OPEN ACCESS

Journal of Advanced Research in Social Sciences

ISSN 2538-919X

Comparative Financial Analysis of Greek Hospitals Before and During the Covid-19 Pandemic

Evaggelia Drakopoulou

Postgraduate Researcher, School of Social Sciences, Hellenic Open University, Patras, Greece

ARTICLE INFO

Keywords:

Ratios, Hospitals, Covid-19, Comparative Analysis, Z-Score

ABSTRACT

During the Covid-19 pandemic, hospitals faced financial and social challenges due to the growing demand for healthcare and the costly measures required to combat the virus. Expenses increased and the hospitals were forced to acquire additional equipment and staff to cope with the crisis. Within this framework, this paper compares and analyses, through certain ratios, the financial data of 6 Greek hospitals before and during the Covid-19 pandemic. The purpose of the study is to determine if: i) the increased expenses worsened the financial condition of the hospitals, and ii) the pandemic created a financial crisis for hospitals. Findings indicate that the pandemic did not create a financial crisis for the hospitals. This, however, does not mean that, on a practical level, managers and policymakers should be complacent regarding the financial self-sufficiency of hospitals.

1. Introduction

The financing of the health system in Greece is carried out by public and private resources. Public funding is achieved through taxes (direct or indirect) and by contributions from employees and employers and the state for civil servants. Private resources come from direct payments for services that are not covered by social security or that are covered but still citizens show their preference in the private health sector. Furthermore, private resources may come from the patient's participation in the cost of care, as for example with paying for the drugs prescribed.

Public funding for health expenditure as a percentage of GDP in Greece was 4.8% in 2018, 5% in 2019, 5.9% in 2020 and 5.7% in 2021 (Foundation for Economic and Industrial Research, 2023). The total funding for health expenditure as a percentage of GDP in Greece was 8.1% in 2018, 8.2% in 2019, 9.5% in 2020 and 9.2% in 2021. Therefore, an increase in health expenditure is observed, mainly in 2020, which is due to the emergence of the Covid-19 pandemic.

*Corresponding author's E-mail address: evaggelia78@yahoo.gr, https://orcid.org/0009-0002-7614-3107

Cite this article as:

Drakopoulou, E. (2025). Comparative Financial Analysis of Greek Hospitals Before and During the Covid-19 Pandemic. *Journal of Advanced Research in Social Sciences, 8*(4): 129-141. https://doi.org/10.33422/jarss.v8i4.1700

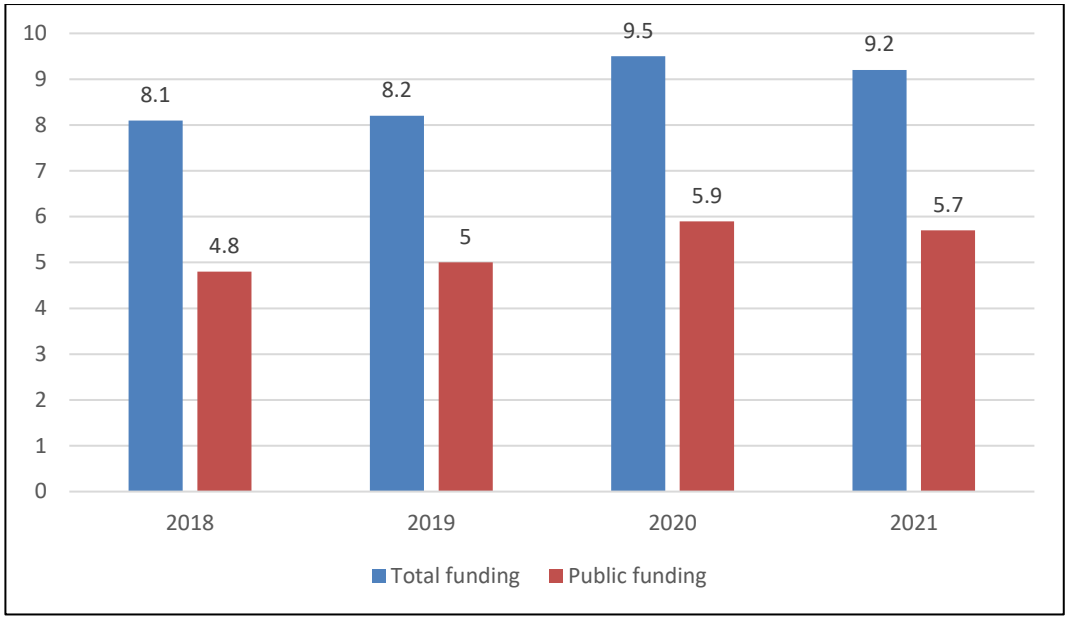

Figure 1. Funding for health expenditure as GDP percentage

One reason health spending increased is the increase in hospital beds in 2020. Specifically, closed care units' beds were 45,053 in 2018, 44,817 in 2019, 45,220 in 2020, 45,101 in 2021, and open care units' beds were 4,253 in 2018, 3,680 in 2019, 3,904 in 2020 and 3,794 in 2021 (Foundation for Economic and Industrial Research, 2023).

