Sustainable Business Growth, Value Creation and Dynamic Competitive Advantage: The Greek Pharmaceutical Industry

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Abstract:

Purpose: The paper assesses the efficiency in the use of inputs and its impact in the value creation measured by the EBITDA return on assets of a company. The latter is utilized to judge whether the companies involved possess a dynamic competitive advantage which creates business value.

Design/Methodology/Approach: A two step Data Envelopment Analysis (DEA) was applied. An input oriented version of the model was employed, using financial data and ratios as inputs and outputs, concerning the Greek owned pharmaceutical companies which are almost entirely comprised of non listed in the Stock Exchange economic entities. In the 1st stage we measured the economic efficiency with which inputs are used. In the 2nd stage we assessed whether the economic efficiency leads effectively into the creation of a lasting competitive advantage, culminating in creating value (return on assets) above the average. We examined whether the efficiency and effectiveness of business ultimately explain the difference in their financial performance and the degree of value creation which is attributed to the endowment of VRIN resources and the existence of dynamic capabilities.

Findings: We found that the efficiency in the use of assets and equity financing explains the EBITDA return on assets, the market value (effectiveness) of equity and eventually the enterprise (EV). Sustainable business growth deciphers the value creation footprint attributed to a tangible dynamic competitive advantage.

Originality/Value: We argue that in the case of non listed companies, the level of value creation is measured by the effectiveness and efficiency in the use of assets and proficiencies employed. It is mirrored in the magnitude of the EBITDA return on assets and ultimately reflected in the enterprise valuation performance using multiples of value drivers such as revenues-sales and EBITDA (earnings).

Keywords: Sustainable performance measurement, economic efficiency, DEA, financial ratios, RBV, dynamic capabilities, enterprise value, resilience.

JEL codes: C14, D21, D24, C61, H41, H51.

Paper Type: Research study.

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1. Introduction

Financial performance measurement comprises the assessment of a broad array of aspects of economic accomplishments, which ultimately determine the degree of strategy formulation and implementation success. It also represents a mechanism fostering competent management and control, which promotes transparency, holds management accountable and supplies the necessary information to improve organization effectiveness and efficiency for the sake of its stakeholders (Behn, 2003). Trustworthy performance measurement tools which disclose the competitive advantage of an organization, must evaluate effectiveness and efficiency as the ultimate dimensions of a resource allocation optimality. These two factors are crucial since "effectiveness is doing the right things, while efficiency is doing things right", according to the renown guru of management (Drucker, 1963). Effectiveness and efficiency are the two sides of the coin of competitiveness, sustainability and resilience.

Revenues and profitability are the main variables of the Marakon profitability matrix which is used in strategic planning (Hax and Majluf, 1983). The magnitude of the revenues earned denotes primarily effectiveness (or alignment with the market), while profitability reveals efficient internal operation. They are inextricably intertwined with the long term viability of the economic entity and each one of these two elements affects the other. A measure of a company's profitable growth above the average of the sector consistently in both dimensions, is a concrete sign of a of sustainable operation based on a tangible competitive advantage secured in the market domain through a fruitful strategy formulation and implementation (Porter, 1996; Kontes, 2011). It is also known that revenue and profits are the final two steps (levels) of the four level mechanism used in the Balanced Scorecard (BSC) apparatus, which is a strategic management system (Kaplan and Norton, 2001).

Revenues measure the effectiveness in the degree of alignment of internal production of the company to the active demand in the market. Profits indicate the level of efficiency with which the company serves the market generating ultimately value for the stakeholders reflected in the return on assets and eventually in the market value of the company. A revenue growth is highly acceptable, as long as it is accompanied by a threshold of profitability (Courtis, 2003). Management should not espouse revenue maximization strategies at any cost, if it hampers ultimately the profitability in the long run according to the Marakon profitability matrix.

The Resource Based View (RBV) tradition contemplates that an organization encompasses a variety of resources physical, human and organizational which are characterized by "heterogeneity and immobility" among companies (Barney, 1991). Resources and competencies through appropriate management create capabilities, which in order create a competitive advantage must be valuable, rare, imperfectly imitable and non substitutable and must be applied by the management through the appropriate strategy. Strategic capabilities require adequate, unique resources and

competencies which generate sustainable value. The different levels of value creation an entity exhibits, is affected by the mix of resources and capabilities that management has in its command and the way it deploys them in business activities along the value chain in order to achieve higher levels of efficiency and effectiveness, using a fruitful strategy. The dynamic capabilities approach, which the newest expression, refinement and extension of the resource-based view, defines economic sustainability and value creation as stemming from a vibrant competitive advantage that aligns constantly resources and competencies to the external environment changes, yielding performance above the average in a sector (Pervan *et al.,* 2018; Porter, 1996; Barney, 1991).

Dynamic capabilities help the organization not only to identify new opportunities in the constantly changing environment, but also to exploit them effectively and efficiently creating value in a unique fashion that cannot be imitated by its competitors (Teece, 1997). Dynamic capabilities allow a company to "sense, seize opportunities and then reconfigure its capacities in an explicit entrepreneurial fashion in order to align the entity harmoniously to its business ecosystem. At the same time the organization strives to shape it as much as possible through innovations and strategic alliance with the rest stakeholders (Teece, 2017). Dynamic capabilities associated with VRIN resources (tangibles and intangibles), integrated appropriately internally and externally through a sensible strategy, are the inextricably intertwined ingredients of a sustainable competitive advantage (Teece, 2018). The latter always is eventually translated into an exceptional, well above the average profitability and value creation footprint.

The existence of dynamic competitive advantage and capabilities are going to be traced by examining the financial performance of the Greek owned productive pharmaceutical companies. It will be assessed whether it is reflected in the companies which systematically outperform their peers with respect to the return on total assets (capital) employed.

The entire pharmaceutical sector in the country encompasses just over sixty companies approximately (ICAP, 2021). Almost half of them are foreign owned subsidiaries of multinational pharmaceutical companies operating in the country, which primarily import from their parent companies the bulk of the drugs sold domestically.

The exports of pharmaceuticals represent 6% of the total exports of the country and it is the second in value after the petroleum products (Fortune Greece, 2020). It is estimated that the total contribution of the sector to the GNP of the country is 3,6 % or 6,7 billion in total annually (2019). Every euro of value added in the sector generates additional 3,3 € for the entire economy. The export potential and the high multiplier effect of the investment spending in the sector, renders it very important for the economy of the e country (Sfee, 2020).

We will measure performance of the Greek owned productive pharmaceutical companies, using data drawn from the financial statements and ratios that are based on them. We utilize financial data as inputs and outputs to apply Data Envelopment Analysis (DEA) methodology in two steps (stages), which we contemplate that is the most suitable instrument for our purpose (Zhu, 2000).

In the first step we employ total assets and equity financing as inputs on one hand, revenues and EBITDA as outputs on the other hand, to apply DEA to measure the efficiency in the use of inputs. In the second step we convert the two outputs of the first step into a meaningful and comprehensive one which measures the EBITDA return on assets as the ultimate effectiveness of a company and its value, given that all entities (except one) of the sector are not listed in the stock exchange. To achieve that, we utilize as inputs at this stage the outputs of the first one in the form of ratio (revenues/assets and EBITDA /revenues).

This transformation is essential in order to align the new inputs of the 2nd stage to the final output, which is a ratio also (ie EBITDA return on assets). Further taking into consideration the intertwined nature of the variables involved (assets, equity capital, revenues, EBITDA and return on assets), DEA is considered as the mechanism that is suitable to accommodate the multiple criteria used to asses performance without making any assumption about the procedures taking place inside the DMU. The latter it is treated as a "black box", which uses inputs to produce outputs without considering in details the internal procedures (Halkos *et al.,* 2011). Then we conclude by considering whether the results of the financial performance measurement using DEA, explain the enterprise value differences based on multiples.

The paper proceeds as follows: In the 2nd section we are discussing the concepts of the performance measurement in relation to the competitive advantage, the role of resources, competencies and the dynamic capabilities. In the 3rd section, we are explaining why we have chosen DEA to measure economic efficiency and value creation using financial data. In the next section we are applying DEA in a sample of thirteen Greek owned pharmaceutical companies and discuss the findings. Finally in the last section we conclude

2. Performance Measurement, Competitive Advantage and Dynamic Capabilities

2.1 Performance Measurement

Financial performance measurement is used, among other things, to evaluate the degree of strategy success. It is alleged that "what gets measured, gets managed" according to Peter Drucker. He further argues that an organization thrives through effectiveness and efficiency in its operation (Drucker, 1963). He argues that

efficiency alone without effectiveness (which means "doing the wrong things, right"), leads to a "heroic failure", while effectiveness without efficiency, brings about just survival (Solitaire, 2014). He assigns predominate role in the effectiveness with which the strategy achieves the goals, without condoning the importance of efficiency at the same time.

