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Long-Term Profitability Prediction under Taxation Changes: Efficiency Analysis of Companies Using DEA Model

Maryam Ghandehari[1], Fatemeh Kamali Yazdi[2,*]

[1] Department of Industrial Engineering, Science and Research Branch, Islamic Azad University, Tehran, Iran; m.ghandehari@iau.ac.ir.

[2] Department of Accounting, Imam Reza International University, Mashhad, Iran; fkamaly2006@yahoo.com.

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Abstract

This research focuses on predicting the long-term profitability of companies in the context of tax regulation changes using the Data Envelopment Analysis (DEA) model. The study adopts an applied approach and employs a descriptive-analytical methodology. To collect the necessary data, financial information from companies listed on the Tehran Stock Exchange was analyzed over a five-year period, spanning from 2016 to 2021. The research aims to assess how changes in tax regulations influence both the profitability and efficiency of companies. By utilizing the DEA model, this study provides a quantitative evaluation of the impact of tax adjustments on corporate financial performance. The findings reveal that tax changes have a significant effect on long-term profitability, with the potential to either improve or diminish a company's financial efficiency and overall profitability. Furthermore, the DEA model has demonstrated its ability to accurately forecast corporate profitability under various tax scenarios. This predictive power makes the model a valuable tool for financial analysts, policymakers, and corporate managers. By leveraging DEA-based insights, decision-makers can better navigate tax policy adjustments, optimize financial strategies, and enhance overall corporate performance.

Keywords: Profitability prediction, Tax changes, Company efficiency, Tehran Stock Exchange.

1 | Introduction

In the fast-paced and dynamic world of economics, tax regulations are among the most influential variables affecting the financial performance of companies [1]. Changes in tax rates, tax exemptions, and fiscal policies play a crucial role in managerial decision-making processes, directly and indirectly impacting resource allocation and corporate profitability [2]. In many countries, including Iran, tax reforms are continuously employed as a tool for macroeconomic management and increasing government revenues [3]. For instance,

Corresponding Author: fkamaly2006@yahoo.com

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recent tax reforms in Iran, which included raising corporate tax rates and modifying tax incentives, have had significant impacts on the performance of businesses and their investment decisions [4].

Given this necessity, predicting the long-term profitability of companies in response to tax changes is of paramount importance, as it can enhance financial and investment decision-making processes [5]. In this study, the Data Envelopment Analysis (DEA) model is employed as an efficient analytical tool to assess the efficiency and productivity of companies under changing tax conditions. This model enables the comparison of corporate performance over different time periods, allowing for a comprehensive evaluation of the impact of tax regulation changes on efficiency and profitability. The application of quantitative methods such as DEA can facilitate a more precise analysis of financial data and help identify effective patterns in corporate economic management [6].

Several studies have examined the effects of tax changes on corporate financial performance. Some research findings suggest that an increase in tax rates can reduce investment incentives and lower corporate profitability [7]. Conversely, other studies indicate that tax reductions can positively influence long-term investments and corporate economic growth [8], as they alleviate financial burdens and enable more optimal resource allocation [9].

For example, in developed countries such as the United States and Germany, flexible tax policies have played a significant role in enhancing productivity and attracting investments [10]. In contrast, countries that have implemented high tax rates without considering economic conditions have experienced a decline in corporate competitiveness [11]. Similarly, in Iran, recent tax reforms, including the removal of certain exemptions and an increase in value-added tax, have led to shifts in corporate economic behavior, highlighting the importance of examining these changes [12].

Moreover, studies utilizing the DEA model to assess corporate performance have demonstrated that this method serves as a highly effective tool for comparing the efficiency of firms under different economic and tax conditions [13]. Previous research indicates that DEA has been widely used in corporate productivity analysis and plays a vital role in evaluating the impact of fiscal policies [14]. However, significant research gaps remain in understanding the effects of tax changes on corporate performance from a long-term productivity perspective, particularly using advanced analytical methods. This study aims to bridge these gaps by leveraging DEA to provide a comprehensive analysis of the impact of tax changes on corporate profitability.

The primary objective of this research is to analyze the impact of tax changes on the long-term profitability of companies using the DEA model. Specifically, the study will examine how tax adjustments influence efficiency of companies and productivity, as well as the financial performance trends they generate. By evaluating these changes before and after tax reforms, a deeper understanding of corporate interactions with such modifications can be achieved, enabling the proposal of suitable strategies to optimize performance.

The significance of this research can be assessed from both theoretical and practical perspectives. Theoretically, this study contributes to the existing literature on the impact of tax changes on corporate productivity and enhances the understanding of how this variable influences economic processes [15]. Practically, the findings of this research can be utilized by financial managers, economic policymakers, and investors to make informed decisions for managing risks and leveraging tax-related opportunities.

