Bankruptcy Prediction of Accepted Companies in Tehran Stock Exchange with Genetic Algorithm Model

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ABSTRACT

This research investigate bankruptcy prediction of accepted companies in Tehran stock Exchange with genetic algorithm model. This research has one hypothesis which is applicable research in terms of purpose and it is correlatve research in terms of method and native. Statistical community includes accepted companies in cement industry for 2001 to 2.13 that according to the limitations, 19 companies were selected in cement industry. Collected data are used as input of genetic algorithm model which are programming by Matlab and minitab and spss software and then outputs of model will be evaluated as obtained results. Two groups of bankrupt and non-bankrupt companies are investigated in the same conditions and according to Article 141 - commercial Act (excess of accumulated loss more than double of capital). Bankruptcy prediction with genetic algorithm for 68/42% member companies in the community is consistent with reality the results show recognition power of genetic algorithm model in companies’ bankruptcy prediction.

KEYWORDS

Bankruptcy prediction, Tehran stock Exchange, genetic algorithm model, cement industry

INTRODUCTION

Increasing competition in economic firms havein creased bankruptcy possibility and have limited accessing to resources [5]. Pervious can ducted researches show that companies hide their bankruptcy and when they announce the bankruptcy formally that in this time, prevention of bankruptcy is a ineffective try and it is very late [10]. It becomes one of the main issues (company's bankruptcy predicting) of research to pic in finance literature in the recent 40 years. Academic researchers have tried to discover the best models of bankruptcy prediction based on the existing data and statistical techniques and not only in developed countries but in developing countries, researches have tried to make new models and they have provided several predictor models according to the different financial and economic environments[7].Based on one of the first researches on financial conditions and situation of companies, this question is arising that can we recognize time of bankruptcy for companies before occurrence and formal announcement?

RESEARCH BACKGROUND

Domestic background:

Darabi and Mohammadi (2011) have investigated the relationship between profit management and financial reporting its effect on bankrupt and non – bankrupt companies in Tehran stock exchange in a research entitled (the relationship between profit managements on financial reporting in bankrupt and non – bankrupt companies in Tehran stock exchange. Its statistical community includes 81 bankrupt companies from 96 bankrupt companies and non – bankrupt companies during there is no period 7 years from 2001 to 2007 and during this research, there is no signify cant relationship between profit management and financial reporting in bankrupt and non bankrupt companies.

Firozian and etal (2011), investigate bankrupt prediction of companies in their research entitled (application of genetic algorithm to predict bankruptcy and its comparison with Altman's z model in accepted companies in Tehran stock exchange) and they concluded that genetic algorithm model has more accu racy towards Altman's z model and genetic algorithm is more conservative than Z model of Altman [4].

Drabi and Habibikandbon (2008), have investigated the relationship between financial ratios and activity continuity, which includes spring ate model, on bankruptcy prediction of accepted companies in Tehran stock exchange in a research entitled (evaluating the financial capability in existing accepted companies in medicinal industry in Tehran stock exchange based on the spring ate’s prediction model) [3].

Foreign background:
Sample composed of on companies, including 236 bankrupt companies and 264 non – bankrupt ones. The results show that prediction accuracy is 93% for one year before bankruptcy and 11/6% for two years before bankruptcy [12].
Cielen (2004) have conducted a research to predict bankruptcy by three patterns – least deviations set, data covering analysis, and one of the decision tree methods. Their researches show that these three method has classification accuracy of 78/9%, 86/4 and 85/5% respectively[2].
Premachandra and et al (2009) have conducted a research entitled (data covering analysis as a tool to analysis bankruptcy: comparative study with logistic regression). Research findings show that data covering analysis method has more accuracy than logistic regression method to predict bankruptcy of companies and this research is efficient for little sample towards regression method[9].
Janova, et al (2012) investigates the evaluation of active company's bankruptcy based on the data covering analysis model. These researchers in traduce data covering analysis model as a useful and powerful tool to predict bankruptcy and predict company's bankruptcy with high accuracy [8].

