

PREDICTION FINANCIAL DISTRESS BY USE OF LOGISTIC IN FIRMS ACCEPTED IN TEHRAN STOCK EXCHANGE

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ABSTRACT

Presenting firms financial status prediction patterns is a way to help investors. The more prediction is closer to reality, the more valid are the decisions based on them. Regarding the effects of financial distress on different interested groups, presenting bankruptcy prediction patterns are always considerable. Prediction firms' financial bankruptcy in Tehran stock exchange by use of logistic model has been studied in this paper. Nine independent variables have been used in this research and the selected samples in fitting the pattern include two groups of 50 members from bankrupt and non- bankrupt firms in Tehran stock exchange. The bankrupt group is selected according to being liable to trading low article 141 from 2002 to 2010 and non-bankrupt group is selected according to random sampling out of producing firms accepted in Tehran stock exchange during this research. The results show that the logistic regression model is 89.7% accurate to predict firm's financial distress and we can generally use four variables in firm's financial distress prediction.

Keywords: *Prediction Distress, Bankruptcy, Logistic Model, Trading Law Article 141*

INTRODUCTION

Prediction future events can change past experience into future incidents prediction (Armestrang, 2001). Rapid development of technology and its effects on trade word along with vast environmental changes, has given an increasing speed to economy a way that competitive approach of economic firms, has limited deriving benefit and increased firms bankruptcy and financial risk possibility. Prediction financial distress or bankruptcy is a way to profit suitably by investing opportunities and to prevent wasting sources. Yang (2001), believes that "undesirable firms financial status cause different groups of society, especially investors including stockholders and creditors to sustain a loss. Not only are the investors but also the directors general and accountants interested in prediction firm financial status scientifically".

Constant formation and winding up trading is natural Elements of every economic system. But firm's obligatory wind up due to bankruptcy is an important matter because this event bears economic and social costs (Altman, 1968). As a general definition, any reduction in firms value due to firms financial status exacerbation, is considered as financial cost.

Up to now, various patterns are presented for predicting firms' financial distress and bankruptcy, including patterns based on univariate analysis, multiple discriminant analysis, logistic regression, probit and recursive partitioning algorithm. Along with significant development of other sciences, like computer and mathematics, financial investigators have paid more attention to applied developments in these sciences in other to designing more accurate patterns. The most remarkable result of this view is presenting patters based on neural networks, fuzzy logic and data envelopment analysis.

In order to prediction productive firms financial distress, we try to use logistic model which is a past of statistical skills and has been used more than other skills in research background.

LITERATURE REVIEW

From economic point of view, firm's bankruptcy can be defined as its causing loss; therefore the firm is suffering failure. As a matter of fact, the firm's output rate is lower than investment cost rate (Weston &

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Copeland, 1992). Bankruptcy firms are described by Newton (1998) as: trade unit that stop their operations due to assignment or bankruptcy or stopping current operations with loss by creditors.

In Iran's trading law, in article 412, bankruptcy is described like this: "the merchant or trading firm's bankruptcy is due to the stopping of paying the debts that must be paid". According to Tehran securities bourse laws, bankrupt firms are selected in this study. Considering this organization laws, the bankrupt firm is the one that has accumulated deficit at least half of the whole investment.

Bankruptcy prediction pattern are one of the instruments to estimate the firm future situation. The first research on bankruptcy prediction was carried on by Thomas and wodlok in 1911. Beaver (1966) was the first who used statistical techniques and financial ratio to predict firm's bankruptcy and Edward Altman (1968) was the first used multiple discriminant analysis to do so. Ohlson in 1981 develop a model use of logistic technique. Odom and Sharda (1990) were the first used neural network model's calculating techniques different from statistical methods in a no experimental study to predict bankruptcy. Some of the most important surveys done into bankruptcy prediction patterns are: Solemani in a research titled "to study bankruptcy prediction indexes in Iran environmental condition" in 2001, spent to present a pattern for prediction bankruptcy in Iran. This pattern included 15 independent variables that some of them were financial rating and some quality variable. In 2003, Fallahpoor in a research titled "firm's financial distress prediction by use of artificial neural systems began to predict productive firm's financial bankruptcy and compared it with the multiple discriminant analysis statistical models and in the end he concluded that the neural system model is meaningfully more precise in prediction than multiple discriminant analysis.

HYPOTHESIS

There is a significant relation between financial ratios and prediction of distressed firm accepted in Tehran stock exchange.