As tax law modifications remain a constant component of government economic policies, access to effective analytical models for predicting their impact on corporate performance plays a crucial role in financial and economic success [16]. This study adopts a comprehensive and analytical approach to address this need, providing scientific and practical solutions to enhance efficiency of companies in the face of tax changes. Additionally, the results of this research can assist economic policymakers in evaluating the effects of tax reforms on businesses and formulating policies that, while securing government revenues, minimize adverse effects on the business environment.

2 | Methodology

This research is applied in terms of its objective and is classified as descriptive-analytical in nature and method. The primary goal of this study is to predict the long-term profitability of companies under tax changes by analyzing their efficiency using the Data Envelopment Analysis (DEA) model. DEA is a non-parametric technique based on linear programming that evaluates the relative efficiency of Decision-Making Units (DMUs) under different conditions. In this study, the DEA model is used to analyze changes in efficiency of companies and forecast their long-term profitability in response to tax law modifications.

The statistical population of this study consists of companies listed on the Tehran Stock Exchange that have been affected by tax changes over a specific period. Since the primary objective is to predict long-term profitability, companies with complete and reliable financial data during the study period and those impacted by tax law changes were selected. A purposive sampling method was employed, and to enhance the validity of the results, criteria such as industry type, asset size, and sensitivity to tax changes were considered when selecting companies.

The data used in this research were collected from reliable sources such as corporate financial reports, income statements, audit reports, and information published by the Securities and Exchange Organization. To ensure data validity, existing data were compared with reputable sources and verified through consultations with financial experts. Additionally, data reliability was confirmed by examining their consistency across different time periods and conducting sensitivity analyses on DEA model results. The research process includes the following steps:

I. Collecting financial data of companies from credible sources.

II. Extracting the required input and output variables for the DEA model, including indicators such as revenue, tax expenses, net profit, and other financial ratios influencing long-term profitability.

III. Implementing the DEA model to assess company efficiency under different tax law conditions.

IV. Forecasting the impact of tax law changes on long-term profitability by analyzing efficiency trends and comparing results across different time periods.

V. Providing practical recommendations based on model results and data analysis.

For data analysis, key financial indicators related to long-term profitability were first identified and examined. The DEA model was then applied to measure efficiency of companies under tax law changes. MATLAB software was used to implement the models and analyze the data. Furthermore, statistical tests were conducted to assess the significance of changes in efficiency of companies, and regression and correlation methods were employed to analyze relationships between variables.

This research specifically focuses on companies listed on the Tehran Stock Exchange that have been affected by tax law changes over different periods. The study covers a minimum five-year period, allowing for an analysis of long-term profitability trends and the impact of tax reforms. Various economic sectors are included to assess the effects of tax changes across different industries.

3 | Findings

Descriptive findings provide a simple overview of the data and different conditions within the statistical population. This section presents key information about the companies, their distribution by industry, and changes in the number of companies over time. The collected data aim to provide a comprehensive picture of corporate conditions under different tax regimes. The distribution of companies across various industries is presented in *Table 1*.

Table 1. Distribution of companies by industry.

Industry	Number of Companies
Oil and Gas Industry	50
Automotive Industry	30
Information Technology Industry	40
Pharmaceutical Industry	20

Table 2 presents the changes in the number of companies over the past five years:

Table 2. Number of companies by year.

Year	Number of Companies
Year 1	100
Year 2	105
Year 3	110
Year 4	120
Year 5	130

Table 3 illustrates the number of companies before and after the implementation of tax law changes:

Table 3. Number of companies before and after tax changes.

Period	Number of Companies
Before Tax Changes	110
After Tax Changes	120

Analytical findings examine complex relationships and trends within the data, aiming to identify significant impacts. These findings analyze efficiency of companies and assess the effect of tax changes on companies, as illustrated in *Fig. 1*.

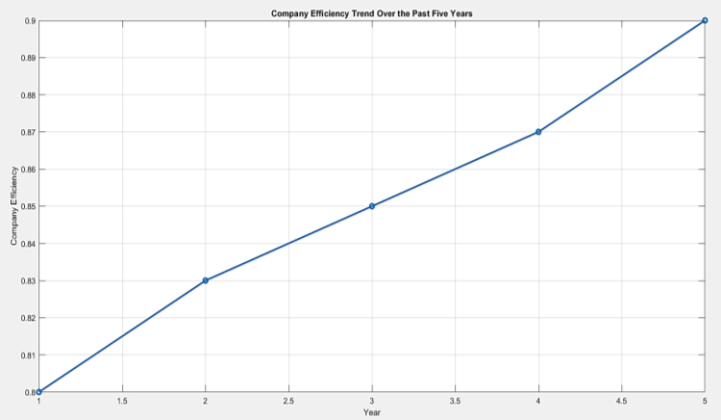


Fig. 1. Trend of changes in efficiency of companies over the past five years.

