

## Financial Performance Evaluation and Prediction of the Financial Crisis on Companies Listed on the Tehran Stock Exchange

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**Abstract:** The financial crisis and the failure of companies is a topic of speculation in the capital market that cost a lot of money. The existence of techniques that can assess the financial performance and predict the financial crisis and when appropriate, give the necessary warning to alert companies can be very useful. The statistical method used to test hypotheses raised in this study is panel data. The population of study consisted of a group of 25 members of companies with financial health and 15 companies with financial crisis. Geographic territory also includes companies listed on Tehran Stock Exchange in six industries of the automotive industry and parts manufacturing, cement, lime and plaster, chemical products, basic metals, petroleum products and machinery and equipment. The results showed a significant relationship between financial performance and financial crisis. Altman model with an overall accuracy of 82.5% managed to classify the companies correctly in groups of financial health and a financial crisis.

**Key words:** Tehran stock, cement, plaster, financial health, financial crisis

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### INTRODUCTION

Evaluating the performance of companies has long been known as a major issue and now one of the most important financial issues for companies is to measure their performance.

The extent to which companies have tried to raise the interests of its shareholders, what criteria Banks and credit institutions consider in lending to companies, what dimensions Business owners consider to pay bonuses to managers and finally, what do public authorities consider according to legal requirements associated with companies, can be responded to in an appropriate way with company performance evaluation method (Bacidore *et al.*, 1997).

It is necessary to confront the challenges facing organizations that managers of these organizations have a model of performance measurement, in order to achieve continuous improvement in all areas. Performance measurement makes steady progress towards targets possible and identifies points of boom and bust. Among the important measures of performance, are financial criteria that its measurement is possible through various methods including financial ratios (Taqizadeh and Fazli, 2011).

In recent decades many researches are done on different financial ratios to assess the impact of the financial situation of the Profitable and unprofitable,

Bankrupt and successful, without the crisis and facing the crisis. Using financial ratios to predict and evaluate the performance have a long history. With the pass of time using financial ratios to predict and evaluate the performance and specially predicting crises and bankruptcies in the form of different models have been impressive (Barac, 2010).

**Theoretical Foundations:** In summing up internal studies it is important that there is a difference between financial distress and bankruptcy. Bankruptcy is the legal status that occurs for companies with a financial crisis. A company might have a crisis for a long time but because there is no law prohibiting, the company is not bankrupt. In financial literature, emphasis on the belief that companies enter the financial crisis, years before the bankruptcy and various economic events occur in the period before the bankruptcy. For example, failure to pay debts or delay in payment of the loan agreement occurs at least 3 years before the bankruptcy. Whitaker (1999) considers financial crisis as a situation in which the cash flows are less than interest expenses on long-term debt.

Beaver (1966) was the first whose research lead to creation of a model to predict bankruptcy. He used univariate analysis, testing the strength of financial ratios to predict bankruptcy.

But the most important models for evaluating the continuity of and bankruptcy prediction model is (Altman, 1983). He called it Z-score model. Knowledge Development (Z-score), is a financial innovation that paved the way for further development of models to predict corporate bankruptcy (Al-Kassar and Soileau, 2014).

Checking the selection of the independent variables in the investigation of the financial crisis over the past 25 years it is stating that both the lack of economic theory and spontaneous variables limits the ability of researchers to develop an overall result for determining a set of specific financial variables as stable indicators for predicting the financial crisis (Nikoomaram and Pourzamani, 2009).

Multivariate analysis, logistic regression and Probit models that are built on the basis of financial ratios are a tool to predict the financial crisis and its steps. Among them multiple discriminant analysis technique are acceptable because it highlights the most effective variable to predict the dependent variable (Ramana *et al.*, 2012). In this study, Altman (1983) bankruptcy model is used that is made the under the multivariate analysis as a predictive indicator of the financial crisis, as well as companies that have been subject to Article 141 of the commercial code have been selected as companies with financial crisis.

