



Research Paper

## Development of Data Envelopment Analysis Model for Financial and Social Evaluation of Companies Based on Stock Returns and Accounting Value

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### ABSTRACT

Corporate social responsibility has long attracted the attention of academics, researchers, NGOs, and the government, and has become an important aspect of corporate operations. Increasing the globalization of business, increasing the strategic importance of stakeholder relations and the growth of corporate image management are the three key factors and the main driver in increasing the importance of corporate social responsibility. Data envelopment analysis is a well-known methodology that is applied to evaluate the selected firms based on the most important features. Therefore, in this research, it is important to examine the social responsibility of companies with emphasis on stock returns and accounting value. For this purpose, information related to the member companies of the stock exchange during a ten-year period from 2010 to 2020 after performing the necessary statistical tests using linear regression and EViews 10 and SPSS 26 software to test We addressed the hypotheses. In this research, multivariate regression method has been used as a statistical method. The results show that there is no relationship between social responsibility and accounting value, but social responsibility has an inverse and significant relationship with corporate stock returns.

## 1 Introduction

The relationship between corporate responsibility and corporate profitability has become one of the most controversial issues today [1]. Many of the benefits of corporate social responsibility reflect the reasons companies use corporate social responsibility. Proponents of corporate social responsibility have given reasons for their use. One of these reasons is that corporate social responsibility is often a

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means of attracting, motivating and retaining talent. Organizations can investigate employees' reasons for staying and leaving the company. They can also examine their responses to different corporate social responsibility rates. In terms of staff motivation, recent research has shown that corporate social responsibility may lead to altruistic communications and contribute to implicit, trust-based and contractual use. Data Envelopment Analysis technique was presented in the CCR paper by Charnes et al. [10], and since then has been developed by various researchers. In this method, the relative efficiency of a set of DMUs which use similar types of (multiple) resources to produce similar types of (multiple) outputs is computed. Finally, DMUs are divided into two groups of efficient and inefficient DMUs. In ordinary DEA models, the input and output values are assumed to be definite [46]. Managers have always considered DEA to be a suitable instrument for evaluation of organizations' performance. This method as a nonparametric method which does not need the function of identified production, can enable managers and directors of organizations having corrective evaluation of self-set to have recognitions of capacity of self-power and weakness points in corrective path to attain the goals [27].

Evaluating the overall performance and monitoring the financial condition of commercial banks has been the focus of numerous research studies [45]. This methodology was proposed by Charnes et al. [10] for the first time and it is based on Farrell's [16] idea. Charnes et al. [10] proposed the first DEA model that was based on the constant returns to scale (CRS) assumption and it is called the CCR model. The company's social responsibility also increases employee motivation and reduces the need for systems for measuring and evaluating cost-effective performance. Corporate social responsibility efforts may lead to cost-effectiveness and cost savings in the value chain. In addition to employee motivational benefits, corporate social responsibility has other benefits in production and after-sales service. For example, a large number of companies have resorted to sustainable and biological forms of production, whereby design and production efforts are inspired by nature [44]. Milton Friedman is one of the people who has controversial views on corporate social responsibility. In an article entitled "Corporate Social Responsibility is to Increase Their Profits," he argues that the company's goal is to maximize shareholder returns, and since only individuals can have social responsibility, companies are only responsible for their shareholders, not in front of the whole community. According to Friedman, companies are artificial and have artificial responsibilities. He believes that managers represent the people who founded the company and therefore the first responsibility of managers is to them. By doing activities outside of the company's profitability by managers, in fact, the financial resources of shareholders, employees and even customers are spent in a way that they may not want.

Friedman states that individuals can, if they wish, use part of their funds through relevant organizations for social activities. He also points out that the entry of organizations into the field of social activities, in fact, their entry into a specialized field includes identifying needs, allocating resources and such activities, which are certainly more successful in specialized institutions than the government in its implementation and They cost less than each company entering the field on its own. In general, although Friedman argues that companies should abide by the laws of the society in which they operate, they claim that companies have no other responsibility to society [48]. Some critics believe that corporate social responsibility is in the hands of companies such as BP, McDonald and BAT, in order to cover up their destructive activities, or many companies use corporate social responsibility strategies to gain public satisfaction and presence in the global market. In addition, as consumers become more aware of the dangers that threaten the environment and limited natural resources, they turn to consuming products that further address their ethical and environmental concerns [2,3]. The need for maximum profit Perhaps the strongest reason for opposition to corporate social participation is related to the theorists of

classical economics, namely maximum profit. This theory was proposed in 1976 by Adam Smith. According to this theory, a company does a community-friendly job when it reduces its costs and increases its efficiency, thereby maximizing profitability. Therefore, if the managers of companies are motivated by the incentive to make a profit, competition will cause them to take steps in the public interest by reducing costs and consequently their prices [4-7]. Given the importance of social responsibility in the profitability and value of the company in this study, we intend to examine the relationship between corporate social responsibility with emphasis on stock returns and accounting value.

