefore, the hypotheses of the study were formulated as follows:

H1: The financial performances of the medical device companies among Fortune 500 companies before the COVID-19 pandemic were different than their financial performances during the COVID-19 pandemic.

H2: The financial performances of the medical device companies among Fortune 500 companies in the first year of the COVID-19 pandemic were different than their financial performances in the second year of the COVID-19 pandemic.

H3: The financial performances of the medical device companies among Fortune 500 companies during the COVID-19 pandemic were different than their financial performances after the COVID-19 pandemic.

2. Materials and Methods

The number of the medical device companies among Fortune 500 companies in 2023 was six (50PROS, 2023). The stock symbols, company names and Fortune 500 ranks of these companies are presented in Table 1.

Table 1. The stock symbols, company names and Fortune 500 ranks of the medical device companies among Fortune 500 companies

Stock Symbols	Company Names	Fortune 500 Ranks
ABT	Abbott Laboratories	99
DHR	Danaher	132
BDX	Becton Dickinson	209
SYK	Stryker	224
BAX	Baxter International	274
BSX	Boston Scientific	323

We collected the financial data of these six companies from their annual financial statements and we used the data to conduct ratio analysis in order to evaluate the financial performances of the companies. Ethics approval was not needed because we used publicly available data. We calculated three liquidity ratios, three turnover ratios, three leverage ratios and three profitability ratios (Brealey et al., 2020; Keown et al., 2014; Tengilimoğlu et al., 2021); thus, we calculated 12 financial ratios in the evaluation of the financial performances of the medical device companies among Fortune 500 companies. The financial ratios that we used in the analyses and their calculations are shown in Table 2.

Table 2. The financial ratios that were used in the analyses and their calculations

Financial Ratios			Calculations
Liquidity Ratios	CR	Current Ratio	Current Assets / Current Liabilities
	QR	Quick Ratio	(Current Assets – Inventories) / Current Liabilities
	CHR	Cash Ratio	(Current Assets – Inventories – Accounts Receivable) / Current Liabilities
Turnover Ratios	ITR	Inventory Turnover Ratio	Cost of Goods Sold / Inventories
	ARTR	Accounts Receivable Turnover Ratio	Net Sales / Accounts Receivable
	ATR	Asset Turnover Ratio	Net Sales / Total Assets
Leverage Ratios	TDR	Total Debt Ratio	Total Debt / Total Assets
	LDR	Long-term Debt Ratio	Long-term Debt / Total Assets
	ICR	Interest Coverage Ratio	Earnings Before Interest and Taxes / Interest Expense
Profitability Ratios	ROA	Return on Assets	Net Profit / Total Assets
	ROE	Return on Equity	Net Profit / Equity
	NPM	Net Profit Margin	Net Profit / Net Sales

In the analyses, we took 2019 as the year before the COVID-19 pandemic, 2020-2021 as the years of the COVID-19 pandemic and 2022 as the year after the COVID-19 pandemic. We conducted Wilcoxon signed-rank tests (Bordens & Abbott, 2002; Gürbüz & Şahin, 2014) with the 2019 and 2020 values to test H1; with the 2020 and 2021 values to test H2; with the 2021 and 2022 values to test H3. We used SPSS statistical package program for conducting the analyses.

3. Results

We did ratio analysis for the medical device companies among Fortune 500 companies and calculated liquidity, turnover, leverage and profitability ratios. The values of the calculated financial ratios are presented in Table 3.