Thus, he does not obviate the task concurrently to stress the need for operational efficiency in the process of pursuing the dominant goals. He does not want though the concern of management for efficiency to derail the process of strategy and end up into a goal displacement in the name of the overriding quest for efficiency. 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".

The mantra "measure, assess and improve" in nowadays is widely applied to business and organization management. It is believed that if you can't measure something, you can't improve it" (Prusak, 2010). Measurement is the prerequisite of improvement and without it there is no a trustworthy base for assessment. Towards that aim we apply tools of measurement that in addition take in to account the interest of a wider range of stakeholders, which put in place checks and balances towards achieving the most sustainable solution possible without a sumptuous deployment of scarce resources.

The appropriate performance measurement tools must eventually and credibly quantify the effectiveness with which an economic entity meets the needs of its customers. It reflects that a (pharmaceutical) company does the "right thing". The company in order to survive and prosper in the long run though, it must additionally serve its customers with efficiency (or it "does things right") in order to generate profits (and provide liquidity). Then it will secure the appropriate level of return to capital invested (for the level of the risk involved) and please its shareholders in order to maintain their support to the management. It comes about when the entity is exploiting resources concurrently effectively and operate economically in fulfilling its strategic goals, creating at the same time value. The latter is a prerequisite for keeping investors and the rest stakeholders happy and securing the necessary capital inflows for further investments and growth. Thus, a suitable performance measurement tool must encompass effectiveness and efficiency, since both are necessary for long term survival and prosperity.

Proficiencies in the internal operations that in addition align the organization creatively with the requirements of its external environment, contribute to the satisfaction of customer and the rest outside stakeholders (suppliers, banks, state, etc.) on one hand, as well of the internal ones (equity holders, management, employees). The harmonious alignment of the external and internal environments, bestows on the organization an adequate market share, which allows it to cover all expenses incurred and yield enough profit as a return to capital employed. It is a concrete proof of the presence of dynamic capabilities that sustain a competitive

advantage of the related business ecosystem, which encompasses all stakeholders and results in superior financial performance.

A meaningful and comprehensive financial performance appraisal is a multilayer task which must be carried o a well structured process with clear goals. It is sensitive to the quality of the data, the methods used and the level proficiency of the evaluator. Given its complexity as a multi facet phenomenon, a single measure covering only one dimension of performance such as leverage, liquidity, activity, profitability etc, is not considered adequate to reflect it accurately and conclusively, in order to be used further as a dependable policy tool. As a result, more comprehensive measures are necessary (Kourtis *et al.,* 2019; Courtis, 2003). The Piotroski F score, Altman's Z score, Beneish's M score, Du Pont analysis represent integrated devices which embrace an array of individual financial ratios which have been conceived as comprehensive screening mechanisms and valuable means for sustainable policy purposes (Kourtis *et al.,* 2019; Curtis and Thalassinos, 2005).

2.2 Growth and Profitability

Efficiency and effectiveness are the two main building blocks of the business viability and prosperity, which are the eventual destination of a meaningful strategy. The Balanced Scorecard (BSC) is a performance measurement and control system, which assesses the degree of success of a strategy in attaining effectiveness and efficiency (Kaplan and Norton, 2001; Curtis *et al.,* 2011). It uses a four level mechanism to track progress, that leads to adequate revenues (3rd level) and ultimately to profitability and return on capital (fourth and final level). The latter two levels of performance are a lagging indicators that take time to be measured since the financial data required for that purpose are not readily available but reported quarterly, semi annually and annually.

In the mean time a crucial interval for possible adjustments and corrective moves is forgone, if operation doesn't unfold according to the plans. That is why the BSC system uses in addition two sets of leading indicators namely the learning (and development) and process levels, which are measured regularly. Those two first levels are found to be pivotal for the revenue generation target which is the third level of assessment that determines the profitability and the return on capital as the final outcome at the fourth level.

Revenues and profits, are key metrics that are mirrored in the financial statements and more specifically in income statement. Revenues and return on equity (profitability) are the main variables of the Marakon profitability-growth matrix (Hax and Majluf, 1983). Business growth rates (revenues) is less stable than profitability across the firms and over time" (Geroski, 1994). This observation indicates that companies protect their profitability much more effectively than the level of revenue growth. Adequate revenues (market share) and profitability is the

only reliable combination to secure sustainable value creation. A measure of performance above the average (of the sector) in both dimensions (profitability and market share) for a Greek owned pharmaceutical company (and not only) for a long period of time, denotes the existence of a successful strategy and a concrete sign of a sustainable operation due to competitive advantage based on dynamic capabilities (Kontes, 2011).

Revenues and market share expansion is a legitimate goal for any business entity. Revenues (sales) represent the remuneration to the company by the market, when the product or services offered are considered as generating value to consumers, given their assigned prices. The amount of revenues generated is the tangible sign that the supply of the company addresses genuine demand in the market. Growing market shares is acceptable, only if it is a consequence of a well founded competitive advantage and not the result of an undue decrease in prices(or increase in costs), which are detrimental to long term profitability, to value creation and finally to the survival of an economic entity. Market orientation of a company that is expressed in sound higher revenues, is positively related to several performance measures that are emanate from it (Matsuno *et al.,* 2000).

On the other hand pursuing excessive growth in revenues and market share when the management succumbs to pressures from the market, may not be advantageous for the company after a certain point. This is due to the fact that it may act at the expense of profitability and finally may end up harming the value of the company (Ramezani *et al.,* 2002).

Management should not espouse strategies of revenue maximization at any cost (Porter, 2001). The revenue growth in the long term is highly acceptable since it permeates any aspect of the financial performance, as long as it is accompanied by a threshold of profitability growth that doesn't hamper the required return on assets. The argument which utilizes revenue expansion models alone or predominantly for business success evaluation based on the argument that enough revenue increase today will bring about profits tomorrow, must be thwarted if it is not adequately justified and only as tactical move.

This type of policy must be pursued cautiously and temporarily only, otherwise it may undermine financial sustainability. It is not the magnitude of the revenue increase that matters only, it is the way it is achieved. Unwise expansion today, may lead to demise tomorrow in case the value created is progressively eroded. By "trying to get a bigger share of the market the firm may destroy value by moving to no-profit zones which represent the black holes of its business universe" (Slywotzky *et al.,* 1998). That is why it must be absolutely clear that although growth is desirable, the quality of growth is vital especially in the era of the fourth industrial revolution that brings profound changes in the economy.

Long-term sustainable market shares can be secured only if the profits are protected and value is created at an acceptable level. That is why a balanced revenue and profit growth, is more preferable by the stakeholders and requires a sustainable growth with the help of the   business ecosystem they foster for the sake of stakeholders involved.

2.3 Strategy, the Dynamic Capabilities and Superior Performance

It is obvious that there are performance differences among firms of the same sector, as there are among industries. The Industrial organization (IO) theory put emphasis on the structure and the concentration conditions of a sector to examine its attractiveness and explain the performance differences. This theoretical tradition, views all firms composing an industry as rather similar (or even identical) in their internal anatomy and fabric, as a result it emphasizes the different industry characteristics and the positioning of each entity in it to explain performance discrepancies among companies.

The approach is based on the structure-conduct-performance (SCP) strategy paradigm developed by Bain (1951), who examined the degree of industry concentration and the corresponding rates of return. Its conclusions popularized and refined further through the five forces model of Porter (1980).   It is focused mainly on the industrial structure and ability of the firm to obtain and exploit market power through the right positioning that allows a company to obtain superior performance (Hawanini, 2003). This tradition doesn't exclude the possibility that the profitability levels may also affect concentration tendencies in certain industries.

The SCP point view though, is to a large extend unable to justify adequately an array of diverse performance levels among the entities operating in a specific industry, despite the scale differences and   barriers to entry factors some of them examine as possible explanations.

According to this stream of thought the characteristics of the immediate external environment a company operates in   and more specifically the industry (pharmaceuticals) structure and the right positioning in it, which is the manifestation of the strategy success, are the sole (or at least the main) contributors to any difference in profitability among the companies comprising an industry. Profits are attributed to the industry structure, its ensuing level of attractiveness and the operational efficiency of an economic entity (McGahan and Porter, 1999). According to Porter (1996) the generic strategies of low cost, product (or services) and focus of a company, are the means in achieving competitive advantage in an industry.

