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RESEARCH PAPER

Empirical Analysis of Factors Affecting Financial Distress at Companies: An Emphasis on Data Mining Models

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Abstract

This study aimed to analyze the effects of macroeconomic factors (e.g., inflation, economic growth, currency exchange rate, and market competitiveness), managerial characteristics (e.g., ability, optimism, entrenchment, and myopia), and corporate governance (e.g., institutional shareholders, ownership concentration, number of shareholders, and managerial independence) on the financial distress risks of companies listed in the Tehran Stock Exchange. For this purpose, data mining models (e.g., Artificial neural networks and decision trees) were used along with the regression method to analyze a sample of 140 TSE-listed companies within the 2007–2020 period. The research results indicated that macroeconomic factors (i.e., external factors) and managerial characteristics (i.e., internal factors) were identified as the first and second most effective factors in the financial distress risk of companies, respectively. However, corporate governance variables were identified as the least effective factors. According to the results of ranking the effects of research variables on financial distress risk, the most effective variables were identified as market competitiveness, managerial myopia, and inflation.

Keywords: Data Mining, Empirical Analysis, Financial Distress.
JEL Classification: G01.

1. Introduction

Financial distress and bankruptcy are two close but different terms. According to a definition given by Altman and Hotchkiss (2006), financial distress occurs when the realized rate of return for the capital used in a business is significantly lower than the expected rate of return. Moreover, Beneish (1999) defined financial distress as a situation in which numerous financial institutions or

financial assets plunge in value drastically. Therefore, although financial distress and bankruptcy are closely related, they are different (Platt and Platt, 2006).

Financial distress and bankruptcy can ultimately bring serious losses to shareholders, creditors, managers, employees, suppliers of raw materials, and customers. Emerging slowly, financial distress can be concealed in a mass of financial and nonfinancial problems. Thus, identifying the factors affecting financial distress is a method of properly benefiting from investment opportunities and preventing the loss of financial resources. (Mashikhi and Ganji, 2014; Andrade and Kaplan, 1998).

In this regard, predicting bankruptcy will be useful when its time horizon is sufficiently long. In other words, bankruptcy is to be predicted in financial distress so that the potentially bankrupt company can take the necessary measures to prevent bankruptcy. Furthermore, the prediction should be made when the signs of financial distress and performance disturbance are not very evident and the occurrence of bankruptcy cannot be foreseen through simple assessment. In other words, it is not very difficult to predict the bankruptcy of a company that has financial distress and many debts. The prediction needs no modeling in this case (Panahi et al., 2014).

Generally, many empirical studies have analyzed the factors affecting financial distress. They have introduced some variables that are correlated with financial distress. However, studies differ in the combination of these variables, which is usually determined concerning researcher's subjective background. the extensive spectrum of explanatory variables affecting financial distress has raised a serious question: what variables should be entered into the empirical model for the regression of financial distress? Given the transparency and sensitivity of this subject, recent cases of financial distress have indicated the failure of warning models in advance. This study considers the failure to be rooted in identifying explanatory variables and designing empirical models, the factors which it tries to improve (Gordon, 1971).

In brief, the innovations of this research as opposed to the other similar studies include both the type of variables and the type of models employed. Moreover, Artificial neural networks and decision trees were used in this study to overcome uncertainty in selecting the variables affecting financial distress and to rank the variables based on their roles in Iran's capital market. Another innovation of this study is to concurrently analyze the effects of macroeconomic factors, managerial characteristics, and corporate governance variables in predicting financial distress at the companies listed on the Tehran Stock

Exchange, to determine the most effective variables. Hence, this study aims to identify the key variables affecting financial distress in Iran's economy within the 2007–2019 period through data mining approaches such as Artificial neural networks and decision trees.

2. Literature Review

Ensuing from financial distress, bankruptcy has serious consequences for companies. After a company goes bankrupt, its shareholders sustain losses and lose some of their capital. Its employees become unemployed and experience consequent effects on their lives. Zubair et al. (2021) indicated that investment in small and medium-sized enterprises would decline during and after financial distress. They concluded that financial distress would have serious effects on all stakeholders of a company, especially the uncertainty about the return on investment, which could deprive a company of resources (Wang et al., 2014).

Financial distress can have either internal or external origins and can result from either the private or public sectors. Accordingly, a growing literature has emerged for the analysis and identification of financial distress. In brief, empirical studies of financial distress can be classified as below:

- Identifying and predicting financial distress (Reinhart and Rogoff, 2009; Cardarelli et al., 2006; Forbes and Warnock, 2012; Citterio and King, 2023; Zhang et al., 2022)
- Estimating costs of financial distress (Calvo et al., 2006; Dell'Ariccia et al., 2008; Campello et al., 2010; Ugur et al., 2022; Kalash, 2023)
- Analyzing determinants of financial distress (Edison, 2000; Percic et al., 2013; Laeven and Valencia, 2018; Abdu, 2022; Phan et al., 2022)
- Distribution mechanism of financial distress to different countries and markets (Frankel and Saravelos, 2012; Hannes Lang, 2018; Gunay and Can, 2022; Fu et al., 2022)
- Effects of financial distress on the legal sector (Claessens et al., 2009; Kose et al., 2013; Moglie and Sorrenti, 2022)

Probably, the most important area of the above mentioned studies is the identification of factors affecting financial distress. In this regard, previous studies have mainly used financial ratios as explanatory variables. However, some other studies have employed economic and managerial variables along with financial variables to predict the financial distress of companies. Despite the importance of financial variables (extracted from the major financial statements) in predicting bankruptcy, some researchers believe that they do not have the

necessary prediction power for particular reasons. Firstly, accounting information indicates events that happened in the past and cannot be used to predict the future. Secondly, the conservativism principle and the historical cost have made book values far away from their real values in the capital market. Finally, accounting information is greatly affected by the accounting procedures selected by management and sometimes earnings management (Bauer and Agarwal, 2014). Hence, this study benefited from a relatively complete series of macroeconomic variables, managerial characteristics, and corporate governance system. The correlation of each variable with financial distress is explained below:

Researchers have conducted many studies on the effectiveness of economic indices in predicting financial distress at different companies. The resultant evidence indicates that those indices were effective. According to Keasey and Watson (1987) and Zavgren (1985), an appropriate model cannot necessarily include financial ratios (*i.e.*, financial variables), and other pieces of information such as economic variables may greatly help predict bankruptcy and financial distress. Hence, these economic variables should be used along with other variables to predict the financial distress of companies. Bayani et al. (2019) indicated that the role of inflation has greatly increased in causing financial distress in recent periods. Rampant inflation and many origins of inflation have made this variable always an important factor in causing financial distress in Iran's economy. companies are affected by their economic environments, and Iran's economy is characterized by rampant inflation, drastic fluctuations in the currency exchange rate, and low rates of economic growth. Hence, this study aimed to first analyze the effects of macroeconomic variables on financial distress at the companies listed on the Tehran Stock Exchange.

Recent studies indicate that ability, optimism, stability, entrenchment, and managerial myopia have had considerable effects on financial distress at different companies. For instance, managerial myopia can jeopardize the competitive advantage of a company and cause financial distress in the long run. Most myopic managers avoid whatever prevents them from achieving their short-term interests (Brochet et al., 2017).