Table 3. The values of the calculated financial ratios

Companies		Liquidity Ratios			Turnover Ratios			Leverage Ratios			Profitability Ratios		
		CR	QR	CHR	ITR	ARTR	ATR	TDR	LDR	ICR	ROA	ROE	NPM
ABT	2019 Values	1.44	1.04	0.55	-3.07	5.88	0.47	0.54	0.38	-6.09	0.05	0.12	0.12
DHR		5.19	4.86	4.21	-4.87	5.61	0.29	0.51	0.43	-30.60	0.05	0.10	0.17
BDX		1.18	0.72	0.31	-3.49	7.37	0.33	0.59	0.48	-1.84	0.02	0.06	0.07
SYK		2.51	1.84	1.18	-1.74	5.14	0.49	0.58	0.43	-16.97	0.07	0.16	0.14
BAX		2.32	1.81	1.22	-3.99	5.99	0.62	0.57	0.39	-13.66	0.06	0.13	0.09
BSX		0.97	0.64	0.27	-1.97	5.87	0.35	0.55	0.39	-1.45	0.15	0.34	0.44
ABT	2020 Values	1.72	1.30	0.76	-2.99	5.40	0.48	0.55	0.38	-9.10	0.06	0.14	0.13
DHR		1.86	1.55	1.01	-4.28	5.51	0.29	0.48	0.38	-16.35	0.05	0.09	0.16
BDX		1.54	1.07	0.66	-3.48	7.14	0.32	0.56	0.45	-1.87	0.02	0.04	0.05
SYK		1.93	1.23	0.70	-1.52	5.31	0.42	0.62	0.47	-7.26	0.05	0.12	0.11
BAX		2.52	1.95	1.33	-3.70	5.62	0.58	0.56	0.40	-9.64	0.06	0.13	0.10
BSX		1.82	1.45	1.04	-2.56	6.47	0.32	0.50	0.38	0.22	0.00	-0.01	-0.01
ABT	2021 Values	1.85	1.46	0.96	-3.59	6.64	0.57	0.52	0.35	-15.41	0.09	0.20	0.16
DHR		1.43	1.09	0.52	-4.16	6.36	0.35	0.46	0.36	-31.92	0.08	0.14	0.22
BDX		1.33	0.92	0.57	-3.83	8.14	0.36	0.56	0.44	-3.61	0.04	0.09	0.11
SYK		2.20	1.47	0.81	-1.85	5.66	0.49	0.57	0.44	-7.53	0.06	0.13	0.12
BAX		2.09	1.52	0.89	-3.13	4.86	0.38	0.73	0.60	-7.69	0.04	0.14	0.10
BSX		1.48	1.10	0.69	-2.30	6.69	0.37	0.48	0.35	-3.16	0.03	0.06	0.09
ABT	2022 Values	1.63	1.23	0.83	-3.10	7.02	0.59	0.50	0.30	-14.89	0.09	0.19	0.16
DHR		1.89	1.52	0.94	-4.03	6.40	0.37	0.41	0.31	-39.30	0.09	0.14	0.23
BDX		1.04	0.63	0.35	-3.22	8.61	0.36	0.52	0.37	-4.48	0.03	0.07	0.09
SYK		1.63	1.00	0.43	-1.72	5.18	0.50	0.55	0.38	-16.98	0.06	0.14	0.13
BAX		1.69	1.12	0.56	-3.57	5.68	0.53	0.79	0.62	5.96	-0.09	-0.41	-0.16
BSX		1.51	1.02	0.51	-2.12	6.44	0.39	0.46	0.34	-2.43	0.02	0.04	0.06

The descriptive statistics of the values of the calculated financial ratios for the medical device companies among Fortune 500 companies are shown in Table 4.

Table 4. Descriptive statistics of the values of the calculated financial ratios

Financial Ratios		N	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
			2019 Values		2020 Values		2021 Values		2022 Values	
Liquidity Ratios	CR	6	2.27	1.56	1.90	0.33	1.73	0.37	1.57	0.29
	QR	6	1.82	1.58	1.43	0.31	1.26	0.25	1.09	0.29
	CHR	6	1.29	1.49	0.92	0.26	0.74	0.18	0.60	0.23
Turnover Ratios	ITR	6	-3.19	1.20	-3.09	0.97	-3.14	0.90	-2.96	0.88
	ARTR	6	5.98	0.75	5.91	0.73	6.39	1.10	6.56	1.19
	ATR	6	0.43	0.12	0.40	0.11	0.42	0.09	0.46	0.10
Leverage Ratios	TDR	6	0.56	0.03	0.55	0.05	0.55	0.10	0.54	0.13
	LDR	6	0.42	0.04	0.41	0.04	0.42	0.10	0.39	0.12
	ICR	6	-11.77	11.16	-7.33	5.94	-11.55	10.90	-12.02	15.81
Profitability Ratios	ROA	6	0.07	0.04	0.04	0.02	0.06	0.02	0.03	0.07
	ROE	6	0.15	0.10	0.09	0.06	0.13	0.05	0.03	0.22
	NPM	6	0.17	0.14	0.09	0.06	0.13	0.05	0.09	0.13

