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Applied-Research Paper

Ranking and Evaluation of Financial Efficiency of Pharmaceutical Companies Accepted in Tehran Stock Exchange with the Approach of Data Envelopment Analysis and Multi-Criteria Decision Making

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ABSTRACT

The complexity of the competitive business environment has highlighted the need to be aware of the organization's strengths and weaknesses and to continuously improve processes. Therefore, managers are looking for a solution for performance measurement of their organization to be able to promote and improve their organization. Evaluating the performance of listed companies in the stock exchange organization is important because, in addition to the managers of the organizations, stock traders can also evaluate the companies and make the necessary decisions about holding, selling or buying the shares of these companies in a timely manner. One of the organization's performance measurement solutions is to use financial ratios. Given that a separate study of financial ratios does not provide a correct view of the efficiency of the organization, so the aggregation of the effect of financial ratios seems to be effective. DEA and MCDM methods are suitable because they enable the achievement of the performance index by considering several factors simultaneously, so the performance obtained from this method is reliable. the main purpose of this study is to rank pharmaceutical companies in the Tehran Stock Exchange between the years 2018 and 2020 using the DEA approach and MCDM and provide a single ranking through the Copeland method.

1 Introduction

Firm performance measurement has always been one of the most challenging issues in the field of management. The purpose of performance measurement is to modify, improve and enhance performance. Today, due to the growth and increasing importance of organizations in society and their presence in the competitive world, performance measurement of organizations and managers has received much attention and various indicators are considered as a measure of managers' performance in organizations[1]. One of these indicators is efficiency, which has been considered by organizations, especially in the last two decades. Attention to efficiency is very important for developing countries. Because these countries face shortages of inputs, factors of production and technology. Therefore, efficient use of available resources is crucial for these countries. For this purpose, managers need to be aware of the efficiency of their organization and examine the causes of efficiency and inefficiency, with proper planning to correct and guide inefficient units. Obviously, by doing so, one can expect the losses due to inefficiency to be minimized [2]. On the other hand, most economists consider the formation of capital as the most important factor of economic progress. Economic development in today's world owes much to the stock market and capital market activities[3]. Investors are always

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looking to make the best financial decisions and the best investment to achieve higher returns. To this end, they seek to rank companies based on their efficiency and performance measurement and buy shares of efficient companies. In this regard, analyzing the current and past situation of companies and identifying the most effective ones according to a few criteria, can be very helpful for investors and prevents the waste of their money and capital[4]. The use of financial information to evaluate the efficiency of companies may be more appropriate than other quantitative and qualitative indicators, due to its objectivity and reliability. Financial statements show a summary of the company's operating, financing and investment activities over a financial period. Financial statement analysis allows decision-makers (lenders, investors and managers to gain an overview of the company's health and competitiveness[5]. Financial statement analysis is often created by using financial ratios based on balance sheet information, profit and loss statement and cash flow statements. Ratio analysis is commonly used for various purposes due to the ease of understanding and presenting various information. It is an important tool for determining the financial condition of a business unit[6], although these methods face serious limitations, such as outdated information in financial statements, different interpretations by different people, changes in accounting policies, company size and the structure of different capital, and although financial ratios are easy to calculate, the interpretation of the relationship between these ratios is often difficult and controversial.

The main problem with the relative analysis of financial statements is that each financial ratio evaluates one dimension of an organization's financial performance, some of which evaluate liquidity, some investigate profitability, another part focuses on the growth ability and finally the last evaluate the organization’s operation manner[7]. So far numerous studies have been conducted on alternative and complementary methods of financial ratios. One of the most widely used methods in this field is data envelopment analysis, which is based on linear programming and was first introduced in 1989 by Charles et al[8]. In fact, data envelopment analysis uses the information of organizations and production units as decision-making units to construct the efficiency frontier. The above is made based on information, in the form of inputs and outputs according to the results of consecutive linear programming, and in fact the degree of inefficiency of each decision unit is equal to the distance of the unit to the efficiency frontier. data envelopment analysis (DEA) divides the set of decision-making units into two groups based on their efficiency value: efficient and inefficient[9]. One of the topics of interest for researchers in the field of DEA is the ranking of units that are in the efficient group, and in this regard, several methods have been proposed. One of these methods, known as the A&P model, was proposed in 1993 by Andersen and Petersen[10]. Using this method, the score of efficient units can be higher than units, and thus, efficient units can be ranked similarly to inefficient units[11]. But one of the bugs of this technique is the inability of the decision maker to involving in the risk situation and the lack of uncertainty as well as the lack of time factor in the results. Therefore, the results of this method may be erroneous in some cases and may not be reliable on their own. In addition to DEA-related models, other methods for ranking have been proposed, including multi-criteria decision process models (MCDM). In this decision model, several measurement criteria are used instead of using one measurement criterion.

Hence, in cases such as the ranking of listed companies, the results are important for both managers of organizations (to improve performance and modeling) and for stock traders (to decide on holding, selling or buying the shares of these companies at the right time), combining the results of data envelopment analysis methods and multi-criteria decision making will improve the results and reduce the error of each method. Therefore, the main purpose and innovation of this research is to try to make these methods more practical by combining them with each other and using new financial ratios as a tool to evaluate the efficiency of organizations. The pharmaceutical industry is one of the main and largest industries in the world. This industry, being one of the strategic industries that play an important role in the health and safety of society, has always been considered by economists and policymakers [12].In today's society, the pharmaceutical industry plays a major role. On one hand, it is an industry whose results have a significant impact on GDP[13]. On the other hand, they play a role in the center of the community health system with their main output. Especially in recent times, due to the presence of a virus that has spread throughout the world and due to the importance of vaccination and achieving public health, the fundamental role of this industry in society has become more apparent. Therefore, performance measurement and strength and weakness identification are essential for both the managers of these organizations and also the investors. Therefore, the purpose of this study is to measure the efficiency of companies in the pharmaceutical industry group listed on the Tehran Stock Exchange in the years 2018 to 2020 using financial information and data envelopment analysis model, ranking these companies using this model and comparing the results using multi-criteria decision models and ultimately providing a single ranking for these companies so that decision-makers can better evaluate their performance through comprehensive rankings provided by companies and move forward for further improvement.

2 Literature Review

Data envelopment analysis and multi-criteria decision-making methods have been used separately or in combination in different research for different purposes. In this section, some researches that are similar to the present research in terms of research purpose or methodology are mentioned. In research entitled "Assessing renewable energy production capabilities using DEA window and fuzzy TOPSIS model" Wang et al.[14] presented a combined method of data envelopment analysis model and fuzzy TOPSIS to prioritize and evaluate the potential of 42 countries in terms of renewable energy production potential. Based on three inputs and two outputs the data envelopment analysis model evaluates the efficiency and capability values of the target countries. Subsequently, the fuzzy TOPSIS model has identified the countries with the highest potential for renewable energy production based on five criteria. In a study entitled "Performance evaluation in distance education by using data envelopment analysis and TOPSIS methods",Ersoy[15] surveyed Turkish public universities in the field of distance education. This study was performed using 6 input variables and 4 output variables. The results of the efficiency analysis using the CCR - DEA model show that 7 universities were efficient and 49 universities were inefficient. In the next step, efficient universities are ranked using the CCR-DEA super-efficiency model and TOPSIS method and the results are compared. These two studies are similar to the present study in terms of using TOPSIS methods and data envelopment analysis and differ from this research in terms of the type of inputs and outputs and the lack of combined ranking. Madhuri et al.[16] conducted research on supplier evaluation and selection in supply chain management using DEA-TOPSIS methods under an intuitive fuzzy environment. The method of this research consists of two stages that combine data envelopment analysis (DEA) and the TOPSIS technique.

