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Analysis of returns to scale and efficiency in the financial performance of listed petrochemical companies by DEA method

S. Rezaeilava[1], M. Fallah Shams Layalestani,[*2], M. Sanei[3], S. BaniHashemi[4]

[(1)] Department of Financial Management, Central Tehran Branch, Islamic Azad University, Tehran, Iran

[(2)] Department of Commerce, Central Tehran Branch, Islamic Azad University, Tehran, Iran

[(3)] Department of Mathematics, Central Tehran Branch, Islamic Azad University, Tehran, Iran

[(4)] Department of Mathematics, Allameh Tabatabai University, Tehran, Iran

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Abstract

One of the components of large companies that, with the support of their competent and efficient managers, are analyzing the capital market, raw materials and products every day, is an accurate calculation tool to advance future goals.

After the end of financial periods and through news and media, announcements of profit and loss, balance sheet and earnings per share and finally changes in stock prices of companies in the capital market are provided to us. Obviously, companies that have achieved better profitability rates and have increased the value of investor stocks have a better position in this market, and other companies have the ability to gain points that have led to positive changes in the market. They maintain their competition to achieve much higher.

In this paper, the financial information of 10 petrochemical companies that are members of the stock exchange for 11 consecutive years is classified by performance appraisal techniques and finally, according to the market analysis and methods used, the results related to the returns of these companies are classified. Has been.

Keywords: Return to Scale - Performance Evaluation of Financial Statements - Efficiency - Data Envelopment Analysis - Returns – Securities.

[*] Corresponding author: Email: mir.Fallah shams@iauctb.ac.ir

1. Introduction

At present, experts and thinkers in the field of management emphasize the importance and position of performance appraisal models, as one of the most important indicators of the development of societies and organizations and also as an important and effective factor in achieving development goals in individual and social dimensions [1].

The complexity of the environment in the competitive field of business and increasing customer expectations, the need to be aware of the strengths and weaknesses of the organization and continuous improvement of productivity has become increasingly apparent. Therefore, one of the main concerns of current organizations is to achieve a comprehensive, reliable and flexible performance appraisal method to use it to obtain accurate and sufficient information about their current position and looking to the future, Learn from past mistakes [2].

In fact, it should be said that the optimal performance of the economic and financial system in any institution and company depends on the existence of an efficient and powerful financial sector. Therefore, developing the right strategies to improve the financial performance of an organization is one of the most important components of the process of evaluating the financial performance of organizations.

Correct evaluation of companies in industries can be a complete mirror of the situation of different companies compared to their competitors and identify the internal strengths and weaknesses as well as the opportunities and external threats of companies. Company valuation plays a very important role in the industry [3].

The introduction of the top companies in the industry determines their position in a competitive environment based on various indicators or variables. This allows the weak companies, on the one hand, to identify their distance with the best and formulate the appropriate strategy to achieve them, and on the other hand, the top companies strengthen their superiority by defining appropriate programs and strategies [4].

Capital formation is the most important factor of economic progress from the point of view of most economic thinkers and the stock market and capital market is one of the most important sources of capital. The sum of these cases leads to increased competition in the market and increased competition ultimately leads to the development of society Financial information is one of the most important factors in most decisions. The more complex the decision environment and uncertainty. Moreover, the difficulties of the decision-making process are added, and in this regard, financial statements are designed to help users identify key relationships and forecasts, and investors use this information to evaluate investment decisions and set priorities [5].

In such an environment, there is a lack of criteria and methods for evaluating companies and helping investors in the Tehran Stock Exchange. Also provide a way to help listed companies know what they need to score to become more efficient and closer to the efficiency threshold [6].

Data envelopment analysis is one of the valid methods in evaluating the financial performance of similar companies, based on inputs and outputs. In this method, using mathematical planning models, a boundary consisting of companies with the best relative efficiency is obtained and this boundary is considered as a criterion for evaluating the performance and formulating strategies to improve the performance of companies [7].

In data envelopment analysis, due to the lack of use of the production function, no predictions are made about the companies under review, and therefore the envelopment analysis models, due to the use of fewer hypotheses in the company

evaluation process, than Similar models have gained a special status.

DEA stands for Data Envelopment Analysis, which means data envelopment analysis is a mathematical programming model for evaluating the performance of decision-making units (DMUs) that have multiple inputs and multiple outputs. Performance measurement has always been considered by researchers because of its importance in evaluating the performance of a company or organization. In 1957, Farrell measured efficiency for a production unit using a method similar to engineering performance measurements. Farrell's case for measuring performance included an input and an output [8].

Charles, Cooper, and Rhodes developed Farrell's view and proposed a model that was able to measure performance with multiple inputs and outputs. Under Cooper's guidance, it was used at Carnegie University under the title Assessing the Academic Achievement of American National School Students in 1976.