## 2 Theoretical Foundations and Research Background

Social responsibility is an issue that is currently being pursued in all developed countries and countries with open economies by all actors such as governments, corporations, civil society, international organizations and scientific centers. Governments look at corporate social responsibility in terms of segregation of duties and responsibilities and moving towards sustainable development. Companies see corporate social responsibility as a kind of business strategy that increases their credibility and market share in a highly competitive environment. Civil society and non-governmental organizations demand corporate social responsibility. Because they are aware of the financial scandals and catastrophes resulting from the performance of companies. International organizations, too, given that corporations are far more influential in today's world than governments. Solving global challenges is considered impossible without the participation of companies, and many politicians, who are also a kind of corporate managers, demand corporate social responsibility. Scientific centers also look at the social responsibility of companies from the perspective of the role of companies in the development of a country and even the development of democracy, the interference of duties, the responsibilities of a company with the government and the resulting overlaps. That is why in today's world of competition, the issue of corporate social responsibility has become a dominant paradigm in the field of corporate governance. The concept of social responsibility organizes activities around a specific framework that supports business and strengthens dialogue with key stakeholders [8,9]. Corporate social responsibility is a flexible concept while it is a method and a goal. Social responsibility is an integral part of an organization's strategy. The success of social responsibility in an organization indicates the extent to which that organization has been able to properly orient and respond to the needs of stakeholders while implementing its organizational model. Accountability means valuing the interrelated relationships that exist between the organization, stakeholders, the economic system, and related communities [11-15].

In Iran, the concept of social responsibility is not yet common due to its novelty, but the perception that industry owners have of corporate social responsibility is mainly in the areas of environment, charitable assistance, job creation and maintenance, efforts that lead to certifications such as compliance. The consumer is associated with organizational or environmental excellence and sponsors conferences and seminars, in other words, Iranian companies consider such activities as corporate social responsibility [17]. The issue of corporate performance has long been an important issue. One of the most important financial issues for companies today is measuring their performance. To what extent companies have tried to increase the interests of their shareholders, what indicators do banks and credit institutions consider in granting facilities to companies, and what dimensions do company owners consider in paying bonuses to managers? [33-38]. Finally, what government authorities pay attention to according to the legal requirements in relation to companies can be answered appropriately with methods of evaluating the performance of companies [18,19]. Managers represent the owners in exploiting their assets, in order to gain more benefits for the owners by accumulating the contributions of several people in order to

perform a single activity and use these assets more effectively. Because landlords benefit from the performance of these lawyers, it is necessary to evaluate their performance [25-29]. Landlords use criteria to control the performance of managers to encourage management to best use their resources to earn Use more wealth. In fact, the owners intend to make optimal use of the scarce resources that they have provided to managers. Owners tend to invest their limited resources where they bring the most returns. In fact, owners or investors have few resources and many opportunities ahead that by choosing one of these opportunities and investing in it, they lose the opportunity to invest in other options [41-43].

