Determining the Ability of Financial Ratio to Predict Firms’ Bankruptcy by Mixed Methods of DANP and Logistic Regression

Farzin Rezaie¹*, Saber Marahemi² and Karim Marahemi³

¹ PHD in state accounting field, Islamic Azad University, Qazvin Unit, Iran
² MA in accounting field, Islamic Azad University, Qazvin Unit, Iran
³ MA in management field, Islamic Azad University, Qazvin Unit, Iran

ABSTRACT

Forecasting of bankruptcy as phenomenon which had taken extra attention of bank investors and financial institutes. Strong signs of bankruptcy can be seen in previous months so on time and accurate forecasting of this financial crisis can be given to managers and creditors for avoidance activities. The goal of this research is determining the abilities of financial proportions in forecasting of companies bankruptcy by using a mixed method of DANP and logistic regression. To achieve research goals the information of 130 companies which have been accepted in Tehran exchange In 6 years (2005-2010) has been used. Power of impact and getting impact of financial proportions by used DIMETEL method and then the final factor has been determined by using mixed method of DANP. Finally, we used logistic regression for determining the abilities of financial proportions in forecasting of bankruptcy. The results show success of this model in forecasting bankrupted companies for the level 89.7% and non-bankrupted companies for 91.7%. In addition percentage of correct forecasting is 90.8% according to Iranian environment.

KEYWORD

companies’ bankruptcy, financial proportions, DANP, logistic regression

INTRODUCTION

The study investigates the ability of financial insolvency prediction using a combination DANP and logistic regression. Predicting the future is the main concerns of humanity throughout history. With the advancement of science and technology, researcher have provided planning and decision-making for future predictions using scientific methods. Although the financial information is prospective, but it is claimed to be useful for predicting the future.

with increasing participation and Businesses and create complexity in economic relations and the Business, Finance functions has significantly changed the governments emphasis to increase economic growth and development of the companies and institutions using these functions has complicate it more. On the other hand the advancement of technology And the Environmental changes caused extensive economic momentum and due to increasing competition of institutions, access to income has been limited and desire for bankruptcy is increased. The financial decisions are more strategic than in the past. Bankruptcy prediction models are one of the techniques and tools to predict the future of company. In this model, the probabilities of bankruptcy are estimated by a group of financial ratios that are combined.

DEFINING THE PROBLEM AND RESEARCH OBJECTIVES

On the Macro-economic theory, socio-economic development is consistent and appropriate with the level of investment. If the investments are not invested in the appropriate Investment opportunities as they used to be or not to be effective, it will cause damage to the national economy (Rees, 1995). There are many definitions on bankruptcies Texts: bankruptcy occurs when the market value of a company’s liabilities exceeds the assets of the Company (the Gateman, 1996). If a company return is low or negative and company the company cannot pay its debt, it is called bankrupt company (Shakeri, 2003). The main Problem is this that there are the companies that Although they don’t Have a good financial position to continue its work, Focused on attracting investment in micro and macro levels and Finally, the company's investment due to various problems are ignored and, on the other hand the Tehran Stock Exchange to identify Bankrupt companies uses Only Article 141 of the Commercial Code.

*Corresponding Author: Farzeen Rezaie
E-mail: farzinrezaei@yahoo.com
Telephone Number: 09122812542
In fact, when law will vote to issue the company that company is called bankrupt, this is when That Important part of the interests of investors, lenders and credibility at this stage has been vanished. Tehran Stock Exchange as trustee and capital market witness has no preventive method and Control to avoid bankruptcy, investors and creditors in this situation to notice of the investee companies In order to protect their investment are facing with a lack of tools to evaluate the performance of the companies. Hence, the prediction of bankruptcy as an economic event is interested by late favorite investors' creditors, managers and investigators. The main questions that this study aims to find answers are as follows:

1. Does the predictability of corporate bankruptcy based on financial ratios is possible or not?
2. Is the effectiveness of each financial ratio equal to the probability of corporate bankruptcy?