The efficiency of the supplier set is evaluated in the first stage using the DEA method and the provided list is filtered. In the second stage, the TOPSIS method is used to select one of the efficient suppliers in the first stage. The integration of the two methods reduces the selection time. Since the presented data and the considered criteria are ambiguous and inaccurate in nature, decisions are made in an intuitive fuzzy environment. The similarity of this research with the present research is in using TOPSIS methods and data envelopment analysis and merging these two methods. Shakraleh Khajavi et al.[17] in research, study on "Data Envelopment Analysis Technique as a Complement to Traditional Analysis of Financial Ratios". In this study, the financial statements of 267 companies listed on the stock exchange were analyzed. The ratios and financial data, 4 inputs and 7 outputs of the BCC cover model formed the input axis of the mentioned technique. Implementation of the model, by evaluating the relative efficiency, provided a list of efficient and inefficient companies.

Hosseinzadeh Lotfi et al. [18] presented a method based on TOPSIS and virtual decision units and used the difference between the distance between the center of gravity of all efficient decision units from the ideal point and the counter-ideal point to eliminate the decision units one by one. One of the advantages of this method is that it is always feasible and its calculations are simple. The background of this research shows that data envelopment analysis and multi-criteria decision-making methods have been considered performance evaluation tools by researchers and the purpose of this research is to make these methods more practical by combining them with each other and using organizations' financial statements as a tool to evaluate the performance of organizations.

3 Preliminaries

3.1 Efficiency

In the general sense, efficiency and methods of its estimation imply the degree and quality of achieving the desired set of goals. Efficiency is part of productivity and is defined in various manners[19]. According to the approvals of the operational audit committee of the auditing organization, efficiency means the ratio of the results obtained from the operation (output) to the resources consumed (input) in comparison with a specific standard[17]. An efficient operation is an operation that provides the maximum efficiency (output) by using optimal methods by consuming the minimum resources (inputs) [19]The calculation method is stated in (1).

$$Efficiency = \frac{\frac{Real\ output}{Real\ input}}{\frac{Expected\ output}{Real\ input}} = \frac{Real\ output}{Expected\ output} \tag{1}$$

Different types of efficiency include scale efficiency, technical efficiency, allocation efficiency, structural efficiency, and financial efficiency, all of which are designed to maximize production at a specific cost or minimize cost at a specific production level, to maximize the profit of the decision-making unit[20]. In this study, considering the effect of financial ratios on efficiency, the financial efficiency concept has been utilized. Financial efficiency is the ratio of financial outputs resulting from the operations and activities of the institution to data related to various factors used in the performance of various activities of the institution[21].

3.2 Methods of estimating Efficiency and Evaluating Performance

Among the methods of performance evaluation, one can refer to traditional and scientific methods, the latter being divided into two branches, parametric and non-parametric [14]. The parametric approach uses statistical methods that are mostly used in the analysis of economic problems. The parametric approach means that using the observed data, the parameters of a specific production function are estimated and then the efficiency of the units under evaluation is determined based on them. One of the important hypotheses of this approach is to determine the type of relationship between data and outputs. With the advancement of technology, parametric methods did not function in dealing with successful problems[22]. Non-parametric methods generally examine the performance of a firm or decision-making unit with the best actual performance of firms within that industry. In this research, the non-parametric approach has been utilized[23].

3.3 Data Envelopment Analysis

To solve the problems resulting from parametric methods, Farrell first developed non-parametric methods in 1957[24]. In fact, DEA is a generalization of Farrell's work in inventing the first non-parametric method. Using the inputs and outputs of the decision-making units and the principles governing them, Farrell presents a set called the possibility of production and calls part of its frontier an approximation of the production function. This frontier is also called the efficient frontier, and the decision-making units located on this frontier are evaluated as efficient. Since DEA is a technique for evaluating the relative efficiency of decision-making units, at least one unit is on the frontier and the rest are located below. The name data envelopment analysis is derived from its envelopment property[25]. In the data envelopment analysis method, unlike some numerical methods, it is not necessary to know the weights in advance and assign them to the input and output of the data. Therefore, It does not require pre-defined functional forms (such as statistical regression methods) and explicit forms of production functions (such as some of the parametric methods). Using mathematical programming techniques, data envelopment analysis may include a large number of variables and relationships and does not possess the problems of methods that are limited in the use of inputs and outputs. DEA also creates many opportunities for collaboration between analysts and decision-makers. These collaborations can be in line with the selection of input and output of the units under evaluation and the manner of operation and modeling in relation to the efficient frontier[2].

3.3.1 CCR Model

In 1978, Charnes, Cooper and Rhodes[26] generalized the Farrel method for the state with multiple inputs and multiple outputs which due to the first letters of the name of the presents becomes known as the CCR method. In the CCR model, the efficiency is defined the same as in parametric methods as the ratio of output to input. The unit with the higher ratio is called the efficient unit. The variables of the problem are underweighted and the answer to the problem provides the most appropriate and desirable values for the weights of decision-making units or zero units and evaluates its efficiency[27]. Its mathematical model is as (2):

$$Max\ Z_0 = \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}}$$

st: for each unit (j= 1, 2, ….., n) (2)

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1$$

$$u_r, v_i \geq 0$$

x_{ij}= The value of i^{th} input for j^{th} unit (i = 1, 2, …., m)
y_{rj}= The value of r^{th} output for j^{th} unit (r= 1, 2, ….., s)
u_r= The weight given to r^{th} output (cost of r^{th} output)
V_i= The weight given to i^{th} input (cost of i^{th} input)
Input is the factor whose increase with keeping constant other factors leads to efficiency decrease and whose decrease with keeping constant other factors leads to efficiency increase. And Output is the factor whose increase with keeping constant other factors leads to efficiency increase and whose decrease with keeping constant other factors leads to efficiency decrease[9]. A DMU is an entity that converts input to output. DMUs are units that perform the same type of tasks and have the same goals and aspirations. The DMUs used in DEA usually have to be homogeneous and have the same inputs and outputs of the same type[8]. Data Envelopment Analysis (DEA) evaluates each organization as a decision-making unit (DMU) based on the process of converting input to output and compares it with other units and determines its efficiency[9]. To increase efficiency, either fix the input and maximize the output, or fix the output and minimize the input. Accordingly, data envelopment analysis models are called input-oriented or output-oriented. If the efficiency is not constant on a scale, the CCR

model is not able to calculate efficiency and productivity**.** To solve this problem, Banker, Charans, and Cooper [28] proposed the BCC model, in which return to scale may vary.