A unique and valuable position by choosing specific activities to perform, it is ultimately based on firm's internal strengths though, requires tradeoffs and the creation of synergies across all company's operations in order to create, maintain

and invigorate competitive advantage and sustainability (Porter, 1996). The operational efficiency in the everyday operation 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. The role of the internal environment of the entity is implicitly undervalued and the emphasis is primarily on the structure of industry and the competition.

There is another school of thought in strategic management, which considers a firm primarily as a bundle, an assembly of resources among which the principal role plays the management, who decides their composition and deployment through the appropriate strategy exercising an entrepreneurial role. This steam of thought recognizes as the founder Penrose (1959). It alleges, contrary to the structure-conduct-performance (SCP) model which emphasizes primarily (if not entirely) the importance of the external factors of the organization, that the resource based view(RBV) of an entity is the origin to actually explain any observed differences in performance among organizations. Differences are emanating from specific factors they are endowed (Barney, 1991).

Each organization possesses a variety of resources physical, human and organizational which in order to be able to create a competitive advantage must be valuable, rare, imperfectly imitable and non substitutable and applied by the management through the appropriate strategy. 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 sought to be comprised of valuable, rare, inimitable, and non substitutable resources, and capabilities that if are operated wisely, lead to knowledge creation (especially of a tacit one), storage, transfer, innovation, agility, and resilience.

So, the mere existence of resources is not enough, it has to become operational by the management's capability to combine them and orchestrate accordingly under the new circumstances each time, to create lasting value.

A capability is a set of learned processes and activities that is deemed as idiosyncratic to each company. Capabilities that are enhanced by learning, that embedded in routines which produce effectiveness and efficiency in running every day operations of the entities are "ordinary and must be distinguished from the

strategic ones that deal with the opportunities, the uncertainty and risk created by the rapid changes in the environment. The latter require accordingly an entrepreneurial attitude of management to create new products and services based on "sensing, seizing and transforming dynamic capabilities, which create value (Teece, 2019).

Those three types of managerial activities can make capabilities dynamic, since they secure creative adaptability and resilience in a disruptive era. It is accomplished by identifying and evaluating opportunities (sensing), to create and capture value stemming from them (seizing), and altering capabilities and resources to align to the external environment (transforming) (Teece, 2014). It enhances the entrepreneurial type management that is based mainly on intangible resources and capabilities that help organizations to develop distinct knowledge (primarily a tacit one), sustainable business models and strategies which   create value in a unique way. It makes decisions about the allocation of resources that fosters orchestration, integration, complementarities and synergies that are embedded in the organizational process, that promote resilience and adaptability by "doing the right thing" primarily, especially under the conditions of risk and uncertainty.

Dynamic capabilities are different than the ordinary ones that are associated mainly with the task of "doing things right" in every day operations, which bolsters mainly productivity and efficiency. The ordinary ones are short term oriented and can imitated more easily with no formidable cost (Teece, 2007; 2019).

All the above take place in a wider business ecosystem which constitutes the environment that an economic entity must monitor and react to. It affects its dynamic capabilities and thus its ability to build sustainable competitive advantage. Successful pharmaceuticals recognize the crucial role of their business ecosystem and take steps to shape it to a certain extend. They also modularize the process to accommodate their strategy to maximize the value creation by orchestrating it   in order to adapt swiftly and gain resilience. The combination and orchestration of assets must be unique in a continuous consultation with the main stakeholders. Then, it is difficult to be replicated by competitors, creates a strong business entity that is capable not only adapt to business ecosystem, but even to harness and shape it (to a certain degree) in order accomplish sustainable growth and above the average financial performance.

Learning, intelligent resource allocation and innovation capabilities lead to competitiveness and financial sustainability in a constantly changing environment. 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). It requires a conducive culture and incentives that promote learning, knowledge storage, sharing, and integrating procedures according to Teece (2018). The intellectual capital is a vital component   the knowledge which is a main pillar of

the sustainable competitive advantage and there is significant relationship between intellectual capital and firms' profitability (Bontis, 2014). Human capital, relational capital and physical capital have a significant role in increasing the profitability of the firm (Gupta *et al.,* 2020).

Going back to the SCP tradition outperforming economic entities are characterized by operational efficiency, effectiveness and appropriate strategic positioning. The combined result of all these factors in an uninterrupted fashion, denotes the existence of a sustained competitive advantage (Porter, 1996). Porter in connection with its five forces model that examines external environment, proposes the value chain framework which examines the main functions as operation, production, marketing and sales as well as the supplementary ones, which represent the internal environment. It is clear though that for both main school of thoughts representing the internal (emphasized by the RBV-dynamic competitive advantage) and external environments (underscored mainly by the SCP paradigm), that "takes two to dance tango". Both (internal and external environments) are necessary in strategy analysis and must be harmoniously connected in order for a company to gain, maintain and upgrade its competitive advantage in order to outperform in the competition and thrive.

This truth is underlined by the most widely used strategy tools and frameworks, which take into consideration concurrently internal and external environments of business operation. SWOT analysis refers to internal environment by examining the strengths and weaknesses (SW), as well as the opportunities and threats (OT). The Strategy, Position, ACtion, and Evaluation (SPACE) matrix examines on one hand two aspects of the internal environment which are the competitive position (product quality, innovation, process cycle, loyalty relations of customers etc) and the financial soundness (equity capital, profitability etc).

Next, the previous two factors are associated with two more elements of the external environment and more specifically the environmental stability and industry attractiveness, in order to determine the appropriate strategy stand of the company. The GE matrix examines the competitive strength of a business (internal environment profitability, product quality, differentiation etc) on one hand and industry attractiveness (external) on the other, to decide the appropriate strategy (McKinsey, 2008; Ward *et al.,* 2005).

It is clear that the dynamic capabilities approach combines both environments, although it gives precedence to the internal one. The quality of the latter is judged by the degree it adapts creatively to achieve resilience, despite the constant and disruptive changes of the corresponding external. Long term resilience requirements must be align with efficiency in order to secure competitiveness and viability. Learning culture, agility and adaptability are essentials to survival and growth for an organization in an uncertain and disruptive business environment at an accelerated pace. An organization to survive and prosper in a complex world

operates in an ecosystem in the framework of which management orchestrates creatively through a strategic road map customers, employees, suppliers, financing, shareholders and the rest stakeholders inside and outside the economic entity.

Regardless which school of thought takes precedence over the other in examining the success of the business strategy, it is clear that sustainable revenue growth and profitability of the business entity are both essential. Revenue growth primarily indicates that business address effectively changes in the external environment through the appropriate of internal resources and capabilities. Profitability indicates principally the quality of internal environment in facilitating the adjustments required through the strategy to address those changes while achieving the necessary return to capital so that the entity grow and prosper.

Revenue and profitability are the two sides of the same coin that can be exploited as proxy measures of the competitive advantage and resilience. The latter require creative adaptability to the changes in the external environment. Alignment of both through strategy, means that the suitability each one of them is judged in relation to the nature and composition of the other and must be codetermined as a pair, in order to produce a suitable strategy.

We base our analysis mainly on the dynamic competitive advantage, since we use financial data and the performance finally is measured by the EBITDA return on total assets (resources), without ignoring external environment changes which are reflected mainly in sales. Profitability in general is a measure of competiveness, reflects strengths (or weaknesses) of a company and is determined primarily by cost efficiency and market share (Hao *et al.,* 2011)

The cornerstone of our attempt is to measure performance based on sustained effectiveness and efficiency in the Greek owned pharmaceutical companies and find out whether it reveals the existence of a competitive advantage which culminates in performance above the average in the sector. So, we combine efficiency and effectiveness in the first stage of the performance measurement process, but in second and final stage we measure whether the results of the previous stage are finally translated into competitive advantage measured by the greater than the average return of total assets (and market value) creation, for the companies that all (but one) are not listed in the stock-exchange. As far as the listed ones is concerned, we maintain the view that "there is a positive significant association between ROA and stock prices in short–term" at least (Alaagam, 2019) without ignoring the opposite views (Asuil, 2019).

We are going to apply performance measurement for the sample of thirteen pharmaceutical companies using DEA it two stages. As inputs and outputs, we exploit published financial data (externally audited) for the years 2015, 2019 and 2020 in the 1st step and financial ratios that are based on them in the 2nd one.