A) Theoretical Foundations

Financial ratios, as shown in advanced statistical models are used to predict business events. Since the beginning of the investigation in relation to the expected bankruptcy by researchers in the fields of accounting and finance, many studies have been conducted which resulted in many models emergence? Empirical models that can successfully develop companies that are bankrupt and non-bankrupt companies. Using the financial ratios to predict bankruptcy originally began by Beaver and then continued by Altman. Beaver compared sample of bankrupt companies, with a sample of bankrupt companies and non-financial ratios for a five-year period prior to the bankruptcy of the predictive capability of the bankruptcy [11]. Altman used multivariate statistical techniques known in the social sciences, known as multiple discriminate analyses. This technique has been extended to Z model and successfully to analyze and evaluate investment business continuity activities have been used [1].

Generally, the forecasting model is divided into three parts (and there's, 2006). Theoretical models, the statistical model and artificial intelligence expert system models.

A. A) Theoretical models

In most theoretical models the focus is on quality aspects and not just the symptoms due course of time that are mainly multivariate statistical techniques. This model includes cash management theory, the theory of the gambler, a measure of balance sheet analysis, validation and Morgan Mc Kinsey's credit portfolio.

A. B) Parametric models

These models are the most basic and most common techniques to predict which functions are used to identify the functions of one variable to functions of several variables in the simplest form of discriminate analysis methods functions and functions of exponential Logistic and other functions. In the univariate model, the emphasizing is on the individual ratios which can be indicative of bankruptcy. In multivariate method the notice is to a combination of several financial ratios and the number of bankruptcies of several combinations of the coefficients obtained for each of the limitations associated with these methods that are such normal distribution assumption multi-variable, groups' equality matrix dispersion Equity risk and group membership. For this reason, researchers with basing linear combination used the other functions and used Logistic and probity models. The most famous parametric prediction models are Altman, Aspryngyt, Ahelson, Zymesky, Zavgern and Shyrata.

A. C) Nonparametric models

At the nonparametric models, there aren’t many limitations of statistical methods and of course the various investigations outside and inside of Iran did not obtained homogeneity results on the absolute accuracy of nonparametric methods. These models such as statistical methods used indicators in relation to the operation of the diverse and more complex. The most popular nonparametric prediction models, is including models of data envelopment analysis, artificial neural networks and neuronal fuzzy network.

History of research

Rezai and Nezhad tolamy (2012) investigate the comparison of the ant algorithm with multiple methods of discriminate analysis and the prediction of financial distress. The research analysis shows that on the 5% significance level, ant model is superior to the analysis of difference and in level 9 %is superior to Logistic [5]. Prema Chandra et al (2009) in their research work introduced, "DEA" as a quick and easy tool for evaluating bankruptcy compared to logistic regression. They used statistical population included 50 bankrupt companies and 910 non-bankrupt companies between 1991 and 2004. They used 9 variables (2 output and input 7) in their studies. The results of this study indicate that the internal logistic regression model works very well while the DEA in the foreign sample. DEA model is also very good at identifying companies go bankrupt while logistic regression model to identify non-bankrupt company to better serve the DEA [15].
Hu and colleagues (2008) applied in their study multilayer perception with non-collective decision-making procedure and its composition to the analysis of financial distress. He has used the 129 samples, that 65 of them were bankrupt. 5 variables used by them are: working capital to total assets, retained earnings to total assets, Earnings before interest and taxes to total assets, market value of equity to total debt to total assets and sales. The results show that the proposed model works better [13].

Cheng et al (2006) presented a model to predict financial distress that combines neural network learning methods and Logistic analysis. He used a method of radial basis function network to establish the prediction model. In this study, performance RBFN Logistic proposed neural network is compared with the traditional analysis. In this study, 7 explanatory variables (variable bit 3 and 4 qualitative variables) were used. The statically population was 64 Taiwanese company in the stock market between 1996 and 2004 that were facing financial distress. The result showed that the model RBFN Than the other two models proposed in the prediction accuracy is superior to uncertain data [13].

