FACTORS INFLUENCING THE FINANCIAL PERFORMANCE STRATEGY OF HEALTHCARE LISTED COMPANIES DURING THE COVID-19 PANDEMIC

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Abstract

This study aims to examine the performance of 1,236 Chinese-listed healthcare companies, focusing on the pre- and post-COVID-19 periods. Utilizing multiple regression, ordinary least squares (OLS), fixed-effects model (FEM), and random-effects model (REM) to investigate the relationship between financial indicators and company performance during the COVID-19 pandemic. The study measures profitability using return on assets (ROA) and return on equity (ROE) as dependent variables. Key financial metrics, namely debt-to-asset ratio (D/A), debt-to-equity ratio (D/E), sales growth (SG), operating cash flows (OCF), and size (S), are used as independent variables in this study. The findings reveal significant variations in company performance across different models and periods. The results suggest that financial liquidity, leverage (Batrancea, 2021), SG, and OCF have a significant impact on company performance (Musa et al., 2022). However, the novelty of this study is that COVID-19 has no statistically significant changes in the profitability of Chinese health firms. This study contributes to a deeper understanding of financial dynamics within the healthcare sector and provides valuable insights for stakeholders navigating the challenges posed by the COVID-19 pandemic.

Keywords: Healthcare Sector, COVID-19 Pandemic, Financial Performance, Return on Equity, Return on Assets, Debt-to-Asset Ratio, Debt-to-Equity Ratio, Sales Growth, Operating Cash Flows

Authors' individual contribution: Conceptualization — J.L. and K.T.; Methodology — K.T.; Data Curation — J.L.; Writing — Original Draft — J.L. and K.T.; Writing — Review & Editing — J.L. and K.T.; Supervision — K.T.; Funding Acquisition — J.L.

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1. INTRODUCTION

The healthcare sector plays a critical role in ensuring the well-being of individuals and communities, and its performance is closely tied to public health outcomes and economic stability. Over the years, the healthcare industry has witnessed significant transformations driven by advancements in medical technology, changes in healthcare policies, and shifts in consumer behavior. However, the outbreak

of the COVID-19 pandemic in late 2019 brought unprecedented challenges to the healthcare sector worldwide, disrupting healthcare delivery systems, straining healthcare resources, and reshaping the landscape of the industry (Liu et al., 2022).

The COVID-19 pandemic has far-reaching implications for healthcare organizations, including hospitals, pharmaceutical companies, medical device manufacturers, and healthcare service providers (Filip et al., 2022). These organizations have faced immense pressure to adapt to rapidly changing conditions, implement new protocols to mitigate the spread of the virus, and ensure the continuity of essential healthcare services. Moreover, the pandemic has exposed vulnerabilities in healthcare supply chains, highlighted disparities in access to healthcare services, and underscored the importance of resilience and preparedness (Smallwood et al., 2022).

Among these challenges, understanding the financial performance of healthcare companies before and after the COVID-19 pandemic is very important. Financial dimensions such as profitability, liquidity, leverage, and operational efficiency provide valuable insights into the resilience of healthcare organizations and their ability to weather the pandemic storm. By analyzing changes in these indicators over time, researchers and stakeholders can gain a deeper understanding of the financial impact of the pandemic on the healthcare sector and identify strategies to enhance financial resilience and sustainability in the future (Ichsani et al., 2022).

The healthcare industry has demonstrated resilience in the face of the COVID-19 epidemic, experiencing significant growth and productivity amidst the downturn, affecting many other Chinese sectors. Data from the Chinese National Bureau of Statistics (NBS) revealed notable increases in investment and added value within the healthcare sector during the first quarter of 2022 (Xue, 2023). Manufacturing activities related to biological medicines and goods saw impressive growth rates, with investments increasing by 15.1% and added value increasing by 10.5%. Production capacity has also surged, with daily outputs reaching hundreds of millions for certain products. For instance, alcohol for medicinal use saw a remarkable 24.8% year-over-year increase, while mask production soared by 3.5 times compared to the previous year. Financial data from Wind, a leading information provider, further underscores the industry's robust performance, with most listed healthcare companies reporting profit growth during the first quarter. Of 328 publicly traded companies, 270 recorded profit increases, accounting for 82% of the total, while only 58 reported net profit declines, constituting 18% of the total (Wang & Xu, 2024).

As a result of the outbreak, several local Chinese hospitals postponed or halted part of their normal medical services, while some general patients decided to minimize the danger by visiting hospitals as infrequently or infrequently as feasible, resulting in a decrease in demand for routine medical services. The epidemic also caused many companies to interrupt their normal business activities, such as postponing all Chinese Medical Association academic meetings until April. For most medical companies, whose main business is not directly related to the epidemic, their revenue will be under great pressure in the first quarter of this year. However, the epidemic reflects the importance and long-term potential of the healthcare industry, and this epidemic may also become a catalyst and gas pedal for the long-term development of China's healthcare industry (Leite et al., 2021).

This research presents a comprehensive analysis of the financial performance of healthcare companies before and after the COVID-19 pandemic. By leveraging real-world data, the researchers examined key financial indicators, such as return on equity (ROE), return on assets (ROA), debt-to-asset ratio (D/A), debt-to-equity ratio (D/E), sales growth (SG), operating cash flows (OCF), and size (S) to assess the impact of the pandemic on the financial health of healthcare organizations. Through statistical analysis, regression models, and robustness checks, the researchers provide insights into the dynamics of the healthcare sector amid the COVID-19 pandemic and offer recommendations for enhancing financial resilience and sustainability in the face of future challenges.

According to the limitations of studying COVID-19 and financial data on the financial impact on listed healthcare companies in China, the following are the research questions:

RQ1: What were the changes in the financial performance of Chinese healthcare companies after the COVID-19 outbreak, and in which direction?

RQ2: How did the financial ratios of healthcare companies in China change after the COVID-19 pandemic, and what impact did this change have on financial performance?