The analytical conclusion derived from these data indicates a continuous increase in efficiency of companies over the past five years. This clearly reflects an improvement in company performance in response to economic and tax changes (*Table 4* and *Fig. 2*).

Table 4. Comparison of efficiency of companies across different years.

Year	Efficiency of Companies
Year 1	0.80
Year 2	0.83
Year 3	0.85
Year 4	0.87
Year 5	0.90

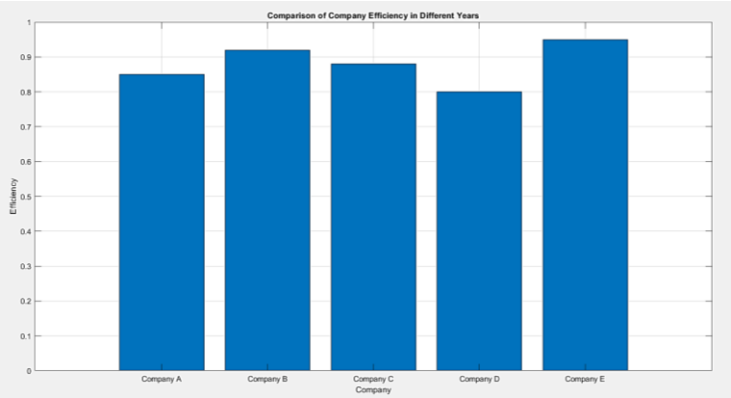


Fig. 2. Comparing efficiency of companies across different years.

Table 5 presents the efficiency scores of the selected companies, indicating variations in their operational performance.

Table 5. Efficiency of companies.

Company	Efficiency
Company A	0.85
Company B	0.92
Company C	0.88
Company D	0.80
Company E	0.95

The impact of tax policy changes on efficiency of companies is presented in the *Table 6*. It can be observed that many companies demonstrated improved efficiency after the tax reforms.

Table 6. Comparison of efficiency before and after tax changes.

Company	Efficiency Before Tax Changes	Efficiency After Tax Changes
Company A	0.80	0.85
Company B	0.85	0.90
Company C	0.78	0.82
Company D	0.82	0.87
Company E	0.75	0.88

The data indicate that most companies experienced an improvement in efficiency following the implementation of tax reforms, as shown in *Fig. 3*.

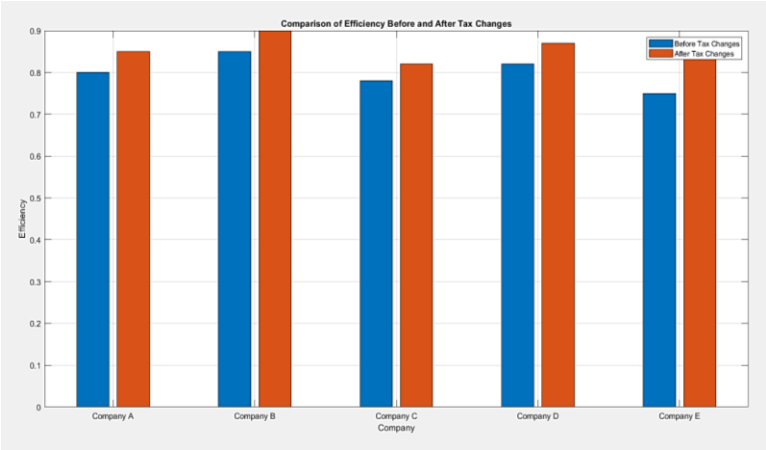


Fig. 3. Comparison of efficiency before and after tax changes.

The key findings of the analysis indicate that the efficiency of companies has steadily increased over the past five years. This upward trend suggests that companies have successfully improved their performance in

response to economic and tax changes. The continuous improvement in efficiency during this period reflects that organizations, by adopting appropriate strategies, have managed to adapt to new conditions and enhance their productivity.

One of the most significant findings of this study is the impact of tax changes on efficiency of companies. The results show that most companies have experienced a significant increase in efficiency following the implementation of tax reforms. This finding suggests that tax reforms, if properly designed and implemented, can positively influence corporate performance and create conditions conducive to productivity growth.