Since this model was proposed by Charans, Cooper, and Roders, it became known as the CCR model, which consists of the first letters of the three names, and in 1978 in an article entitled Measuring the Efficiency of Decision Units Recipient presented [9].

In fact, data envelopment analysis is based on a series of optimizations using linear programming, which is also called non-parametric method.

In this method, an efficient boundary curve is created from a series of points that are determined by linear programming. To determine these points, two assumptions of constant and variable returns to scale can be used. The linear programming method, after a series of optimizations, determines whether the decision-making unit in question is on the efficiency frontier or outside it. In this way, efficient and inefficient units are separated from each other. The DEA technique covers all data and for this reason it is called data envelopment analysis [10].

One of the most basic and at the same time the most common methods of measuring efficiency is the use of ratios. These ratios are used in various financial, economic and industrial fields. If efficiency is used as a ratio of outputs. To define inputs, it will be easy to calculate and analyze for single-input-single-output units, but in most real-world problems we are faced with units with multiple inputs and outputs, and as a result we need methods that combine inputs and outputs. Outputs as a single indicator, achieve a suitable criterion for measuring performance [11].

Returns to the scale of the pattern used:

Efficiency on a scale represents the relationship between changes in the inputs and outputs of a system. One of the capabilities of the DEA method is the application of different patterns corresponding to returns to different scales as well as measuring returns per unit scale.

A. Fixed-scale returns: That is, each multiple of inputs produces the same multiple of outputs. The CCR model assumes constant-scale returns of units. Therefore, small and large units are compared.

B: Efficiency on a variable scale: that is, any multiple of inputs can produce the same multiple of outputs, or less or more, in the outputs. The BCC model assumes return-to-scale variables [11].

One of the important topics in microeconomics and data envelopment analysis is the issue of scale returns, which has been the subject of many studies. In economies of scale, the impact of factors of production on output is defined for multiple inputs and single outputs. In data envelopment analysis, scale research is performed only by simultaneously increasing all inputs in equal proportions.

So the question arises to increase all inputs. What changes the outputs of decision-making units? If the ratio of output increases to increases more than increases, returns are incremental or ascending. If the ratio of increase in output is less than increase in input, the return is on a decreasing or declining scale. If the ratio of output increases with increasing inputs, the efficiency is constant on a scale.
Poor et al, considering the return rates of 1, 3, 5, and 10 years and stock dividends as output variables and the price-to-earnings ratio, beta, and the benchmark of returns as input variables, using data envelopment analysis to evaluate the performance of 185 large companies in the United States. Have reviewed [12].
They conclude that data envelopment analysis is able to:
1. Provide a unique combination scale for securities.
2- To help the decision maker which of the securities is more suitable in terms of multiple indexes.
3. Provide information such as how much improvement is needed to make each of the securities efficient with respect to specific inputs and outputs [13].
Banu provide a model that can be used to evaluate the performance of a mutual fund. This template uses data envelopment analysis method. The main purpose of this research is to use data envelopment analysis to define the performance indicators of investment companies and can be in the form of several inputs before us [14].
For example, risk criteria and investment costs can be mentioned. But data envelopment analysis can take into account other output indicators in addition to the average rate of return that can be measured by traditional indicators.
In addition, data envelopment analysis can determine for each inefficient company, a set of efficient companies (peer group) that represents a hybrid portfolio, as a criterion (benchmark or benchmark) the type and type of portfolio [14].
According to the topic in this dissertation, statistics and information of ten years of financial statements of petrochemical companies listed on the stock exchange and OTC securities are analyzed using data envelopment analysis technique and the relevant results of the process of selecting and placing specific indicators of Inputs and outputs are considered unique in their kind.

2- Background

Stock Exchange:
The idea of creating a stock market was formed when a number of European traders lost their business activities, so they thought of a solution to prevent or minimize this loss. As a result, a number of traders participated in some of their activities in order to share potential profits and losses with them. This experience was successful, so gradually every trader tried to continue his business activities in this way; This method was especially suitable for people who were engaged in large-scale economic activities. Gradually, this experience became legal and became the formation of joint stock companies. The first experience was the formation of a joint stock company in Russia, which in 1353 decided to move goods from northern Europe to East Asia and China without bypassing Africa, and this was the business that was most likely to lose. To do this, a number of businessmen provided the necessary capital, and each of them shared in the company's profits and losses in proportion to their capital, and this was done successfully. Later, with the expansion of exchanges in Europe, more capital and more partners were needed. To do this, we needed centers to be able to establish a relationship between investors and investors. Such centers were established and named stock exchanges. The world's first stock exchange was established in the 17th century in

Amsterdam, the Netherlands, and today most countries in the world have stock exchanges. In Iran, the law on the establishment of the stock exchange was approved in 1345 and began to work on February 6, 1967.

