

Cash Flow in Predicting Financial Distress and Bankruptcy

OGNJAN ARLOV, SINISA RANKOV, SLOBODAN KOTLICA

Faculty of Business Studies
University Megatrend Belgrade
Goce Delceva 8
SERBIA

oarlov@megatrend.edu.rs, rankovs@megatrend.edu.rs, kotlicasl@megatrend.edu.rs

Abstract: - Purpose of this study is to determine whether cash flow impacts business failure prediction using the BP models (Altman z-score, or Neural Network, or any of the BP models which could be implemented having objective to predict the financial distress or more complex financial failure-bankruptcy of the banks or companies). Units of analysis are financial ratios derived from raw financial data: B/S, P&L statements (income statements) and cash flow statements of both failed and non-failed companies/corporates that have been collected from the auditing resources and reports performed. A number of these studies examined whether a cash flow improve the prediction of business failure. The authors would have the objective to show the evidence and usefulness and efficacy of statistical models such as Altman Z-score discriminant analysis bankruptcy predictive models to assess client on going concern status. Failed and non-failed companies were selected for analysis to determine whether the cash flow improves the business failure prediction aiming to proof that the cash flow certainly makes better financial distress and bankruptcy prediction possible.

Key-Words: - bankruptcy prediction, financial distress, financial crisis, transition economy, auditing statement, balance sheet, profit and loss accounts, income statements

1 Introduction

A majority of auditors, as well as a number of corporate financial managers, have not been quick to embrace the use of cash flow ratios. Traditionally the auditors have tended to rely more on transaction cycle or a balance sheet approach [1]. Both of these approaches, unfortunately did not place emphasis on either cash flow statement, or even on cash, cash flow itself. Auditors do not only fail to utilize statements of cash flow in conjunction with income statement and balance sheet as a way of tracing top cash flow statement common items, they also use extensively the analysis of current ratio and the quick ratio. As such, it is important to accord cash flow statement the importance that it deserves. Analysis of the company financial status, based on the traditional ratios (the authors have found in searching the correct financial data), failed to identify severe liquidity problems that eventually might led to a bankruptcy of the company (impact of negative cash flows). The information contained on a cash flow statement stresses the existing differences between on one hand, the operating profits of a company and on the other hand, the decrease / increase in bank cash flow balance over a similar accounting period.

2 Use of Cash Flow as Predictor to Failing Business

Significance of a cash flow analysis towards a bankruptcy prediction of a firm has been augmented by a study carried out by Terry Ward and Benjamin Foster. These authors compared the trends in the various components of a cash flow statement-operating cash flow, investing cash flow and financing cash flow. This was more of a comparative study that consisted of healthy companies on one hand, and firms that had consequently filed for bankruptcy, on the other hand [2]. The observations by these authors was that healthy companies have a tendency towards comparatively stable association amongst the three components of a cash flow: operating, investing and financing activities. In addition, the authors noted that unhealthy companies were characterized by depreciating cash flows from operating, investing and financing cash flows about one or two years before they filed for bankruptcy. This study is vital as they portray the significance of assessing cash flows information while examining a company's financial condition.

The prediction criteria for business failure are often made use of for two basic reasons. First, the

success or failure of a business has to some extent, been fundamentally associated with the net outflow and inflow cash elements from a number of business activities [3]. For instance, the failure by a company to obtain the cash from a number of its operations could result in such firm having to borrow extra cash, or even be forced to do away with several of its capital investments as a solutions of meeting its obligations. Should such a situation go on for a longer time period, such a firm may be faced by a state of imminent bankruptcy.

Balance sheet data is static for it measures a single point in time, namely the balance sheet date.

The income statement, on the other hand, contains many non-cash transactions, whereas the cash-flow statement is dynamic. It records the changes in the other statements over a period and focuses on cash available for operations and investments [4]. The value of cash flow information that it can be used to assess the quality of earnings, financial flexibility and assists in forecasting cash flows. If cash flow ratios can be used as a liquid measure, that can predict financial failure and, ultimately, bankruptcy. Therefore, an early warning of possible distress can ultimately help to prevent subsequent financial failure.

