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Changes Conservatism And Bankruptcy Prediction Model Using Artificial Neural Networks In Tehran Stock Exchange: An Empirical Approach

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Abstract: Bankrupt firms and commercial establishments make many problems for governments and users of financial information to investors and creditors to load special pin and increase the risk of investment. Better decisions are made and the resulting liquidity problems and financial investors and the company are prevented. One of the most important models is the model which can predict corporate bankruptcy. The bankruptcy prediction models, can help investors exposure to companies that are in bankruptcy, have been identified and their capital to invest in a better place. Hence conservatism as a model to study the rate of change, in this study, 102 companies listed on the Stock Exchange in the form of bankrupt and non-bankrupt companies used. Most of the Altman model and artificial neural network is less than, but of the two models is much less expensive.

Keyword:bankruptcy prediction, conservatism, asymmetric information

INTRODUCTION:

Every now and then and in some part of this wide world ,there happens economic or financial crisis and spreading news related to that agitate and distress the stock exchange of the valued documents and the active investors in that. The current economic crisis which started from United States and housing sector from the year 2008 and still continues by the early months of 2013 is one of such things. It is a crisis that has caused many problems not only for the American statesmen and investors but also many of the statesmen around the world. It is a crisis that, only in the year 2008, has caused Federal Reserve and federal government of America to spend more than 52 billion dollars in order to control that crisis and improve the status of companies (Helwege, 2010). It is at a time that the advent of crisis in one country or company is not a threat for all the investors but there are investors who, using the thoughtful and appropriate actions, turn it into an opportunity. This group of investors using the appropriate tool of prediction can take the right decision in the right time and take step in the way of their own interest and even increasing their interest.

Additionally, the ever increasing speed of different economic sectors which has occurred as a result of changes happening in IT, has caused the ever increasing competition of economic firms in different industries and has limited access to benefit and economic resources. That increases the chance of bankruptcy for the legal persons and companies (Odam & Sharda, 1990).

As in the years 2008 and 2009, more than thousands of big and small companies went bankrupt and this has increased the risk for investment and ruined much of economic resources. This is how we can admit that decision making in the financial affairs is always along with risk and lack of confidence; and the more is the level of risk, the investors and other users of financial information need to receive more information in order to add up to their knowledge and information (Jafari, 2011). One way to increase information and knowledge of investors is to use the proper models of prediction regarding the future of the company. The most important of such models is the bankruptcy predicting model. Models for predicting bankruptcy are one of the tools to estimate the future situation of the companies which have drawn the attention of many investors (Shin et al., 2005). The present research discusses the subject of how to predict bankruptcy in a different way. This research uses analytical method for its predictions and compares it with statistical models and the nerves network.

REVIEW OF LITERATURE

The researchers are always after discovery of a tool through which they can predict important events that are to happen in the future. The most important of such events for which users of financial information have a lot of interest include: bankruptcy, the level of benefit, output of the stock and monetary fund's of future (Shin et al., 2005). Bankruptcy prediction, a prediction is binary, where the company is go bankrupt or go bankrupt or none of the model as a predictive model is selected, companies must be able to determine whether or not go bankrupt. Researchers have used various methods to predict bankruptcy include:

1 - Statistical Prediction Models, 2 - Predictive models based

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on expert systems, and 3 - Models of the theoretical prediction (Aragonite, 1986). Taken together, all these models can be divided into two categories: the first category prediction models of financial ratios and the second uses analytical models, which are used to predict the signs (Mine & Zhang, 2008). Group 1, the models are based on statistical methods based are such models in a univariate and multivariate. Group 2 included those models predicting bankruptcy is based systems and artificial intelligence. These kinds of models from 1990 onwards with the extended use of intelligence in an artificial environment, finance and accounting, came into existence. Among these models, the models can be fuzzy sets, genetic algorithms and artificial neural network model are (Mine & Zhang, 2008). Use of these models, along with the time and resources, so instead we use this method to predict failure of management to understand the overall landscape of enterprise applications. Managers often spend a lot of accurate information about the overall prospects for the company and get the chance of bankruptcy in the coming years. The fact that they have this information confidential and not passed on to consumers, Research carried out in the presence of information asymmetry between investors and managers have proven (Frankel & Li, 2004). The users of financial information with respect to the behavior of managers and signals would be able to anticipate the market could collapse. It seems to be a sign that investors can use to predict the likelihood of future corporate bankruptcies, the level of conservatism used by administrators. According to Givoly, conservatism in financial reporting is one of the most important contracts, which resulted in the recognition and measurement of income and assets are exercising caution (Givoly & Hayn, 2000).