Most companies enter financial crisis as a result of poor management and economic crisis. At the initial stages of the financial crisis, the average operating profit of the company is measured based on unadjusted profit and after controlling for other factors that make significant changes to increase performance. Jensen's hypothesis proven results (agency theory) suggests that the financial crisis is a kind of corrective action that improves the performance of the company. In the years after the entry into financial crisis, the company's performance and market value, improves (Whitaker, 1999).

What is important is that, to predict and evaluate future financial performance of the business units, is one of the most important elements in decision-making for investors. For this purpose, financial management scholars around the world think of models to predict financial performance (Barac, 2010). The financial crisis has significant economic costs. But the signs of the financial crisis do not reveal themselves quickly but make an implicit in the midst of massive amounts of financial and non-financial information. The key to success in this field is early detection of financial difficulties. Existence of techniques for evaluating financial performance and forecast financial crisis and conduct research that can help to resolve these issues at the appropriate time, be

alerting companies and making them sober and dynamic can be useful. The study will examine the question whether there is a relationship between financial performance and financial crisis of companies and is it possible to predict the financial crisis by Altman (1983) bankruptcy model?

**Research literature:** Adnan and Dar in a comparative study of predicting of the financial crisis found that almost 70% of the 89 analytical models in years 1967- 2005 which used the mentioned models to predict financial performance, have been formed on the basis of financial ratios. This reveals the importance of using the financial ratios with high information content of performance evaluation models.

Ramana *et al.* (2012) examined the financial performance and predict the risk of financial crisis in the elected cement company in India. They used Altman model 1968 and Springate 1978 and examined the performance of cement companies in 2001 and 2010 using financial ratios of liquidity Working capital and debt ratio. The results showed that liquidity, working capital and liquidity position and weak financial performance ultimately led to the financial crisis.

Al-Kassar and Soileau (2014) to assess the financial performance and bankruptcy prediction, examined data of six companies in years 1998-2011. To assess the financial performance they used seven financial ratios and to predict financial crisis used four financial ratios used in the model Toffler. The results showed that at the 0.05 level there is a significant correlation between financial performance and forecasting bankruptcy.

Maharani and colleagues in investigating the use of financial and non-financial historical information to distinguish successful companies from unsuccessful, using data from 2 years 2002 and 2003 of 120 companies, attempted to predict successful and unsuccessful companies.

Variables consist of three financial variables (return on equity, sales growth and profit growth) and 3 non-financial variables (turnover, number of buyers and the number of transaction). The results indicate a significant relationship between financial and non-financial information and stock returns and fundamental signals of financial and non-financial can be used to rank companies (Mehrani *et al.*, 2004).

Bahram far and Saeed predicted the financial and market performance of listed companies in Tehran Stock Exchange during years 1998-2005. They used 19 financial ratios as the study variables. They offered two distinct models for predicting successful companies and unsuccessful ones. The first model, using statistical

analysis, logit, predicted probability of a company belonging to the Group of successful or unsuccessful in terms of return on equity (market performance). The second model also uses a similar methodology to predict the return on equity (financial performance). The results showed that between the indexes of activity, financial leverage, the average size of the book value of assets, and the type of industry, there are statistically significant differences (Bahramfar and Saei, 2006).

Fathali and Haeri (2013) reviewed bankrupt and not bankrupt companies (in terms of financial performance) and provided model to predict the success of companies in the Stock Exchange in 2001-2007.

The results showed that there is a difference between the average of successful and unsuccessful companies in liquidity and activity indices and unsuccessful company's liquidity is low. Also operation index in unsuccessful company had a more unfavorable situation (Fathali and Haeri, 2013).

Motahar *et al.* (2013) investigate the use of financial and non-financial measures in assessing the performance of electricity distribution companies in Central Province began using data from 2008-2011. Results indicated that with confidence interval of 95% Performance evaluations are more likely to use financial measures compared to non-financial criteria, and do not consider all financial and non-financial criteria at same level.

Panahi and colleagues predicted the bankruptcy companies listed on the Tehran Stock Exchange. In their model they used financial ratios of Altman model with current ratio. The model estimation with linear probability model, Logit models and Probit models, took place for a sample of 134 companies, including the companies in the stock exchange in 2003. Probability model with 8/45% Precision, Logit 75% and pProbit 8/70%, managed to predict the situation of companies correctly.