Also, health expenditure increased due to the increase in hospital staff. In more detail, the nursing staff amounted to 38,952 in 2018, 39,105 in 2019, 42,014 in 2020 and 42,681 in 2021. The doctors were 23,354 in 2018, 22,940 in 2019, 23,935 in 2020 and 24,412 in 2021. The paramedical personnel consisted of 7,752 people in 2018, 7,732 people in 2019, 8,209 people in 2020 and 8,268 people in 2021. Auxiliary nurses or nursing assistants amounted to 6,044 in 2018, 5,897 in 2019, 6,369 in 2020 and 6,551 in 2021.

Due to the aforementioned increase in health spending, the purpose of this study is to compare and analyze the financial data of six Greek hospitals for the period 2018-2021, in order to conclude whether: i) the increased spending worsened the financial status of the hospitals under investigation, and ii) the Covid-19 pandemic has created a financial crisis for hospitals, imposing the need for long-term preparation and resilience to similar crises in the future.

The reason the period 2018-2021 was chosen is to compare and analyze financial data before (2018 and 2019) and during (2020-2021) the Covid-19 pandemic. Also, the specific hospitals were chosen because they were Covid-19 hospitals (providing, that is, medical treatment to infected patients) per Health Region in the period 2020-2021. So, another objective is to check if there are differences depending on the health region in which each hospital operates. Overall, this economic analysis falls within the field of social sciences and is of particular importance in social terms as it captures critical operational parameters of important structures within society, such as hospitals.

2. Literature Review

The financial well-being of hospitals, as economic units, is mainly traced through a set of specific financial ratios. These indicators embrace crucial elements constituting the substance of effective financial management (Curtis & Roupas, 2009). Lee (2015) compared the results of the financial analysis of National University Hospitals in Korea between 2008 and 2011 and showed that there was a general decrease in total assets as well as an increase in liabilities. The

study also revealed a decrease in total medical revenues, and an ongoing deficit in several hospitals. These research findings can be used by managers or by researchers within the medical industry to enable informed decision-making as well as optimized execution. Furthermore, governments can realize the need to support national university hospitals. Holmes et al. (2013) analyzed the financial performance of rural hospitals concluding that special payment provisions are important determinants. Eliminating the special rural hospital payment from the government would have considerable adverse financial consequences such as a negative total margin, and a difficulty remaining financially viable in the long run. Fragkiadakis et al. (2016) employed a non-parametric modeling approach to assess the efficiency of Greek public hospitals between 2005–2009. The authors used data envelopment analysis, and their findings indicate that during that period (prior to the outbreak of the Greek crises) efficiency, mainly in economic terms, deteriorated.

Giancotti et al. (2017) analyzed existing literature on scale efficiency and optimal size of the hospital sector showing that economies of scale are present for merging hospitals. Based on that, policies for expanding larger hospitals and closing or restructuring smaller ones should be pursued. He, Jessri & Zhang (2022) measured the effect of the pandemic on financial performance (period: 2017 – 2020) of the repeated measurements for California hospitals, concluding that hospital managers need to find ways to assist hospitals recover from Covid-19. Li, Al-Amin & Rosko (2023) found that even though hospitals' operating margins have been declining for 10 years, Covid-19 caused this decline to get worse, especially as far as rural hospitals are concerned. According to Petrakis & Matalliotakis (2025), during the pandemic public hospital revenues became heavily dependent on government funding and to cope with future crises hospitals as well as the national healthcare system need to adopt structural changes. Rhodes, Santos & Young (2023) analyzed data spanning 2019 and 2020 and found that investor-owned hospitals were less financially affected compared to public and nonprofit hospitals. Finally, for Wang, Bai & Anderson (2022), there was a reduction in the operating margins of hospitals in the United States of America in 2020, even though their overall profit margins remained like those in prior years.

In this study, the six hospitals under investigation are:

(1) Athens General Hospital of Thoracic Diseases “Sotiria” (1st Health Region). The hospital (henceforth called 'Sotiria') was founded in 1902 and was originally dedicated to the treatment of tuberculosis. Today, it is a general hospital that offers a wide range of medical services, specializing in pulmonology and diseases of the respiratory system. During the pandemic, "Sotiria" played an important role in incident response and patient care, providing special intensive care units and other infrastructure to address urgent needs (URL: https://www.sotiria.gr/).

(2) General Hospital of Attica Sismanoglio-Amalia Fleming (1st Health Region). The hospital (hereinafter referred to as 'Sismanoglio') is a public hospital located in Marousi, Attica. The hospital was built with a donation from the brothers Anastasios and Konstantinos Sismanoglou with the foundation stone being laid in 1936. In 1985 it joined the National Health System (known as ESY) as a General Hospital (URL: https://www.sismanoglio.gr/sismanoglio.gr). The "Amalia Fleming" interconnected hospital is a public hospital in Athens, which also belongs to the National Health System of Greece. During the pandemic, the hospital was twice converted into a Covid-19 hospital (URL: https://www.flemig-hospital.gr).

