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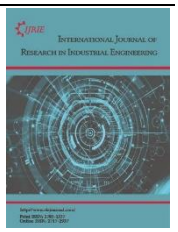

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Ranking of Companies in Generating Operating Cash Flows Based on Data Envelopment Analysis

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Abstract

The purpose of this research is to evaluate and rank the efficiency of pharmaceutical companies in creating operational cash flows in line with the objectives of financial reporting. The research method for collecting theoretical bases and research data is library studies. In this research, in order to evaluate the efficiency of pharmaceutical companies in creating operational cash flow, the Data Envelopment Analysis (DEA) model with weight limit is used. The results of this research show that Farabi pharmaceutical company has the highest efficiency score in creating Operating Cash Flows (OCFs) and Loqman pharmaceutical company has the lowest efficiency score. The findings of this research confirm that DEA is a suitable technique for evaluating the performance of companies in creating operational cash flow. Also, this technique, along with traditional financial analysis, can be considered a useful instrument for deciding and evaluating the performance and efficiency of companies. This article can make analysts more familiar; financial and accounting researchers with DEA applications in financial and accounting analysis. Also, this research can expand the use of scientific models in financial and accounting research.

Keywords: Company efficiency, Operating cash flow, Data envelopment analysis, Pharmaceutical industry.

1 | Introduction

One of the objectives of financial reporting is to provide accounting information to it's users about the amount and timing of future cash flows. Operating Cash Flows (OCFs) is a critical economic resource for each business entity. In this regard, making cash from operations to pay profits, repaying debts, paying expenses, and making investments are of paramount importance for companies to continue their activities [1]. Moreover, previous studies have documented the effect of the company's potential in creating OCF and profit on the company's value. The outcomes of these studies confirm that the direct method is valuable to investors when predicting future cash flows and earning [2]. OCF is assumed as a basis to calculate the credit rating of companies and provides increasing information content in forecasting companies' performance indices and credit risk [3]. OCF is a useful tool in assessing the quality of accruals and profit quality [4]. OCFs are considered to calculate Free Cash Flows (FCFs), which are considered to evaluate managers' performance and determine the value of the business entity from investors' perspective [5].

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Given the significance of OCFs in analyzing companies' performance and financial position, the present study aimed to employ the Data Envelopment Analysis (DEA) to develop a method to evaluate companies' performance according to the data obtained from the operational section of the cash flows statement. For this purpose, the direct OCF calculation method is adopted. In direct method, usually real cash inflows and outflows taken directly from company operations. This means it measures cash as its received or paid, rather than using the accrual accounting method. In indirect method, accountants adjust net income to calculate OCFs. This is adjusted as needed using information from the asset and liability accounts on the balance sheet to arrive at cash flows. According to some researchers, the direct OCF method provides more reliable data than the indirect method; hence, the former is of higher quality in financial reporting and is more powerful in forecasting the future OCF [6]. In a similar vein, some researchers have stated that the direct method decreases information asymmetry, enhances the liquidity of the shares, and reduces the transaction cost. Moreover, companies preparing the cash flow statement using the direct method have higher future earnings response coefficients than other companies [7].

Our motivation for choosing DEA is the efficiency of this method for financial analysis. We select DEA technique since it is a strong and flexible method in measuring financial performance. This is because it simultaneously considers several variables as input and output variables to evaluate the company's efficiency. Moreover, DEA is a decision-making tool and can provide further information compared to traditional analysis methods (e.g., financial ratios) [8]. This technique compares companies in the same industry in terms of efficiency. The comparison is acceptable since the traditional analysis compares each company' efficiency with the mean or the median of all companies in the research sample [9]. DEA can overcome complications aroused by the lack of a common measurement scale [1].

The difference between this research and the previous studies is that they evaluate the manager's efficiency based on accrual accounting indicators. Using DEA, most of the previous studies analyzed the manager's performance regarding the employed resources (i.e., assets as an input and accrued sales as an output) [9]. The present study, however, aimed to evaluate the manager's efficiency in creating OCF on a cash basis according to the cash flow statements. Consistent with the objectives of financial reporting, this assessment provides useful information about the capability to generate future OCF for accounting information users. We believe this issue can improve perception of financial analysts, investors and creditors about firms performance in line with the objectives of financial analysis. The findings of the present study can also expands the use of DEA in accounting research. Since accounting researchers are less familiar with DEA, the present study can make them more familiar with the application of DEA in the financial and accounting analysis. The following sections describe the theoretical foundations of the study, methodology, data analysis, and conclusions.