For the purpose of obtaining the sector average for each ratio for each year, the mean values of the financial ratios of the medical device companies were taken. The mean values for all liquidity and profitability ratios were lower in 2020 (1.90 for CR; 1.43 for QR; 0.92 for CHR; 0.04 for ROA; 0.09 for ROE; 0.09 for NPM) than 2019 (2.27 for CR; 1.82 for QR;

1.29 for CHR; 0.07 for ROA; 0.15 for ROE; 0.17 for NPM). The mean values for two turnover ratios were lower in 2020 (5.91 for ARTR; 0.40 for ATR) than 2019 (5.98 for ARTR; 0.43 for ATR) and for one turnover ratio were higher in 2020 (-3.09 for ITR) than 2019 (-3.19 for ITR). The mean values for two leverage ratios were lower in 2020 (0.55 for TDR; 0.41 for LDR) than 2019 (0.56 for TDR; 0.42 for LDR) and for one leverage ratio were higher in 2020 (-7.33 for ICR) than 2019 (-11.77 for ICR).

The mean values for all liquidity ratios were lower in 2021 (1.73 for CR; 1.26 for QR; 0.74 for CHR) than 2020 (1.90 for CR; 1.43 for QR; 0.92 for CHR). The mean values for two turnover ratios were higher in 2021 (6.39 for ARTR; 0.42 for ATR) than 2020 (5.91 for ARTR; 0.40 for ATR) and for one turnover ratio were lower in 2021 (-3.14 for ITR) than 2020 (-3.09 for ITR). The mean values for one leverage ratio were the same in 2021 and 2020 (0.55 for TDR), for one leverage ratio were lower in 2021 (-11.55 for ICR) than 2020 (-7.33 for ICR) and for one leverage ratio were higher in 2021 (0.42 for LDR) than 2020 (0.41 for LDR). The mean values for all profitability ratios were higher in 2021 (0.06 for ROA; 0.13 for ROE; 0.13 for NPM) than 2020 (0.04 for ROA; 0.09 for ROE; 0.09 for NPM).

The mean values for all liquidity, leverage and profitability ratios were lower in 2022 (1.57 for CR; 1.09 for QR; 0.60 for CHR; 0.54 for TDR; 0.39 for LDR; -12.02 for ICR; 0.03 for ROA; 0.03 for ROE; 0.09 for NPM) than 2021 (1.73 for CR; 1.26 for QR; 0.74 for CHR; 0.55 for TDR; 0.42 for LDR; -11.55 for ICR; 0.06 for ROA; 0.13 for ROE; 0.13 for NPM). The mean values for all turnover ratios were higher in 2022 (-2.96 for ITR; 6.56 for ARTR; 0.46 for ATR) than 2021 (-3.14 for ITR; 6.39 for ARTR; 0.42 for ATR). The results of the Wilcoxon signed-rank tests where we compared the 2019 and 2020 values of the financial ratios and assessed whether their mean ranks differ to test H1 are presented in Table 5.

Table 5. The results of the Wilcoxon signed-rank tests for the 2019 and 2020 values of the financial ratios

Financial Ratios		Negative Ranks	Positive Ranks	Ties	Z	p
Liquidity Ratios	CR	2	4	0	-0.105	0.917
	QR	2	4	0	-0.105	0.917
	CHR	2	4	0	-0.105	0.917
Turnover Ratios	ITR	1	5	0	-1.051	0.293
	ARTR	4	2	0	-0.524	0.600
	ATR	4	1	1	-1.625	0.104
Leverage Ratios	TDR	4	2	0	-0.843	0.399
	LDR	3	2	1	-0.542	0.588
	ICR	2	4	0	-1.363	0.173
Profitability Ratios	ROA	2	1	3	-1.069	0.285
	ROE	4	1	1	-1.355	0.176
	NPM	4	2	0	-1.378	0.168