(3) AHEPA General University Hospital of Thessaloniki (4th Health Region). The hospital (hereinafter referred to as 'AHEPA') is the second largest hospital in Thessaloniki. It was inaugurated in 1951 and is part of the National Health System. The hospital is located in the Campus of the Aristotle University of Thessaloniki (URL: https://www.ahepahosp.gr/).

(4) General University Hospital of Evros - General University Hospital of Alexandroupolis (4th Health Region). The Hospital (hereinafter referred to as 'Alexandroupolis') is one of the most important hospitals in Northern Greece. It is located just outside the center of Alexandroupolis and is associated with the Democritus University of Thrace serving the prefecture of Evros and Thrace in general (URL: https://pgna.gr/).

(5) General University Hospital of Patras (6th Health Region). The Hospital (hereafter referred to as 'Patras') is one of the largest and most important hospitals in Western Greece. It was established in 1988 and operates in close cooperation with the University of Patras. The hospital is in Rio, a suburb of Patras, about 7 kilometers northeast of the city center (URL: https://www.pgnp.gr/).

(6) General University Hospital of Ioannina (6th Health Region). The Hospital (hereinafter referred to as 'Ioannina') is one of the largest hospitals in Northwest Greece and operates in close collaboration with the Medical School of the University of Ioannina. The hospital was founded in 1986 and has a capacity of 760 beds. It is located close to the University of Ioannina (URL: https://uhi.gr/).

3. Methodology

Regarding methodology, the tool of financial ratios was used. Ratios are numerical tools that analysts use for decision making. In general, ratios are the ratio of two quantities, where the quantities are accessible from the companies' published balance sheets and income statements.

The analysis of the ratios is mainly carried out over time and within any industry. With the longitudinal ratio analysis, the possible existence of a trend and control of economic-social findings related to the situations that prevail at that time in a global level. Intra-industry analysis examines the position of a company in relation to other enterprises, by studying comparative data of companies operating in the same business sector. Also, with the intra-industry analysis, findings are compared with certain desired goals.

Ratios reveal relationships between accounting or statistical figures and are used for various analyses, such as evaluating a company's financial condition. In addition, they help identify and correct weaknesses compared to other businesses operating in the same industry. Analysis of ratios provides insights into underlying conditions, and they serve mainly as the starting points of analysis. By being properly interpreted, they highlight areas that require further investigation. They can reveal important relations and comparisons as well as trends and conditions that are difficult to detect. Furthermore, they seem to be more useful when they are future oriented. Nevertheless, their usefulness depends on their good application and interpretation (Subramanyam, 2014). Overall, the advantages of using ratios include simplifying financial statements, facilitating intra-industry comparisons, planning a company's action, and making investment decisions. A main disadvantage is that it does not consider external factors, such as a global decline in growth.

In this study, sixteen ratios from four general categories were used to analyze the financial statements of the six hospitals. The categories are as follows:

(1) Liquidity Ratios by which a correlation is made between short-term liabilities and current assets of a company. The importance of these figures lies in the fact that with the liquidation of assets, the repayment of liabilities becomes possible. This category includes the Current Ratio, the Acid Test Ratio and the Cash Ratio.

(2) Activity Ratios which are directly related to asset turnover. Turnover refers to the time it takes to convert an item from a current asset to another item that is either more readily or

immediately liquidable, i.e. inventories to receivables and receivables to cash, respectively. This category includes the Receivables Turnover Ratio and Average Collection Period of Receivables, the Asset Turnover Ratio, the Fixed Assets Turnover Ratio, the Owner's Equit Turnover Ratio and the Short-Term Liabilities Repayment Speed Ratio and Average Payment Period of Liabilities.

(3) A company's Profitability Ratios show the results achieved over a period of time compared to the means utilized to produce the specific result. This category includes the ratios of Gross Profit Margin, Return on Total Assets, Net Profit Margin and Return on Net Worth.

(4) Financial Structure and Sustainability Ratios refer to the various forms of financing that make up the company's capital structure. In capital structure there are the company's loan funds, as well as its own funds. The capital structure of each company also indicates the percentage of risk assumed by the creditors. This category includes Equity the Total Capital Ratio, the Equity to Debt Ratio, the Equity to Fixed Assets Ratio and the Current Assets to Total Liabilities Ratio.

4. Findings

Using the annual financial statements of the six hospitals for the period 2018-2021, the data for analysis was extracted from which certain findings were derived. Below some of them are being presented.