2 | Theoretical Foundations

2.1 | Operating Cash Flow

OCFs are the inflows and outflows resulting from the business entity's main income-making operations. OCFs indicate to what extent a business entity can generate cash from its main operation. Accordingly, the assessment of a company's capability to generate OCF provides financial analysts and other users with useful information for financial reporting. Moreover, information about past cash flow can be used to evaluate the amount, timing, and ambiguity of future cash flows [10]. OCFs provide useful information in line with the objectives of financial analysis for financial analysts [11]. OCF is a critical criterion in forecasting companies' financial health [12].

Compared to profit, OCF is less affected by management's discretion; hence, it is an efficient measure of the profit quality [13]. When companies are in a financial crisis, OCF is more strongly correlated with stock returns than profit, suggesting that investors in the capital market in a financial crisis give higher importance to information about OCF than profit [14]. This reveals the positive and significant effect of OCF on the profit sharing policy [15]. OCF can provide creditors with useful information about the company's

capability in meeting its financial obligations [16]. Evaluating the future OCFs of a business entity is of paramount importance for financial institutions and banks when making loan decisions [17].

2.2 | DEA in Financial Performance Appraisal

As a non-parametric method, DEA separately appraises the economic entities' performance. In DEA, performance appraisal is performed based on input and output data, and there is no need to determine the type of relationships between those data in advance. Using linear programming, DEA assesses the relative efficiency of economic entities and allows comparing the performance of those entities using multiple input and output data. Technical efficiency in DEA refers to the ability to reach maximum output from a given set of inputs. Efficiency is the transformation of inputs into outputs and is determined for each decision-making entity using real data [9].

DEA is highly efficient in assessing companies' performance. The traditional financial analysis methods use financial ratios (e.g., Return on Sales (ROS), Return on Assets (ROA), and Asset Turnover (ATO)) separately for the performance appraisal of each economic entity's. If an economic entity possesses several inputs in the output creation process, DEA can simply determine each economic entity's efficiency using the optimal combination of the output and the input. This implies that DEA simultaneously combes several accounting variables as input and output data to calculate an optimal numerical criterion for companies' financial performance. DEA is a non-parametric frontier estimation methodology underpinned by the optimization principle as this technique can evaluate efficiency over time and need no presumption on the efficiency frontier. DEA allows managers to have a correct appraisal of their entities and make correct and rational decisions about the optimal allocation of resources [18].

2.3 | Research Background

DEA is an appropriate technique for converting different ratios and financial data into a single and comparable standard, called "efficiency". DEA is a suitable supplement for the traditional analysis of financial statements using financial ratios [19]. Using DEA to appraise companies' efficiency, researchers have indicated that DEA can strongly determine and classify efficient and inefficient enterprises. Research findings have also documented the higher efficiency of DEA compared to other traditional methods [20]. Another study used the DEA window analysis to evaluate the efficiency of pharmaceutical companies. The findings revealed that the DEA window analysis provided more useful information about performance appraisal compared to the traditional analysis technique [21], [22].

Studies on the time-based DEA of the financial statements of the companies accepted in the Tehran stock exchange suggest that only Iran auto parts company could maintain its full efficiency during six years of appraisal [23]. Furthermore, some researchers have introduced cash flow management as one of the useful criteria for companies' performance appraisal in the value chain. These researchers employed the reverse DEA and showed the effectiveness of measuring companies' efficiency using cash flows in the value chain [24]. In a survey on the performance appraisal of investment companies using DEA, the findings suggested that out of 34 investment companies, only four companies with an efficiency score of one were efficient, implying that 12% of investment companies were efficient and 88% were ineffective [25]. Another study examined the efficiency of audit firms using DEA. The researchers employed the cross-efficiency DEA and ranked Behmand, Azmoudeh Karan, and Arvin Arqam Pars accounting firms first to third in terms of efficiency, respectively. They proposed DEA as an appropriate method for analyzing auditing institutions' efficiency to evaluate auditors' work quality [26].