Zadeh and Noferesti (2010) in the application of Altman and Springate in bankruptcy prediction of companies listed in the Tehran Stock Exchange, used details of a five-year period 2001-2005, to predict corporate bankruptcy. The results show that both models have the ability to predict bankruptcy in stock but Altman (1983)'s model is more accurate than the Springate model.

## MATERIALS AND METHODS

**Research methodology:** Since the results of this research could be effective in investors' decisions, in terms of purpose it is functional and given that this study deals with the status quo and determines the relation between

Table 1: Selection of the sample (firms with financial crisis and non-crisis)

All six industry companies on the stock exchange 29/12/1392	No. of companies (143)
Companies that after 1380 have been accepted in exchange	-33
Companies whose fiscal year does not end until 29 March or have changed in financial year	-19
The companies that their information was not enough to get some variables	-41
Companies that in terms of the nature of activity, are the financial intermediary firms	-6
Total companies with financial crisis and the lack of financial crisis	44
Companies with a net loss	19
Companies that are not covered by Article 141 of the commercial code	-4
Total company with the financial crisis testable	-15
Total companies who lacked the financial crisis testable	25
The entire sample testable with considering the assumptions	40

the different variables using regression analysis, so in the nature, it is correlational. The research is applied research is because the results of this research can be used for a wide range of corporate executives, shareholders, investors, creditors and researchers. Considering that the aim of the present study was to investigate the status quo so in nature it is correlational.

In this study, to collect information on the theoretical foundations of research topics, the study of books, articles and referring to specialized sites (library method) are used and to calculate the variables, mining documents is used. The data needed to calculate the research variables were extracted from the Tadbir Pardaz database. In the case of incomplete data contained in the database, some of the financial information are gathered through reports and Kedal Web site and Management website development Research and Islamic Studies Stock Exchange.

The population consisted of the companies that are active in automotive industry and parts manufacturing, cement, lime and plaster, chemical products, basic metals, petroleum products and machinery and equipment listed on the Tehran Stock Exchange. Reason of using this information is because of their transparency and diversity in companies listed on the Tehran Stock Exchange and the period of this study is 2001-2013 for thirteen years. According to Table 1 for the sample, systematic elimination method is used.

By using all of the above criteria, 40 companies (25 companies with the financial health and 15 companies with the financial crisis) were selected as sample. Thus, according to the 13 year study period (2001-2013) the observations arrive to a 520 firm-year (13×40 companies).

**Hypothesis:** In line with the above theoretical foundations the following hypothesis can be raised:

Table 2: The independent variables

Financial ratios of Al- Kassar and Soileau (2014)			Financial ratios of bankruptcy model (1983)		
Sign	Financial ratios	Type of ratio	Sign	Financial ratios	Type of ratio
R <sub>1</sub>	Current assets to total liabilities	L	X <sub>1</sub>	Working capital to total assets	Liquidity
R <sub>2</sub>	Current assets to current liabilities	L	X <sub>2</sub>	Retained earnings to total assets	Profitability
R <sub>3</sub>	Cash to current liabilities	L	X <sub>3</sub>	Profit before tax to total assets	Profitability
R <sub>4</sub>	Sale of accounts receivable	MP	X <sub>4</sub>	Equity to total debt	Leverage
R <sub>5</sub>	Current liabilities to total assets	MP	X <sub>5</sub>	Sales to total assets	Activity
R <sub>6</sub>	Sales to working capital	MP			
R <sub>7</sub>	Profit before tax in current liabilities	P			

- H<sub>1</sub>: There is a significant relationship between the financial performance and financial crisis
- H<sub>2</sub>: To predict the financial crisis using Altman (1983) bankruptcy model is possible

### Variables

#### Independent variables

**Financial Performance:** In order to calculate taxes for each year model of Al-Kassar and Soileau (2014) as regards the No. 1 will be used in Eq. 1 (Table 2):

$$FP = \sum (P + MP + L) \quad (1)$$

Where:

FP = Financial Performance

P = The average profitability ratio (average profitability ratios available)

MP = Average management performance of the relevant ratio (average performance ratios available)

L = The average liquidity ratio (average liquidity ratios)