The effect of managerial optimism on financial distress can also be discussed. Most of the optimistic managers look very much forward to their decisions and consequent outcomes, especially investment decisions. They also believe that the stock market has undervalued their companies, something which results in costly external financing (Gervais, 2007). This study tries to analyze

the effects of some of the major personality traits and structural characteristics of managers on financial disasters at companies.

Eventually, the effect of corporate governance on financial distress risk reduction is justifiable in agency theory, according to which the risk of agency costs may drive companies toward financial distress. In agency theory, a company is a series of agency relationships, the most important of which connects the owner and the manager of a company. Given the separation of ownership from management in both intellectual and physical aspects with different utility functions, agency costs will be imposed on the company. there is always the risk that an agent takes action that does not favor the interests of owners. These costs will increase the financial distress risk (Wolk et al., 2013). At the same time, corporate governance mechanisms (i.e., a series of relationships among board of directors, shareholders, and other stakeholders as well as a series of attempts at balancing power among groups) can be considered factors in improving efficiency and performance (Meshki et al., 2015). Hence, the final goal of this study is to analyze the effect of corporate governance on the financial distress risks of companies.

3. Data Collection

In this study, a desk method was employed to codify the theoretical foundations, whereas a field method was adopted to collect financial data from various sources (*e.g.*, financial statements of companies, CDs provided by Securities and Exchange Organization of Iran, Rahavard Novin, and www.codal.ir). Afterward, databases were created, abridged, and classified in Microsoft Excel, and research hypotheses were tested in IBM SPSS Modeler 18.

4. Statistical Population and Sample

The statistical population included the companies listed on the Tehran Stock Exchange due to their easily accessible, standard, and homogenous information. The systematic sampling method was employed to select the research samples meeting the following conditions:

1) The financial information should be available for the research period (i.e., from 2017 to 2020).
2) The fiscal year should end on March 20 (or March 21).
3) The companies should be listed on the Tehran Stock Exchange up to March 21, 2007 (*i.e.*, before this date), and the companies should not be excluded from the Tehran Stock Exchange within the research period.

4) The fiscal year should not change during the research period.
5) companies should not be included among financial institutes, banks, and investment companies due to the specific nature of their activities, revenues, and activities.
6) There should not be any trading breaks longer than six months.

After the constraints were applied, 140 companies met the above conditions within the 2007–2020 period. No sampling was done, and all eligible companies were selected. Given the calculation of some research variables, the data from 2005 and 2006 were used.

5. Research Hypotheses

Hypothesis 1: Macroeconomic factors have significant effects on the financial distress risk at TSE-listed companies.

Hypothesis 2: Managerial characteristics have significant effects on the financial distress risk at TSE-listed companies.

Hypothesis 3: The corporate governance system has a significant effect on the financial distress risk at TSE-listed companies.

5.1 Research Variables and Methodology

5.1.1 Dependent Variable

In this study, the dependent variable is defined as the financial distress risk of companies. It was measured through Altman's Z-score (1983) and Ohlson's model (1980).

5.1.2 Altman's Z-Score

Altman (1968) sought to predict the financial distress and bankruptcy of businesses by adopting multiple discriminant analysis (MDA) and using financial ratios as independent variables. He introduced his famous model as Z-score, which is well-known for the prediction of financial distress and bankruptcy.

$$Z - Score = 0.717x_1 + 0.847x_2 + 3.107x_3 + 0.420x_4 + 0.998x_5 \quad (1)$$

where

x_1: the ratio of working capital to total assets

x_2: the ratio of retained earnings to total assets

x_3: the ratio of earnings before interest and tax to total assets

x_4: the ratio of book values of corporate shares (*i.e.*, equity) to book values of debts

x_5: the ratio of sales (*i.e.*, incomes) to total assets

In this model, the lower the Z-score, the higher the financial distress risk at a company. In other words, companies with scores above 2.9 are classified as healthy companies, whereas the ones with scores below 1.23 are classified as bankrupt companies.

5.1.3 Ohlson's Model

Ohlson (1980) used the logistic regression model to predict financial distress and bankruptcy. Ohlson's prediction model managed to predict the bankruptcy risks of companies for the first, second, and third years with accuracies of 85.1%, 87.6%, and 82.6%, respectively, as below. The best separating ratios in Ohlson's model was the ratio of total debts to total assets and the ratio of net income to total assets (Ghadiri Moghadam *et al.*, 2009).

$$Z = -1.32 - 0.407x_1 + 6.03x_2 - 1.43x_3 + 0.0757x_4 - 2.37x_5 - 1.83x_6 + 0.285x_7 - 1.72x_8 - 0.521x_9 \quad (2)$$

where

x_1: the logarithm of ratio of total assets to gross national product (GNP)

x_2: the ratio of total debts to total assets

x_3: the ratio of working capital to total assets

x_4: the ratio of current debts to current assets

x_5: virtual variable (If total debts exceed or equal to total assets, this variable is 1; otherwise, it is 0.)

x_6: the ratio of net profit to total assets

x_7: the ratio of operating cash to total debts

x_8: virtual variable (If the net profit is negative for the previous two consecutive years, it is 1; otherwise, it is 0.)

x_9: variations in the net profit (the ratio of variations in the net profit to the absolute value of current profit added by profit from last year)

According to the logit analysis, the resultant Z for each company-year was placed in the following equation to calculate the bankruptcy risk. The lower the resultant value of P(z), the more severe the financial distress. The company is classified as bankrupt if P(z) is greater than 0.5. If P(z) is smaller than 0.5, the company is classified as non-bankrupt or low bankruptcy risk (Ohlson, 1980).

$$\mathrm{P(z)} = \frac{1}{(1 + e^{-z})} \quad (3)$$

5.2 Independent Variables

In this study, the independent variables were defined as macroeconomic factors, managerial characteristics, and corporate governance systems. They are measured as below.

5.2.1 Macroeconomic Factors

5.2.1.1 Inflation

Inflation denotes the constantly nonstop increase in prices of products and services which will finally reduce the public purchase power and disrupt an economy. Inflation is measured through variations in the consumer price index (CPI) announced by a central bank.

5.2.1.2 Economic Growth

Economic growth means the monetary value of final products and services manufactured inside a country in a specific year. Economic growth is measured through variations in gross national product (GNP) announced by a central bank.

5.2.1.3 Variations in Currency Exchange Rate

This variable is measured through variations in the per capita currency exchange rate in the free market.

