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THE EFFECT OF FINANCIAL RATIOS ON THE BANKRUPTCY PREDICTION OF LISTED COMPANIES ON THE TEHRAN STOCK EXCHANGE

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ABSTRACT

The present research aimed to investigate effects of financial ratios on the bankruptcy prediction of listed companies on the stock exchange. The statistical population consisted of all listed companies on the Tehran Stock Exchange from the beginning of 2006 to the end of 2016. The research sample consisted of 80 companies in six industries and they were selected using the systematic elimination method. The present research used 15 financial ratios and the Article 141 of the Commercial Code to review the corporate financial crisis. Hypothesis test was done using the correlation method between variables and multivariate regression equations through the logistic model. Research results indicated effects of financial ratios on the bankruptcy prediction.

Keywords: *Bankruptcy Prediction, Financial Ratios, Stock Exchange.*

INTRODUCTION

The occurrence of crises and their effects and consequences are critical issues for companies. After the bankruptcy of a company, its shareholders will lose a portion of their capital, and also its employees will become unemployed and their lives and families will be affected. Therefore, the bankruptcy and its relevant issues are the main issues in the theory of corporate behavior and corporate finance. The bankruptcy can be prevented by anticipation of its occurrence before its creation or according to revealed signs of financial turmoil. In addition to the great importance of this issue for companies themselves, policy makers, investors, banks and lending institutions are also highly interested in the bankruptcy prediction. Investors and banks are not willing to invest in companies which are at the risk of bankruptcy; hence, they seek for the bankruptcy prediction. On the other hand, as the bankruptcy has adverse consequences for the employment and workforce, the policymakers are also seeking to identify companies that are entering the bankruptcy to be able to promptly adopt supportive policies on those companies or industries.

Rapid advances in the technology and enormous environmental changes have accelerated the economy, limited the increasing competitiveness of institutions to make profits, and increased the likelihood of bankruptcy. This situation gives rise to concerns of capital owners and other stakeholders, and thus they are interested in assessing the financial position of a company and its movement towards the bankruptcy. Accordingly, the financial decision making has become more strategic than before. The appropriate factual and scientific indicator is necessary for each institution in making financial decisions about an institution. The proper assessment of the

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probability of corporate bankruptcy is a suitable indicator for this purpose (Rezaei and Goldouz, 2012). The discovery of operational and financial problems of companies is combined by analyzing financial ratios. Financial ratios are the tools for measuring companies by investors and managing business entities to assess the current status and predict their future status. Researchers have found that financial ratios of bankrupt firms (unsuccessful) are not favorable in comparison with financial ratios of successful companies; and the analysis of ratios can be useful in predicting the bankruptcy. Using financial ratios and investigating figures contained in financial statements, it is possible to identify signs of liquidity problems and predict financial distress of companies (Pourheidari and Koupaei, 2010). Therefore, the main objective of this paper was to investigate effects of financial ratios on the bankruptcy prediction of listed companies on the Tehran Stock Exchange.

LITERATURE REVIEW

Delkhosh and Malek (2016) examined the role of earnings quality on the bankruptcy prediction of companies. Therefore, they utilized data of 33 companies listed on the Tehran Stock Exchange during 2008 to 2013. They used Francis model to measure the earnings quality, and Altman's model to assess the bankruptcy. The relationships of research variables were investigated in three main hypotheses. Results of the research hypothesis test indicated the ability of earning quality in predicting the corporate bankruptcy. In a study entitled "Predicting Stock Returns Using Financial Ratios; An Exploration in Recent Studies", Barzegari Khanghah and Jamali (2016) stated that what is important to users of financial information is not applied principles and procedures in the accounting, but the output of a financial system, because it helps them achieve their goals. Results of the present study, which referred to internal research, indicated that profitability ratios play greater roles in predicting stock returns than other financial ratio groups. In this regard, ratios of return on assets and return on equity had the greatest ability to explain changes in stock returns. Shahabadi and Arghavani (2015) examined the ability of bankruptcy prediction in companies with the institutional ownership by Altman's model. This study used the bankruptcy prediction ability of Altman Z and Springate models to predict the bankruptcy of companies with the institutional ownership. The present research consisted of a hypothesis. Altman Z Model was able to predict the bankruptcy of companies with the institutional ownership. Results of analyzing hypotheses indicated that Altman Z model was not able to predict the bankruptcy of companies with the institutional ownership.