Wallace (2004), using "neural network" designed a model. In this model, the values of key financial ratios for the past bankruptcy than reported in the literature were used. His used ratios include working capital to total assets, cash flow to total assets, net profit to total assets, total liabilities to total assets, current assets to current liabilities and assets in debt fast ongoing. Wallace model has an overall accuracy of 94% and examined 65 financial ratios of the previous studies [16].

Bazrafshan and Rahmani (2013) examined the effect of default risk on the cash flow forecast of abnormal accruals. The results suggest that the increased risk of bankruptcy intensity of accruals and cash flows are reduced [3].

Rezaei and Gholooz (2011) compare the predictive power of patterns of Zavgyn bankruptcy, Zymesky and Shyrata on the companies listed in Tehran Stock Exchange. The results showed 98.6 percent accuracy of Shyrata pattern, 87 percent of Zavgyn pattern and 89.6 percent of Zymsky model in predicting bankruptcy are comply with the conditions of the environment [4].

Mohammad Zadeh and Noferesti (2009) in their study, evaluate the use of models in predicting bankruptcy Altman and Asprynget Stock Exchange listed companies in Tehran. The population in this study consisted of 108 bankrupt company consists of 50 companies and 58 non-bankrupt company. Considering the results, both a model has the ability to predict bankruptcy Altman and Asprynget in Tehran Stock Exchange and Altman's model has more accuracy than the Asprynget model [5].

Soleimani (2010) assessed the performance of the financial crisis for Iranian companies. The research statistical sample prediction models are 30 successful and 30 unsuccessful company that was among the companies listed in Tehran Stock Exchange. The results show the expected continuation of the companies listed on the Stock Exchange for one or two years before the cessation of activities [6].

Moqadam and Sajjadi (2008), conduct a research on the prediction of corporate bankruptcy using the Logistic model. The results show that it can be claimed that the Logistic model in predicting bankruptcy was associated with a 95% confidence. Logistic model also accurately predicted the collapse, one year before bankruptcy 92%, 95% two years before the bankruptcy and bankruptcy three years ago was 97% [8].

Raie and Falah Poor (2004) did a research on financial distress prediction using artificial neural networks to predict financial distress of manufacturing companies. The results show that the neural network model is more accurate than multiple discriminate analysis [2].

Research hypotheses
1. The financial performance on the prediction of corporate bankruptcy is different.

2. Financial performance in the prediction of corporate bankruptcy is different depending on the used model.

Methods
This study considering the nature of the data component is quantitative research because it uses the statistics and numbers. It is also possible to investigate the events of the last data base. This survey research is applied research and the empirical method of accounting and the applied research is solidarity method.

Population, sample and study period
The population of this study consisted of all firms listed in Tehran Stock Exchange data for the years 2010-2005, the selected sample is based on the following conditions:
1. Have published their financial data and data systems are available on rdis.ir.
2. Financial year have not changed.
3. They were not among investment companies, leasing, Banks, Insurance. Due to the limitation of the foregoing, during the period of 6 years, 130 companies were selected as sample consisted of 58-year Bankrupt Company under Article 141 of the Commercial Code and Article 141 of the 72 years non-bankrupt company.

B) Statistical Methods

To test the hypothesis of statistical methods, DANP and logistic regression were used. B, A) De Metal Method (DEMATEL)

DEMATEL method is based on graph (diagraph) that can be divided into two factors cause the breakdown. This diagraphs, showed the dependency relationship between the elements of a system, so that the numbers on each Diagraph, indicates the severity of impact of an element on the other element. Hence, the DEMATEL method can convert the relationship between cause and effect of structural factors into a comprehensive model of a system. Lin and Wu Di motel process model (2008) is as follows [14]:

1) Calculate the initial phase matrix direct relationship: First, we calculate the mean of experts to mean:

\[
\tilde{Z} = \left( \frac{Z^1 + Z^2 + \cdots + Z^n}{p} \right)
\]

In this research the actual data used to calculate the arithmetic mean is not required.