4.1 Liquidity Ratios

Regarding Liquidity Ratios, we present the findings of the Current Ratio. This ratio shows the level of liquidity of a company and the margin of safety that its managers have to deal with unpredictable changes in working capital flows (large values indicate that the company is operating in a conducive environment). A Current Ratio greater than one means that what the company is expected to collect (its current assets) covers what it will have to pay (short-term liabilities). A larger ratio reveals a favorable situation of the financial unit, at least in terms of liquidity, but... not so much in terms of profitability. According to international norms, a value >2 is very good, between 1.5 and 2 is good, between 1 and 1.5 is moderate and <1 is unsatisfactory.

In Figure 2 we see that,

- The ratio has values greater than one for all years and for the six hospitals under consideration. This indicates positive findings for the working capital and for the liquidity of the hospitals.
- For the entire period, from 2018 to 2021, the value of the ratio increased only for the 'AHEPA' (specifically, by 93.21%).

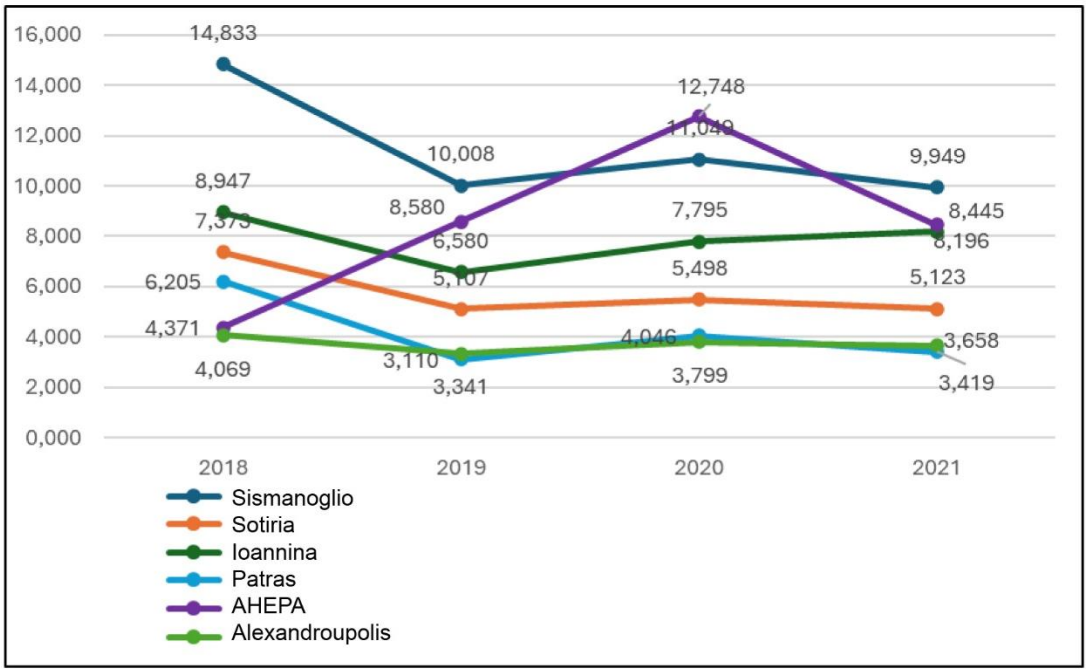

Figure 2. Current ratio analysis

4.2 Activity Ratios

In the Activity Ratios, we will look at the findings of the Receivables Turnover Ratio. This ratio indicates how many times, during an accounting year, the company's receivables will be collected on average. Smaller values in the average receivables turnover period indicate positive findings for the entity (because funds are not tied up and can be invested elsewhere). The faster the turnover, the faster the company collects and there is a reduced likelihood of losses from bad customers.