On the other hand, the goal of investors is to gain more wealth and profits. So, they choose the option that will bring them the most benefits, and those benefits should be enough to cover the cost of giving up other options. This is a decision and every reasonable investor should choose the option that is most expected to pay off. Now how to show the result of the company's activity and the results obtained in a reasonable and reliable way. The management labor market also puts a lot of direct pressure on the company to categorize managers based on their performance and determine their rewards. The application of these pressures is due to the undeniable fact that the operating company is always looking for new managers in a competitive labor market [20]. Managers also recognize that in the managerial labor market, their performance is used to determine the opportunity for wages outside the company, and to what extent managers have been able to play a role in increasing the wealth of stakeholders. The larger the company and the larger the number of shareholders, the less power it has to penetrate and access the company's information resources. Shareholders as an owner need to be aware of the performance of their representatives to make comparisons and decide whether to continue or discontinue the investment at the same time. Managers submit periodic financial reports to report on their performance. Shareholders can evaluate their investments with the information provided to them. The criteria that are considered in this regard are important from the point of view of both investors and managers. Investors always evaluate the performance of companies in order to identify favorable investment opportunities. What motivates shareholders to invest their savings in certain activities is the optimal performance of the industry, which will result in increasing the value of the company and ultimately increasing the wealth of shareholders [21]. Performance appraisal should be such as to indicate the extent to which an entity achieves its economic objectives. Performance appraisal will not only be useful as an evaluation of past activities, but also as a guide for decision makers in presenting some measurable goals for the future. To what extent companies have tried to increase the interests of their shareholders, what indicators do banks and credit institutions consider in granting facilities to companies, and finally, what are the governmental authorities considering in relation to the legal requirements regarding What points do companies pay attention to is one of the cases in which the results of evaluating the performance of companies give a proper answer to this question [22,23].

There have been various studies on the issue of social responsibility, some of which are discussed below. Derakhshan Mehr and Hamedanloo [13] investigated the relationship between disclosure of corporate social responsibility and the concurrence of stock prices with emphasis on institutional ownership in companies listed on the stock exchange. The results of their research showed that there is no relationship between corporate social responsibility and stock price concurrence and there is no relationship between corporate social responsibility in terms of environment and stock price at the same time and there is no relationship between corporate social responsibility in terms of employees and stock price. does not have. There is no relationship between corporate social responsibility in terms of community responsibilities and at the same time stock price. There is no relationship between corporate social responsibility in terms of community responsibilities and stock price concurrency. Mousavi et al. [32] examined the explanation of corporate social responsibility and its impact on the risk of falling stock prices; The

results show that there is no significant relationship between fulfilling corporate social responsibility and the risk of falling stock prices. Darabi and Salmanian [12], they researched and examined the relationship between social responsibility reporting and its dimensions including environment, employee welfare, social activity and energy consumption with value and risk of the company. The results of their research showed that there is a significant relationship between social responsibility reporting and company risk and value. Hajiha and Sarfaraz [20] examined the relationship between social responsibility and equity costs of companies listed on the Tehran Stock Exchange.

To measure corporate social responsibility as an independent variable, from the criteria set by the American Institute known as KALD, which ranked organizations according to social and environmental criteria each year, as well as to measure the cost of salaries. The shareholders used the Gordon model. Their research findings show that social responsibility has an inverse and significant relationship with equity costs. Thus, by increasing the disclosure of social performance, managers reduce the rate of return expected by investors (equity costs) and bring lower financing costs for the company. In other words, corporate responsibility information has informational content for investors. Badavar Nahandi et al. [9] investigated the relationship between social responsibility and the performance of companies listed on the Tehran Stock Exchange. The results of their research show that after controlling company size, financial leverage and systematic risk, there is a positive and significant relationship between social responsibility and company performance. Appuhami and Tashakor [3] examined the effect of audit committee characteristics on the disclosure of corporate social responsibility in Australian companies. The results of their research showed that there is a positive and significant relationship between the characteristics of the audit committee, such as size, independence and gender diversity of audit committee members and disclosure of corporate social responsibility. Wang and Sarkis [50] examined the effect of social responsibility disclosure on firms' financial performance and used the variables of asset return rate and cytochrome ratio as representative of firms' financial performance variables. Their results showed that liability disclosure variable Social has had a positive effect on both performance appraisal criteria. Han et al. [24] used the variables of equity rate of return, market value-to-book value ratio, and stock rate of return as representative of corporate financial performance variables. Their findings showed that of the social responsibility indicators, only the corporate governance index has a significant positive effect on corporate financial performance and environmental and social indicators of social responsibility have no effect on corporate financial performance. Zhang [52] presented evidence that improving social performance had a negative effect on the rate of return on assets, while it had a positive effect on the rate of return on property rights and the quota ratio. Monika et al. [34] in a study examined the relationship between corporate social responsibility with the concurrence of stock prices and the risk of falling stock prices. The results show that there is a relationship between corporate social responsibility and the stock price and the risk of falling stock prices.