The objectives of this study are to assess the impact of COVID-19 and other key financial indicators, such as the current ratio (CR), D/A, D/E, SG, OCF, and S of healthcare companies in China in response to the COVID-19 pandemic. In this context, this study contributes to the existing literature by examining the financial performance of healthcare companies during the COVID-19 pandemic. The study employed regression models (ordinary least squares [OLS], fixed-effects model [FEM], and random-effects model [REM]), and robustness checks using Hausman test, the researchers seek to provide insights into the financial resilience and sustainability of healthcare organizations amidst the challenges posed by the pandemic. Through this research, the researchers hope to take the findings to support the decision of policymakers, healthcare leaders, and stakeholders about the implications of the COVID-19 pandemic on the financial health of the healthcare sector and identify strategies to enhance resilience (Lesmana & Daryanto, 2019). In addition, this study provides actionable insights and recommendations for healthcare companies in China to enhance their financial resilience and performance amid the challenges posed by the COVID-19 pandemic and other economic uncertainties. This study contributes to a better understanding of the dynamics among COVID-19, financial variables, and the performance of healthcare companies in China, ultimately providing valuable insights for stakeholders in the healthcare industry.

The structure of this paper is as follows. Section 2 reviews the relevant literature. Section 3 presents the methodology that has been used to conduct empirical research. Section 4 illustrates the findings of this study. Section 5 outlines the conclusion and recommendations.

2. LITERATURE REVIEW

Analyzing financial performance is important in comprehending organizations' operational efficacy, resilience, and long-term sustainability. Within the healthcare sector, financial performance is distinctive because of its direct ramifications on public health and the stability of the national economy. This sector operates at the confluence of societal welfare and economic forces, wherein proficient financial administration is crucial for sustaining service provision, especially in times of crisis.

Extensive research has been conducted to understand the financial dynamics of healthcare organizations and their responses to various external factors, including economic fluctuations, regulatory changes, and technological advancements (Batrancea, 2021; Bolton et al., 2021; Chen et al., 2022; Filip et al., 2022; Ichsani et al., 2022; Kaye et al., 2021; Provenzano et al., 2020). However, the outbreak of the COVID-19 pandemic in late 2019 introduced unprecedented challenges to the healthcare industry, prompting a renewed focus on understanding the financial resilience and sustainability of healthcare organizations in the face of global crises (Achim et al., 2022; Leite et al., 2021; Lesmana & Daryanto, 2019; Liu et al., 2022; Musa et al., 2022; Rafieepour et al., 2021; Sun et al., 2021; Wang et al., 2021; Xue, 2023).

Prior to the COVID-19 pandemic, some studies highlighted the importance of financial indicators such as D/A, D/E, SG, OCF, and S in assessing the financial health and performance of healthcare companies. These financial indicators play a crucial role in determining healthcare organizations' profitability, liquidity, and operational efficiency, influencing their ability to deliver quality care and achieve sustainable growth (Pink et al., 2007; Sahoo et al., 2022).

The COVID-19 pandemic has significantly affected the financial landscape of the healthcare sector, presenting challenges and opportunities for healthcare organizations (Basuony et al., 2023; Kaye et al., 2021). Studies have documented the immediate financial implications of the pandemic, including disruptions to healthcare services, decline in patient volumes, and increased costs associated with pandemic response efforts. These challenges have been particularly pronounced for healthcare organizations with limited financial reserves and high debt levels, highlighting the importance of financial resilience and risk management in mitigating external shocks (Bolton et al., 2021; Giovando, 2022).

In response to the COVID-19 pandemic, healthcare organizations have implemented various strategies (Azizi et al., 2021; Elavarasan & Pugazhendhi, 2020; Farsalinos et al., 2021; Rafieepour et al., 2021) to navigate financial uncertainties and ensure the continuity of essential services. These strategies include cost-containment measures, revenue diversification initiatives, and investments in digital health technologies to enhance efficiency and improve patient outcomes. Additionally, government interventions such as stimulus packages, loan programs, and regulatory relief measures have provided financial support to healthcare organizations, helping them weather the economic downturn caused by the pandemic (Provenzano et al., 2020).

Despite these efforts, the long-term financial implications of the COVID-19 pandemic remain uncertain (Achim et al., 2022).

CR is an important financial indicator used to evaluate the financial liquidity of healthcare organizations (Amagtome & Alnajjar, 2020; Wackers et al., 2024). It assesses a company's ability to cover short-term liabilities using its short-term assets. The COVID-19 pandemic has significantly affected China's medical industry's CR because of interruptions in the healthcare supply chain, a decline in patient volume, and changes in patient behavior (Rababah et al., 2020; Sharma et al., 2020).

During the COVID-19 pandemic, the healthcare industry encountered significant financial challenges driven by the surging demand for healthcare services and the need to invest in new equipment and technology to address the crisis effectively. Consequently, many healthcare companies found themselves compelled to resort to increased debt financing to meet these unprecedented demands, consequently impacting their D/A (Batrancea, 2021; Ismaeel & Soliman, 2022).

Amid the COVID-19 pandemic, the D/E ratio assumed heightened importance for healthcare companies, given their substantial financial challenges. With the global economic slowdown and market instability, healthcare industry firms grappled with maintaining financial stability and fulfilling their debt obligations. The pandemic triggered a sharp upswing in healthcare expenditure, necessitating substantial investments by governments and healthcare providers in medical equipment, supplies, and infrastructure to combat the virus (Musa et al., 2022).

The COVID-19 pandemic has introduced various challenges that have significantly impacted SG in the healthcare industry. For example, many hospitals and clinics were compelled to suspend or reduce their services owing to government-mandated lockdowns and safety measures. This results in decreased revenue and, consequently, a decline in SG for several companies (Sun et al., 2021). Conversely, some healthcare companies involved in producing medical equipment and supplies have experienced increased demand during the pandemic, leading to robust SG. Additionally, certain companies can quickly adapt to evolving market conditions by integrating new technologies or expanding their telemedicine services, further boosting their SG (Munde & Mishra, 2022; Wang et al., 2021).

The COVID-19 pandemic has posed significant challenges to the OCF of healthcare organizations in China. For example, many hospitals and clinics have experienced disruptions in their cash flows due to reduced patient volumes, delayed payments from insurers, and increased expenses related to pandemic response measures (Sun et al., 2021). Furthermore, implementing lockdowns and social distancing measures has decreased healthcare providers' revenue generation. This reduction in revenue, coupled with increased costs associated with acquiring personal protective equipment (PPE) and implementing safety protocols, puts pressure on the OCF of many healthcare companies (Wang et al., 2021). These challenges may have impacted the growth and overall size of assets for certain companies within the industry (Francis, 2020).