5.2.1.4 Market Competitiveness

The Lerner index was employed to evaluate competitiveness in the market of products. This index is defined as the prices of products subtracted from the final costs of production in a company. This index can directly indicate the market power of a company (i.e., its ability to consider a price higher than the final cost) (Namazi et al., 2015). Although the Lerner index is utilized to determine the market power of products made by a company, it does not separate the special factors of a company such as the effect of pricing power of product market from industrial factors. Hence, the moderated version of the Lerner index that includes the competitiveness power is defined below (Sharma, 2010):

$$LI_{IA} = LI_i - \sum_{i=1}^{N} \omega_i \, LI_i \tag{4}$$

where

LI_i: the ratio of sales subtracted by the costs of production and sales (*i.e.*, operating profit) divided by sales

ω_i: the ratio of sales by company *i* in an industry of interest

5.2.2 Managerial Characteristics

5.2.2.1 Managerial Ability

Managerial ability means management efficiency in creating income (Huang and Sun 2017). Management efficiency is evaluated through the data envelopment analysis (DEA) model described as the following conceptual model and variables (Figure 1) :

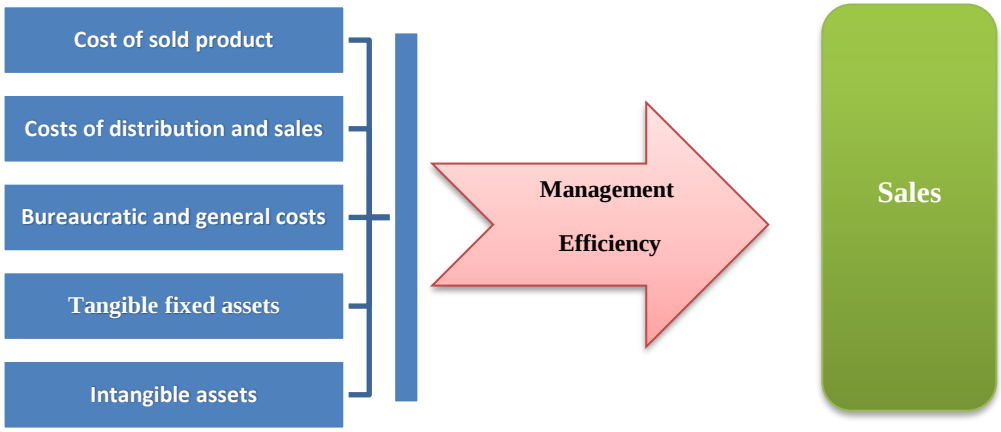


Figure 1. Managerial Ability Conceptual Model
Source: Demerijan et al. (2013).

In this method, management efficiency is evaluated through the production function which indicates the maximum outputs determined by a combination of inputs. The DEA model is analyzed separately for each industry year. The values of this model range between 0 and 1 (a value of 1 indicates the highest management efficiency). The resultant DEA values are then used as dependent variables in the following regression model. Finally, the residual values ($\varepsilon_{i,t}$) of the following regression model indicate managerial ability.

$$FrimEff = \beta_0 + \beta_1 Assets_{i,t} + \beta_2 MShare_{i,t} + \beta_3 PosFCF_{i,t} + \beta_4 Age_{i,t} + Year + \varepsilon_{i,t} \quad (5)$$

where

$Assets_{i,t}$: the natural logarithm of total assets of a company

$MShare_{i,t}$: a company's market share evaluated through the ratio of company sales to the industry sales

$PosFCF_{i,t}$: this variable is 1 if the free cash flow is positive; otherwise, it is 0.

$Age_{i,t}$: the natural logarithm of a company's age since establishment

5.2.2.2 Managerial Optimism

Managerial optimism is evaluated through methods based on the rates of investments, and a common method is to make more investments than sales. In this method, overinvestment will be used to identify managerial optimism. Overinvestment is identified through the following method (Schrand and Zehman, 2011):

$$Investment_{i,t} = \beta_0 + \beta_1 Sale\_Growth_{i,t-1} + \varepsilon_{i,t} \quad (6)$$

where

$\text{Investment}_{i,t}$: the capital expenditures (payable cash) to acquire or construct fixed assets, intangible assets, and other assets.

$\text{Sale\_Growth}_{i,t-1}$: the growth in previous sales of a company compared with that of its previous year

If future investment exceeds the sales growth (*i.e.*, the residual values of the above model ($\varepsilon_{i,t}$) are positive), overinvestment has been made; otherwise, underinvestment is observed. Hence, if overinvestment occurs, managerial optimism is observed (and $\varepsilon_{i,t}$ is 1); otherwise, the residual is 0.

5.2.2.3 Managerial Entrenchment

Managerial stability and entrenchment emerge over time. First, when a manager assumes responsibility, it is necessary to gain experience and acquire skills for the new position. However, after a transition period which has been specified three years in the research literature (Fredrickson et al., 1988), a manager reaches authority and stability. Hence, if a CEO's tenure is at least three years in this study, management is considered stable and given the value of 1; otherwise, it is given the value of 0.

5.2.2.4 Managerial Myopia

In this study, an independent variable is managerial myopia. When the manager of a company is myopic, he/she will spend the long-term future of the company on improving its short-term status. In other words, the long-term future of a company is sacrificed for its short-term status. In companies with myopic managers, despite financial success and the availability of necessary opportunities and resources for investment in long-term assets, none of such investments are made. Therefore, the companies that report excessive returns (*i.e.*, profitability) and lower costs of marketing, research, and development than expected will most probably be characterized by managerial myopia. To identify and determine myopic companies, it is first essential to estimate the expected

returns on assets, marketing fees, and R&D costs of each company within the research period through the following equations (Anderson and Hsiao, 1982):

$$ROA_{i,t} = \beta_0 + \beta_1 ROA_{i,t-1} + \varepsilon_{i,t} \quad (7)$$

$$Mktg_{i,t} = \beta_0 + \beta_1 Mktg_{i,t-1} + \varepsilon_{i,t} \quad (8)$$

$$R\&D_{i,t} = \beta_0 + \beta_1 R\&D_{i,t-1} + \varepsilon_{i,t} \quad (9)$$

where

$ROA_{i,t}$: returns on assets measured through the ratio of net profit to total assets

$Mktg_{i,t}$: the ratio of marketing fees and sales to total assets

$R\&D_{i,t}$: the ratio of R&D costs to total assets

After the expected (estimated) values of returns on assets, marketing fees, and R&D costs are calculated through the above models, the real values are compared with the predicted values. The companies are then classified into the following four major groups based on differences between the aforesaid values ($\varepsilon_{i,t}$) (Table 1).

Table 1. Classification of Companies

Group 1	Group 2	Group 3	Group 4
Positive difference between predicted and real returns on assets	Positive difference between predicted and real returns on assets	Positive difference between predicted and real returns on assets	Negative difference between predicted and real returns on assets
Negative difference between predicted and real marketing fees and R&D costs	Only the difference between one of marketing fees and R&D costs	Positive difference between predicted and real marketing fees and R&D costs	

Source: Research finding.

The companies of Group 1 are characterized by myopic management because their marketing fees and R&D costs decreased, although they had positive financial performance and increasing returns on assets.

5.2.3 Characteristics of Corporate Governance

5.2.3.1 Institutional Shareholders

The ownership of institutional shareholders is based on the ratio of total shares owned by banks, insurance companies, holdings, investment companies, pension funds, financing companies, investment funds, and public organizations, institutions, and companies to total shares.

5.2.3.2 Ownership Concentration

Ownership concentration means that a few shareholders own many of shares. The free float is used as an index of ownership structure in terms of ownership

concentration. The free float indicates the number of shares expected to be tradable soon in the future and be owned by individuals who are willing to sell them to the highest bidder. In other words, the free float percentage refers to the shares not owned by strategic shareholders; therefore, ownership concentration is measured through the non-float share percentage.

