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Performance evaluation of petrochemical firms accepted in Tehran stock exchange using DEA (window analysis)

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Abstract

In the past two decades, organizational performance management has become one of the most attractive topics of study. Each organization is needed to evaluate its system to determine the appropriateness and quality of your work in dynamic environments. Data envelopment analysis provides a theoretical framework for performance analysis and performance measurement. The data envelopment analysis (DEA) is a linear programming technique, whose main purpose is to compare and evaluate a number of similar decision making units which have different amounts of used inputs and produced outputs. Dynamic method of data envelopment analysis (window analysis), is a method that enables the calculation of performance over time and can result in improved outcomes.We use the model described in this paper, the performance of listed companies in the petrochemical industry review. The evaluation results are indicated with different companies. The results showed that the six companies are 80% more efficient.

Keywords: Efficiency, Performance evaluation, Window Analysis, Stock

Introduction

Continuous improvement of organizational performance creates massive force of synergy that can support the developmental programs and create opportunities for organizational excellence. In this case, governments, organizations and institutions exert proceeding effort without the review and getting awareness of the progress rate, objectives achieving and without identification of challenges facing the organization, obtaining feedback and information of the implementation rate of formulated policies and identifying the cases that need serious improvement, performance continuous improvement will not be possible. Also, all of the mentioned cases are not possible without measurement and evaluation.The proper evaluation of companies and different industries can be full mirror of their status towards their competitors and specify the internal strengths and weaknesses as well as the opportunities and external threats (Ghodratiyan Kashan, & Anvariye Rostami, 2004). Thus, the evaluation of companies plays a very important role in industry. Introducing the industry's top companies determines their position in a competitive environment based on the various parameters or variables. On one hand, this causes the weak companies recognize their distance with the premiers and develop appropriate strategies for achieving them and on the other hand, the top companies by defining appropriate policies and strategies, and extending their superiority. English physicist Lord Kelvin said about the necessity of the measure: whenever we could measure what we talk about it and express it in terms of facts and figures ,then, we can say that we know something about the subject. Otherwise, our knowledge was imperfect and will never reach maturity stage. Financial information is one of the most important factors in most of deciding. Whatever the decision be more complex and also uncertainty be more, the difficulty of decision-making process is added. In this regard, the financial statements to assist users in identifying key relationships and designed predictions and investors use these kinds of information to evaluate investment decisions and priorities (Mehrani, Mehrani, & Karami, 2004). Cover analysis of data shows a concept of efficiency levels calculating within a group of organization, which assess the performance of each unit compared with a number of units with the highest performance (Martin, Kocher and Sutter, 2000). This technique is based on linear programming approach that its main purpose is to compare and assess the efficiency of a number of similar decision-maker units

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having different number of inputs used and output generated. These units can be a bank's branches, schools, hospitals, refineries, power plants, offices covered by a government department and similar factories. The intention of efficiency comparing and assessing is that a decision-making unit compared with other units, how good uses its resources in line with production are.

Significance of research

The main issue in all of the organizational analysis is performance and its improvement requires measurement. So, an organization cannot be conceivable without the performance appraisal system. In such environments, vacancies of criteria and procedures for companies' evaluating and helping investors at Tehran Stock Exchange feel essential. The point that must be mentioned is that, unfortunately, very few investigations are dynamic on performance evaluation and only evaluate efficiency at a point in time and evaluation during temporal period is ignored. The significant point of this article also refers to the evaluation of active petrochemical companies in Tehran Stock Exchange, according to the dynamic model of Data Envelopment Analysis.