3.3.2 BCC Model

CCR models are among the models with fixed returns to scale. The fixed returns to scale model is appropriate when all units act in optimum scale. In evaluating the efficiency of units, whenever incomplete competition space and conditions impose restrictions on investment; Causes unit inactivity on an optimal scale [27]. In 1984, Banker, Charnes and Cooper [28] presented a new model by changing CCR concerning the first letters of their names, it was known as the BCC model. The BCC model is a model of the DEA model that deals with the evaluation of the relative efficiency of units with variable returns to scale [27]. BCC model is as (3) for evaluation of the efficiency of the unit under investigation (zero):

$$Max\ Z_0 = \frac{\sum_{r=1}^{s} u_r y_{r0} + \omega}{\sum_{i=1}^{m} v_i x_{i0}}$$

Subject to:

$$\frac{\sum_{r=1}^{s} u_r y_{rj} + \omega}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1 \qquad (j=1,2,\ldots,n) \tag{3}$$

$u_r, v_i \geq 0$

ω free in terms of signs

As observed, the difference between this model and the CCR model is in the free variable in ω sign. In the BCC model, the sign ω could specify the return to scale for each unit. Since the objective function and constraints of this model are nonlinear, so to convert this model to a linear programming model, Equation (4) and Equation (5) are used.

$$\text{Max}\ Z_0 = \sum_{r=1}^{s} u_r y_{r0} + \omega$$

Subject to:

$$\sum_{i=1}^{m} v_i x_{i0} = 1 \tag{4}$$

$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} + \omega \leq 0$

(j=1,2,…..,n)

$u_r, v_i \geq 0$

ω free in terms of signs

$$\text{Min}Z_0 = \sum_{i=1}^{m} v_i x_{i0} + \omega$$

Subject to:

$$\sum_{r=1}^{s} u_r y_{r0} = 1 \tag{5}$$

$\sum_{i=1}^{m} v_i x_{ij} - \sum_{r=1}^{s} u_r y_{rj} + \omega \leq 0$ *(j=1,2,…..,n)*

$u_r, v_i \geq 0$

ω free in terms of signs

Equation 4 shows the input-oriented BCC models in which we seek to maximize the total weighted outputs while the total weighted inputs are equal to one, and Equation 5 shows the output-oriented

BCC models in which we seek to the minimum the total weight of the inputs while the total weighted outputs are equal to one. It should be noted that the BCC input-oriented method and the BCC output-oriented method are two methods for linearizing the initial BCC model, which is used in different situations according to the type of problem[29]. The advantage of data envelopment analysis is its non-parametric nature. In fact, in nonparametric methods, no default fixed form is considered for the production function and the production function is determined using the outputs and inputs of the production units and by the units themselves. In this method, instead of using statistical methods, mathematical programming methods are used and instead of the production function, the production frontier is considered[30]. The DEA model uses cross-production function methods to achieve an index for measuring the efficiency of units. Although DEA models are expanding day by day and have become specialized, all of them are based on a number of main models designed and explained by the founders of this method, such as SBM, BC, CCR, etc[25].

3.3.3 A & P Model

DEA successfully divides the set of DMUs into two groups: efficient DMUs and inefficient DMUs. DMUs in the efficient group, usually more than one, have the same efficiency score. However, it is not possible to claim that their performance is in fact the same, and as a result, the issue of ranking efficient DMUs has been raised. Using super-efficiency models can help provide a more accurate list of efficient companies. Hyper-efficiency refers to a modified DEA model in which firms can have performance values greater than one (100%). In this regard, different models are presented. One of them is the A & P method being utilized in this study, which was proposed in 1993 by Andersen and Petersen [10], and aims to provide a system for ranking decision-making units that distinguish between decision-making units located at frontier points. In this case, to calculate the performance of an enterprise, the data related to that enterprise is removed from the matrix. Therefore, in the linear programming model that is implemented for this firm, the firm itself does not exist as part of the base frontier, and if this firm is fully efficient in the initial standard DEA model, it will have a higher efficiency value than the one in the current model. The steps for implementing this method are as follows[31]:

Step 1: The CCR or BCC model is solved for the units under study to identify efficient and inefficient units.

Step 2. For the efficient units obtained from the previous step (units whose score is equal to one in the first step), Equation (6) is solved.

$$\begin{aligned}
&\text{Min} \quad \theta \\
&\text{Subject} \quad \text{to:} \\
&\sum_{j=1, j\neq 0}^{n} \lambda_j x_{ij} \leq \theta x_{ij} \qquad i = 1,2,\ldots\ldots,m \\
&\sum_{j=1, j\neq 0}^{n} \lambda_j y_{rj} \geq y y_{rj} \qquad r = 1,2,\ldots\ldots,t \\
&\sum_{j=1}^{n} \lambda_j = 1 \\
&u_r, v_i \geq \varepsilon
\end{aligned} \tag{6}$$

3.4 Multi-Criteria Decision Making

Multi-criteria decision-making methods seek to evaluate a set of options according to a set of criteria. In most cases, decisions are desirable when they are based on several criteria or indicators. In multi-criteria decision-making methods, instead of using one criterion, several measurement criteria are used[32]. Multi-criteria decision-making as a science has its own concepts, approaches and models and helps the decision-maker to identify, describe and evaluate options. This type of decision plays a vital role in many real-world issues. Among the types of models, one can mention the TOPSIS models and the Simple Additive Weighting method (SAW), which we will explain below[33].

3.4.1 TOPSIS Technique

The TOPSIS technique, or preference methods based on similarity to the ideal solution, first introduced by Hwang and Yoon[34], is one of the multi-criteria decision-making methods. This technique can be used to rank and compare different options and select the best option and determine the distances between options and group them. One of the advantages of this method is that the criteria or indicators used for comparison can have different units of measurement and have a negative and positive nature. In other words, negative and positive indicators can be used in combination with this technique. According to this method, the best option or solution is the closest solution to the ideal solution or option and the farthest from the non-ideal solution. The ideal solution is the solution that has the highest profit and the lowest cost and, in short, results from the sum of the maximum values of each of the criteria. Solving the problem with this method requires the following seven steps: [35]

Step 1. Quantifying and scaling the decision matrix including m options and n criteria (N) as (7):

$$x = \begin{bmatrix} x_{11} & \dots. & x_{1n} \\ \cdot & \dots. & \cdot \\ x_{m1} & \dots. & x_{mn} \end{bmatrix} \tag{7}$$

Step 2. Normalize the decision matrix. In this normalization, the value of r_{ij} is calculated as (8):

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} X_{ij}^2}} \tag{8}$$

Step 3. Calculate the weighted normalized decision matrix. Weights are used for multiplication with the normalized values v_{ij} as (9):

$$v_{ij} = r_{ij} * w_j^i \ = 1,2,\dots\dots,m \ \ and \ j = 1,2,\dots\dots,n \tag{9}$$

where w_j is the weight of the jth criterion or attribute and $\sum_{j=1}^{n} w_j = 1$

It should be noted that in many multi-criteria decision-making problems, weighting the indicators and criteria is an effective step in the problem-solving process. There are various methods for weighting the criteria and indicators, including the methods of the hierarchical analysis process, network analysis process, SWARA, Shannon entropy, and so on. In the present study, the Shannon entropy method has been used to calculate the weight of each of the indicators. Shannon's entropy method is one of the most widely used and widely cited methods for calculating weight in multi-criteria decision-making, which was proposed by Shannon and Weaver in 1974. Entropy represents the amount of uncertainty in a continuous probability distribution. The main idea of this method is that the higher the scatter in the values of an index, the more important that index is. One of the strengths of this method and the reason for using it in this research is that there is no need for the opinions of decision-makers in this method.