METHODOLOGY

This research methodologically is an analytical-mathematical research. The method used in this research is field method by use of historic information of distressed and non-distressed firms in two educational and empirical groups.

Statistical Society and Sample

In this paper, statistical population is admitted producing firms in Tehran securities bourse, to select the statistical sample, couple sampling has been used as follow:

1 –selecting bankrupt firms: to select distressed firms, 50 firms were randomly selected from among producing firms that were under article 141 of law from 2001 to 2009.

2 - Selecting non bankrupt firms: after determining 50 distress firms, for each of them a non-bankrupt firm was selected as a couple. The criterion for selection of non-bankrupt firm is its equal size with the non-bankrupt firm. The criterion indicates the size of the firm is sum of total assets.

As for it was not possible to select distress and bankrupt firms according to their sum of total assessment out of similar industries, we do not match distressed and bankrupt firms from this point of view.

Collecting Data

To collect data, the firm's financial statements existing in Tehran stock exchange library, firm's financial statements in the internet site of research management, development and Islamic studies of Tehran stock exchange and financial information from Tadbirpardaz software, were used. To calculate, analyze the necessary data we use the extensive excel page. Collecting data has been for the sample firms in year t. this year for the distressed firms is the year before becoming distressed and for non-distressed firm, the year before its couple become distressed.

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Logistic Model

The LR technique is multivariable analyses that consider all existing predicting factors in problems simultaneously. In this model a concept named superiority ratio (event occurrence probability ratio (pi) to event not occurrence ratio (1-pi) is used and this ratio’s logarithm is calculated by following formula. This model is known as logistic model.

$$\ln\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \beta_i x_i$$

This model is parametric technique that is used extensively by researchers for predicting bankruptcy. In logistic regression the depended variable is qualitative and it has just two answers. These two topics generally refer to the membership in a group or yes and no answer. In the common regression equation, a number of prediction variables with coefficient for prediction are a possibility which its value changes from 0 to 1. Collins and green (1982) proved that the logistic model, as an economic approach, is performable like statistic univariate analysis model, while it uses less statistic hypotheses.

Variable are divided into two categories, dependent and independent, in logistic model.

1. Dependent variable: it is a qualitative and discrete variable. This variable is being bankrupt or non-bankrupt. In this study the firms include in 141 Article of trading low are considered as bankrupt.
2. Independent variable: The logistic models predict the rank of each sample firm by allocating same weights to dependent variables. To determine the possibility of membership in a definite group (bankrupt or non-bankrupt), this rank is used.

Independent variable in this paper is one of the most effective rations used in financial distress prediction and in previous works of researchers like altman(1968) and Permachandra (2009). These variables are:

- Cash flow/ total assets (CFTA)
- Net income/total assets (NITA)
- Working capital/ total assets (WCTA)
- Current assets/ total assets (CATA)
- Earnings before interest and taxes/ total assets (EBTA)
- Earnings before interest and taxes/interest expense (EBIE)
- Current liabilities/ total assets (CLTA)
- Total debt/ total assets (TDTA)
- Market value/book value of common equity (MVCE)

RESULTS

In this part first descriptive statistic table of the variable (table1) after omitting the outliers is presented and after that we present the research hypotheses test.

Table1- Descriptive Statistics after Removing Outliers

Variable	N	minimum	maximum	mean	Std. Deviation
WCTA	92	-.831	.700	.05658	.239224
CATA	92	.169	.973	.70812	.164783
CFTA	91	-.418	.469	.05836	.156027
EBTA	92	-.265	.793	.10730	.148498
EBIE	89	-10.826	67.692	6.00756	12.409075
MVCE	91	-1.582	5.675	2.07128	1.310350
NITA	92	-.289	.443	.04661	.122288
TDTA	92	.291	1.330	.74162	.167062
CLTA	92	.269	1.320	.64713	.182382
Bankruptcy	92	0	1	.50	.503
Valid N (listwise)	87				

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The regression model to study is:

$$Z_i = \beta_0 + \beta_1 WCTA_i + \beta_2 CATA_i + \beta_3 CFTA_i + \beta_4 EBTA_i + \beta_5 EBIE_i + \beta_6 WVCE_i + \beta_7 NITA_i + \beta_8 TDTA_i + \beta_9 CLTA_i + \varepsilon_i$$

Results of the regression to be reliable, the fitted regression model should be generally significant. The number of possibility pertains to the general test of models coefficients being not significant equals 0.00 which is rejected surely. As a result, total significance of model coefficients is approved. So a significant relation between independent variables is considered and bankruptcy is observed (table 2).