Studies have highlighted the significant role of asset size in shaping healthcare companies' financial performance. Chen et al. (2022) find a positive correlation between the size of assets in Chinese

hospitals and their financial success. This suggests that larger hospitals may have greater resources to invest in advanced technologies and equipment, attract and retain talent, and offer a broader range of services to patients.

Agency theory provides the dynamics of principal-agent relationships within organizational frameworks and their consequential effects on financial performance (Bendickson et al., 2016; Kasbar et al., 2023; Shapiro, 2005). The congruence of managerial actions with shareholder objectives is paramount for enhancing financial outcomes (Kasbar et al., 2023). The principal-agent dynamics characteristic of healthcare organizations entail shareholders delegating financial decision-making authority to managers. The efficacy of these relationships exerts a direct impact on financial performance. Conflicts of interest can arise if managers put their personal gain ahead of shareholders, impacting financial performance (Battilana et al., 2022). Agency costs may arise from such conflicts, resulting in inefficiencies and diminished financial performance. To alleviate these costs, Agency Theory underscores the significance of governance mechanisms that harmonize the interests of managers and shareholders. Robust governance structures, encompassing transparent financial reporting, fair executive remuneration, and independent boards, are instrumental in enhancing financial performance within Chinese healthcare organizations (Kasbar et al., 2023).

In addition to agency theory, other pertinent theories can substantiate the relationships delineated in the hypotheses. Stakeholder theory posits that the financial performance of an organization is contingent upon its ability to effectively address the requirements of all its stakeholders (Choi & Wang, 2009; Friedman & Miles, 2002) — employees, clients, and the community — rendering this, particularly the COVID-19 pandemic. Moreover, the resource-based view (RBV) theory highlights that a business's intrinsic assets and capabilities, including financial administration and operational prowess, are indispensable for its competitive positioning and financial achievements (Lockett et al., 2009; Nandi et al., 2021). These theoretical perspectives, in conjunction with agency theory, furnish a holistic framework for comprehending the determinants that influence the financial performance of Chinese healthcare firms.

The following hypotheses investigate the relationship between various financial indicators and the financial performance of healthcare companies in the Chinese sector: financial performance is typically measured using metrics such as ROA and ROE, which provide insights into a company's profitability and efficiency in utilizing its assets and equity. ROA and ROE are among the most commonly used metrics in financial performance analysis (Attayah et al., 2022; Batchimeg, 2017; Lassala et al., 2017). The hypotheses explore how different financial indicators, including the CR, D/A, D/E, SG, OCF, and S, may influence the financial performance of Chinese healthcare companies, with ROA and ROE as dependent variables. Additionally, COVID-19 is proposed as one of the variables that may influence the financial performance of Chinese healthcare companies.

H1: Current ratio positively influences the financial performance of Chinese healthcare companies, as measured by return on assets and return on equity.

A higher CR indicates a company's ability to cover its short-term liabilities with short-term assets, which may indicate liquidity and financial stability. Thus, it is hypothesized that higher CR will lead to improved financial performance in the Chinese healthcare sector.

H2: The debt-to-asset ratio positively influences the financial performance of Chinese healthcare companies.

A higher D/A ratio suggests that a company has more assets financed through debt, which may indicate higher leverage and potential profitability. Therefore, we hypothesize that a higher D/A ratio will improve financial performance in the Chinese healthcare sector.

H3: The debt-to-equity ratio positively influences the financial performance of Chinese healthcare companies.

A higher D/E ratio indicates a higher proportion of financing from debt relative to equity, which may imply higher financial leverage and potentially higher returns for shareholders. Hence, we hypothesize that a higher D/E ratio will improve financial performance in the Chinese healthcare sector.

H4: Sales growth is expected to have a positive impact on the financial performance of Chinese healthcare companies.

Higher SG indicates increased revenue, which can contribute to improved profitability and return. Therefore, we hypothesize that a higher SG will improve financial performance in the Chinese healthcare sector.

H5: Operating cash flows are posited to positively influence the financial performance of Chinese healthcare companies.

OCF reflects the cash generated from a company's core operations, which can be used for investments, debt repayment, and other activities. Thus, it is hypothesized that higher OCF will lead to improved financial performance in the Chinese healthcare sector.

H6: COVID-19 is posited to negatively influence Chinese healthcare companies' financial performance (return on assets and return on equity).

The COVID-19 pandemic has introduced unprecedented challenges and disruptions to the global economy and healthcare sector, which may impact companies' financial performance. Therefore, we hypothesize that COVID-19 may influence financial performance in the Chinese healthcare sector.

3. RESEARCH METHODOLOGY

3.1. Population and sample selection

This study focuses on the financial performance of healthcare companies listed on the Shanghai and Shenzhen Stock Exchanges in China, covering the period from before to after the COVID-19 pandemic. The sample included 206 healthcare companies, selected based on specific inclusion and exclusion criteria: 1) listed on the Shanghai and Shenzhen Stock Exchanges, 2) publicly available financial reports for both pre- and post-COVID-19 periods, and 3) operating in the healthcare sector, including equipment and supplies, providers and services, healthcare technology, and pharmaceuticals.

In the preliminary stage, data collection from Bloomberg was 293. After cleaning the data to include the completed financial information,

206 companies were used in this study. The data were collected for six years from 2017–2022. The total number of firm-year observations was 1,236.

3.2. Research method

The quantitative investigation included multiple regression analysis and descriptive statistics to examine the relationship between independent factors and the financial success of healthcare businesses during the COVID-19 epidemic. Multiple regression analysis was employed.