5.2.3.3 Number of Shareholders

The ownership structure of a company can also be evaluated through the number of its shareholders. The larger the number of shareholders, the higher its socioeconomic value in the capital market. Many economists believe that the number of shareholders is a major determinant of a company's value and policies. Given the incomplete publication or concealment of the number of shareholders on the financial statements of companies or the stock exchange databases, the logarithm of the number of shares is used as a criterion for determining the number of shareholders.

5.2.3.4 Management Independence

The management independence of a board of directors is operationally defined through the ratio of the number of non-governing members to the total number of members.

6. Methods and Material

This study analyzed the effects of a series of macroeconomic factors (e.g.., inflation, GNP, currency exchange rate, and market competitiveness), managerial characteristics (e.g., ability, optimism, entrenchment, and myopia), and corporate governance variables (e.g., institutional shareholders, ownership concentration, number of shareholders, and management independence) on the financial distress risks of TSE-listed companies. For this purpose, data mining models (e.g., Artificial neural networks and decision trees) were employed to check the research hypotheses. Artificial neural networks are among the methods of developing classifiers. In Artificial neural networks, a learned model is represented as a series of interconnected nodes along with their weighted edges. Artificial neural networks can be employed to model a nonlinear function that maps an input vector like X onto a value like Y. Moreover, a neural network is a simplified model of information processing in the human brain. The basic units of Artificial neural networks are neurons, which are usually organized in different layers. Generally, a neural network consists of three layers: the input layer, the

hidden layer, and the output layer. These layers are interconnected with different weights. Learning in a neural network is achieved by moderating these weights mapped onto each edge between neurons. The decision tree model is a decision support tool that uses trees for modeling. Decision trees are usually used in various studies and operations, especially in decision analysis, to determine the most promising strategy. Decision trees are also adopted to describe calculations of conditional probabilities.

In Artificial neural networks and decision trees, all variables are entered as input variables into the research model. The significance level (*i.e.*, 95% in this study) of the logarithms is then considered excluding the insignificant variables. In the next step, the significant variables are presented in order of effectiveness.

7. Results

7.1 Descriptive Statistics and Frequency Tables

Measures of central tendency and measures of dispersion were used for descriptive statistics and data analysis. Moreover, frequency tables and frequency percentages of observations were presented for virtual variables. Winsorization was then applied to eliminate outliers in some research variables. According to the results of normality tests, research variables had normal or semi-normal distributions (Table 2).

Table 2. Descriptive Statistics of Main Variables

Variables		Average	Median	standard deviation	Skewness coeff	kurtosis coeff	min	max
Title	**Abbr**							
financial distress risks - Altman	AltmanZ	2.144	1.991	1.130	0.649	0.695	-0.446	5.543
financial distress risks - Ohlson	OhlsonZ	0.916	0.968	0.118	-2.161	4.086	0.505	0.999
Inflation	Inflation	0.225	0.200	0.114	0.442	-1.183	0.090	0.43
economic growth	Growth	0.012	0.019	0.050	0.316	-0.142	-0.065	0.125
currency exchange rate	Currency	0.347	0.058	0.535	1.617	1.532	-0.014	1.824
market competitiveness	Compet	-0.034	-0.032	0.141	-0.130	2.100	-0.681	0.591
managerial Abilities	ManAbility	0.500	0.500	0.289	0.000	-1.200	0.000	1.000
managerial independence	ManInd	0.664	0.600	0.190	-0.294	0.041	0.000	1.000
institutional shareholders	InstitOwn	0.718	0.783	0.231	-1.316	1.128	0.000	1.000
ownership concentration	ConcOwn	0.761	0.799	0.156	-1.026	1.168	0.068	1.000
number of shareholders	NumOwn	8.388	8.306	0.697	0.962	1.748	6.699	11.480

Source: Research finding.

Table 3. Frequency Table of Virtual Variables

Variables		Sample size	Frequency		Percentage Frequency	
Title	**Abbr**		**0**	**1**	**0**	**1**
managerial optimism	ManOptim	1960	1310	650	66.8%	33.2%
managerial entrenchment	ManEntr	1960	1003	957	51.2%	48.8%
managerial myopia	ManMyopia	1960	1432	528	73.1%	26.9%

Source: Research finding.

Table 4. Data Mining Results of Artificial Neural Networks

Variables		Abbr.	Results of Artificial neural networks model Based on the measure of the financial Disaster			
			Altman Model		Ohlson Model	
			coeff	Sign	coeff	Sign
Macroeconomic factors	Inflation	Inflation	0.169	*	0.123	*
	economic growth	Growth	0.064	*	0.062	*
	currency exchange rate	Currency	0.015	*	0.064	*
	market competitiveness	Compet	0.419	*	0.417	*
Management features	managerial Ability	ManAbility	0.000	-	0.000	-
	managerial optimism	ManOptim	0.057	*	0.032	*
	managerial entrenchment	ManEntr	0.065	*	0.041	*
	managerial myopia	ManMyopia	0.108	*	0.104	*
Corporate governance variables	institutional shareholders	InstitOwn	0.103	*	0.082	*
	ownership concentration	ConcOwn	0.000	-	0.075	*
	managerial independence	ManInd	0.000	-	0.000	-
	number of shareholders	NumOwn	0.000	-	0.000	-
insignificance -					significance *	

Source: Research finding.

According to the results presented by descriptive statistics of research variables, the mean of financial distress was reported 2.144 by Altman's Z-score; however, it was reported 0.916 by Ohlson's model. These results indicate that most of the companies in the research sample were in healthy or relatively healthy conditions in terms of financial distress and that a few of them faced severe financial distress (and bankruptcy). The mean of inflation, economic growth, and currency exchange rate growth were also reported as nearly 23% (0.225), 1% (0.012), and 35% (0.347), respectively. The mean of competitiveness was determined -0.034 by the Herfindahl–Hirschman index (HHI) for companies in the research sample. Although this value approaches zero, it indicates a higher level of competitiveness in the market of products. According to the other results, the independence of the board of directors was 0.664, a value which means that nearly 66% of board members of companies were non-governing members. The frequency table of research variables demonstrated that the frequency percentage of companies with myopic management was 27%. Moreover, managerial myopia was measured at 33% at the sample companies. The other results suggested that management stability and entrenchment exited at a considerable percentage in nearly half of the sample companies (Table 3).