Kim et al. [31] in a study on the relationship between corporate social responsibility and the risk of falling stock prices. The results show that there is a significant inverse relationship between corporate social responsibility and the risk of falling stock prices. Servaes and Tamayo [40] conducted a study entitled *The Impact of Social Responsibility on Company Value*. The results show that there is a positive relationship between corporate social responsibility and corporate value in companies where the level of customer awareness or public awareness is higher through the advertisements made by the company and for companies where customer or public awareness is low. This relationship is weak or negative. The results also showed that the effect of awareness on the relationship between social responsibility and corporate value is negative for companies that have little reputation in the community. Ferns and Prakash [17] examined the development of corporate responsibility reporting on corporations in Eastern

Europe and North America. The results of their research showed that the social reports published by European companies have a higher level of social response than North American companies. In Eastern Europe, the quality of social reporting varies from country to country, but they have more detailed social reporting topics than similar companies in North America.

The data envelopment analysis of mathematical programming formulation is based on a technique that develops efficient frontiers with the efficiency related to each decision-making unit in a DEA problem set on the concept of evaluating the performance of decision-making options based on the performance of outputs created through input consumption. The key DEA models are classified into two categories of CCR and BCC, each can be assessed in two input-based and output-based methods [1]. However, these methods are different in terms of constant or variable returns to scale. In the CCR method, the constant return to scale is assumed, whereas the variable return to scale is considered in the BCC model. In this regard, the constant return to scale means that outputs will change as much as the inputs change. For instance, if inputs are doubled, the outputs will be doubled. However, variable return to scale means that outputs are not changed relative to inputs [39]. The assumption of constant return to scale is applicable when firms operate at an optimal scale. Nonetheless, different issues such as competitive effects and limitations lead to firms' failure to operate at an optimal scale. Using the assumption of constant return to scale will result in the impairment of the values calculated to technical efficiency when all firms do not operate at optimal scale (Izadikhah 2018). In this study, the assumption of a variable return to scale was considered, which seems logical since commercial units do not usually operate at optimal scale. Whether we consider the problem as an input or output depends on the implementation goal, which can be either maximizing output or minimizing input. Given the fact that our goal was maximizing the output (increasing the level of risk disclosure), the BCC model of DEA with an output nature was selected to estimate the efficiency score of DMUs. The CCR model is the first data envelopment analysis model which takes its name from the initials of its creators (Charnes, Cooper, Rhodes). In this model, to determine the highest efficiency ratio and to involve the amount of inputs and outputs of other decision-making units in determining the optimal weights for the unit under study, the following basic model was proposed:

$$\begin{aligned} \text{Max: } & \frac{\sum_{r=1}^s u_r y_{ro}}{\sum_{i=1}^m v_i x_{io}} \\ \text{s. t. : } & \frac{\sum_{r=1}^s u_r y_{rj}}{\sum_{i=1}^m v_i x_{ij}} \leq 1, \end{aligned}$$

$$j = 1, 2, \dots, n, \quad u_r \geq 0 \quad v_i \geq 0$$

This model is named using the initials of its creators, Banker, Charnes, and Cooper. Unlike the CCR model, which assumes a constant return to scale ratio, the BCC model assumes a variable return to scale ratio. To scale, by calculating technical efficiency in terms of scale efficiency and management efficiency, a very detailed analysis is provided. To build input-oriented and output-oriented models in the main BCC model, the same principles of the CCR model are used in the model. Input-oriented efficiency increases with decreasing inputs, but in the output-oriented model, efficiency increases with increasing inputs. The BCC multiplicative model with the input-oriented form is as follows:

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

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

$$\sum_{r=1}^s u_r y_{rj} - \sum_{i=1}^m v_i x_{ij} \leq 0 \quad j = 1, 2, \dots, n \quad v_i \geq 0 \quad u_r \geq 0$$

In this part, we elaborated on research findings after assessing the performance of banks active in the banking industry of Iran based on a quantitative criterion (i.e., DEA), applying the output-based BCC model with a variable return to scale in order to rank the banks. The following model was designed after assessing the mechanisms of corporate governance in banks and extracting data related to risk disclosure in the text of financial reporting:

Inputs included: major shareholder, board independence, the duality of CEO duties

Outputs included: positive risk disclosure words, negative risk disclosure words, capital adequacy ratio

In the present study, the variable assessed was risk disclosure. First, financial reporting were evaluated for the first level of critical discourse analysis based on Norman Fairclough’s model, followed by assessing the text in terms of disclosure of positive or negative risk words.



