Optimizing a multi-objective model to determine the optimal extent of voluntary information disclosure

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ABSTRACT

The purpose of this study is to determine the optimal level of voluntary disclosure by considering the accounting, market and combined performance criteria of those companies listed on Tehran Stock Exchange by different industries. In this research, we intend to use the Games software to turn the functions of a multi-objective problem into a single-objective problem. Objective functions include maximizing a variety of corporate performance metrics. To obtain values in the functions, the comprehensive criterion method (Lp-Metric) is used which was obtained by using mathematical equations of optimal voluntary disclosure values in different industries. For this purpose, the data related to 108 companies listed on Tehran Stock Exchange from 2009 to 2019 in 8 industries were collected separately. The present research is method-analytical-mathematical and applied in terms of purpose. The results show that from the 8 industries during the research period, the ceramic tile industry has the lowest optimal rate of voluntary disclosure and the automotive and spare industry parts have the highest optimal rate of voluntary disclosure. The optimal rate of voluntary disclosure indicates that those industries that are more important have the highest rate of optimal disclosure.

Keywords:

Voluntary Disclosure, Corporate Performance, Optimization, LP-pemetric Method.

1. Introduction

With the separation of ownership from management and the existence of conflicting goals between the agent and the broker, problem-related to agency will arise. Part of these problems are due to the lack of financial information available to investors, that is companies that provide additional and voluntary disclosure of information about their activities improve good relationship between the agent and the broker. In recent years, the dissatisfaction of investors, financial markets and other key stakeholders with the mandatory financial reporting of companies has led to an increase in the demand for voluntary comprehensive information on the long-term leadership and the performance of managers. This dissatisfaction has been the attention of scientific associations, legal and professional authorities around the world (Boesso & Kamar, 2007). In relation to agency, the manager has information advantage. Management might take actions that are in conflict with the interests of other stakeholders. Voluntary disclosure provides a better opportunity to apply agency theory, that is to say, the management, which has better access to the company's private information than foreign owners and investor, can establish reliable communications in the market to increase the value of the company by decrease agency costs (warui waweru, 2018). In other words, it can be said that more voluntary disclosure will enable investors to make better judgments about the company and identify potential misuse of resources by company managers (Setayesh et al., 2014). The company's performance shows the success rate of the company in achieving the its goals and maintaining and improving performance in today's competitive world to satisfy the demands of shareholders and also attract new investors, which in turn it has become essential. Therefore, it is claimed that companies' performance is often considered by investors, creditors, managers and governments (Asadi et al., 1397).

Therefore, identifying and considering the factors affecting the performance of companies has become very important. One of these influential factors is the level of voluntary disclosure. In fact, the performance of the company by determining the optimal level of voluntary disclosure is an influencing factor on the main goal of the company, which is maximizing the wealth of shareholders. A company that is not profitable cannot survive in the market for long. Lack of consideration to the optimal level of disclosure may cause serious problems for the company. Therefore, the optimal level of voluntary disclosure is important in a way to increase the liquidity of stocks, shareholder's wealth and improve the performance of companies and ultimately the continuity of business activities. In this regard, the question in this study is whether it is possible to determine the optimal level of voluntary disclosure in different industries related to companies listed on Tehran Stock Exchange by considering the performance of companies.

2. Theoretical Foundations and Rresearch question

During the last decades, financial crises in America and European countries have caused different issues, including information transparency and voluntary disclosure in financial reporting processes to be considered deeply by professional associations (Akhgar & Ghorbani, 2019). Voluntary disclosure usually consists of the information that is related to companies' strategies, competitive issues, productive activities, marketing strategies, and human capital matters. Even with an increase in mandatory disclosure, companies attempt to provide voluntary information constantly. Therefore, the motivation of such behaviours has attracted a lot of attention which in turn leads to the issue of voluntary disclosure being attractive (Setayesh et al., 2014). Providing voluntary information on the identification, measurement, and disclosure of accounting items in the financial statements would attract investors and improve the financial condition and management image of the company effectively (Iatridis & Alexakis, 2012). Another important result of voluntary disclosure is the abetment of uncertainty which in turn would reduce the need to monitor management activities and consequently increases the value of the company (Gitzmann & Trombetta, 2003). Undoubtedly, disclosure an important consideration in CEO supervision, and may therefore influence agency problems. In addition, a better understanding of investors of the manager regarding prognosticating potential economic changes increases the value of the company and the managers are able to provide voluntarily their predicated information concerning the future economic environment of the company and to provide management profits forecasts which heighten