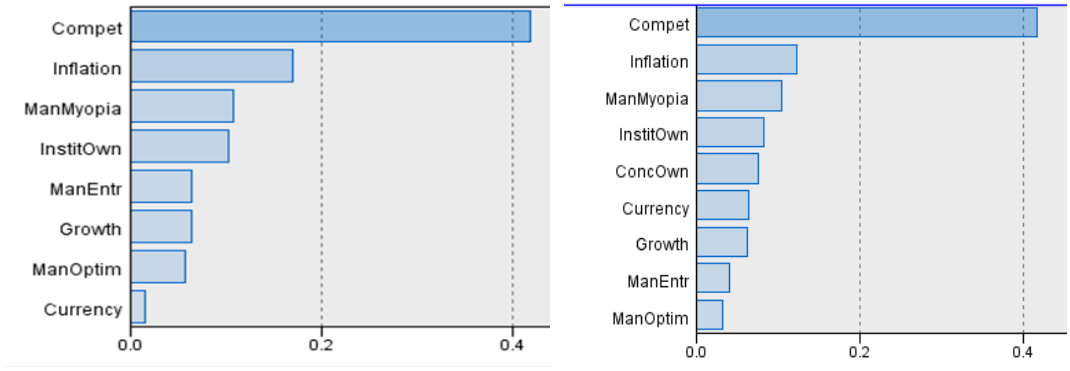
7.2 Results of Artificial Neural Networks

Table (4) presents the results of Artificial neural networks based on the two criteria for evaluating the financial distress risk (*i.e.*, Altman's Z-score and Ohlson's model). According to Table (4), all variables of macroeconomic factors were identified as effective in the financial distress risks of companies in both Altman's Z-score and Ohlson's model. The coefficients of effectiveness indicated that market competitiveness was the most effective variable of macroeconomic factors. Hence, this finding confirms the first research hypothesis stating that macroeconomic factors have significant effects on the financial distress risks of companies concerning Artificial neural networks as well as both Altman's Z-score and Ohlson's model.

The results indicated that optimism, entrenchment, and myopia were among the managerial characteristics affecting the financial distress risks of companies in terms of both criteria. Moreover, managerial ability had no significant effects. Given the significant effects of three out of five managerial characteristics on the financial distress risks of companies, it can be concluded that most managerial characteristics had significant effects on the financial distress risk. This finding confirms the second research hypothesis stating that

managerial characteristics had significant effects on the financial distress risks of companies based on Artificial neural networks.

Regarding corporate governance variables, the results indicated that only institutional shareholders had a significant effect on the financial distress risks of companies in terms of both Altman's Z-score and Ohlson's model. The other variables of corporate governance (*i.e.*, ownership concentration, number of shareholders, and management independence) had no significant effects. This finding rejects the third research hypothesis stating that the corporate governance system had significant effects on the financial distress risks of companies based on Artificial neural networks.



A: Alman's Z-score B: Ohlson's model

Figure 2. Identifying the Variables Affecting Financial Distress with Artificial Neural Networks

Source: Research finding.

In Figure 2, the vertical axis represents the variables having significant effects on the financial distress risk, whereas the horizontal axis indicates the effectiveness of each variable. These diagrams present the most effective variables first and then show the other significant variables in a downward order (the insignificant variables were excluded). The results of Artificial neural networks for both criteria indicated that market competitiveness, inflation, and managerial myopia were the most effective variables in the financial distress risks of companies.

7.3 Data Mining Results of Decision Trees

Table (5) reports the results of decision trees based on the C5 model and two criteria for evaluating the financial distress risk.

Table 5. Data Mining Results of Decision Tree Model

Variables		Abbr.	Results of Decision Tree Based on the measure of the financial Disaster			
			Altman Model		Ohlson Model	
			coeff	Sign	coeff	Sign
Macroeconomic factors	Inflation	Inflation	0.176	*	0.092	*
	economic growth	Growth	0.017	*	0.037	*
	currency exchange rate	Currency	0.054	*	0.028	*
	market competitiveness	Compet	0.291	*	0.391	*
Management features	managerial Ability	ManAbility	0.079	*	0.000	-
	managerial optimism	ManOptim	0.033	*	0.000	-
	managerial entrenchment	ManEntr	0.091	*	0.073	*
	managerial myopia	ManMyopia	0.242	*	0.267	*
Corporate governance variables	institutional shareholders	InstitOwn	0.018	*	0.042	*
	ownership concentration	ConcOwn	0.000	-	0.023	*
	managerial independence	ManInd	0.000	-	0.048	*
	number of shareholders	NumOwn	0.000	-	0.000	-
insignificance -					significance *	

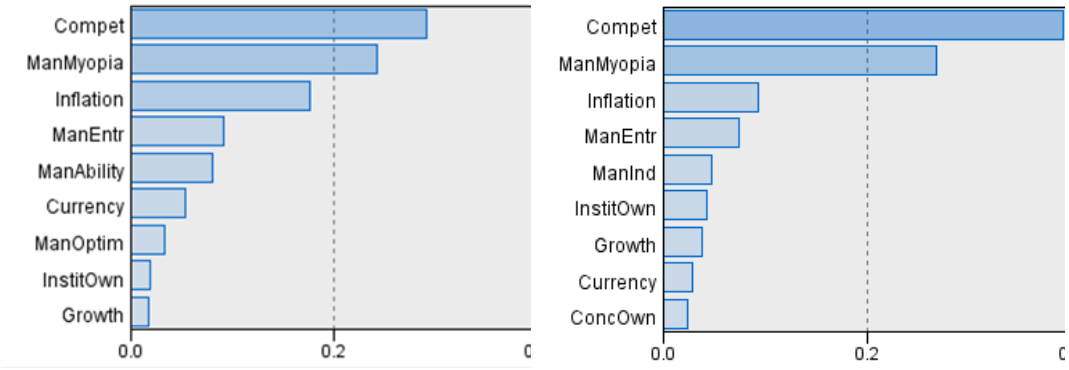
Source: Research finding.

According to Table (5), all variables of macroeconomic factors affected the financial distress risks of companies in terms of both Altman's Z-score and Ohlson's model. The coefficients of effectiveness indicated that market competitiveness and inflation were the most effective variables of macroeconomic factors. This finding confirms the first research hypothesis stating that macroeconomic variables have significant effects on the financial

distress risks of companies based on the decision tree model in terms of both Altman's Z-score and Ohlson's model.

The results also indicated that entrenchment and myopia were reported to be among the managerial characteristics affecting the financial distress risks of companies based on the two criteria; however, managerial ability and managerial optimism had no significant effects (because they were significant in only one criterion). Given the significant effects of two out of five managerial characteristics on the financial distress risks of companies, it can be concluded that managerial characteristics had no significant effects on the financial distress risk. This finding rejects the second research hypothesis stating that managerial characteristics have significant effects on the financial distress risks of companies based on the decision tree model.

Regarding corporate governance variables, the results indicated that only institutional shareholders had a significant effect on the financial distress risk in terms of both Altman's Z-score and Ohlson's model. However, no significant effects were left by ownership concentration, number of shareholders, and management independence. This finding rejects the third research hypothesis stating that the corporate governance system had significant effects on the financial distress risks of companies based on the decision tree model.



A: Alman's Z-score B: Ohlson's model

Figure 3. Identifying the Variables Affecting Financial Distress Risk with Decision Tree

Source: Research finding.

The results of the decision tree model indicated that market competitiveness, managerial myopia, and inflation had the most significant effects on the financial distress risks of companies (Figure 3).

7.4 Results of Regression Model

Table (6) presents an overview of the results obtained from the regression model based on the two criteria for evaluating the financial distress risk (for the sake of brevity, regression tables were not included). The coefficients of determination were reported 0.463 and 0.466 based on Altman's Z-score and Ohlson's model, respectively. These values were both significant. Moreover, the coefficients of determination were used instead of coefficients of variables to make the results of the regression model comparable to those of the data mining models. According to Table (6), all variables of macroeconomic factors affected the financial distress risks of companies in terms of both Altman's Z-score and Ohlson's model. The coefficients of determination indicated that market competitiveness and inflation were the most effective variables of macroeconomic factors. This finding confirms the first research hypothesis stating that macroeconomic factors have significant effects on the financial distress risks of companies based on the regression model in both Altman's Z-score and Ohlson's model.

