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A Strategic Financial Management Evaluation of Private Hospitals' Effectiveness and Efficiency for Sustainable Financing: A Research Study

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Abstract:

Purpose: *The purpose of the study is to evaluate the performance of private hospitals and identify conditions that secure sustainable financing of the sector.*
Design/Methodology/Approach: *The Data Envelopment Analysis (DEA) was used as the main tool to measure efficiency and effectiveness among fifteen (15) major private hospitals in Greece. Audited financial statement data were analyzed as a basis for the assessment of their performance. An input oriented model was applied due to the fact that assets and employee expenses are more likely to be under the control of management in private hospitals, compared to revenues and CFFO. The latter were used as outputs that represent measures of effectiveness and efficiency respectively which secure sustainability. We opted for the Variable Return to Scale (VRS) version of DEA (in connection with the CRS one), since hospital are systems extremely depended on the human capital and the knowledge management, as a means of creating value and are characterized by non-linear dynamics.*
Findings: *The great majority of the hospitals in the sample exhibit increasing and decreasing returns scale. Inefficiencies found to emanate from a non-optimal scale of the hospitals rather, than from management's lack of capability to transform inputs to outputs.*
Practical Implications: *The study aspires to frame options and help management to make informed choices that promote sustainable development of the private sector, which are also applicable to the public one. It is essential for public authorities to judge the meaningful performance of the private hospitals, to administer accordingly the level of its subsidies through public insurance funds, the claw back and rebate policies in a period of fiscal austerity and act accordingly to attract or deter the inflow of scalable private funds in healthcare to promote human wellbeing.*
Originality/Value: *Performance differences, can be leveraged to guide improvements in the operation of the private hospitals and reforms in the health care system.*

Keywords: *Hospitals, efficiency, effectiveness, financial data, DEA, sustainable strategy.*
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Paper Type: *Research study.*

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1. Introduction

Health is defined "as the state of complete physical, mental, and social well-being" according to World Health Organization (WHO) and as such it connotes an unambiguous autonomous value, since it promotes balance and homeostasis to the systems of every human being. That is why the importance of good health is enshrined in the 3rd principal ("good health and wellbeing") of the seventeen (17) Sustainable Development Goals (SDGs), which constitute the Agenda 2030 (Unido, 2016).

Health, besides its self-evident and undisputable precious value for the human being, also affects the productivity of labor. Physical and mental readiness potentially boosts it (all other factors being fixed), since it secures the energy and the availability of human capital, which is not constrained by the barriers attributed to illness. As a result, the Economic Forum of Davos includes health as one of the twelve pillars that constitute the Global Competitiveness Index (GCI) it studies and publishes each year (since 1979) for 141 countries worldwide. Health and skills comprise the human capital, that is one of the four groups of factors that are forming the composite GCI. It is constructed annually for each of those countries to classify them according to their competitiveness ranking (WEF, 2016). The appreciation of the impact factor of the healthcare systems has on the economic growth and resilience of the economies worldwide, has been gravely enhanced after the strike of the Covid-19 pandemic. It affected seriously but not symmetrically all the regions of the world, changing immensely the prospects of each individual economy and society in the years ahead.

Due to its vital role to human wellbeing, the total healthcare expenditures as a share of GDP in 2017, amounted to a substantial 9.9% on average in the EU (in Germany and France 11,3%) and 8,0% in Greece. There is a retreat from the high of 9,9% achieved by Greece in 2010, due to economic crisis that reduced health care spending after the austerity measures applied to the economy. During this period, the numerous public health insurance funds were brought under the umbrella control of a unique organization (called EOPYY) in 2011 and this development exacerbated further the reduction in the public healthcare spending. All these developments contributed that healthcare spending per capita on average for Greece to be only €1.348, while for the rest EU members was €2.887 respectively and for Sweden was 5 200 € in 2018 (Eurostat, 2019).

The weaknesses of the public hospitals to respond to the demand for their services due to their under financing, became even more clear during the present Covid 19 pandemic period during which were proven incapable of handling the specific crisis (although it had almost stopped treating patients with ordinary diseases).The dwindling role of the public sector was partially replenished by the private one, the share of which in the total spending was elevated accordingly during the last

decade. It is true also that Greece today has one of the most "privatized" health care systems among EU countries attributed primarily to the deficient public financing. The "complementary status of the private sector is no longer disputed", although it may thwart the equitable access of all citizens (Siskou *et al.,* 2008). Only about 60% of health spending in Greece is publicly funded, compared with the almost 80% on average, in the rest EU countries (OECD, 2018). In 2017, the bulk (42 %) of total spending in the country went on inpatient care, indicating the vital role of hospitals as the backbone of the entire sector.

In the light of all the aforementioned developments especially during the last decade, a better understanding of the hospitals performance is a crucial step forward in securing that the insufficient resources of the sector are allocated optimally. With the reduction in total spending per capita in Greece, the quest for a more effective and efficient use of the existing healthcare spending resources is increasing. It is more important especially for countries where the participation of the private sector is high and intensified (as it happens in Greece) meant to fill the gap the deficient public financing creates, while the demand and costs in a such a sensitive industry are steadily increasing. The aging of the population requires a greater intensity of services for older people, while at the same time the spending on new healthcare related technologies and medicine increases the demand for additional funding (European Observatory on Health Systems and Policies, 2019).

Efficiency analysis in health care sector has attracted significant interest in recent decades, due to escalating health care costs and fiscal restraints. The World Health Organization (WHO) supports the development of a financing systems that will allow access to services to all people are entitled to, without suffering an unbearable burden to pay for them. The WHO encourages the design of health care systems that will protect the needy from having to pay for services, recognizes the near insurmountable task to find adequate sources of financing of the system and stresses the need optimum use of available resources (WHO, 2010).

A recent Canadian study Comparing Performance of Universal Health Care Countries uses 43 indicators, representing four wide categories referring to the: availability, use and access to resources of resources, as well as to quality and clinical performance (Barua *et al.,* 2020). Jacobs *et al.* (2006) state, that "efficiency has become a central objective of policy makers within most healthcare systems". At the same time, the Value-Based Purchasing (VBP) program in US, rewards hospitals for their provision of efficient, good quality and patient centered care (Turner *et al.,* 2015). This scheme of bonuses creates "stronger incentives that would improve the linkage between efficiency and profitability (Rosko *et al.,* 2020). The "integration of quality and financial management plans may be proven very beneficial for hospitals" (Bernes *et al.,* 2017). It was found that "good patient experience is associated with higher hospital profitability" according to Deloitte (2016), which has been exploring the value of patient experience. Efficiency, effectiveness, quality care and financial viability of hospitals are strongly

associated, and the value of patients' favorable impression of the treatment offered to them. The good impression of patients is reflected in either greater demand for services (quantity wise) and/ or in higher prices paid. Both boost the amount of total revenues and cash flows from operations (and profits as a result).