The relationship between the financial performance of healthcare companies and the selected factors was analyzed using a panel data regression model. This model aims to quantify the effect of the independent factors on corporate performance across different periods and company-specific characteristics. The utilization of the panel data model facilitates the examination of corporate performance longitudinally while simultaneously considering firm-specific attributes. The model takes the following form:

$$ROA_{it} = \alpha + \beta_1 CR_{it} + \beta_2 DA_{it} + \beta_3 DE_{it} + \beta_4 SG_{it} + \beta_5 OCF_{it} + \beta_6 S_{it} + \beta_7 CV19_{it} + \varepsilon \quad (1)$$

$$ROE_{it} = \alpha + \beta_1 CR_{it} + \beta_2 DA_{it} + \beta_3 DE_{it} + \beta_4 SG_{it} + \beta_5 OCF_{it} + \beta_6 S_{it} + \beta_7 CV19_{it} + \varepsilon \quad (2)$$

where,

- ROA_{it} = return on assets of the Chinese healthcare listed companies *i* at time *t*;
- ROE_{it} = return on equity of the Chinese healthcare listed companies *i* at time *t*;
- CR_{it} = current ratio of Chinese healthcare listed company *i* at time *t*;
- DA_{it} = debt-to-asset ratio of Chinese healthcare listed company *i* at time *t*;
- DE_{it} = debt-to-equity ratio of Chinese healthcare listed company *i* at time *t*;
- SG_{it} = sales growth of Chinese healthcare listed company *i* at time *t*;
- OCF_{it} = operating cash flows of Chinese healthcare listed company *i* at time *t*;
- S_{it} = size of Chinese healthcare listed company *i* at time *t*;
- $CV19_{it}$ = a dummy variable where 0 is the year before COVID-19 (2017–2019), 1 is the year after COVID-19 (2020–2022);
- ε = the error term;
- α and β_1, β_2, β_3, β_4, β_5, β_6, β_7 = the coefficients to be estimated.

This research utilized multiple regression analysis and panel data modeling. However, different approaches, including time series, structural equation modeling (SEM), and difference-in-differences (DiD), may have also suited the research inquiry.

Rather than opting for panel data regression methods, one could have utilized a time series analysis to investigate the financial health of healthcare institutions throughout defined time frames, particularly highlighting the changes in financial measures leading up to, throughout, and post the COVID-19 outbreak. Time series methodologies like autoregressive integrated moving average (ARIMA) or vector autoregression (VAR) are likely to provide impactful insights into how these variables evolve over time and may improve the reliability of future performance estimates.

Another approach to explore the causal links between various independent variables, like financial metrics, and dependent variables, could be through SEM. This methodological framework would enable the concurrent analysis of multiple relationships and the assessment of mediating effects, including the function of COVID-19 as a mediating variable influencing the relationship between financial indicators and organizational performance.

If the study had aimed to assess times prior to and after the pandemic, a DiD framework might have been leveraged to delve into the fallout of COVID-19 on the economic standing of healthcare companies. DiD explores the fluctuations in outcomes (*ROA, ROE*) between a treatment set (entities undergoing pandemic effects) and a comparison set (entities or sectors that faced fewer disruptions from the pandemic) to isolate the causal influences of COVID-19.

4. RESULTS

4.1. Descriptive analysis

The average *CR* is 2.72, indicating that companies generally had 2.72 times more current assets than current liabilities, with high variability (standard deviation of 2.67). The range was from 0.11 to 31.20. On average, companies financed 16.28% of their *D/A*, with significant variability (standard deviation = 13.84%). The ratio ranges from 0.00% to 69.27%. The average *D/E* is 36.39%, suggesting reliance on equity financing, albeit with substantial variability (standard deviation of 46.92%). The range ranged from 0.00% to 293.36%. The average *SG* rate was 21.85%, with a wide range of performance (standard deviation of 44.63%), from -86.37% to 397.80%. The average *OCF* was 2.83 with significant variability (standard deviation of 3.14), ranging from -86.37 to 397.80. The average *S* of the companies was 8.45, with a standard deviation of 1.30, ranging from 4.86 to 12.20, indicating differences in the scale of operations. The average *ROA* is 6.65%, with high variability (standard deviation of 9.02%), ranging from -54.10% to 73.77%. The average *ROE* was 12.16%, with significant variability (standard deviation of 16.36%), ranging from -75.41% to 176.19% (see Table 1).

Table 1. Descriptive information

Variable	Mean	Std. dev.	Min	Max
CV19	0.50	0.50	0.00	1.00
CR	2.72	2.67	0.11	31.20
D/A	16.28	13.84	0.00	69.27
D/E	36.39	46.92	0.00	293.36
SG	21.85	44.63	-86.37	397.80
OCF	2.83	3.14	3.42	4.26
S	8.45	1.30	4.86	12.20
ROA	6.65	9.02	-54.10	73.77
ROE	12.16	16.36	-75.41	176.19

Note: n = 1,236.
Source: Authors' elaboration.

4.2. Correlation analysis

A moderate negative correlation of -0.444 was observed between *CR* and *D/A* ($p < 0.05$). This finding suggests that companies with higher *CR* tend to have lower *D/A*, indicating stronger short-term liquidity and lower reliance on debt financing. A weak positive correlation of 0.216 was found between *SG* and *OCF* ($p < 0.05$). This indicates that companies with higher *SG* tend to generate higher *OCF*, reflecting strong operational performance and revenue generation. A weak negative correlation of -0.050 was observed between *SG* and *S* ($p < 0.05$). This suggests that larger companies tend to experience higher SG rates, potentially because of their broader market presence and economies of scale. There was a moderate positive correlation of 0.250 between *ROA* and *CR* ($p < 0.05$). This indicates that companies with higher CR tend to have higher *ROA*, reflecting efficient asset utilization. Similarly, there was a moderate positive correlation of 0.159 between *ROE* and *CR* ($p < 0.05$). Companies with higher *CR* tend to have higher *ROE*, indicating efficient capital utilization and potential shareholder value creation (see Table 2).

Table 2. Correlation

Variable	CR	D/A	D/E	SG	OCF	S	ROA	ROE
CR	1							
D/A	-0.444	1						
D/E	-0.356	0.863	1					
SG	0.069	-0.039	-0.047	1				
OCF	0.091	-0.085	-0.091	0.216	1			
S	-0.215	0.352	0.349	-0.050	0.461	1		
ROA	0.250	-0.339	-0.296	0.436	0.399	-0.076	1	
ROE	0.159	-0.205	-0.207	0.482	0.428	-0.027	0.923	1

Source: Authors' elaboration.