Then for each company to evaluate the financial performance of the regression model below is used. Mathematical equation that includes all financial performance ratios to obtain a single value for each company is calculated in Eq. 2:

$$FP(Y) = B_0 + B_1X_1 + B_2X_2 + B_3X_3 \dots B_nX_n + \varepsilon \quad (2)$$

Where:

FP = Financial performance of a company

B<sub>1</sub> = Initial index score of 1

X<sub>1</sub> ratio = 1

N = Number of ratios

n = Fixed

**Financial crisis:** To predict the financial crisis Altman (1983) model as Eq. 3 is used (Zadeh and Noferesti, 2010):

$$Z = 0.717X_1 + 0.847X_2 + 3.1X_3 + 0.42X_4 + 0.99X_5 \quad (3)$$

Where:

X<sub>1</sub> = Working Capital to Total Assets (WC/TA)

X<sub>2</sub> = Retained Earnings to Total Assets (RE/TA)

X<sub>3</sub> = Profit before tax to Total Assets (EBT/TA)

X<sub>4</sub> = Book Value of Equity to Book Value of Total debt (BVE/BVTL)

X<sub>5</sub> = Sales to Total Assets (Sales/TA)

Altman (1983) depending on the value Z-score, three areas of decision-making (three parameters) are proposed.

- If Z' = 21/1 financial crisis is very high risk
- If 1.21 < Z' < 2/9 probability of weak financial crisis
- If Z' = 2/9 there is no possibility of the financial crisis

## RESULTS AND DISCUSSION

**The results of hypotheses testing:** Hypothesis test one given below from Table 3-5.

**The first hypothesis test:** In order to test the first hypothesis, given that the data used in this study are combined (firm-year) and the combined data care compilation or panel, in order to make a choice between panel data and compilation data F Limer test is used. To check the results of F limer, if the probability of F-statistic is >0/05, the compilation approach should be used otherwise panel data method should be used. Test results of F Limer test are summarized in Table 6.

As can be seen, the p-value <0.05 are equal to zero and as a result, using panel data will be accepted. If accepted, the panel data, to choose between a fixed or random effects, the Hausman test is used.

In Hausman test, if chi-square statistic is greater than 0/05, the technique of random-effects and otherwise fixed-effects method is used. According to the p-value Hausman test in Table 7 is equal to zero and less than 0.05, thus using fixed effects will be accepted. In this study, before fitting the model, to identify the presence or absence of autocorrelation, the Durbin-Watson test was used. Durbin-Watson is limited to the range of 4 ≤ DW ≤ 0. If the value is zero, there is positive complete correlation

Table 3: Descriptive statistics, model parameters Al-Kassar and Soileau (2014)

Variable parameters	FP	R1	R2	R3	R4	R5	R6	R7
Average	-3.88	1.04	1.28	0.10	13.48	0.59	-23.81	0.37
Middle	5.27	0.94	1.11	0.06	4.57	0.62	2.05	0.20
Maximum	738.81	5.01	9.00	0.91	511.15	1.40	1455.19	5.06
Minimum	-3418.81	0.03	0.12	0.01	0.05	0.01	-6841.99	-0.82
SD criterion	184.52	0.60	0.88	0.12	31.43	0.22	366.94	0.59
Skewness	-14.99	2.57	3.85	3.62	8.99	-0.03	-15.18	3.38
Elongation	258.33	13.92	23.95	30.34	126.31	3.50	262.45	19.66

Table 4: Descriptive statistics, model parameters of Altman (1983)

Variable parameter	X1	X2	X3	X4	X5
Average	0.05	0.08	0.15	0.70	0.93
Middle	0.07	0.06	0.11	0.41	0.81
Maximum	0.72	2.64	0.75	28.83	9.67
Minimum	-0.57	-1.45	-0.34	-0.53	0.02
SD criterion	0.22	0.25	0.18	1.54	0.75
Skewness	0.05	1.95	0.60	12.65	5.19
Elongation	3.26	33.91	3.85	220.53	46.58