The results indicated that there were relatively more instances where the values of the liquidity ratios in 2020 were higher than those in 2019 (Negative Ranks: 2, Positive Ranks: 4, Ties: 0 for CR; Negative Ranks: 2, Positive Ranks: 4, Ties: 0 for QR; Negative Ranks: 2, Positive Ranks: 4, Ties: 0 for CHR); where the values of the turnover ratios in 2020 were lower than those in 2019 (Negative Ranks: 1, Positive Ranks: 5, Ties: 0 for ITR; Negative Ranks: 4, Positive Ranks: 2, Ties: 0 for ARTR; Negative Ranks: 4, Positive Ranks: 1, Ties: 1 for ATR); where the values of the leverage ratios in 2020 were lower than those in 2019 (Negative Ranks: 4, Positive Ranks: 2, Ties: 0 for TDR; Negative Ranks: 3, Positive Ranks: 2, Ties: 1 for LDR; Negative Ranks: 2, Positive Ranks: 4, Ties: 0 for ICR); and where the

values of the profitability ratios in 2020 were lower than those in 2019 (Negative Ranks: 2, Positive Ranks: 1, Ties: 3 for ROA; Negative Ranks: 4, Positive Ranks: 1, Ties: 1 for ROE; Negative Ranks: 4, Positive Ranks: 2, Ties: 0 for NPM).

Moreover, according to the Wilcoxon signed-rank tests' results for liqudity ratios (Z: -0.105 and p>0.05 for CR; Z: -0.105 and p>0.05 for QR; Z: -0.105 and p>0.05 for CHR), turnover ratios (Z: -1.051 and p>0.05 for ITR; Z: -0.524 and p>0.05 for ARTR; Z: -1.625 and p>0.05 for ATR), leverage ratios (Z: -0.843 and p>0.05 for TDR; Z: -0.542 and p>0.05 for LDR; Z: -1.363 and p>0.05 for ICR) and profitability ratios (Z: -1.069 and p>0.05 for ROA; Z: -1.355 and p>0.05 for ROE; Z: -1.378 and p>0.05 for NPM) there were no statistically significant differences between any of the financial ratios' values in 2019 and 2020. Therefore, H1 was rejected. The results of the Wilcoxon signed-rank tests where we compared the 2020 and 2021 values of the financial ratios and assessed whether their mean ranks differ to test H2 are presented in Table 6.

Table 6. The results of the Wilcoxon signed-rank tests for the 2020 and 2021 values of the financial ratios

Financial Ratios		Negative Ranks	Positive Ranks	Ties	Z	p
Liquidity Ratios	CR	4	2	0	-1.367	0.172
	QR	4	2	0	-1.153	0.249
	CHR	4	2	0	-1.153	0.249
Turnover Ratios	ITR	3	3	0	-0.524	0.600
	ARTR	1	5	0	-1.572	0.116
	ATR	1	5	0	-0.943	0.345
Leverage Ratios	TDR	4	1	1	-0.677	0.498
	LDR	5	1	0	-0.954	0.340
	ICR	5	1	0	-1.572	0.116
Profitability Ratios	ROA	1	5	0	-1.701	0.089
	ROE	0	6	0	-2.214	0.027
	NPM	0	5	1	-2.032	0.042