4.3. Main results and discussion

The variance inflation factor (VIF) analysis is performed and presented in Table 3. VIF is a measure used in regression analysis to detect multicollinearity — a situation where two or more independent variables are highly correlated. If VIF equals 1 means that there is no correlation between the predictor variable and other variables (no multicollinearity). However, if VIF is between 1 to 5 ($1 < VIF < 5$) means a moderate correlation but generally acceptable, whereas VIF over 5 presents a high correlation that could indicate problematic multicollinearity. The reciprocal of the VIF, or 1/VIF, represents the proportion of the variance of the variable that is not explained by the other predictors. If $1 / VIF \approx 1$ indicates the variable is largely independent of others. If 1 / VIF approaches 0 indicates that the variable is highly correlated with other variables (multicollinearity is present) (Daoud, 2017; Shrestha, 2020). In this study, VIF is below 5, where the highest is 4.33, and 1 / VIF is not approaching 0, where the lowest is 0.231. The multicollinearity has a moderate correlation, but is generally accepted (see Table 3).

Table 4 presents the results of multiple regression analyses examining the impact of various financial variables on the *ROA* and *ROE* for listed healthcare companies in China, using different estimation methods: 1) OLS, 2) FEM, and 3) REM.

Table 3. Variance inflation factor analysis

Variable	VIF	1/VIF
CR	1.3	0.769
D/A	4.33	0.231
D/E	4.03	0.248
SG	1.1	0.911
OCF	1.56	0.639
S	1.72	0.583
CV19	1.09	0.916
Mean VIF	2.16	

Source: Authors' elaboration.

The impact of the *CR* varied across models. While it was positive and significant in the OLS model for *ROA* (0.219, $p < 0.05$), it was negative and highly significant in the FEM model (-0.450, $p < 0.01$), indicating that higher liquidity may not always translate into better performance within individual companies.

Both the *D/A* and *D/E* generally had a negative impact on *ROA* and *ROE*, particularly in the FEMs. For instance, *D/A* has a coefficient of -0.278 ($p < 0.01$) for *ROA* and -0.148 ($p < 0.05$) for *ROE* in the FEM model. This finding suggests that higher leverage adversely affects financial performance, highlighting the risks associated with high levels of debt.

SG consistently showed a positive and significant impact on both *ROA* and *ROE* across all the models. For example, in the OLS model, the coefficient for *SG* is 0.068 ($p < 0.01$) for *ROA* and 0.140 ($p < 0.01$) for *ROE*. This highlights the critical role of SG in

enhancing financial performance, indicating that companies that managed to increase their sales during the pandemic performed better financially.

OCF is another variable that exhibits a positive and highly significant impact on both *ROA* and *ROE* in all models. The coefficient of *OCF* was 0.002 ($p < 0.01$) for both *ROA* and *ROE* in the OLS model. This underscores the importance of cash generation from normal business operations in improving companies' financial health.

The effect of company *S* on financial performance shows mixed results. It was positive and significant for *ROA* in the OLS (0.991, $p < 0.01$) and FEM (1.128, $p < 0.05$) models, but negative and significant for *ROE* in the OLS (-2.003, $p < 0.01$) and REM (-1.412, $p < 0.01$) models, suggesting that larger firms may not always achieve higher profitability relative to their equity.

The direct impact of the *CV19* variable was not significant in any of the *ROA* and *ROE* models. For instance, the coefficient for *CV19* is 0.205 for *ROA* and 0.246 for *ROE* in the OLS model, with p-values greater than 0.05. This indicates that other financial variables played a more critical role in determining healthcare companies' performance during the pandemic.

The adjusted R-squared values indicate that the models explain a substantial portion of the variability in *ROA* and *ROE*. For *ROA*, the adjusted R-squared in the OLS model was 0.3907, whereas for *ROE*, it was 0.3816.

The Hausman test results favored the FEM as the optimal model for both *ROA* and *ROE*, with Prob. > Chi^2 = 0.0000 and 0.0002, respectively. This suggests that the FEM provides the most reliable estimates by accounting for individual-specific effects that could bias the results if not included.

The regression analysis highlights that debt ratios (*D/A* and *D/E*) generally have a negative impact, particularly in FEM, reflecting the adverse effects of high leverage. The ratios of *SG* and *OCF* positively influence both *ROA* and *ROE*. The varying significance and direction of the *CR* and *S* across different models suggest the complex nature of the impact of these variables on financial performance. The Hausman test results favor the FEM, suggesting it provides the most reliable estimates for these data. The main results regarding the multiple regression models can be found in Table 4.

Table 4. Main results

Variables	*ROA*			*ROE*		
	OLS	***FEM***	***REM***	***OLS***	***FEM***	***REM***
Constant	13.601***	0.208	12.005***	23.822***	9.131	21.733***
CR	0.219**	-0.450***	-0.139	0.135	-0.636***	-0.260
D/A	0.167***	-0.278***	-0.234***	-0.058	-0.148**	-0.107*
D/E	0.009	0.005	0.008	-0.016	-0.053**	-0.034**
SG	0.068***	0.056***	0.062***	0.140***	0.119***	0.128***
OCF	0.002***	0.002***	0.002**	0.005***	0.005***	0.005***
S	0.991***	1.128**	-0.525**	-2.003***	0.434	-1.412***
CV19	0.205	-0.503	0.214	0.246	-0.553	0.223
R-squared	0.3942			0.3851		
Adjusted R-squared	0.3907			0.3816		
R-squared within		0.424	0.414		0.421	0.416
R-squared between		0.176	0.342		0.239	0.331
R-squared overall		0.288	0.378		0.335	0.377
Hausman	Prob. > Chi^2 = 0.0000. FEM is optimal.			Prob. > Chi^2 = 0.0002. FEM is optimal.		

*Note: *** Designates the 1% significant coefficients, **designates the 5% significant coefficients, and * designates the 10% significant coefficients. N = 1,236.*
Source: Authors' elaboration.

The influence of *CR* on financial performance presented a mixed picture. While it exerted a positive influence on *ROA* in the OLS model (coefficient of 0.219, p-value < 0.05), it exhibited a negative effect in the FEM model (coefficient of -0.450, p-value < 0.01). This variability indicates that while liquidity holds significance, it may not invariably translate into superior performance for individual firms. This incongruity leads to the rejection of *H1*, which posits that *CR* would positively impact financial performance. The findings imply that a harmonious balance between liquidity and efficient asset utilization is requisite for achieving optimal financial health.

In contrast, both debt ratios (*D/A* and *D/E*) generally exhibited a negative effect on *ROA* and *ROE*, particularly within the FEM. For instance, *D/A* presents a coefficient of -0.278 for *ROA* and -0.148 for *ROE* in the FEM framework. These findings reject *H2* and *H3*, which postulated that higher debt ratios would positively influence financial performance. The results suggest that increased leverage can adversely affect financial performance, especially during a pandemic when cash flow patterns may be inconsistent.