Gerami-Shirazi and Gerami-Shirazi (2014) studied the relationship between the bankruptcy and the capital structure and used an independent variable derived from the Altman's bankruptcy model including the return on assets, asset turnover ratio, liability to equity ratio, retained earnings to total assets ratio, and working capital to total assets ratio for the effect of bankruptcy on the capital structure (the dependent variable). Research results indicated that Altman's model of bankruptcy could predict the probability of corporate bankruptcy up to three years before the bankruptcy, and it was also found that there was not any significant relationship between the capital structure and the bankruptcy. Akbari Khosroshahi and Ghanavati (2013) examined the relationship between the board structure and bankruptcy. In this research, the number of board members, the board independence and the tenure period of executives (dependent) were examined as independent variables, and Altman's bankruptcy model was

tested as an independent variable in the form of a multiple regression model. Research findings indicated that there was a direct and significant relationship between the board size and the independence of board members with the bankruptcy. Results also indicated the lack of relationship between executives' tenure period and the bankruptcy. Rezaei and Goldouz (2012) compared the predictability of bankruptcy models by Zavgren, Zmijewski and Shirata in listed companies on the Tehran Stock Exchange. The purpose of this study was to determine the efficiency of models by Zavgren and Zmijewski, and their mean of independent variables, and F-value of Shirata's model. Results indicated the accuracy of 98.6% for Shirata's model, 87% for Zavgren's model, and 89.6% for Zmijewski's model in adaptation to the Iranian environmental conditions.

In a paper entitled "The Bankruptcy Law and Finance Affairs of Banks", Rodano et al. (2016) emphasized the importance to identify distinctive effects of liability payment (liquidity) and reorganization because they believed that these processes differently considered the tension in the bankruptcy law between the continuation of persistent and growing business, and maintaining incentives for repayment. In a paper entitled "The Corporate Financing Decisions in the Financial Crisis", Gutierrez et al. (2014) concluded that the impact of financial crisis on the investment is different based on available investment opportunities to firms, so that firms in a crisis with fewer opportunities have higher tendency to a little investment, while firms in crisis with better opportunities do not show different investment behavior than normal firms.

Bruno et al. (2010) examined the relationship between the corporate governance and bankruptcy according to the liability levels. Their results indicated that companies with better corporate governance had lower liability costs and more credibility. Moreover, further supervision and enforcing harder bankruptcy laws had positive impact on liability levels. Fitch and Selzak (2010) examined the ability of corporate governance mechanisms to prevent companies from the financial distress. They utilized Altman Z model and interest coverage ratio to determine the financial distress level. Their results indicated that the independent board had the greatest impact in preventing the financial distress with a greater percentage of independent members and a large part of company's shares for internal managers.

THEORETICAL PRINCIPLES AND HYPOTHESES

Bankruptcy is an important issue in the financial management because it is almost ancient and very common. The bankruptcy may occur in a small retail shop, which fails to meet its rental obligations and becomes closed or in a large manufacturing company due to the lack of favorable liquidity and continuous annual losses (Hajiha, 2005, p. 64). It is essential to investigate causes of bankruptcy from financial perspectives and explain financial and accounting principles and more importantly evaluation of bankruptcy using very common models. Bankruptcy is a legal act whereby assets of a debtor are generally given to creditors.

From the accounting perspective, the bankruptcy is possible in two forms: 1. Activity bankruptcy, and 2. Liquidity bankruptcy. These two types of bankruptcy have different theoretical frameworks that form financial ratios for creating bankruptcy prediction models. Given that the liquidity bankruptcy often occurs, liquidity ratios in structures of bankruptcy prediction models are not hidden for providers of these models and they have widely used them, so that most of bankruptcy prediction models have variable(s) derived from liquidity ratios. Bankruptcy

processes of liquidity may be normally due to the company's reduced cash balance and related to the activity bankruptcy and vice versa (Aminian and Shafati, 2015).