The fundamental questions raised in the minds in line with the formation of this research are as follows:

1. How can the companies' performance with dynamic model of data envelopment analysis (window analysis) be assessed?

2. What are the available efficient companies in the petrochemical industry in the Stock Exchange?

Review of Literature

Performance evaluation

- Performance evaluation is the process of measuring, valuing and judging the performance during the certain period.
- Performance evaluation in organizational dimension is often synonymous to the effectiveness of activities. Effectiveness refers to the achieving rate of goals and programs with characteristic of efficient operations and activities(Atkinson, Waterhouse, and Wells, 1997).
- Performance evaluation in dimension of how to use the resources is expressed in terms of efficiency indicators. If in its simplest definition, we know the efficiency as the ratio of output to input, in fact the performance evaluation system will be examined the efficiency rate of management decisions concerning the best use of the resources and facilities.
- Performance evaluation consists of performance measurement through comparing the current situation with the desired or ideal situation according to predetermined criteria that meet certain characteristics (Neely, Gregory, Platts, 1995).
- Totally, performance evaluation system refers to assessment process and evaluating, measuring and comparing the rate and how to achieve the desired status with criteria and specified attitude in the certain covered scope and area with certain specific parameters and in given time period with the aim of review, reformation and continuous improvement.

Efficiency

Someone considers the efficiency equal to effectiveness and defines it as optimal production capacity with minimum energy consumption, time, money or materials. Upon this basis, efficiency is introduced in general concept as the degree and quality of achieving to a set of desired aims (Webster, Miriam,1983).

The simplest, yet most general definition of efficiency has been offered by Peter Drucker. According to Drucker, job efficiency is doing decently and appropriately. In the Katz and Kahn's perspective (1678),efficiency is the ratio of generated inputs to required output for production of these inputs.

- Distinguish the potential efficiency from actual efficiency. Potential efficiency indicates the productivity amount of an organization, if it acts optimally, while the actual efficiency refers to the actual ratio of input to the real level of outputs. Actual efficiency is usually smaller than the potential(Osborne, Bovaird, &Martin 2002).
- Another definition of Efficiency (performance) refers to the ratio of actual output to standard output or actually the ratio of performed work's amount to the amount of work that must be done.
- Richard Daft knows efficiency as the amount of resources consumed to produce a unit of product that can be calculated based on the ratio of consumption to production. In the simplest case, we have only one input and one output that the efficiency is the ratio of input to output. For example, the efficiency of a machine can be obtained by division of the traveled distance on the amount of consumed fuel. This ratio can be compared with the other obtained ratios. But, in most cases, units consist of several input and output. Efficiency in this case is defined as follows:

Efficiency= Sum of inputs' weights / Sum of outputs' weights (Daft, Rychardal, 2005).

- This definition requires a set of weights that need to be defined. If two units have the same inputs

and at least one of the outputs of the second unit be less than the corresponding outputs of the first unit, it is said that the second unit is inefficient than the first unit. But, instead of comparing a unit with other units separately, we compare the inputs and outputs with the linear combination of all inputs and outputs.

Effectiveness

The first proposed approach to the effectiveness was very simple. Effectiveness had been as a degree or the extent to which an organization will achieve its objectives. Great management thinker Peter Drucker, defines effectiveness as "doing things right".

- Richard Daft knows an organization's goals understanding as the first steps that must be taken to understand the effectiveness. He defines aim as the best conditions of organization in future and the efficacy and the degree or extent to which the organization will achieve its intended goal.
- And effectiveness of organization is a degree or extent to which the organization will achieve its intended goal. He expresses that effectiveness has a general concept and contains a large number of variables. The common point of all provided definitions is the achievement rate of goals. But, to days, researchers believe that effectiveness measurement requires observation of multiple criteria that evaluate the organization's duty, based on the different characteristics. In the effectiveness of the organization, paying attention to the tools of equipment as well as the obtained outcomes (objectives) are essential.

Relationship between effectiveness and efficiency

Efficiency is a prominent character that in addition to the ability to do normal work of life, in a preferred way includes showing intelligence, simulation, enlightenment, sharp thought and applying them. In this case, the efficiency also has the concept of effectiveness in itself.