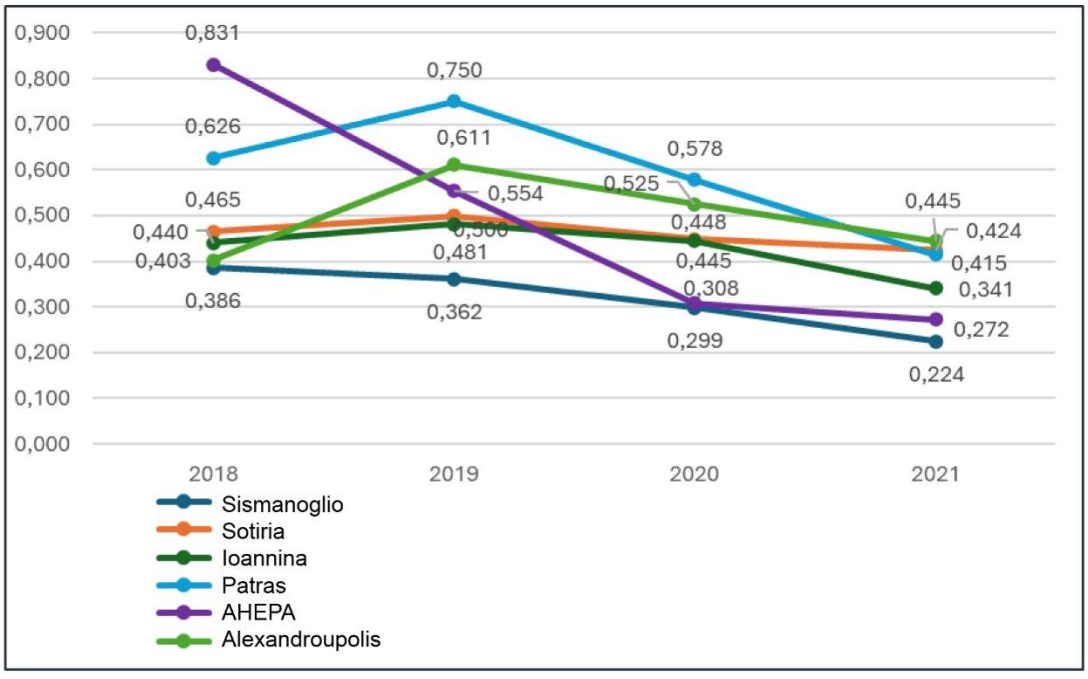

Figure 3. Receivables turnover ratio analysis

In Figure 3 we notice that,

- Before the pandemic (years 2018 and 2019), the value of the ratio increases for four of the six hospitals. On the contrary, the value of the ratio decreases for 'Sismanoglio' and for 'AHEPA'. In fact, the ratio of 'AHEPA' shows an alarming decline, as the value decreases by 40.9% from 2018 to 2021.
- On average, the ratio is higher for 'Patras', which indicates the ability and speed it has in converting its claims into actual collections. After the beginning of the pandemic (years 2020 and 2021), the value of the ratio is reduced for all hospitals.

4.3 Profitability Ratios

In Profitability Ratios, we will look at the findings of the Return on Total Assets Ratio. This ratio is used to calculate the return on total assets of a business. It shows how efficiently all assets are being used to generate profits. It is worth noting that, through this ratio, the management of a company is also evaluated.

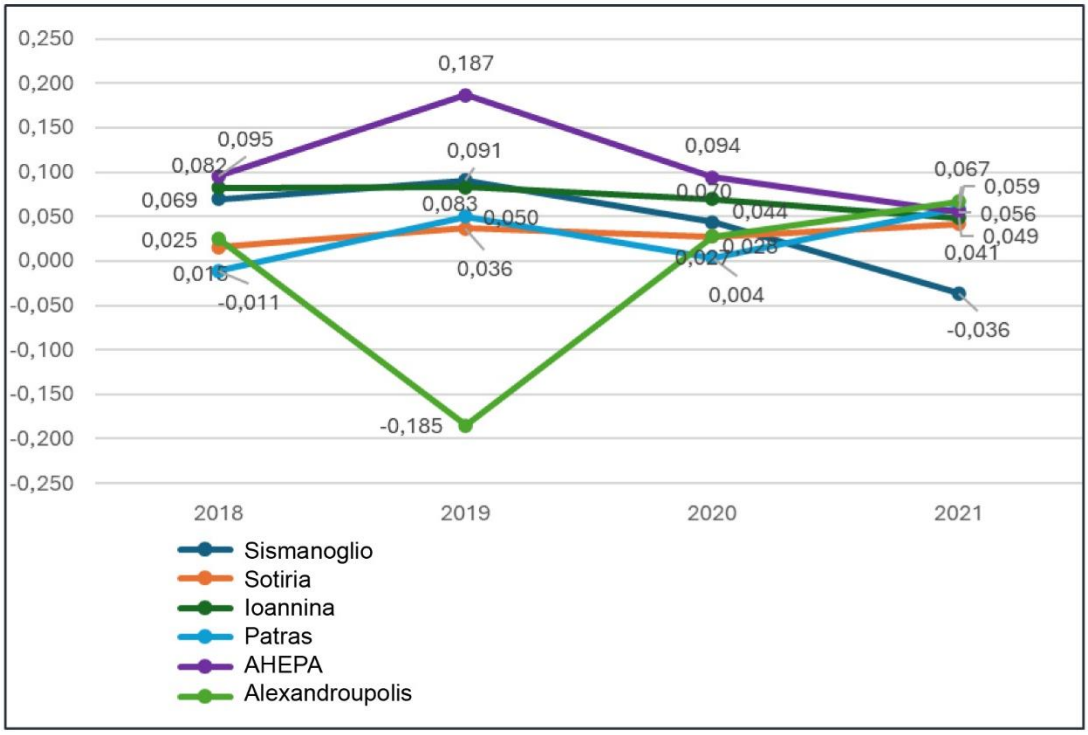

Figure 4. Return on total assets ratio analysis

The analysis (see Figure 4) indicates that, all values of the Return on Total Assets Ratio are positive (>0), with exceptions in the values for 'Patras' in 2018, for the 'Alexandroupolis' in 2019 and for 'Sismanoglio' in 2021, where values are negative. For these three hospitals and for these years it appears that the assets are not being used efficiently at all.

