Studying bankruptcy risk, productivity and firm strategy in companies listed in Tehran stock exchange

Leila Rahmani Movahed¹*, Bagher Shamszadeh²

1. Department of Accounting, Hamedan Branch, Islamic Azad University, Hamedan, Iran
2. Department of Accounting, Bu Ali Sina Hamedan University, Hamedan, Iran

*Corresponding Author email: leila.movahed17@yahoo.com

ABSTRACT: The purpose of this research is to examine the relationship between productivity, firm strategy and bankruptcy risk in companies listed in Tehran stock exchange. In case of bankruptcy all groups that are somehow related to the company will be affected. The current research tries to survey the factors reducing the bankruptcy risk. In the current research two factors: company productivity and company strategy are surveyed. The criterion for selecting bankrupt companies in this research is Altman model and eventually the information of 50 bankrupt companies listed in Tehran Stock Exchange during 8 years (2006-2013) are gathered. Data envelopment analysis (DEA) is used for measuring productivity and two Porter's generic strategies, cost leadership strategy and differentiation strategy are used for measuring company strategy. Findings achieved from testing hypotheses which are panel data show that there is a negative and significant correlation between productivity and bankruptcy risk. Also the correlation between cost leadership strategy, differentiation strategy and bankruptcy risk is negative and significant. Thus it is concluded that one of the mechanisms through which the company strategy affects bankruptcy risk is productivity. Research results showed that higher levels of productivity result in lower levels of bankruptcy risk; and also higher levels of each of the two strategies of cost leadership and differentiation result in reducing the bankruptcy risk. Mediation analysis results confirm that productivity acts as an intermediate channel and delivers the effect of cost leadership strategy to bankruptcy risk.

Keywords: Data Envelopment Analysis (DEA), Bankruptcy Risk, Altman Model, Company Strategy, Mediation Effect.

INTRODUCTION

Bankruptcy is considered as one of the most important events in today’s world of business. The competitive atmosphere dominating the financial markets leads many companies to bankruptcy, eliminating them from the competition. This concerns financiers and the society in general, leading them to find methods for foresting financial crises so they can prevent the loss of both their principal capital and its interest.

Bankruptcy occurs when a company is no longer able to fulfill its obligations and seeks the assistance of the government to reorganize its debt structure or sell its assets. For example, the bankruptcy of General Motors in 2009 which was caused by: heavy debts to the labour union regarding the working and the retired personnel, and in general, the union’s refusal to cooperate which led the company to declare bankruptcy. Other factors in GM’s bankruptcy were loss, loss of all titles, drops in sales, and even decline in production. The real repercussions of GM’s bankruptcy were experienced by its workforce – a workforce that had been accumulating valuable experiences for years and now had to experience harsh living conditions. Finally, General Motors Automotive Company, the symbol of the American industry, declared bankruptcy after a century of activity, 172 billion in debt. In a plan agreed on by the US Government and the GM executives, a smaller company was formed that could compete with other automakers on a global scale. Based on that plan, the US Government repaid GM’s debts, gave it 50 billion dollar worth of funding, and took the ownership of 60 per cent of the stocks of the new company in return.

Statement of the problem

These days we are witnessing financial crises taking place all over the globe. Escalation of industrial competition has caused the bankruptcy of many companies, removing them from the competition. Intensified
competition for making profit has increased the odds of bankruptcy; nonetheless, through continues improvement of their practices, economic institutions can remain in the competition. Since bankruptcy has significant economic, social, and political repercussions, defining the factors that influence bankruptcy is of great importance and it is through this that financial decision-making is ever more strategic. Bankruptcy prediction models are one of the means of forecasting the future of companies. Bankruptcy models of this sort generally use financial data that monitor the general performance or the situation of the company. Yet, there are few studies that use the efficiency variables to examine the effects of performance or strategy on the risk of bankruptcy. In their research, (Bacht & Sierra 2003) found that productive efficiency measured using stochastic frontier model, has a relation with risk of bankruptcy. We will expand this research by examining the effects of the efficiency and the strategy of company on risk of bankruptcy.

The present research aims to examine the relation between competitive cost leadership strategy and the [strategy of] differentiation with the risk of bankruptcy. Put more accurately, we will examine whether through adoption of the strategies of cost leadership and differentiation, risk of bankruptcy can be minimised. This research will also examine the mediator effects of efficiency on the relation between cost leadership strategy and risk of bankruptcy.