In China, results of a study show that procurement and application of funds in Chinese companies have an average growth rate of 2.75% and fund procurement gains more importance than fund application [27]. In another study, by using of DEA corporate social performance and financial performance is

investigated. The results show that corporate social performance impacts negatively and significantly financial performance [28]. Financial ratios examine only one aspect of the company's performance, and therefore, the company's performance cannot be calculated correctly. Also, due to the multitude of financial ratios, sometimes the evaluation results will be misleading [29].

According to the literature, traditional methods using financial ratios to measure and evaluate efficiency have disadvantages such as one-dimensionality and suffer from limitations and inadequacies of financial ratios. In other words, the evaluation of efficiency using such methods may result in less accurate and objective findings and mislead users. Some researchers evaluated companies' efficiency and ranking using the DEA model underpinned by negative variables. They found out that quick ratios and the profit margin are main coefficients among the financial ratios [30]. The super efficiency model of DEA was also studied in primary and developed profitability models for 15 banks during a two-year period. The research results exhibited no strong correlation between efficiency values and financial ratios in the main profitability model; however, their relationship was strong in the developed profitability model [31].

In another study, the researchers also examined the effectiveness of the banking network using DEA with bootstrap data. They reported the 56.1% efficiency for the country's banking network, indicating no favorable efficiency [32]. DEA confirmed the higher annual efficiency of participation banks compared to other banks [33]. Some studies on companies' bankruptcy have also confirmed DEA as a useful technique and tool to forecast the likelihood of bankruptcy and predict companies' financial health. In the bankruptcy prediction model, companies' efficiency is one of the effective variables [34].

Furthermore, some studies used DEA and reported that the operational efficiency of multinational companies was higher than other companies. They suggested the positive and significant effect of intellectual capital on companies' performance [35]. Another study addressed banks' efficiency using the network DEA technique and reported their low efficiency. The researchers used this technique and examined some scenarios to promote banks' efficiency. Finally, they suggested improving banks' efficiency using DEA [36]. Research on financial distress reveals that the frontier DEA model is highly acceptable for detecting decision-making entities under different financial conditions over several periods as it can provide solutions to promote the performance of such entities with financial problems [37].

3 | Research Methodology

In this study, the statistical sample encompassed 19 companies in the pharmaceutical industry in Iran. The research was a case study in analyzing the data. The library method was also used to research the theoretical foundations of the study. Because the study was carried out in a real environment (i.e., stock exchange companies), it was a field study conducted in 2021. The pharmaceutical industry was selected because of the high significance of operating cash in this industry. In the pharmaceutical industry, the sales prices of pharmaceutical products are determined by the government, and the concerned companies have many demands from drug distribution companies and the Ministry of Health for selling their pharmaceutical products. Moreover, the raw materials of this industry are mostly imported; hence high foreign exchange funds are required. This implies that the importance of cash management in the pharmaceutical industry is as high as in other industries. *Table 1* indicates that the non-significant value of the average cash received from customers versus the average cash paid to the parties to the company's contract (namely suppliers and sellers of raw materials), employees for salaries wages, the government for taxes, and others.

In the present study, input variables were cash paid to employees for salaries and wages, to suppliers for the purchase of goods and services, to the government for taxes, and to others for other operating expenses. Moreover, the cash received from customers for the sale of goods and services was the output variable. Lingo software was used to analyze the data and solve the model.

4 | Research Findings

4.1 | Descriptive Statistics

In *Table 1*, descriptive statistics of input and output variables (i.e., mean, median, standard deviation, minimum, and maximum) are presented. The table shows the average cash received from customers for the sale of goods and services (3983531 Million Rials), the average cash payment for salaries and wages (9646655 Million Rials), cash paid for tax (114597 Million Rials), cash paid for other operational expenses (279479 Million Rials), and cash paid for the purchase of goods and services (3622698 Million Rials). Also, this table shows that the most payments for salaries and the purchase of materials and goods were from sellers.

Table 1. Descriptive statistics of variables (values are in Million Rials).