In the markets, two types of assets, real assets and financial assets, are generally traded. Real assets are the same as physical assets such as land, buildings and various goods such as cars, appliances, etc. But financial assets are paper assets and better to say documents, such as stocks and bonds.

A stock exchange is a market in which various assets are traded. Hence, the types of stock exchanges can be classified into three general categories: commodity exchange, currency exchange and stock exchange.

How is the stock price determined in the stock market?

The stock market pricing system is designed in such a way that no one can interfere in pricing; In this way, in the stock exchange, individuals can not personally buy or sell stocks, and this must be done through the stock exchange brokerages and their brokers. Brokers are people who work under the supervision of the stock exchange organization.

Admission to the stock exchange is that, both sellers and buyers of stocks, in the first step, submit their demand to the stockbrokers. Brokers appear in the stock exchange hall every day except Thursdays and holidays and enter all buying and selling requests into the trading system. After entering the list of demands in the trading system, the demands are in two lines; Purchase queue and sales queue are prioritized based on price and arrival time. This system is designed to put the prices that are cheaper to sell and the purchase demands that have a higher price in the first row. Thus, whoever sells at the cheapest price is at the forefront of the sales queue and whoever buys at the most expensive price is at the forefront of the buying queue and therefore will trade before others. Of course, if two requests enter the system at the same price, the system gives priority to the request that has entered the trading system earlier. This performance of the system indicates that the trading process and stock prices are determined based on supply and demand and it is not possible for individuals to intervene in it.

Why invest in the stock market?

Investors, wherever they invest, in addition to seeking profit, in choosing the type of investment, they seek a place that gives more profit, is reliable and legal, whenever they want to be able to know the status of their investment, any When they want to be able to cash their capital and ... some also have higher standards. For example, they seek to invest in something that benefits society as well as themselves. For example, it creates employment and ... the stock market is one of the centers that has all these features. So investing in the stock market is not only beneficial for investors and investors, but also has significant benefits for the whole society.

What are the benefits of the stock market for investors?

A. Income

The most important goal of any investment person is to earn money. Investing in the stock market can fulfill this demand in two ways. First, through the payment of profits from the activities of factories and companies; In this way, factories or companies whose shares are listed on the stock exchange share among the shareholders the part of the profit that comes from the sale of their goods and services. In this way, those who have participated in these centers by buying shares of companies or stock exchange factories earn money in this way. The second way to earn the income of stock

exchange shareholders is due to the useful and effective activities of the managers of the respective companies, which increase the stock price of the companies, which means increasing the shareholders' assets.

B. Liquidity capability

Those who invest in the stock market can convert their stock into cash much faster than many other investments if they need it. All you have to do is go to the first stockbroker and submit your stock sale application form. The convenience of selling stocks is such that even in the most difficult conditions, if a person offers his stocks a little less than the market price, his capital will be cashed in the shortest time. However, many other investments do not have this feature. For example, suppose someone invests in a car, land, or house and now needs money. It is clear that converting any of these items into cash would be far more difficult than selling shares of listed companies.

C. Participate in decisions

The decision to manage the listed companies is made with the opinion of the capital owners. According to the law, people who buy shares of listed companies can attend the meetings of the relevant company and be informed of the company's workflow by hearing the activity report, and also with their right to vote to elect the board of directors, desired plans and dividends to shareholders. The company should comment. This advantage of listed companies has made it possible for shareholders to be both aware of the company's activities and to participate in decisions.

D. Ensure investment location

The stock market is a very safe place to invest. To prove this claim, it is enough to pay attention to the law governing the stock exchange. The stock exchange is established in accordance with the securities market law and operates in accordance with it. In the law, in addition to specifying all the activities of the stock exchange and any kind of activity is done by obtaining a legal license, a supervisory body called the "Exchange Organization" is also considered to monitor all the activities that are performed. Another point is that according to the law, listed companies are obliged to provide their authorized information to buyers and sellers on a regular basis. This will make the market more transparent, so that anyone with the necessary information to buy and sell can trade with confidence. As a result, the law governing the stock market and the envisaged mechanisms provide a safe place to invest.

3. Concepts and generalities of data envelopment analysis

Optimal use of resources in organizations has always been the focus of managers. The reason for this is the limitation of resources and their maximum use. Therefore, it is necessary to use a scientific method to evaluate the performance of units that use these resources. Several methods have been proposed in this regard. All of these methods are based on estimating a function called a production function. The output function is a function that produces the maximum possible output for different input vectors. Identification and estimation of the production function is possible by two methods, parametric and non-parametric. With the advancement of technology, non-parametric methods were not very successful in dealing with real problems and had disadvantages. To solve the problems caused by parametric methods, non-parametric methods such as DEA are used, which include mathematical models to calculate the relative efficiency of decision-making units and provide a suitable model to inefficient units to improve their performance.