Fig. 1: Data Envelopment Analysis Model

### 3 Research Methodology

This study is correlational in nature and content, which analyzes the correlation relationship using secondary data extracted from the financial statements of companies listed on the Tehran Stock Exchange. This research has been done in the framework of deductive-inductive reasoning. The reason for using the correlation method is to discover the correlation relationships between the variables. In the present study, we will first test the correlation between research variables and if there is a correlation between research variables, we will estimate multiple regression models. On the other hand, the present study is post-event (quasi-experimental), ie it is based on the analysis of past and historical information (financial statements of companies). This research is also a library and analytical-causal study and is based on the analysis of panel data (data panel). The research is considered as an applied goal and as a descriptive-correlation method.

First model of the research

$$BV_{i,t} = \alpha_0 + \beta_0 CSR\_SCORE_{i,t} + \beta_1 INF_{i,t} + \beta_2 Size_{i,t} + \beta_2 Lev_{i,t} + \varepsilon_{i,t}$$

Second model of the research

$$R_{i,t} = \alpha_0 + \beta_0 CSR\_SCORE_{i,t} + \beta_1 INF_{i,t} + \beta_2 Size_{i,t} + \beta_2 Lev_{i,t} + \varepsilon_{i,t}$$

In the above models of social responsibility, the independent variables, the variables of stock return and accounting value are the dependent variables and the variables of inflation rate, company size and financial leverage are control variables.

**Social Responsibility (CSR\_SCORE):** Social responsibility is obtained from the sum of the results of the following 4 criteria:

Community: If the company has a training support program for members of the profession or industry or community, it is equal to one, otherwise it is equal to zero.

Diversity: The logarithm of the number of board members is used

Environment: Two criteria have been used to measure this variable:

1- The ratio of fixed assets to total assets

2- If the company has ISO 14000 certification, it is one, otherwise it is equal to zero

Product characteristic: The ratio of research and development and advertising costs to sales is used.

Research dependent variables are:

**Accounting Value (BV):** In order to calculate the book value of the company, we consider the book value. To do this, we accumulate the accumulated price minus depreciation

**Stock returns (R):**

$$\text{Stock returns} = \frac{(P_{t+1} + P_t) + D}{P_t}$$

$P_{t+1}$  : Share price at the end of the period

$P_t$ : Share price at the beginning of the period

$D$ : Cash profit

Also, the control variables of the present study include the following components:

**Inflation Rate (INF):** Inflation can be obtained by extracting from statistical sites and the central bank.

**Company size (SIZE):** The natural logarithm of the company's assets

**Financial Leverage (LEV):** The following equation is used to measure this variable. In this regard:

$$\text{Leverage}_{i,t} = \frac{\text{Debt}_{i,t}}{\text{Asset}_{i,t}}$$

$\text{Leverage}_{i,t}$  : Company financial leverage  $i$  in year  $t$

$\text{Debt}_{i,t}$ : Total debt of company  $i$  at the end of year  $t$

The hypotheses of the present study are as follows:

1- There is a significant relationship between social responsibility and accounting value of companies in inflationary conditions.

2- There is a significant relationship between social responsibility and stock returns of companies in inflationary conditions.

In this section, we describe the multiplier CCR model. Suppose  $DMU_j (j = 1, \dots, n)$  is a set of homogeneous DMUs that consume  $m$  inputs,  $x_{ij} (i = 1, \dots, m)$ , to produce  $s$  outputs,  $y_{rj} (r = 1, \dots, s)$ . If

$DMU_o$  is the unit under evaluation, its efficiency is measured using the following model, known as the multiplier CCR model (Charnes et al. [10]).

$$\begin{aligned} \theta_o^* &= \max \sum_{r=1}^s u_r y_{ro} \\ \text{s.t.} &: \sum_{i=1}^m v_i x_{io} = 1 \\ &\sum_{r=1}^s u_r y_{rj} - \sum_{i=1}^m v_i x_{ij} \leq 0 \quad j = 1, \dots, n \end{aligned} \quad (1)$$



$$u_r, v_i \geq 0 \qquad r = 1, \dots, s \qquad i = 1, \dots, m$$

$u_r$  and  $v_i$  indicate the relative importance of the output and input vectors, respectively.

**Definition**  $DMU_o$  is efficient if and only if  $\theta_o^* = 1$ .

## 4 Research Findings

The findings of this study can be stated as follows.

### 4.1 Descriptive statistics of research variables

A summary of the status of descriptive statistics related to model variables after screening and deletion of outlier data using Eviews10 software is presented in Table 1.