Table 1: Selecting the cash flow ratios

List of indicators (ratios) and calculation results as a set of modified input
(accounting specifics in regard with the by laws Balance sheet items)

no	NAME OF indicators	Calculating ratio	2012.	2013.
1	calculating yields on capital	net profit / Capital	29.40%	24.59%
2	yields on property	net profit / Total assets	27.71%	21.19%
3	yields on capital	Capital long-term reservation / Total liability	94.27%	86.15%
4	Participation of borrowing capital in the total capital	Short + long term liabilities / Total liability	5.73%	13.85%
5	Participation lasting and long-term capital in the total capital	Capital + debt rezerv. + debt. / total liability	94.27%	87.50%
6	Current ratio	Current Assets / short-term liabilities	14.65	6.14
7	Net working capital	working capital assets (000 rsd) / Short-term liabilities	3,793,221	3,779,685
8	Turnover net working assets	business income / Net working capital	0.66	0.69
9	liquidity ratio first degree	cash / short-term liabilities	0.16	0.06
10	liquidity ratio second degree	working capital assets / short term liabilities	11.72	4.76
11	Market capitalisation A.D. (Thousand din)	market price ordinary shares on the day 31.07. x number of of shares	2,642,640	3,855,720
12	Earning Per Share	profit for the ordinary shareholders (net profit)	1,019.22	944.46

3 Description and Environment of Bankruptcy Problem

Corporate bankruptcy is an event which has a big impact on management, shareholders, employees, creditors, customers and other stakeholders. Signs of potential financial distress are evident long before bankruptcy occurs. Financial distress begins when a corporation is unable to meet its scheduled payments or when the projection of future cash flows points to an inability to do so in the near future. Therefore, accurate prediction of bankruptcy has become an important issue in the financial

world. A major focus of the Basel II/Basel III regulations to minimize credit risk is another reason why timely identification of corporate bankruptcy is desirable. There are various factors that are related to corporate bankruptcy. High interest rates and heavy debt burden are factors which definitely have negative influence on the financial situation of a firm. Industry-specific characteristics and government regulations can also contribute to financial distress within any firm.

4 Corporate Distress and Bankruptcy

The number of business failures and bankruptcies increased together with the increase in corporate distress. Four generic terms, describing credit risk events, that are generally found in literature for corporate distress are failure, insolvency, default and bankruptcy. Their individual economic meaning is described in the following paragraphs.

Failure means that the realized rate of return on invested capital, with allowances for risk consideration, is significantly and continually lower than prevailing rates on similar investments. Somewhat different criteria has also been utilized, including insufficient revenues to cover costs and cases of the average return on investment being below the firm's cost of capital. A firm could be an economic failure for many years without failing to cover its current obligations because of the absence of legally enforceable debt.

Insolvency is a term used in a more technical way. It indicates lack of liquidity, so it is more cash based, which happens when a company cannot meet its financial obligations. Technical insolvency most often is the cause of formal bankruptcy declaration. Bankruptcy comes along when the insolvency of a company becomes critical, when the total liabilities of a company exceed a fair value valuation, for example stock based, of its total assets. Default is another condition that is inescapably associated with distress. Defaults always occur between the debtor firm and a creditor class [5].

The firm's creditors and the owners of the firm are the two primary groups of interest when a firm is in corporate distress or filing for bankruptcy. These two groups both have an extremely large importance in the evaluation of the bankruptcy reorganization process. The goal of the reorganization process is to restructure the firm in a way that the firm's financial situation will stabilize and that no other financial problems will occur in the near future [6].

5 Bankruptcy Prediction

Bankruptcy prediction has long been an important and widely studied topic. It is particularly important especially for three groups of recipients [7]:

- managers, as the most important factor for decision-making, also bookkeepers responsible for preparing financial reports on the company's activity;
- banks, need to predict the possibility of default of a potential counterparty before they extend a loan and

- auditors, who according to the International Auditing Standards have to express their opinion about threats to the continuation of the company's activity.

The traditional approach for banks for credit risk assessment is to produce an internal rating, which takes into account various quantitative as well as subjective factors, such as leverage, earnings, reputation, etc., through a scoring system [2]. The problem with this approach is of course the subjective aspect of the prediction, which makes it difficult to make consistent estimates. Some banks, especially smaller ones, use the ratings issued by the standard credit rating agencies, such as Moody's and Standard & Poor's.

A review of bankruptcy prediction models

According to [3], a classification of the methods and techniques of prior research on bankruptcy prediction is as follows: Univariate ratio models, Multiple discriminant analysis, Linear probability models, Multivariate conditional probability models such as Logit and Probit, Recursive partitioning models, Survival analysis (proportional hazard model), Expert systems, Mathematical programming, Neural networks, Artificial Intelligence and Rough sets approach.