Matrix calculation of direct relations:

To calculate the matrix of direct links, the numbers corresponding to (i.e. linguistic variables 1, 2, 3 and 4), each of these numbers indicates the severity of impact and impacted accountability through regression coefficient of financial ratios used in this study were obtained. Then using the corresponding numbers, triangular fuzzy numbers for each linguistic variable (i.e. the numbers 1, 2, 3, 4) are defined in the original matrix that is shown as follows:

\[
\tilde{X} = \left[ \begin{array}{cccc}
\tilde{x}_{11} & \tilde{x}_{12} & \cdots & \tilde{x}_{1n} \\
\tilde{x}_{21} & \tilde{x}_{22} & \cdots & \tilde{x}_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
\tilde{x}_{n1} & \tilde{x}_{n2} & \cdots & \tilde{x}_{nn}
\end{array} \right] = \tilde{X}_{ij} = \frac{\tilde{u}_{ij}}{s} = \left( \frac{l_{ij}}{s}, \frac{m_{ij}}{s}, \frac{u_{ij}}{s} \right)
\]

The normal distribution for the initial phase matrix initially low, medium and high financial will be calculated for each ratio and then select the great amount of all numbers and divide all of the matrix phase number to the matrix phase of the value to obtain normalized distribution matrix.

3) Calculate the final phase of the matrix:

\[
\tilde{T} = \lim_{n \to \infty} (\tilde{X}^1 + \tilde{X}^2 + \cdots + \tilde{X}^n)
\]

\[
\tilde{T} = \left[ \begin{array}{cccc}
\tilde{t}_{11} & \tilde{t}_{12} & \cdots & \tilde{t}_{1n} \\
\tilde{t}_{21} & \tilde{t}_{22} & \cdots & \tilde{t}_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
\tilde{t}_{n1} & \tilde{t}_{n2} & \cdots & \tilde{t}_{nn}
\end{array} \right]
\]

\[
[l_{ij}] = X_1 \times (1 - X_1)^{-1} \quad \tilde{t}_{ij} = (l_{ij}, m_{ij}, u_{ij})
\]

\[
[l_{mij}] = X_m \times (1 - X_m)^{-1}
\]

\[
[l_{uij}] = X_u \times (1 - X_u)^{-1}
\]

4) Calculate \( \tilde{D}_1 + \tilde{R}_1 \) : \( \tilde{D}_1 - \tilde{R}_1 \):

\[
D = \sum_{i=1}^{n} \tilde{t}_{ij}
\]

\[
R = \sum_{i=1}^{n} u_{ij}
\]

3. CALCULATE the amounts OF \( (\tilde{D}_1 - \tilde{R}_1) \)^{def} and \( (\tilde{D}_1 + \tilde{R}_1) \)^{def}: at this stage we proceed to non-fuzzy performing of fuzzy numbers. Values \((\tilde{D}_1 + \tilde{R}_1)^{def}\) indicate the rate and degree of IMPORTANCE AND \((\tilde{D}_1 - \tilde{R}_1)^{def}\) indicate the influence of the expression and the effect of their expression. When \((\tilde{D}_1 - \tilde{R}_1)^{def}\) positive, effective measures is are in place and when it is negative, the measures (index) takes place in group.

B. B) Analytic network process (ANP)

This is a hierarchical framework for the systematic analysis of all factors affecting the issue fully prepared to develop the principles and practices of several options, the
answer may be selected. Analytic Network Process (ANP) is a generalized hierarchical process (AHP). AHP is a special case of ANP, applying the AHP method is as follows: 1. Define the problem, 2) the hierarchy, 3) questionnaire design, 4) Paired comparison component, 5) Compatibility Test and 6) inconsistency rate option.

C) Analysis of the implementation of research findings

C. A) the results of the implementation of Dematel (DEMATEL)

To implement this approach, the regression coefficient for each financial ratio to calculate the coefficients of the numbers are impressive and effective (1, 2, 3 and 4) and then the affected and affecting numbers will be converted to the fuzzy numbers (the equivalent linguistic variables) according to the following table.