the value of stocks and the competitive position of the company in related-industry in the capital market as well. However, having commercial benefits, voluntary disclosure imposes costs on companies .Theory of voluntary disclosure, in this regard, claims that managers would disclose the information if the advantages of disclosure outweigh its costs (Heitzman et al., 2010). Managers may prefer a level of voluntary disclosure that reduces user's awareness, therefore the quality of information (such as completeness, reliability, accuracy, and timeliness) prepared and provided by the managers may not have the expected quality of Users outside the organizations (Harvey & Roper, 1999). Thus, it is increasingly important to get more companies to address the issue of transparency and there improving the level of voluntary disclosure of information. In global exchanges, public policy discussions regarding corporate voluntary disclosure reveal that an increased level of voluntary disclosure is a key to achieve the desired change in transparency. The companies which are responsible for this change often describe the increased in the level of voluntary disclosure as providing the information needed for greater transparency (Gul & Leung, 2004). On the other hand, managers concern about additional costs that may generate asymmetric information and agency costs for shareholders as well, which would lead to the destruction of the balanced atmosphere of trust (Hermalin & Weisbach, 2012). By increasing the level of voluntary disclosure of companies, investors can gain more accurate information about the current situation and future strategies of the company in which a mechanism is created which reduces the opportunistic behaviours and self-centred decisions of managers (Mahdavi & Alizadeh Talatapeh, 2014). As a result, to gain the trust of investors to invest in the capital market, the companies could boost transparency in Provide both financial and non-financial information. To intensify transparency, companies can make a decision to expand their disclosure policies and accordingly take voluntary disclosure as an important economic tool (Hamidian et al., 2017). The most compelling reason for emphasizing voluntary disclosure and transparency is that these two lay the foundation for maintaining the interests of shareholders. Complete or full disclosure approaches along with transparency in reporting can create a safe condition and ensure that the interests of investors are protected. Moreover, the research has

shown that voluntary disclosure has a positive effect on company performance and protects shareholders and stakeholders' interests. In other words, the lack of transparency of information and ambiguity in financial reporting may lead to suspicion and immoral behaviours along with devaluation (Madhani, 2009). Recent research has also indicated that increasingly voluntary information would heighten the company's value, accordingly, it reduces the cost of financing (Orens et al., 2009). Most of the previous studies have also concluded that further voluntary disclosure would reduce information asymmetry and reduce the cost of capital (Diamond and Verrecchia; 1991). Most shares of the company can trade by reducing the information asymmetry between the company and the market. In this way, the liquidity of stocks will increase and will attract large investment institutions. Thus, with an increased in demand, not only the company's stock price but also the company's performance would rise (Botosan and Plumie, 2002). According to the above mentioned, company managers can take the advantage of voluntary disclosure of information which influences both the performance and profitability of companies (Setayesh et al., 2014). The optimal level of disclosure is the level in which the company's performance would achieve to its best (or the highest) possible level; based on the effect of disclosure on performance, by increasing disclosure and exceeding the optimal level of disclosure, it is expected that the company's performance may decrease. Increasing information disclosure and its effect on reducing information asymmetry, and solving the problems related to improper selection and improving the company's performance, the rate of deviation from the optimal level of disclosure reduces the company's performance.

Different results have been reported concerning disclosure and firm performance (Garay & Gonzalez, 2010; Line et al., 2013). On the one hand, increasing the level of company disclosure leads to an increase in the cost of stock capital and will negatively affect the company's performance (Dhaliwal et al., 2011). On the other hand, companies will increase their reputation by disclosing more information to their users, which will help them gain more attention, support and legitimacy from shareholders and the community (Dawod & Charfeddine, 2018). Research has shown that voluntary disclosure has a positive effect on company performance and protects the interests of shareholders

and stakeholders. So far, no research has been conducted to determine the optimal level of disclosure at local and abroad. Internal and external research in the field of disclosure and performance, including Hassan et al. (2009), in an article investigated the relationship between mandatory and voluntary disclosure and the value of company in Egypt. The results of this study demonstrated that there is no significant relationship between voluntary disclosure and company value, but there is a significant negative relationship between mandatory disclosure and company value.Uyar and Kilich (2012) determined the potential for value creation through voluntary disclosure. The results of this study showed that companies that provide more voluntary disclosure are more valuable to investors, and this increases the value of these companies. PingYang (2013) examined information feedback, adverse selection, and optimal disclosure policy. The results of the study suggest that disclosing part of the advantage of traders' information from obtaining information, it will reduce private incentives to obtain information, and thus has two opposite effects on monetary value. On the one hand, the information gap limits the knowledgeable and less knowledgeable traders and improves the liquidity of the company's stock. On the other hand, this in turn reduces the information feedback from the stock exchange for actual decisions. These transactions determine the optimal disclosure policy. This model explains why company value can be higher in an environment that simultaneously promotes information disclosure and the production of private information, and therefore makes firm growth are being more ambiguous than values. Jankangard (2014) in a study carried out the test of optimal disclosure hypothesis. The research results showed that the optimal disclosure hypothesis predicts the costs associated with voluntary disclosure will lead to an optimal disclosure that maximizes the value of the company. Banerjee et al. (2014) examined the effect of disclosure on market-based performance and accounting. They found that the effect of disclosure on market-based performance is very weak and positive and the effect of disclosure on performance based on accounting is significant and negative.