Altman model and approach-Z-score

Altman then started with 22 ratios that seemed to be intuitively plausible as bankruptcy predictors. The variables were classified into five standard ratio categories, including liquidity, profitability, leverage, solvency, and activity. The ratios were chosen on the basis of their popularity in the literature and their potential relevancy to the study, and there were a few "new" ratios in the analysis. After every run, he excluded the ratio that contributed least to the explanatory power of the model. Eventually, he came up with a model that contained only five ratios. The final discriminant function is as follows:

$$Z = 0.012 \times X_1 + 0.014 \times X_2 + 0.033 \times X_3 + 0.006 \times X_4 + 0.999 \times X_5 \quad (1)$$

where, X_1 is working capital/total assets, X_2 is retained earnings/total assets, X_3 is Earnings before interest and taxes (EBIT)/total assets, X_4 is market values of equity/book value of total debt, X_5 is sales/total assets and Z is overall index.

X1, Working Capital/Total Assets (WC/TA)

The working capital/total assets ratio, frequently found in studies of corporate problems, is a measure of the net liquid assets of the firm relative to the total capitalization. Working capital is defined as the difference between current assets and current liabilities.

X2, Retained Earnings/Total Assets (RE/TA)

Retained earnings is the account which reports the total amount of reinvested earnings and/or losses of a firm over its entire life. The account is also referred to as earned surplus. It should be noted that the retained earnings account is subject to “manipulation” via corporate quasi-reorganizations and stock dividend declarations.

X3, Earnings Before Interest and Taxes/Total Assets (EBIT/TA)

This ratio is a measure of the true productivity of the firm’s assets, independent of any tax or leverage factors. Since a firm’s ultimate existence is based on the earning power of its assets, this ratio appears to be particularly appropriate for studies dealing with corporate failure.

X4, Market Value of Equity/Book Value of Total Liabilities (MVE/TL)

Equity is measured by the combined market value of all shares of stock, preferred and common, while liabilities include both current and long term. The measure shows how much the firm’s assets can decline in value (measured by market value of equity plus debt) before the liabilities exceed the assets and the firm becomes insolvent.

X5, Sales/Total Assets (S/TA)

The capital-turnover ratio is a standard financial ratio illustrating the sales generating ability of the firm’s assets. It is one measure of management’s capacity in dealing with competitive conditions.

6 Description of the Statistical Sample

The power of a model to discriminate between solvent and insolvent companies lies in a factor of paramount importance: data. In the last fifteen years, data has become to define credit quality. Moody’s and S&P have started to generate historical and monthly updates of default rates by credit rating, so that instead of thinking about risk as high or low, it is now, say, 0.15% annualized default rate (BBB rated) versus a 1.5% annualized default rate (BB). In addition, the shift towards the collection of more default data has been driven by

the new Basel II and III capital accord which focuses credit on measurement. KMV, before being bought by Moody’s, argued that statistically their Merton model’s expected default frequency (EDF) was statistically more powerful than agency ratings, a quantitative assertion that invites competition and measurement that did not happen before.

Time horizon refers to the period over which the default probability is estimated. It is the period of time following the observation point A (say following 12 months) and ending at point B, where companies are classified into two classes (i.e., into 'bankrupt' and 'non-bankrupt').

Formulation of the Statistical Sample

The sample used for the development of the models includes 70 firms identified defaulters over five years (2007-2011). The assessment of financial variables for private companies is performed separately as the objective is to test their ability to predict credit risk and to detect the variables with the highest predictive power. For the appropriate assessment of this type of data, financial ratios are chosen instead of the main figures taken from financial statements because financial ratios determine directly the financial standing of the private companies.

For all the firm-years of the selected dataset, 10 financial ratios are calculated (the key financial ratios are in line with the liquidity and debt ratio) using the most recent financial statement. The ratios were chosen mainly based on their earlier use in previous studies and modes. Financial ratios are classified into the following groups [8]: Liquidity, Asset, Profitability, Debt, Market.

Drivers of a default risk and bankruptcy

1. Volatility: higher equity volatility implies higher probability of a firm’s asset value falling below its level of debt, which implies insolvency.
2. Size: for non-traded companies, size proxies for much of equity volatility. Bigger companies are generally more diversified in their exposure to geographies, products, and people, and this lowers their prospective volatility. Size is also related to “market position”.
3. Profitability: Higher profitability should raise a firm's equity value. It also implies a longer way for revenues to fall or costs to rise before losses occur. Combining profitability with interest expense makes it a combination of leverage and profitability.
4. Leverage/Gearing: In addition to profitability, leverage is a key measure of firm risk. The

higher the leverage, or gearing, the smaller the cushion for adverse shocks. Thus, higher leverage implies higher default probabilities.