**Table 1:** Descriptive statistics related to research variables

	Accounting Value	Stock Return	social responsibility	Inflation Rate	Financial Leverage	Company Size
mode	4687.72	968783.9	0.923	19.568	1.015	5.717
mean	2645	0	0.842	21.5	0.697	5.612
Max	42193	50961796	1.676	37.36	58.989	8.359
Min	408	-23333613	0.648	9.25	0.012	3.542
Std. Dev.	5351.95	4689927	0.236	9.238	2.112	0.858
skewness	2.684	6.978	1.168	0.567	21.118	0.361
Elongation	12.508	6.052	3.482	2.073	56.8198	3.199
quarter	4982.809	169062.6	237.954	89.628	13406993	23.465
Prob.	0.000	0.000	0.000	0.054	0.000	0.000

According to the observations of Table 1, the highest deviation of the specified criterion is the variable of return on assets, and it indicates that this variable has many fluctuations and the lowest scatter of data is related to social responsibility. Also, market value, stock returns and financial leverage are skewed and stretched at the same time, and among all variables except the inflation rate, stretch is observed. Jark test statistics - does not confirm the normality of research variables. Since the p-value of the variable of the producer price index is less than 0.05, it indicates that the data of this variable is not normal. But the inflation rate variable has a normal distribution.

### 4.2 Shapiro-Wilk Normality Test

The philosophy of the Shapiro-Wilk test is similar to that of a few. In this test, a regression relationship is considered between the sequential statistics of the data and the expected values of the ordinal statistics of the normal distribution, and the test statistic is something like a coefficient of determination in regression that the higher it is, the closer the data distribution is to The distribution is normal and small values of test statistics refute the null hypothesis (normal data distribution). The Shapiro-Wilk test is based on a regression relationship or correlation analysis between sequential statistics and their desired values.

**Table 2:** Shapiro-Wilk normality test

Variables	Statistic	Degree of Freedom	Sig
Stock Return	.2670	983	.000
Accounting Value	.6970	983	.000
social responsibility	.8490	983	.000
Financial Leverage	.5890	983	.000
Company Size	.9870	983	.000

Usually if the significance level in the Shapiro-Wilk test is shown in this table with sig. The display is greater than 0.05. The data can be assumed to be normal with high confidence. Otherwise, it cannot be said that the data distribution is normal. Therefore, the hypothesis that the distribution of these variables is normal at the 95% confidence level is rejected and indicates that the dependent variables do not have a normal distribution and we must use non-parametric test to examine the correlation between variables.

### 4.3 Correlation Between Research Variables

In this section, using Spearman correlation coefficient, the relationship between research variables and the correlation between them is investigated and analyzed by SPSS 62 software. The matrix of correlation coefficients between the research variables is presented in Table 3.

**Table 3:** Spearman correlation

		social re- sponsi- bility	Ac- counting Value	Stock Return	The in- flation rate	Financial Leverage	Com- pany Size
social re- sponsibility	Spearman correlation	1					
	Prob.						
Accounting Value	Spearman correlation	-.014	1				
	Prob.	.664					
Stock Re- turn	Spearman correlation	.068*	.044	1			
	Prob.	.019	.167				
The infla- tion rate	Spearman correlation	-.013	.001	-.037	1		
	Prob.	.647	.974	.201			
Financial Leverage	Spearman correlation	-.056	-.011	-.009	.025	1	
	Prob.	.054	.727	.751	.380		
Company Size	Spearman correlation	.025	.002	.000	-.021	-.235**	1
	Prob.	.393	.957	.989	.460	.000	

According to the results of Spearman test, stock returns are positively correlated with social responsibility and also financial leverage is negatively correlated with company size. But there is no correlation between other research variables.

### 4.4 Reliability Test

In this section, first, the static or reliability of research variables was investigated. Hadri test was used to evaluate the reliability. The results of this test are shown in Table 4.

**Table 4:** Hadri Test

Variable	t-Statistics	P-value
Accounting Value	5.94076	0.000
Stock Return	7.81542	0.000
social responsibility	7.80923	0.000
The inflation rate	12.7414	0.000
Financial Leverage	5.66156	0.000
Company Size	7.54620	0.000

According to the results of Table 4 of this test, because the value of P is less than 0.05, all variables are at a stable level during the research period. This means that the mean and variance of the variables have been constant over time and the variance of the variables has been constant between different years. As a result, the use of these variables in the model does not cause false regression.