The Mid-term Evaluation of the third health EU program (2014-2020) of the projects undertaken by the countries of the European Union, applied criteria such as relevance, coherence, effectiveness, efficiency and added value. All these steps can be considered as parts that are embedded the following rational of an integrated system of assessment. The projects comprising the entire third program, must be relevant and coherent, so that effectiveness is promoted, through the strategy that connects them organically. If projects are in addition implemented efficiently, then value is created. The report explains that appropriate projects are those that accommodating existing needs and challenges, fulfilling those objectives in coherent way that facilitate synergies in promoting effectiveness. It is achieved by adopting a more strategic and holistic medium-term approach, with participation from the bottom (the countries members of the union) and securing co-funding. The report underscores the fact that any persistent inefficiencies and inadequacies in data, heavily undermine the monitoring of implementation ability of managers, impede transparency, and seriously thwarts accountability for providing cost-effective solutions to associated health challenges the EU faces in promoting a responsive and sustainable system (Director General for Health, 2017). The evaluation process just described, consequently underlines the need for assessing effectiveness, efficiency, and sustainability as the main pillars in measuring the performance of a responsive health system. It is the rational that this study tries to espouse and adjusts it accordingly to assess the performance of the private hospitals.

The availability of the necessary resources at the macro level is determined by the total spending, which is usually presented as a percentage of the GNP (and the spending per capita) of the country involved. At the micro level, the availability of resources can be associated the total capital invested and the cost of staff employed at the hospital level. The use of those resources on the other hand, the access to them, the quality of clinical performance determines the amount of revenues originally and the Cash Flows from Operations (CFFO) of the private hospitals we examine. These are four variables that can be used safely, to assess the performance of the private hospitals in Greece in a congruent and productive fashion. It represents an extension of the evaluation of public hospitals to take care of their individual characteristics, while retaining the main rational intact.

Sound financial management and quality care are inextricably linked and tangible indications (if not proofs) of optimum resources allocation. Strict adherence to these factors that are ssociated with the performance of both of public and private funds, denotes that investments in the healthacare sector are on the right trajectory

and do not lose sight of the difficult journey ahead. The sluggish, partial, and insufficiently inclusive public spending in the health care sector especially during the Covid-19 pandemic in Greece, is the harbinger of further actual restraints in the public hospitals despite the expectations that the underfunding situation will reverse. The supplementary role of the private healthcare sector is expected to be enhanced even further in the country. Thus, its performance with respect the effectiveness and efficiency of the existing resources is vital for the wellbeing of the entire society.

2. Literature Review

2.1 Performance Measurement: Effectiveness and Efficiency

Performance measurement is not an end itself, but a valuable tool of effective management and control. Despite some inherent obstacles to its unanimous and indisputable acceptance by all parties involved, performance appraisal if it is orderly applied having in mind its limitations, it is a valuable means that promotes transparency, holds management accountable and supplies it with the data needed to improve organization effectiveness and efficiency, for the sake of all stakeholders (Behn, 2003). It is known that "what gets measured, gets managed" according to well respected respected patriarch of management (Drucker, 1963).

According to him "performance has become decisive well beyond the economic sphere or even the social spher" (Drucker, 2006). He also maintains the view that only through the coexistence of effectiveness and efficiency in the operation, the organization thrives. Efficiency alone without effectiveness (by "doing the wrong things, right„), leads to a "heroic failure„ and effectiveness without efficiency brings about just mere survival (Solitaire, 2014). Dependable performance tool must at least measure effectiveness and efficiency as the ultimate dimensions of the optimality of the resource allocation of an entity, since "effectiveness is doing the right things, while efficiency is doing things right", according to the renown guru of management (Drucker, 1963). He assigns predominate role in effectiveness, which means achieving the goals the strategy assigned. He does not obviate the task at the same time to stress the need for operational efficiency in the process of pursuing the dominant goals. He does not want though the concern for efficiency to derail the process of strategy and end up in a goal displacement in the name of the quest for efficiency as the main concern. That is why he warns that "there is surely nothing quite so useless, as doing with great efficiency what should not be done at all" (Drucker, 1963). This is the cornerstone of our attempt to measure performance based on effectiveness and efficiency, the guide to apply the equivalent input and output variables, as well as the corresponding tool of analysis to carry out the task.

The mantra "measure, assess and improve" is in nowadays widely espoused and applied in business and organization management. It is believed that whatever is

measured properly, is gets managed better and improved, since "If you can't measure something, you can't improve it" (Prusak, 2010). We believe performance measurement and we strongly feel that if it is done with the necessary caution knowing the limitations and the traps of the task, it can only be proven beneficial to more effective and efficient allocation of resources, for the sake of society at large. We denounce excessive and blind confidence in the measurement tools especially the ones used in isolation, as well as to any aberrations in their application that are prone to lead to key metric shenanigans and convenient performance outcomes. We try to combine tools of measurement and involve all stakeholders to create check and balances, that will contribute positively towards achieving the most optimal solution possible, without a sumptuous deployment of scarce resource, especially in precious the healthcare sector. A task of paramount importance for the authorities, especially in periods of economic hardships, as the current Covid-19 pandemic remind us.

So, the appropriate performance measurement must quantify the effectiveness with which an organization (a hospital) meets the needs of its customers (patients). It reflects that the hospital is doing the "right thing". To survive and prosper in the long run though, it must serve its customers with profit (and provide liquidity), that secures the appropriate level return to capital invested (for the level of the risk involved). It comes about only by exploiting resources efficiently and operate economically i.e., if "it does things right", in fulfilling the goals. Thus, a suitable performance measurement apparatus must encompass effectiveness and efficiency since are both necessary for long term survival, that is a prerequisite for keeping investors and the rest stakeholders happy and capital inflows for further investments (for development) secured.

External and internal operation proficiencies contribute to customer and the rest outside stakeholders (suppliers, banks, state, etc.) satisfaction on one hand, as well of the equity holders, management, employees, which are the main internal ones. At the same time external and internal harmonious alignment bestows on the organization an adequate market share, that will allow it to cover all expenses incurred and yield enough profit. Profitability and return on capital invested is the result of a successful matching of firms internal and external (industry) environments.

The outperforming economic entities are characterized by operational effectiveness and appropriate strategic positioning. The combined result of both factors is a sustained competitive advantage (Porter, 1996). The industry structure and the right positioning in it, which is the manifestation of the strategy success, leads to sustained competitive advantage which is the main driver of the above the average profitability. Profits are attributed to the industry structure, its ensuing level of attractiveness and the operational efficiency of an economic entity (McGahan and Porter, 1999). The approach is based on the structure-conduct-performance (SCP)

strategy paradigm that was developed by Bain (Pawlowska, 2007). It is focused mainly on the industrial structure and ability of the firm to obtain and exploit market power through the right positioning, to obtain superior performance (Hawanini, 2003). The operational effectiveness through continuous improvement it entails, is contemplated as a necessary but not sufficient condition of success, since it can potentially be imitated without prohibitive cost. A unique and valuable position by choosing specific activities to perform based on firm's internal strengths, requires tradeoffs and the creation of synergies across all company's operations maintain and invigorate competitive advantage and attain sustainability.

Contrary to structure-conduct-performance (SCP) model, which emphasizes principally the importance of the external factors of the organization, the resource-based theory attempts to explain observed differences in performance among organizations emanating from specific factors they are endowed (Barney 1991). The different levels of efficiency an entity exhibits, is affected by the mix of resources and capabilities management has in its command and They must be deployed in business activities skillfully so that create value along the value chain by achieving operational efficiency and effectiveness.