Step 4: The ideal (A^*) and negative ideal (A^-) solutions are determined by the following equations (as (10) and (11)):

$$A^* = \{(max_i v_{ij} | j \epsilon C_b), (min_i v_{ij} | j \epsilon C_c)\} = \{v_j^* | j = 1, \dots, m\} \quad (10)$$

$$A^- = \{(min_i v_{ij} | j \epsilon C_b), (max_i v_{ij} | j \epsilon C_c)\} = \{v_j^- | j = 1, \dots, m\} \quad (11)$$

Step 5: Compute the separation measures by using the m-dimensional Euclidean distance. These separation measures of each alternative are from the positive ideal solution and the negative ideal solution as follows (as (12) and (13)):

$$s_i^+ = \sqrt{\sum_{j=1}^{n} (v_{ij} - (v_j^*))^2} \quad j=1,2,\dots,m \quad (12)$$

$$s_i^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - (v_j^-))^2} \quad j=1,2,\dots,m \quad (13)$$

Step 6: Find the relative closeness to the ideal solution. The relative closeness of the alternative A_i with respect to A* is defined as follows (as (14)):

$$RC_i^* = \frac{s_i^-}{(s_i^-) + (s_i^+)} \quad i = 1, \dots, n \quad (14)$$

Step 7: Rank the preference order. The RC values specify the preferability ranking of the alternatives [36].

3.4.2 Simple Additive Weighting (SAW) Method

In this method, after determining the importance coefficient of the indicators(weight of the indicators), the importance coefficient of each option is obtained and the optimal option is the option with the highest coefficient of importance. If the vector W (weight of the importance of the indicators) is assumed and A is the most appropriate option, then A* is obtained as follows[36] (as (15)).

$$A^* = \left\{ A_i \middle| max \frac{\sum_{j=1}^{n} w_j r_j}{\sum_{j=1}^{n} w_j} \right\} \quad (15)$$

In this research, the Shannon entropy method has been used in the evaluation of alternatives by the Simple Additive weighting (SAW) method, similar to the TOPSIS method. According to the explanations provided in Section 3.4.1 , one of the most important reasons for using this method to determine the weight of indicators in this research is the high accuracy of this method, which is the result of not needing the opinions of decision-makers.

3.5 Copeland Method

If several methods are used for decision problems, the results can be combined using the Copeland method. In this method, the number of wins and losses is determined for each option. Winning means the number of times that an option has a better rank than other options in most methods, and losing means the number of times that an option is ranked less than or equal to other options compared to other options in different methods[37]. Then the number of losses are deducted from the number of victories and the result is the score of that option. The candidate with the highest number of points wins the election. The higher the number of wins minus losses, the higher the ranking[38].

4 Research Methodology

This research is applied in terms of purpose and descriptive in terms of data collection. To collect research information, library and field studies were conducted, which included field study tools, including questionnaires and interviews. The statistical population of this study includes companies in the pharmaceutical industry that were accepted on the Tehran Stock Exchange between the years 2018 and 2020. Due to the unavailability of information from a number of companies, 32 companies were finally selected as a sample.

Step 1: Determining the Time Period: The time period of the research is from 2018 to 2020.

Step 2: Identifying the Data: The data and information required to conduct this research, including the financial statements of companies and indicators extracted from them have been collected from Rahavard Novin and Tadbir pardazesh software and documentation center of Tehran Stock Exchange.

Step 3: Identify the Indicators: Financial information is one of the most important factors in most decisions. The more complex the decision-making environment and the greater the uncertainty, the greater the difficulties of the decision-making process, and in this regard, financial statements are designed to help users identify key relationships, and investors use this information to evaluate investment decisions and prioritize. Financial ratios create mathematical and logical relations between the items in the financial reports that are used for qualitative evaluation of quantitative information and classification and prediction of the future status of companies (decision-making units)[39]. The independent variables in this study are financial ratios that have been used in two input and output groups.

Appropriate financial indicators for evaluating companies were first selected by reviewing the most credible research conducted in the field of evaluating the financial efficiency of companies[40][41], then in the next step by obtaining the opinion of 20 financial experts (who were faculty members of the university and were active in Projects and articles in the field of finance or had executive experience in the field of stock exchange for at least 5 years) And using Delphi method in relation to the initially selected indicators, evaluation was done and the most important and widely used indicators according to experts opinions in this field were used as input and output to evaluate companies using data envelopment analysis. The selected indicators are shown in Table 1. Also to classify these indicators as input and output indicators according to the definition provided in Section 3.3.1, since the input is a factor that by increasing and keeping constant all other factors, efficiency decreases and by reducing it and keeping constant all other factors Efficiency increases, and debt ratio and debt to equity ratio have this property, so these variables were selected as an input, and since the output is a factor that by increasing it and keeping constant all other factors, efficiency increases and by decreasing it and keeping constant All other factors efficiency decreases and return on assets, return on equity, fixed assets circulation, total assets circulation and profit margin have this property, so these variables were selected as output.

The factors that should be taken into account in the selection of data factors (input) and output are:

1. There is a conceptual relation between inputs and outputs.
2. A value relation between inputs and outputs is inferred in practice.
3. The relation between inputs and outputs is direct.
4. The inputs and outputs are not negative and each DMU has at least one positive input and output.
5. {(input+ output) * 2 or ((input+ output) * MAX 3}≤ the number of DMU.[42]

Causes the DEA pattern cannot take negative data, for adjustment of negative numbers, the smallest negative number of each input and output should be specified and added to the variables, data set (variables) will be prepared for the implementation of DEA pattern by MATLAB software. It should be noted that the indicators used in multi-criteria decision-making methods are the financial ratios stated in Table 1, which are used in the form of profit and cost variables.

Table1: Research Variables

Name of variable	Symbol	Variable	Method of calculation
Debt ratio	TLTA	Input	Total assets/ total debts (without stakeholders' right)
Debt to special value ratio	TDE	Input	Stakeholders' rights/ total debts
Return on assets	ROA	Output	Assets/ net profit after tax deduction
Return on equity	ROE	Output	Stakeholders' right/ net profit after tax deduction
Fixed assets circulation	CATA	Output	Fixed net assets/ total revenues (sale)
Total assets circulation	NSTA	Output	Total assets/ total revenues (sale)
Profit margin	PM	Output	Sale/ net profit after tax deduction

Next, efficient and inefficient companies were identified using the DEA model and efficient companies were ranked using the A&P model and then companies were ranked using the SAW and TOPSSIS methods. Finally, in order to provide a single ranking of the results of the DEA and MCDM models The Copland method was used.