3. Research Methodology

3.1 DEA Model and Variables

The Data Envelopment Analysis (DEA) is a non-parametric comparative performance assessment tool, that can be applied to any group of entities that transform a variety of inputs to outputs, and doesn't have to specify in advance the type of relationship among them (Coelli, 1996). DEA represents a linear programming based technique for measuring the relative performance (not the absolute one) of any organizational unit, that allows comparisons in case of multiple inputs and outputs. It is utilized as a method of performance evaluation, best-practice benchmarking and auditing competitiveness as well (Cook *et al.,* 2014; Guan *et al.,* 2006). A main advantage of the DEA over a parametric approach is that it does not require any rigorous assumption concerning the production technology, the relative efficiency measures can be derived based on the available data (inputs and outputs) of the DMUs involved.

The technique was introduced initially by Charnes (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 (output oriented version). The administration of efficiency facilitates the management's role to gain competitiveness, profitability and long term viability in a wider possible sense. In our case we apply an input oriented approach, since only the inputs (assets and equity capital) are controlled by the management and not the outputs which are mainly the sales (revenues), profits (EBITDA) and finally the Ebitda return on Assets (Ebitda/Assets).

A Decision Making Unit (DMU) is any entity that exploits inputs to produce a form of output. Relative technical efficiency is the ability of the DMU to obtain output, from a given set of inputs. It is 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 under scrutiny. It is a relative measure compared to the one(s) of the peer units and not an absolute one, which 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 and it not necessarily an absolute optimal performance. The resulting efficiency scores lie between just above zero (for the underperforming) and one (for the relative optima ones).

The DEA scores divide DMUs into two categories, the efficient and inefficient ones. Score one (1) gets the entity (ies) which is located on the efficient frontier and constitutes the base for comparison (benchmark). Their position is characterized as Pareto optimal. Their output can't change, without a corresponding change in inputs. The inefficient DMUs on the other hand are rated greater than zero, but lower than

one (1). A DMU can improve efficiency through DEA benchmarking by adopting best practices, appropriate strategy and a more suitable production scale.

We apply DEA window analysis using as inputs the total assets and equity financing to measure revenue and EBITDA profitability as outputs in the first stage to assess economic efficiency of the resources used. EBITDA is equal to Operating profit (or EBIT) plus depreciation and amortization. It is a measure of profitability that is less amenable to manipulation than the net income, which is affected by interest expenses, depreciation and appreciation as well tax differences (Curtis and Thalassinos, 2005).

In the second stage, we use as inputs the outputs of the previous step in the form of ratios. More specifically the inputs at the 2nd step are the Revenue/Assets and EBITDA/Revenue ratios and the only output is the ratio EBITDA return on assets, which measures the effectiveness and success of the business strategy (AICPA 2012)

EBITDA return on assets = EBITDA / Revenue X Revenue / Assets

The two inputs (ratios) are the crucial building blocks of evaluating the EBITDA return on Assets (EBITDA / assets), which is the financial arbiter of a successful strategy. The return on assets encapsulates the outcome of the effective use of assets (capital) as it is reflected in their turnover ratio (Revenue / Assets) and the internal efficiency with which revenues are converted to EBITDA (profits). The turnover of assets depicts the level of activity, the growth and the effectiveness with which a company is linked to the market conditions (external environment) through the products (services) and prices it offers. It is delineated through the effectiveness with which the management transforms assets to revenues. It subsequently is translated in to a sustainable above the average return on capital and ultimately in to a corresponding equity (and enterprise) value appreciation, as paramount tangible sign of a dynamic competitive advantage.

The EBITDA margin (EBITDA/ Revenues) mirrors the efficiency and prudence with which the management transforms revenues to EBITDA (profits), in order the company thrives and grows by creating value for a greater array of members of its stakeholders ecosystem (and not just to shareholders, as the net profit margin figure conveys). It measures profitability which is not affected by the capital intensity of the economic entity, its leverage, depreciation, amortization and taxation levels. It is also an acceptable proxy for cash flow and a measure of the business ability to cover external capital obligations.

Measuring the EBITDA return on assets as a measure of value creation, we avoid to be trapped in comparisons that are distorted due to different leverage ratios that management may choose (using low equity) to artificially boost the Return on

Equity (ROE). That is why we don't apply a complete Du Pont analysis, since the leverage ratio is not employed (Curtis, 2003).

Using earnings before interest, taxes, depreciation and amortization (EBITDA), unnecessary distortions to net income are eschewed attributed to different interest expenses, depreciation - amortization charges and taxes. Its return on assets explains in a succinct fashion how management switch its assets (capital invested) to revenues initially, to profits later and return on assets (value) finally. The latter secures survival and growth of an economic entity through the creation of a competitive advantage attributed to dynamic capabilities.

All the input chosen in the DEA application must be characterized by a positive correlation to the output. Any changes (increase or decrease) of inputs must affect output to the same direction. It is also advisable inputs and outputs to use comparable methods and units of measurement (for instance absolute numbers and ratios should not be used concurrently in a certain step), as we can see in the first and second stages of our application (Pidd, 2012).

Total technical (or global) efficiency (TTE), is a comprehensive measure of performance measurement which combines the degree input allocation capability of management (PTE) reflected in the VRS ratio and the scale of operation (SE). Having calculated CRS (TTE) and VRS (PTE) efficiency ratios, the Scale efficiency (SE) can be derived as a ratio as follows SE = CRS (TTE)/ VRS (PTE), as we know.

The CRS/ VRS ratio measures the scale efficiency attributed to the DMU scale (size) of operations. A company is said to be scale efficient, if its size of operations maximizes productivity TTE/PTE=SE=1. The value of scale efficiency denotes whether a DMU is operating under optimal, increasing or decreasing scale (Avrikan, 2011). Its values range between zero and one. When SE is equal to one (1), the VRS and CRS are equal and the DMU is operating at the optimal scale level. In every other case, we have scale inefficiency.

Besides the concept of total technically efficient which entails that a set of outputs are attained using the smallest possible amount of inputs (for the input oriented version), there is also the concept of the allocative efficiency, that measures the ability of a firm to apply the inputs at optimal proportions in accordance with their existing prices.

When a DMU is at the same time technically and allocatively efficient, it is characterized as cost (or economic) efficient (Coelli, 1996). The latter is considered the most comprehensive and integrated concept of efficiency of all the above. Data drawn from the financial statements of the pharmaceutical companies under consideration are expressed in values encapsulating quantities and corresponding prices.

DEA as a performance measurement device creates value also by itself since it fosters benchmarking and best practices in the management process contributing to bridge the gap of underperformers with the best performing actors in the sector. It enhances efficiency and improves wealth, while attracting additional investments. Performance measurement in general enhances management control, monitoring, reporting, increases learning, motivation and justifies rewarding schemes. It accommodates effective communication with the internal and external stakeholders of the economic entity, aids strategic planning and finally promotes an optimal resource allocation (Berry *et al.,* 2005).

A comprehensive and enlightened review of the literature regarding DEA applications in sustainability can be found in Zhou *et al.* (2018), who allege that "DEA is a valuable tool of sustainability performance evaluation". DEA is widely used to measure performance in many sectors of economic activity (utilities, hospitals, pharmaceuticals banks, hotels, ports, education, agriculture, ports etc.).

3.2 Two Steps of Data Envelopment Analysis

We apply a two stage DEA window analysis to measure economic performance by examining a sample of thirteen (13) Greek pharmaceutical companies. Boussofiane *et al.* (1991) suggest that the number of DMUs to include in the DEA application should be at least equal to the sum of number of inputs and outputs utilized, multiplied by three. In our case this condition is obviously fulfilled, since two inputs and two outputs variables are exploited.

In the first step we examine as inputs the amount of investment on total assets (total capital) and the extend it is financed by the equity capital. As outputs we use revenues (sales) and the EBITDA that represents the earnings of operations. An input oriented DEA version is utilized, since only inputs (total assets and equity) are under the control of the management in   a pharmaceutical enterprise. The efficiency ratios at this stage, show which company (ies) is best in minimizing investments in total assets and equity financing, while producing the present amount of outputs (in terms of revenues and EBITDA).

In the 2rd step we use as inputs the asset turnover (Revenues/Assets) and EBITDA margin (EBITDA/Revenues) financial ratios, which integrate the two output variables of the previous step. We employ also the   return on   assets (EBITDA/Assets) as the only final output. The latter is utilized to judge whether the companies   involved possess a dynamic competitive advantage, which creates business value. It is   depicted by the return of assets of a company that is superior compared to the average of the corresponding sector (Porter, 1996; Barney, 1991).