It is possible to calculate the efficiency and determine the pattern in this method with the help of the production function, and it is impossible to determine this function accurately. Therefore, we have to define a

set called the production possibility set so that part of its boundary will be an estimate of the production function.

Definition: $DMU_j\ (j=1,...,n)$, with input vector $x_j=(x_{1j},...,x_{mj})$ and output vector $y_j=(y_{1j},...,y_{sj})$. Production capability set is a set that includes all producible DMU_s, which are defined as follows:

$$T=\left\{\begin{pmatrix}x\\y\end{pmatrix}|\text{Negative vector x can produce non}-\text{negative vector y}\right\}$$

Where X input vectors and Y output vectors are the decision makers. The above definition determines the possibility of production according to the efficiency to scale of production technology. In order to build the T set, we accept the principles that underlie the theory and construction of DEA models.

Principle 1) Inclusion of observations: All observations belong to the collection, meaning that:

$$\begin{pmatrix}x_j\\y_j\end{pmatrix}\in T,\qquad j=1,...,n.$$

Principle 2) Convexity: This principle states that the set of production possibilities is convex, in other words:

$$\forall\begin{pmatrix}x'\\y'\end{pmatrix},\forall\begin{pmatrix}x''\\y''\end{pmatrix},\forall\lambda\left[\begin{array}{l}\begin{pmatrix}x'\\y'\end{pmatrix}\in T,\ \begin{pmatrix}x''\\y''\end{pmatrix}\in T,\\ \lambda\in[0,1]\Rightarrow\begin{pmatrix}\lambda x'+(1-\lambda)x''\\ \lambda y'+(1-\lambda)y''\end{pmatrix}\in T\end{array}\right].$$

Principle 3) Feasibility: This principle states that if X can produce Y, then any input greater than X can produce Y, and X can produce any output less than Y, in other words:

$$\forall\begin{pmatrix}x\\y\end{pmatrix},\ \forall\begin{pmatrix}\bar{x}\\\bar{y}\end{pmatrix}\left[\begin{array}{l}\begin{pmatrix}x\\y\end{pmatrix}\in T,\ \bar{x}\ge x,\\ \\ \bar{y}\le y\ \ \Rightarrow\begin{pmatrix}\bar{x}\\\bar{y}\end{pmatrix}\in T\end{array}\right].$$

Principle 4) Radiation Infinity (Return to Fixed Scale): This principle states that if we have $\begin{pmatrix}x\\y\end{pmatrix}\in T$ then for every $\lambda\ge 0$: $\begin{pmatrix}\lambda x\\\lambda y\end{pmatrix}\in T$.

Principle 5) Minimal Interpolation: We consider the smallest set that applies to the first to fourth principles.

CCR model

The set T in technology with fixed efficiency is shown with T_C and is:

$$T_C=\left\{\begin{pmatrix}x\\y\end{pmatrix}\middle|\begin{array}{l}x\ge\sum_{j=1}^{n}\lambda_j x_j,\ y\le\sum_{j=1}^{n}\lambda_j y_j\ ,\\ \lambda_j\ge 0\ ,\ j=1,...,n\end{array}\right\}.$$

The C symbol indicates that the T_C production facility set is constructed by accepting the principle of constant scale returns. Evaluating a DMU in this set leads to building a model called CCR, which is one of the basic models of DEA. According to definition T_C, the CCR model in the nature of input in model (2-1) is:

$$\begin{aligned}&\theta_o^*=\min\theta\\ &s.t.\quad \sum_{j=1}^{n}\lambda_j x_{ij}\le\theta x_{io},\qquad i=1,...,m,\\ &\qquad\ \sum_{j=1}^{n}\lambda_j y_{rj}\ge y_{ro},\qquad r=1,...,s,\\ &\qquad\ \lambda_j\ge 0,\qquad j=1,...,n.\end{aligned}\quad(1)$$

BCC model:

By removing the principle of return to a fixed scale, a set of production possibilities is obtained, which is denoted by T_V and is:

$$T_V=\left\{\begin{pmatrix}x\\y\end{pmatrix}\middle|\begin{array}{l}x\ge\sum_{j=1}^{n}\lambda_j x_j, y\le\sum_{j=1}^{n}\lambda_j y_j, \sum_{j=1}^{n}\lambda_j=1,\\ \lambda_j\ge 0\ ,\ j=1,...,n\end{array}\right\}.$$

The V in this set means returns to the variable scale. This set was first introduced by Bunker et al. (1984) and the model that evaluates DMU_s in this set is known as the

BCC model. The BCC model is given in the nature of input in Model (2-2):

$$\begin{aligned} \theta_o^* &= \min \theta \\ s.t. \quad & \sum_{j=1}^{n} x_{ij}\lambda_j \le \theta x_{io}, \; i = 1,\dots,m, \\ & \sum_{j=1}^{n} y_{rj}\lambda_j \ge y_{ro}, \; r = 1,\dots,s, \\ & \sum_{j=1}^{n} \lambda_j = 1 \\ & \lambda_j \ge 0, \; j = 1,\dots,n. \end{aligned} \tag{2}$$