• Selecting the Data Envelopment Analysis Model

The type of DEA model used in this research is input-oriented BCC. This is because a change in inputs does not cause a change in output in the same proportion and the companies under review do not operate optimally, Returns to scale are variable; So the BCC model is a more suitable model[43]. The reason for choosing the input-oriented view for the model is that in this research, the management of companies does not have much control over the amount of output (profit) but can reduce their input and thus increase efficiency. Therefore, the input-oriented method is used. Finally, the Anderson and Peterson (A&P) model is used to rank efficient units[44].

• Choosing Models of Multi-Criteria Decision Making

Multi-criteria decision-making has a very wide technical variety and this may confuse the analyst or the user, and the main criticism of the methods of this type of decision-making is that when applying different models to a particular problem, these methods will provide different answers.[45] The models used in this research have been selected by reviewing past articles and surveys of experts. The ability to solve real-world problems, the constraint of results for the decision maker, the complete ranking of options and the ability to use group decision-making were the most important indicators in choosing the decision model, from which TOPSIS and SAW models were selected. The SAW method is ideal in terms of ease of use but has a weakness in ranking and determining the weight of the problem criteria. TOPSIS method is ideal in terms of the reliability of results but weak in terms of model sensitivity analysis.[46]

5 Case Study

As mentioned in the introduction, the pharmaceutical industry is one of the main and largest industries in the world. This industry, as one of the strategic industries that play an important role in the health and safety of society, has always been considered by economists and policymakers. And has a special place in trade; Therefore, evaluating performance and identifying strengths and weaknesses of organizations is essential for both managers of these organizations and investors. Therefore, in this study, the pharmaceutical industry has been studied as a case study. In this regard, first, the efficiency of the companies of the Pharmaceutical Industries Group listed on the Tehran Stock Exchange in the years 2018 to 2020 has been evaluated by using financial information and the data envelopment analysis model and the ranking of these companies is presented. At this step, the ranking provided is used to identify the reference company for each company. Then, in the next step, using two multi-criteria decision-making methods, another ranking of the companies of the pharmaceutical industry group is presented, and finally, to provide a comprehensive and unified ranking of these companies to the decision makers (managers of organizations and Investors) to help them to evaluate the performance of organizations and help them to make appropriate decisions, the Capland method has been used. The inputs and outputs of the model were identified by reviewing the research and opinions of experts. The output-oriented BCC model was used to determine the relative efficiency of companies in the desired time period. DEA successfully divides the set of DMUs into efficient DMUs and inefficient DMUs. DMUs in the efficient group, usually more than one, have the same efficiency score. However, it is not possible to claim that their performance is actually the same, so in order to rank the efficient units, the A&P model is used, and the output of the BCC and A&P models is shown in Table 2.

Table 2: Results from The Implementation of Output-Oriented BCC and Andersen and Petersen Model

DMUS	2018		2019		2020	
	BCC	**A&P**	**BCC**	**A&P**	**BCC**	**A&P**
Pakhsh Alborz	0.8955	0.8955	0.9173	0.9173	0.9753	0.9753
Daroi Tamin. investment	1	1.345	1	2.0996	0.924	0.924
Shafa Daro. investment	0.7918	0.7918	0.8125	0.8125	0.8789	0.8789
Alborz Daro	0.8149	0.8149	0.8501	0.8501	0.843	0.843
Iran Daro	0.7374	0.7374	0.5931	0.5931	0.7154	0.7154
Pars Daro	0.8208	0.8208	0.8544	0.8544	0.8653	0.8653
Tehran Daro	0.9985	0.9985	1	2.309	1	2.690
Tehran Shimi	0.745	0.745	0.6306	0.6306	0.7489	0.7489
Daro Aboureihan	0.8677	0.8677	0.8841	0.8841	0.9563	0.9563
Daro osve	0.7593	0.7593	0.7255	0.7255	0.8144	0.8144
Daro Amin	1	1.398	1	4.645	1	2.5049
Daro Eksir	0.8876	0.8876	0.9108	0.9108	0.9659	0.9659
Daro Jaberebne Hayan	0.994	0.994	1	1.789	1	1.567
Daro Razak	1	1.890	0.9967	0.9967	1	1.900
Daro Zahravi	0.7739	0.7739	0.7577	0.7577	0.8267	0.8267
Daro Sobhan	0.5796	0.5796	0.5618	0.5618	0.6338	0.6338
Daro Abidi	0.7928	0.7928	0.8023	0.8023	0.83	0.83
Daro Farabi	0.9547	0.9547	0.973	0.973	0.979	0.979
Daro Loghman	0.4943	0.4943	0.5325	0.5325	0.5215	0.5215
Daropakhsh	0.989	0.989	1	1.245	1	1.1394
Darosazi Alhavi	1	1.0186	1	1.0278	1	1.1452
Darosazi Kosar	0.4119	0.4119	0.5041	0.5041	0.4501	0.4501
Roozdaro	1	1.012	1	1.034	1	1.818
Sobhan Daro	0.3481	0.3481	0.4087	0.4087	0.4117	0.4117
Alborz. investment	0.7016	0.7016	0.5622	0.5622	0.711	0.711
Sina Daro	1	1.895	1	1.237	1	1.389
Shirin Daro	0.5456	0.5456	0.5344	0.5344	0.6062	0.6062
Shimi Daropakhsh	1	1.0113	1	1.004	0.9734	0.9734
Faravarde Tazrighi	0.445	0.445	0.5296	0.5296	0.4565	0.4565
Mavad Daropakhsh	0.9932	0.9932	0.9967	0.9967	0.9939	0.9939
Daropakhsh factories	0.7411	0.7411	0.5933	0.5933	0.7446	0.7446
Kimidaro	0.3421	0.3421	0.3938	0.3938	0.3691	0.3691

Results from the implementation of output-oriented BCC show that Daro Amin, Darosazi Alhavi, Roozdaro, and Sina Daro companies have always been efficient during the research period and are considered suitable for investment because it can be said that the possibility of financial distress is very low for these companies, due to the favorable trend of their activities. In addition, the results of the Super efficiency method indicate that Daro Razak company in 2018, Daro Amin company in 2019 and Tehran Daro company in 2020 had the highest efficiency among other companies. The point from Table 2 is that efficiency is a relative process here. In other words, the efficiency evaluation of industries is relative to the existing industries and industrial activities, and it is possible that if the set of units and activities under study changes, the efficiency of the efficient sectors will also change. As mentioned in the introduction, one of the main bugs of the technique is the inability of the decision maker to Involve the risk conditions and the lack of uncertainty as well as the lack of time factor in the results. Therefore, the results of this method may be erroneous in some cases and may not be reliable on their own. Therefore, the ranking provided in Table 2 alone may not be reliable. In addition to DEA-related models, other methods for ranking have been proposed, such as the Multi-Criteria Decision Process (MCDM) models.