In the 1st stage we measure the economic efficiency with which inputs are used. In the 2nd stage we measure whether the economic efficiency leads effectively into the creation of a lasting competitive advantage, that is culminating in creating value

(return on assets) above the average. The latter is considered as the tangible outcome of a fruitful strategy, since the companies of the sample are not listed (except one them) in the stock exchange to measure the ultimate business value reflected in stock prices (Zhu, 2000).

3.2.1 The 1st step (stage) of DEA –Efficiency in the use of resources

We examined the years 2015, 2019 and 2020 in order to measure any changes in the performance of the Greek pharmaceutical companies. We have chosen as the main inputs data that are included in the financial statements and more specifically the total assets and equity capital which are found in the balance sheets of companies. We employ also revenues and EBITDA, which are crucial items of the income statements, as the primary outputs.

Then we apply an input oriented version of DEA, since assets and equity are controlled by the management, while outputs (revenues and EBITDA) are not. This step is used to measure primarily efficiency (Curtis, 2019).

We contemplate the amount of total assets utilized as one of the main factors which drives performance in the sector, since pharmaceuticals are a "very capital intensive industry", but also a knowledge driven one (Boekestein, 2006). Total assets engulf not only the physical, but also the intangible ones. The latter and the R&D spending are crucial in establishing competitive advantage, consumer loyalty and create value for the customers in the pharmaceutical sector. Intangibles allow a company to lower cost or to implement differentiation strategies. By doing so, the company decreases the number of competitors, creates barriers to entry, minimizes the number of substitutes, achieves wider recognition in the market and enhances ultimately the profitability (Fils, 2019).

Equity capital financing of assets, is the other input variable that is found in the balance sheet also. Equity funds bestow flexibility in the operations since it decreases the rigidity emanating from the steady financial obligations and enhances security by relieving the burden of the cumbersome interest expenses obligations. Equity funding is one of the prerequisites in attracting further external sources of capital, which is indispensable to the business operation that in addition affects profitability and risk. The efficiency of the economic function of an entity (capital sources, interest and tax payments on the other) is assessed using three different ratios through the HOB model, which measures the financial performance along the value chain is (O' Higgins *et al.,* 1999). It evaluates efficiency at each stage of operations, separately. The repercussion of production, marketing and sales, and general management are measured through three more ratios (Courtis, 2003; Curtis and Thalassinos, 2005).

We are going to assess efficiency and effectiveness as the main components of the competitive advantage and value, with the use of DEA. The efficiency factor is assessed mainly through EBITDA at this stage. Effectiveness is assessed in the first

stage in a preliminary fashion through the amount of revenues that is a proxy for the degree of alignment of a company with the market conditions and consumers. We must note that the ultimate tally of effectiveness is the business value as we will discuss in the 2nd stage (Zhu, 2000). A proxy of it for the entities that are not listed in the stock exchange can be considered the return on assets we argue. It measures competitive advantage (efficiency and effectiveness) if it is compared to the average one in the sector.

A threshold of revenue is necessary for a business viable operation. Revenue is the third level of balanced scorecard (BSC) a performance reckoning device, that in the fourth and final level determines profitability (Kaplan and Norton, 2001). The previous two levels (learning and growth, as well as the quality of the business processes) are not captured by the financial statement data and cannot be used in DEA. Those two levels provide measures which are used as the leading indicators signaling whether the current course of company operations will fulfill   the sales and profitability targets that constitute the lagging indicators (especially the last one).

Leading indicators assist the management to act promptly in the case the goals are not met. The BSC tool exemplifies concretely how learning and human capital growth, the processes improvement and consumer satisfaction that is translated in to sales, affect immensely the business unit performance. Kaplan and Norton through the multi level performance evaluation scheme they propose, allege that the human capital quality and development, the quality of the internal processes and the value proposition of a business enterprise to its costumers affect the financial performance of the entity by enhancing revenues and profitability (Pidd, 2012; Curtis *et al.,* 2011).

It has been found that pursuing excessive growth in revenues and market share when the management succumbs to the pressures of the financial markets for growth, this tactic may not be advantageous for the company itself after a certain point, since it may act at the expense of profitability and finally may end up harming the value of the company   (Ramezani *et al.,* 2006). That is why a balanced revenue and profit growth is more preferable by the stakeholders and requires a sustainable growth with the help of the company's business ecosystem. Long term viability requires profitable revenue growth. It is accomplished through   the attainment of an economic efficiency   and a minimum market share, especially for capital intensive companies that exhibit high break-even point of operations. It is achieved more effectively by companies operating in an ecosystem and not as individual actors in a complex and constantly changing business environment.

Revenue and market share expansion is a quite legitimate goal for any business entity. Growing market shares must be acceptable only as a consequence of or a remuneration to a well founded competitive advantage and not the result of an undue decrease in prices or increase in costs, which are detrimental to long term

profitability, value creation and finally to the firm's survival. Market orientation is in general positively related to several performance measures (Matsuno *et al.,* 2000).

Management should not espouse strategies of revenue maximization at any cost (Porter, 2001). The argument that utilizes revenue expansion models alone for business success evaluation, with the reasoning that enough revenue increase today will bring about profits tomorrow must be thwarted, if it is not adequately justified as a tactical move and only. It is not the magnitude of the revenue increase that matters most, it is the way it is achieved. Unwise expansion today, may lead to demise tomorrow in case the value is progressively eroded. Many companies continue to pursue a market share and volume rate growth strategy. This type of policy must only be pursued with cautiously and temporarily only; otherwise it may lead to a trap. By "trying to get a bigger share of the market the firm may destroy value by moving to no-profit zones which represent the black holes of its business universe" (Slywotzky *et al.,* 1998).

That is why it must be absolutely clear that although growth is desirable, the quality of growth is vital especially in the era of the fourth industrial revolution that brings profound changes in the economy. Long-term sustainable market shares can be secured only if the profits are protected and value is created at an acceptable level. Sustained revenues and net income growth is the only reliable way to create value. "Growth rates are more variable than profitability across the firms and over time" (Geroski, 1994). This observation indicates that companies protect their profitability much more effectively than the revenue growth.

We opted to exploit EBITDA as the main measure of the profitability dimension for the pharmaceutical sector. It is a more broad measure than net profits and is more appropriate for a socially sensitive sector as the pharmaceutical one. It is considered also by many as a proxy measure of operating cash flow, which allows companies to finance growth from the ordinary operations, although it doesn't include any changes in working capital accounts, as the Cash Flow From Operations (CFFO) does, which is more suitable for liquidity purposes alone (Kourtis, 2020; Curtis *et al.,* 2021). EBITDA as a consequence is considered as a more inclusive indicator (compared to net profits, ROE, ROA etc that reflect purely profitability) that measures profitability and liquidity (to a certain extend) at the same time.

In the first stage we measure sustained performance through revenues and profits (EBITDA) as the Marakon matrix does (Hax *et al.,* 1983; Curtis *et al.,* 2021). Competitiveness is the amalgam of the two dimensions of effectiveness and efficiency reflected initially in revenues and EBITDA respectively. The ultimate measure of them is the EBITDA return on assets which is measured in the 2nd stage using as inputs the outputs of the first step. It is used as a proxy for the market value of the companies which are not available, since they are not listed in the stock exchange.

3.2.2 The 2ⁿᵈ stage DEA –the effectiveness of the strategy

During the second stage of DEA we measure on one hand how effectively revenue realized compare to assets utilized and efficiently (through the EBITDA generated) the pharmaceutical companies operate. The second step of the measurement process based on DEA, uses as inputs the revenues and the EBITDA which represent the outputs of the 1ˢᵗ stage, in the form of ratios. More specifically we translate revenue to the total assets turnover ratio (revenue/ total assets) and we also transform   the absolute value of EBITDA   into its respective margin with respect to the production unit sold (EBITDA/Revenues). The first ratio measures primarily effectiveness and the second one efficiency, which are the two factors which co-determine the notion of the competitive advantage (Drucker, 1963; Porter, 1996).

These two ratios are the main elements of the EBITDA return on Assets ratio, which measure profitability in a more broad way compared to ROA that uses net income in the nominator and is more inclusive than any other single ratio (Curtis, 2019).

At the second stage, we assess whether revenues and EBITDA (inputs) created in the first stage are translated effectively and efficiently (according to DEA measurement) into an acceptable return on capital for the investors which represents the output. The latter is utilized as a measure of value, since all the companies of the sample (except one) are not traded in the stock-exchange. We measure the return on assets of each individual company and compare it to the average one for the entire sample to discern which company outperforms, due to the presence of a competitive advantage which leads to value creation (Barney, 1991; Porter, 1996).