Peter Drucker, the great management theorist in Innovation and Entrepreneurship (1985) book writes: Emphasis on efficiency without special attention to effectiveness is misleading and dangerous. Efficiency means doing things better than what is currently going on. Therefore, the costs and savings should be considered. But, the new and pioneering techniques on effectiveness means the decision-making on how to do work, utilize the opportunity to increase revenue, market expansion and emphasis on transformation of the current economic situation. Efficiency has limited scope than the effectiveness and is used in relation to without organization works. While the effectiveness has broader concept and may include optional field of organization that defines to what extent organization meet the satisfaction of stakeholders. And, how well it meets its goals, while efficiency refers to the issue of how well an organization converts the data to the output. Efficiency and effectiveness are not necessarily aligned and does not move in the same direction. In some organizations, efficiency leads to effectiveness, and in some others, there is no relationship between these two. An organization may have a higher level of performance, but fails to achieve its goals. Because produces goods that don't have applicant. Also, the organization may reach to its revenue goals, but does not work. Peter Drucker believes that a manager's performance should be evaluated with criteria of the efficiency and effectiveness. He considers effectiveness more important among two indicators, because if wrong targets are selected, it cannot be compensated with any degree and amount of efficiency. In efficiency, the cost is mostly taken into consideration while ineffectiveness, the objective is given more attention.

Data Envelopment Analysis (DEA)

Data envelopment analysis is a mathematical programming technique for evaluating the efficiency of decision-making units (DMUs) with several inputs and outputs. Performance measuring has always been considered by researchers because of its importance in assessing the performance of a company or organization. In 1957, Farrell measured efficiency for productive unit by using of a technique similar to efficiency measuring in engineering topics. The cases that are considered by Farrell in measurement of efficiency by Farrell include the one input and one output. Charnz, Cooper and Rhodes developed the Farrell approach and presented a model that was able to measure the efficiency of multiple inputs and outputs. This model is called data envelopment analysis and is used for first time in doctoral thesis of Educational Rhodes, entitled Assessment of educational achievement of American National school students at the Carnegie University in 1976 (Mehregan).

Background of the study

Akbariand Din Mohammad (2005) measured the efficiency of four largest milk production companies through window model as a sub-model of data envelopment analysis. Factors have been studied in this research including labor, capital, raw materials and output of milk and other income, farm incomes. The results show

that utilization of window analysis method is suitable for measuring the efficiency of decision making units, and none of the desired productive units despite the efficiency in some years, don't have the productivity

Liang*et al* (2006)conducted a research entitled to "a data envelopment analysis of bond shipbuilding industry ranking in Taiwan. They aim to provide a simple and explicit approach to rank the bond. Researchers used the data envelopment analysis methods to achieve their research goals in 1997-2004. Results indicate the successfulness of model in bond's ranking

Malhatra and *et al* (2007) used data envelopment analysis method to evaluate companies' bonds. They selected two financial ratios as input of model and six financial ratios as its output. Researchers' perspective in choosing the input and output ratios is based on that these ratios show better the borrower's financial ability to pay the principal and interest of debt. The number of considered decision-making units was 34 companies. Results indicated that, eight of them in terms of their ability to pay the principal and interest of debt, were more efficient than other companies (Malhotra, Malhotra, &Russel, 2007).

Chang *et al* (2007) conducted a research to introduce the data envelopment analysis method as another method for companies' credit ratings. At first, researchers describe that method and how to use it as a proper way for credit ratings. The following numerical examples show that the data envelopment analysis method has sufficient capability for credit rating of business units (Cheng, Chiang, & Tang, 2007).

Min and Lee (2008),in a study with aim of credit rating, used data envelopment analysis method. To this end, researchers used audited financial data of a number of manufacturing companies. He considered financial expenses ratio to sales, current liabilities to asset and total asset to total liabilities as input and capital ratios to total asset and current assets to current debt as output of model. Researchers believe that the result of study including credit rating obtained by using data envelopment analysis is reliable and trusted. For this purpose, researchers compared the results with other methods (Min, and Lee, 2008).