Table 3: Results of Ranking Companies Using DEA and MCDM Models

DMU	2018			2019			2020		
	SAW	**TOPSIS**	**DEA**	**SAW**	**TOPSIS**	**DEA**	**SAW**	**TOPSIS**	**DEA**
Pakhsh Alborz	12	10	13	11	9	13	14	13	11
Daroi Tamin. investment	1	2	4	5	2	3	16	12	15
Shafa Daro. investment	13	15	19	16	19	18	15	16	16
Alborz Daro	16	17	17	17	16	17	18	19	18
Iran Daro	22	21	24	20	22	24	21	23	24
Pars Daro	15	13	16	18	18	16	13	15	17
Tehran Daro	11	11	8	4	1	2	1	3	1
Tehran Shimi	21	22	22	21	20	22	20	21	22
Daro Aboureihan	14	16	15	12	14	15	17	11	14
Daro Osve	23	23	21	22	17	21	23	22	21
Daro Amin	3	1	3	1	4	1	3	4	2
Daro Eksir	16	12	14	14	15	14	11	17	13
Daro Jaberebne Hayan	5	8	9	6	5	4	5	5	5
Daro Razak	3	3	2	13	11	10	2	1	3
Daro Zahravi	19	16	20	24	21	20	22	18	20
Daro Sobhan	25	28	26	23	25	26	24	27	26
Daro Abidi	18	19	18	19	23	19	19	24	19
Daro Farabi	17	14	12	9	10	12	9	8	10
Daro Loghman	27	24	28	25	27	28	30	30	28
Daropakhsh	9	7	11	2	6	5	6	7	8
Darosazi Alhavi	6	6	5	7	3	8	8	6	7
Darosazi Kosar	29	32	30	28	28	30	31	28	30
Roozdaro	7	4	6	10	8	7	4	2	4
Sobhan Daro	31	31	31	30	32	31	28	29	31
Alborz. investment	24	22	25	27	26	25	27	25	25
Sina Daro	2	5	1	3	7	6	7	9	6
Shirin Daro	28	29	27	29	24	27	25	20	27
Shimi Daropakhsh	10	9	7	8	12	9	10	10	12
Faravarde Tazrighi	31	27	29	31	30	29	32	31	29
Mavad Daropakhsh	8	13	10	15	13	11	12	14	9
Daropakhsh factories	32	26	23	26	29	23	26	26	23
Kimidaro	26	30	32	32	31	32	29	32	32

Simultaneous application of these two categories of scientific methods can reduce the errors resulting from each of these methods and provide a more comprehensive ranking. Therefore, combining the results of data envelopment analysis methods and multi-criteria decision-making in issues where the ranking of alternatives is of great importance, will improve the results and reduce the error of each method. Therefore, this study tries to improve the ranking, reduce the errors caused by each method and make the results more practical by combining data envelopment analysis methods and multi-criteria decision-making. The results of ranking companies using DEA and MCDM models are shown in Table 3. In order to achieve a single result from the ranking of companies, the Copeland method has been used. Table 4 shows the final results of ranking companies during the research period.

Table 4: Final Ranking by The Copeland Model

DMU	2018	2019	2020
Pakhsh Alborz	12	11	12
Daroi Tamin. investment	2	3	15
Shafa Daro. investment	17	18	17
Alborz Daro	18	16	18
Iran Daro	22	23	23
Pars Daro	15	17	16
Tehran Daro	10	2	1
Tehran Shimi	21	21	21
Daro Aboureihan	16	14	14
Daro osve	23	19	22
Daro Amin	1	1	3
Daro Eksir	13	15	13
Daro Jaberebne Hayan	7	5	5
Daro Razak	3	12	2
Daro Zahravi	20	22	19
Daro Sobhan	25	24	26
Daro Abidi	19	20	20
Daro Farabi	14	10	9
Daro Loghman	26	27	29
Daropakhsh	9	4	7
Darosazi Alhavi	6	7	6
Darosazi Kosar	31	29	30
Roozdaro	5	8	4
Sobhan Daro	32	31	28
Alborz. investment	24	25	27
Sina Daro	4	6	8
Shirin Daro	28	28	24
Shimi Daropakhsh	8	9	10
Faravarde Tazrighi	29	30	31
Mavad Daropakhsh	11	13	11
Daropakhsh factories	27	26	25

Examining the results of unifying the ranking of companies using the Copeland method shows that Daro Amin Company is ranked first, except for 2020, which had a loss and has not had the best performance, therefore reducing the company's ranking. The ranking results of Tehran Shimi company have been stable. Also, the results of ranking using data envelopment analysis and multi-criteria decision-making methods are very similar in many cases, and therefore the combination of the results can provide us with more accurate ranking and also reduce the likelihood of errors.

6 Conclusion

6.1 Results and Discussion

In terms of macroeconomics, the stock market is one of the most complete methods to attract stagnant liquidity of people who are not easily able to make the best use of their capital[47]. The stock market, on one hand, leads to broad participation of individuals in the ownership of units and the benefit of investment benefits, and on the other hand, by attracting liquidity and directing them to constructive and useful economic activities, will achieve the government's anti-inflationary targets; Because the funds needed for economic activities are provided from current money, and this phenomenon has a significant impact on the amount of money in circulation and its control. Given the role of investment decision-making and considering the diversification debate to achieve an optimal portfolio, it is necessary to select companies from the existing ones that have better [14]. Therefore, the performance measurement of these companies is important. One of the important parameters in performance measurement is efficiency. Investors are always Importance to the information related to companies' efficiency in order to make financial decisions and make the most optimal investments[48].

One of the indicators used to examine the financial performance of any organization is financial ratios[6]. Although the analysis of financial ratios has a long history in the process of performance measurement of organizational finance, one of the many problems in their use is that it is one-dimensional and only a specific organizational dimension can be examined and analyzed by their utilization [49]. Therefore, methods that are able to aggregate financial information to calculate the efficiency and performance measurement of the organization are suggested to solve this problem. The present study uses data envelopment analysis and multi-criteria decision-making methods and financial ratios to measure efficiency and financial efficiency and also provides a ranking of pharmaceutical companies listed in the Tehran Stock Exchange Organization between 2018 and 2020 based on a balanced and comprehensive approach. The data envelopment analysis method is one of the most important methods that has had a special scientific place in recent decades due to the avoidance of mental and arbitrary methods and having high accuracy in conclusions. Therefore, decision-making units widely use this method to evaluate efficiency[44]. The reasons for choosing data envelopment analysis as a suitable model for measuring the efficiency of units can be found in the unique ability of this model in realistic evaluation, simultaneous evaluation of a set of factors, no need for predetermined weights, competitiveness, frontier orientation evaluation and portraying the best performance situation instead of the desired situation[50]. Multi-criteria decision-making methods are also desirable that evaluate a set of options using several criteria or indicators and lead to more favorable decisions for evaluating and ranking organizations. This research has improved the ranking and reduced the errors caused by each method and made the results more practical by combining data envelopment analysis methods and multi-criteria decision-making. The results of this study are as follows:

1) By evaluating the efficiency of companies for each financial year using data envelopment analysis (the BCC method), the units under study were divided into two groups of efficient and inefficient units. Efficient units are units whose efficiency score is equal to one, and inefficient units are units whose efficiency size is less than one. For example, among the companies of the pharmaceutical industry group, 7 companies are efficient and 25 companies are inefficient in 2018, 8 companies are efficient and 23 companies are inefficient in 2019, 8 companies are efficient and 24 companies are inefficient in 2020.