All the above we are going to apply in a sample which contains thirteen (13) companies out of the twenty nine in total purely Greek owned pharmaceutical companies, that produce drugs domestically. The sample includes only the companies which have published financial statements for the specified period on one hand and on the other exhibit positive equity capital and EBITDA all years (2015, 2019 and 2020) under examination. Financial data represent a more homogeneous set of inputs and outputs, since are expressed in values and take in to consideration quality differences. Concurrently, constitute a more trustworthy database since are based on externally audited data, that eschew (to a certain degree) measurement differences,   errors and manipulations (Curtis *et al.,* 2019; Kourtis *et al.,* 2017).

4. DEA Application, Results and Discussion

In order to apply DEA, we employ as inputs total assets and equity and as outputs revenues and EBITDA. The data are presented in Table 1 and concern   thirteen Greek owned   pharmaceutical companies for the years 2015, 2019 and 2020.

Table 1. *Input, output variables and descriptive statistics of pharmaceutical companies ('000 euro).*

	2015				2019				2020			
DMUs	Total Assets	Equity	Revenues	EBITDA	Total Assets	Equity	Revenues	EBITDA	Total Assets	Equity	Revenues	EBITDA
1	160.853	34.700	199.260	12.897	194.447	31.703	232.120	7.955	234.905	41.147	292.695	20.837
2	212.959	97.296	150.384	36.073	245.757	91.036	205.068	55.931	321.274	121.834	227.265	59.388
3	204.846	70.893	123.333	27.641	256.137	108.812	146.672	34.147	284.626	139.616	175.952	51.845
4	133.818	42.032	119.784	7.023	200.352	57.507	97.612	18.904	213.324	78.296	107.338	33.488
5	127.416	58.261	48.987	7.689	167.985	67.765	68.998	13.613	178.164	74.519	74.651	14.614
6	33.145	7.935	43.363	1.151	52.750	7.635	55.365	3.522	55.164	9.974	60.357	7.131
7	43.847	5.561	28.653	2.187	49.686	9.009	40.502	2.799	61.605	11.702	41.272	4.849
8	18.701	5.844	17.864	4.458	50.001	16.332	30.779	2.572	51.244	16.518	32.916	4.030
9	25.248	21.355	17.627	1.963	35.075	24.110	28.382	2.248	48.220	27.024	34.078	4.510
10	24.541	9.297	16.664	2.788	39.468	10.918	25.887	3.723	40.229	12.985	32.772	6.102
11	92.275	36.018	28.315	4.893	76.135	31.692	20.165	4.619	75.375	32.359	20.837	4.534
12	13.437	6.231	14.985	839	13.765	6.418	16.497	1.311	13.815	6.003	14.748	810
13	9.715	3.749	10.696	663	27.851	4.058	14.838	1.410	29.699	5.593	16.065	3.270
AVERGE	84.677	30.705	63.070	8.482	108.416	35.923	75.607	11.750	123.665	44.428	86.996	16.570
MAX	212.959	97.296	199.260	36.073	256.137	108.812	232.120	55.931	321.274	139.616	292.695	59.388
MIN	9.715	3.749	10.696	663	13.765	4.058	14.838	1.311	13.815	5.593	14.748	810
MEDIAN	43.847	21.355	28.653	4.458	52.750	24.110	40.502	3.723	61.605	27.024	41.272	6.102
STD	75.010	29.751	62.793	11.059	89.755	34.671	73.852	16.269	107.243	45.253	89.703	19.568

Source: *Own study.*

The companies of the sample represent total revenues of 1.130.944.877 euro or 74,8 % of the entire sector of the Greek owned pharmaceuticals in 2020 (ICAP, 2021). Companies which exhibit negative EBITDA and/or equity capital in one year or did not published financial data for the three years under examination, are not included in the sample. As it can been inferred from the mean, the median and standard deviation of all variables used as input and outputs in the DEA the application, there is a considerable diversity in the scale of operation and performance among the thirteen DMUs (companies) of the sample.

Applying an input oriented DEA, under CRS and VRS versions, using the total assets and equity capital as inputs on one hand and revenues and EBITDA as outputs on the other in the first step of analysis, we get the results presented in Table 2 underneath (the scale efficiency (SE) is the ratio CRS/ VRS (TTE/PTE) for the thirteen companies of our sample.

Under the Constant Return to Scales (CRS) version of DEA in the year 2015, three (3) DMUs (No. 1, 6 and 8) were traced as operating with comparative (relative) optimal Total Technical Efficiency (TTE) among their peers. The three aforementioned companies, appear to exhibit Total (global) Technical Efficiency (TTE), Pure Technical Efficiency (PTE) under the VRS version of DEA and Scale Efficiency (SE), equal to one (TTE=PTE=SE=1 or CRS=VRS=SE=1). The DMUs No. 1 and 6 excel (comparatively) based mostly on their proficiency to

transform assets (capital) to revenues (scale of activity), while the DMU 8 outperforms primarily due to its efficiency in creating higher EBITDA margin (profitability) according to the data of Table 3.

Table 2. *CRS, VRS and SE scores of the Greek owned Pharmaceutical companies - 1st   Step of DEA*

DMUs	Companies	2015			2019			2020		
		CRS	VRS	SE	CRS	VRS	SE	CRS	VRS	SE
1	Vianex	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
2	Pharmathen	0,730	1,000	0,730	1,000	1,000	1,000	1,000	1,000	1,000
3	Demo	0,610	1,000	0,610	0,643	0,650	0,989	0,985	0,989	0,996
4	Elpen	0,716	0,717	1,000	0,557	0,558	0,998	0,865	0,872	0,993
5	Uni-pharma	0,356	0,388	0,919	0,434	0,440	0,986	0,496	0,502	0,989
6	Innovis	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
7	Galenica	0,947	1,000	0,947	0,749	0,793	0,945	0,611	0,695	0,879
8	Coper	1,000	1,000	1,000	0,542	0,545	0,994	0,597	0,640	0,932
9	Intermed	0,606	0,631	0,960	0,675	0,701	0,963	0,681	0,726	0,938
10	Anfarm	0,638	0,657	0,972	0,658	0,813	0,810	0,938	1,000	0,938
11	Lavipharm	0,291	0,291	1,000	0,296	0,365	0,809	0,349	0,430	0,811
12	Petsiavas	0,889	0,961	0,926	1,000	1,000	1,000	0,857	1,000	0,857
13	Iassis	0,885	1,000	0,885	0,673	1,000	0,673	0,838	1,000	0,838
AVERAGE		0,744	0,819	0,819	0,819	0,759	0,759	0,786	0,835	0,835

Source: Own study.

The worst TTE performance under CRS in 2015 among the thirteen DMUs (pharmaceuticals companies) of the sample, is demonstrated by the DMU No. 11, which achieved a ratio equal to 0,291. It denotes that in order the specific company (Lavipharm S.A) to become also relative efficient (as the three aforementioned entities), it must achieve the current level of its outputs (revenues and EBITDA), using less inputs (total assets and equity capital) by 70,9 % approximately, compared to the present level. The average total efficiency ratio of the entire sample for the year 2015 was approximately 0,744 (Table 2). It indicates that in order the current level of output must be achieved, on the average a reduction of inputs used to the tune of 25,6%   must be pursued to realize an optimum total efficiency ratio analogous to the three outperforming DMUs which are located on the efficient frontier.

In the year 2019, we discovered that four (4) DMUs   are considered as operating with optimal total technical efficiency under CRS. These are the No. 1, 2, 6 and 12. All these companies exhibit Total   (global) Technical Efficiency (TTE), Pure

Technical Efficiency (PTE) and Scale Efficiency SE) equal to one (TTE=PTE=SE=1). In 2019 the worst performance with TTE ratio equal to 0,296 is shown by the same (as in 2015) DMU No. 11. It is interesting to note that the specific company is the Lavipharm SA which is the only legal entity listed at the Athens stock exchange which belongs to the Greek owned pharmaceutical companies.

During 2020 the three DMUs 1, 2 and 6 continue to achieve TTE=PTE=SE=1. The DMU 12 retreats to a non efficient status (TTE=0,857), from its optimal performance of the previous year. The DMU 11 is the worst performing company once again. It exposes the lowest TTE ratio equal to 0,349 (when the average one of the sample is 0,788), indicating that the company must curtail the level of its inputs for the year by 65,1 %, in order its performance to become comparatively optimal. During the entire period of the years 2015, 2019 and 2020 under examination, only DMUs No 1 and 6 displayed relatively optimal TTE (CRS) performance in using assets and equity capital, in order to translate them in to revenues and EBITDA.