Hamrouni et al. (2015) concluded that there is a positive relationship between the level of disclosure and the rate of performance of the company. Sharafoddin and Davood (2018) in an article entitled "The Impact of Total, Mandatory, Optional Disclosure on Company Performance in Market Development" examined the relationship between the company disclosure and the company performance on Kuwait Stock Exchange. The results of their study revealed that the linear relationship between total, mandatory and voluntary disclosure and firm performance is not significant, while there is strong evidence for a non-linear relationship between types of disclosure and proxy firm performance. In particular, they found strong evidence for u-shaped relationship between disclosure and corporate performance. Setayesh et al. (2014) in a study determined the relationship between voluntary disclosure and the performance of companies listed on Tehran Stock Exchange. They concluded that there was no significant relationship between voluntary disclosure and return on assets and return on equity; whereas, there is a significant positive relationship between voluntary disclosure and performance scores calculated as a comprehensive measure of performance. Khoshtinat et al. (2018) investigated the effect of earnings management on the level of disclosure and actual financial performance of companies listed on Tehran Stock Exchange. The results show that company disclosure is likely to lead to benefits, but after an optimal level, increasing disclosure reduces the firm's actual financial performance. In addition, this optimal level does not change when there is a difference between corporate supervision conditions (for example, an independent board of directors). These results show that strict supervision on senior executives has no effect on further disclosure of the company.

In this study, the effect of voluntary disclosure indicators on the performance of companies and according to its influence and utilizing mathematical modeling to determine the optimal level of voluntary disclosure of information of companies listed on stock exchange of companies in different industries. Therefore, based on the previous studies and the theoretical foundations of the subject, in this research, the main research question has been posed as follows:
Q: What is the optimal level of disclosure - performance change in each industry?

3. Optimization
Optimization seeks to find the best achievable value of a defined objective function over a given range of

values. The simplest mode of the objective function is to minimize or maximize the real function by systematically selecting real values or correct numbers from a set of values (Amiri and Poorkazemi, 2012). In the process of finding the best acceptable answer, one must consider both the limitations and the needs of a problem. A problem may have various answers, for which the objective function is defined to compare them and select the optimal solution. The choice of this function relies on the nature of the problem (Blum and Roli, 2008). A division of optimization methods includes local optimization and global optimization. In the local optimization method, it starts from an initial hypothetical point and continues to find the extreme point, and if the first and nearest extreme point is found, it introduces it as the optimal point; these methods cannot optimize the functions that have many local minima and maxima. The solution is to optimize using global optimization. There are two types of them (definite and probabilistic methods). In definite methods, the answer search space is checked in full count to determine the optimal value. In probabilistic methods, the response space is randomly checked and a good response is introduced that can also be optimal (Ramjin and Smith, 1994).

4. Research Method

The present research is analytical-mathematical in terms of method. The goal is to optimize, search and select the best value. Preparing a model of optimization problems consists of three steps: a) Definition of decision variables (including independent and dependent variables), b) Definition the objective function, and c) Extraction of constraints (Mehregan, 2009). In this study, in the first step, the independent and the dependent variables (input and output variables) were identified. Then, using the comprehensive benchmarking method (LP Metric), the relationship between independent and dependent variables of the research and in general, the research objective function was formulated and the limitations of the research variables were determined. Finally, the optimal values of voluntary disclosure of companies listed on Tehran Stock Exchange were optimized by industry (objective function optimization). The comprehensive benchmarking method (LP-metric) is a multi-criteria decision-making method (MCDM) that solves multi-objective decision models (MODEM). The ideal and comprehensive benchmarking

techniques are methodologies used in decision making with multiple criteria. These approaches have common roots and use a definite target point in the standard space to model decision-maker preferences. This definite target point according to the ideal planning technique is to take the expectation levels, which represent the most desirable values for different criteria. According to the comprehensive criterion technique, this target point is to take reference levels. The required data for this research have been extracted from Cadal Database and Islamic Research, Development and Studies Management Database using Rahavard Novin information software and companies' financial statements.

5. The population and Research Sample

This research is applied in terms of purpose and the type of library study, using historical information as a post-event. The statistical sample will be selected using the elimination method. Yet, a ten-year period from 2009-2018 is considered. The statistical sample was selected after applying the following restrictions:

1) Companies that have been listed on Tehran Stock Exchange until the beginning of 2008.
2) Due to the increasing of comparability, increasing the power of comparison and matching of their fiscal year should lead to the end of March and have not changed their fiscal year during the research period.
3) Companies that are not part of investment ones, financial intermediation, leasing companies, holding companies, insurance companies and banks.

Finally, according to the above-mentioned restrictions, 108 companies related to 8 industries were selected as the statistical population. Finally, data analysis and hypothesis testing were performed using EViews software.