The empirical results demonstrate that *SG* exerted a consistently affirmative and statistically significant influence on both *ROA* and *ROE* across all analytical models employed. This outcome lends credence to *H4*, which asserts that *SG* would positively affect financial performance. The findings underscore the pivotal role of revenue generation in augmenting financial performance, particularly in times of crisis. Organizations that succeeded in augmenting their sales during the pandemic were comparatively more robust financially, indicating that adaptability in service offerings and market strategies is crucial for organizational resilience.

The *OCF* revealed a notable and statistically relevant influence on both *ROA* and *ROE*, showing a coefficient of 0.002 on *ROA* and coefficient of 0.005 on *ROE* in the OLS, FEM, and REM assessed. This finding corroborates *H5*, which proposed that elevated *OCF* would contribute to enhanced financial performance. The results elucidate the necessity of sustaining robust *OCF*, which is imperative for fulfilling short-term obligations and facilitating investments in growth opportunities. The capacity to generate cash from core operational activities is essential, particularly during periods marked by economic uncertainty.

The impact of COVID-19 on financial performance exhibited heterogeneous results. It illustrated no statistically significant differences for *ROA* and *ROE*. This observation suggests that during COVID-19, even though the health crisis situation may negatively influence the firms, it does not affect the firms' profitability. The results indicate that *H6*, which contended that COVID-19 would negatively influence financial performance, is not supported. In other words, it can be interpreted that the health firms in China are resilient enough during COVID-19.

These findings are consistent with the literature reviewed in this study. For instance, Liu et al. (2022) emphasized the importance of open innovation in times of crisis, which is reflected in the varied performance of companies depending on their adaptability and strategic initiatives. Smallwood et al. (2022) discuss the broader impact of the pandemic on healthcare workers, which indirectly affects financial performance through operational efficiency and costs. Ichsani et al. (2022) provide a comparative analysis of financial performance before and during the pandemic, which supports the observed variability in financial health among companies. This study also resonates with the findings of Achim et al. (2022) on the impact of COVID-19 on financial management, highlighting the crucial role of liquidity and efficient cash flow management. Moreover, the mixed impact of company size on financial performance echoes the observations by Chen et al. (2022) regarding the influence of hospital asset size on financial outcomes.

5. CONCLUSION

This study provides a comprehensive analysis of the financial performance of healthcare-listed companies in China during the COVID-19 pandemic. By examining key financial indicators such as the *CR, D/A, D/E, SG, OCF, S, ROA*, and *ROE*, it offers valuable insights into how these companies navigated the unprecedented challenges brought about by the pandemic.

The results present mixed impacts of *CR* on *ROA* and *ROE*. In the OLS model, *CR* positively and significantly impacts *ROA* (coefficient of 0.219, $p < 0.05$), supporting *H1* for *ROA*. However, in the FEM, *CR* negatively influenced both ROA (coefficient of -0.450, $p < 0.01$) and *ROE* (coefficient of -0.636, $p < 0.01$). *H1* is not supported. Contrary to *H2*, *D/A* consistently illustrates a negative impact on both *ROA* and *ROE* across all models, particularly in FEM (coefficient of -0.278, $p < 0.01$ for *ROA* and -0.148, $p < 0.05$ for *ROE*). This indicates that higher leverage is generally detrimental during a pandemic. The impact of the *D/E* is significantly negative. In the FEM, *D/E* negatively influenced *ROE* (coefficient of -0.053, $p < 0.05$), *H3* is not supported. This suggests that increased leverage did not positively contribute to financial performance during the pandemic. *SG* has a positive and significant effect on both *ROA* and *ROE* across all models (e.g., coefficient of 0.068, $p < 0.01$ for ROA in OLS and 0.140, $p < 0.01$ for ROE in OLS), supporting *H4*. This result underscores the importance of revenue growth in enhancing financial performance during a pandemic. OCF consistently positively and significantly impacts both *ROA* and *ROE* (coefficient of 0.002, $p < 0.01$, for both metrics in all models); *H5* is supported. This emphasizes the importance of efficient operations and cash management. The direct impact of the *CV19* is not significant in any of the models for *ROA* and *ROE*, indicating that while the pandemic had an overarching influence on financial performance, individual financial indicators played a more critical role in determining performance. This suggests that *CV19* does not influence the firms' performance, as hypothesized.

This study's findings have several important implications for managers, investors, and policymakers. The finding suggests that maintaining adequate liquidity is crucial for weathering economic downturns. High leverage can be particularly risky during crises, suggesting the need for careful debt management and maintaining lower debt levels. Companies that can maintain solid OCF and SG are better positioned to succeed, highlighting the need for effective operational strategies. The pandemic has underscored the importance of adaptability and resilience in corporate strategy. Future research could explore the long-term impacts of the pandemic on financial performance, consider sectors beyond healthcare, and investigate the role of government policies and interventions in shaping corporate outcomes during crises.

There are some limitations of the study. The present study is confined to healthcare enterprises that are publicly traded on the Shanghai and Shenzhen Stock Exchanges, China. This geographical constraint may limit the applicability of the results to alternative regions or nations that possess distinct healthcare infrastructures and economic contexts. Future studies may broaden the focus to encompass healthcare organizations from diverse countries, thereby facilitating a more exhaustive comprehension of the global healthcare environment during periods of crisis. Subsequent research could extend over an extended duration of the pandemic.

Moreover, this research focuses on financial measures but misses the importance of non-financial aspects that could shape performance, like employee morale, patient satisfaction, and the effectiveness of operations. Future research could adopt a more integrative framework by including financial and non-financial indicators to provide a more comprehensive perspective on healthcare performance. In addition, this research does not extensively investigate the influence of governmental interventions and policies during the pandemic, which could substantially affect the financial performance of healthcare entities. To our curiosity, COVID-19, as a potential variable that influences the profitability of healthcare companies, has no statistical significance. This contradicts the expectation that future research may explore why or what factors interfere with the relationship. Future research endeavors could explore alternative potential mediating or moderating variables, such as market conditions or organizational resilience, to enhance the understanding of these dynamics.