Definition Suppose n decision-making units each consume m inputs to generate s outputs. (X_0, Y_0) Consider a possibility of production and $\beta > 0$ fixed values and $\alpha(\beta)$ in $\alpha(\beta) = MAX\{\alpha | (\beta x_0, \alpha y_0) \in T\}$ (T set of possibility of production). Now consider $\gamma = \lim_{\beta \to 1} \frac{\alpha(\beta) - 1}{\beta - 1}$, in which case the return on a scale is expressed as follows:

A) $if \; y > 1, it \; has \; I.R.S \; (X_0, Y_0),$

B) $if \; y = 1, it \; has \; I.R.S \; (X_0, Y_0),$

C) $if \; y < 1, it \; has \; I.R.S \; (X_0, Y_0),$

If the left and right boundaries are not equal, the following situations occur:

1) $\lim_{\beta \to 1^-} \frac{\alpha(\beta) - 1}{\beta - 1} = 1, \lim_{\beta \to 1^+} \frac{\alpha(\beta) - 1}{\beta - 1} < 1$

2) $\lim_{\beta \to 1^+} \frac{\alpha(\beta) - 1}{\beta - 1} < 1, \lim_{\beta \to 1^-} \frac{\alpha(\beta) - 1}{\beta - 1} > 1$

3) $\lim_{\beta \to 1^+} \frac{\alpha(\beta) - 1}{\beta - 1} = 1, \lim_{\beta \to 1^-} \frac{\alpha(\beta) - 1}{\beta - 1} > 1$

4) $\lim_{\beta \to 1^-} \frac{\alpha(\beta) - 1}{\beta - 1} < 1, \lim_{\beta \to 1^+} \frac{\alpha(\beta) - 1}{\beta - 1} < 1$

5) $\lim_{\beta \to 1^-} \frac{\alpha(\beta) - 1}{\beta - 1} > 1, \lim_{\beta \to 1^+} \frac{\alpha(\beta) - 1}{\beta - 1} > 1$

In parts 1, 2, 3 the returns are on a fixed scale and in mode 4 the returns are on a descending scale and in 5 cases the returns are on an ascending scale.

Due to the lack of a limit, and also due to the very small practical application of the Bunker definition of return to scale, other definitions of return to scale are based on observations, which are discussed below. The BCC model was first used in the DEA to determine scale returns.

If the DMU_o in the BCC model is efficient and the $U^* y - V^* x + u_0 = 0$ superplane relies on (X_o, Y_o), the return on the scale depends on the u_o^* mark.

Theorem 1: Suppose (X_o, Y_o) is efficient in the BCC model and (V^*, U^*, u_0^*) is the unique optimal solution of the BCC model multiplicative form in the DMU_o evaluation if:

A) $u_o^* > 0$ Then the return on the DMU_o scale is incremental.

B) $u_o^* = 0$ Then the return to the DMU_o scale is constant.

C) $u_o^* < 0$ Then the return on the DMU_o scale is decreasing.

The supporting page cloud may be unique or multiple. Finding all optimization solutions can be very difficult and sometimes impossible. Thus, instead of solving the BCC model, they first tried to solve two linear programs with objective functions u_0^- and u_0^+.

Theorem 2: Consider the following linear planning problems:

$$\begin{aligned} u_0^+ = \quad & Max \; u_0 \\ s.t. \quad & VX_0 = 1 \\ & UY_j - VX_j + u_0 \le 0, \quad j = 1,\dots,n, \; j \ne o, \\ & UY_o - VX_o + u_0 = 0, \\ & U \ge 0, V \ge 0, \end{aligned}$$

and

$$u_0^- = Min\ u_0$$
$$s.t.\ VX_0 = 1$$
$$UY_j - VX_j + u_0 \le 0,\ j = 1,...,n,\quad j \ne o,$$
$$UY_o - VX_o + u_0 = 0,$$
$$U \ge 0,\ V \ge 0,$$

In this case if:

A) If $u_0^+ > 0$ and $u_0^- > 0$ at point (X_o, Y_o) returns to the ascending scale.

B) If $u_0^+ < 0$ and $u_0^- < 0$2 at point (X_o, Y_o) returns to a descending scale.

C if $u_0^+ \ge 0$ and $u_0^- \le 0$ at point (X_o, Y_o) yields on a constant scale.

Maximum Production Scale Size (MPSS): In 1984, Bunker defined the largest output scale size as the output size that has the highest average output per virtual production unit that shares the same DMU_o input and output combination. In fact, for the set of T production possibilities, the maximum size of the production scale is the size of the scale at which the output produced by each unit of inputs is the maximum.