6. Research Variables and their Operational Definition
6.1. Dependent Variable

In this research, the performance of companies is a dependent variable. In this research, accounting criteria and criteria based on accounting and market information and value-based criteria (economic criteria) are used to evaluate the performance of companies. Using financial statement information,

accounting criteria including asset return rate, equity return rate, accounting and market criteria including P/E and Q Tobin ratios and economic criteria (based on value) including economic value-added, market value added are calculated.

6.1.1. Accounting Criteria

The accounting ratios used in the research include the rate of return on assets (ROA) and the rate of return on equity (ROE) which are calculated as follows:

- **Rate of Return on Assets (ROA)**

This ratio indicates the efficiency of using the assets and the amount of profit per Rial of the funds invested in the company. This ratio is as follows:

Equation (1)

$$ROE = \frac{\text{Net Profit}}{\text{Total Assets}}$$

- **Rate of Return on Equity (ROE)**

This ratio examines the efficiency of a company in creating net profit for shareholders. This ratio expresses how much net profit the business unit earns for each shareholder investment unit. This ratio is as follows:

Equation (2)

$$ROE = \frac{\text{Net Profit}}{\text{Total owner equity}}$$

6.1.2. Criteria Based on Accounting and Market Information

The ratios based on accounting and market information that used in the research include economic value-added (EVA) and market value-added (MVA) which are as follows.

- **Economic Value-Added (EVA)**

Economic value-added is the estimate of a company's actual economic profit in a year and represents the remaining profit after deducting the cost of capital. Economic value-added is obtained from net profit by reducing the opportunity cost of equity, so it is a measure that considers the opportunity cost of all resources used in the company. Economic value-added is a measure of management ability to increase performance and value-added.

If EVA is greater than zero, it means that the company has been successful and has been able to create wealth for its shareholders. If EVA equals zero, the company only achieves a return equal to the cost of capital, so value-added is zero; and if EVA is less than zero, it means a loss of shareholder wealth. In these cases, the shares of these companies are usually sold at a fraction. Economic value-added was first proposed by Stern Stewart and calculated as follows:

Equation (3)

$$EVA_t = NOPAT_t - (WACC_t * Capital_{t-1})$$

Where:

EVA is economic value-added in period t

NOPAT is net operating profit after tax at the end of the period

WACC is weighted average cost of capital at the end of the period

Capital is capital employed in the first period

The weighted average cost of capital is calculated as follows:

Equation (4)

$$WACC = W_d * k_d + W_e * k_e$$

Where:

W_d is the ratio of common stock in the entire capital structure

W_e is the debt ratio in the whole capital structure

K_d is the cost of equity rate of stakeholders

K_e is the cost of debt rate

Equation (5)

$$Wd = \frac{\text{Debt interest balance at the end of the period}}{\text{Debt interest balance at the end of the period} + \text{Equity balance end of period}}$$

Equation (6)

$$We = \frac{\text{Equity balance end of period}}{\text{Equity balance end of period} + \text{Debt interest balance at the end of the period}}$$

How to Calculate Cost of Equity Rate (K$_e$)

In this research, the discounted cash flow method (rotating model) has been used to calculate the cost of equity rate of stakeholders:

Equation (7)

$$k\,e = \frac{D1}{P\,0} + g$$

D$_1$ is cash earnings per share per

P_0 is price per share at the end of the year

g is the rate of growth

The following method has been used to calculate the rate of growth: Equation (8)

How to Calculate the Cost of Debt Rate (K$_d$)

The cost of debt is the one that a company incurs to finance through borrowing or issuing bonds.

Equation (8)

$$g = \frac{sales\ revenue\ of\ the\ last\ year - \ sales\ revenue\ of\ the\ current\ year}{sales\ revenue\ of\ the\ last\ year}$$

Equation (9)

$$K = \frac{Financial\ expenses}{Avergae\ short-term\ and\ long-temr\ received\ financial\ facilities}$$

K$_d$ = Debt cost rate) * 1- t)   t=٢٢,٥٪

The capital employed is calculated as follows:

Equation (10)

Capital$_t$ = total assets - Total interest-free debt (short-term and long-term)

- **Market Value - Added (MVA)**

To obtain the market value-added, the difference between the average market value of owner equity during the year and the average book value of owner equity is used. The average book value of owner equity is the sum of owner equity at the beginning and end of the period, divided into two (Hejazi and Arefi, 2004). Stuart defines market value-added as the excess of capital market value (debt and equity) relative to its book value.

Equation (11)

MVA = Market value of the company – capital employed

Market value-added is a reflection of accumulated wealth for shareholders. In practical terms, the MVA index is a market assessment of the effective use of a company manager who has used scarce resources under his control and has established his position in the company for this purpose.

6.1.3. Value-Based Criteria (Economic Criteria)

The ratios based on accounting and market information used in the research include the P/E and Q-Tobin ratios, which are calculated as follows.

- **Price-Earnings Ratio (P/E)**

The price-earnings ratio, also known as P/E ratio is a common tool for analyzing the situation of companies, industries and markets, which is obtained by dividing the market value of one share by the profit of the same share and indicates the amount that investors must pay for each Rial of profit. The P/E ratio uses the firm's earnings as a basis for the value of its stock investment and evaluates market index and share in different ways.