The dynamic capabilities approach, which the newest expression and refinement of the resource-based view of the strategy's success, defines economic sustainability stemming from a vibrant competitive advantage that align resources to external environment changes (Teece *et al.,* 1997). It is attained through the capacity of an organization to purposefully create, extend, or modify its resource base" (Helfat *et al.,* 2009). The latter is comprised of valuable, rare, inimitable, and non-substitutable resources, that lead in recent years primarily to knowledge creation (especially of a tacit one), storage, transfer, innovation, agility, and resilience. The learning process is crucial to dynamic capabilities and knowledge management applications in the healthcare organizations, which are extremely dependent on data and information to provide care and positive impact healthcare outcomes through the coordination of "physical assets, employees, suppliers-materials, customers, organization assets and improve any everyday aspect of the organizational performance (Almansoori *et al.,* 2020). The combination and orchestration of these types of assets must be unique in a continuous consultation with the main stakeholders and difficult to be replicated by competitors, create a strong entity that is capable not only adapt to business ecosystem, but even harness and shape it to a certain degree in order accomplish sustainable development and above the average financial performance.

Learning intelligent resource allocation and innovation capabilities lead to competitiveness and financial sustainability in a constantly. Entities as hospitals "can successfully deploy and develop their strategic human assets while managing the tradeoffs in their service and geographical diversification strategies", to influence their financial performance (Kor, 2005). The pivotal role of human capital for the knowledge creation and management capabilities process through it,

is reflected in the statement "There is only one thing that gives you sustainable competitive advantage – what you know, how you use what you know, and how fast you can know something new" (Prusak, 2010). Human resources are perhaps "the most important of the health system's inputs and usually the biggest single item in the recurrent budget for health" (WHO, 2000). Capability building and learning based growth, is more valuable during the pandemic than ever (McKinsey, 2020). That is why hospital must obtain the organizational capacity and culture to achieve it.

2.2 DEA, Efficiency and Financial Data

A valuable model that measures performance, suitable for assessing a comparative small set of data is the Data Development Analysis (DEA). It is intended as a method for performance evaluation and best-practice benchmarking (Cook, Tone, and Zhu, 2014), as well as for auditing competitiveness (Guan *et al.,* 2006).

Efficiency measurement has been recognized as a precious factor of performance evaluation, since it considered as an inextricable ingredient of the value creation process. That is why hospitals must embrace efficiency in its investments in structure, process, and human resources to create value (Jacobs, 2006). Efficiency achievement through best practices though, although is essential it can potentially be imitated though and is not considered as a lasting source of competitive advantage, when external environment changes constantly. So technical efficiency alone is necessary, but not sufficient condition for financial sustainability (profitability). The concurrence of both efficiency and profitability it is alleged "can ensure a reasonable return to stakeholders that minimizes the risk of bankruptcy, that otherwise leads to misallocation of resources" (Kumar, 2008). The study accepts that efficiency alone does not lead automatically to sustainability. Efficiency must be supplemented by effectiveness, alignment of internal and external organizational environments through the appropriate strategy, that will provide effectiveness. It is of course true that other things being equal, an improvement in efficiency bolsters profitability and return on assets (capital).

Efficiency is a means that affects more broad economic measures. It is argued that "inefficiencies due to wasted resources affects earnings, cash flow and growth through the negative repercussions (Greene *et al.,* 2004). Rosko *et al.* (2020) examined the relationship of efficiency and profitability in the case of hospitals and found a positive association between size, industry concentration and profitability. They added that firm-level scale economies reduce costs and enhance the bargaining power of systems, which in turn increases revenue. The size of operation increases the ability of larger hospitals to negotiate better rates with suppliers and health insurance, build brand recognition and economies of scale in their strategies.

Hospitals with significantly lower profitability margins, it is alleged that leave less financial cushion to weather sustained financial pressures (Reiter *et al.*, 2014). The strong financial position is necessary for hospitals, since any "notable financial deficiencies could limit their abilities to meet the growing demands on the industry" (Bazzoli *et al.*, 2014). Poor financial performance further influences the outcomes of the care and limits access, since either reducing services and/or causing hospital closures (Bazzoli *et al.*, 2014; 2008). There is "predominant finding about positive association between financial performance and quality " in the hospital sector in US (Barnes *et al.*, 2017).

We espouse the idea that sound financial position of hospitals is a precondition for the quality and long-term duration of the supply of healthcare services. That is why we deem as inconceivable to comprehend why private hospitals are treated as philanthropist organizations, on the basis alone that serve a sector that is so sensitive for the public wellbeing. The latter is true, but at the same time sustainability without funding is not possible and private funds require returns to be attracted to the sector. This is one reason why we use financial statement data that are expressed in values to measure resources used and incomes generated throughout the year, to track their genuine financial positions and forecast the viability of healthcare units (hospitals).

We choose to employ value data, although most of the studies using DEA using physical inputs and outputs to evaluate efficiency, since by incorporating prices in connection with quantities, renders input and output data in more comparable form by taking care of the differences in quality, which is an insurmountable task to carry out otherwise in the case of services and affects the measurement outcomes. It is known that the validity of DEA outcomes (and not only), depends heavily on the degree of comparability of input and output data. Financial data are more homogeneous, and they are also audited.

Most of the rich literature related to the evaluation of efficiency and performance in general of the healthcare facilities and hospitals (either public or private) using the DEA model (and not only), usually utilize as inputs variables as: the number of beds, the number of doctors and nurses, administrative staff, the number of specific or all medical devices, medicines, and materials. As outputs employ, the bed occupancy rate, the bed turnover rate, the average nursing time in day, resident time out-patient (Kohl *et al.*, 2018; Kumar *et al.*, 2010; Cwiakala *et al.*, 2020**;** Nayar *et al.*, 2008; Polyzos, 2012; Zakowskaa *et al.*, 2020; Stefko *et al.*, 2018; Osei *et al.*, 2005; Lo *et al.*, 1996; Zavras *et al.*, 2002). To measure performance through dimensions such as effectiveness, efficiency, and financial soundness of hospitals, we opted to use data from their audited financial statements.

We picked the scale of revenues as representing effectiveness (intended outcome) and the size of Cash flows from Operations (CFFO) as a measure of economic efficiency. Lasting effectiveness plus efficiency determine competitiveness,

financial sustainability, and good governance (as well as social and ecological concerns are at least partially met). Thus, using DEA method of performance measurement with output variables (revenues and CFFO) representing efficiency and effectiveness is considered as a more full-fledged and integrated method to establish well founded indicators, that can be used as beacons of best practices management and development, compare to the measurement of technical efficiency (productivity) alone.