Analysis of financial ratios is a tool for determining financial position of companies. In fact, financial ratios reveal important realities about financial operations and situation of a company. Their ratios can be measured according to the accurate relationship between main items of financial statements. It also determined the company's financial strengths and weaknesses. Financial analysts use financial ratios to analyze the financial status of a company. The use of financial ratios for analyzing financial statements is a consequence for the evolution of accounting. Financial ratios may be differently categorized. One of the most commonly used categorization is as follows:

A. Liquidity ratios
B. Activity ratios
C. Financial leverage ratios
D. Profitability ratios
E. Market ratios

Ratios make it possible for users to make qualitative judgments based on quantitative values and information (Ghalibaf-asl, 2006). According to the above-mentioned principles, the following hypothesis is considered and tested in order to achieve the research objectives:

Hypothesis: Financial ratios have an impact on the bankruptcy prediction of listed companies on the stock exchange.

RESEARCH METHOD

The present study had applied method in terms of its objective since its results could be applied in practice. It was a descriptive-correlational study based on the implementation method because, on the one hand, it investigated the current state of as society without any interference, and on the other hand, it used the regression to examine relationships of variables. It was a post-event research in terms of data nature. The statistical population consisted of all non-financial firms (manufacturing) listed on the Tehran Stock Exchange from the beginning of 2006 to the end of 2016. The studied sample consisted of 80 companies that were selected using the systematic elimination method based on three criteria as follows:

1. Detailed information about annual financial statements of each company should be available on the board of Tehran Stock Exchange for a 11-year period from 2006 to 2016).
2. Studied companies should be members of the Stock Exchange until the end of year.
3. Companies, which did traded over one of studied years, were excluded from the statistical population.

Data collection was done by a desk method. The necessary data for the research literature was collected from Persian and Latin specialized books and magazines, and extracted papers from the Internet; and the research data was periodically extracted from existing databases and information software such as Rahavard Novin software and financial statements of listed companies on the Tehran Stock Exchange as well as websites like www.tsetmc.ir from 2006 to 2016. The correlation method between variables and multivariate regression equations was used through the logistic model in order to test hypotheses. Eviews software was used to analyze target data and tests. Raw data of research was collected according to the research population.

Therefore, the raw data related to test variables were first extracted; and logistic regression equations were used to test hypotheses.

Dependent variable: Bankruptcy

Like a research by Asad (2011), the bankruptcy was the dependent variable of the present research, and it was expressed as a logit model. Therefore, if a company was included in the Article 141 within the last three years, it gained the Number 1, otherwise it received zero according to Article 141 of the Commercial Code (Mansour, 2002).

Independent variable: Financial ratios

Financial ratios of this study consisted of five main groups: 1- Profitability ratios, 2- Liquidity, 3. The ability to pay liabilities, 4- Activity ratios, and 5- The ownership and asset structure ratio.

1. Profitability ratios (return on sales):
   - Gross profit to sales (GP/ SAL)
   - Earnings before interest to sales tax (EBIT/ SAL)
   - Net profit to sales (NP/ SAL)

2. Liquidity ratios (These ratios measure the ability of a company to pay short-term liquidities at the maturity):
   - Current assets to current liabilities (CA/ CL)
   - Current assets- current inventory to current liabilities (CA-INV/ CL)
   - Working capital to total assets (WC/ TA)

3. Liability payment power ratios (These ratios determine to what extent a company provides its financial needs from other resources):
   - Total liabilities to total assets (TL/ TA)
   - Current liabilities to total assets (CL/ TA)
   - Total liabilities to equity (TL/ Eq)

4. Activity ratios (this ratio can measure the efficiency of a company in the application of its resources):
   - Inventory to sale (INV/ SAL)
   - Sales to total assets (SAL/ TA)
   - Cost of goods sold to sales (CS/ SAL)

1. Structure ratios (including three general categories namely "ratio of structure to total assets", "ratio of structure to current assets", and "the ownership structure ratio"):
   - Fixed assets to total assets (FA/ TA)
   - Inventory to total assets (INV/ TA)
   - Retained earnings to total assets (RE/ TA)

RESEARCH FINDINGS

In general, descriptive statistics indicated that the selected sample had a large variety indicating the variety of selected companies, and thus the ability to generalize sample results to the research population.