Table 6. Results of the Regression Model

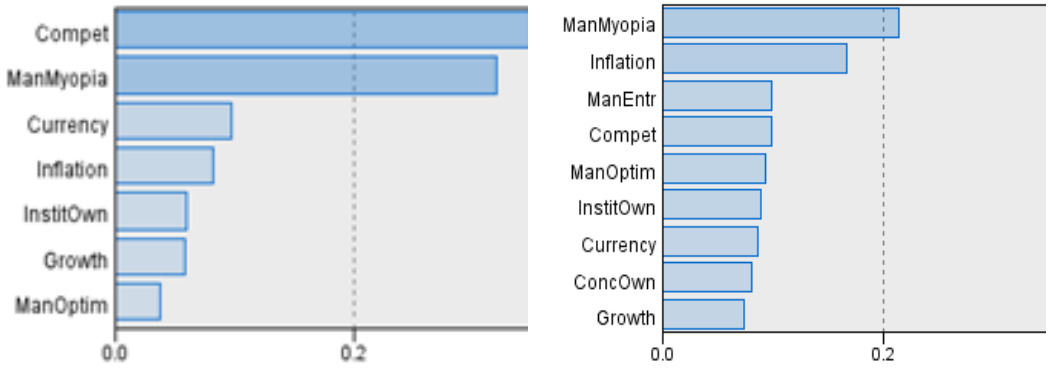
Variables		**Abbr.**	**Results of Regression Based on the measure of the financial Disaster**			
			Altman Model		**Ohlson Model**	
			coeff	**Sign**	**coeff**	**Sign**
Macroeconomic factors	Inflation	Inflation	0.082	*	0.167	*
	economic growth	Growth	0.059	*	0.074	*
	currency exchange rate	Currency	0.097	*	0.086	*
	market competitiveness	Compet	0.347	*	0.098	*
Management features	managerial Ability	ManAbility	0.000	-	0.000	-
	managerial optimism	ManOptim	0.038	*	0.093	*
	managerial entrenchment	ManEntr	0.000	-	0.099	*
	managerial myopia	ManMyopia	0.319	*	0.214	*
Corporate	institutional	InstitOwn	0.059	*	0.089	*

governance variables	shareholders					
	ownership concentration	ConcOwn	0.000	-	0.081	*
	managerial independence	ManInd	0.000	-	0.000	-
	number of shareholders	NumOwn	0.000	-	0.000	-
	insignificance -				significance *	

Source: Research finding.

According to the results, managerial optimism and managerial myopia were among the managerial characteristics having significant effects on the financial distress risks of companies based on both criteria. However, managerial ability and managerial entrenchment had no significant effects. Given the significant effects of two out of five managerial characteristics on the financial distress risks of companies, it can be concluded that managerial characteristics had no significant effects on the financial distress risk. This finding rejects the second research hypothesis stating that managerial characteristics have significant effects on the financial distress risks of companies based on the regression model.

According to the findings, institutional shareholders proved to be the only variable of corporate governance having a significant effect on the financial distress risks of companies in terms of both Altman's Z-score and Ohlson's model. Moreover, no significant effects were left by ownership concentration, number of shareholders, and managerial independence. This finding rejects the third research hypothesis stating that corporate governance has a significant effect on the financial distress risks of companies based on the regression model.



A: Alman's Z-score B: Ohlson's model

Figure 4. Identifying the Variables Affecting Financial Distress Risk with Regression Model

Source: Research finding.

The results of the regression model and Altman's Z-score indicated that market competitiveness, managerial myopia, and currency exchange rate had the greatest effects on the financial distress risks of companies, whereas Ohlson's model introduced the most effective variables as managerial myopia, inflation, and managerial entrenchment (Figure 4).

7.5 Aggregate Results of Data Mining Models and Regression Model

Table (7) reports the results regarding the effects of macroeconomic factors, managerial characteristics, and corporate governance on the financial distress risks of companies based on Artificial neural networks, decision tree, and regression model.

Table 7. Comparing the Results of Data Mining Models with Those of Regression Model

Variables		Abbr.	Results of Data Mining Models				Regression	
			ANN		DT			
			Altman	Ohlson	Altman	Ohlson	Altman	Ohlson
Macroeconomic factors	Inflation	Inflation	*	*	*	*	*	*
	economic growth	Growth	*	*	*	*	*	*
	currency exchange rate	Currency	*	*	*	*	*	*
	market competitiveness	Compet	*	*	*	*	*	*
Management features	managerial Ability	ManAbility	-	-	*	-	-	-
	managerial optimism	ManOptim	*	*	*	-	*	*
	managerial entrenchment	ManEntr	*	*	*	*	-	*
	managerial myopia	ManMyopia	*	*	*	*	*	*
Corporate governance variables	institutional shareholders	InstitOwn	*	*	*	*	*	*
	ownership concentration	ConcOwn	-	*	-	*	-	*
	managerial independence	ManInd	-	-	-	*	-	-
	number of shareholders	NumOwn	-	-	-	-	-	-
insignificance -			significance *					

Source: Research finding.

Table 8. Results of Research Hypotheses

No.	Hypothesis	Result
1	Macroeconomic factors have significant effects on the financial distress risks of companies.	Confirmed
2	Managerial characteristics have significant effects on the financial distress risks of companies.	Confirmed
3	The corporate governance system has a significant effect on the financial distress risks of companies.	Rejected

Source: Research finding.

Table 9. Comparing the Three Variables with the Greatest Effectiveness in Data Mining Models and Regression Model

Ranking of variables in the degree of influence	Data Mining Models				Regression	
	ANN		DT			
	Altman	Ohlson	Altman	Ohlson	Altman	Ohlson
1st	Compet	Compet	Compet	Compet	Compet	ManMyopia
2nd	Inflation	Inflation	ManMyopia	ManMyopia	ManMyopia	Inflation
3rd	ManMyopia	ManMyopia	Inflation	Inflation	Currency	ManEntr

Source: Research finding.

According to the results, the three models indicated that all macroeconomic factors had significant effects on the financial distress risks of companies. The findings also demonstrated that managerial optimism, entrenchment, and myopia had significant effects on the financial distress risk. Given the effectiveness of three out of five managerial characteristics, it can generally be concluded that managerial characteristics had significant effects on the financial distress risks of companies. The other findings indicated that corporate governance variables had no significant effects on the financial distress risks of companies, and only one out of three variables had a significant effect. Given the results, Table (8) presents the conclusions on research hypotheses:

Table (9) presents three variables with the greatest effects on the financial distress risks of companies in each model. These results indicate that market competitiveness and managerial myopia were the first and second most effective variables in the financial distress risks of companies, respectively.