4.4 Financial Structure and Sustainability Ratios

In the Financial Structure and Sustainability Ratios, we will look at the findings of the Current Assets to Total Liabilities Ratio. This indicates the liquidity that the company has so that to repay its long-term obligations (when the value of the ratio is low, this indicates that long-term obligations can be paid from working capital, except for unforeseen events). It shows the relationship between current assets and total liabilities. So, it is an indication of the long-term liquidity of the financial entity. Values >1 mean that current assets exceed the company's total liabilities.

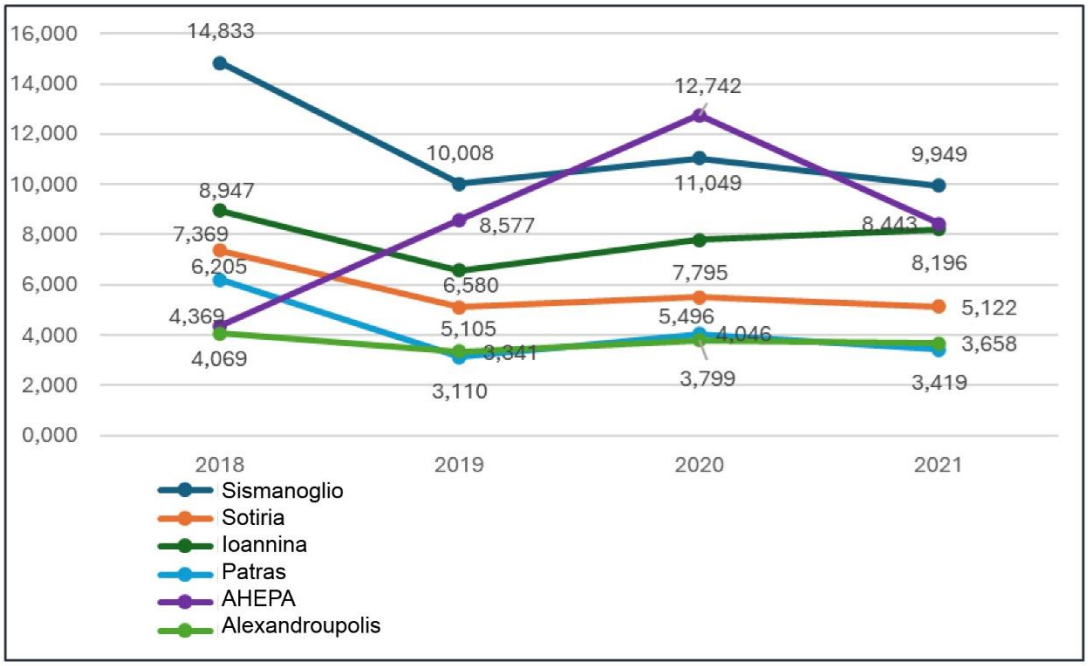

Figure 5. Current assets to total liabilities ratio analysis

In Figure 5 we see that,

- In five of the six hospitals, the value of the ratio decreased from 2018 to 2019 and increased from 2019 to 2020, making evident once again the effect that the Covid-19 pandemic had on the indicators. In 2021-21 there were no significant variations.
- The only ratio that followed a different course concerns the 'AHEPA' hospital where it increased from 2018 to 2019 and from 2019 to 2020, while it decreased from 2020 to 2021.

4.5 Altman's Z-score Analysis

On a second level of analysis, the creditworthiness and long-term financial strength of the six hospitals was measured. The sustainability of every hospital was carried out using the Altman's Z-score prediction model. The model was created by the American economist Edward I. Altman (1968). Through this statistical method, the financial strength of a company is assessed, and a prediction is made of the probability that the company will go bankrupt during the next two years. To calculate the Z coefficient, certain ratios are used that have been calculated from the data of the published balance sheets and are weighted with certain coefficients. This method also has certain disadvantages. First of all, calculations are sample-based. The analysis is based on the assumption that the ratios are accurate indicators of bankruptcy, which is not always the case. Also, the model does not predict when bankruptcy will occur and therefore cannot be considered particularly accurate, especially when the data come from past periods within a constantly changing economic environment (BajajFinserv, 2025).

Distress detectors, such as the Altman's Z-score model, and the application of measures predicting financial trouble in hospitals have been used in several studies (Langabeer et al., 2018; Karakolias & Polyzos, 2015; Price, Cameron & Price, 2005; Coyne & Singh, 2008). Depending on the company's sector of activity, there are three different Z-score models. The first model contains industrial firms that are not traded on the stock exchange. The second model refers to traded manufacturing firms. The third model contains firms operating in other industries. In the three models, different weighting factors are associated to the ratios that make

up the models. Also, different values of Z are given which indicate whether the estimated probability of bankruptcy is high or low.