Table 5: Correlation coefficient

Correlation	FP	X1	X2	X3	X4	X5
t-statistics						
prosbability						
FP	1.000000					
-						
-						
X1	0.035788	1.000000				
0.815036	-					
0.4154	-					
X2	0.033508	0.411770	1.000000			
0.763056	10.28405	-				
0.4458	0.0000	-				
X3	0.064256	0.297281	0.540696	1.000000		
1.465464	7.086366	14.62884	-			
0.1434	0.0000	0.0000	-			
X4	0.033533	0.307393	0.272197	0.209132	1.000000	
0.763621	7.3521127	6.438200	4.867397	-		
0.4454	0.0000	0.0000	0.0000	-		
X5	0.062063	0.105236	0.066275	0.188562	-0.032240	1.000000
1.415269	2.408511	1.511721	4.369995	-0.734143	-	
0.1576	0.0164	0.1312	0.0000	0.4632	-	

and if 4, negative correlation between the residuals. If this amount is about 2, there is no correlation. The results of this test are provided in Table 8.

According to the Durbin-Watson statistic that is equal to 2.12, it was found that the model has not autocorrelation. As well as for detection of residual variance heterogeneity we use white test. The null hypothesis in F or LM statistic tests of homogeneity of residual variance statistic is that if the p-value is  $>0.05$ , the null hypothesis is accepted. According to the Table 9 above and the p-value obtained for the white test which is 0.97 and is  $>0.05$  and p-value = 0.05, the null hypothesis (there is homogeneity of variance) is accepted which shows there are no Volatility problems for residual. To investigate the linearity of the relationship between independent and dependent variables in the regression model coded test is used. In this test the null hypothesis is the correction of the model. The  $p > 0.05$ , the null

Table 6: F Limer test

F-Limmer statistics (modile 1)	Possibilit	Result
5.5	0.00	Panel

Table 7: Hausman test

Model	Chi-square	Possibility	Result
1	42.4	0.00	Fixed effects

Table 8: Durbin-Watson

Durbin-Watson statistic	Amount of lack of solidarity
2.121.5	$>DW > 1.5$

Table 9: Check the consistency of variance

Statistic value	p-value
F-statistic (0.52)	0.97

Table 10: Check the linearity of variables

Statistic value	p-value
0.65	0.42

Table 11: The results of data analysis to test the first hypothesis

Variable	Coefficient	SD	t-statistic	p-value
C	-10.603	0.851	-12.453	0.000
X1	9.701	4.816	2.014	0.045
X2	5.526	1.379	4.007	0.000
X3	2.382	0.811	2.937	0.004
X4	4.369	0.438	9.964	0.000
X5	5.034	1.354	3.718	0.000

$R^2 = 0.84$ ; F-statistic = 0.3.7; Adj.  $R^2 = 0.82$ ; Prob. (F-statistic) = 0.00

hypothesis is accepted and the model is correctly specified. The results for the model presented in the following Table 10.

According to the test p-value equal to 0.42 and  $>0.05$ , the null hypothesis is accepted and indicated that the model is correctly specified. To test the first hypothesis the regression model below is used in Eq. 4:

$$FP = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon \quad (4)$$

Financial performance values for the 40 samples are enclosed on file in the CD. The results of the analysis of the data are presented in Table 11.

According to the p-value obtained for the statistic F, which is the zero ( $p = 0.05$ ),  $H_0$  is rejected which show that all the regression coefficients are not zero. So between all independent variables and the dependent variable at the same time there is a significant relationship. According to the Table 11 and the t-statistic, p-value for

Table 12: Financial indicators to measure the financial crisis

Results	Ratio	Coefficients of ratios (%)	Coefficient
The lower value indicates the company is approaching the financial crisis	WC/TA	0.717	9.701
The lower value indicates the company is approaching the financial crisis	RE/TA	0.847	5.526
The lower value indicates the company is approaching the financial crisis	EBT/TA	3.1	2.382
The higher value indicates the company is approaching the financial crisis	BVE/BVTL	0.42	4.369
The lower value indicates the company is approaching the financial crisis	Sales/TA	0.92	5.034

Table 13: Altman (1983) model test results

Forecast accuracy (%)		Results of classify samples based on the Altman Z			The number of samples		
		Weak crisis	With crisis	Healthy	Total	With crisis	Healthy
82.5	33	7	11	22	40	15	25

independent variable of the financial crisis (X1-X5) that all are less than the level of 0.05 ( $p = 0.05$ ), null hypothesis (assuming no relationship between financial performance and financial crisis) is rejected, resulting in a significant positive relationship between financial performance and financial crisis. As a result, the first research hypothesis is accepted. The adjusted R2 value is equal to 0.82 which show that 82 percent of dependent the variable are explained by the independent variables, in other words 82% of the dependent variable is related to the independent variable.

