FIRM FINANCIAL DISTRESS PREDICTION WITH STATISTICAL METHODS: PREDICTION ACCURACY IMPROVEMENTS BASED ON THE FINANCIAL DATA RESTATEMENTS

Ivica Pervan - Petra Pavić - Maja Pervan

Abstract

Firm failure phenomenon has been in the focus of academic research for many years. Pioneering work of Beaver and Altman triggered many papers, which were trying to explain and predict firm failure. However, developed failure models entirely relay on original financial data and do not take into account potential data problems resulting from accounting manipulations. However, empirical research and anecdotal evidence (Enron, WorldCom, Parmalat, etc.) shows that accounting data can be manipulated. In this paper authors proposed the model for restatement of financial statements and tested it on the sample of 345 firms from Croatia. Empirical testing has shown that usage of restated financial data increases overall failure prediction accuracy by 5.3 percentage points. In the segment of non-distressed firms prediction accuracy was increased by 10.4 percentage points, while in the segment of distressed firms prediction accuracy was increased by 1.5 percentage points. Such findings indicate that accounting manipulations can affect failure prediction accuracy and that proposed model can be useful for prediction accuracy improvements.

Key words: financial distress prediction, accounting manipulations

JEL Code: M41, G33

Introduction

Beaver (1966) was pioneer in the area of firm failure research and found that the best univariate discriminator between failed and non-failed firms was cash flow/total debt ratio. Altman (1968) improved research methodology by usage of multiple discriminate analysis– MDA and developed famous Z score model. In the period from 1968 to 1980 majority of studies were using MDA, but after Ohlson (1980) for the first time used logit analysis, many following papers used conditional probability models. Namely, MDA has got a few very

restrictive assumptions: data set is dichotomous, normally distributed independent variables, equal variance-covariance matrices across groups, prior groups' probability and absence of multicolinearity. Since empirical data (financial ratios) rarely satisfy all previously described assumptions, recent failure studies often employ conditional probability models. These methods are more robust in comparison with MDA since there are no requirements for data normality and equality of dispersion matrices. Although, there is large set of firm failure literature, there is no clear evidence which "classical" statistical method is the best for modelling of firm failure. Studies reach heterogeneous conclusions and therefore there is no resulting consensus on statistical method choice (Balcaen & Ooeghe, 2006).

Although studies in this stream of academic research can be generally classified as "firm failure studies" there are differences regarding the failure definitions and measurement of dependent variable (in distinguishing among failed and non-failed firms). Some researchers define failure as a firm's bankruptcy (Altman, 1968; Nam & Jinn, 2000; Pervan, Pervan & Vukoja, 2011), some as a firm's inability to pay financial obligations – financial distress (Beaver, 1966; Vuran, 2009), while some authors use firm insolvency – blocked account (Pindado & Rodrigues, 2004; Pervan & Kuvek, 2013). Therefore, although a large number of studies deal with the issue of firm failure, developed models are often based on different definitions of the firm failure and consequently models are not directly comparable because they do not predict the probability of the same failure event.

An important aspect of firm failure studies is the issue of used sampling model and usage of failure prediction model in predictive purposes. Namely, in order to develop model which could be used for the failure prediction it is necessary that firm sampling (for failed and non-failed firms) was done randomly. But, literature review has shown that many studies have used non-random samples of failed and non-failed firms. Deakin (1972) was the first one that raised the question of sampling regarding the Altman's 1968 Z score model. Namely, Altman did not use random selection of firms, but applied match pair sample approach. In modelling sample Deakin used randomly selected 11 failed and 23 non-failed firms. Classification error of the model was relatively low up to three years before bankruptcy (3-4.5%), but for the fourth and fifth year before bankruptcy prediction error has sharply risen (21% and 17%). Usage of match pair sample approach often results with over-sampling of failed firms and overstatement of the model accuracy for failed firms.

Another very important issue in failure modelling is the reliability of used financial ratios and financial statements. Review of firm failure literature has shown that researchers

completely relay on ratios calculated on the basis of publicly available annual reports without questioning the reliability of such data. But, Positive Accounting Theory - PAT argues that choice of accounting policies is not primarily driven by the fair presentation of financial position and results, but instead of that it is affected by managers' own interests and firm interests. PAT is operationalized trough three hypotheses (Watts & Zimmerman, 1986): bonus plan hypothesis, debt covenant hypothesis and political costs hypothesis. Empirical research related to PAT has confirmed opportunistic managerial behaviour in relation with bonus hypothesis (Healy, 1985) and firm avoidance of debt convent violations based on predefined financial ratios values (Dichev & Skinner, 2002).