Basu (1997) show less conservatism practices to reduce profitability and assets in response to bad news and the More in showing assets and accounting gains in response to the good news defines. In general, conservatism is a concept that has been reported to decrease retained earnings by later identify and recognize revenue faster than costs, the valuation of assets and liabilities is low .In fact, tend to show less show more assets and liabilities are, in fact, a conservative management is applied. This research is based upon three theories: First theory is called theory of lack of financial symmetry which indicates that there is contradiction of information between the managers and other users. The second theory is a psychological theory which states that individuals in the face of trouble use the closest tool and not the best one in order to save themselves. The third theory is that investigating the extant signals in market, we can find out valuable information. Therefore, the present research is to study the changes in the conservative rate as one signal to predict the bankruptcy of extant companies in the sample. It also compares the precision of this type of prediction with the predictions based on the statistical model of Altman and artificial nerves network after it could determine the fault of those predictions. In the following, there is given an example of the previous researches:

In the year 1985, Casey and Bartczak conducted a research using 209 companies in two groups of bankrupt and not bankrupt in order to evaluate the subject that whether circulation of operational monetary units can be used in the analysis related to bankruptcy. They have selected the considered data in the time period 1971-1982. Their statistical method was to analyze the multiple decimal points. However, their study did not conclude the evidence is sufficient to use operating cash flow in bankruptcy prediction models provide. According to some experts, this research is largely in the absence of other researchers operating cash flow as a valid predictive power failure, has been influential (Casey & Bartizak, 1985).

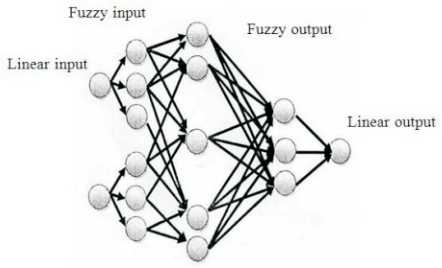
Boston et al. (1994), in a study evaluated the ability of models' predict, based on financial ratios in field of distinguish between bankrupt and non-bankrupt firms. They used the Altman basic model for achieve this purpose. Their sample consists of 204 companies, which 195 of these companies were used in the Altman research. The researchers used a long period of time. They were also examined ability Altman models for 8 years prior to bankruptcy. The result of their research is based on the fact that the models are able to predict the bankruptcy (Postoun et al., 1994).

Kim and Gu (2006) in research began to compare the performance of two multiple discriminant analysis and logit analysis models in bankruptcy prediction. for doing such work, they were used financial data of 36 companies in two bankrupt and non-bankrupt groups between 1986 and 1998. The goal of this research was to design an appropriate model to predict bankruptcy restaurants, the methods used in designing the model, were logit and multiple discriminate analyses. The number of independent variables for each model in this study consists of 12 financial ratios. Their research results indicate the accuracy of the logit model for forecasting bankruptcy in bankruptcy year is about 93%. In addition, the study of Kim and Gu (2006) reveals that the logit analysis model, and multiple discriminant analysis accurately predicted the bankruptcy of the restaurants have the same amount of performance.

Slim in 2007, using fuzzy logic techniques offers model for predicting bankruptcy. He

Exhibit 1

Fuzzy principles



believed that the manner predicted by other methods such as back propagation neural network and linear discriminant analysis in bankruptcy prediction has better performance. He used 17 financial ratios in 68 financial firms for the design of

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fuzzy model is in the years 2000-2005. He fuzzy neural network has five part, fuzzy network is used in the form of Exhibit 1 presents the study of sound. This study confirms the common argument so that the average prediction accuracy of linear discriminate analysis for bankruptcy models, back propagation neural network and fuzzy neural network in the training of the 70/83% 81.92% and 97.92% and 60% respectively in the test sample, 70% and 90%. It suggests that the fuzzy neural network in the training samples and in both the test samples in terms of prediction accuracy show better performance of self (Slim, 2007).

Wu along with a number of researchers in 2007 paid to compare the models to predict bankruptcy (financial distress), at the first study they using the technique of support vector (SVM) and genetic algorithm paid to the design of a hybrid model, the next step this researchers were compared the prediction accuracy of this model with models of multiple discriminant analysis, Probit, logit , Artificial neural network and modeling techniques support vector simple. The study period is from 1988 to 2002 (Wu et al, 2007).