So a possibility of generating (X_o, Y_o) in T is an MPSS if and only if for every β, α that $(\beta X_0, \alpha Y_0) \in T$ then $\frac{\alpha}{\beta} \le 1$. That is, to increase productivity, you have to move until $\frac{\alpha}{\beta} \ne 1$. So if it is possible to produce (X_o, Y_o), an MPSS then the efficiency on the scale of this unit is neither increasing nor decreasing. From the above, the following theorem can be deduced.

Theorem: If $(X_0, Y_0) \in T$ is an MPSS then it has a fixed scale return.

Practical example:

In this section, first the selected input and output factors are mentioned and then how to collect information is discussed. In the following, according to the method used in data analysis, which is one of the applied techniques to obtain efficiency and efficiency to scale, is mentioned.

Since the basis for measuring performance in data envelopment analysis is the ratio of output to input, in this section we will introduce inputs and outputs - the same data and outputs.

According to the research conducted on the evaluation of financial performance in petrochemical companies that are members of the Tehran Stock Exchange and OTC, 5 surveys and 2 outputs were identified through surveys and discussions with experts and experts in this field. The indicators selected in the petrochemical companies that are members of the stock exchange and OTC are as follows:

Table 1- Inputs and Outputs

Capital	Non-current liabilities	Current liabilities	Non-current assets	Current assets	**Input**
Tax	Profit and loss per share		Distributable profit and loss		**Output**

Introduction the indicators

Current assets & Non-current assets: In financial accounting, assets are the resources that a company requires in order to run and grow its business. Assets are divided into two categories, current and noncurrent assets, which appear on a company's balance sheet and combine to form a company's total assets. You may think of current assets as short-term assets,

which are necessary for a company's immediate needs; whereas noncurrent assets are long-term, as they have a useful life of more than a year.

Current liabilities & Non-current liabilities: Current liabilities or short-term liabilities are financial liabilities that mature in a fiscal year or in an operating cycle (whichever is shorter). In contrast, non-current or long-term liabilities are financial liabilities that mature in more than one fiscal year or operating cycle.

Capital: Capital in the balance sheet refers to the assets minus the debt of a company. This asset is not limited to cash, but includes cash equivalents, such as stocks and investments. Capital is the personal contribution of the investor to advance the goals of the company.

Distributable Gains and Losses: Net income minus expenses incurred by the company, after the imposition of a performance tax.

Profit and loss per share: Net profit and loss of the company, divided by the number of shares issued.

Performance tax: A proportion of the government's share of the company's net profit.

In this research, the available and available information and documents from stock exchange sites, stock exchange companies and management sites were used, and in this regard, while reviewing and viewing the articles and books presented that include the subject of analysis, has been.

4. Data analysis method

The first step to analyze the data is to collect information, this information was provided through the above mentioned sources. Then, in order to provide information for analysis, it selected the selected information and in the next step, the required information was classified and summarized after monitoring. In the next step, the collected information was processed using GAMS software and using a computer. Finally, this process, after reviewing and adapting to the tables and analyzes available in the capital market, was presented in the form of various histograms.

Analysis of results

Since the poor performance of some petrochemical units that are members of the stock exchange leads to the lack of optimal use of available resources and proper efficiency of these units, it is necessary to make decisions to measure and evaluate the units of the organization.

One of these decisions is the ranking of petrochemical companies. Which shows the position of companies among similar units? Estimating rankings helps organizations to design their organization's strategy. Another method used to evaluate units is to calculate the performance of organizational units, which helps managers predict and evaluate the amount and process of performance and evaluation on a unit scale.

According to the results obtained from the tables (efficiency) and (return to scale) and performance movement chart, it is observed that DMU_2 has the highest average value of efficiency and the highest number of returns to constant scale during this study. The efficiency index varies between zero and one, and the highest efficiency is related to an index with number one.

The result of this analysis can be helpful to other companies to change the method by modeling the behavior of efficient units to improve their performance and differentiate themselves from other companies, and since the amount of efficiency is a function of selected inputs and outputs that affect performance Is also corporate finance, it is also seen in the output of the tables that DMU6 with an efficiency of 0.439. Get the latest rank in performance and lowest return on a constant scale.

Meanwhile, during the years 1391 and 1392, the return to scale with the highest constant value with the highest efficiency during the calculated period, ie 804% in 1391 and 805% in 1392 has been aligned, for which the following interpretations can be provided.

Interpretation 1: Just as the movement of the stock index chart is in line with the average productivity chart, the average performance chart is in line with the return-to-scale return chart.

Second Interpretation: Increasing the input factors will only increase the efficiency and vice versa reducing it will reduce the efficiency.

Third Interpretation: In the years when we see the most efficiency in the ranking of companies, increasing the input of companies could probably have been one of the factors of this increase.

The nature of CCR The efficiency of petrochemical companies in each year compared to the community in question has been calculated using the input model. The results of scale returns are shown in the tables below.