Hypothesis analysis

Hypothesis: Financial ratios affect the bankruptcy prediction of listed companies on the stock exchange.

This hypothesis is about the impact of financial ratios on the corporate bankruptcy prediction and is tested using the following model:

$$\begin{aligned}\text{Bankruptcy}_{it} = {} & \alpha_i + \alpha_1 \text{CA/CL}_{it} + \alpha_2 \text{CA} - \text{INV/CL}_{it} + +\alpha_3 \text{CL/TA}_{it} + \alpha_4 \text{CS/INV}_{it} \\ & + \alpha_5 \text{EBIT/SAL}_{it} + \alpha_6 \text{FA/TA}_{it} + \alpha_7 \text{GP/SAL}_{it} + \alpha_8 \text{INV/SAL}_{it} + \alpha_9 \text{INV/TA}_{it} \\ & + \alpha_{10} \text{OP/SAL}_{it} + \alpha_{11} \text{RE/TA}_{it} + \alpha_{12} \text{SAL/TA}_{it} + \alpha_{13} \text{TL/EQ}_{it} + \alpha_{14} \text{TL/TA}_{it} \\ & + \alpha_{15} \text{WC/TA}_{it} + +\varepsilon_{i,t}\end{aligned}$$

The logistic regression model was used to test hypotheses of the present study since the dependent variable had classes and gained two values (zero and one). It did not need preconditions for performing the linear regression such as the linear relationship between independent and dependent variables, Homoscedastic variance of dependent variable and independent variables, the normal distribution of dependent variable and residuals or the model measurement error. However, there was the issue of multicollinearity in the logistic regression meaning the linear function of each independent variable towards each other. Therefore, standard errors should be partial for each beta coefficient. If any independent variable has a high standard error, it indicates a multicollinearity on that variable.

Results of the main hypothesis test are presented in Table 1. According to LR statistic and its probability, it can be concluded that the regression equation was significant at the confidence level of 99%. The coefficient of determination of the model indicated the relevance of independent variable with the dependent variable (bankruptcy). According to Table 1, the coefficient of determination was 0.80. Therefore, 80 percent of variance of the dependent variable was explained on average by this model. According to results of testing the probability model of variables, the Retained earnings to total assets (RE/ TA) had a probability of less than 0.01; hence, this variable was significant at the confidence level of 99%. Variables namely, the cost of goods sold to inventories (CS/ INV), Earnings before interest to tax sales (EBIT/ SAL), Gross profit to sales (GP/ SAL), Inventory to sales (INV/ SAL), Total liability to equity (TL/ Eq), Total liability to total assets (TL/ TA), and Working capital to total assets (WC/ TA) had probabilities of less than 0.05 and were significant at the confidence level of 95%, but variables namely the current assets to current liabilities (CA/ CL), Current assets- inventory to current liabilities (CA-INV/ CL), Current liabilities to total assets (CL/ TA), Fixed assets to total assets (FA/ TA), Inventories to total assets (INV/ TA), Operating profit to sales (OP/ SAL), and Sales to total assets (SAL/ TA) had probabilities of greater than 0.05 and were insignificant at the confidence level of 95%. Given the probability of variables in the model and significance of variables namely the retained earnings to total assets, cost of goods sold to inventory, Earnings before interest to sales taxes, gross profit to sales, inventory to sales, total liability to equity, total liability to total assets, and working capital to total assets, which were the main variables in confirming or rejecting hypotheses, it can be claimed that among studied financial ratios in the present research, the above-mentioned variables affected the bankruptcy prediction, but other variables did not affect the bankruptcy prediction of companies.