Revenues are the culmination of a successful strategy that leads to competitive advantage and sustainability. Revenue's reliability can be tested if we calculate the ratio of receivables to sales every year and compare it with the corresponding of the previous one, to find out if it increases only spuriously. The value creation requires profits and return on capital above its costs. Profits require genuine revenues and true expenses. Accruals may distort accounting profits if the management is determined to do so and the circumstances permit. That is why we replace them with cash flows from operations (CFFO), that are less amenable to manipulations (Kourtis *et al.*, 2019). The latter not only provide an indispensable guide to test the validity of profits, but also is the lifeline for the hospitals given that supply the necessary liquidity through the operations, that can finance an increase in revenues that is necessary for the growth of the entity. CFFO based performance measurement, that excludes unduly increases in receivables intentionally (that boost technically revenues) or in inventories (that lower the cost of goods sold and raise profits), avert any mischievous attempt of perpetrating financial shenanigans to deceive stakeholders. CFFO without revenue growth (to obtain and retain a sizable market share) is problematic in the long run, especially for hospitals that are heavily invested in non-current assets and the breakeven point in revenues terms is high, compare to its total capacity. Thus, the revenues of hospitals represent effectiveness in their operation, that results from healthcare care services offered to society, while CFFO emanating from the efficiency achieved. Both secure financial sustainability through funding from operations and the achievement of an adequate return to capital employed.

Connecting organizational growth and value creation through the output variables (revenues and CFFO) in the DEA model, not only we measure performance in a consistent and harmonious manner that is justified by the strategic financial management principles, we make also at the same time a step forward to accounting gimmicks and possible fraudulent financial reporting (Kourtis *et al.*, 2019). It is crucial not only because we are in a better position to detect any waste of resources, but also it is known that DEA measurements are sensitive to mistakes with respect the input and output figures applied in the model. DEA assumes data to be free of measurement error and will provide unreliable results if the integrity of data is not assured (Kumar *et al.*, 2008). So, by purifying data to a certain extend (using audited ones and the application of the M score of Benish) and by

measuring effectiveness and efficiency at the same time, we are more confident with the outcome of the performance measurement with the use of DEA.

As input variables of the model, on one hand total assets are exploited as a proxy for the size of hospitals and staff expenses on the other as representing a "good proxy for the number of employees" (Ouenniche *et al.,* 2018). Total assets that are heavily dominated by non-current ones, is a proxy for bed capacity that determines the amount of revenues and profits. Staff remunerations represent the greatest portion of the expenses in the income statement, and it is crucial for the results of the hospital operations, while also delineates the quality of the human capital employed. Healthcare services are knowledge based and the cost of staff is a good surrogate for the caliber of the personnel employed.

The output variables of revenues and Cash flows from operations are the critical variables, since define growth, that is financed through the operation in a sustainable fashion. The size of CFFO determines not only the necessary liquidity, but also the genuine or the fictitious character of the reported earnings (Curtis, 2020; Tarczynski *et al.,* 2020; Kourtis, 2019).

Performance measurement with respect these two outputs factor, directs the attention of the management on the dimensions that must be preserved and promoted further, in order assure sustainability. Any possible reservations that may be expressed for the economic efficiency evaluation focus of private hospitals, on the ground of the significance of the health care services for the wellbeing the society as whole, that necessitates the provision for the accessibility of to the public, are understandable to a certain extent, since it rests primarily on the shoulders of the authorities. The state is responsible to accommodate needy citizens through a public insurance coverage and subsidies when it is deemed appropriate. At the same time, it is its duty to make sure that quality services demanded, get paid adequately to continue providing coverage. Otherwise, private hospitals will not survive and the gap in the services required must be filled by additional public spending, that is increasingly difficult due to fiscal austerity measures. In case though that is substantiated private hospitals earn excessive returns (that are hardly discernible during the past decade at least) for the capital they invest and the risk they bear, the government can use the claw back ant rebate mechanisms they are equipped with and taxation to normalize the situation for the shake all stakeholders involved, that must be consulted at any stage of decision-making process.

It is believed that DEA works particularly well with small samples. DEA though, provides "poor discrimination on the performance" in the case of lack of sufficient observations (or other factors) limiting the effective discrimination among them. (Podinovski *et al.,* 2007). It happens as the number of DMUs decreases beyond some critical boundaries, as well as the sum of input and output variables the number of efficient units increases and is due to insufficient degrees of freedom.

That is why it is suggested that the number of DMUs is equal or greater three times the sum of the variables (inputs plus outputs) used by the model (Cooper *et al.*, 2006; Avrikan, 2011).

A possible troublesome dimension that may be developed in the private healthcare market is to be concentrated through a new wave of hospital acquisitions by 3-4 existing dominant groups to stabilize profitability and reduce the associated risk factors. Such a development besides the welcomed synergies, economies of scale, service quality improvement and cost reduction, may exert unduly constraints in the sector by creating a troublesome oligopoly agreement, which potentially mitigate the beneficial market forces impetus and finally will lead to unjustified price hikes that my hinder accessibility of the citizens to healthcare essential services. Even in that case the independent authority that oversees the sound competitive conditions in the market, may intervene to regulate or thwart decisively such developments. Stakeholders' role is crucial for both private and public sector to secure sustainability especially in such a sensitive and pivotal sector as the healthcare services. That is why we feel it is fruitful to the public authorities to monitor and comprehend fully the financial status and supplementary role of the private healthcare sector, to be able to make well -informed decisions that benefit the society at large.

3. Research Methodology

3.1 DEA Model and Variables

Based on the aforementioned rational we measure economic efficiency using two inputs and two outputs, as we explained previously, by examining a sample of fifteen (15) hospitals operating 5.145 beds totally and producing well above the 75 % of the total turnover of sector in 2019. The number of the fifteen (15) hospitals has comprise the sample, has exceeded the minimum number of DMUs its considered advisable, given the number of the four variables that are examined. The dataset of hospitals is more than three times the sum of inputs and output variables included (Cooper *et al.*, 2006; Avrikan, 2011).

As far the credibility of values of the four variables used to assess performance is concerned, it is obtained by using audited published data on one hand, that in addition have been checked for possible manipulation using the M score (Beneish, 1999). The integrity of data analyzed mitigate or even neutralize repercussions of the agency problem and information asymmetry on inputs and outputs figures, that distort the DEA based performance measurement outcome. It was verified that the M score (at least for the thirteen of hospitals in 2019), was less the threshold value of -2,22 {(or -1,78), ranging from - 3,58 to -2,46}, indicating that the data are not likely to have been manipulated in order to portray an artificial picture. So, additional precautionary steps have been taken to avoid measurement mistakes (or

even intentional financial shenanigans), that are more difficult to identify when physical input and output data have been utilized. It is also true that non-financial data very rarely have being verified officially by a certified third party, besides the fact that quality discrepancies are more prevalent, when data concerning only quantities are reported and analyzed. Finally, economic efficiency embraces both technical and allocative efficiencies and thus it is more inclusive and as such, more conclusive for the society than the selective one of corresponding technical one. Possible environmental and general societal dimensions can be further incorporated in the DEA model in value terms, as measures of effectiveness are incorporated also.

The input orientation of the model chosen to be applied, was determined by the appreciation on which of the two categories of variables (inputs or outputs) the management of the hospitals, can exert a decisive control. In the case of private hospitals more control can be exerted on assets (or capital) invested and the staff employed, as opposed to revenues and CFFOs which are the output dimensions. The last two are practically out of the reach of the management control and a natural concomitant of the success of strategy followed, which is determined by the quality of the alignment of internal environment and to the changes of the external one of the health care units.