The goal of this research is to study the relationship between strategy, efficiency, and risk of bankruptcy. Since bankruptcy has significant economic, social, and political repercussions, this paper seeks to examine the factors that reduce the risk of bankruptcy.

In this research, through proving the relation between efficiency and risk of bankruptcy, a new method will be added to the methods of forecasting bankruptcy. This means that investors and financiers that seek to evaluate the bankruptcy risk of the possible investment, also need to consider the efficiency of the company. Our results also show that companies that try to avert bankruptcy need to focus on improvement of efficiency as part of the overall improvement of performance.

In the second aspect of this research, concepts of the strategies of companies and risk of bankruptcy will be examined. For companies, the two general strategies of Porter [which are] cost leadership and differentiation are used. Companies can only sell their products to the potential buyers and maintain higher than average profit when they produce their products at lower overall production cost, or when their products have distinct qualities; this means that for companies which are capable of successfully adopting either of these two strategies, the risk of bankruptcy is lower. Studies show that companies that pursue both of these strategies achieve better performance. Although the manner of implementing these two strategies are different – i.e. cost leadership relies on improved efficiency while differentiation seeks innovation and brand loyalty – yet, successful adoption of either of these strategies lead to better performance.

Questions of the research
With regard to the conceptual framework of the subject and the goal of this research, we seek to answer the following questions:
Is there a significant relation between higher productivity and risk of bankruptcy and can higher efficiency reduce the risk of bankruptcy?
Also, there is a relation between higher degrees of cost leadership, differentiation, and bankruptcy; can cost leadership reduce the risk of bankruptcy?
In order to answer these questions, three hypotheses are proposed as follows:

Hypotheses of the research
Hypothesis 1: Higher productivity reduces the risk of bankruptcy.
Hypothesis 2: Risk of bankruptcy decreases in companies that seek higher cost leadership and differentiation.

Research model
Domain of the research
Subjective domain of the research
The subjective domain of the research is the examination of the relation between strategy, efficiency, and risk of bankruptcy in companies listed with Tehran Stock Exchange.

Locational domain of the research
The locational domain of the research is Tehran Stock Exchange.

Chronological domain of the research
Chronological domain of this research is the data available from the period from March 21, 2006 to March 20, 2014.
The data on the methodology of the research
In this research we use the data available from Tehran Stock Exchange’s data base.

The statistical population of this research is all of the companies accepted in Tehran Stock Exchange March 21, 2006 to March 20, 2014.
The following criteria are used for determining the statistical samples through systematic elimination method:
Companies the fiscal year of which end on either March 20 or 21 of each year.
The company should not be a financier or a financial mediator
Finally, companies the data for which are not available or the deviated observations of which have been eliminated.
Companies which have exited the bourse between March 21, 2006 and March 20, 2014.
[Companies] that have not changed their fiscal year during the [mentioned] period
Finally, based on the Altman (z') model, from the 120 remaining companies, 50 companies were identified as bankrupt, and 70 were identified as non-bankrupt.

Data analysis
The data have been calculated using the Excel 2010 software and are analysed using Spss18 and Eview7 software.

Data analysis in the section of descriptive data is initiated through calculation of central indexes including average, median, and indexes of standard deviation dispersion and skewness and skewness elongation index. These indexes are carried out separately and in a general manner. Panel analysis has been used to analyse the models. In these models, presence or absence of effects (fixed or random) have been studied and finally the most suitable model has been evaluated. The basis for deduction has been the level of significance so that whenever the level of significance of the test is below 0.05, the hypothesis is rejected with 95% assurance.

Results and interpretation of the sub-hypotheses of the first hypothesis:
First sub-hypothesis
There is a significant relationship between productivity and the risk of bankruptcy.

With respect to table 4-4, between productivity and Altman’s score of t = 5.86, significance level of (0.000) is confirmed and because it is below 5 per cent, it means that with effectiveness coefficient of (0.13), productivity has a direct relationship with Altman’s score; with regard to “the invert relationship between Altman’s score and risk of bankruptcy,” it can be deduced that one unit increase in productivity reduces the risk of bankruptcy by 0.13 of a unit.

Second sub-hypothesis
There is a significant relationship between loss and the risk of bankruptcy.