### 4.5 Chaw Test

To properly determine the estimation of the regression model, one must first examine whether there are heterogeneities or individual differences. If there is heterogeneity, the panel data method is used, otherwise the Pooled method is used. Therefore, the Chow test is performed to determine the application of the fixed effects model versus the integration of whole (integrated) data. The hypotheses of this test are as follows:

$H_0$ : Pooled Model

$H_1$ : Panel Model

**Table 5:** Chaw Test Results

Test effects	Statistics Value	D.F.	Prob.	Results	Hypothesis
<b>F Chi-Square</b>	9.347286	(117,1006)	0.000	Panel Data Model	First
	825.425342	117	0.000		
<b>F Chi-Square</b>	19.715661	(85,722)	0.000	Panel Data Model	Second
	645.358599	92	0.000		

The results of the Chow test show that the p value in the model is less than 0.05, so the  $H_0$  hypothesis is rejected and the  $H_1$  hypothesis is confirmed, so it can be concluded that individual heterogeneity (invisible individual effects). There is and should be used panel data method to estimate the model. As a result, the Hausman test is performed to determine the use of the fixed effect model versus the random effect model in the next step.

### 4.6 Hausman Test

The Hausmann test is based on the existence or absence of an association between regression error and model-independent variables. The hypotheses of this test are:

$H_0$ : Random Effect

$H_1$ : Fixed Effect

**Table 6:** Hausman Test Result

Chi-Square statistics	Degree of Freedom	P-value	Test Result	Hypothesis
19.668	12	0.021	Constant	First
23.880	12	0.021	Constant	Second

As Table 6 shows, the value of P is less than 0.05, which means that there is a relationship between the estimated regression error and the independent variables, so Hypothesis H0 is rejected and Hypothesis H1 is accepted. According to the results of Chow test and Hausman test, the most appropriate method for estimating the hypothesis test is the fixed effects model.

#### 4.7 Test Results of the First Research Hypothesis

The first hypothesis of this study is the relationship between social responsibility and accounting value of companies in inflationary conditions. This hypothesis is estimated using model (1) as panel data as follows:

$$BV_{i,t} = \alpha_0 + \beta_0 CSR\_SCORE_{i,t} + \beta_1 INF_{i,t} + \beta_2 Size_{i,t} + \beta_3 Lev_{i,t} + \varepsilon_{i,t}$$

**Table 7:** Results of Estimating the First Research Model

Variables	Symbols	Coefficient	Standard Error	t-Statistics	Probability	Result
Width of origin	C	46.895	495.313	9.384	0.000	
social responsibility	CSRSCORE	-39.221	382.938	-1.024	0.306	Confirm
The inflation rate	INF	3.931	20.508	0.192	0.848	Reject
Financial Leverage	LEV	15.117	70.384	2.218	0.027	Confirm
Company Size	SIZE	27.193	109.339	0.249	0.804	Reject
F-test:8.535	Probability :0.000		The coefficient of determination: 79.44			
Durbin-Watson Test: 1.855			Adjusted coefficient of determination: 81.63			

According to the results of Table 7, the amount of F statistic and its significance level is less than 0.05, so the null hypothesis is significant with 95% confidence and based on the available data is well able to express the dependent variable. Also, according to the coefficient of determination, about 79% of the changes of the dependent variable are expressed by independent and control variables. Watson camera statistic with a value of 1.85 shows that the residuals in the regression are not autocorrelated. According to the t-statistic of social responsibility with a value of -1.024 and the significance level of this test, which is less than 0.05 and is equal to 0.306, the existence of a significant relationship between social responsibility and accounting value is rejected and the first main hypothesis is accepted.

In the first main model of this research, among the control variables, only financial leverage, with a statistical value of 2.218 t and a significance level of less than 5% with a value of 0.027, has a direct and significant relationship with the accounting value of companies. But other control variables in this model have no significant relationship with the accounting value of companies due to having a p-value greater than 0.05. According to the findings of the table above, the estimated regression model of the first hypothesis is as follows:

$$BV_{i,t} = 46.895 - 39.221 CSR\_SCORE_{i,t} + 3.931 INF_{i,t} + 27.193 Size_{i,t} + 15.117 Lev_{i,t} + \varepsilon_{i,t}$$