The alignment each hospital attains is affected ultimately by the degree of VRIN attributes of its resources, and how processes and activities are orchestrated and applied to create dynamic capabilities, appropriate to its market positioning in the sector, that exploits uniquely the five forces operating in it. The organization's goal is to establish, preserve and upgrade a swift and dynamic competitive advantage that provides agility, resilience, and excellence in the hospital, that will be translated into market share and value creation ultimately, if operational effectiveness is also achieved (Porter, 1996).

That is why only an input orientation is more appropriate in our case. An input minimization target is legitimate concern for the management of private hospitals, provided that the quality of the clinical outcomes that secured the existing scale of revenues and value creation process, are not compromised. On the contrary, the scale of the output variables is not usually practically within the reach of DMUs control, although it can affect them through the appropriate strategy. That is why the size of the output variables measure the degree of the strategy success of the management. Consequently, we chose to proceed with the input-oriented version of efficiency measurement.

4. Research Results and Discussion

In Table 1 underneath, the input and output data of fifteen (15) private hospitals in Greece (which published financial statements for the year 2019), are presented. Twelve of them are general hospitals and the rest three maternity clinics. These

two categories of hospitals account for 60 % and 15 % respectively of the entire private healthcare sector spending in Greece (ICAP, 2018). We must take also into account, that the total net sales of the entire private sector in 2016, were 800 mil for the general hospitals and 300 mil euros for the maternity clinics (Deloitte, 2017) Our sample contains 15 hospitals that in 2019 generated sales 925,2 mil in total (or 84% of total revenues in 2016 of the two subsectors -general and maternity clinics).

Table 1. *Input and output 2019 data (in '000 Euros)*

	Input 1	**Input 2**	**Output 1**	**Output 2**
DMUs	**Assets.**	**Personnel Cost**	**Revenues**	**CFFO**
DMU 1	309.025,00	36.742,00	143.106,00	39.556,00
DMU 2	373.425,04	71.798,00	190.671,00	30.788,03
DMU 3	220.481,97	22.750,57	95.714,07	28.264,56
DMU 4	122.951,34	27.870,19	51.030,11	0,01
DMU 5	54.034,15	5.751,76	15.046,48	6.101,17
DMU 6	223.737,98	32.350,50	111.218,98	8.440,00
DMU 7	71.706,06	15.560,00	47.827,26	3.593,45
DMU 8	43.920,50	6.250,00	16.970,12	3.320,53
DMU 9	36.973,27	7.277,39	31.744,24	8.220,02
DMU 10	72.151,66	13.691,87	45.938,98	4.964,56
DMU 11	60.957,00	4.580,50	12.033,41	665,85
DMU 12	63.962,03	17.566,63	47.168,97	9.517,69
DMU 13	15.861,17	4.650,00	12.080,31	499,60
DMU 14	101.766,48	24.555,62	76.483,61	9.945,94
DMU 15	84.258,97	13.234,00	28.148,93	3.624,70

Source: *Data extracted from hospitals annual reports.*

In the following Table 2, the main descriptive statistics of the data used in the model are presented. The descriptive statistics (mean, median, St. Dev., etc.) of input and output variables of the private hospitals used in the model, denote that the units of our sample diverge significantly with respect to their size. Most particularly, the much higher value of mean compares to the median and the quite high standard deviation in the case of the main input variable of total assets, indicates very clearly the wide variability in the scale (capital invested or bed capacity) of operations of the hospitals involved. As a matter of fact, the maximum value of total assets, is 23,5 times higher, than the minimum respective value of the sample. An analogous behavior between maximum and minimum is exposed by the output variable CFFO and even more pronounced indeed (since the minimum is virtually zero). It is known that this last variable measures the level of liquidity provided from operations and at the same time tests the authenticity of profitability, that is often jeopardized by misstatements and other aberrations due

to discretion allowed by the accrual's basis of accounting (Kourtis 2017; 2019; Beneish 1999; Curtis and Thalassinos, 2005).

Table 2. *The descriptive statistics of the inputs and outputs variables of the Greek private hospitals ('000 euros)*

Statistics	**Total Assets**	**Personnel Cost**	**Revenues**	**CFFO**
Total	1.855.212,62	304.629,03	925.182,47	157.502,10
Mean	123.680,84	20.813,93	61.678,83	10.500,14
Median	72.151,66	15.560,00	47.168,97	6.101,17
St.Dev.	107.355,98	17.613,35	52.768,48	12.205,45
Maximum	373.425,04	71.798,00	190.671,00	39.556,00
Minimum	15.861,17	4.650,00	12.080,31	0,01

Source: *Data extracted from the annual reports of hospitals.*

In the cases of revenues and the costs of staff, the differences among the hospitals are less volatile compare to the previous variables but still quite great, since the maximum figure of the variables is more than 15 times, the minimum ones. The great oscillation of all four variables between maximum and minimum, indicates that the scale (assets) of hospitals vary considerably, and an acceptable level of performance and sustainability (manifested in CFFO levels) is not comfortably secured.

The input orientation economic efficiency scores reflect the degree the management must reduce the inputs according to the best practice performance of the DMUs located on the efficiency frontier, while hospitals producing the specific number of outputs as before. On the other hand, an output oriented one, maximizes output for the predetermined amount of inputs consumed and it is more appropriate for the public hospitals where assets-investments and employees (and hence the cost of staff) are largely given for the management, which must strive to achieve the optimum output for these input resources.

The efficiency frontier that emanates from the DEA model, envelops the inefficient hospitals (and reflects the relative efficiency score of each one), in comparison to DMUs which are forming the frontier and represent the best practices cases which are transforming inputs into output in the most efficient (relatively) fashion. The output variables in our case includes variables that measure the degree of growth and sustainability and finally the degree of strategy success for the creation of competitive advantage and value {if their return on Invested capital- assets (ROIC) exceeds the Weighted Cost of Capital (WACC), Damilano *et al.*, 2017}. The value is sustainable, if the return on capital is consistently above the average of the sector (Porter, 1996).

The hospital sector is a complex one to compete and sometimes is necessary to use a hybrid strategy (low cost, differentiation and quality, focus) to be successful (Walters *et al.*, 2004). Hospitals considered as complex adaptive systems (Ellis *et al.*, 2011; The Health Foundation, 2010), and are characterized primarily as knowledge (explicit or tacit) creating organizations, due to their heavy dependence on human capital for their operation (Krawczyk, 2012). All these characteristics suggest that the input output relationship is not linear.

Thus, the variable return to scale DEA is contemplated to be the most dominant version. This conviction is further invigorated by the fact that seamless scale continuity is not prevalent in such organizations, that are heavily dependent on fix assets for their operation and in these cases, linearity is a rather rare event. To operate at the suitable scale is not always axiomatic in the case of healthcare organizations due to the absence of free competition conditions in some cases, the government interventions etc. Then, the operation under optimal scale is not always feasible (or even not attractive in certain instances). The impact of hospital scale on their efficiency is evaluated using a three-step process. First, the model was estimated assuming CRS. Second, the model was run assuming VRS. Third, scale efficiency was obtained by dividing each hospital's CRS total technical efficiency score by its VRS pure technical efficiency score (Osei *et al.*, 2005).