Table 2 - Details of the research companies

Research Symbol	Stock Symbol	Company Name
DMU1	Kermasha	Sanaye Petroshmi Kermanshah
DMU2	Shiran	Sanaye shimiyae iran
DMU3	Shiraz	Petroshmi shiraz
DMU4	Shabriz	Palayesh naft tabriz
DMU5	Shasfha	Petroshmi esfahan
DMU6	Shapna	Palayesh naft esfahan
DMU7	Shafan	Petroshmi fanavaran
DMU8	Shakharak	Petroshmi khark
DMU9	Sharak	Petroshmi shazand arak
DMU10	Vapetro	Sarmayehgozari Petroshmi

Table 3- Returns to the scale of petrochemical companies listed on the stock exchange in the evaluation period

The number of years of a company's declining return on a period	The number of years a company has a fixed return on a period	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	Decision maker unit
3	8	Fixed	Fixed	Descending	Descending	Descending	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	DMU1
1	10	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Descending	DMU2
2	9	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Descending	Fixed	Descending	Fixed	DMU3
2	9	Fixed	Fixed	Fixed	Fixed	Descending	Fixed	Fixed	Fixed	Descending	Fixed	Fixed	DMU4

3	**8**	**Fixed**	**Fixed**	**Descending**	**Fixed**	**Descending**	**Descending**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**DMU5**
7	**4**	**Descending**	**Descending**	**Descending**	**Descending**	**Descending**	**Descending**	**Fixed**	Descending	**Fixed**	**Fixed**	**Fixed**	**DMU6**
7	**4**	**Fixed**	**Fixed**	**Descending**	**Descending**	**Descending**	**Descending**	**Descending**	Descending	**Fixed**	Descending	Fixed	**DMU7**
4	**7**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Descending**	**Fixed**	**Fixed**	Fixed	Descending	Descending	Descending	**DMU8**
6	**5**	**Fixed**	**Fixed**	**Fixed**	**Descending**	**Descending**	**Fixed**	**Descending**	Fixed	Descending	Descending	Descending	**DMU9**
6	**5**	**Fixed**	**Fixed**	**Fixed**	**Descending**	**Descending**	**Descending**	**Fixed**	Descending	Descending	Fixed	Descending	**DMU10**
Total returns		**9**	**9**	**6**	**5**	**2**	**6**	**8**	**6**	**6**	**6**	**6**	Number of companies with fixed returns in a fiscal year
37%	**63%**	**1**	**1**	**4**	**5**	**8**	**4**	**2**	**4**	**4**	**4**	**4**	Number of companies with declining returns in a fiscal year

Table 4- Average efficiency of companies during the period

Average performance over the entire period	Efficiency in 2014	Efficiency in 2013	Efficiency in 2012	Efficiency in 2011	Efficiency in 2010	Efficiency in 2009	Efficiency in 2008	Efficiency in 2007	Efficiency in 2006	Efficiency in 2005	Efficiency in 2004	**Decision maker unit**
0.898	0.77	0.82	0.64	0.76	0.89	1	1	1	1	1	1	DMU1
0.962	1	1	1	1	1	1	1	1	1	1	0.58	DMU2
0.515	0.84	0.93	0.46	0.47	0.64	0.31	0.46	0.43	0.39	0.43	0.31	DMU3
0.613	0.77	0.49	0.35	0.27	0.45	0.46	0.54	1	1	0.82	0.59	DMU4
0.885	0.89	1	0.59	0.78	0.78	0.69	1	1	1	1	1	DMU5
0.439	0.4	0.33	0.28	0.29	0.42	0.38	0.65	0.83	0.59	0.33	0.33	DMU6
0.815	0.92	0.96	0.49	0.68	0.65	0.8	0.88	0.94	1	0.65	1	DMU7
0.796	0.94	1	1	1	0.4	1	1	0.75	0.63	0.63	0.41	DMU8
0.518	0.52	0.51	0.5	0.44	0.4	0.51	0.8	0.55	0.53	0.57	0.37	DMU9
0.683	1	1	0.78	0.63	0.63	0.47	0.44	0.45	0.74	0.85	0.52	DMU10
0.712	0.805	0.804	0.609	0.632	0.626	0.662	0.777	0.795	0.788	0.728	0.611	Average efficiency of companies in a year