	Output Variable	Input Variable			
	Cash Received from the Sale of Goods and Services	Cash Payment for the Purchase of Goods and Services	Cash Paid for other Operating Expenses	Cash Payment for Taxes	Cash Payment for Salaries and Wages
Average	3983531	3622698	279479	114597	6466559
Median	3939872	2382464	258793	83145	5019112
Std.	2335023	2409824	127647	87278	5038664
Min	693793	980510	103101	10773	1126882
Max	8887906	10310087	634722	293526	21323156

4.2 | Efficiency Appraisal Model

In this section, a DEA model is described to evaluate the efficiency of decision making entities. The model is in the field of efficiency appraisal with weight limit. Suppose n decision making entities with m inputs and s outputs. $DMU_j(j = 1,2, \dots, n)$ converts the input vector with components $x_{ij}(i = 1, \dots, m)$ into the output vector with components $y_{rj}(r = 1, \dots, s)$. The efficiency of the oth entity $(o = 1,2, \dots, n)$ is calculated using the multiple CCR model as follows:

$$\begin{aligned} &\min \sum_{i=1}^{m} u_r y_{r0}, \\ &\textstyle\sum_{i=1}^{m} v_i x_{i0} = 1, \\ &\sum_{i=1}^{m} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0, \quad j = 1, \dots, n, \\ &u_r \ge 0, \quad r = 1, \dots, s, \\ &v_i \ge 0, \quad i = 1, \dots, m, \end{aligned} \tag{1}$$

where the variables are

x_{ij}: Input rate i for jth entity i = 1, ..., m.

y_{rj}: Output rate r for the jth entity r = 1, ..., s.

v_i: The weight given to the ith input.

u_r: The weight given to the rth output.

The following definition is also proposed:

Definition 1. DMU_o is CCR efficiency when the optimal value of the objective function of *Model (1)* is 1; otherwise, it is inefficient.

The problem with *Model (1)* is the optimistic assessment of efficiency as several entities may be efficient as such ranking is not possible. Accordingly, cross-efficiency DEA models are used to solve such a problem. This section provides a DEA model with a higher discriminating power for ranking than traditional DEA models.

The multi-criteria DEA model was proposed to promote the discrimination power in classical DEA [38]. The first objective function (d_0) defines the efficiency of a decision-making entity classically. The other two objective functions (d_j and M) offer more limiting functions, respectively. In the proposed multi-criteria DEA model, three objective functions are analyzed separately with no priority for the functions. Since d_j and M tend to provide less efficient entities compared to the first objective function, these two functions in the multi-criteria DEA, compared to the classic DEA, offer higher discrimination power. The proposed DEA model of presented multi-criteria data is defined as follows [38]:

$$
\begin{aligned}
&\max \sum_{i=1}^{m} u_r y_{r0} \ (\text{or } \min d_o),\\
&\min M,\\
&\min \sum_{j=1}^{n} d_j,\\
&\textstyle\sum_{i=1}^{m} v_i x_{io} = 1,\\
&\sum_{i=1}^{m} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} + d_j = 0, \quad j = 1, \dots, n,\\
&M - d_j \geq 0, \quad j = 1, \dots, n,\\
&u_r \geq 0, \quad r = 1, \dots, s,\\
&v_i \geq 0, \quad i = 1, \dots, m,\\
&d_j \geq 0, \quad j = 1, \dots, n.
\end{aligned}
\tag{2}
$$

In this three-objective problem, the efficiency value of the first objective is from DMU_0, which should be maximized. The second objective minimizes the maximum inefficiency of DMU_j, and the last objective minimizes the total inefficiency of DMU_j. Ideal planning is used to solve this three-objective problem. The first target ideal is 1, and this value for the second and third goals is zero. Accordingly, the single-objective ideal planning model is as follows:

$$
\begin{aligned}
&\min(d_1^+ + d_2^- + d_3^-),\\
&\textstyle\sum_{i=1}^{m} u_r y_{r0} + d_1^- - d_1^+ = 1,\\
&M + d_2^- - d_2^+ = 0,\\
&\textstyle\sum_{j=1}^{n} d_j + d_3^- - d_3^+ = 0,\\
&\textstyle\sum_{i=1}^{m} v_i x_{io} = 1,\\
&\sum_{i=1}^{m} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} + d_j = 0, \quad j = 1, \dots, n,\\
&M - d_j \geq 0, \quad j = 1, \dots, n,\\
&u_r \geq 0, \quad r = 1, \dots, s,\\
&v_i \geq 0, \quad i = 1, \dots, m,\\
&d_j \geq 0, \quad j = 1, \dots, n,\\
&d_1^-, d_1^+, d_2^-, d_2^+, d_3^-, d_3^+ \geq 0.
\end{aligned}
\tag{3}
$$