4.1 Data Envelopment Analysis (DEA) Application

The Data Envelopment Analysis (DEA) is a non-parametric performance assessment tool, that can be applied to any type of entities (profit or non-profit oriented) that transforms a group of inputs to corresponding outputs. Its advantage is it does not have to specify in advance the type of relationship among them (Coelli, 1996). It is the appropriate input and output variables availability, that determines the suitability of the DEA model and the quality of the outcome. It is a tool t is used to assess the degree of success of the transformation of process of inputs into outputs, by calculating measures reflecting the efficiency of it. An additional advantage of the model is its capacity of incorporating any number of inputs and outputs into the analysis, that can be of any nature if are comparable and their measurement reveals its true magnitude that can be applied consistently to all entities under assessment.

DEA allows the evaluation of performance of any type of organizations in a comparative (not an absolute) fashion among them, using multiple inputs and outputs uniformly. The model declares efficient and inefficient DMUs only among the members of the sample that is scrutinized. A Decision-Making Unit (DMU) is any entity that exploits inputs to produce any form of output. Relative Technical Efficiency is the "ability of the DMU to obtain output, from a given set of inputs compare to rest units of the sample. DEA is also able to discern further among inefficient units. At the same time though, is almost impotent to assess efficient

DMUs in a hierarchical order with respect their level of absolute efficiency, to end up unanimously with an undisputable optimum one.

DEA represent a linear programming-based technique for measuring the relative performance of organizational units. The technique was introduced initially by Charnes *et al.* (1978) to measure the efficiency of input conversion into outputs. A measure of firm efficiency proposed by Farrell (1957) who defined the technical efficiency as the ability to obtain maximum output from a given set of inputs. Efficiency measures how effectively inputs are transformed to specific outputs. The administration of efficiency contributes to the management's role to gain competitiveness, profitability, and long-term viability in a wider possible sense.

Efficiency represents an index of total outputs produced, divided by the total input used for that purpose. The efficiency score of each unit is expressed compared to the optimal performance of DMUs that excel in the group of reference that is under scrutiny. It is a relative measure compared to the one of the peer units and not an absolute one, that cannot be improved further (even for the so-called efficient units). It is merely the champion in performance among the members of the group measured. The resulting efficiency scores lie between zero and one. DEA scores divide DMUs into two categories, the efficient and inefficient ones. Score one (1) gets the case (s) located on the frontier that is considered efficient and constitutes the base for comparison. Their position is characterized as Pareto optimal. The output cannot change without a corresponding change in inputs. The inefficient DMUs are rated greater than zero, but lower than one (1). A DMU can improve efficiency through DEA benchmarking, the adoption of best practices and appropriate strategy to obtain a more suitable production scale.

Charnes *et al.* (1978) in their work (following Farrel's seminal contribution) assume that Constant Returns to Scale (CRS) prevail (a change in inputs leads to an exactly proportional change in output) and proposed a frontier that measures the overall efficiency. The isoquant describes the "technological set" to produce the certain amount of output. It is a model under the assumption that the DMUs are operating at an optimal scale. It can happen when perfect competition prevails, and no constraints exist in the market.

The BCC model developed by Banker *et al.* (1984) refines further the previous model and discerns that the overall technical efficiency is consisting of two factors, a) the pure technical and b) the scale inefficiencies. So, it identifies also whether at the given scale of operation, increasing or decreasing returns to scale possibilities exist. If imperfections in the market do occur, it may not be possible for DMUs to reach an optimal size of operations. In that situation, which is not scarce, the BCC model is appropriate to tackle the issue of the DMUs' return to scale. The latter applies when a percentage change in inputs, does not lead to an equal (but greater or lower) change in output. In that case the scale of operation is crucial and discerns the pure technical efficiency. So, a DMUs must decide on how to improve

of efficiency and choose the appropriate scale of operation to achieve that. So, the DEA CCR and BCC models are used to derive the total technical, pure technical and scale efficiency, having calculated efficiency ratios under the CRS and VRS assumptions.

The first step in applying the model is to estimate total-overall efficiency. In the CRS version of the model, the scale of operation of the DMU is irrelevant, and any change in inputs is translated into proportional movement in outputs. It is assumed that variable (increasing or decreasing) returns to scale do not exist.

Using the data of inputs and outputs for the 15 hospitals of the sample that are exposed in the table 1 and calculating the scores under the CRS version, we observe that only DMUs No 3 and 9 (or 13 % of the total number of units) are totally (overall) efficient, showing Total Technical Efficiency (TTE) score equal to one (1), as it is unveiled in the corresponding column of the following Table 3.

Table 3. *Total technical, purely technical, scale and type of scale efficiencies*

DMUs	**CRS (TTE)**	**VRS (PTE)**	**SE=TTE/PTE**	**Type of inefficiency**
DMU 1	0,90870	1,00000	0,90870	DRS
DMU 2	0,60881	1,00000	0,60881	DRS
DMU 3	**1,00000**	1,00000	1,00000	--
DMU 4	0,48341	0,52819	0,91522	DRS
DMU 5	0,85884	1,00000	0,85884	IRS
DMU 6	0,78815	0,94737	0,83193	DRS
DMU 7	0,77686	0,85735	0,90612	DRS
DMU 8	0,62247	0,86810	0,71705	IRS
DMU 9	**1,00000**	1,00000	1,00000	--
DMU 10	0,74158	0,79736	0,93004	DRS
DMU 11	0,60226	1,00000	0,60226	IRS
DMU 12	0,85892	0,97229	0,88340	DRS
DMU 13	0,88709	1,00000	0,88709	IRS
DMU 14	0,87536	1,00000	0,87536	DRS
DMU 15	0,48762	0,51273	0,95103	IRS
Mean	**0,76667**	**0,898893**	**0,85839**	
Efficient units	**2**	**8**	**2**	
Inefficient units	**13**	**7**	**13**	

Source: *Own study.*

The resource utilization of these two hospitals is relatively optimal and it not characterized by any waste of the inputs used. These two hospitals represent the best practice or the so-called efficient frontier of the sample and thus are becoming the reference set for the rest 13 inefficient ones units. The TTE scores among the

inefficient hospital range from 0,483 of the DMU No 4, to 0.909 of the hospital No 1. This finding implies that the hospitals No 4 and 1, can potentially reduce their current input levels by as much 51,66 and 9,13 percentage points respectively, in accordance with the performance of the best practice case of the frontier, while leaving their output level intact. An analogous interpretation of the overall TE scores, can be extended for the other inefficient hospitals of the sample.

The above observations indicate that the hospitals of the group operate with a substantial discrepancy in their overall efficiency performance, as the diversity of the TTE scores of the individual DMUs clearly reflect. The average TTE score denotes that in producing same amount of output, it would need on average only 76,7% percent of the amounts of inputs presently being used (or the number of inputs can be reduced 23,3 percentage points and still attain the same output), if it operated as efficiently as the ones located on the efficient frontier. It is tantamount to a boost of 1 / 0,767= 130,4 % in output, by applying the existing number of inputs by the 15 hospitals.

The descriptive statistics based on the scores of the overall efficiency under CRS assumption, are presented in the following Table 4.