**The second hypothesis test:** To test the second hypothesis the regression model (model developed model of Altman) is used in Eq. 5:

Table 12 shows percent of the coefficients obtained from coefficients defined in Altman (1983)'s model as well as the coefficient of the fitted regression model to predict the financial crisis.

#### Altman (1983) model parameters:

- If  $Z' = 21/1$  financial crisis is very high risk
- If  $1.21 < Z' < 2/9$  probability of weak financial crisis
- If  $Z' = 2/9$  there is no possibility of the financial crisis

In the following table Altman Z model results according to the parameters of the model are offered to test hypotheses. Years of crisis, is 2013. According to the results of Table 13 above, we can say that the financial crisis of companies using Altman model can be predicted with accurately at 82.5%. As a result, the second hypothesis is accepted and predicting the financial crisis by Altman bankruptcy model is possible, Altman's model out of healthy 25 companies, and 15 companies that have a financial crisis; predicted 22 companies as healthy and 11 companies with financial crisis and 7 companies with weak financial crisis. In total, Altman model among the 40 companies, correctly, predicted the financial condition of 33 companies.

Owners, managers, investors and creditors, businesses and public institutions are interested in

assessing the Company's financial situation because the financial crisis will impose a huge cost to them. One way to help stakeholders is providing prediction models about financial situation of companies. The more the predictions are closer to reality the decision will be more accurate. Financial distress prediction models are one of the tools to estimate the company's status.

This study aims to evaluate the relationship between financial performance and financial crisis, and also predict the financial crisis using a model of bankruptcy. For this purpose the information of 500 years-companies, including the companies in six industries listed in Tehran Stock Exchange in 2011-2013 were used. In order to assess the financial performance of Al-Kassar and Soileau (2014) model was used and Altman model was used to predict the financial crisis. The results showed a significant positive correlation between financial performance and financial crisis. Also it is possible to predict the financial crisis by Altman bankruptcy model. Altman bankruptcy model predicted the financial crisis of companies with accurately of 82.5 percent. Altman model among the 40 companies, correctly, predicted 33 companies in group of healthy and with financial crisis companies. By using all of the above criteria, 40 companies (25 members of companies with financial health, and 15 companies with financial crisis) were selected as sample. Thus, according to the 13 year study period (2001-2013) makes 520 firm-year observations (13 years  $\times$  40 companies).

## CONCLUSION

The results in the first hypothesis, are consistent with the results of the study (Al- Kassar and Soileau, 2014), (Ramana *et al.*, 2012), fits together and contained the same results. This research regarding the superiority of financial information on non-financial information, are in line with the research of (Mehrani *et al.*, 2004). In terms of the use of financial measures to assess performance, it is consistent with the results. The results in the second hypothesis are consistent with the results (Fathali and Haeri, 2013; Zadeh and Nofaresti, 2010).

## RECOMMENDATIONS

Based on the determination of financial performance assessment models and predicting the financial crisis. In future research, the pattern will be used as the basis for evaluating financial performance and operating public and private manufacturing firms to decide on the necessary measures, including divestiture, restructuring, senior management changes or sales or even with the financial crisis.

Industries always for product development purposes and control over its raw materials, decide to merger and acquisition with other companies. These industries at the time of decision of purchase evaluate them and investigate their financial situation so that they do not face financial problems after integration. According to the results presented in this study, these industries can predict situation of these companies in the future using the models used in this study.

Stockbrokers, Analysts and financial advisors that have the task of analyzing the financial position of local companies in stock, and describe the Company's future financial position for prospective companies who are buying shares can also use the model of this study.

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