REFERENCES

Achim, M. V., Safta, I. L., Văidean, V. L., Mureşan, G. M., & Borlea, N. S. (2022). The impact of COVID-19 on financial management: Evidence from Romania. *Economic Research-Ekonomska Istraživanja, 35*(1), 1807–1832. https://doi.org/10.1080/1331677X.2021.1922090

Amagtome, A. H., & Alnajjar, F. A. (2020). Integration of financial reporting system and financial sustainability of nonprofit organizations: Evidence from Iraq. International *Journal of Business & Management Science, 10*(1), 27–47. https://search.ebscohost.com/login.aspx?direct=true&db=bsu&AN=147653531&site=ehost-live

Attayah, O. F., Dhiaf, M. M., Najaf, K., & Frederico, G. F. (2022). Impact of COVID-19 on financial performance of logistics firms: Evidence from G-20 countries. *Journal of Global Operations and Strategic Sourcing, 15*(2), 172–196. https://doi.org/10.1108/JGOSS-03-2021-0028

Azizi, M. R., Atlasi, R., Ziapour, A., Abbas, J., & Naemi, R. (2021). Innovative human resource management strategies during the COVID-19 pandemic: A systematic narrative review approach. *Heliyon, 7*(6), Article e07233. https://doi.org/10.1016/j.heliyon.2021.e07233

Basuony, M. A. K., Bouaddi, M., EmadEldeen, R., & Noureldin, N. (2023). The effect of gender board diversity across market quotation on firm performance: Evidence from the UK. *Corporate Ownership & Control, 20*(2), 146–155. https://doi.org/10.22495/cocv20i2art12

Batchimeg, B. (2017). Financial performance determinants of organizations: The case of Mongolian companies. *Journal of Competitiveness, 9*(3), 22–33. https://doi.org/10.7441/joc.2017.03.02

Batrancea, L. (2021). The influence of liquidity and solvency on performance within the healthcare industry: Evidence from publicly listed companies. *Mathematics, 9*(18), Article 2231. https://doi.org/10.3390/math9182231

Battilana, J., Obloj, T., Pache, A.-C., & Sengul, M. (2022). Beyond shareholder value maximization: Accounting for financial/social trade-offs in dual-purpose companies. *Academy of Management Review, 47*(2), 237–258. https://doi.org/10.5465/amr.2019.0386

Bendickson, J., Muldoon, J., Liguori, E., & Davis, P. E. (2016). Agency theory: The times, they are a-changin'. *Management Decision, 54*(1), 174–193. https://doi.org/10.1108/MD-02-2015-0058

Bolton, P., Kacperczyk, M., Hong, H., & Vives, X. (2021). *Resilience of the financial system to natural disasters.* Centre for Economic Policy Research (CEPR).

Chen, C., Song, X., & Zhu, J. (2022). How slack resource affects hospital financial performance: The evidence from public hospitals in Beijing. *Frontiers in Public Health, 10*, Article 982330. https://doi.org/10.3389/fpubh.2022.982330

Choi, J., & Wang, H. (2009). Stakeholder relations and the persistence of corporate financial performance. *Strategic Management Journal, 30*(8), 895–907. https://doi.org/10.1002/smj.759

Daoud, J. I. (2017). Multicollinearity and regression analysis. *Journal of Physics: Conference Series, 949*, Article 012009. https://doi.org/10.1088/1742-6596/949/1/012009

Elavarasan, R. M., & Pugazhendhi, R. (2020). Restructured society and environment: A review on potential technological strategies to control the COVID-19 pandemic. *Science of the Total Environment, 725*, Article 138858. https://doi.org/10.1016/j.scitotenv.2020.138858

Farsalinos, K., Poulas, K., Kouretas, D., Vantarakis, A., Leotsinidis, M., Kouvelas, D., Docea, A. O., Kostoff, R., Gerotziafas, G. T., Antoniou, M. N., Polosa, R., Barbouni, A., Yiakoumaki, V., Giannouchos, T. V., Bagos, P. G., Lazopoulos, G., Izotov, B. N., Tutelyan, V. A., Aschner, M., … Tsatsakis, A. (2021). Improved strategies to counter the COVID-19 pandemic: Lockdowns vs. primary and community healthcare. *Toxicology Reports, 8*, 1–9. https://doi.org/10.1016/j.toxrep.2020.12.001

Filip, R., Gheorghita Puscaselu, R., Anchidin-Norocel, L., Dimian, M., & Savage, W. K. (2022). Global challenges to public health care systems during the COVID-19 pandemic: A review of pandemic measures and problems. *Journal of Personalized Medicine, 12*(8), Article 1295. https://doi.org/10.3390/jpm12081295

Francis, J. R. (2020). COVID-19: Implications for supply chain management. *Frontiers of Health Services Management, 37*(1), 33–38. https://doi.org/10.1097/HAP.0000000000000092

Friedman, A. L., & Miles, S. (2002). Developing stakeholder theory. *Journal of Management Studies, 39*(1), 1–21. https://doi.org/10.1111/1467-6486.00280

Giovando, G. (2022). Governance responsibility in Italy to monitor corporate performance. *Corporate Ownership & Control, 19*(4), 153–162. https://doi.org/10.22495/cocv19i4art13

Ichsani, S., Wijaya, J. H., Hendiarto, S., & Hertina, D. (2022). Comparative study of the financial performance on pharmaceutical and healthcare companies before and during the COVID-19 pandemic. *Jurnal Ad'ministrare: Jurnal Pemikiran Ilmiah dan Pendidikan Administrasi Perkantoran, 9*(1), 245–254. https://doi.org/10.26858/ja.v9i1.36524

Ismaeel, F. N., & Soliman, M. M. (2022). The effect of corporate governance on the financial performance of SME listed companies in Egypt. *Corporate Ownership & Control, 20*(1), 95–102. https://doi.org/10.22495/cocv20i1art9

Kasbar, M. S. H., Tsitsianis, N., Triantafylli, A., & Haslam, C. (2023). An empirical evaluation of the impact of agency conflicts on the association between corporate governance and firm financial performance. *Journal of Applied Accounting Research, 24*(2), 235–259. https://doi.org/10.1108/JAAR-09-2021-0247