This ratio is a rate below or above the value of the stock price. The formula of this ratio is as follows:

Equation (12)

$$P/E = \frac{the\ market\ value\ of\ each\ share}{profit\ of\ share}$$

- **Q-Tobin (Tobin's Q)**

This ratio is a measure of performance which with an integrated approach, in addition to using listed information in the financial statements, information and market values have also been used to measure it. This ratio is obtained by dividing the market value of the company by the book value of the company's assets and it is as follows.

The value of the ordinary stock market at the end of the year is normally obtained by multiplying the number of ordinary shares of the company in the balance-sheet by the market price of the company's share. Needless to say, that the basis for obtaining and

applying the market price of companies' shares is based on the latest stock transactions at the end of the last two weeks of the year ending March 20. On the one hand, the book value of the company's debts with a maturity of less than one year and long-term and the book value of the company's total assets are extracted from the companies' balance sheets. On the other hand, due to the lack of preferred stock for the companies, the market value of preferred stock at the end of the year for companies will be zero (Modares and Farajzadeh, 2008).

Equation (13)

$$Q - tobin = \frac{\text{Market value of shareholders} + \text{the book value of total debts (long term and short term)}}{\text{the book value of the compay's assets}}$$

6.2. Independent Variable

The independent variable of this research is the level of voluntary disclosure of companies' information. In this study, the checklist of Poorheidari and Hosseinpoor (2012) has been used. The final checklist consisted of 11 voluntary disclosures. Then, by reviewing the annual financial statements, explanatory notes and reports of the general assemblies and the board of directors, each item in the checklist that was disclosed by the companies is assigned with one, otherwise it is assigned with zero. Finally, the voluntary disclosure index is calculated by dividing the sum of disclosed items by the total number of items to be disclosed. In general, the optional disclosure index is calculated as follows:

Equation (14)
$$VDI = \Sigma_{i=1} \frac{d_i}{n}$$

In this equation, if the item is disclosed, d_i is considered equal to one, otherwise, zero is considered. The maximum number of disclosures (n) is also equal to 60.

6.3. Control Variables

To control other variables that are somehow effective in analyzing the research problem, the necessary

control variables have been determined according to the literature review and are as follows:

Lev: Financial leverage is obtained by dividing debts into assets.

Size: The size of the company is equal to the logarithm of the total assets of the company.

MB: Ratio of market value to book value, this ratio is obtained by dividing the market value of equity by the book value of equity.

7. Research Findings

7.1. Descriptive Statistics

Descriptive statistics of research variables that have been measured using 108 companies' data that are active in Tehran Stock Exchange related to 8 industries during 2009 to 2018.

As shown in Table 1, companies have an average of 54% of voluntary disclosures. The range of changes in voluntary disclosure is from 33% to 77. The standard deviation of data shows the dispersion of data from the mean. Low standard deviation indicates low data disperse from the mean and high standard deviation indicates high data disperse from the mean. The optional disclosure variable with a standard deviation of 0.11 has the lowest dispersion of the mean and the variable ratio of market value to book value with a standard deviation of 1.82 has the highest dispersion of the mean.

Table (1) Descriptive Statistics

Research variables	Mean	Median	Max	Min	Standard deviation
VD	0/5467	0/55833	0/76667	0/3333	0/11173
ROA	0/07029	0/06325	0/63055	-0/97317	0/14952
ROE	0/21159	0/21777	0/92289	-1/06691	0/29178
P/E	6/07976	5/92705	38/12635	-29/15180	8/47264
Q -Tobin	1/50659	1/32658	6/28472	0/58391	0/63618
EVA	0/07033	0/04548	7/52889	-6/72090	0/38771
MVA	20/60713	20/56877	26/84726	16/96544	1/57324
Size	12/16564	12/07703	14/58770	10/79256	0/63416
Lev	0/68128	0/65276	2/70181	0/18024	0/28485
M/B	2/09968	1/82588	10/38233	-8/30471	1/82593

7.2. Mathematical Modelling and its Results

Structurally, the present research falls into the category of mathematical modelling. Mathematical programming includes decision variables, objective functions, constraints. First, the structure of the multi-objective mathematical planning model is presented. In this section, the proposed formulated model is presented. In the first step, to express the mathematical form of the model, decision variables are introduced and used in the formulation of the proposed model. The below table shows the decision variables (including independent or input variables and dependent or output variables).