<table>
<thead>
<tr>
<th>Table1. equivalent linguistic variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linguistic variables / numbers</td>
</tr>
<tr>
<td>No effect (No) – 0</td>
</tr>
<tr>
<td>Very little impact (VL) – 1</td>
</tr>
<tr>
<td>Low impact (L) – 2</td>
</tr>
<tr>
<td>High impact (H) – 3</td>
</tr>
<tr>
<td>Dramatic effect (VH) – 4</td>
</tr>
</tbody>
</table>

And in order to calculate normal-phase matrix , we calculate the value s (Normalization factor) to calculate .on next step to calculate the final matrix (matrix p), normalized fuzzy matrices direct relations for three-phase components of high, medium and The lower limit (U, M and L) were obtained separately. And then after calculating the inverse matrix, the final matrix of relationships between indicators and the \( D_1 + R_1 \) values and \( D_1 - R_1 \) Indicating the degree of importance indices that were calculated that the influence prioritization is as follows table:

<table>
<thead>
<tr>
<th>Table2. prioritize impact of financial ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicators</td>
</tr>
<tr>
<td>The ratio of book value to book value of total liabilities</td>
</tr>
<tr>
<td>Sales of tangible fixed assets</td>
</tr>
<tr>
<td>Non-Current total debt to equity ratio</td>
</tr>
<tr>
<td>Ratio of total liabilities to total assets</td>
</tr>
<tr>
<td>Net income to total equity at beginning of year</td>
</tr>
<tr>
<td>Ratio of inventory to total assets</td>
</tr>
<tr>
<td>Ratio of current assets to current liabilities</td>
</tr>
<tr>
<td>Earnings before interest and taxes to total assets ratio</td>
</tr>
<tr>
<td>Inventory to sales ratio</td>
</tr>
<tr>
<td>Quick assets to current liabilities</td>
</tr>
<tr>
<td>The ratio of total debt to total equity</td>
</tr>
<tr>
<td>The ratio of book value to market value of equity</td>
</tr>
<tr>
<td>Income before depreciation relative to sales revenue</td>
</tr>
<tr>
<td>Sales ratio to total</td>
</tr>
</tbody>
</table>
The ratio of retained earnings to total assets - U - 2.122 15
Inventory turnover ratio - U - 2.120 16
Ratio of total equity to tangible fixed assets - U - 2.106 17
Net income to total assets - U - 2.105 18
Proportion of their total sales - U - 2.062 19
Ratio of working capital to total assets - U - 2.004 20

C. B) the results of the implementation of DANP:
In this method, the final matrix obtained from the DE metal model that is called unbalanced super-matrix will be converted to the super weighted matrix; it means matrix elements of the sum of a column. Then each element to be weighted matrix K that is an arbitrary number so all elements in each row are equal to each so the factor of importance (weights) will be set, the following table shows the coefficient of each of the indicators:

Descriptive statistics were
In general, the methods by which data can be processed and summarized, is called descriptive statistics. These statistics are calculated to describe the sample. The goal of it is to study sample population parameters (Azar and Momeni, 2010).
In order to perform logistic regression, the company studied is divided into two groups of bankrupt firms and non-bankrupt companies. The response variable has two levels of bankruptcy and non-bankruptcy. The goal is to keep a company's financial ratios; probability of bankruptcy is estimated on the basis of the information yet to be decided. Note that in this study, only 130 companies studied during the research and research in terms of sampling, true, and the one hand, 20% proportion of financial is considered, most of the independent variables have a number of the effective meaningfulness bankruptcy that are not eliminated. Also, there is a line between the independent variables cause inaccurate estimates of the regression coefficients. In order to reduce the space of independent variables, the criteria that they consider both linear and linear variables make up the most time, we excluded from the model. The LINEAR scale is shown with VIF symbol so that in this respect, VIF represents the variance inflation factor for variable $j$ and $R^2_j$ is the coefficient of determination that is also a model of the $j$-the variable as the dependent variable and the other variables in the model are independent. In this study, the line greater than 3 for the model are inappropriate because they achieve an optimal model, the variables are eliminated to the extent possible based on the criterion of linear time that has come to smaller values of 3 and finally 8 financial ratio was significant in predicting bankruptcy and the rest of the 12 financial ratios were excluded from the model because of multicollinearity.