The main aim of this paper is to develop a model for restating of original annual report information in order to get more reliable information required to develop more accurate failure prediction model. The paper is organized as follows: in the section 1 the problem of accounting manipulations is analysed, while the section 2 explains the proposed model for annual report restatement. On the basis of original and restated annual reports, in section 3 authors develop and compare failure prediction models what is followed by concluding remarks and references.

1 Financial statements and problems of manipulations

According to the modern financial reporting frameworks, a financial reporting should provide useful information about firm's financial position, firm's financial results and its cash flows. In accordance with the previously described aims of financial reporting, firms produce three basic financial statements: balance sheet, income statement and cash flow statement. On the basis of financial statements investors and creditors can calculate different financial ratios which provide information about firm's profitability, liquidity, solvency and cash flows.

Modern financial reporting is based on accounting standards, which define methods for initial and subsequent measurement of assets, liabilities, sales, expenses, gains and losses. However, majority of standards incorporate alternative methods which can be chosen for recording of specific business transaction. According to International Financial reporting Standards, firm can choose among FIFO or average pondered price for the stock, historical cost of fair value for PPE, historical cost or fair value for financial instruments, etc. Besides alternative methods within accounting standards there is certain area for managerial assumptions and estimations. Thus, for example, a firm can choose amortization period for the fixed assets as well as amortization method. Taken all together it is clear that accounting

standards provide general guidelines for measurement, while leaving certain area for accounting policies and assumptions choice. Discretion area is necessary since accounting standards can't prescribe strict rules that would be appropriate for all firms and industries.

Accounting manipulations can be pointed towards improvements of published accounting numbers (earnings, sales, assets), what often happens in large listed firms where agency problem exists. But, in economies where capital markets are not a main source of financing and where ownership is concentrated in a large shareholders blocks, incentives for accounting manipulations can be driven by tax minimization. In the case when firms do not raise capital through the capital markets, financing is often realized through the bank credits. Banks use financial statements and ratios for credit risk management and therefore arises firm's incentive to present good financial data in order to achieve high credit score, which will in turn results with a lower interest rate and collateral requirements.

2 Model for restating of financial statements

On the basis of theoretical knowledge, practical experience and available data, in this section a model with five adjustments of original financial statements is proposed. First, we put focus on short term firm borrowings, which should represent short term assets, i.e. assets which should be transformed into cash within one year. In order to avoid personal and corporate income tax, firm owners in Croatia often withdraw cash from the firm trough the balance sheet position called "short term borrowings". In that case the problem lies in the fact that borrowings are often not transformed into the cash within one year, but continue to be balance sheet item for longer period. If amount of short term borrowings remains unchanged at the year-end balance sheet, such borrowings should not be treated as short term borrowings but as long term borrowings. Implementation of described manipulative practice results with misclassified current assets and consequently inflates firm liquidity ratios.

Short term receivables from related parties represent receivables against firms' related parties, which can be parent company, subsidiary, joint venture, associated company, member of key management personnel and their life partners. Since in business practice related parties often do not have or follow strict contracts for such receivables they should be accounted as a long term receivables. Proposed restatement reduces firm liquidity ratios, since current assets are reduced.

Interest expense represents negative element of income statement (or capitalized asset) and short term liability if it is not settled at balance sheet date. Anecdotal evidences from

Croatian practice shows that firms intentionally do not record full amount of interests and consequently increase earnings and understate reported current liabilities. For the purpose of this restatement we have employed estimated average interest rate of 6%[1] as a minimal rate, which should result with reliable interest expense and current liability. Rate of 6% was applied to the reported amount of loans and if recorded interest expense/liability was lower that calculated amount restatement was done by increasing P&L expenses and liabilities. Such restatement reduces firm profitability, liquidity and solvency ratios.

Current portion of long term debt represents short term liability related with debt that should be settled within period of one year. In practice, firms often try to reduce short term liabilities in order to present higher liquidity by showing current portion of long term debt as a long term debt. In other words, firms intentionally misclassify short term for long term liabilities. Restatement in this segment is done by dividing long term debt with 7 years, which represents average period for long term debt for the firms in the sample. If current debt liabilities are lower than calculated amount any difference is reclassified as short term debt.

The final restatement of the original data was related with the short term receivables. Due to Croatian tax regulations, a few restrictive assumptions must be realized in order to make receivables write-off tax deductible. Since in Croatia a financial reporting is still tax oriented many firms that do not fulfil tax rule requirements do not make uncollectable receivables write-offs. Therefore, for the purpose of the model we have decided to write-off all receivables older than 150 days. All previously described restatements were applied to the original financial statements and restated data set is produced, which was used for calculation of financial ratios.