Table (2) input and output variables

Y	ROA, ROE, P/E, Tobins Q, EVA, MVA
X_1	VDI
X_2	Ln(assets)
X_3	Leverage
X_4	MB

Y are output variables (dependent) of the company's performance indicators that include:
ROA: Return on assets
ROE: Return on equity
P/E: price-earnings ratio
Q-Tobin (Tobin's Q)
EVA: Economic value added
MVA: Market value added

X are input variables (independent) that include:
X_1: Independent variable of voluntary disclosure
X_2: Control variable LN total assets
X_3: Financial leverage

X_4: Ratio of book value to market value

Then the normalization of the data is done using equations 1 and 2:

Equation (15)

$$xn_i = \frac{\left(x_i - x_i^{\min}\right)}{\left(x_i^{\max} - x_i^{\min}\right)} \qquad \forall i = 1,2,3,4$$

Equation (16)

$$yn = \frac{\left(y - y^{\min}\right)}{\left(y^{\max} - y^{\min}\right)}$$

Then, using equations (1) and (2), the coefficients of input variables (independent and control) to output variables (dependent) are presented and described in the following model, the results of which are presented in Table (2).

Equation (17)

$$Y_n = b_0 + b_1 xn_1 + b_2 xn_2 + b_3 xn_3 + b_4 xn_4 + b_5 xn_1^2 + b_6 xn_2^2 + b_7 xn_3^2 + b_8 xn_4^2 + b_9 xn_1 xn_2 + b_{10} xn_1 xn_3 + b_{11} xn_1 xn_4 + b_{12} xn_2 xn_3 + b_{13} xn_1 xn_4 + b_{14} xn_3 xn_4$$

The MSE criterion is used to evaluate the accuracy of the model used and performance efficiency. MSE is the mean square error index obtained by dividing the sum of the squares of the error difference by the number of samples. This indicator shows the distance between the degraded and the actual values. R^2 is the adjusted coefficient of determination in the model that represents the percentage of change of the dependent variable by which the independent variable is explained. For example, 60% of changes in the return on assets variable are explained by independent variables and the rest are related to other dependent

variables. There is a target function in each optimization operation and there may be limitations depending on the type of problem (Rajabi, 2012). In this research, after determining the decision variables, the objective function and the constraints of the problem are defined as follows.

Equation (18)

$Max\ ROA\ (x_1, x_2, x_3, x_4)$

$Max\ ROE\ (x_1, x_2, x_3, x_4)$

$Max\ P/E\ (x_1, x_2, x_3, x_4)$

$Max\ TobinsQ\ (x_1, x_2, x_3, x_4)$

$Max\ EVA\ (x_1, x_2, x_3, x_4)$

$Max\ MVA\ (x_1, x_2, x_3, x_4)$

$S\ .t$

$X_2 = X_2^0$

$X_3 = X_3^0$

$X_4 = X_4^0$

$0 \le x_1 \le 1$

The objective function of the problem is to maximize each of the performance indicators (output variable or dependent variable) according to the coefficients of the input variables (independent variables including voluntary disclosure and control variables). The constraint of the problem is related to the input variables. In other words, the voluntary disclosure variable takes values from zero to one. And the control variables that are the characteristics of the company, each of which has specific values for each company. After specifying the multi-objective functions, then all the objectives are combined into one objective and the single-objective function is defined as follows.

In the above mathematical models, λ is a covariate variable. W shows the percentage of the performance indicators (output or dependent variable). In this study, the importance of all performance indicators is considered the same which their importance level is 1.6. If the maximum value of each performance indicator is subtracted, the optimal value is obtained. The limitations of the single-objective model are similar to the multi-objective model. By converting the mathematical model presented above from the normalized optimal VDI to the actual optimal VDI. An example of optimizing the VDI index for Absal Company based on the procedure presented above is as follows. First, we obtain the maximum value of each of the six indices based on the obtained regression functions.

In the next step, based on the multi-objective problem defined, we obtain the minimum value of λ, which is a normalized univariate function based on VDI, as follows:

Table (3) normalization of the datas

Multipliers	Dependent variables					
	ROA	**ROE**	**PE**	**TobinsQ**	**EVA**	**MVA**
b_0	-0/0626	-0/1278	0/1952	-1/1537	0/5238	-1/1174
b_1	0/4436	-0/3483	0/1392	-0/0660	0/0734	0/0072
b_2	0/5035	0/9278	-0/3355	-0/2955	0/1344	-0/5590
b_3	0/6971	2/5411	0/4956	4/5356	-0/0772	4/1491
b_4	1/2318	1/2742	0/8543	2/4623	0/0275	3/0685
b_5	-0/0761	-0/1260	-0/0260	0/0457	-0/0421	0/0310
b_6	-0/0963	-0/6087	0/0876	0/0891	0/0094	-0/0004
b_7	0/0654	0/0567	-0/0361	0/0293	-0/1038	0/0090
b_8	-0/2731	-0/2345	-0/3028	0/0433	-0/0109	-0/2427
b_9	-0/5279	0/1713	-0/1264	0/1557	-0/2435	0/5115
b_{10}	0/2479	-0/0512	0/1808	-0/1537	0/3692	-0/1563
b_{11}	-0/3340	0/9286	-0.1204	-0/0614	-0/0155	-0/3600
b_{12}	-0/6347	-0/3745	0/0766	-0/7861	-0/3379	-0/7231
b_{13}	0/3470	-0/5627	0/5179	0/3694	0/2222	0/4337
b_{14}	-2/3469	-5/2053	-1/6345	-8/0125	-0.1526	-8/0673
MSE	0/0035	0/0172	0/0144	0/0028	0/0026	0/0148
R^2	0/6024	0/2091	0/0975	0/7873	0/1162	0/4547