Table2- model coefficients significant general test

	Chi- square	DF	Sig.
Model	80.879	9	.000

Hypotheses Study

The possibility number pertain to statistical zero hypothesis based on nonexistence of relation between independent variable of flow capital to total assets (WCTA), and dependent variable of bankruptcy ($H_0:\beta_1=0$) equals 0.398 which is bigger than 0.05. So the Hypothesis is not rejected for %95 sure, and so there is not a significant relation between the two variables.

The possibility number pertain to statistical zero hypothesis based on nonexistence of relation between independent variable of current assets to total assets (CATA), and dependent variable of bankruptcy ($H_0:\beta_2=0$) equals 0.173 which is bigger than 0.05. So the Hypothesis is not rejected for %95 sure, and so there is not a significant relation between the two variables

The possibility number pertain to statistical zero hypothesis based on nonexistence of relation between independent variable of Cash flow to total assets (CFTA), and dependent variable of bankruptcy ($H_0:\beta_3=0$) equals 0.507 which is bigger than 0.05. So the Hypothesis is not rejected for %95 sure, and so there is not a significant relation between the two variables.

The possibility number pertain to statistical zero hypothesis based on nonexistence of relation between independent variable of Earnings before interest and taxes to total assets (EBTA), and dependent variable of bankruptcy ($H_0:\beta_4=0$) equals 0.397 which is bigger than 0.05. So the Hypothesis is not rejected for %95 sure, and so there is not a significant relation between the two variables.

The possibility number pertain to statistical zero hypothesis based on nonexistence of relation between independent variable of Earnings before interest and taxes to interest expense (EBIE), and dependent variable of bankruptcy ($H_0:\beta_5=0$) equals 0.172 which is bigger than 0.05. So the Hypothesis is not rejected for %95 sure, and so there is not a significant relation between the two variables.

The possibility number pertain to statistical zero hypothesis based on nonexistence of relation between independent variable of Market value to book value of common equity (MVCE), and dependent variable of bankruptcy ($H_0:\beta_6=0$) equals 0.467 which is bigger than 0.05. So the Hypothesis is not rejected for %95 sure, and so there is not a significant relation between the two variables.

The possibility number pertain to statistical zero hypothesis based on nonexistence of relation between independent variable of Net income to total assets (NITA), and dependent variable of bankruptcy ($H_0:\beta_7=0$) equals 0.778 which is bigger than 0.05. So the Hypothesis is not rejected for %95 sure, and so there is not a significant relation between the two variables.

The possibility number pertain to statistical zero hypothesis based on nonexistence of relation between independent variable of Total debt to total assets (TDTA), and dependent variable of bankruptcy ($H_0:\beta_8=0$) equals 0.019 which is smaller than 0.05. So the Hypothesis is rejected for %95 sure, and so there is a significant relation between the two variables.

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The possibility number pertain to statistical zero hypothesis based on nonexistence of relation between independent variable of Current liabilities to total assets (CLTA), and dependent variable of bankruptcy ($H_0:\beta_9=0$) equals 0.123 which is bigger than 0.05. So the Hypothesis is not rejected for %95 sure, and so there is not a significant relation between the two variables (table 3).

The fitted model is also:

Table 3- To study significant of variable in the model

Variables in the Equation						
		B	S.E.	Wald	df	Sig.
Step 1 ^a	WCTA	-5.331	6.312	.713	1	.398
	CATA	10.856	7.970	1.855	1	.173
	CFTA	-2.433	3.664	.441	1	.507
	EBTA	-20.035	23.672	.716	1	.397
	EBIE	-.441	.322	1.867	1	.172
	MVCE	-.363	.499	.530	1	.467
	NITA	8.183	28.999	.080	1	.778
	TDTA	26.828	11.424	5.515	1	.019
	CLTA	-18.925	12.265	2.381	1	.123
Constant	-11.228	4.631	5.878	1	.015	

a. Variable(s) entered on step 1: WCTA, CATA, CFTA, EBTA, EBIE, MVCE, NITA, TDTA, CLTA.

$$Z_i = -11.228 - 5.331 WCTA_i + 10.856 CATA_i - 2.433 CFTA_i - 20.035 EBTA_i - 0.441 EBIE_i - 0.363 MVCE_i + 8.183 NITA_i + 26.828 TDTA_i - 18.925 CLTA_i$$

$$P_i = \frac{1}{1 + e^{-z_i}}$$

At last, regarding the above hypotheses confirmation we can rely on the results of the fitted model.