### 4.8 Test Results of the Second Research Hypothesis

The second hypothesis of this study is the existence of a significant relationship between social responsibility and stock returns of companies in inflationary conditions. This hypothesis is estimated using model (2) as panel data as follows:

$$R_{i,t} = \alpha_0 + \beta_0 CSR\_SCORE_{i,t} + \beta_1 INF_{i,t} + \beta_2 Size_{i,t} + \beta_3 Lev_{i,t} + \varepsilon_{i,t}$$

**Table 8:** Results of estimating the second research model

Variables	Symbols	Coefficient	Standard Error	t-Statistics	Probability	Result
Width of origin	C	4.520	0.974	5.434	0.000	
social responsibility	CSRSCORE	-0.682	0.167	-5.728	0.000	Confirm
The inflation rate	INF	-1.295	0.297	0.899	0.369	Reject
Financial Leverage	LEV	-1.237	0.277	-2.428	0.015	Confirm
Company Size	SIZE	-0.153	0.120	0.501	0.616	Reject
F-test: 1.839		Probability : 0.000		The coefficient of determination: 79.628		
Durbin-Watson Test: 2.155		Adjusted coefficient of determination: 81.112				

According to the results of Table 8, the amount of F statistic and its significance level is less than 0.05, so the null hypothesis is significant with 95% confidence and based on the available data is well able to express the dependent variable. Also, according to the coefficient of determination, about 51% of the changes of the dependent variable are expressed by independent and control variables. Watson's camera statistic with a value of 1.65 shows that the residuals in the regression do not have autocorrelation. According to the social responsibility t-statistic with a value of -5.728 and the significance level of this test, which is less than 0.05 and equal to 0.000, the existence of a significant relationship between social responsibility and stock returns of companies is accepted and the main hypothesis.

The second is confirmed. In the second model of this study, among the control variables, only financial leverage, with a statistical value of -2.428 t and a significance level of less than 5% with a value of 0.015, has an inverse and significant relationship with the stock returns of companies. But other control variables in this model have no significant relationship with the accounting value of companies due to having a p-value greater than 0.05. According to the findings of the table above, the estimated regression model of the first hypothesis is as follows:

$$R_{i,t} = 4.520 - 0.682 CSR\_SCORE_{i,t} - 1.295 INF_{i,t} - 0.153 Size_{i,t} - 1.237 Lev_{i,t} + \varepsilon_{i,t}$$

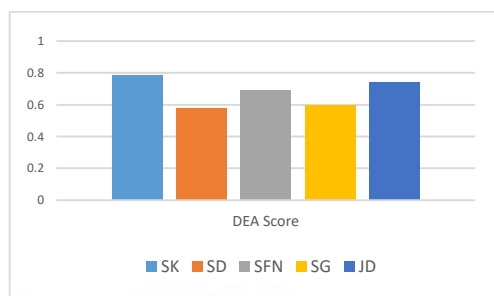
### 4.9 Financial Evaluation Using Data Envelopment Analysis

In the final stage, that the main criteria are established, we employed the selected criteria to rank the 86 member companies of the stock exchange during a ten-year period from 2010 to 2020. The well-known DEA method is applied. The obtained results are described in Table 9. The name has been stated as their abbreviations to protect the anonymity of the company. The analysis is done based on the general scenario. Due to simplicity, only the top five companies are showed. Table 9 illustrates the results. The company SK has been recognized as the best by considering all criteria.

**Table 9:** General evaluation by means of DEA models

	DEA Score	Rank
SK	0.7826	1
SD	0.5768	4
SFN	0.6919	3
SG	0.5987	5
JD	0.7422	2

Fig. 2 illustrated the status of the firms.

**Fig. 2:** Efficiency of units

## 5 Discussion and Conclusion

In this study, a model of corporate social responsibility characteristics was presented with emphasis on stock returns and accounting value. According to the results of the test of research hypotheses, the first hypothesis of the research is about the significant relationship between social responsibility and accounting value of companies in the economic crisis. Which is less than 0.05 and is equal to 0.306, the existence of a significant relationship between social responsibility and accounting value was rejected and the fourth main hypothesis was accepted. Also, the second hypothesis of the study is about the significant relationship between social responsibility and stock returns of companies in an economic crisis. And equal to 0.000, the existence of an inverse and significant relationship between social responsibility and stock returns of companies is accepted and the second main hypothesis is confirmed. In this regard, the results of this study are in line with the results of Kurdistan et al. [30,47,49,51].

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