3 Research data, methodology and variables

Research sample was provided by one commercial Croatian bank, and data base included original financial statements data on the 354 bank's corporate clients. Since dependent variable in failure study must be dichotomous, for the purpose of this research all firms in the sample are divided into one of the following two groups:

- Group marked as 1 – firm is in financial distress since it has unsettled loan liabilities for period longer than 30 days.

[1] Used rate of 6% is calculated as average interest rate for the sampled firms. Different sample or different period would probably result with different average interest rate.

- Group marked as 0 – firm is not in financial distress since it doesn't have unsettled loan liabilities for period longer than 30 days.

On the basis of previously described criteria, 154 firms (43.5%) were financial stabile, while 200 firms (56.5%) were in financial distress. Such a high ratio of distressed firms was a consequence of the economic crises in the period of analysis and bad portfolio of bank clients. Here one must observe that used definition[2] of failure firms was very broad and included firms which were 30 days or more late in loan payments. Independent variables in the model were financial ratios which were calculated on the basis of original and restated financial statements. Initial set of 25 financial ratios included ratios of solvency, liquidity, activity, profitability and cash flow.

Initial data analysis[3] and used Kolmogorov-Smirnov test has revealed that independent variables were not distributed normally and therefore usage of MDA was not appropriate. Therefore, the authors have decided to use LR as a statistical method for data modelling. Since many of applied financial ratios used the same variables in its calculation, there was a possibility of multicolinearity problem in the estimated model. The problem of multicolinearity in the estimated model causes inefficiently estimated parameters and high errors, which in turn results with many insignificant variables and high explanatory power of the estimated model. In order to control for this problem Pearson Correlation coefficients were used.

4 Empirical findings

In order to find statistically significant discriminators between financially distressed and non-distressed firms the T-test was used. Mean comparison based on original and restated financial data has revealed that the ratios presented in Table 1 were good discriminators.

[2] If definition of firm failure was narrower (for example only bankrupted firms) ratio of failed firms in the sample would be much lower.
[3] All data analysis was done with the usage of IBM® SPSS® 22 Statistics software.

Tab. 1: T-test for equality of means for financial ratios

Financial ratio	Calculation	T-test for Equality of means – original data	T-test for Equality of means – restated data
Debt Ratio – D/A	Total Debt/Total Assets	0.001	0.001
Current Ratio - CR	Current Assets/Current liabilities	0.001	0.001
EBITDA Margin	EBITDA/Sales	0.001	0.001
OCF Coverage	Operating Cash Flow/(Interest + Current Debt)	0.001	0.001

Source: Compiled by authors

Significant mean differences (Table 1) were observed for original and restated data set variables at the 1% significance level. As theoretically expected average D/A ratio was significantly higher for distressed firms, while CR, EBITDA Margin and OCF Coverage means were significantly higher for non-distressed firms.

Tab. 2: Correlations among selected independent variables – original data set

		D/A	CR	EBITDA Margin	OCF Coverage
D/A	Pearson Correlation	1	-,005	-,061	-,124*
	Sig. (2-tailed)		,918	,250	,020
	N	354	354	354	354
CR	Pearson Correlation	-,005	1	,059	,176**
	Sig. (2-tailed)	,918		,268	,001
	N	354	354	354	354
EBITDA Margin	Pearson Correlation	-,061	,059	1	,030
	Sig. (2-tailed)	,250	,268		,569
	N	354	354	354	354
OCF Coverage	Pearson Correlation	-,124*	,176**	,030	1
	Sig. (2-tailed)	,020	,001	,569	
	N	354	354	354	354

Source: Compiled by authors

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Second important step in development of the failure prediction model was controlling for multicolinearity among selected independent variables. Matrix of Pearson Correlation coefficients (Table 2) has shown that all independent variables based on original data set had

correlation much lower than 0.8 indicating that model based on the independent variables' from the Table 1 is free of multicolinearity. The same finding regarding correlation of independent variables was confirmed for variables based on restated data set. The final step in the modelling was estimation of failure prediction model with usage of the LR. LR model based on original data had Chi-square of 179.039, with significance of 0.001% indicating that the overall fitting of the model was good. Another approach of measuring the model fitting was Nagelkerke R Square. Calculated Nagelkerke R Square was 53.2% indicating relatively strong relationship between the used independent variables and financial distress prediction. LR model based on the restated data resulted with higher Chi-square (258.377) and it was also significant at 0.001% level. Moreover, restated data model had higher level of fitting since Nagelkerke R Square was 69.5%, i.e. 16.3 percentage points higher in comparison with original data model.