Table 4. *The descriptive statistics of the overall-Total technical efficiency scores (TTE) for the Greek private hospitals*

Statistics	**All Hospitals**	**Efficient**	**Inefficient**
Sample Units	15	2	13
Average TTE	0,767	1,000	0,751
St.Dev.	0,170	0	0,152
Minimum	0,483	1,000	0,483
Maximum	1,000	1,000	0,908
Median	0,788	1,000	0,777
Average Inefficiency	0,233	0	24,9
% of units	100	13,3	86,7

Source: *Own study.*

The hospitals included in the group, exhibit quite dispersed scores of efficiencies and it indicates that may be considerable ground for improvements in their operations. The great majority of hospitals (13 out of 15) displays inefficient operation. Their efficiency scores range from as low 48,3 % to 90,8%, while the benchmark performance is 100%. It indicates that the diverse scale of operation based on the assets employed, exhibited analytical in Table 1, is followed by a quite varying performance and that reveals that there is enough space for improvement in the use of precious resources in the hospital sector.

Technical efficiency under CRS, corresponds to the global (overall) measure of firm performance or total efficiency and is composed of two dimensions, the VRS efficiency or the so called Pure Technical Efficiency (PTE) and a Scale Efficiency measure (SE). The first reveals the extent to which the hospital is inadequate managed in transforming inputs into outputs efficiently and the second is determined by the degree of optimality of the chosen scale of operations. So, these two factors must be segregated, in order someone to identify the exact possible cause of observed inefficiency in MDUs (the hospitals in our case).

The pure technical efficiency (PTE) score emerges from BCC model through the assumption of VRS, that does not contain the scale effects. It arises solely due to the employment of not optimal combination of inputs and attributed to inept management practices. The adoption of the appropriate method of DEA is decided by the following observation "If the majority of the DMUs portray different scores under the two assumptions, then it is preferable to adopt VRS (as in our case). It is tantamount to the statement if the majority of DMUs are evaluated as having the same efficiency scores under both methods, then the VRS version is deemed redundant and CRS efficiency is adequate (Avrican, 2011).

The CRS global efficiency does not discern inefficiencies attributed to management skillfulness and the appropriateness of the scale of operations as does VRS, which decomposes efficiency by measuring SE as PTE/TTE or TTE(CRS)= PTE(VRS) x SE (columns 2, 3 and 4 of Table 3). The CRS model assumes radial movement of all DMUs and gives scores TTE. The VRS on the other hand assumes a convex combination of the observed DMUs as the production possibility and the score emanating is PTE. Comparison of the CRS and VRS scores disentangles the sources of inefficiency that a DMU might display (Cantor *et al.*, 2017). Since TTE(CRS) is always equal or smaller than PTE(VRS) score, the SE score lies between zero and one. When coincide in size, the DMU operates at the optimal productive scale "locally and globally" (Ederrer, 2015). Otherwise, the scale size of operation should change.

As we move from CRS to VRS assumptions, we observe from Table 3 in the corresponding column, that hospitals No 3 and 9 are located on both TTE and PTE efficient frontiers. In addition, we observe that six (6) more hospitals (No 1, 2, 5, 11, 13 and 14) that were measured as total technically inefficient previously, they are becoming pure technically efficient. Thus, the efficient hospitals under VRS were increased in eight totally. Inefficiency in these six hospitals is attributed to inappropriate scale (size) under which operate and not to the incapability of management to translate inputs into outputs through their appropriate combination. It is known Pure Technical efficiency denotes how efficiently inputs are converted into outputs, irrespectively of the scale of the hospital. As far as the rest seven hospitals that are positioned neither on CRS

frontier nor on VRS one, are confronting inefficiency problems attributed to both poor management practices and to suboptimal (higher or lower) scale of operation.

The quality of operation management that determines the PTE and the SE (to a certain degree) is a capability that the RBV stream of thought considers as an essential internal attribute in conceptualizing organizations (Barney, 1991). The external alignment through the "appropriate positioning in an attractive sector" is indispensable for the other school of thought (Porter, 1996), since operational optimization although necessary, is not sufficient to secure sustainable development. The dynamic capability extension of the RBV combines both by aligning internal and external environment in a dynamic fashion that encompasses operational efficiency through the appropriate orchestration of resources embedded in a congruous strategy (Teece, 2007).

The third step of the model is reflected in the column of Scale efficiency (SE) that is calculated based on the adjustment of the DMUs scale. Having estimated the efficiency score of DMUs under CRS and VRS we are able now to calculate the scale effect (SE) using the formula SE= TTE/PTE. The value of SE depends upon the divergence between Total Efficiency and the Pure one. The larger the difference between OTE and PTE scores, the lower the value of SE (Table 5).

Table 5. *The descriptive statistics of the TTE, PTE and SE scores for the Greek private hospitals in 2019*

Statistics	**TTE**	**PTE**	**SE**
Sample Units	15	15	15
Efficient DMUs	2	8	2
%	13,3	53,3	13,3
Efficiency mean	**0,767**	**0,899**	**0,858**
St. Dev	0,170	0,167	0,123
Minimum	0,483	0,513	0,602
Median.	0,788	1,000	0,887
Maximum	1,000	1,000	1,000
Inefficiency Mean	0,233	0,101	0,142

Source: *Own study.*

From Table 5, we observe that on average the total efficiency score is 0,767 and indicates that a reduction of inputs by 23,3 percentage points is needed in accordance with the best practice hospitals under the CRS assumption. We also observe that by adopting the VRS version the average PTE score becomes 0,899, which denotes that a portion 10,1 percentage points of the total average inefficiency are attributed to an improvement in the management of inputs

configuration. Finally, an additional reduction of 14,2 percentage points in inputs can be attained by adjusting their scale of operation and still achieve the same output according to the reference set of hospitals. Thus, suboptimal scale of operations, is the major source of inefficiency of the sample.

The mean of SE is 0,858 and lower than mean pure technical efficiency 0,899, thus it implies that the great share inefficiency in the sample (and the sector) is attributed more to non-optimal operating scale size of the hospitals, compare to the management's capability to transform efficiently inputs to outputs. The last column indicates that only DMUs 3 and 9 operate at an optimal scale, that shall not be changed. The remaining 13 hospitals must change the scale of their operations in order to obtain an optimal size. The mean of the fourth column divulges that on the average the hospitals of the sample could consume 14,2 percentage points lower inputs by altering their size of operation and still attain the same output.

The VRS version engulfs positive or negative economies of scale as it is unveiled in the last column of the table 2. VRS is the type of frontier appropriate to estimate efficiencies when a change in inputs leads to disproportionate change (increase or decrease) in the outputs. From the Table 3 we observe also that under CRS thirteen hospitals (or 86.7%) were technical inefficient. The means show that most of the technical inefficiency is in the form of scale inefficiency. Eight (or 61,5 %) out of thirteen inefficient hospitals, display Decreasing Return to Scale (DRS) and the remaining five (or 38,5 %) Increasing Returns to Scale (IRS). Scale efficiency is assigned to size of operation at which the average productivity is at its maximum level. The effect of scale to be neutralized, the first category of hospital must reduce investments and scale down their operations to achieve CRS. The second group of the remaining five DMUs shall expand their scale of operations to attain CRS. DMUs 5, 8, 11, 13 and 15 that exhibit increasing returns to scale (IRS) must expand the size of operation, while the rest shall contract given that presently operating under Decreasing Returns to Scale (DRS). SE less than one (1) denotes scale inefficiency, that stems from the presence of either IRS or DRS. We conclude that more than 6 out of 10 inefficient hospitals that are a total of 13 (out of 15 examined), of the private healthcare sector in Greece, operate at scale higher than the optimum, that affects their performance and sustainability with respect their assets and staff costs. Also, almost four (38,5%) out of the 10 inefficient units, must increase their scale to reach CRS.