Cooper *et al*. (2001)created a method for determining the efficiency of decision making units and how to deal with imprecise data such as: interval data and fuzzy data. The model presented in this paper entitled to DEA, is imprecise which is obtained from transformation of a nonlinear programming problem into a liner programming through a series of conversion and substitutive variables. The results indicate that the mentioned model presents more accurate results than the classical DEA model to determine efficiency in the real world problems (Cooper, Park &Yu,2001).

Wang *et al*. (2005) presented a new technique for the solution of interval DEA models in order to reduce both complexity and lasting stage of solution of this method and also provide a method for ranking and finding efficient and inefficient decision making units. The results show that the solutions obtained by this method are so close to solutions of present interval DEA model and have less complexity and requires shorter time to solve it. Also, interval data envelopment analysis method is a suitable method to measure the efficiency of decision making units in risky and uncertainty conditions (Wang, Greatbanks& Yang, 2005).

Despotis*et al*. (2006), in a study by presenting a method, provided the opportunity to assess decision-making units with uncertain data. In this method, uncertain and imprecise values are replaced by a set of intervals and for units with imprecise data, the efficiency rate of each decision-making units are identified with condition of identifying the top and bottom range of interval. In this research, the proposed model was used in applicable form in field of efficiency determining of high schools in the Greece and the obtained results are more precise compared with classical DEA method (Despotis, Maragos & Smirlis, 2006).

Souza and Miranda (2003) applied an output-oriented DEA model to estimate the efficiency of banks in Brazil and results indicate the relationship between efficiency and the risk of bank failure

Methodology

Design Process

The design process model is as follows: First, we specify the decision-making unit of DMU that we are going to evaluate its efficiency and then due to the characteristics and features of the DMU and by using of systematic approach begin to determine the data and outputs for these DMUs. Then, by data collecting in relation to data values and output of each of DMUs, formulate its efficiency evaluation model according to one of original models of DEA then after DEA model, for each DMU, its efficiency score is obtained and based on the results obtained from the model, the analysis of the efficiency status of DMU is done In this regard, the financial ratios are used as research variables that are divided into two groups of input variables and output variables. These variables are as follows and were selected

according to the research of Malhotra, Malhotra (2008), Worthington (1998).

The input variables include the cost of goods sold, fixed assets and current assets. The output variables include operating income to sales ratio (net sales margin), net profit to equity (return on investment), net income to assets (return on assets), sales. It is noteworthy that data used in this research have been extracted from information software of exchange and document reports of surveyed companies.

Table 1. Input and output variables

Row	Inputs	Outputs
1	Current Assets	Return On Assets
2	Fixed Assets	Return on investment
3	cost of goods sold	Sale
4		Profit to sales ratio

Statistical Population

The study population consisted of firms that were active during the period (2003-2010) in the petrochemical industry in the Tehran Stock Exchange.

Description of Model

It is worth noting that the performance is measurable in both conditions of constant and variable returns to scale. The first data envelopment analysis model is called CCR. Forming the basis of the model of efficiency defined as the ratio of output to a single input. Formation basis of this model refers to definition of efficiency as the ratio of output to input. In other words, the CCR model for calculating technical efficiency is the ratio of weighted sum of outputs (virtual output) to the sum of the weighted inputs (digital inputs) rather than an input to an output,

In other words, in CCR model for calculating technical efficiency, rather than an input to an output, the ratio of sum of weighted outputs (virtual output) to the sum of the weighted inputs (digital inputs) is used. The development basis of this model refers to inputs reduction and simultaneously, outputs increasing of under investigation unit (approach, input, output and orientation).