The DMU No 2 operated optimally for the years 2019 and 2020, the DMU No. 8 for the year 2015 and the DMU No. 12 for the year 2019 only. DMU 2 (Pharmathen S.A) improved its economic efficiency in the use of assets (and equity) and becomes optimally efficient in generating revenues (external alignment) and EBITDA (internal proficiency) in 2019 and 2020 compared to 2015. We observe also, that the great majority of DMUs are operating under non inefficient scale during the entire period since TTE is not equal to PTE and SE (Table 2).

The next step is to explore whether the efficiency in the use of the inputs in the first step, is reflected consequently in measurable value creation. Thus we proceed one step further using as the final output this time the financial ratio EBITDA return on assets and as inputs the outputs (revenues and EBITDA) of the 1st step expressed in ratios (assets turnover and EBITDA margin) to facilitate DEA. We consider it as a measure of value creation and a surrogate of the changes in the market value of equity, since almost all the companies (except one) are not listed in the stock exchange, where the market value is almost available.

We consider as value creating entities the companies that realize EBITDA return on assets above the average in the sample according to Porter (1996). The EBIDTA return on assets is a measure of value creation, which does not take into consideration separately the individual sources of capital (internal-equity and external one). It is the tangible financial footprint of the presence (or absence) of a competitive advantage based on dynamic capabilities. An EBITDA return on assets score for a pharmaceutical company that is above the average one observed in the sector, it is contemplated as the outcome of some kind of competitive advantage.

In the second step of the DEA application we are using two ratios (EBITDA/ Revenues and Revenues/Assets) as inputs, and one ratio (EBITDA/Assets) as output. The outputs (revenues and EBITDA) of the 1st step, are transformed in to ratios in order to be compatible with the measures of the return on assets. The latter is a tangible estimate of the competitive advantage in a free market, a value creation signal and an investment screening criterion. By comparing the return on assets for each company to the average of the sector, we discern the outperforming pharmaceutical companies, which are not listed (except one) at the Athens stock exchange.

According to the original data published in the financial statement which have being reflected in the table 1, the corresponding ratios used as inputs and output in the 2nd step of DEA and their descriptive statistics are presented in the following Table 3.

Table 3. *EBITDA margin, Assets turnover and EBITDA return on Assets ratios of the Greek owned Pharmaceutical companies*

2015				2019			2020		
	EBITDA Margin	Assets Turnover	EBITDA Return on Assets	EBITDA Margin	Assets Turnover	EBITDA Return on Assets	EBITDA Margin	Assets Turnover	EBITDA Return on Assets
1	0,065	1,239	0,08	0,034	1,194	0,041	0,071	1,246	0,089
2	0,24	0,706	0,169	0,273	0,834	0,228	0,261	0,707	0,185
3	0,224	0,602	0,135	0,233	0,573	0,133	0,295	0,618	0,182
4	0,059	0,895	0,052	0,194	0,487	0,094	0,312	0,503	0,157
5	0,157	0,384	0,06	0,197	0,411	0,081	0,196	0,419	0,082
6	0,027	1,308	0,035	0,064	1,05	0,067	0,118	1,094	0,129
7	0,076	0,653	0,05	0,069	0,815	0,056	0,117	0,67	0,079
8	0,25	0,955	0,238	0,084	0,616	0,051	0,122	0,642	0,079
9	0,111	0,698	0,078	0,079	0,809	0,064	0,132	0,707	0,094
10	0,167	0,679	0,114	0,144	0,656	0,094	0,186	0,815	0,152
11	0,173	0,307	0,053	0,229	0,265	0,061	0,218	0,276	0,06
12	0,056	1,115	0,062	0,079	1,198	0,095	0,055	1,068	0,059
13	0,062	1,101	0,068	0,095	0,533	0,051	0,204	0,541	0,11
AVERAGE	**0,128**	**0,819**	**0,092**	**0,136**	**0,726**	**0,086**	**0,176**	**0,716**	**0,112**
MAX	0,25	1,308	0,238	0,273	1,198	0,228	0,312	1,246	0,185
MIN	0,027	0,307	0,035	0,034	0,265	0,041	0,055	0,276	0,059
MEDIAN	0,111	0,706	0,068	0,095	0,656	0,067	0,186	0,67	0,094
STDEV	0,078	0,314	0,058	0,079	0,292	0,050	0,082	0,279	0,044

Source: *Own study.*

We espouse the view that "companies must focus on resiliency, profitability and sustainability" as it is stated in the Davos Agenda (Klein, 2021). Resilience and sustainability are measured by the long term return on capital of a company, compared to the average one of the sector. High returns on capital (assets) are secured in nowadays through the operation in ecosystems. Due to the complexity

and the scale of the problems business organizations cannot handle them successfully working alone and only networks of them can succeed in offering sustainable solutions which can create sustained value.

The elements that define the outperformance of a company with respect the return on the total assets (total capital), indicate that superior value creation (and appropriation) stems from efficiency in the use of the resources (internally) and the alignment with the external environment at the same time. Both affect the performance of en entity compared to the average one for the entire sector. Internal efficiency and external alignment to the market demand (effectiveness) through the right the strategy, finally exerts influence in the value of the firm. In the first stage we use resources (total assets and equity financing) to convert them into revenues and EBITDA (profit).

Those in the second stage are used as inputs to obtain value in the form of EBITDA return on assets. Comparing the return with the average one in the sector, we are able to clarify which companies attained a dynamic competitive advantage. A sustainable achievement for a long time period, denotes the presence of resilience and agility in a such a socially sensitive sector as the pharmaceutical one, which is crucial for the economic and societal wellbeing (Curtis *et al.,* 2019, Kourtis *et al.,* 2021). Applying DEA in the 2nd step, we get the following results with respect CRS, VRS and SE ratios which are disclosed in Table 4 below.

Table 4. *CRS, VRS and SE ratios -The 2nd step of DEA*

	2015			2019			2020		
DMUs	**CRS**	**VRS**	**SE**	**CRS**	**VRS**	**SE**	**CRS**	**VRS**	**SE**
1	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
2	0,961	1,000	0,961	1,000	1,000	1,000	1,000	1,000	1,000
3	0,898	0,977	0,919	0,854	0,972	0,878	1,000	1,000	1,000
4	0,767	1,000	0,767	0,710	0,993	0,715	1,000	1,000	1,000
5	0,629	1,000	0,629	0,723	1,000	0,723	0,671	1,000	0,671
6	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
7	0,627	1,000	0,627	0,837	1,000	0,837	0,752	1,000	0,752
8	1,000	1,000	1,000	0,681	1,000	0,681	0,743	1,000	0,743
9	0,698	0,967	0,722	0,853	0,999	0,854	0,813	0,992	0,819
10	0,708	0,960	0,737	0,952	0,990	0,961	1,000	1,000	1,000
11	0,692	1,000	0,692	0,798	1,000	0,798	0,697	1,000	0,697
12	0,899	1,000	0,899	0,995	1,000	0,995	0,857	1,000	0,857
13	0,908	0,997	0,911	0,746	0,982	0,760	0,773	0,992	0,779
AVERAGE	**0,830**	**0,992**	**0,836**	**0,858**	**0,995**	**0,862**	**0,870**	**0,999**	**0,871**

Source: Own study.

In 2015, the DMUs No. 1, 6 and 8 (excelled in the 1st step) exhibit also comparative total efficiency excellence (CRS=VRS=SE=1) in the 2nd step in generating EBITDA return on assets. In 2019, from the four companies (No. 1, 2, 6 and 12)

which found as totally technical efficient in the 1st step, only the first three of them realize efficient return on assets in the 2nd step by creating synergies and total effectiveness in boosting returns and value.

Finally in the 2nd step in 2020, a greater number of companies (notably No. 1, 2, 3, 4, 6 and 10) were found as optimal in generating value in the form of the return on assets, compared to No. 1, 2 and 6 which were relatively optimal in using their assets and equity in the 1st step. We observe that the optimality of an entity in the 2nd step with respect EBITDA return on assets (a proxy of value creation), presupposes total technical efficiency at least above the average of the sample with respect the use of inputs in the 1st step. The specific companies although exhibit capabilities which create synergies and improve the return on assets (value) in the 2nd step, there is space to improve further in the 1st step by enhancing their total efficiency in using assets and equity as inputs, to generate more revenues and EBITDA outputs.