$$Min \, \lambda$$

$$\lambda \geq w_{ROA} \times \frac{ROA^{\max} - ROA\,(x_1, x_2, x_3, x_4)}{ROA^{\max}}$$

$$\lambda \geq w_{ROE} \times \frac{ROE^{\max} - ROE\,(x_1, x_2, x_3, x_4)}{ROE^{\max}}$$

$$\lambda \geq w_{PE} \times \frac{PE^{\max} - PE\,(x_1, x_2, x_3, x_4)}{PE^{\max}}$$

$$\lambda \geq w_{TobinsQ} \times \frac{TobinsQ^{\max} - TobinsQ\,(x_1, x_2, x_3, x_4)}{TobinsQ^{\max}}$$

$$\lambda \geq w_{EVA} \times \frac{EVA^{\max} - EVA\,(x_1, x_2, x_3, x_4)}{EVA^{\max}}$$

$$\lambda \geq w_{MVA} \times \frac{MVA^{\max} - MVA\,(x_1, x_2, x_3, x_4)}{MVA^{\max}}$$

$$S \, t$$

$$x_2 = x_2^0$$

$$x_3 = x_3^0$$
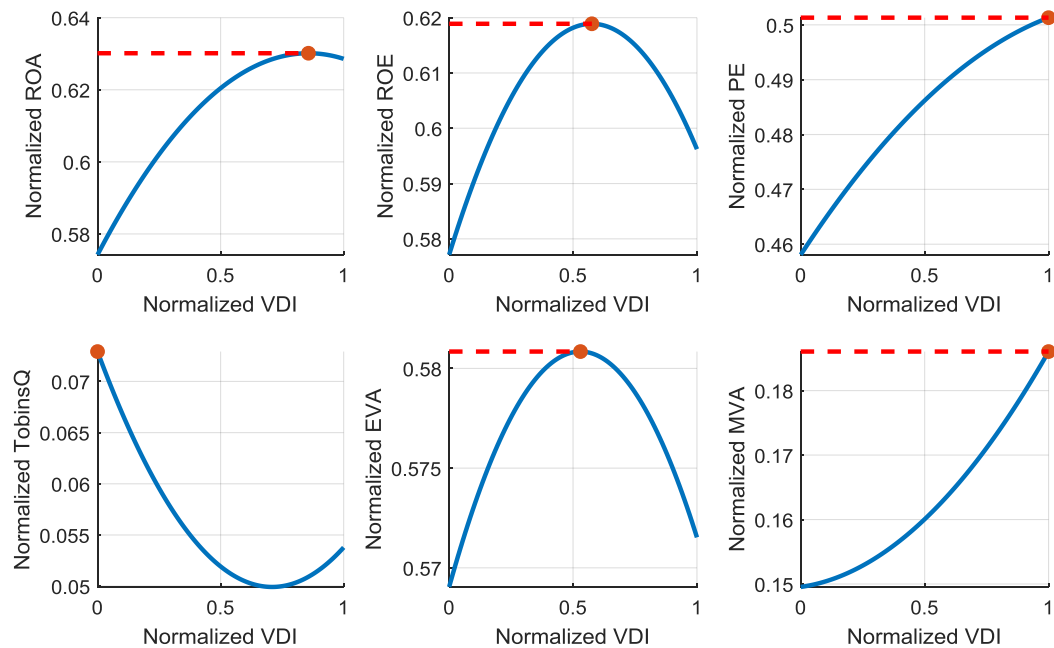
$$x_4 = x_4^0$$

$$0 \leq x_1 \leq 1$$

Figure (1) Optimization of VDI index for Absal company

Index	Value
ROA^{max}	0/6301
ROE^{max}	0/6189
PE^{max}	0/5013
$TobinsQ^{max}$	0/0729
EVA^{max}	0/5808
MVA^{max}	0/1861

In the next step, based on the multi-objective problem defined, we obtain the minimum value of λ, which is a normalized univariate function based on VDI, as follows:
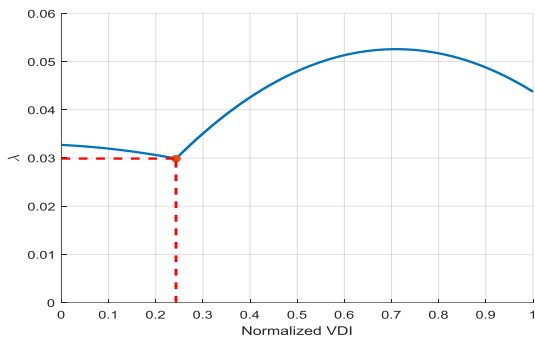

Figure (2)Optimized normalized VDI diagram

It is now possible to calculate the actual optimal VDI value for the target company using the normalized value of the optimal normalized VDI based on the following equation.

