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The Creation Of bankruptcy prediction model with using Ohlson and Shirata models

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ABSTRACT

The increase of trading exchange capacity in the Iranian trading stock market clears the use of models which can predict the financial position of Iranian companies. One of the most significant threats of a national economy is the bankruptcy of its firms. Assessment of bankruptcy provides valuable information on which governments, investors and shareholders can base their financial decisions in order to prevent possible losses. Using the financial ratios is one of the useful methods to analyze the financial reports, the prediction of financial distress and bankruptcy. In this research we made two models for prediction of bankruptcy regarding Iranian economical situation. We studied the ohlson and shirata models using logistic regression method. For this purpose, the researchers has examined and compared the ability of "ohlson and shirata" models. For classifying and ranking companies, we used the "Article 141" of business law to determine the bankrupt companies, as well as simple Q-Tobin to specify the solvent companies. We used statistical method of "Enter Logistic" to test the first and second hypothesis the results shows that the created models are able to predict the bankruptcy.
KEYWORDS: Bankruptcy prediction model, financial ratio, Ohlson model, Shirata model, Logestic regression

INTRODUCTION

Auditors should be interested in acknowledging the probability in the going-concern of the company. State agents need a reliable diagnostic tool to support bankrupt companies. Financial health of a company can help each individual beneficiary (for example clients, employees and managers). Many studies have been done to find effective experimental methods to predict the financial crisis that its result is the creation of different models to predict financial crisis. Studies show that the companies' going-concern has a close connection with company's ability to fulfill its commitments [9]. So the adjustment of the models based on cash flow ratios originating from the operation based on the condition of the country, can provide a more appropriate criterion in order to predict the going-concern of the companies. The purpose of this study is to test the ability of two models, Ohlson and Shirata to predict bankruptcy of the approved companies in Tehran's Stock Exchange. Bankruptcy is a situation when a company or a natural person's financial position is low and weak To the extent that in practice and legal way they are unable to pay their debt sand fulfills their obligations. In 1968 Altman [1] used legal aspects of high studies to describe bankruptcy. Beaver [2] in 1966 defined bankruptcy from creditors' point of view. He indicated that bankrupt companies are those that were unable to meet their debt obligations to their creditors. Bankruptcy of a company is not only legal aspect; it is a situation of financial press and dilemma in its prior period. The prediction of company failure has been well researched, using the developed countries data. A variety of models have been developed in the academic literature using techniques such as multiple discriminant analysis (MDA), logit, probit, recursive partitioning, hazard models, and neural networks. Review of the related literature is provided by many researchers. Despite the variety of models available, both the business community and researchers often rely on the models developed by Altman [1] and Ohlson [10]. A survey of the literature shows that the majority of international failure prediction studies employ MDA. Multiple Discriminant Analysis (MDA) is a method for compressing a multivariate signal to yield a lower dimensional signal amenable to classification.MDA is not directly used to perform classification. It merely supports classification by yielding a compressed signal amenable to classification. The method described in Duda et al. [4] projects the multivariate signal down to an M−1 dimensional space where M is the number of categories.MDA is useful because most classifiers are strongly affected by the curse of dimensionality. In other words, when signals are represented in very high dimensional spaces, the classifier's performance is catastrophically impaired by the over-fitting problem. This problem is reduced by compressing the signal down to a lower-dimensional space as MDA does. A review of some studies relevant to this article follows. Beaver [2] presented empirical evidence that certain financial ratios, most notably cash flow/total debt, gave statistically significant signals well before actual business failure. Altman [1] extended Beaver's analysis by developing a discriminant function which combines