8. Conclusion

This study analyzed the effects of macroeconomic factors (e.g., inflation, GNP, currency exchange rate, and market competitiveness), managerial characteristics (e.g., ability, optimism, entrenchment, and myopia), and corporate governance variables (e.g., institutional ownership, ownership concentration, number of shareholders, and management independence) on the financial distress risks of companies listed in the Tehran Stock Exchange. According to all results obtained from the statistical methods, the variables of macroeconomic variables and managerial characteristics had the greatest effects on the financial distress risks of companies, whereas corporate governance variables were the least effective. This finding is inconsistent with the results reported by Meshki and Hashemi (2015) and Lashkan and Wijekoon (2012) but consistent with the results reported by Moradi and Hosseinzadeh (2017). In other words, the financial distress risks of companies are significantly affected by macroeconomic factors (known as external factors) and managerial characteristics (known as internal factors).

Regarding the effectiveness of each variable, the results indicated that market competitiveness, inflation, currency exchange rate, economic growth, managerial myopia, managerial optimism, managerial entrenchment, and institutional shareholders were among the variables affecting the financial distress risks of companies. Moreover, the results of ranking the independent variables in terms of their effects on the financial distress risk demonstrated that market competitiveness, managerial myopia, and inflation had the greatest effects

on the quality of financial distress at companies. Overall, the results suggested that macroeconomic factors, which are mainly hard to control by a company, had the greatest effects on the financial distress risks of companies. Therefore, policymakers should pay attention to these factors to improve the business atmosphere, mitigate the political and economic risks, and lower the financial distress risk. In addition, the effects of managerial characteristics on financial distress draw further attention from shareholders and public assemblies of companies to the better recruitment of more competent board members and managers.

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References

Abdu, E. (2022). Financial distress situation of financial sectors in Ethiopia: A review paper, *Cogent Economics & Finance*, *10*(1). Retrieved from https://www.tandfonline.com/doi/full/10.1080/23322039.2021.1996020

Altman, E. (1968). Financial ratio, discriminant analysis, and the prediction of corporate bankruptcy. *Journal of Finance*, *23*, 589-610. Retrieved from https://onlinelibrary.wiley.com/doi/10.1111/j.1540-6261.1968.tb00843.x

Altman, E. I. (1983). *Corporate Financial Distress- A Complete Guide to Predicting, Avoiding, and Dealing with Bankruptcy*. New York: John Wiley & Sons.

Altman, E. I., & Hotchkiss, E. (2006). *Corporate Financial Distress and Bankruptcy: Predict and Avoid Bankruptcy, Analyze and Invest in Distressed Debt*. New York: John Wiley & Sons.

Anderson, T.W., & Hsiao, C. (1982). Formulation and Estimation of Dynamic Models Using Panel Data. *Journal of Econometrics, 18* (1), 47-82. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/0304407682900951

Andrade, G., & Kaplan, S. (1998). How costly is financial (not economic) distress? Evidence from highly leveraged transactions that became distressed. *Journal of Finance*, *53*, 1443-1493. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/0022-1082.00062

Bauer, J., & Agarwal, V. (2014). Are hazard models superior to traditional bankruptcy prediction approaches? A comprehensive test. *Journal of Banking & Finance*, *40*, 432–442. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0378426613004858

Bayani, O., Mohammadi, T., Bahrami, J., & Tavakolian, H. (2019). Effect of Shock Factors Affecting Financial Crises in Iran's Economy: Autoregressive Vector Models Variable-Time Parameters. *Economical Modeling*, *13*(46), 45-72. Retrieved from https://sanad.iau.ir/Journal/eco/Article/995466

Beneish, M. D. (1999). The Detection of Earnings Manipulation. *Financial Analysts Journal*, *55*(5), 24-36. Retrieved from https://www.tandfonline.com/doi/abs/10.2469/faj.v55.n5.2296

Brochet, F,. Limbach, P., Schmid, M., & Scholz , M. (2017). CEO Firm Match Quality, Entrenchment, and the Relation between CEO Tenure and Firm Value, *Finance Meeting Eurofidai*, *18*, 109-131. Retrieved from https://publications.aaahq.org/accounting-review/article-abstract/96/6/47/4388/CEO-Tenure-and-Firm-Value?redirectedFrom=fulltext

Calvo, G. A., Izquierdo, A., & Loo-Kung, R. (2006). Relative Price Volatility under Sudden Stops: The Relevance of Balance Sheet Effects. *Journal of International Economics*, *69*(1), 231-254. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0022199605000693

Campello, M., Graham, J. R., & Harvey, C. R. (2010). The real effects of financial constraints: Evidence from a financial crisis. *Journal of Financial Economics*, *97*, 470-487. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0304405X10000413

Cardarelli, R., M. A. Kose & S. Elekdag. (2010). Capital Inflows: Macroeconomic Implications and Policy Responses. *Economic Systems*, *34*(4), 1-62. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0939362510000361

Citterio, A., & King, T. (2023). The role of Environmental, Social, and Governance (ESG) in predicting bank financial distress. *Finance Researhc Letters*, *51*, 103411.Retrieved from https://www.sciencedirect.com/science/article/pii/S1544612322005888

Claessens, S., M. A. Kose & M. Terrones. (2009). What Happens During Recessions, Crunches and Busts? *Economic Policy*, *60*, 653-700. Retrieved from https://academic.oup.com/economicpolicy/article-abstract/24/60/653/2924932

Dell'Ariccia, G., Detragiache, E., & Rajan, R. (2008). The Real Effect of Banking Crises. *Journal of Financial Intermediation*, *17*, 89-112. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S104295730700040X

Demerjian, P., Lev, B., Lewis, M., & MacVay, S. (2013). Managerial ability and Earnings quality. *The Accounting Review*, *88*(2), 463-498. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1650309

Edison, H. (2000). Do Indicators of Financial Crisis Work? An Evaluation of an Early Warning System. Federal Reserve Board of Governors. *International Finance*

Discussion Papers, 675, 1-74. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1002/ijfe.197

Forbes, K. J., & Warnock, F. (2012). Capital Flow Waves: Surges, Stops, Flight, & Retrenchment. *Journal of International Economics, 88*(2), 235-51. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0022199612000566

Frankel, J. A., & Saravelos, G. (2012). Can Leading Indicators Assess Country Vulnerability? Evidence from the 2008–09 Global Financial Crisis. *Journal of International Economics, 87*(2), 216–231. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0022199611001735

Fredrickson, J. W., Hambrick, D. C., & Baumrin, S. (1988). A model of CEO dismissal. *Academy of Management Review, 13*(2), 255–270. Retrieved from https://journals.aom.org/doi/10.5465/amr.1988.4306882

Fu, Z., Chen, Z., Sharif, A., & Razi, U. (2022). The role of financial stress, oil, gold and natural gas prices on clean energy stocks: Global evidence from extreme quantile approach. *Resources Policy, 78*, 102860. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0301420722003063

Ghadiri Moghadam, A. A. F, Gholampourfard, M. M., & Nasirzadeh, F. (2009). Review of the prediction power of altman and ohlson models in predicting bankruptcy of listed companies in tehran stock exchange. *Knowledge and Development, 16*(28), 193-220. Retrieved from https://danesh24.um.ac.ir/article_25680.html

Gervais, S., Heaton, J. B., & Odean, T. (2007). *Overconfidence, Investment Policy, and Manager Welfare*. Durham: Fuqua School of Business, Duke Univ.