The results indicated that there were relatively more instances where the values of the liquidity ratios in 2021 were lower than those in 2020 (Negative Ranks: 4, Positive Ranks: 2, Ties: 0 for CR; Negative Ranks: 4, Positive Ranks: 2, Ties: 0 for QR; Negative Ranks: 4, Positive Ranks: 2, Ties: 0 for CHR); where the values of the turnover ratios in 2021 were higher than those in 2020 (Negative Ranks: 3, Positive Ranks: 3, Ties: 0 for ITR; Negative Ranks: 1, Positive Ranks: 5, Ties: 0 for ARTR; Negative Ranks: 1, Positive Ranks: 5, Ties: 0 for ATR); where the values of the leverage ratios in 2021 were lower than those in 2020 (Negative Ranks: 4, Positive Ranks: 1, Ties: 1 for TDR; Negative Ranks: 5, Positive Ranks: 1, Ties: 0 for LDR; Negative Ranks: 5, Positive Ranks: 1, Ties: 0 for ICR); and where the values of the profitability ratios in 2021 were higher than those in 2020 (Negative Ranks: 1, Positive Ranks: 5, Ties: 0 for ROA; Negative Ranks: 0, Positive Ranks: 6, Ties: 0 for ROE; Negative Ranks: 0, Positive Ranks: 5, Ties: 1 for NPM).

Moreover, according to the Wilcoxon signed-rank tests' results for liqudity ratios (Z: -1.367 and p>0.05 for CR; Z: -1.153 and p>0.05 for QR; Z: -1.153 and p>0.05 for CHR), turnover ratios (Z: -0.524 and p>0.05 for ITR; Z: -1.572 and p>0.05 for ARTR; Z: -0.943 and p>0.05 for ATR) and leverage ratios (Z: -0.677 and p>0.05 for TDR; Z: -0.954 and p>0.05 for LDR; Z: -1.572 and p>0.05 for ICR), there were no statistically significant differences between any of the liqudity, turnover and leverage ratios' values in 2020 and 2021. On the other hand,

the Wilcoxon signed-rank tests' results for profitability ratios (Z: -1.701 and p>0.05 for ROA; Z: -2.214 and p<0.05 for ROE; Z: -2.032 and p<0.05 for NPM) showed that; although there were no statistically significant differences between ROA's values in 2020 and 2021, the 2020 values of ROE and NPM were significantly different from their 2021 values and the 2021 values of ROE and NPM were higher than the 2020 values of ROE and NPM. Therefore, H2 was accepted. The results of the Wilcoxon signed-rank tests where we compared the 2021 and 2022 values of the financial ratios and assessed whether their mean ranks differ to test H3 are presented in Table 7.

Table 7. The results of the Wilcoxon signed-rank tests for the 2021 and 2022 values of the financial ratios

Financial Ratios		Negative Ranks	Positive Ranks	Ties	Z	p
Liquidity Ratios	CR	4	2	0	-0.943	0.345
	QR	5	1	0	-1.153	0.249
	CHR	5	1	0	-0.943	0.345
Turnover Ratios	ITR	1	5	0	-1.367	0.172
	ARTR	2	4	0	-0.734	0.463
	ATR	0	5	1	-2.060	0.039
Leverage Ratios	TDR	5	1	0	-0.954	0.340
	LDR	5	1	0	-1.787	0.074
	ICR	3	3	0	-0.314	0.753
Profitability Ratios	ROA	3	1	2	-1.134	0.257
	ROE	4	1	1	-1.633	0.102
	NPM	3	2	1	-1.219	0.223

The results indicated that there were relatively more instances where the values of the liquidity ratios in 2022 were lower than those in 2021 (Negative Ranks: 4, Positive Ranks: 2, Ties: 0 for CR; Negative Ranks: 5, Positive Ranks: 1, Ties: 0 for QR; Negative Ranks: 5, Positive Ranks: 1, Ties: 0 for CHR); where the values of the turnover ratios in 2022 were higher than those in 2021 (Negative Ranks: 1, Positive Ranks: 5, Ties: 0 for ITR; Negative Ranks: 2, Positive Ranks: 4, Ties: 0 for ARTR; Negative Ranks: 0, Positive Ranks: 5, Ties: 1 for ATR); where the values of the leverage ratios in 2022 were lower than those in 2021 (Negative Ranks: 5, Positive Ranks: 1, Ties: 0 for TDR; Negative Ranks: 5, Positive Ranks: 1, Ties: 0 for LDR; Negative Ranks: 3, Positive Ranks: 3, Ties: 0 for ICR); and where the values of the profitability ratios in 2022 were lower than those in 2021 (Negative Ranks: 3, Positive Ranks: 1, Ties: 2 for ROA; Negative Ranks: 4, Positive Ranks: 1, Ties: 1 for ROE; Negative Ranks: 3, Positive Ranks: 2, Ties: 1 for NPM).