In our analysis, the third Z-score model is used (Altman, 1993), since the companies/hospitals under study are non-manufacturing companies. The third model is described by the following formula[1]:

$Z=6,56\cdot X_1+3,26\cdot X_2+6,72\cdot X_3+1,05\cdot X_4$.

Where,

X_1= Working capital ÷ Total assets

X_2= Retained earnings ÷ Total assets

X_3= Earnings before interest and taxes ÷ Total assets

X_4= Equity book value ÷ Total liabilities

The two critical values of the model are 1.1 and 2.6. When the value of Z is under 1.1, the company is within the danger zone. When the value of Z is between 1.1 and 2.6, the company under consideration is in the gray zone and no secure conclusion can be drawn about its financial situation unless other factors are considered. When Z-score is above 2.6, the company is in the safe zone. Based on these critical values, for the first year the probability of bankruptcy is 95%, and for the next two years, the probability of bankruptcy is 70%.

Diagram 1. Distress, gray and safe zone according to the third Z-score model

Distress zone	Grey zone	Safe zone
< 1.1	1.1 - 2.6	> 2.6

1.1 2.6

In our study, data were extracted from the balance sheets of the six hospitals under study for the 2018-2021 period, and the values of the X_1, X_2, X_3, and X_4 ratios were calculated to estimate the probability of bankruptcy. These ratios are presented in Tables 1-4.

Table 1. The X_1 ratio for each hospital

	2018	2019	2020	2021
Sismanoglio	14.833	10.008	11.049	9.949
Sotiria	7.373	5.107	5.498	5.123
AHEPA	4.371	8.580	12.748	8.445
Alexandroupolis	4.069	3.341	3.799	3.658
Ioannina	8.947	6.580	7.795	8.196
Patras	6.205	3.110	4.046	3.419

[1] In the third model, where the companies are not listed on the stock exchange, the X_4 ratio is calculated in a different way than the other models.

Table 2. The X_2 ratio for each hospital

	2018	2019	2020	2021
Sismanoglio	-0.067	0.007	0.050	0.011
Sotiria	0.011	0.048	0.071	0.105
AHEPA	0.741	0.642	0.647	0.595
Alexandroupolis	0.338	0.211	0.136	0.170
Ioannina	0.213	0.337	0.348	0.005
Patras	-0.331	-0.395	-0.305	-0.170

Table 3. The X_3 ratio for each hospital

	2018	2019	2020	2021
Sismanoglio	0,067	0,058	0,037	-0,019
Sotiria	0,004	0,008	0,006	0,005
AHEPA	0,262	0,115	0,078	0,051
Alexandroupolis	0,004	-0,003	-0,018	0,036
Ioannina	0,068	0,076	0,064	0,039
Patras	-0,032	-0,023	-0,090	-0,076

Table 4. The X_4 ratio for each hospital

	2018	2019	2020	2021
Sismanoglio	0.177	0.219	0.181	0.172
Sotiria	0.745	0.783	0.713	0.641
AHEPA	0.004	0.003	0.002	0.002
Alexandroupolis	0.030	0.035	0.031	0.023
Ioannina	0.193	0.230	0.190	0.159
Patras	0.040	0.054	0.042	0.031

The bankruptcy probabilities for the six hospitals are given in Table 5 and Figure 6.

Table 5. The Z-score values for each hospital

Z-score = $6,56X_1 + 3,26X_2 + 6,72X_3 + 1,05X_4$				
	2018	**2019**	**2020**	**2021**
Sismanoglio	97.717	66.301	73.079	65.351
Sotiria	49.206	34.530	37.086	34.654
AHEPA	32.848	59.159	86.262	57.681
Alexandroupolis	27.853	22.622	25.275	24.824
Ioannina	60.045	45.011	52.900	54.205
Patras	39.458	19.012	24.989	21.394