### Table 4. Descriptive static of research variables

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Count</th>
<th>The average of Deviation Criterion Skewers Cache Seek Max</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR</td>
<td>130</td>
<td>0.0960</td>
<td>0.437</td>
<td>0.013</td>
</tr>
<tr>
<td>QR</td>
<td>130</td>
<td>0.0650</td>
<td>0.333</td>
<td>0.2596</td>
</tr>
<tr>
<td>ITO1</td>
<td>130</td>
<td>0.0580</td>
<td>0.137</td>
<td>0.5655</td>
</tr>
<tr>
<td>INVE</td>
<td>130</td>
<td>0.0283</td>
<td>0.152</td>
<td>4.709</td>
</tr>
<tr>
<td>ROI1</td>
<td>130</td>
<td>0.0308</td>
<td>0.104</td>
<td>3.435</td>
</tr>
<tr>
<td>ROE</td>
<td>130</td>
<td>-0.238</td>
<td>0.0469</td>
<td>-4.483</td>
</tr>
<tr>
<td>TLEV</td>
<td>130</td>
<td>-0.094</td>
<td>0.184</td>
<td>-8.513</td>
</tr>
<tr>
<td>LLEV</td>
<td>130</td>
<td>0.0465</td>
<td>1.747</td>
<td>5.232</td>
</tr>
<tr>
<td>OE</td>
<td>130</td>
<td>0.0113</td>
<td>0.210</td>
<td>6.666</td>
</tr>
<tr>
<td>ASSTO</td>
<td>130</td>
<td>0.0350</td>
<td>0.189</td>
<td>7.24</td>
</tr>
<tr>
<td>ROA2</td>
<td>130</td>
<td>0.0073</td>
<td>0.099</td>
<td>-9.594</td>
</tr>
<tr>
<td>WCR</td>
<td>130</td>
<td>-0.0225</td>
<td>0.022</td>
<td>-9.730</td>
</tr>
<tr>
<td>ROS</td>
<td>130</td>
<td>0.0360</td>
<td>0.150</td>
<td>8.143</td>
</tr>
<tr>
<td>BTD</td>
<td>130</td>
<td>-0.0262</td>
<td>0.134</td>
<td>-9.940</td>
</tr>
<tr>
<td>RER</td>
<td>130</td>
<td>-0.0282</td>
<td>0.050</td>
<td>0.846</td>
</tr>
<tr>
<td>Cash</td>
<td>130</td>
<td>0.0903</td>
<td>1.727</td>
<td>5.345</td>
</tr>
<tr>
<td>INVE2</td>
<td>130</td>
<td>0.0969</td>
<td>0.029</td>
<td>1.120</td>
</tr>
<tr>
<td>FATO</td>
<td>130</td>
<td>0.0579</td>
<td>0.503</td>
<td>9.447</td>
</tr>
<tr>
<td>TLEV2</td>
<td>130</td>
<td>0.0034</td>
<td>0.043</td>
<td>9.405</td>
</tr>
<tr>
<td>BTM</td>
<td>130</td>
<td>0.0068</td>
<td>0.087</td>
<td>-0.437</td>
</tr>
</tbody>
</table>

### Table 5. The classification of observations

<table>
<thead>
<tr>
<th>Separating groups based on observations and model predictions</th>
<th>Predicted model by the: Non-bankrupt</th>
<th>Bankrupt</th>
<th>Percentage of correct classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vises</td>
<td>66</td>
<td>6</td>
<td>91.8</td>
</tr>
<tr>
<td>Non-bankrupt</td>
<td>6</td>
<td>52</td>
<td>98.7</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>90.8</td>
</tr>
</tbody>
</table>
The results in Table 3 indicate that the fitted model of group correctly classified 91.7% non-bankrupt companies and the Group bankrupt companies 89.7 percentage of observations. In other words, using the model correctly predicted the possibility that non-bankruptcy of a non-bankrupt company to 91.7 of the possibility of bankruptcy of a company that is correctly predicted and 89.7 respectively for bankrupt. Overall, the model correctly predicted is the 90.8%.