CCR Model

CCR model is the first Data envelopment analysis model consisting of the initial letters of its inventors (Charnz, Cooper, &Rhodes, 1985). In this model, for determining the highest efficiency ratio and involvement of inputs and outputs, therateof other decision =making units in determining the optimal weights for the under assessment unit, the following base model was proposed:

$$Max: \frac{\sum_{r=1}^{s} u_r y_{ro}}{\sum_{i=1}^{m} v_i x_{io}}$$

$$s.t.$$

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \le 1, j = 1,2,\ldots,n$$

$$u_r \ge 0, v_i \ge 0$$

Fractional programming model

The above fractional programming model is known as the CCR model in which u_r refers to the weight of output of r; n_i the input weight of i and o, is the latest under assessment decision maker unit ($o \in \{1,2,...,n\}$).Also y_{ro} and x_{io} respectively refers to the output values of r and input value of i for under assessment unit (Unit o) and y_{rj} and x_{ij} respectively refers to the output values of r and input value of i for j unit. S refers to the number of outputs; m the number of inputs; also n indicate the number of units. Note that the efficiency definition in fractional model of CCR is "the outcome of division of combined weight of outputs by the weighted combination of inputs."

Input-oriented and output-oriented in solution of CCR model

In DEA models, strategies to improve the inefficient units are reaching the efficiency frontier. Efficiency frontier consists of units with efficiency value of 1. In general, there are two types of strategies for improvement of inefficient units and their arrival to efficiency frontier (Charnes, Cooper &Rhodes, 1978):

A. Inputs' reduction without reducing output until the achievementtoaunit on the efficient frontier (this view is called the input nature of performance improvement or efficiency assessment with input-driven nature).

B. Outputs' enhancement until the achievement of aunit on the efficient frontier without attracting more inputs (this attitude iscalledthe output nature of performance improvement or efficiency assessment with output-driven nature).

These two models of efficiency improvement are shownin Figure 1. As shown in the figure, unit A is inefficient. A1 shows the improvement withthe nature of the input- oriented (input) and A2 indicates the improved version of the nature of the output-driven (output).

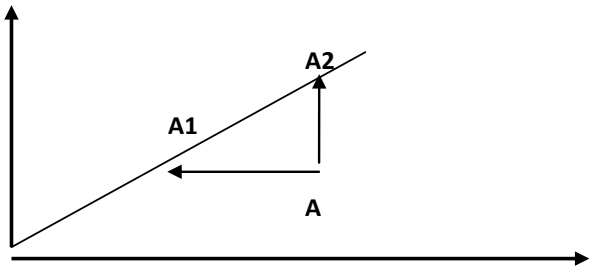

Figure 1. Improve efficiency model

In data envelopment analysis models with viewpoint of input-oriented, we are looking to achieve the technical inefficiency that should be reduced in inputs so without changing the outputs rate, the unit is placed on the efficient frontier. But, in output-based approach, we are looking towards the ratio that should increase the outputs so without changing the input rate, unit reaches to the efficient frontier. With suggestion of Charnz and Cooper, with implementation of limitation $\sum_{i=1}^{m} V_i x_{io} = 1$ in fractional programming model CCR, this model was converted to the following linear programming model:

$$Max \sum_{r=1}^{s} u_r y_{ro}$$

$$s.t.: \sum_{i=1}^{m} V_i x_{io} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0 \qquad j = 1,\ldots,n$$

$$u_r \ge 0 \qquad v_i \ge 0$$

input oriented CCR multiple model

The above Efficiency determining model, is known to the input oriented CCR multiple model (CCR.I). But for conversion of fractional CCR model into a linear programming model other methods can be used too. In this method with implementation of limitation $\sum_{r=1}^{s} u_r y_{ro} = 1$ fractional programming model CCR was converted to the following linear programming model which express the output oriented CCR multiple model (CCR.O).

$$Min \sum_{i=1}^{m} V_i x_{io}$$

$$s.t. \sum_{r=1}^{s} u_r y_{ro} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0 \quad j = 1,\ldots,n$$

$$u_r \ge 0 \quad v_i \ge 0$$

Output oriented CCR multiple model

In this study, according to the nature of companies, the second method is investigated. The DEAP software was used to calculate efficiency that has been presented by Timcoliin 1995.As initially was pointed the window analysis has been used for efficiency calculating and in following explanations are given about it.