Moreover, according to the Wilcoxon signed-rank tests' results for liqudity ratios (Z: -0.943 and p>0.05 for CR; Z: -1.153 and p>0.05 for QR; Z: -0.943 and p>0.05 for CHR), leverage ratios (Z: -0.954 and p>0.05 for TDR; Z: -1.787 and p>0.05 for LDR; Z: -0.314 and p>0.05 for ICR) and profitability ratios (Z: -1.134 and p>0.05 for ROA; Z: -1.633 and p>0.05 for ROE; Z: -1.219 and p>0.05 for NPM), there were no statistically significant differences between any of the liqudity, leverage and profitability ratios' values in 2021 and 2022. On the other hand, the Wilcoxon signed-rank tests' results for turnover ratios (Z: -1.367 and p>0.05 for ITR; Z: -0.734 and p>0.05 for ARTR; Z: -2.060 and p<0.05 for ATR) showed that; although there were no statistically significant differences between ITR's and ARTR's 2021 values and their 2022 values, the 2021 values of ATR were significantly different from its 2022 values and the 2022 values of ATR were higher than the 2021 values of ATR. Therefore, H3 was accepted.

4. Discussion and Conclusion

We did ratio analysis and then conducted Wilcoxon signed-rank tests to evaluate the financial performances of the medical device companies among Fortune 500 companies before, during and after the COVID-19 pandemic. According to the results of the Wilcoxon signed-rank tests where we compared the 2019 and 2020 values of the medical device companies among Fortune 500 companies' financial ratios, there were no statistically significant differences between them. This suggests that the medical device companies among Fortune 500 companies were able to keep their financial performances steady when they first experienced the COVID-19 pandemic.

The results of the Wilcoxon signed-rank tests where we compared the 2020 and 2021 values of the medical device companies among Fortune 500 companies' financial ratios showed that there were no statistically significant differences between the values of the companies' liquidity, turnover and leverage ratios; however the values of two of the three profitability ratios (ROA and NPM) were significantly different and were higher in 2021 than 2020. This indicates that the medical device companies among Fortune 500 companies were able to increase their profits in the second year of the COVID-19 pandemic.

Moreover, the findings of the Wilcoxon signed-rank tests where we compared the 2021 and 2022 values of the medical device companies among Fortune 500 companies' financial ratios showed that there were no statistically significant differences between the values of the companies' liquidity, leverage and profitability ratios; however the values of one of the three turnover ratios (ATR) were significantly different and were higher in 2022 than 2021. This implies that the medical device companies among Fortune 500 companies were able to use their assets more efficiently after the COVID-19 pandemic.

Our findings suggest that the medical device companies among Fortune 500 companies had a strong financial performance before, during and after the COVID-19 pandemic. The results of the present study are in accordance with the results of other similar studies which found that the COVID-19 pandemic did not have a significantly negative impact on the financial performances of companies in the healthcare sector and its sub-sectors (Gidwani & Damberg, 2023; He et al., 2023; Tengilimoğlu et al., 2023; Zheng et al., 2023), although there are also studies that found a significant and negative impact of the COVID-19 pandemic on healthcare companies' financial performances (Mahssouni et al., 2022). However, it is important to note that; although no significant difference was found according to the Wilcoxon signed-rank test results in the study, there was a difference in the change rates over the years. In the literature, business strategies are found to have a positive impact on companies' financial performances during the COVID-19 pandemic (Maemunah & Cuaca, 2021). Therefore, managers and policymakers in the medical device sector may benefit from our findings to develop strategies for possible future pandemics and crisis periods.

The main limitation of the study is that we specifically focused on the medical device sector, and more specifically on the medical device companies among Fortune 500 companies; thus, our results are not generalizable. Moreover, we only focused on the COVID-19 pandemic. Similar analyses can be done in other sectors and for different crisis periods. Also, different criteria for financial performance can be used and different statistical analyses can be conducted.

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