Gordon, M. J. (1971). Towards a theory of financial distress. *Journal of Finance, 26* (2), 347–356. Retrieved from https://onlinelibrary.wiley.com/doi/10.1111/j.1540-6261.1971.tb00902.x

Hannes Lang, J. (2018). Cross-country Linkages and Spill-overs in Early Warning Models for Financial Crises. *ECB Working Paper Series, 2160*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3199724#

Huang, X., & Sun, Li. (2017). Managerial Ability and Real Earnings Management. *Advances in Accounting, 39*, 91-104. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0882611015301255

Gunay, S., & Can, G. (2022). The source of financial contagion and spillovers: An evaluation of the covid-19 pandemic and the global financial crisis. *PLoS ONE 17*(1), e0261835. Retrieved from https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0261835

Kalash, I. (2023). The financial leverage–financial performance relationship in the emerging market of Turkey: the role of financial distress risk and currency crisis, *EuroMed Journal of Business, 18*(1) 1-20. Retrieved from

https://www.emerald.com/emjb/article-abstract/18/1/1/94528/The-financial-leverage-financial-performance?redirectedFrom=fulltext

Keasey, K., & Watson, R., (1987). Current cost accounting and the prediction of small company performance, *Journal of Business Finance and Accounting, 13*, 51-70. Retrieved from https://onlinelibrary.wiley.com/doi/10.1111/j.1468-5957.1986.tb01172.x

Kose, M. A., Loungani, P., & Terrones, M. (2015). *Collapse and Revival: Understanding Global Recessions and Recoveries*. Washington: International Monetary Fund.

Laeven, L., & Valencia, F. (2018). Systemic Banking Crises Revisited. *International Monetary Fund Working Paper, 206*. Retrieved from https://www.imf.org/en/Publications/WP/Issues/2018/09/14/Systemic-Banking-Crises-Revisited-46232

Lashkan, A. M., & Wijekoon W.M.H.N.. (2012). Corporate governance and corporate failure. *Procedia Economics and Finance*, *2*(1), 191-198. Retrieved from https://www.sciencedirect.com/science/article/pii/S2212567112000792

Mashikhi, B., & Ganji, H. (2014). The impact on the quality of earnings bankruptcy prediction using artificial neural network. *Financial Accounting and Auditing Research*, *6*(22), 147-173.Retrieved from https://sanad.iau.ir/en/Journal/faar/Article/1073925

Meshki Miavaghi, M., & Hashemi, M. (2015). Investigating the Relationship between Corporate Governance with Bankruptcy Probability in Companies Listed in Tehran Stock Exchange. *Journal of Accounting and Social Interests*, *5*(2), 37-58. Retrieved from https://jaacsi.alzahra.ac.ir/article_2176.html?lang=en

Moglie, M. L., & Sorrenti, G. (2022). Revealing "Mafia Inc."? Financial Crisis, Organized Crime, and the Birth of New Enterprises. *The Review of Economics and Statistics*, *104* (1), 142–156. Retrieved from https://direct.mit.edu/rest/article-abstract/104/1/142/97638/Revealing-Mafia-Inc-Financial-Crisis-Organized?redirectedFrom=fulltext

Moradi, M., & Hosseinzadeh, S. (2017). The Role of Corporate Governance in Firm`s Financial Distress: Pre- and Post-Internal Controls Instruction. *Financial Accounting Research*, *9*(3), 67-90. Retrieved from https://far.ui.ac.ir/article_22532.html?lang=en

Namazi, M., Rezaei, G., & Momtazian, A. (2015). Product Market Competition and Accounting Information Quality. *Journal of Accounting Advances*, *6*(2), 131-166. Retrieved from https://jaa.shirazu.ac.ir/article_2858.html?lang=en

Ohlson, J. A. (1980). Financial ratios and the probabilistic prediction of bankruptcy Wanke, *Journal of Accounting Research 18* (1), 109-131. Retrieved from https://www.jstor.org/stable/2490395

Wank, P., Barros, C. P., & Faria, J. R. (2015). Financial distress drivers in Brazilian Banks: A dynamic slacks approach. *European Journal of Operational Research, 240*(1), 258-268. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0377221714005475

Panahi, H., Asadzadeh, A., & Jalili Marand, A. (2014). A Five-Year-Ahead Bankruptcy Prediction: the Case of Tehran Stock Exchange. *Financial Research Journal, 16*(1), 57-76. Retrieved from https://jfr.ut.ac.ir/article_51840.html?lang=en

Percic, S., Apostoaie, C. M., & Cocriş, V. (2013). Early Warning Systems For Financial Crises- A Critical Approach. *CES Working Paper, 5*(1), 77-88. Retrieved from Retrieved from https://www.econstor.eu/handle/10419/198231

Phan, T. D., Hoang, T. T., & Tran, N. M. (2022). Cash flow and financial distress of private listed enterprises on the Vietnam stock market: A quantile regression approach, *Cogent Business & Management, 9*(1). Retrieved from https://www.tandfonline.com/doi/full/10.1080/23311975.2022.2121237

Platt, H.D., & Platt, M.B. (2006). Understanding differences between financial distress and bankruptcy. *Review of Applied Economics, 2*(2), 141-157. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=876470

Reinhart, C. M., & Rogoff, K. S. (2009). *This Time is Different*. New Jersey: Princeton University Press.

Schrand, C. M., & Zehman, S. L. (2011) Executive Overconfidence and the Slippery Slope to Financial Misreporting. *Journal of Accounting and Economics 53*, 311–29. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0165410111000644

Sharma, V. (2010). Stock returns and product market competition: Beyond industry concentration. *Review of Quantitative Finance and Accounting, 37*, 283-299. Retrieved from https://link.springer.com/article/10.1007/s11156-010-0205-0

Ugur, M., Solomon, E., & Zeynalov, A. (2022). Leverage, competition and financial distress hazard: Implications for capital structure in the presence of agency costs, *Economic Modelling, 108*, 105740. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0264999321003291

Wang, L., Kuang, N., & Shu, M.-H. (2014). Impacts of R&D-marketing Interaction: market performance of new products. *International Journal of Economics and Statistics, 2*, 137-144. Retrieved from https://www.naun.org/main/NAUN/economics/2014/a322001-297.pdf

Wolk, H. I., Dodd, J. L., & Rozycki, J. J. (2013). *Accounting theory: Conceptual issues in a political and economic environment* (8th Ed.). Newcastle: Sage Publication Inc.

Zavgren, C. V. (1985). Assessing the vulnerability to failure of American industrial firms: a logistic analysis, *Journal of Business Finance and Accounting*, *12*(1), 19-45. Retrieved from https://onlinelibrary.wiley.com/doi/10.1111/j.1468-5957.1985.tb00077.x

Zhang, Z., Wu, C., Qu, S., & Chen, X. (2022). An explainable artificial intelligence approach for financial distress prediction. *Information Processing & Management*, *59*(4), 102988. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0306457322001030

Zubair, S., Kabir, R., & Huang, X. (2020). Does the financial crisis change the effect of financing on investment? Evidence from private SMEs. *Journal of Business Research*, *110*, 456-463. Retrieved from https://www.sciencedirect.com/science/article/pii/S0148296320300758

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