Window Analysis

In the review of data envelopment analysis models and efficiency measurement of decision-making units, each DMU is measured at only one time. But, in most real studies, the observations related to DMUs are over a period of time, and in the form of time series data and it is important when we want to examine the efficiency of decision making units over a period of time and determine its changes. In this case, the behavior of a DMU can be investigated over a period of time by comparing the average weight, in a form that behaves differently in a time towards the other time.Itsadvantage is that the function of a DMU over a specified time period can be compared with the function of same DMU in other time period or with other DMU.The window analysis that was performed in aircraft maintenance operations in the United States of America by Charnzand colleagues in 1985 was the best state of high performing method for measuring the efficiency of decision-making units (Alirezaie, 2001). To perform the window analysis, the information obtained about the 14 tactical flying of combat aircraft in America's Air Force for a period of 7 months. To begin the analysis the three months periods was chosen as a time period.

In this technique, the performance of each DMU is evaluated over time so that it has a different identity at any time. Performance of a unit in a particular period is placed in front of his performance in other courses, in addition to the performance of other units. This approach helps the performance of each DMU to be detected over time. This method is based on the moving average. In this study, samples with small size is useful.

Input-oriented window analysis model constant returns to scale

$$\text{Min } \theta = \theta'_{Kw\,t}$$

$$\text{s.t :}$$

$$-X_{Kw}\lambda + \theta X'_t \ge \cdot$$

$$Y_{Kw}\lambda - Y'_t \ge \cdot$$

$$\lambda\, n \ge 0 \ ,(n=1,\ldots..,_{N\times W})$$

Input Matrix

$$X_{KW}=(X_K^{1}, X_K^{2},\ldots,X_KN, X_{K+1}^{1}, X_{K+1}^{2},\ldots, X_{K+1}^{N}, X_{K+W}^{1}, X_{K+W}^{2},\ldots, X_{K+W}^{N})$$

Output Matrix

$$Y_{KW}=(Y_K^{1}, Y_K^{2},\ldots, Y_KN, Y_{K+1}^{1}, Y_{K+1}^{2},\ldots, Y_{K+1}^{N}, Y_{K+W}^{1}, Y_{K+W}^{2},\ldots, Y_{K+W}^{N})$$

In this stud, we examined the studied companies in six three-year window and calculate the efficiency of each unit and at the end results will be presented.

Table 2.The studied windows and years

Title	Years
First window	2005-2004-2003
Second window	2006-2005-2004
Third window	2007-2006-2005
Fourth window	2008-2007-2006
Sixth window	2009-2008-2007
Fifth Window	2010-2009-2008

Here is an example of the implementation method of window analysis with two units and in four times.

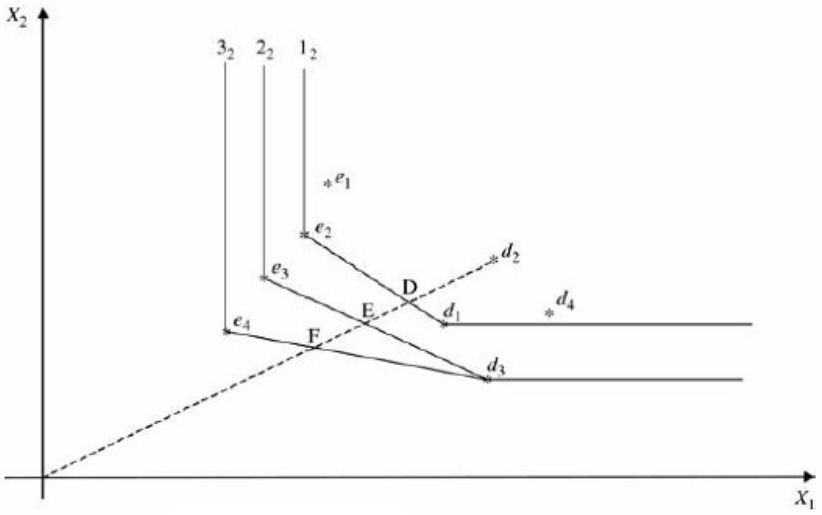

Figure 2.Window Analysis example

Results

According to the research process, due to figure and model implementation, finally the results obtained from the model which is based on the efficiency of each period and total efficiency of each decision unit are described in Table 3.