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ratios in a multivariate analysis. He found that his five ratios outperformed Beaver's cash flow to total debt ratio. Ohlson raised questions about the MDA model, particularly regarding the restrictive statistical requirements imposed by the model. To overcome the limitations, Ohlson [10] employed logistic regression to predict company failure. He used the logit model and US firms to develop an estimate of the probability of failure for each firm. He argued that this method overcomes some of the criticisms of MDA, which requires an assumption of a normal distribution of predictors, and suffers from the arbitrary nature of identifying non-failed "matching" firms. He selected nine independent variables that he thought should be helpful in predicting bankruptcy, but provided no theoretical justification for the selection [13]. (The nine variables are described in the methodology section of this paper). He then selected industrial firms from the period 1970-1976 that had been traded on a US stock exchange for at least 3 years. He ended up with 105 failed firms and 2000 non failed firms. Three models were estimated: the first to predict failure within 1 year, the second to predict failure within 2 years and the third to predict failure in 1 or 2 years. He then used a logistic function to predict the probability of failure for the firms using each model [15]. Following up on concerns about the MDA model, Lau [8] used US companies and extended the logit model concept by using five categories of firm financial health ranging from financial stability to bankruptcy and liquidation. This methodology allows calculation of the probability that a firm will move into each of the categories and provides a better approximation to the continuum of alternative financial judgment and actions in reality. Tseng [14] use a quadratic interval Logit model for forecasting bankruptcy in United Kingdom (UK). The results show that this model can support the Logit model to discriminate between groups and it provides more information to researchers. Kouki [7] test the predictive power of the main standard bankruptcy prediction models. They compare at once Multivariate Discriminate Analysis (MDA), the Logit model and the Neural Network (NN) models and their predicting power of firm bankruptcy. They use a sample of 60 failing and performing Tunisian firms; during a period of three years before bankruptcy (2000-2002). They found out that Neural Network is the most powerful at a very short term horizon. However, Multivariate Discriminate Analysis and Logit regression are the most powerful at a medium horizon of two and three years before bankruptcy. Gang and Xiaomao [6] with use of Logistic Regression Analysis (LRA) were attempting to by Improving Z-score Model predict corporate bankruptcy in Listed Companies in China. Their research results showed that compared with Altman [1] Z-score model, the new model is of better prediction effect. Akbar Pourreza Soltan Ahmadi [11] attempted to predict the bankruptcy of companies using the Logit model. Therefore, they selected a sample of 49 bankrupt companies and 49 non-bankrupt companies for the years 2005 to 2007. In order to designing a model they used 19 finance ratios. Based on research results, Logit model with variables of net profit to total assets ratio, the ratio of retained earnings to total assets and debt ratio have more power to predict corporate bankruptcy in Iran.

Research hypothesis explains the researcher proposed solution to answer the question. Therefore an appropriate theory depends on how to express problem .In other words, the root of a hypothesis is mixed with the selection of the problem and their expression .the hypotheses of this research are:

1- Ohlsons'expanded model has the ability to predict the stop of activity in approved companies of the Tehran Stock Exchange.

2- Shiratas'expanded model has the ability to predict the cessation of activity in approved companies of the Tehran Stock Exchange

1. MATERIALS AND METHODS

In this study, there is one dependent variable that has two statuses. Companies' status in terms of financial ability is successful (going-concern) or unsuccessful (bankrupt). Dependent variables in this research are financial ratios used in research models. They are in this research:

Ohlsons' model is:

$$Y = B_O + B_1 X_1 + B_2 X_2 + B_2 X_2 + B_2 X_2 + B_2 X_2 + B_2 X_2 + B_2 X_2 + B_9 X_9$$

Failing: is 0 for failed firm-years and 1 for other firm-years.

Independent variables are:

X_1: Log (total assets/GNP price-level index).

X_2: Total liabilities divided by total assets.

X_3: Working capital divided by total assets.

X_4: Current liabilities divided by current assets

X5: 1 if total liabilities exceed total assets, 0 otherwise

X_6: Net income divided by total assets

X_7: Funds provided by operations (income from operation after depreciation) divided by total liabilities.

X_8: 1 if net income was negative for the last 2 years, 0 otherwise

X_9: (NIt-NIt-1)/ (|NIt|+|NIt-1|), where NIt is net income for the most recent period. The denominator acts as a level indicator. The variable is thus intended to measure the relative change in net income

Shiratas' model is:

$$Z = B_{o} + B_{10}X_{10} + B_{11}X_{11} + B_{12}X_{12} + B_{13}X_{13}$$

Independent variables are:
X_{10}: Retained Earnings to Total Assets
X_{11}: (Current period liabilities and shareholders equity/Previous period liability and shareholders equity)-1
X_{12}: Interest and discount expense/ (Short term borrowings + long term borrowings + corporate bond+convertible bond + note receivable discounted)
X_{13}: (average of (Note payable + accounts payable)* 12)/Sales Failing point in this model is z=.38[12].
We use the 2012 version of Tadbirpardaz (the Iranian database of Tehran Stock Exchange) annual data files and samples of use of the all firms in Tehran Stock Exchange between 2003to 2011 with data available to calculate the research variables. In some cases whereby the required data is incomplete, we use the manual archive in the TSE's library. We eliminate banks and financial institutions from sample. Imposing all the data-availability requirements yields 60 firm-years over the period 2003-2011. This is the full sample that we use for testing research hypotheses. The research's samples are divided into two types. The first group: This includes successful and going-concern companies with a sample of30 companies. The main criterion for selection of these companies is the use of simple Tobin's Q index. The second group: This includes unsuccessful and without going-concern companies with a sample of30 companies. The main criterion for selecting companies for this group is Iran's Commercial Law Article 141. According to this unit of reform act of Iranian law, if a company's accumulated losses become more than half of the capital, the company must reduce its capital or to stop its activities to separate the companies into two groups of successful and unsuccessful, Binary Logistic Analysis statistical method and spss 15 software are used. Assumptions are related to adjustment of models and measures in order to get the ability to differentiate successful and unsuccessful companies [5]. For this purpose Statistical methods such as Binary Logistics Analysis and Enter are used.
An explanation of logistic regression begins with an explanation of the logistic function, which, like probabilities, always takes on values between zero and one: [16]

Formula (1)

$$\pi(x) = \frac{e^{(\beta_o + \beta_{1x} + e)}}{e^{(\beta_o + \beta_{1x} + e)} + 1} = \frac{1}{e^{-(\beta_o + \beta_{1x} + e)} + 1}$$

And

Formula (2)

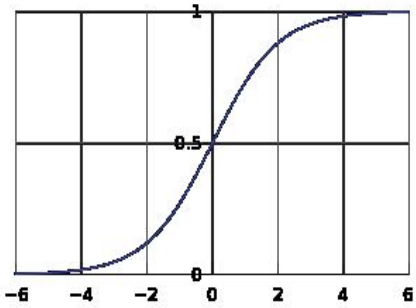
$$g(x) = \ln\frac{\pi(x)}{1-\pi(x)} = \beta_o + \beta_{1x} + e$$

Formula (3)

$$\frac{\pi(x)}{1-\pi(x)} = e^{(\beta_o + \beta_{1x} + e)}$$

A graph of the function is shown in figure 1. The input is $\boldsymbol{\beta_0 + \beta_{1x} + e}$ and the output is $\boldsymbol{\pi(x)}$. The logistic function is useful because it can take as an input any value from negative infinity to positive infinity, whereas the output is confined to values between 0 and 1. In the above equations, **g(x)** refers to the logit function of some given predictor X, in denotes the natural logarithm, $\boldsymbol{\pi(x)}$ is the probability of being a case, $\boldsymbol{\beta_0}$ is the intercept from the linear regression equation (the value of the criterion when the predictor is equal to zero), $\boldsymbol{\beta_{1x}}$ is the regression coefficient multiplied by some value of the predictor, base e denotes the exponential function and e in the linear regression equation denotes the error term. The first formula illustrates that the probability of being a case is equal to the odds of the exponential function of the linear regression equation. This is important in that it shows that the input of the logistic regression equation (the linear regression equation) can vary from negative to positive infinity and yet, after exponentiation the odds of the equation, the output will vary between zero and one. The second equation illustrates that the logit (i.e., log-odds or natural logarithm of the odds) is equivalent to the linear regression equation. Likewise, the third equation illustrates that the odds of being a case is equivalent to the exponential function of the linear regression equation. This illustrates how the logit serves as a link function between the odds and the linear regression equation. Given that the logit varies from $\boldsymbol{(-\infty, +\infty)}$ it provides an adequate criterion upon which to conduct linear regression and the logit is easily converted back into the odds [13]

Figure1 (graph of the function)



2. RESULTAS AND DISCUSSION

The First hypothesis:

The effective variables concerned that can predict bankruptcy one year prior of the stop of operation include x_6 and x_7

Ohlson's adjusted model based on the test that was done for one year before activation stop is based on effective variable as followings:

Formula (4)

$$Y = \frac{e^{-2.157+16.453\,x_6-8.304\,x_7}}{1+e^{-2.157+16.453\,x_6-8.304\,x_7}}$$

Table 1 has presented ability and accuracy of ohlson's adjusted pattern according to the information that is one year before the activation stop.