With respect to table 1, between loss and Altman’s score of t = 8.34, significance level of (0.000) is confirmed and because it is below 5 per cent, it means that with effectiveness coefficient of (-0.51), loss has an indirect relationship with Altman’s score; with regard to “the invert relationship between Altman’s score and risk of bankruptcy,” it can be deduced that one unit increase in loss increases the risk of bankruptcy by 0.51 of a unit.

Evaluation of the second model
As we stated earlier, first the suitable model is selected from among the models (combined model, model with fixed effects, and models with random effects); the results from Chow Test are provided in the table below:

<table>
<thead>
<tr>
<th>Table 1. Analysis of the second hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redundant Fixed Effects Tests</td>
</tr>
<tr>
<td>Pool: Untitled</td>
</tr>
<tr>
<td>Test cross-section fixed effects</td>
</tr>
<tr>
<td>Effects Test</td>
</tr>
<tr>
<td>Cross-section F</td>
</tr>
<tr>
<td>Cross-section Chi-square</td>
</tr>
</tbody>
</table>

The possibility is equal to 0.91; therefore, the zero hypothesis of use of the combined hypothesis is validates and the model without the effects (or with combined effects) is the suitable [model].
To test the second hypothesis the following model is used:
Second hypothesis: There is a significant relation between companies' position in terms of strategy and risk of bankruptcy.

AltmanZkt = a₀ + a₁ Cost leadershipkt + a₂ Differentiationkt + a₃ losskt a₄ Leveragekt + a₅ Ln (MV)kt + a₆ Cashkt + Year & Industry Dummies 1ₖ

The following table contains the results from panel analysis:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.747917</td>
<td>0.117561</td>
<td>14.86811</td>
<td>0.0000</td>
</tr>
<tr>
<td>COST LEADERSHIP</td>
<td>0.077608</td>
<td>0.002217</td>
<td>34.99994</td>
<td>0.0000</td>
</tr>
<tr>
<td>DIFFERENTIATION</td>
<td>0.017807</td>
<td>0.006688</td>
<td>2.662633</td>
<td>0.0078</td>
</tr>
<tr>
<td>LOSS</td>
<td>-1.64E-07</td>
<td>3.23E-08</td>
<td>-5.085686</td>
<td>0.0000</td>
</tr>
<tr>
<td>LEVERAGE</td>
<td>-0.000516</td>
<td>6.82E-05</td>
<td>-7.563976</td>
<td>0.0000</td>
</tr>
<tr>
<td>MV</td>
<td>0.072120</td>
<td>0.002436</td>
<td>29.60442</td>
<td>0.0000</td>
</tr>
<tr>
<td>CASH</td>
<td>4.43E-08</td>
<td>1.08E-08</td>
<td>4.091713</td>
<td>0.0000</td>
</tr>
<tr>
<td>YEAR_INDUSTRY_DUMMIE</td>
<td>0.007509</td>
<td>0.009121</td>
<td>0.823252</td>
<td>0.4104</td>
</tr>
</tbody>
</table>

R-squared               | 0.062558    | Mean dependent var | 1.582066    |
Adjusted R-squared      | 0.062223    | S.D. dependent var  | 1.596003    |
S.E. of regression      | 1.545551    | Akaike info criterion | 3.709046    |
Sum squared resid       | 46799.95    | Schwarz criterion   | 3.712264    |
Log likelihood           | -36340.65   | Hannan-Quinn criter. | 3.710100    |
F-statistic             | 186.7785    | Durbin-Watson stat  | 1.872327    |
Prob(F-statistic)       | 0.000000    |                    |             |

Result and interpretation of the sub-hypotheses of the second hypothesis
First sub-hypothesis
There is a significant relationship between cost leadership and the risk of bankruptcy.
With respect to table 2, between cost leadership and Altman's score of t = 34.9, significance level of (0.000) is confirmed and because it is below 5 per cent, it means that with effectiveness coefficient of (0.07), cost leadership has a direct relationship with Altman's score; with regard to "the invert relationship between Altman's score and risk of bankruptcy," it can be deduced that one unit increase in cost leadership reduces the risk of bankruptcy by 0.07 of a unit.