Equation (20)

$VDI_{opt}=VDI_{min}+NormalizedVDI_{opt}*(VDI_{max}- VDI_{min})$

λ	0/0299
NormalizedVDI$_{opt}$	0/2430
VDI$_{opt}$	0/24909

The above procedure is implemented for all companies and finally, the optimal amount of voluntary disclosure of each industry for each year is presented in the following table.

In the present study, the daily value of each company was considered as a criterion for determining the level of importance of each company in each industry. The steps for determining the optimal amount of voluntary disclosure in each industry for each year are as follows: step (1): The daily value of all companies in each industry for each year was calculated separately. Step (2): Then for the level of importance of each company in each relevant industry, we divide the daily value of each company by the sum of the daily value of the relevant industry and the weight of each company is determined. Step (3): Then multiply the optimal VDI of each company that we have obtained in step 2 and get the optimal VDI of each company according to its importance in the relevant industry. Step (4): Finally, the optimal VDI of each company is added every year and the optimal VDI of each industry is obtained every year. The results of Table 3 show that among the 8 industries during the research period, the ceramic tile industry has the lowest optimal VDI and the automotive and parts industry have the highest optimal VDI.

Table (4) Optimal values of each industry

Year/Industry	88	89	90	91	92	93	94	95	96	97
Machinery & Equipment	0/6480	0/5269	0/6315	0/6532	0/5748	0/4910	0/5169	0/4971	0/5331	0/6333
Basic metals	0/6444	0/6259	0/6303	0/6331	0/6286	0/6643	0/6736	0/6614	0/6598	0/6363
Automotive and parts	0/6922	0/6734	0/6894	0.6915	0.6585	0.6673	0/6515	0/6707	0/6588	0/6624
Chemical	0/6107	0/4262	0/5865	0/5964	0/5622	0/5718	0/5594	0/5483	0/5592	0/5502
Non metallic mineral	0/5290	0/4534	0/4303	0/4568	0/4595	0/4250	0/3455	0/4201	0/4263	0/3873
Medicinal	0/6752	0/6669	0.6402	0.6628	0/.6254	0/6016	0/4771	0/4509	0/4033	0/3883
Stucco&Cement & Lime	0/5840	0/5557	0.5531	0/5691	0/6086	0/5967	0/4742	0/4681	0/4782	0/5045
Tile And ceramics	0/4776	0/4213	0/4113	0/4053	0/4093	0/4121	0/4181	0/4551	0/4121	0/3921
Nutritive except sugar	0/6317	0/5796	0/5874	0/5916	0/5730	0/5395	0/5417	0/5867	0/4465	0/6715

8. Discussion and Conclusion

In this research, using the comprehensive benchmark method (LP metric), the optimal amount of voluntary disclosure has been determined by considering the effect of various performance appraisal indicators on voluntary disclosure. As a result, according to the

research findings obtained from the research question using information from 108 companies, we conclude that the optimal VDI values showed that among the 8 industries during the research period, the ceramic tile industry has the lowest amount of VDI Optimal and the automotive industry has the highest amount of optimal VDI. Therefore, to attract investors and achieve the best profitability in different industries, the optimal values of each industry must be taken into careful consideration. In global exchanges, public policy discussions regarding the corporate voluntary disclosure show that increasing the level of voluntary disclosure is a key to achieve the desired change in transparency. The companies that are responsible for this change often describe the increase in the level of voluntary disclosure as providing the needed information for greater transparency (Gul & Leung, 2004). However, having commercial benefits, voluntary disclosure imposes costs on companies. Voluntary disclosure, in this regard, claims that managers would disclose the information if the advantages of disclosure outweigh its costs (Heitzman et al., 2010). In this regard, executives are responsible for selecting the optimal level of disclosure. The existence and intensity of disclosure depend on the executive directors, whose interests are inherently in conflict with the interests of the stakeholders. A closer analysis shows that when the disclosure is too high, the firm's actual financial performance decreases. These results are completely in line with the initial predictions and theoretical foundations in this field. To increase transparency, companies should expand voluntary disclosure policies. Based on the agency theory proposed in the theoretical foundations, it was predicted that increasing the amount of disclosure will lead to reducing information asymmetry which in turn will increase the company's performance. Based on the results of the present study, it is suggested that the board of directors of companies use the results of this research in making decisions related to determining the level of voluntary disclosure, considering the performance evaluation indicators of the company. To optimize voluntary disclosure, it is suggested that in future research, using field methods and completing a questionnaire by professionals and experienced in this profession (such as CEOs and financial managers of companies) will determine the level of importance of corporate performance indicators and then optimize

the voluntary disclosure and compare the results with the results of the present study.

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