2) Since data envelopment analysis models divide decision-making units into two efficient and inefficient categories, and there may be several efficient units, most decision-makers are looking for a complete ranking of decision-making units. In this paper, Andersen and Petersen’s super-efficiency method has been used to rank efficient companies using data envelopment analysis, and by ignoring one limitation, efficient units have been re-ranked. Daro Razak company in 2018, Daro Amin company in 2019 and Tehran Daro company in 2020 had the highest efficiency among companies according to this method.

3) One of the most important advantages of data envelopment analysis is that in this method, a set of efficient units (virtual unit) is identified for each inefficient decision unit, which can be used as a model to improve their performance. The decision units that make up this combination are the model groups for the inefficient decision unit. This method can also determine the amount of improvement required in each of the inputs and outputs of the inefficient unit (using the weights given to the variables). For example, the higher the fixed asset turnover, total asset turnover, and profit margin, the better the firm's chances of being classified as an efficient unit, and the higher the debt ratio and debt-to-equity ratio, the more likely that the company will be inefficient. In pharmaceutical companies, Daro Amin, Darosazi Alhavi, Roozdaro, and Sina Daro companies, which have the highest efficiency with data envelopment analysis method, have been selected as a model for other companies, and in fact, other companies in this group should put the policies and weight combinations of the company's data and outputs at the forefront of their performance in their financial path.
4) Companies that are efficient in all years and have better rankings using a combination of both data envelopment analysis and multi-criteria decision-making, were identified as suitable for investment and it can be said that the probability of bankruptcy of these companies is very low due to the favorable trend of these companies; Because they have not entered the field of financial distress.
5) The results show that TOPSIS performs better than DEA in terms of computational complexity and sensitivity to changes in the number of DMUs. However, it has been found that the output rankings of these two models are very similar in many cases.
6) Finally, it can be stated that the main result of this research is to provide a single ranking through the combination of data envelopment analysis methods and multi-criteria decision making and the use of financial ratios. Examining previous research, it was found that these tools have not been used together in research so far, and therefore the main innovation of this research is in using new financial ratios and aggregating financial information in evaluating the performance of companies listed on the stock exchange Which are obtained using the opinions of experts, and also is in use of the combination of data envelopment analysis methods and multi-criteria decision making to reduce the errors resulting from each method and provide a valid ranking. This ranking is important in that it can be used both for stock market investors to decide whether to buy or sell stocks and for managers of organizations to evaluate the performance of their organization and identify efficient organizations and model them. As shown in Table 3, the rankings obtained from each of the multi-criteria decision-making methods and data envelopment analysis are different in many cases, so their combination causes, errors in each of the methods, such as The inability of the decision maker to intervene in the risk conditions and the lack of uncertainty as well as the lack of time factor in the results and the weakness in determining the weight of the problem criteria and the sensitivity analysis of the model to be reduced and a more comprehensive ranking is provided.
The present study is similar to the research of Wang et al.[14] and Ersuy [15] in terms of using TOPSIS methods and data envelopment analysis and in terms of integration the methods and results obtained from the combination are somewhat similar to the research of Madhuri et al[16], Also, this research is similar to the research of Khajavi et al. [17]. In terms of the type of selected inputs and outputs, the type of selected financial ratios is different. It should be noted that the lack of access to information from some companies caused these companies to be removed from the study community. Also, the lack of information from some companies has shortened the research period.

6.2 Suggestions for Future Work

In order to further improve research in this field, researchers are suggested to use the introduced model in future research to evaluate the efficiency and ranking of other industries. Also, using the integrated DEA-MCDM approach of fuzzy and gaining weight each of the inputs and outputs of the

DEA model using qualitative and quantitative methods should be on the agenda. Researchers are also encouraged to use the financial ratios provided in this study for other industry groups to evaluate the results and compare them with previous research.

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Appendix

In this section, the studied raw data is presented in the form of inputs and outputs

Table 5: Input Values

Company Name	Inputs					
	Debt to special value ratio			Debt ratio		
	2018	2019	2020	2018	2019	2020
Pakhsh Alborz	10.58	9.07	13.27	0.91	0.90	0.93
Daroi Tamin. investment	0.20	0.28	0.32	0.16	0.22	0.24
Shafa Daro. investment	0.17	0.36	0.78	0.14	0.27	0.44
Alborz Daro	0.79	0.78	0.68	0.44	0.44	0.41
Iran Daro	1.32	1.45	1.73	0.57	0.59	0.63
Pars Daro	1.31	4.45	1.69	0.57	0.82	0.63
Tehran Daro	5.12	6.47	7.80	0.84	0.87	0.89
Tehran Shimi	3.74	2.54	1.77	0.79	0.72	0.64
Daro Aboureihan	2.96	3.40	4.59	0.75	0.77	0.82
Daro osve	1.15	1.21	1.41	0.53	0.55	0.58
Daro Amin	1.53	0.89	0.89	0.60	0.47	0.47
Daro Eksir	4.92	6.78	5.18	0.83	0.87	0.84
Daro Jaberebne Hayan	0.84	0.97	1.22	0.46	0.49	0.55
Daro Razak	1.57	1.68	2.25	0.61	0.63	0.69
Daro Zahravi	2.88	2.93	3.99	0.74	0.75	0.80
Daro Sobhan	1.21	0.01	1.09	0.55	0.01	0.52
Daro Abidi	4.81	2.97	2.97	0.83	0.75	0.75
Daro Farabi	1.44	2.10	1.78	0.59	0.68	0.64
Daro Loghman	2.89	2.96	3.34	0.74	0.75	0.77
Daropakhsh	3.83	4.53	0.26	0.79	0.82	0.20
Darosazi Alhavi	1.03	1.27	0.78	0.51	0.56	0.44
Darosazi Kosar	1.09	1.10	0.91	0.52	0.52	0.48
Roozdaro	0.89	2.23	1.88	0.47	0.69	0.65
Sobhan Daro	0.76	0.95	1.25	0.43	0.49	0.56
Alborz. investment	1.62	1.56	1.67	0.62	0.61	0.63
Sina Daro	0.86	0.92	0.92	0.46	0.48	0.48
Shirin Daro	1.21	1.02	1.34	0.55	0.50	0.57
Shimi Daropakhsh	2.02	2.51	3.94	0.67	0.72	0.80
Faravarde Tazrighi	0.57	0.40	0.66	0.36	0.28	0.40
Mavad Daropakhsh	0.96	1.12	1.87	0.49	0.53	0.65
Daropakhsh factories	3.19	4.65	4.47	0.76	0.82	0.82
Kimidaro	1.03	1.26	1.51	0.51	0.56	0.60