Table 5. Estimated coefficients significant levels of financial ratios

<table>
<thead>
<tr>
<th>Financial ratios</th>
<th>Symbol</th>
<th>Coefficient</th>
<th>Wald statistic</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed parameter</td>
<td>C</td>
<td>-y/895</td>
<td>y/895</td>
<td>../..</td>
</tr>
<tr>
<td>Quick assets to current liabilities</td>
<td>QR</td>
<td>-y/895</td>
<td>y/895</td>
<td>../..</td>
</tr>
<tr>
<td>Inventory turnover ratio</td>
<td>ITO1</td>
<td>y/895</td>
<td>y/895</td>
<td>../..</td>
</tr>
<tr>
<td>Inventory to total assets ratio</td>
<td>INVE</td>
<td>y/895</td>
<td>y/895</td>
<td>../..</td>
</tr>
</tbody>
</table>

Based on the significant levels found in the table comparing the "real assets to current liabilities" with significant levels 0.008 "inventory turnover ratio" with a significance level of 0.011, "inventory to total assets" with the 0.016 significant "proportion of total equity to tangible fixed assets" with a significance level of 0.022, "the ratio of sales to total assets", with a significance level of 0.018, "retained earnings to total assets ratio" with the significantly less than the 0.001 and the "ratio of book value to market value of equity" in the model are significant at a significance level of 0.005, while the impact of "the ratio of sales to raise cash" with a significance level of the model 0.176 is not significant. The regression coefficients obtained for each variable represents its influence on the probability of bankruptcy of the company. The possibility of following equation is calculated for each combination of variables:

\[ P(A) = \frac{e^U}{1 + e^U} \]

According to the results of Table 4, we can say that the research hypothesis is accepted that is based on the difference between the amounts of financial performance in predicting corporate bankruptcy, the first type of error 0.05. This means that with 95% certainty, the proportions specified in the table above effect on the bankruptcy probability and the effectiveness due to the influence of different factors which vary in size are formed. Based on the estimated model, the probability of failure of each of the surveyed companies is equal to:

If the probability is greater than the value of 5.0 that is achieved, the firm is bankrupt or if the estimate is smaller than 5.0, the companies will be considered non-bankrupt. The research model is estimated as follows:

Conclusion

In this research the ability to use financial ratios to predict bankruptcy combination DANP and logistic regression methods were studied. Since the number of 12 financial ratios were not included in the model and didn’t have significant effect and the entry of the regression model only 8 variable, it can be concluded that the performance of various financial ratios to predict studied bankruptcy firms were significantly different. The first hypothesis is confirmed 0.05 Type I error level. The coefficient of the financial impact of each type of error in the model and 0.05 has been different. The second research hypothesis is confirmed which is based on the difference in the projected financial performance of the bankruptcy of the respective regression model error of the first kind 0.05 .also it should be noted that the study had some limitations:
Due to the effects of inflation in the country, the effects of inflation on financial ratios were not considered.

**RECOMMENDATION**

1. Due to the accurate prediction of 89.7% of the research on bankruptcy and creditors, it will be offered to investors to use it as a tool to evaluate the continuity or non-continuity of the company.
2. It is suggested to study the impact on the ability of the industry to predict bankruptcy by financial ratios.
3. It is suggested that the effect of the bankruptcy prediction using artificial neural networks, genetic algorithms, or DEA will be studied.

**REFERENCES**

[12] Cheng Chi-Bin; Chen, Chin-Lung; Fu, Chung-jean(2006). "Financial distress prediction by a radial basis function network with Applications".