The model accuracy study is in table 4 which the model accuracy equals % 89.7 in sum.

Table 4- To study the model accuracy according to prediction

Observed	Predicted		
	0	1	Percentage Correct
Bankruptcy 0	39	4	90.7%
Non-Bankruptcy 1	5	39	88.6%
Overall percentage			89.7%

The final regression model is achieved after eliminating non-significant variable like this:

$$Z_i = \beta_0 + \beta_1 EBTA_i + \beta_2 EBIE_i + \beta_3 TDTA_i + \beta_4 CLTA_i + \varepsilon_i$$

$$P_i = \frac{1}{1 + e^{-z_i}}$$

Therefore to study bankruptcy, use of the above 4 variable is enough and there is no need for the information of other variables. The possibility number pertain to general test of model coefficients non-significant also equals 0.00 which is rejected for %0.95 sure and so the models all coefficient significance

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is confirmed. According a significant relation between the two independent variables is considered and bankruptcy is observed (table 5).

Table5- model coefficients significant general test

	Chi-square	Df	Sig.
Model	80.879	9	.000

The possibility number pertain to statistical zero hypothesis based on nonexistence of relation between independent variable of Earnings before interest and taxes to total assets (EBTA), and dependent variable of bankruptcy ($H_0:\beta_1=0$) equals 0.042 which is smaller than 0.05. So the Hypothesis is rejected for %95 sure, and so there is a significant relation between the two variables.

The possibility number pertain to statistical zero hypothesis based on nonexistence of relation between independent variable of Earnings before interest and taxes to interest expense (EBIE), and dependent variable of bankruptcy ($H_0:\beta_2=0$) equals 0.043 which is smaller than 0.05. So the Hypothesis is rejected for %95 sure, and so there is a significant relation between the two variables.

The possibility number pertain to statistical zero hypothesis based on nonexistence of relation between independent variable of Total debt to total assets (TDTA), and dependent variable of bankruptcy ($H_0:\beta_3=0$) equals 0.007 which is smaller than 0.05. So the Hypothesis is rejected for %95 sure, and so there is a significant relation between the two variables.

The possibility number pertain to statistical zero hypothesis based on nonexistence of relation between independent variable of Current liabilities to total assets (CLTA), and dependent variable of bankruptcy ($H_0:\beta_4=0$) equals 0.045 which is smaller than 0.05. So the Hypothesis is rejected for %95 sure, and so there is a significant relation between the two variables (table 6).

Table 6- to study significant of variable in the model

Variables in the Equation						
		B	S.E.	Wald	df	Sig.
Step 1 ^a	EBTA	-13.799	6.998	3.888	6.312	.042
	EBIE	-0.314	0.194	3.636	7.970	0.43
	TDTA	24.255	8.982	7.293	3.664	0.007
	CLTA	-13.394	7.262	3.402	23.672	0.045
	Constant	-6.680	2.856	5.471	4.631	0.019

a. Variable(s) entered on step 2, EBTA, EBIE, TDTA, CLTA.

The fitted model is also:

$$Z_i = -6.68 - 13.799 EBTA_i + 0.314 EBIE_i + 24.255 TDTA_i - 13.394 CLTA_i$$

$$P_i = \frac{1}{1 + e^{-Z_i}}$$

So we can confirm the independency of remainders for %95 sure. Finally, regarding the above hypotheses confirmation, we can rely on the results of the fitted model (table 7).

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Table 7- To study the model accuracy according to prediction

Observed	Predicted		
	0	1	Percentage Correct
Bankruptcy 0	37	6	86.0%
Non-Bankruptcy 1	5	41	89.1%
Overall percentage			87.6%

CONCLUSION

The logistic model prediction accuracy for non-bankruptcy firms is 89% and for bankruptcy firms is 91%, which compared to previous researches achieved desirable results.

Of course commenting on a firms bankruptcy by each of the models, is just suggestive of beware about firm future status and is not confirming definite bankruptcy of that firm (Rood Poshti & et al. 2009). This research has two basic limitations: 1- it is not possible to non-bankruptcy sample firms and distressed sample firms from the kind of industry point of view, for we are not able choose non-bankruptcy firms and distressed firms which their total assets are almost equal regarding the industry. 2- the research variable used in the logistic model as independent variable, are selected regarding previous research and the professors view, so the dependent variable are up to the researcher.

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