Regarding the second and sixth constraints, *Model (3)* is as follows:

$$\begin{aligned}
&\min(d_1^+ + d_2^- + d_3^-),\\
&\textstyle\sum_{i=1}^{m} u_r y_{r0} + d_1^- - d_1^+ = 1,\\
&\textstyle\sum_{j=1}^{n} d_j + d_3^- - d_3^+ = 0,\\
&\sum_{i=1}^{m} v_i x_{io} = 1,\\
&\sum_{i=1}^{m} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} + d_j = 0, \quad j = 1, \dots, n,\\
&d_2^+ - d_2^- - d_j \geq 0, \quad j = 1, \dots, n,\\
&u_r \geq 0, \quad r = 1, \dots, s,\\
&v_i \geq 0, \quad i = 1, \dots, m,\\
&d_j \geq 0, \quad j = 1, \dots, n,\\
&d_1^-, d_1^+, d_2^-, d_2^+, d_3^-, d_3^+ \geq 0.
\end{aligned} \tag{4}$$

This model is called CCR-GP, in which d d_1^+ ،d_2^- و d_3^- are deviation from the first to the third ideal, respectively. When this model is implemented, the efficiency of DMU_0 can be calculated as follows:

$$\theta = \frac{\sum_{i=1}^{m} u_r^* y_{rj}}{\sum_{i=1}^{m} v_i^* x_{ij}}, \tag{5}$$

where v_i^*, u_r^* are the optimal weights obtained from *Model (4)*.

One of the problems of DEA models is optimistic assessment, which evaluates DMUs in the best case. In such an assessment, several DMUs may be efficient, and no ranking is possible. One solution to this problem in DEA is weight constraints [39]. This section offers a weight limit method for the CCR-GP model. The presented model is as follows:

$$\begin{aligned}
&\max \alpha - (d_1^+ + d_2^- + d_3^-),\\
&\sum_{i=1}^{m} u_r y_{r0} + d_1^- - d_1^+ = 1,\\
&\sum_{j=1}^{n} d_j + d_3^- - d_3^+ = 0,\\
&\textstyle\sum_{i=1}^{m} v_i x_{io} = 1,\\
&\sum_{i=1}^{m} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} + d_j = 0, \quad j = 1, \dots, n,\\
&d_2^+ - d_2^- - d_j \geq 0, \quad j = 1, \dots, n,\\
&u_r \geq \alpha, \quad r = 1, \dots, s,\\
&v_i \geq \alpha, \quad i = 1, \dots, m,\\
&d_j \geq 0, \quad j = 1, \dots, n,\\
&d_1^-, d_1^+, d_2^-, d_2^+, d_3^-, d_3^+ \geq 0.
\end{aligned} \tag{6}$$

This linear programming model is to evaluate efficiency with weight constraints; hence, the first priority is applied to the weight constraint since the goal is to first apply the weight limit and then appraise the performance in the best conditions with the weight limit.

4.3 | Data Analysis

In this section, the companies' efficiency is evaluated. *Table 2* presents the input and output information of the concerned companies. In this table, cash received from the sale of goods and services is input variable, and cash payment for the purchase of goods and services, cash paid for other operating expenses, cash payment for taxes and cash payment for wages are output variables.

Table 2. Inputs and outputs (in Millions of Rials).

Output Variable	Input Variable				
Cash Received from the Sale of Goods and Services	Cash Payment for the Purchase of Goods and Services	Cash Paid for Other Operating Expenses	Cash Payment for Taxes	Cash Payment for Wages	Company Name
6831114	6317377	249904	83145	1281120	Alborz Daru
3939872	4544421	266446	40717	9479622	Pars Daru
4245050	5227064	327999	77175	11007530	Aburaihan Daru
2084875	2382464	407658	142738	5480295	Osve Daru
8887906	7178272	472421	259084	15113316	Exir Daru
3224458	2080694	252233	43338	6180008	Jaber Ebne Hayyan Daru
5379799	5577668	334660	293526	1577087	Razak Daru
4070940	2851693	155559	114363	6404481	Daru Zahravi
5001814	4516238	103101	167876	1126882	Farabi Daru
693793	2359568	294809	24992	5045655	Loghman Daru
1740067	2116651	233203	31018	4662198	Cosar Daru
1473135	1666540	258793	10773	4051172	Rouz Daru
1760439	2238440	156703	54136	4624652	Zagros Pharmed Pars Daru
4130296	1869858	322332	166890	4982175	Sina Daru
2776768	1857975	163934	64265	4019981	Shimi Darupakhsh
2115939	980510	176730	169992	2165131	Fraravarde Tazrighi
7626365	10310087	634722	276439	21323156	Darupakhsh Karkhanejat
7290461	3237613	334172	55293	9321045	Darupakhsh Mavvad
2414003	1518140	164724	101591	5019112	Kimi Daru

