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Creation 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. 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 researcher 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

1. 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 patterns to predict financial crisis [1]. Studies show that the companies' going-concern has a close connection with company's ability to fulfill its commitments. So the adjustment of the patterns 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 patterns, Ohlson and Shirata, and two developed patterns based on the original patterns using the other ratios to predict bankruptcy of the approved companies in Tehran's Stock Exchange

2. Theoretical Frameworks , Background Research and Hypotheses

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 fulfill their obligations. In 1968 Altman used legal aspects of hi studies to describe bankruptcy [6]. Biverin 1966, Damphousse and Zapondis in 2000, and Tampson in 2000 defined bankruptcy from creditors' point view [4]. They expressed that bankrupt companies are those companies that are unable to do 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 developed country data (Beaver 1966; Altman 1968; Wilcox 1973; Deakin 1972; Ohlson 1980; Taffler 1983; Boritz, Kennedy and Sun 2007). 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. Summaries of the literature are provided in Zavgren (1983), Jones (1987), O'leary (1998), Boritz, Kennedy and Sun (2007) and Agarwal and Taffler (2007). Despite the variety of models available, both the business community and researchers often rely on the models developed by Altman (1968) and Ohlson (1980) (Boritz et al. 2007) [10]. A survey of the literature shows that the majority of international failure prediction studies

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employ MDA (Altman 1984; Charitou et al. 2004) [8]. A brief review of a few of the studies relevant to this article follows. Beaver (1966) presented empirical evidence that certain financial ratios, most notably cash flow/total debt, gave statistically significant signals well before actual business failure. Altman (1968) extended Beaver's (1966) analysis by developing a discriminant function which combines ratios in a multivariate analysis. Altman found that his five ratios outperformed Beaver's (1966) cash flow to total debt ratio. Ohlson raised questions about the MDA model, particularly regarding the restrictive statistical requirements imposed by the model (Ohlson 1980). To overcome the limitations, Ohlson (1980) 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 no failed "matching" firms. Ohlson selected nine independent variables that he thought should be helpful in predicting bankruptcy, but provided no theoretical justification for the selection. (The nine variables are described in the methodology section of this paper.) Ohlson 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 [9]. 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. Following up on concerns about the MDA model, Lau (1987) 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." Beneda (2006) investigated returns, bankruptcies and firm distress for new US public companies that issued IPOs from 1995 through 2002[12].. Beneda found that the average first year returns for IPO companies under performed the market and that Ohlson's model was effective in identifying companies that had a higher probability of bankruptcy and financial distress and earned lower than average returns Research hypothesis explains the researcher proposed solution to answer the question. Therefore an appropriate theory depends on how to express problem [11].In other words, the root of a hypothesis is mixed with the selection of the problem and its expression .the hypothesis of this research is:

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

3. Research Variables:

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 (bankruptc). Dependent variables in this research are Financial ratios used in research models. They are in this research:

Variables of Ohlsons' model:

$$Y = B0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + B_9X_9$$

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

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

X_5: 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.

Variables of Shiratas' model:

$$Z = B_0 + B_{10}X_{10} + B_{11}X_{11} + B_{12}X_{12} + B_{13}X_{13}$$

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

4. Data

We use the 2012 version of Tadbirpardaz (the Iranian database of Tehran Stock Exchange) annual data files and sample all firms in Tehran Stock Exchange between 2003and 2011 with sufficient 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 [5]. 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

5. Statistical Methods Used for Data Analysis

To separate the companies into two groups of successful and unsuccessful, Binary Logistic Analysis statistical method and spss 15 software are used [2]. . Assumptions are related to adjustment of patterns and measures in order to get the ability to differentiate successful and unsuccessful companies. For this purpose Statistical methods such as Binary Logistics Analysis and Enter are used.

6. Test Results of the Hypothesis

The First hypothesis:

Relative effective variable of one year before activation stop that can explain prediction of companies activation stop are X_6 and X_7.

Ohlson's adjusted pattern based on the test that was done for one year before activation stop based on Relative effective variable are as following:

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

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

Types Of Companies	Predicted model				The overall accuracy	
	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 H0 hypothesis is rejected and research hypothesis is accepted in 90%confidence level

Second hypothesis:

Relative effective variable of one year before activation stop that can explain prediction of companies activation stop is only X_{10}

Shirata's adjusted pattern based on the test that was done for one year before activation stop based on Relative effective variable are as following:

$$y = \frac{e^{-.209+26.715x10}}{1+e^{-.209+26.715x10}}$$

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

Table 2

Types Of Companies	Predicted model				The overall accuracy	
	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 variables 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

7. Conclusion

This article has investigated the bankruptcy models. We studied the Ohlson and Shirata models using logistic regression method. 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.

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