Table 3.Results of applying the model

Dmu 10			-----			Dmu1			Dmu
3	2	1	3	2	1	3	2	1	Window
		88.73			---			77.72	2003
	91.38	91.38		----	---		66.95	52.2	2004
85.35	84.15	84.15	---	----	---	100	98.67	98.67	2005
82.48	80.77		---	----		85.91	84.46		2006
74.24			----			83.57			2007
80.54	85.43	88.01	----	----	----	86.57	76.69	76.2	Mean
6	5	4	6	5	4	6	5	4	Window
		75.88						81.63	2006
	78.54	78.71					81.22	82.63	2007
94.97	93.07	93.07	----	----	----	80.97	78.89	78.89	2008
83.07	82.77		----	----		78.76	77.81	---	2009
84.36						68.22		---	2010
87.46	84.78	82.55	----	----	----	75.98	79.31	81.54	Mean
	84.08			-------			79.30		Total mean

To better understanding, the subject of a decision making unit (Dmu1) is explained: in the first window through inputs and outputs used in the first three-year period, the efficiency was calculated 76.2. In the following, due to the window approach the sections have changed and the next period was calculated by considering the previous period, as well as the subsequent periods were calculated until the efficiency numbers fell to 75.98 in the last window that indicate the better performance of company in the first period to the last period. As the results obtained in the sample Table 1indicate, only the unit one has a function equal to 1 in a specific time period. But in general by considering all the courses, although efficiency may be higher than other units but in all window has not reached to a hundred percent. For example, in the decision-making units of 10 in the first window, the average efficiency of this unit was equal to 88.01% and efficiency is reduced over time when approaching to 2010 year. So far in the sixth windows for years 2008, 2009 and 2010 efficiency reach to 87.467%which can be very useful for investors and managers to know whatever they proceeded had the same or even weaker performance, or at least worked average than their competitors. For example, if each year be considered in each window, almost according to the desired window have different functions that if using a simple form of data envelopment analysis its recognition was not possible. In following each DMUrate is presented according to the efficient DMU which can be used for desired evaluations.

Table 4. Each DMUrate according to the efficient DMU

DMU	Efficiency	Rank
4	98,72	1
6	93,308	2
7	90,608	3
2	84,919	4
10	84,800	5
8	82,332	6
5	79,824	7
1	79,304	8
9	78,785	9
3	62,632	10

Conclusions

Since organizations are trying to survive and know their attendance necessary at the national and international arena, they should place the principle of continuous improvement in epigraph of their activities. This principle is not reachable unless its achievement area with improvements in performance management is possible. This improvement can be created by taking feedback from the internal and surrounding environment and analysis of strengths and weaknesses and the opportunities and threats of the organization, accountability and attracting the customer satisfaction with creating and applying the performance appraisal system with appropriate model which makes a significant contribution to the flexibility of the program and goals and mission of organizations in today's dynamic environment. Its evaluation and performance measurement and development requires culture building and promote organizational culture. Conventional data envelopment analysis models for measuring and evaluating the performance of under study unit, two distinct approaches are used: Reducing the size of input without changing the size of the output (input-based approach) and increasing the size of the output without changing the size of the input (output-oriented approach). In this paper, a new approach of data envelopment analysis to evaluate efficiency of the under study unit was presented that aiming to measure efficiency over time and so, the results are improved.

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