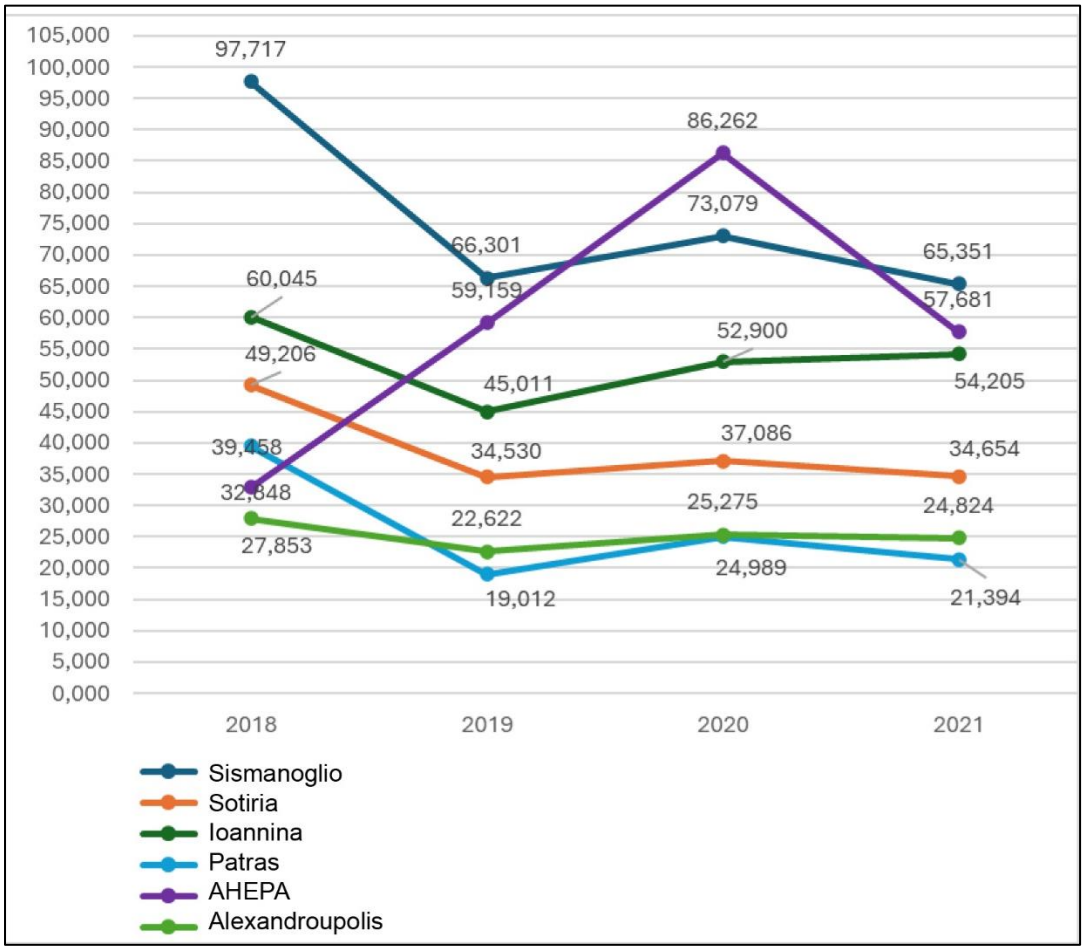

Figure 6. The Z-score values for each hospital

Based on the above, we see that no value of the Z-Score is either in the dangerous zone (below 1.1 i.e. a 90% probability of distress/bankruptcy in one year), nor in the gray zone (1.1-2.6, i.e. no reliable conclusion can be drawn). All values are in the safe zone (>2.6). Therefore, none of the six hospitals will face creditworthiness problems over the next two years. All six hospitals demonstrate good financial health.

5. Conclusions and Suggestions

The analysis of the ratios for the six hospitals between 2018-2021 shows that the Covid-19 pandemic did not create a financial crisis for the hospitals. This finding is also confirmed by Altman's Z-Score model, where all Z-Score values are in the safe zone and far away from the critical value of 2.6. Investigating the sustainability of hospitals can boost research in this field by offering new tools to measure the financial dynamics of various healthcare facilities. The application and assessment of a financial distress projection model strenghens the health sector to deal with future major crises, similar to the Covid-19 pandemic, more effectively. The fact that in the present study no risk of bankruptcy was found should not discourage health policy makers from having a broad debate about the structuring of public health units and the possibility of entering a financial distress situation. The distress phenomenon is always probable and the relevant projection tool to address this probability is available.

Evaluating the impact of the pandemic on Greek hospitals' finances is not a static observation. It provides the necessary background for dynamic interventions and practical implications.

Hospital managers and policymakers can use these findings in decision-making processes. In particular, the fact that no distress occurred should not preclude the implementation of structural changes. Changes that will make hospital units more autonomous and less dependent on state economic policy. If hospitals have their own 'special purpose' or 'emergency' funds, then they can, in combination with the expertise they have in the specific problems they face, use them effectively in a future health crisis.

Furthermore, there seem to be no differences in the hospitals depending on the health district in which each hospital operates. In most of the empirical findings from calculating the ratios, each ratio followed an opposite course from 2018 to 2019 (before the start of the pandemic,) during the years 2019-2020 (beginning of the Covid-19 pandemic) and from 2020 to 2021 (second year of the pandemic).

Thus, the increased needs created in hospitals, both in terms of equipment and in staff, from 2020 onwards did not worsen their financial situation. One reason is because this increase in needs was offset to some extent by the increase in expenditure as a percentage of GDP, both from public funding (from 5% in 2019 to 5.9% in 2020 and 5.7% in 2021), and from total funding (from 8.2% in 2019 to 9.5% in 2020 and 9 .2% in 2021).

Of course, this does not mean that there is no room for corrective measures. There is, for instance, considerable scope for improvement in the absorption and allocation of funds for public hospitals in Greece, as the corresponding percentages of expenditure as a percentage of GDP in the EU27 from public financing were 7.9% in 2019, 8.8% in 2020 and 8.9% in 2021 (Foundation for Economic and Industrial Research, 2023).

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