Wang's (2006) research entitled accounting conservatism and earnings forecast reviews the effect of conservatism on the future profits and whether financial analysts and stock market inventors used from conservative information of current period to predict future profits. The results of this study indicate that analysts included conservative in their predictions. So, their predictions too conservative, including the systematic error and also analysts forecast error not responsible for the pricing errors of stock market.

Givoly in 2000 paid to examine changes in the attitude of profit, cash flow and accruals has over4decades.total 896companies n this study were tested during two sub-period 1951-1980and 1981-1998.the results indicate that cash flows from operations have remained constant during the period, but non-operating accruals have been reduced, in other words, in the two periods they had more reduce. So, this matter makes much reduced total accruals. This indicates that the calculation is very conservative accounting earnings over time. The results also showed that corporate profitability is more conservative even easier, and conservatism in addition to profitability with cash returns indicators of assets is measured by operating cash flow has a direct relationship.

Min and Jeong (2008) examined the role of reaction to those creditors and lenders to provide. The research of this study indicate that changes in the conservatism of can help to creditors and lenders for correct economic decisions and signing contracts contributed significantly to dept.

RESEARCH HYPOTHESIS

1.There is a relationship between bankruptcy and conservatism among firms in the capital market rate changes in a time interval of 3 years.
2.There is a relationship between bankruptcy and conservatism among firms in the capital market rate changes in a time interval of 5 years.
3. Altman multiple discriminate model to predict bankruptcy of companies in the stock market.
4. ANN model predict bankruptcy of companies in the stock market.
5.Type I error rate Altman's bankruptcy prediction models, artificial neural network and analytical models with the same conservative changes.
6.Type II error rate Altman bankruptcy prediction models, artificial neural network and analytical models with the same conservative changes.

The variables of research: Independent (predicting) variable

In the extant research, two different activities are done. First, designing one network is done in order to predict bankruptcy. Every artificial nerves network is made up of two sectors on the whole. The first part is the input layer of the network in which economic proportions are used as the input of the network in order to predict bankruptcy. The number of these inputs and their type is a very important point which should be determined with a logical method. To determine the number or type of financial proportions of the input in the artificial nerves network, the first and third methods are used which are the insight and understanding of the researcher and the previous researches. The second part of an artificial nerves network is a hidden layer which in fact includes certain weights that network allots to any of the input variables considering the educational sample. The third part of the artificial network is a response which the researcher analyzing it will come to know about the precision of the network in categorizing the companies in two groups of bankrupt and not bankrupt. The second step in the present research is to study the level of conservative changes in the educational samples, select a proper number as the bankruptcy rate, execute test in the test sample and study the precision of the designed model along with other models which are Altman and artificial nerves network. The independent variables of this research are the same proportions which in every model are needed in order to categorize the member companies of sample into bankrupt and not bankrupt. This is presented in the index 1.

Index 1 independent variables Altman models and Neural Network

Variable symbol	Independent variables	Model name
X_1	Working capital to total assets ratio	Altman Multiple discriminant model
X_2	Ratio of retained earnings to total assets	
X_3	Income before deducting interest and Taxes to total assets	
X_4	The ratio of equity to total liabilities	

Variable symbol	Independent variables	Model name
	Four of the Altman model	Neural Network
X_5	Net Sales to Total Assets Ratio	

This innovative model is conservative rate changes in the independent variable. Conservative measure, measure a variety of models that can be defined in model 1 - Fltham and Olson (1995), 2 - Model Basu (1197), 3 - Model Gyvly and Hine (2000), 4 - Models Beaver and Ryan (2000), 5 - model Penman and Zhang (2002), 6 - model (2004) pointed

out. In this study to measure conservatism Gyvly and Gee model is used. The conservative model is the sum of the changes in accruals per year divided by total assets. Whatever it is more than over several years, is also more conservative in this research is the theory of mind the rate of conservatism in bankruptcy each year than the year before, and the rate of non-bankrupt conservatism or more per year compared to previous years without change. The model is as follows:
(1 -) × (operating accruals) / (total assets in the first period) = Conservative Index

Two operating accruals are calculated as follows:

In the first case:
OPACC =

OPACC = ΔAR + ΔINV + ΔPE - ΔAP - ΔTP

Changes in prepayment	ΔPE	Operating accruals	OPACC
Changes in accounts payable	ΔAP	Changes in accounts receivable	ΔAR
Changes in taxes payable	ΔTP	Changes in Inventories	ΔINV

And in the second case:
(Depreciation + interest expense) - operating cash flow = Operating accruals.