Model (6) is used to evaluate efficiency. Lingo software is used to solve the model, the results of which are presented in *Table 3*.

Table 3. Efficiency scores in Model (6).

Efficiency Scores	Company	Number
0.987	Alborz Daru	1
0.724	Pars Daru	2
0.424	Aburaihan Daru	3
0.426	Osve Daru	4
0.656	Exir Daru	5
0.688	Jaber Ebne Hayyan Daru	6
0.806	Razak Daru	7
0.707	Daru Zahravi	8
1	Farabi Daru	9
0.209	Loghman Daru	10
0.445	Cosar Daru	11
0.246	Rouz Daru	12
0.248	Zagros Pharmed Pars Daru	13
0.562	Sina Daru	14
0.454	Shimi Darupakhsh	15
0.605	Fraravarde Tazrighi	16
0.234	Darupakhsh Karkhanejat	17
0.563	Darupakhsh Mavvad	18
0.354	Kimi Daru	19

According to *Table 3*, Farabi pharmaceutical company is efficient, and others companies are inefficient. Companies can be ranked by efficiency scores. Regarding the scores, Farabi pharmaceutical company, with the highest efficiency score, is ranked first, and Loqman pharmaceutical company, with the smallest efficiency score, is ranked last. Alborz Daru and Razak Daru are ranked second and third respectively. In other words, the findings of this study show that the mentioned companies have performed better in

creating operational cash flows compared to other companies. This method allows unique ranking, and that is what traditional DEA methods fail to do.

5 | Discussion and Conclusion

In the present study, pharmaceutical companies were ranked in terms of efficiency in generating OCF using DEA. According to the findings, Farabi and Loqman pharmaceutical companies have the highest and the lowest efficiency scores in the first and the last ranking in terms of generating OCF, respectively. The findings implly that DEA is a suitable technique for performance appraisal. Besides traditional financial analysis, DEA can be regarded a useful tool for decision-making and evaluating companies' performance and efficiency. Since DEA compares each company's efficiency with its industry counterparts and can propose a model to appraise efficiency simply, financial analysts and managers can correctly assess their decision-making entities and make correct and rational decisions for the optimal allocation of resources.

The present findings also confirm that DEA is a suitable supplement for assessing the financial performance of business entities in line with the goals of financial reporting; hence, this technique can remove the limitations and inadequacies of financial ratios. Because DEA can provide more reliable and accurate findings compared to traditional financial ratios, it can provide financial information users with appropriate and reliable information. The findings of this paper show that DEA is a strong mathematical model for financial analysis. This method can be used alongside traditional analysis to evaluate financial performance. It seems that this method can improve traditional financial analysis. In line with financial reporting objectives, we argue that DEA provides new insights into financial analysis. Also, DEA can be considered as a move towards matching traditional ratio analysis with decision usefulness theory. This paper emphasizes that DEA can be a useful tool for cash flows management. Therefore, the results of this research can be consistent with the theoretical foundations and previous studies (36, 37). The findings of this study emphasize that creating and managing cash flows is very important for financial performance. Cash flows, sales growth and profitability are the resources of companies for continued activity and survival. So, this paper expands the awareness of financial and accounting analysts and researchers about the applications of DEA in financial and accounting analyses. In other words, the research findings can expand scientific models on financial and accounting research. Capital market analysts can use the efficiency scores obtained from the DEA to evaluate the market performance and the financial performance of companies at the same time. Also, these scores can be a criterion for evaluating the financial health of companies.

Financial analysts and other financial information users are recommended to calculate companies' efficiency in making money and OCFs and include them in their decision-making models to assess companies' performance. Future researchers are suggested to examine the effectiveness of companies in creating profit and OCF comparatively using DEA.

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