**RESEARCH HYPOTHESIS**

Genetic algorithm model is an appropriate tool to predict bankruptcy of accepted companies in Tehran stock exchange (in cement industry).

**RESEARCH VARIABLES**

To gain an appropriate model that have acceptable performance in bankruptcy prediction, we should use some factors which can created stable model in the best way and with highest intervention about bankruptcy prediction. So selecting optimized variable has direct effect on optimized performance of model.

**Dependent variable of research:**

Dependent variable is a variable which its changes are due to independent variables [11].
In this study, dependent variable is financial situation of companies that is classified in to groups – bankrupt and non – bankrupt.
Based on article 141 of commercial act, if account balance of company's accumulated loss is at least half capital, it is classified as bankrupt company.

**Independent variable:**

In research method, independent variable is a physical or social environment feature which after selection, intervention or manipulating by researcher, it accepts some amounts to observe its impact on other variable [11]. Independent variable of research is different in each studied models.

**Independent variables of research in genetic algorithm model:**

During 3 steps, selection process of prediction variables is used in genetic algorithm. In first step, by investigating the bankruptcy prediction literature, 40 variables were selected among 60 variables (financial ratio) as predictor variables. These financial ratios are selected based on utility in the literature. In the second step, 25 variables were selected among 40 variables based an access to crucial data.

1. Total assets logarithm
2. Current assets / current liabilities
3. Cash / current liabilities
4. (Cash + short – term investment)
5. Future assets/ current liabilities
6. Future assets/ total assets
7. Current assets/ total assets
8. Cash/ total assets
9. Working capital/ total assets
10. Sales/ receivable accounts
11. Operational profit/ sales
12. Net in com/ sales
13. Sales/ current assets
14. Sales/ total assets
15. Sales/ fixed assets
16. Operational profit/ total assets
17. Profit before tax fraction/ total assets
18. Net income/ total assets
19. Net income/ equity
20. Profit before interest and tax/ interest cost
21. Accumulated profit/ total assets
22. Liabilities/ equity
23. Total liabilities/ total assets
24. Equity/ total assets
25. Book value of equity/ book value of total liabilities

Which are selected in third step by implementing genetic algorithm of 7 variables as final variable [6].

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Independent variable</th>
<th>Fiscal year</th>
<th>group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bankrupt companies (0) and non-bankrupt companies (1) in 2010</td>
<td>Calculated Septet fiscal ratios for 2009</td>
<td>2009</td>
<td>Training data group</td>
</tr>
<tr>
<td>Bankrupt companies (0) and non-bankrupt companies (1) in 2011</td>
<td>Calculated Septet fiscal ratios for 2010</td>
<td>2010</td>
<td></td>
</tr>
<tr>
<td>Bankrupt companies (0) and non-bankrupt companies (1) in 2012</td>
<td>Calculated Septet fiscal ratios for 2011</td>
<td>2011</td>
<td></td>
</tr>
<tr>
<td>Bankrupt companies (0) and non-bankrupt companies (1) in 2013</td>
<td>Calculated Septet fiscal ratios for 2012</td>
<td>2012</td>
<td></td>
</tr>
</tbody>
</table>

Generally, the methods by which we can collect data and process and summarize them are descriptive statistics. This kind of statistics merely describes community or sample and its goal is to calculate the parameters of research community or sample.
Tab.2. Descriptive statistics for research variables