The results of the DEA application in two steps, revealed that DMUs No. 1, 6 and 2 as the relative outperformers in the sample. These companies seem to apply different generic strategies for competitive advantage (Porter, 1996). As a result, the first two DMUs generate high assets turnover ratio (sales/assets) attributed mainly to higher revenues, while the third one exhibits much higher EBITDA margin ratio (EBITDA/Revenues, Table 3).

It is known that when a company is trying to get a bigger share of the market primarily, it may sometimes destroy value (Slywotzky *et al.,* 1998; Ramezani *et al.,* 2006). The DMU 2 which achieves high profit margins (probably through product differentiation and/or focus), attains the highest EBITDA return on assets among its peers all years (2015, 2019 and 2020) with 16,9 %, 22,8% and 18,5 % respectively. It indicates the existence of dynamic capabilities which galvanize and upgrade its competitive advantage, fostering resilience and adaptability through an appropriate strategy. The management of the specific DMU No. 2 orchestrates assets and proficiencies, creating synergies across the business activities. It boosts return on assets and the market.

It is interesting to compare the outperformer DMUs No. 2 and the underperformer DMU No. 11, since for these two companies we can find their equity values. We are placing them in juxtaposition to each other, since he DMU 11 is the only Greek owned pharmaceutical company which is listed at the Athens stock exchange and DMU 2 was sold by the BC Partners fund to the Partners Group in July 2021 for a disclosed value of 1,6 billion euro. The BC partners had acquired the company for 475 million euro in 2015 (Bloomberg, 2021). The specific year represents the starting point of our study. The underperforming company Lavipharm S.A (DMU 11), exhibited market value approximately 24,4 mil euro in July 2021.

According to the data drawn from the financial statements, the DMU 2 (Pharmathen S.A) during the five year period 2015-2020 grew as it is reflected in the increase of total assets and equity (inputs) by 51% and 25% respectively (Table 1). These changes bolstered its revenues and EBITDA (outputs) by 51% and 65% accordingly, as we discovered in the 1st step of the DEA analysis. In the same period, DMU 11 (Lavipharm S.A) exhibited a reduction in its assets and equity by 18% and 10% respectively, which decreased its revenues and EBITDA by 26 and 7% correspondingly.

These developments eventually brought about an EBITDA return on assets equal to 18,5% and 6,0% for the Pharmathen S.A (DMU 2) and Lavipharm S.A (DMU 11) respectively in 2020, when the corresponding average return for the companies of the sample was 11,2% (Table 3). We observe that DMU 2 reveals an EBITDA return on assets well above the average and the DMU 11 demonstrates a performance far below it. The TTE ratio of DMU No. 2 in the 1st and 2nd steps for the final year 2020 was one (1) and for the DMU No. 11 was 0,349 and 0,697, when the average one was 0,786 and 0,870 respectively (the situation looks similar for the previous year 2019 also with respect those two companies). It indicates that DMU No. 11 consistently underperforms with respect the average company of the sample, while DMU 2 outperforms every year. It is known that enterprise value (EV) = market value of total shares (equity) + Debt - cash. Thus, the underperforming company Lavipharm S.A (DMU 11), exhibited enterprise value approximately 65,0 million euros in July 2021.

The question which arises next, is whether all the above differences in TTE during the 1st and 2nd steps according to DEA, are reflected eventually in the market value of equity difference among them (Zhu, 2000) and the enterprise valuation as a multiple of the EBITDA and revenues, which are widely used ratios. More specifically in our case Pharmathen (DMU 2) was sold on July, 2021 seven (7) times its revenues and almost twenty seven (27) times its EBITDA of the year 2020, as it can be observed in Table 5 below.

Table 5. *Equity valuation of Pharmathen (DMU 2) and Lavipharm (DMU 11)-EBITDA and Revenues multiples*

Companies (DMUs)	2020 (million €')		
	Revenues	EBITDA	Enterprise Value
Pharmathen (DMU No. 2)	227,3	59,4	1.600,0
Lavipharm (DMU No. 11)	20,8	4,5	65,0
Multiples	(times)		
Pharmathen	**7,0**	**26,9**	
Lavipharm	**3,1**	**14,4**	

Source: *Own study.*

The enterprise value of the DMU 11 on the other hand, was valued 3,1 times of its revenues and 14,4 times its EBITDA of 2020.

It is evident from the aforementioned ratios that the outperformance of Pharmathen in both steps of the DEA analysis, is translated in to a far superior equity valuation and enterprise value using revenue and EBITDA multiples. It represents a remuneration to its dynamic competitive advantage which fosters a sustainable growth for the specific company. Investors have better expectations about the company's ability to create value in the future. We argue that efficiency discrepancies in the use of assets and equity funds in the first step and the capability levels in the second step, are accordingly translated in to equity value and enterprise value differences between these two companies based on value drivers multiples (sales-revenues and EBITDA-earnings) approach.

The performance of the DMU No. 2 indicates adaptability, sustainability and resilience, as it is disclosed in the data of Tables 2 and 3 for the years 2019 and 2020 with regards to the one of the initial year 2015 (Carvalho *et al.,* 2016). Those ingredients are attributed to dynamic capabilities which are ultimately reflected in its equity valuation based on revenue and EBITDA multiples in 2021 when the company was sold, compared to one of the DMU No. 11. The former company attained in 2021 enterprise value 125,8% and 86,8% more with respect its revenues and EBITDA multiples of the year 2020, compared to the DMU No. 11.

The Pharmathen S.A company (DMU 2) not only appears to posses resources and competencies that can be characterized as VRIN (valuable, rare, inimitable and not substitutable), but also they are orchestrated properly by a capable management in processes and activities. It allows the company to align internal environment to the external changes in a harmonious fashion, satisfying customers and thus creating considerable value in a turbulent environment. It is reflected predominately in the 2nd step of the DEA analysis (which uses as inputs the outputs of the first step), culminating in the value creation which is measured initially by the EBITDA return on assets (since the company is not listed in the stock exchange).

The EBITDA return on assets is a more broad and inclusive ratio of profitability compared to ROE or ROA, since it addresses a greater variety of stakeholders and it is a more suitable measure for industries like pharmaceuticals, given their wider repercussions on the societal wellbeing (Curtis, 2019). The corresponding average ratio for the entire sample of companies was 11,2% and for DMU No. 2 was 18,5% in 2020. Lavipharm S.A (DMU No. 11) on the other hand, demonstrated EBITDA return on total capital quite low equal to 6,0% in 2020 (and every previous year).

A study of many more companies listed in the stock-exchange is necessary to validate further our findings that the EBITDA return on assets evolution (measured

in the 2nd step of DEA) is a good proxy for the advancements in the enterprise value of the companies involved.

4. Conclusion

In our study we utilized financial performance measurement using DEA to trace whether the presence of the dynamic capabilities can be identified and measured. We used a RBV of the competitive advantage which underscores the importance of the unique resources, competencies and dynamic capabilities of a business entity in boosting its adaptability and resilience. The latter is depicted by a sustainable above average financial performance and value creation through an appropriate strategy. Towards that aim a two steps DEA application was executed for the Greek owned pharmaceutical companies.

The financial data of a sample of thirteen major companies, Greek owned pharmaceutical companies, were utilized covering the years 2015 (as a base), 2019 and 2020. Those companies are characterized as capital intensive and export oriented entities with substantial value added value for the native economy. In the first step of DEA, as inputs (resources) were employed the total assets and equity financing in order to measure the efficiency in their use to generate revenues and EBITDA. In the second step, the outputs of first one were used as inputs in the form of financial ratios in order to determine whether the capabilities of the business organization create synergies along the activities of the value chain to generate an above the average sustained EBITDA return on total assets. The latter is eventually contemplated as a manifestation of a competitive advantage and attestation of the existence of dynamic capabilities for the outperforming entities.

The results of the application of DEA showed that efficiency and effectiveness in operations are the necessary ingredients to establish competitive advantage and sustained above the average EBITDA return on assets. In the case of two companies of the sample (Pharmathen SA and Lavipharm SA) for which data of their market value of equity and enterprise values are available, we discover further that those correspond directly to the findings of the two step DEA. The market value of the equity of those two companies represent the other side of the coin of the financial performance reflected ultimately in the return on assets and depicts whether financial efficiency is ultimately culminates in the enterprise value differences   using multiples (based on value drivers such as revenues and EBITDA -earnings).

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