The first case study was used to calculate operating accruals and the balance sheet data have been extracted. In this study, the second method is used to calculate operating accruals. The Exhibit 2 shows the independent variables of the model conservatism.

Exhibit No. 2 independent variables conservative model

How to Calculate conservatism = (1 -) × (accruals) / (sum of beginning assets)

How to calculate accruals = change in current assets - current liabilities change

Changes in current assets= Changes in accounts receivable Changes in prepayment Changes in Inventories

change Advance Changes in accounts payable −Changes in current liabilities

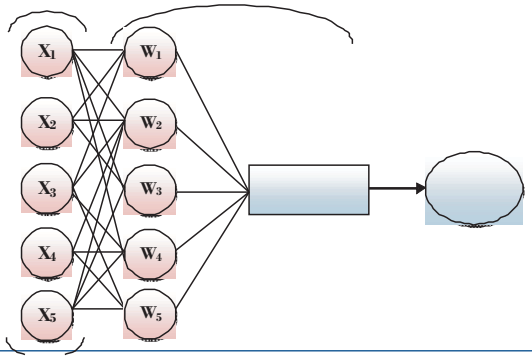
DEPENDENT VARIABLE

Research on the prediction of bankruptcy, an allowance of zero or one dependent variable (0,1). The analytical model change conservatism, the conservatism rates ranged from 3 or 5 years as a function of decreasing, the company is close to bankruptcy. While the other two models, and it is virtually zero, and the results are presented. Zero means that the model tested in this model, the non-bankrupt companies surveyed predicted. Altman's model, this happens when the total weight of the product in the financial ratio is greater than 2.60 And the neural network model is considered to be zero when the variable is the sum of the weights determined by multiplying the independent variable, is less than 0.5. However, in their review of the model as a dependent variable is allocated, meaning that companies surveyed, the model is expected to go bankrupt and insolvent companies, it should be classified in the group. Altman's model when the dependent variable is allocated an amount of the total weight of the product in their financial ratios is less than 1.10. Research on the neural network model when the dependent variable is equal to a weighted sum of the product of the input is greater than 0.5, then as part of the bankrupt and insolvent companies are classified.

$$Z = 6.56x_1 + 3.26x_2 + 6.72x_3 + 1.05x_4$$

In fact, the artificial neural network software program or a semiconductor chip that can act like a human brain (Menhaj , 1384), the structure of neurons in the human brain is like a grid and is composed of three parts. The first layer is the input layer of the network is input. The second hidden layer in which the input weights of training samples determined by the network and the input is multiplied by the weight. The third part of the study is that the dependent variable, the output of the network. Exhibit No. 3 and 4 mathematical structure of a neural network used as a study shows.

Index.3: artificial neural network image



In fact, the method through which the network works is similar to two previous models to a good extent. When the input level is given, considering the level of threshold, one figurative level of zero (0) or one (1) will be allotted to it. This zero (0) or one (1) in fact determines the precision level of model in signifying whether company is bankrupt or not. If the model allots zero level to one company, it means that model have considered that company not to be bankrupt and if number one is given to one company, it shows that nerves network has placed that company in the group of the bankrupt. The closer this decimal amount is to reality and the less is the number of the network mistakes, the network will have more functionality.

METHODOLOGY AND CONCLUSIONS

The present research can be categorized as a periodical one from the methodological viewpoint. In this research, two variables regression method is used in order to analyze data. The main objective of this research is to choose the most precise model for predicting bankruptcy from among three models of Altman, analytical model for the changes in the conservative rate and artificial nerves network model. In order to do that, first the above models should be used in the capital market of Iran; it means that examples of two bankrupt companies and not bankrupt ones should be selected. Afterwards, the required independent variables of

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each model which are in fact financial proportion should be calculated and placed in the respective model. When these financial proportions are placed in the models, the dependent variable model which is a binary amount of 0 or 1 will be determined. Hereby, zero (0) indicates that company is not bankrupt and one (1) means bankruptcy. To test the first four theories, we have to use correlation coefficient test of r; in the sense that if there is a meaningful positive relationship between recognition of the model under study and the real situation of the sample, it means that model under study has the capability to generalize. Now it is time to test the fifth and sixth theories. In fact, the objective of these two theories is to test the recognition precision of the bankruptcy models. As there are three groups (models) in this research and the result of these three models are of distance type, the ANOVA (analysis of multidimensional variance) should be used.