Tab. 3: LR summary – original and restated data models

Variable	Original data model		Restated data model	
	B	Sig.	B	Sig.
D/A	1.790	0.003	2.907	0.001
CR	-2.013	0.001	-2.338	0.001
EBITDA Margin	-4.510	0.001	-7.060	0.001
OCF Coverage	-0.001	0.002	-0.005	0.097
Constant	-0.059	0.842	-0.737	0.035

Source: Compiled by authors

Table 3 shows that only variable D/A has positive sign indicating that increase of debt increases the probability of financial distress. Other three statistically significant variables (CR, EBITDA Margin and OCF Coverage) have negative signs indicating that the increase of these variables reduces the probability of financial distress. Signs of all variables are logical, in accordance with theoretical literature and comparable with previous findings.

Tab. 4: Classification Results – original and restated data models

	Original data model	Restated data model	Difference between original and restated model
Non-distressed	73.4%	83.8%	+10.4 p.p.
Distressed	87.0%	88.5%	+1.5 p.p.
Overall Percentage	81.1%	86.4%	+5.3 p.p.

Source: Compiled by authors

As mentioned earlier the main aim of this study was do develop model for restatement of financial statements in order to eliminate accounting manipulations and improve failure prediction accuracy. Data from the Table 4 indicate that model based on restated data has overall accuracy of 86.4%, while model with original data has accuracy of 81.1%. Prediction accuracy in the segment of non-distressed firms with original data equals 73.4%, while accuracy increases to 83.8% with restated data. In other words, data restatement in the segment of non-distressed firms has improved accuracy for 10.4 percentage points. In the segment of distressed firm prediction accuracy had increased from 87.0% to 88.5%.

Conclusion

In this study authors developed the model for financial data restatement in order to eliminate problem of accounting manipulations and improve failure prediction accuracy. Restatements are done on the short term borrowings, receivables from related parties, interest expense, long term debt and short term receivables. Empirical assessment of failure prediction models based on the original and the restated data has revealed that conducted data adjustments were reflected in the models accuracy. Model with restated data has resulted with a higher overall accuracy (+5.4 p.p.); accuracy in the segment of financially non-distressed firms increased for 10.4 percentage points, while accuracy in the segment of financially distressed firms increased for 1.5 percentage points confirming the usefulness of accounting data restatements. Such findings indicate that accounting manipulations can affect failure prediction accuracy and that proposed model can be useful for prediction accuracy improvements.

References

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *Journal of Finance, 23*(4), 889-607.

Balcaen, S., & Ooeghe, H. (2006). 35 years of studies an business failure: on overview of the classic statistical methodologies and their related problems. *The British Accounting Review, 38*, 63-93.

Beaver, W. (1966). Financial ratios as predictor of failure. *Empirical Research in Accounting, Empirical Studies, Journal of Accounting Research, 4*, 71-111.

Deakin, E. B. (1972). A discriminant analysis of predictors of business failure. *Journal of Accounting Research*, *10*(1), 167-179.

Dichev, I. D., & Skinner, D. J. (2002). Large-sample evidence on the debt covenant hypothesis. *Journal of Accounting Research*, *September*, 1091-1123.

Healy, P. M. (1985). The effect of bonus schemes on accounting decisions. *Journal of Accounting and Economics, April*, 85-107.

Ohlson, J. A. (1980). Financial ratios and the probabilistic prediction of bankruptcy. *Journal of Accounting Research*, *18*(1), 109-131.

Nam, J., & Jinn, T. (2000). Bankruptcy prediction: Evidence from Korean listed companies during the imf crisis. *Journal of International Financial Management and Accounting*, *11*(3), 178-197.

Pervan, I., Pervan, M., & Vukoja, B. (2011). Prediction of company bankruptcy using statistical techniques. *Croatian Operational Research Review*, *11*(2), 158-166.

Pervan, I., & Kuvek, T. (2013). The relative importance of financial ratios and nonfinancial variables in predicting of insolvency. *Croatian Operational Research Review*, *13*(4), 187-197.

Pindado, J., & Rodrigues, L. F. (2004). Parsimonious models of financial insolvency in small companies. *Small Business Economics*, *22*, 51-66.

Vuran, B. (2009). Prediction of business failure: a comparison of discriminant and logistic regression analyses. *Istanbul University Journal of the School of Business Adminstration, 38*(1), 47-65.

Watts, R. L., & Zimmerman, J. L. (1986). *Positive accounting theory*. Englewood Cliffs: Prentice-Hall.

Contact

Ivica Pervan
Faculty of Economics, University of Split
Cvite Fiskovica 5, 21 000 Split, Croatia
pervan@efst.hr

Petra Pavic
Hypo Alpe Adria Bank d.d.
Domovinskog rata 49, 21 000 Split, Croatia
petra.jakasa@hypo-alpe-adria.hr

Maja Pervan
Faculty of Economics, University of Split
Cvite Fiskovica 5, 21 000 Split, Croatia
maja.pervan@efst.hr