Table 6: Output Values

Company Name	**Output**								
	Return on assets			**Return on stakeholders' right**			**Fixed assets circulation**		
	2018	**2019**	**2020**	**2018**	**2019**	**2020**	**2018**	**2019**	**2020**
Pakhsh Alborz	4.3	3.52	2.06	49.8	35.42	29.37	60.84	38.31	33.18
Daroi Tamin. investment	37.35	34.93	33	44.68	44.63	43.64	16.55	19.16	21.94
Shafa Daro. investment	27.53	29.56	24.89	32.08	40.29	44.28	54.06	77.52	78.47
Alborz Daro	31.95	30.35	32.59	57.19	54.02	54.91	8.96	9.8	9.53
Iran Daro	24.78	19.53	16.03	57.39	47.88	43.79	12.15	13.94	8.99
Pars Daro	31.2	3.47	21.21	72.16	18.92	56.99	5.76	0.84	3.38
Tehran Daro	8.31	4.46	2.29	50.87	33.36	20.13	36.24	3.6	3.41
Tehran Shimi	5.2	9.07	12.82	24.62	32.16	35.46	1.69	2.96	2.7
Daro Aboureihan	16.58	13.94	10.64	65.7	61.29	59.44	7.71	9.86	10.82
Daro osve	25.62	25.28	22.7	54.99	55.78	54.61	3.67	3.9	4.14
Daro Amin	21.13	12.33	12.33	53.37	23.26	23.33	7.93	1.99	1.99
Daro Eksir	10.99	1.84	6.51	65.04	14.34	40.24	21.72	19.34	22.41
Daro Jaberebne Hayan	27.05	23.8	20.18	49.71	46.87	44.83	7.09	8.43	9.88
Daro Razak	27.12	21.75	19.49	69.55	58.23	63.34	19.23	20.69	7.33
Daro Zahravi	20.47	17.16	12.82	79.41	67.46	64.01	8.05	10.04	9.58
Daro Sobhan	13.02	47.04	12.57	28.8	47.65	26.22	0.8	542.92	0.97
Daro Abidi	5.69	9.92	9.92	33.08	39.33	39.33	2.61	3.66	3.66
Daro Farabi	22.68	12.54	14.87	55.39	38.89	41.29	14.65	7.17	5.49
Daro Loghman	6.33	5.05	3.7	24.62	20.01	16.04	0.94	1.07	1.11
Daropakhsh	8.34	6.99	38.2	40.26	38.69	47.95	0.92	0.78	34.39
Darosazi Alhavi	12.34	12.89	8.2	25.03	29.21	14.56	1.14	1.38	1.38
Darosazi Kosar	14.29	5.1	10.47	29.94	10.72	19.99	5.84	2.77	0.84
Roozdaro	17.6	5.83	3.95	33.3	18.84	11.37	1.85	2.26	1.84
Sobhan Daro	40.91	34.05	26	71.93	66.31	58.59	4.9	5.27	4.92
Alborz. investment	10.44	10.79	8.8	27.38	27.63	23.49	0.91	1.07	0.97
Sina Daro	33.87	30.56	32.94	62.86	58.68	63.34	5.66	5.35	3.4
Shirin Daro	36.68	23.22	17.15	81.09	46.86	40.18	16.3	8.98	10.11
Shimi Daropakhsh	13.62	9.67	6.12	41.16	33.96	30.23	8.03	7.49	8.9
Faravarde Tazrighi	31.44	32.61	28.57	49.37	45.6	47.55	3.14	3.82	2.19
Mavad Daropakhsh	30.6	25.08	21.86	59.93	53.24	62.76	6.63	6.6	6.8
Daropakhsh factories	14.52	6.1	7.1	60.83	34.46	38.89	4.19	3.52	3.16
Kimidaro	28.58	24.2	18.37	58.06	54.58	46.02	5.13	5.86	6.01

Table 7: Output Value

Company Name	**Output**					
	Total assets circulation			**Profit margin**		
	2018	**2019**	**2020**	**2018**	**2019**	**2020**
Pakhsh Alborz	1.61	1.51	1.19	2.67	2.34	1.73
Daroi Tamin. investment	0.38	0.35	0.34	98.81	98.45	98.44
Shafa Daro. investment	0.28	0.3	0.25	98.17	99.16	98.61
Alborz Daro	0.95	0.99	0.91	33.73	30.6	35.89
Iran Daro	1.01	0.92	0.77	24.48	21.3	20.85

Table 7: Output Value

Company Name	Output					
	Total assets circulation			Profit margin		
	2018	2019	2020	2018	2019	2020
Pars Daro	0.5	0.07	0.43	62.42	52.77	49.41
Tehran Daro	0.74	0.55	0.47	11.19	8.06	4.87
Tehran Shimi	0.25	0.56	0.51	20.43	16.26	24.94
Daro Aboureihan	0.85	0.8	0.73	19.43	17.37	14.51
Daro osve	0.76	0.73	0.66	33.88	34.48	34.41
Daro Amin	0.7	0.59	0.59	30.3	20.93	20.93
Daro Eksir	0.99	0.88	0.94	11.1	2.09	6.9
Daro Jaberebne Hayan	0.67	0.62	0.57	40.45	38.21	35.24
Daro Razak	0.74	0.7	0.64	36.7	31.22	30.54
Daro Zahravi	0.76	0.87	0.71	27.05	19.72	17.94
Daro Sobhan	0.13	0.48	0.13	98.75	98.17	98.15
Daro Abidi	0.55	0.82	0.82	10.4	12.16	12.16
Daro Farabi	0.67	0.56	0.63	33.9	22.32	23.44
Daro Loghman	0.41	0.43	0.42	15.44	11.68	8.82
Daropakhsh	0.08	0.07	0.38	101.04	105.99	100.54
Darosazi Alhavi	0.46	0.52	0.35	26.86	24.96	23.42
Darosazi Kosar	0.63	0.59	0.2	22.82	8.61	52.21
Roozdaro	0.69	0.43	0.35	25.51	13.52	11.44
Sobhan Daro	1.02	0.96	0.76	40	35.49	34.18
Alborz. investment	0.1	0.11	0.09	99.53	98.4	100.7
Sina Daro	0.81	0.86	0.82	41.76	35.61	40.18
Shirin Daro	1.69	1.11	1.05	21.73	20.88	16.33
Shimi Daropakhsh	0.95	0.95	0.88	14.33	10.17	6.96
Faravarde Tazrighi	0.77	0.86	0.61	40.62	38.03	46.6
Mavad Daropakhsh	0.87	0.83	0.77	35	30.39	28.42
Daropakhsh factories	0.73	0.59	0.65	19.86	10.4	10.9
Kimidaro	0.8	0.67	0.59	35.54	36.19	31.02