Exhibit 4 results in the first and second hypotheses:

	Correlation between reality and the model of Altman			For year
Results	Status	Sig	The correlation coefficient	
There is a positive relationship between model and reality of	Within the critical region	0.000	0.698	t
	Within the critical region	0.000	0.558	t-1
The first hypothesis was accepted	Within the critical region	0.000	0.698	t-2
Significant at the 0.05 level, but there are also 0.001				

U_Mann Whitny test for significance of difference between groups				For year
Interpreting test		Sig	Z	
Sig is greater than 0.05 if there is no significant difference between the means		0.89	-0.13	t
		0.23	-1.20	t-1
		0.89	-1.33	t-2
The significant level is 0.05				

Exhibit 5 results in the third and fourth hypotheses

Year t-2	Year t-1	For year t	Accurately model the performance of Altman
%92	%92	%98	Bankrupt
%67	%61	%69	Non-bankrupt
%79.5	%76.5	%83.5	Total accuracy

	Correlation between reality and the model of Altman			For year
Results	Status	Sig	The correlation coefficient	
There is a positive relationship between model and reality of	Within the critical region	0.000	0.678	t
	Within the critical region	0.000	0.588	t-1
The third hypothesis was accepted	Within the critical region	0.000	0.698	t-2
Significant at the 0.05 level, but there are also 0.001				

U_Mann Whitny test for significance of difference between groups				For year
Interpreting test		Sig	Z	
Sig is larger than 0.05 if there is no significant difference between the means		0.89	-0.14	t
		0.23	-1.21	t-1
		0.89	-1.35	t-2
The 0.05 level				

	Correlation between reality and model recognition			For year
Results	Status	Sig	The correlation coefficient	
There is a positive relationship between model and reality of	Within the critical region	0.000	0.889	t
	Within the critical region	0.000	0.962	t-1
The fourth hypothesis was accepted	Within the critical region	0.000	0.844	t-2
Significant at the 0.05 level, but there are also 0.001				

U_Mann Whitny test for significance of difference between groups				For year
Interpreting test		Sig	Z	
Sig is larger than 0.05 if there is no significant difference between the means		0.28	-1.07	t
		0.11	-1.59	t-1
		0.11	-1.59	t-2
The 0.05 level				

Exhibit No. 5: the fifth and sixth hypotheses

	Average alpha error	The fifth hypothesis
The mean error rate alpha Altman model = $\mu\alpha_1$	6%	Altman model
Mean alpha error of neural network models = $\mu\alpha_2$	5.8%	Conservative analytical model changes
The average error rate of alpha-conservative changes in the analytical model = $\mu\alpha_3$	2%	Neural Network Model
Testing showed that the alpha error rate is the same in the three models.	0.000	

Results of Testing			
H0 was accepted	$\mu\alpha_1 \neq \mu\alpha_2 \neq \mu\alpha_3$	H_0	The fifth hypothesis
H1 was rejected	$\mu\alpha_1 = \mu\alpha_2 = \mu\alpha_3$	H_1	

	Average beta error	The sixth hypothesis
Mean of error level beta-in Model Altman = $\mu\beta_1$	34%	Altman model
The mean error rate in the Beta neural network model = $\mu\beta_2$	14%	Conservative analytical model changes
The mean error of the analytical model change conservatism Beta = $\mu\beta_3$	9%	Neural Network Model
Testing showed that the beta error of three models is the same.	0.000	

Results of Testing			
H0 was accepted	$\mu\beta_1 \neq \mu\beta_2 \neq \mu\beta_3$	H_0	The sixth hypothesis
H1 was rejected	$\mu\beta_1 = \mu\beta_2 = \mu\beta_3$	H_1	

CONCLUSION

Bankruptcy of legal persons and companies is not a new phenomenon and from past to present, the economic society has faced it. Today, the technologic progresses have facilitated the financial and economic affairs. Speeding up financial affairs, despite having many advantages, is one of the reasons why the companies and economic firms go bankrupt. Using the statistical models in order to predict bankruptcy began from year 1960. It didn't take long before new models based on efficient artificial intelligence system appeared and many researchers' minds were drawn to them all around the world. Present research studies the capability of prediction of three models: multiple decimal point of Altman, artificial nerves network and changes in the conservative rate. Results indicate that these three models are capable in predicting bankruptcy at least three years before it happens in Tehran's stock exchanges of valuable documents. But the nerves network model is more precise.

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