A comparison among the analyzed companies reveals that Company E has demonstrated the best performance among all firms. This company has achieved the highest efficiency improvement after the tax changes. This finding highlights the importance of managerial strategies and the ability to adapt to changing economic conditions. The superior performance of Company E can serve as a successful example for other companies in optimizing financial and operational processes in response to tax reforms.

4 | Discussion

The findings of this study indicate that tax law changes have a lasting impact on efficiency of companies and profitability. This finding contrasts with some previous studies that focused on the short-term effects of such changes [17]. Specifically, while prior research primarily reported a temporary decline in efficiency of companies during the initial periods of tax reforms [18], this study demonstrates that, in the long run, companies can experience positive effects by adjusting their management strategies and increasing productivity. This discrepancy may be attributed to factors such as the gradual adaptation of firms to tax changes and structural reforms that yield favorable results in the long term.

From a comparative perspective, studies that have examined the effects of taxation across different industries often suggest uniform impacts of these policies across all economic sectors [19]. In contrast, the findings of this research indicate that different industries respond differently to tax changes. For instance, in industries requiring long-term investments, such as information technology and pharmaceuticals, tax reforms may have different effects compared to sectors like oil and gas or automotive manufacturing. These findings align with recent research emphasizing structural differences among industries in response to tax policies [20].

Another key aspect that distinguishes this study is its emphasis on the role of managerial strategies in moderating the effects of taxation. Unlike some studies that have analyzed taxation as an independent factor [21], this research demonstrates that companies employing optimal managerial strategies have been able to mitigate potential negative impacts and leverage tax changes as an opportunity to enhance productivity. This finding suggests that tax policies alone do not determine efficiency of companies; rather, resource management and internal decision-making play a crucial role in the long-term success of firms.

Finally, in contrast to some studies that have examined tax reforms primarily from the perspective of government revenues and macroeconomic effects [22], [23] this study focuses on their impact on firm performance. This shift in perspective can help policymakers design tax systems that, in addition to achieving macroeconomic objectives, also consider their effects on efficiency of companies and competitiveness.

Considering these factors, the findings of this study indicate that if tax reforms are properly designed and implemented, they can contribute to the long-term improvement of corporate performance while also providing a solid foundation for more sustainable economic policymaking.

5 | Conclusion

The primary conclusion of this study highlights the importance of analyzing efficiency of companies in response to tax changes and the necessity of employing analytical tools such as Data Envelopment Analysis (DEA) in financial and managerial decision-making processes. The findings indicate that tax changes directly impact the long-term profitability of firms, and these effects can lead to either an increase or decrease in efficiency and financial performance. Therefore, in situations where tax regulations are subject to change,

forecasting corporate profitability using analytical models like DEA becomes particularly significant, as this model has demonstrated its ability to provide accurate predictions of tax impacts on profitability. Consequently, DEA serves as an effective tool for policymakers and managers in making informed financial and tax-related decisions. One of the most critical outcomes of this study is the necessity for continuous updates and thorough evaluations of tax policies. If tax changes are implemented timely and effectively, they can positively influence corporate profitability and efficiency. Hence, it is recommended that tax policymakers incorporate insights derived from analytical models such as DEA when designing and implementing tax reforms, particularly in response to economic crises and fluctuating market conditions. Utilizing data-driven approaches can help ensure that tax policies are structured to maximize economic benefits.

Corporate managers can also leverage DEA to predict the effects of tax changes on their firms' profitability and efficiency. These predictions enable them to refine their financial planning and managerial strategies more effectively. Given that DEA can illustrate tax impacts through precise efficiency comparisons across different fiscal periods, managers can make more informed decisions regarding financial adjustments and operational improvements. Furthermore, a key finding of this study is that the effects of tax changes may vary across different industries. For instance, firms operating in specific sectors may exhibit distinct responses to new tax regulations. Therefore, it is advisable that tax policies account for industry-specific differences to prevent adverse effects on particular sectors and to optimize economic outcomes.

Finally, this research suggests that future studies should further investigate the effects of tax changes on other financial and economic indicators while employing more advanced models for profitability and efficiency analysis. Additionally, examining corporate behavior in response to tax regulation changes across different countries and comparing these responses could provide valuable insights for policymakers and managers. Such efforts could contribute to more effective financial and tax decision-making and help create a favorable economic and financial environment for corporate growth and development.

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Author Contribution

M. Gh: conceptualized the study, designed the methodology, and conducted the data analysis. F. K. Y: contributed to data collection, interpretation of results, and manuscript writing. Both authors reviewed and approved the final version of the manuscript.

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Data Availability

The financial data analyzed in this study were obtained from the Tehran Stock Exchange. The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest related to this research.

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