<table>
<thead>
<tr>
<th>Kurtosis</th>
<th>Skewness</th>
<th>Variance</th>
<th>Standard deviation</th>
<th>Mean</th>
<th>Max</th>
<th>Min</th>
<th>Amplitude of change</th>
<th>Number</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.490</td>
<td>0.065</td>
<td>0.247</td>
<td>2.58</td>
<td>1.101</td>
<td>1.04910</td>
<td>0.0203</td>
<td>2.97</td>
<td>-1.86</td>
<td>4.84</td>
</tr>
<tr>
<td>0.490</td>
<td>1.784</td>
<td>0.247</td>
<td>-5.48</td>
<td>0.889</td>
<td>0.94279</td>
<td>-0.0461</td>
<td>2.20</td>
<td>-3.94</td>
<td>6.14</td>
</tr>
<tr>
<td>0.490</td>
<td>-0.411</td>
<td>0.247</td>
<td>-0.52</td>
<td>1.126</td>
<td>1.06131</td>
<td>0.0491</td>
<td>2.31</td>
<td>-2.54</td>
<td>4.85</td>
</tr>
<tr>
<td>0.490</td>
<td>0.054</td>
<td>0.247</td>
<td>-0.43</td>
<td>0.999</td>
<td>0.99953</td>
<td>-0.0278</td>
<td>2.49</td>
<td>-2.62</td>
<td>5.11</td>
</tr>
<tr>
<td>0.490</td>
<td>0.275</td>
<td>0.247</td>
<td>-0.089</td>
<td>0.824</td>
<td>0.90751</td>
<td>-0.0247</td>
<td>2.64</td>
<td>-2.66</td>
<td>5.30</td>
</tr>
<tr>
<td>0.490</td>
<td>-0.751</td>
<td>0.247</td>
<td>0.172</td>
<td>0.871</td>
<td>0.93310</td>
<td>0.0122</td>
<td>1.94</td>
<td>-1.68</td>
<td>3.62</td>
</tr>
<tr>
<td>0.490</td>
<td>0.002</td>
<td>0.247</td>
<td>0.048</td>
<td>1.000</td>
<td>1.00023</td>
<td>0.0064</td>
<td>2.43</td>
<td>-2.49</td>
<td>4.92</td>
</tr>
</tbody>
</table>

The results of hypothesis

The calculation results of dependent and independent variable of genetic algorithm.

The obtained results of seven financial ratios are calculated for each firm in each year according to the explained by using artificial variable of \((Y_{i}^{(1)})\) in two groups – non – bankrupt companies (1) and bankrupt companies (0) – based on the article 141 of commercial act for companies which are member of this community based on the next year bankruptcy that frequency of these two classes for each year in training and experimental groups is as table.

Tab.3. The frequency of bankrupt and non – bankrupt companies for each year separately.

<table>
<thead>
<tr>
<th>No. of bankrupt companies</th>
<th>No. of non-bankrupt companies</th>
<th>Studied companies number</th>
<th>Year</th>
<th>Classification of community</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>14</td>
<td>19</td>
<td>2009</td>
<td>Training group</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>19</td>
<td>2010</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>19</td>
<td>2011</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>47</td>
<td>57</td>
<td>Total of training group</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>18</td>
<td>19</td>
<td>2012</td>
<td>Experimental group</td>
</tr>
<tr>
<td>1</td>
<td>18</td>
<td>19</td>
<td>Total of experimental</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>55</td>
<td>76</td>
<td>Total of total</td>
<td></td>
</tr>
</tbody>
</table>

Each of the member companies in the community in each studied year is considered as a decision – making unit (DMU) and after doing some calculation related to the used financial ratios in excel software, data of each year – company is used in respect to the determined application in genetic algorithm as first data, in the calculations related to forenamed technics by matlab software.

Tab 4. The results of financial ratios calculations, genetic algorithm

<table>
<thead>
<tr>
<th>GA result</th>
<th>Yi</th>
<th>Financial ratios</th>
<th>DMUi</th>
<th>company</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V7</td>
<td>V6</td>
<td>V5</td>
<td>V4</td>
</tr>
</tbody>
</table>

152
In table 4, each of companies which are community member is considered as decision – making unit (DMU) in each studied year and data of each year – company are used in respect to the determined application in genetic algorithm calculations.

**CONCLUSION**

In this research, bankruptcy prediction of companies is conducted by genetic algorithm method. Research hypothesis is stated as follows:

Genetic algorithm model is an appropriate tool for predicting bankruptcy of accepted companies in stock exchange in cement industry.

The hypothesis is tested by using genetic algorithm model. The results show that using genetic algorithm model I useful for bankruptcy prediction and it has ability to predict bankruptcy and it can be used by investors and financial analysts.

**REFERENCES**

envelopment analysis, European Journal of Operational Research, 154, 526-532.