Kaye, A. D., Okeagu, C. N., Pham, A. D., Silva, R. A., Hurley, J. J., Arron, B. L., Sarfraz, N., Lee, H. N., Gamble, J. W., Liu, H., Urman, R. D., & Cornett, E. M. (2021). Economic impact of COVID-19 pandemic on healthcare facilities and systems: International perspectives. *Best Practice & Research Clinical Anaesthesiology, 35*(3), 293–306. https://doi.org/10.1016/j.bpa.2020.11.009

Lassala, C., Apetrei, A., & Sapena, J. (2017). Sustainability matter and financial performance of companies. *Sustainability, 9*(9), Article 1498. https://doi.org/10.3390/su9091498

Leite, H., Lindsay, C., & Kumar, M. (2021). COVID-19 outbreak: Implications on healthcare operations. *The TQM Journal, 33*(1), 247–256. https://doi.org/10.1108/TQM-05-2020-0111

Lesmana, N., & Daryanto, W. M. (2019). Financial performance analysis of healthcare companies before and after the implementation of BPJS KESEHATAN program during the period of 2011–2016. *International Journal of Business, Economics and Law, 20*(1), 32–42. https://www.ijbel.com/wp-content/uploads/2020/02/IJBEL20_31.pdf

Liu, Z., Shi, Y., & Yang, B. (2022). Open innovation in times of crisis: An overview of the healthcare sector in response to the COVID-19 pandemic. *Journal of Open Innovation: Technology, Market, and Complexity, 8*(1), Article 21. https://doi.org/10.3390/joitmc8010021

Lockett, A., Thompson, S., & Morgenstern, U. (2009). The development of the resource-based view of the firm: A critical appraisal. *International Journal of Management Reviews, 11*(1), 9–28. https://doi.org/10.1111/j.1468-2370.2008.00252.x

Munde, A., & Mishra, N. (2022). Corporate performance: SMEs performance prediction using the decision tree and random forest models. *Corporate Ownership & Control, 20*(1), 103–113. https://doi.org/10.22495/cocv20i1art10

Musa, H., Rech, F., Chen, Y., & Musova, Z. (2022). The deterioration of financial ratios during the COVID-19 pandemic: Does corporate governance matter? *Folia Oeconomica Stetinensia, 22*(1), 219–242. https://doi.org/10.2478/foli-2022-0011

Nandi, S., Sarkis, J., Hervani, A., & Helms, M. (2021). Do blockchain and circular economy practices improve post COVID-19 supply chains? A resource-based and resource dependence perspective. *Industrial Management & Data Systems, 121*(2), 333–363. https://doi.org/10.1108/IMDS-09-2020-0560

Pink, G. H., Daniel, I., Hall, L. M., & McKillop, I. (2007). Selection of key financial indicators: A literature, panel and survey approach. *Healthcare Quarterly, 10*(1), 87–98. https://doi.org/10.12927/hcq.2007.18661

Provenzano, D. A., Sitzman, B. T., Florentino, S. A., & Buterbaugh, G. A. (2020). Clinical and economic strategies in outpatient medical care during the COVID-19 pandemic. *Regional Anesthesia & Pain Medicine, 45*(8), 579–585. https://doi.org/10.1136/rapm-2020-101640

Rababah, A., Al-Haddad, L., Sial, M. S., Chunmei, Z., & Cherian, J. (2020). Analyzing the effects of COVID-19 pandemic on the financial performance of Chinese listed companies. *Journal of Public Affairs, 20*(4), Article e2440. https://doi.org/10.1002/pa.2440

Rafieepour, A., Masoumi, G., & Dehghani, A. (2021). Health responses during the COVID-19 pandemic: An international strategy and experience analysis. *Health in Emergencies and Disasters Quarterly, 6*(3), 147–160. https://doi.org/10.32598/hdq.6.3.310.1

Sahoo, M., Srivastava, K. B. L., Gupta, N., Mittal, S. K., Bakhshi, P., & Agarwal, T. (2022). Promoter ownership, institutional ownership, and firm performance. *Corporate Ownership & Control, 20*(1), 162–175. https://doi.org/10.22495/cocv20i1art15

Shapiro, S. P. (2005). Agency theory. *Annual Review of Sociology, 31*(1), 263–284. https://doi.org/10.1146/annurev.soc.31.041304.122159

Sharma, A., Gupta, P., & Jha, R. (2020). COVID-19: Impact on health supply chain and lessons to be learnt. *Journal of Health Management, 22*(2), 248–261. https://doi.org/10.1177/0972063420935653

Shrestha, N. (2020). Detecting multicollinearity in regression analysis. *American Journal of Applied Mathematics and Statistics, 8*(2), 39–42. https://doi.org/10.12691/ajams-8-2-1

Smallwood, N., Harrex, W., Rees, M., Willis, K., & Bennett, C. M. (2022). COVID-19 infection and the broader impacts of the pandemic on healthcare workers. *Respirology, 27*(6), 411–426. https://doi.org/10.1111/resp.14208

Sun, Y., Bao, Q., & Lu, Z. (2021). Coronavirus (COVID-19) outbreak, investor sentiment, and medical portfolio: Evidence from China, Hong Kong, Korea, Japan, and U.S. *Pacific-Basin Finance Journal, 65*, Article 101463. https://doi.org/10.1016/j.pacfin.2020.101463

Wackers, E., Smit, R., Stadhouders, N., & Jeurissen, P. (2024). Assessing the relation between financial performance and long-term bank loan interest rates for healthcare providers in the Netherlands: a panel data analysis. The European Journal of Health Economics, 25(5), 845-855. https://doi.org/10.1007/s10198-023-01629-z

Wang, Q., Su, M., Zhang, M., & Li, R. (2021). Integrating digital technologies and public health to fight COVID-19 pandemic: Key technologies, applications, challenges and outlook of digital healthcare. *International Journal of Environmental Research and Public Health, 18*(11), Article 6053. https://doi.org/10.3390/ijerph18116053

Wang, X., & Xu, J. (2024). Evaluating private hospital performance before and during COVID-19 in China. *Medicine, 103*(21), Article e38327. https://doi.org/10.1097/MD.0000000000038327

Xue, Y. (2023). The developmental impact of Chinese healthcare applications on medical economics during COVID-19. *Advances in Economics, Management and Political Sciences, 4*, 236–242. https://doi.org/10.54254/2754-1169/4/20221065