The scale inefficiency is approximately 14,2 % on the average for the 15 hospitals of our sample. The great part of the scale inefficiency in the eight (8) of them, emanates from their operation at a decreasing return to scale region. The average capacity of these is almost 419 beds each. The rest five (5) inefficient hospitals exhibit increasing returns to scale and the average capacity per each unit is virtually 228 beds. So, the first group of hospitals must reduce its average bed capacity from the present level of the 419, while the second one must increase its

capacity from the existing magnitude of 228 beds. The two (2) hospitals that operate under efficient scale show average bed capacity of nearly 327 beds, that is proven to be an optimal size for efficiency. These adjustments are expected to constitute the private hospitals an ever more constructive force in supplementing the public sector in the formation of a cohesive, sustainable, and resilient healthcare system for benefit of the entire country. The adaptations will bolster effectiveness and efficiency in the use of scarce inputs exploited by the private hospitals. As the results suggest, during 2019 the economic performance of the entities of the specific sample, was quite diverse and unsatisfactory to the detriment of the optimal allocation of scarce resources in the healthcare sector.

The model of DEA certainly indicates the directions of improvements. To materialize successfully though, a meticulous research is needed into how exactly efficiency will be enhanced, promoting ESG awareness in nowadays. We shall not forget that hospitals are complex systems that to gain, retain and upgrade o sustainable competitive advantage must build appropriate dynamic capabilities (operational culture included), that act as a fixed-point strange attractor, where all the trajectories of operation converge culminating in a sustainable state of operation (Curtis *et al.*, 2011). This state of functioning must be based primarily on human capital, information, and knowledge creation (and a tacit one), while engaging regularly with the wider health ecosystem stakeholders as a process enshrined in its culture, adopting the appropriate scale, and focusing on pursuing capability building to deliver quality healthcare services that result also in solid financial outcomes.

Given the unstable performance in the private hospitals industry, concentration through mergers and acquisitions as it happens the last few years in Greece, is a response to not so rosy financial situation of the sector, even though 2019 was a rather good year following 10 years of economic hardship for the entire country. The economic austerity will continue and intensify for a few years ahead, due to the recession caused by the Covid-19 pandemic of 2020 and the precarious fiscal position of the country.

Mergers and acquisitions of hospitals that are currently observed, will lead to a further concentration that will allow the largest 3-4 groups of hospitals to prevail and be the dominant players in the sector. Their size and market power may erect barriers into more competition and to the entrance of new players, affecting the five forces that determine the attractiveness of the sector (Porter, 1996). Their aim seems to be the stabilization of revenues at a more acceptable for them level on one hand by increasing their bargaining power against customers (primarily insurance companies and the state) and on the other subdue their expenses by bolstering their clout against suppliers. The concentration and more cooperation among fewer players may ultimately reduce competition among the existing hospitals, discourage new entrances and reduce the availability of substitutes. The increase of the size of competing groups of hospitals though, will increase

their breakeven point of revenues and may bring about diseconomies of scale. Due to the uncertainty that currently plague the sector, it may be beneficial for them to forge closer links with private insurance companies to create new health insurance products, that will benefit both and the society at large (in a win-win situation), if accessibility in the system is facilitated with the support and regulation of the state. So as the size of groups increases, their next move may include insurance company acquisitions, more vertical integration, and the creation of health insurance schemes, that will boost their revenue prospects and greater accessibility of the public. It will solidify their economic viability and enhance the optimality in the resource's allocation in healthcare, that will boost hopefully inclusive economic growth and native people's wellbeing.

5. Conclusion

We studied the performance of private hospitals in Greece, due to fact that hospitals in general are the main pillar of the healthcare system. At the same time the private sector is representing above the 40% of total spending in it and is increasing due to fiscal restraints. In addition, the availability of accurate data is by far greater for the entities of private sector. It facilitates the analysis and secures the trustworthiness of results.

Performance measurement is necessary for transparency, accountability, and the decision-making process as a means of improvement through the adoption of best practices. The performance evaluation comprises the effectiveness and efficiency of hospitals in order to secure sustainable financing. The assessment of both these two attributes contribute to optimization in the allocation of resources in the critical sector of healthcare, that promotes economic and social wellbeing.

We opted to use as inputs and outputs data which were extracted from audited financial statements, since values obviated the thorny issue of measuring efficiency and effectiveness based on quantities alone that may differ widely in quality. The latter is a parameter that is captured by the prices that are embedded in value terms either in inputs or outputs. that is inherently sensitive to the trustworthiness of data. In addition, value data used in the analysis were prior audited by an outside authority. Furthermore, some of the crucial output data used (as CFFOs) are less amenable to distortions (compare to accrual accounting based profits). Finally, we checked all data used for the possibility of manipulation by the management (due to information asymmetry and levels of agency relationships problems-Mishra,2004), with the use of the M score of the Beneish Model.

An input-oriented DEA model applied, since crucial parameters as assets and staff expenses used as inputs, are more controllable by the management. The CRS and VRS assumptions were used, since only two (or 13,3%) of the 15 hospitals was founded to operate optimally under CRS and 8 under VRS. Hospitals are human

capital and knowledge-based organization in their value creation process, which a complex adaptive system (CAS) which are open, characterized by interdependencies among its parts and non-linearity.

Performance measurement with respect effectiveness and efficiency, represent an objective basis for improvement of operation. The socially responsible hospitals offer more qualitative treatment and are more attractive to stakeholders and society. So, they are remunerated accordingly by higher revenues (and market shares), greater profitability and incoming cash flows.

The disaggregation of the TTE score into PTE and SE, unveiled that the greatest part of inefficiencies manifested, is attributed to the suboptimal scale operation of the hospitals. Thirteen, out of the 15 hospitals in total, operate under decreasing (8 of them) or increasing (5 of them) returns to scale. The fact that best practice economic efficiency measured by revenues and CFFO as outputs, is achieved by a reference set of hospitals of different sizes, it indicates that optimal resource allocation can be achieved by scalable investments that emulate benchmark performance and facilitate a sustainable financing through their operations.

The study is an attempt to contribute to the facilitation of the decision-making process to make informed choices, by revealing the genuine financial condition of the private hospitals that promote sustainable development of the sector. It is essential for public authorities to assess the performance of the private hospital in order to administer accordingly the level of its subsidies through public insurance funds, the claw back and rebate policies in a period of fiscal austerity and act accordingly. The appropriate claw back and rebate amounts can be also tuned to new investments in the sector. It will help authorities to attract or deter the inflow of additional private funds in healthcare sector.

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