Table 1: Analysis of the main hypothesis

Estimated Period: 2006-2016
Method: ML - Binary Logit (Quadratic hill climbing)

McFadden Coefficient of Determination (McFadden R-squared)	0.80677				
LR statistics	260.6659				
Probability (ProbLR statistic)	0				
Explanatory variable	Coefficient	standard error	Z statistics	Probability	Confidence level
CA/CL	0.144618	0.812235	0.1780495	0.8587	Insignificant
CA-INV/CL	-0.489077	0.951023	-0.514264	0.6071	Insignificant
CL/TA	1.011078	1.542087	0.6556556	0.512	Insignificant
CS/INV	-1.644286	0.732201	-2.245675	0.0247	95%
EBIT/SAL	-0.410755	0.181424	-2.264061	0.01302	95%
FA/TA	1.871882	1.272837	1.4706376	0.1414	Insignificant
GP/SAL	-2.1445	1.064594	-2.014379	0.0456	95%
INV/SAL	0.939896	0.455542	2.0632477	0.0391	95%
INV/TA	-1.7054	1.733996	-0.983507	0.3254	Insignificant
OP/SAL	-1.37405	0.583972	-2.352945	0.0201	95%
RE/TA	-6.3765	0.827283	-7.707759	0	99%
SAL/TA	0.207748	0.180484	1.1510605	0.2497	Insignificant
TL/EQ	0.007434	0.003108	2.3918919	0.0168	95%
TL/TA	1.056662	0.495446	2.1327491	0.0321	95%
WC/TA	-2.48784	1.098054	-2.265681	0.0234	95%
C	-4.57557	1.509616	-3.030952	0.0024	99%

DISCUSSION AND CONCLUSION

The present paper examined effects of financial ratios on the bankruptcy prediction of listed companies on the stock exchange. Results of the hypothesis test indicated the significance of variables namely the Retained earnings to total assets (RE/ TA), Cost of goods sold to inventories (CS/ INV), Earnings before interest to sales tax (EBIT/ SAL), Net profit to sales (NP/ SAL), Inventory to sale (INV/ SAL), Total liabilities to equity (TL/ Eq), Total liabilities to total assets (TL/ TA), Working capital to total assets (WC/ TA) that were are the main variables in confirming or rejecting hypotheses, and thus it can be claimed among the investigated financial ratios in the present research, the above-mentioned variables affected the bankruptcy prediction, but other variables namely the Current assets to current liabilities (CA/ CL), Current assets-current inventory to current liabilities (CA-INV/ CL), Current liabilities to total assets (CL/ TA), Fixed assets to total assets (FA/ TA), Inventory to total assets (INV/ TA), Operating profit to sales, and Sales to total assets (SAL/ TA) did not affect the bankruptcy prediction of companies. Since it is possible to predict the activity halt phenomenon in the economic environment of Iran and this prediction could be based on the information content of financial statements of companies, it indicated the available financial content of financial statements and its optimal use in the capital market.

The research results were inconsistent with a research by Taghipour and Nabavi (2017) who investigated relationships of financial ratios and corporate governance indices in predicting the bankruptcy of listed companies on the Tehran Stock Exchange. The findings indicated that there was not any significant relationship between applied financial ratios and corporate governance

indices of this study with results of Altman's model as the status of studied companies. However, the research findings were consistent with a research by Panahi et al. (2014) entitled "A Five-Year Prediction of Bankruptcy in Listed Companies on the Tehran Stock Exchange" for investigating and providing a bankruptcy prediction model in five years before the bankruptcy. According to their results and based on data of 2003, the estimated model was able to predict the status of these companies in 2008 with the accuracy of 78%. The findings were also consistent with results of a research by Soleimani-Amiri (2013) who examined the power of financial ratios to predict the financial crisis of companies. Results of testing the predictability of model reflected the fact that the model was able to correctly predict the financial crisis until three years prior to the corporate financial crisis.

Applied suggestions

Investors are always looking for a good investment status. According to results of the present study, investors can use adjusted models for each industry to assess the future financial status of companies. Corporate managers are always eager to evaluate future weaknesses and threats. The use of activity halt prediction models is a method that can be used by managers to evaluate the future performance. Examining the financial status of borrowers and ensuring the return on investment are among the problems of banks and financial institutions in high-loan payments to legal and real people who are often industry owners. Given the research results, banks can use the obtained models of this research as tools for analyzing the future financial status of loan applicants. As an oversight organization, this organization can use effective ratios, which were expressed in adjusted models, as warning signs, review the status of companies before inclusion of companies in the Article 141, and ask them to take preventive measures. Stock exchange brokers and financial advisers, who are responsible for analyzing the financial status of listed companies on the stock exchange and outlining the future financial status of companies for stock applicants, can consider variables and results of the present research in selecting investment portfolios.

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