Table 1: result of ohlson prediction model

Type of companies	Predicted model					
	unsuccessful		successful		number	percentage
	number	percentage	number	percentage		
unsuccessful	28	93	2	7	30	93
successful	3	10	27	90	30	90
total					60	91.7

Since variables of x6 and x7 in ohlson's adjusted pattern has the test statistic of Errorless than 10%, As a result H_0 hypothesis is rejected and research hypothesis is accepted in 90%confidence level

Second hypothesis:

The effective variables concerned that can predict bankruptcy one year prior o the stop of operation include X10 shirata's adjusted model based on the test that was done for one year before activation stop based on Relative effective variable are as following:

Formula (5)

$$Y = \frac{e^{-.209+26.715\,x_{10}}}{1+e^{-.209+26.715\,x_{10}}}$$

Table 2 has presented ability and accuracy of shirata's adjusted pattern according to the information given one year before the activation stop.

Table 2: result of shirata prediction model

Type of companies	Predicted model					
	unsuccessful		successful		number	percentage
	number	percentage	number	percentage		
unsuccessful	25	83.33	5	16.67	30	83.33
successful	6	20	24	80	30	80
total					60	81.7

Since a variable of x10 in shirata's adjusted pattern has the test statistic of Errorless than 10%, As a result H0 hypothesis is rejected and research hypothesis is accepted in 90%confidence level.

The results show that the created models are able to predict the bankruptcy. Findings show that two model can predict bankruptcy but not all of its variables. Our Suggests for future research are:

-Comparing the ability of research models in predicting activation stop using the adjusted financial statements based on current values.

-Comparing other models and developing those models through cash flow ratios.

REFERENCES

1. Altman, E., I., 1968. Financial ratio, discriminant analysis and the predication of corporate bankruptcy. Journal of finance, 23(4): 589-609.
2. Beaver, W.H., 1966. Financial Ratios as predictors of failure. Journal of Accounting research, 4:71-111.
3. David L. Olson, Dursun Delen, Yanyan Meng , 2012, Comparative analysis of data mining methods for bankruptcy prediction, Decision Support Systems, Volume 52, Issue 2, January 2012, Pages 464-473.
4. Duda R, Hart P, Stork D, 2001. Pattern Classification, Second Edition. New York, NY, USA: John Wiley and Sons.
5. Federico Ciliberto, Carola Schenone, 2012, Bankruptcy and product-market competition: Evidence from the airline industry. International Journal of Industrial Organization, Volume 30, Issue 6, November 2012, Pages 564-577.
6. Gang, H.U. and Z. Xiaomao, 2009. International Conference on Information Management, Innovation Management and Industrial Engineering, pp: 240-244.
7. Kouki, M, 2009. Toward a Predicting Model of Firm Bankruptcy: Evidence from the Tunisian Context. Journal of Middle Eastern Finance and Economics. Issue 14:pp26-43.
8. Lau, L., A, Hing, 1987. A Five-State Financial Distress Prediction Model. Journal of Accounting Research, Vol. 25, No. 1: 127-138.
9. Liang Lin, chia. , 2007.Validation of a Rolling-logit Model to Predict TSE Corporate Bankruptcy, Degree of Doctor of Philosophy, Lynn University.
10. Ohlson, J. A., 1980. Financial Ratios and the Probabilistic Prediction of Bankruptcy, Journal of Accounting Research (spring): 109-131.
11. Pourreza Soltan Ahmadi, A., 2012. Corporate Bankruptcy Prediction Using a Logit Model: Evidence from Listed Companies of Iran. World Applied Sciences Journal 17 (9): 1143-1148.
12. Shirata, C.Y., 1995. Read the Sign of Business Failure. Journal of Risk and Management, Vol. 23, pp.117-138.
13. Tereza Tykvová, Mariela Borell, 2012, Do private equity owners increase risk of financial distress and bankruptcy?, Journal of Corporate Finance, Volume 18, Issue 1, February 2012, Pages 138-150.
14. Tseng, 2005.A quadratic interval logit model for forecasting bankruptcy, Journal of omega, Volume 33, Issue 1, February: 85–91.
15. Udaya Shetty, T.P.M. Pakkala, T. Mallikarjunappa.2012. A modified directional distance formulation of DEA to assess bankruptcy: An application to IT/ITES companies in India Expert Systems with Applications, Volume 39, Issue 2, 1 February 2012, Pages 1988-1997.
16. Zmijewski, M. E., 1984. Methodological Issues Related to the Estimation of Financial Distress Prediction Models. Journal of Accounting Research 24: 59-82.