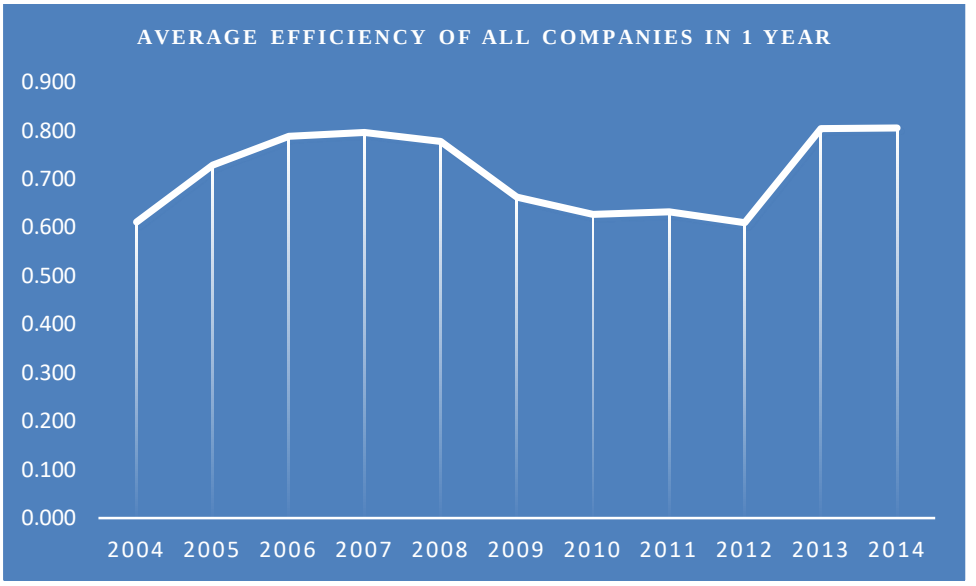

Figure 1- Average efficiency of companies during the period

5. Conclusion:

In the final summary in two areas of efficiency and scale returns for 10 petrochemical companies listed on the Tehran Stock Exchange and OTC during the 11-year evaluation period, as well as practical and future proposals are presented.

In the current situation and due to the dynamics of the economy and the rapid developments of global markets, the capital market of each country has been considered more than ever as a necessary precondition for using all capacities and achieving full employment.

In this section, the purpose is to finalize the research and answer the questions.

This conclusion is based on the tables and diagrams of the fourth chapter and appendices.

Question 1: What is the efficiency of petrochemical companies that are members of the Tehran Stock Exchange and OTC?

According to the results obtained in the third part, the efficiency of companies with the help of 8 factors: current assets, non-current assets, current debts, non-current debts and capital as input and tax factors, distributable profit (loss) and profit Each share after tax is shown as output factors.

In the above table and diagram, it is observed that the highest efficiency in 2014 with the number 0.805 And 2013 with the number 0.804 And the lowest efficiency is related to the years 2012 with the number 0.609 And 2003 with the number 0.611 Is.

The results obtained from the performance diagram show the three time periods in the following order.

From 2004 to 2007, we are witnessing an upward slope of efficiency to the highest point.

Efficiency slope from 2007 to 2012 has a downward slope. And from 2012 to 2014, we are witnessing a steep upward slope again.

While observing the output of the table of returns to scale, it is observed that the highest return to constant scale in 2013 and 2014 with 10 companies.

When the result is a return to an upward scale, it means that the company has the ability to increase the input absorption to increase the output. And the company has

the potential to increase the size of the company. For example, if the input increases by 10%, the output increases by more than 10%.

When the result is a return to a downward scale, it means that the company is not able to increase the input absorption to increase the output.

When the result of the return is on a constant scale, it means that the size is optimal and the company has the most benefit with this input and expenditure and there is no need to change the company.

According to the observations in the output table of returns to scale:

1. During 2013 and 2014, 90% of companies have returns on a constant scale and efficiency is at its peak. And in 2010, when the efficiency index is down, 80% of companies have returns on a downward scale. This means that the results of these two indicators are complementary.

2. In none of the companies and during the 11 years under review, returns on an ascending scale were not found, and this means that the companies surveyed in this study throughout the period, did not need more input to increase efficiency.

Performance index in 1390 from 0.609 To 0.805 At the end of 2014, it climbed and as a result, the stock market index increased significantly from 25905 units to 79015 units, while the main groups and companies that were directly related to the exchange rate and the dollar, such as petrochemicals, which are also export-oriented. They had foreign exchange earnings and at the same time they recognized and recorded a large profit from the exchange rate exchange, and this caused the stray liquidity to be diverted to these groups, which had 80% of the stock market value, without considering other factors.

Future - Research Suggestions:

A) Find the relationship between environmental factors and the performance of companies listed on the stock exchange

B) Evaluate the performance of petrochemical companies using financial and non-financial indicators.

C) Calculate the meta-Malmquist to determine the progress and decline of companies in a given period of time.

D) Analysis of performance sensitivity and effective indicators on it in petrochemical companies, members of the Tehran Stock Exchange and OTC, using data envelopment analysis.

E) Design and development of an intelligent decision support system, in order to analyze the sensitivity of selected parameters of managers in multi-stage decision-making units, so that by intelligent design of input and output factors and determining the relationship between selected parameters by the manager Estimate other remaining parameters. Given that the selected parameters can include any desired subset of input, or output parameters.

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