Second sub-hypothesis
There is a significant relationship between differentiation and the risk of bankruptcy.
With respect to table 1, between differentiation and Altman's score of t = 2.6, significance level of (0.007) is confirmed and because it is below 5 per cent, it means that with effectiveness coefficient of (0.017), differentiation has a direct relationship with Altman's score; with regard to "the invert relationship between Altman's score and risk of bankruptcy," it can be deduced that one unit increase in cost leadership reduces the risk of bankruptcy by 0.017 of a unit.

Results from the hypotheses of the research
Results from the first hypothesis
In the regression equation of the first hypothesis, AlmanZkt is the criterion for forecasting the bankruptcy of company k in year t which is calculated according to the adjusted AltmanZ model (1983). Lower Altman soccer means higher risk of bankruptcy. Productivitykt is the productivity of company k in year t which has been obtained using the DEA model.
As it is evident in table 1, the relation between productivity and Altman score is positive and significant. With regard to "the invert relationship between Altman's score and risk of bankruptcy," it can be deduced that the relation between productivity and bankruptcy is negative and significant. It shows that the higher the productivity, the lower the risk of bankruptcy.
In the following, in line with the previous research, we have also determined numerous control variables as determiners of the risk of bankruptcy.
There is a negative and significant relation between the company's loss index (Losskt) and the Altman score and with regard to "the invert relationship between Altman's score and risk of bankruptcy," it can be
deduced that the relation between company's loss and risk of bankruptcy is positive and significant. Companies that post loss are at more risk of bankruptcy. This conclusions corresponds with the previous research e.g. Shamvai (2001), Homberg (2005), and Eberhard et al. (2008).

There is a positive and significant relation between the company's size Ln(MV)\text{py} and the Altman score and with regard to “the invert relationship between Altman’s score and risk of bankruptcy,” it can be deduced that the relation between company's size and risk of bankruptcy is negative and significant. Larger companies are at less risk of bankruptcy. This conclusions corresponds with the previous research e.g. Pill et al. (1986) and Bits & Nasi (1989).

There is a positive and significant relation between the company’s cash (Cash\text{py}) and the Altman score and with regard to “the invert relationship between Altman’s score and risk of bankruptcy,” it can be deduced that the relation between company's cash and risk of bankruptcy is negative and significant. Companies with more liquid assets are at lower risk of bankruptcy and companies that maintain less cash are at higher risk of bankruptcy.

Also, according to Bernanke (1981), in order avert bankruptcy and repay expenses and loans, companies [should] maintained a sufficient reserve of cash and use caution in choosing borrowers and credit sales. High liquidily reduces the risk of bankruptcy; so that bankrupt companies initially face shortage of cash before failing in fulfilling their obligations, and finally, even though their activities might be profitable, they go bankrupt (Khantang, 1997). Also, these results correspond with that of Campbell et al. (2005) and Prano et al. (2010). The results of the hypotheses also complies with the findings of Namazi et al. (2014).

Our analysis shows positive correlation between the productivity of a company and Altman Z score and in fact shows that there is a negative relation between higher productivity and risk of bankruptcy. In general, these results confirm hypothesis 1; hypothesis one states that productivity has predictiv effect of the risk of bankruptcy and companies with higher productivity have lower risks of bankruptcy.

**Results from the second hypothesis**

The second hypothesis of this research examines the relation between the strategic position of companies and risk of bankruptcy. We will evaluate the second regression model so through it the effect of strategic positioning on the risk of bankruptcy can be measured.

In the regression equation of the second hypothesis, Cost leadership\text{kt} strategy and Diffraction\text{kt} strategy show the strategic stance of company k in year t and is made based on the Balsam et al. model (2011). According to table 2, in the results of the examination of hypothesis 2, the relation between Cost leadership\text{kt} strategy and Altman score is positive and significant and with regard to “the invert relationship between Altman’s score and risk of bankruptcy,” it can be deduced that the relation between Cost leadership and bankruptcy is negative and significant. Also, the relation between Diffraction strategy and Altman score is positive and significant and with regard to “the invert relationship between Altman’s score and risk of bankruptcy,” it can be deduced that the relation between Diffraction and bankruptcy is negative and significant.

In total, with these results the second hypothesis is validated. Second hypothesis, Risk of bankruptcy decreases in companies that seek higher cost leadership and differentiation.

Also, according to Balsam (2011) we calculated criteria for the two general strategies of Porter (1980). Using the available data we find out that when companies successfully implement these strategies, the risk of their bankruptcy declines.

**REFERENCES**