5. Liquidity: Liquidity is a common variable in most credit decisions - a fact that is brought to mind that a bank will only lend you money when you don't need it. That is, if you have sufficient current assets, you can pay current liabilities, but neither do you need working capital. Liquidity is also an obvious contemporaneous measure of default, since if a firm is in default, its current ratio must be low. Thus, lower liquidity (current assets/current liabilities) implies higher default probabilities.
6. Growth: both high and low growth rates are associated with higher default probabilities.
7. Inventories: higher inventory levels imply higher default probabilities.

Multivariate Discriminant Analysis

MDA is a statistical technique used to classify an observation into one of several a priori groupings dependent upon the observation's individual characteristics [9]. It is used primarily to classify and/or make predictions in problems where the dependent variable appears in qualitative form, bankrupt or non-bankrupt. Therefore, the first step is to establish explicit group classifications. The number of original groups can be two or more. Some analysts refer to discriminant analysis as "multiple" only when the number of groups exceeds two. Others prefer to cite the multiple concepts with respect to the multivariate nature of the analysis. After the groups are established, data are collected for the objects in the groups [10]. MDA in its most simple form attempts to derive a linear combination of these characteristics which "best" discriminates between the groups. If a particular object, for instance, a corporation, has characteristics (financial ratios) which can be quantified for all of the companies in the analysis, the MDA determines a set of discriminant coefficients. When these coefficients are applied to the actual ratios, a basis for classification into one of the mutually exclusive groupings exists. The MDA technique has the advantage of considering an entire profile of characteristics common to the relevant firms, as well as the interaction of these properties. This analysis is concerned with two groups, consisting of bankrupt and non-bankrupt firms. Therefore, the analysis is transformed into its simplest form: the discriminant function [11]:

$$Z = V1X1 + V2X2 + \dots + VnXn \quad (2)$$

The function shown in Eq. (2) transforms the individual variable values to a single discriminant score, or z-value, which is then used to classify the object where $V1, V2, \dots, Vn$ are discriminant coefficients and $X1, X2, \dots, Xn$ are independent variables.

The MDA computes the discriminant coefficients V_i , while the independent variables X_i are the actual values [12].

Assumptions of Discriminant Analysis

Normal distribution: It is assumed that the data (for the variables) represent a sample from a multivariate normal distribution (Figure 1: Normal distribution function). It is noted that violations of the normality assumption are not "fatal" and the resultant significance test is still reliable as long as non-normality is caused by skewness and not outliers. Homogeneity of variances/covariances: MDA is very sensitive to heterogeneity of variance-covariance matrices. Before accepting final conclusions for an important study, it is a good idea to review the within-groups variances and correlation matrices. This assumption simplifies the calculation of the discriminant function but it is easily avoided with the use of quadratic analysis, if not satisfied [13].

Non-multicollinearity: If one of the independent variables is very highly correlated with another, or one is a function (e.g., the sum) of other variables, then the tolerance value for that variable will approach zero (0) and the matrix will not have a unique discriminant solution. Such a matrix is said to be ill-conditioned.

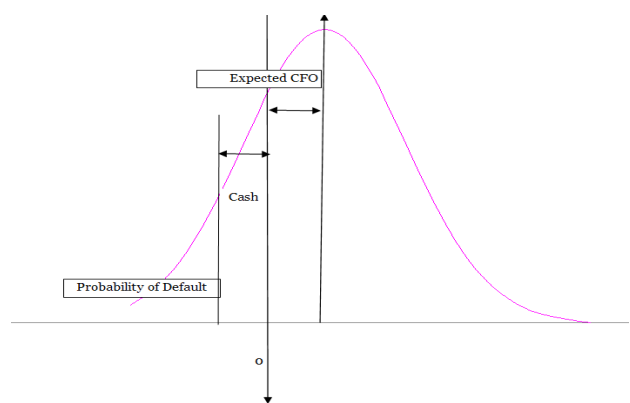


Figure 1: Normal distribution function, cash and expected CFO.

There must also be low multicollinearity of the independent variables. To the extent that independents are correlated, the standardized discriminant function coefficients will not reliably assess the relative importance of the predictor

variables. Development and the results of the MDA Model and ratio analysis The first step involves the creation of a “parent” sample that will then be partitioned into two separate “child” datasets, namely the training and validation (or hold-out sample) [14].

The parent sample consists of a one-to-one proportion of cases in each group (i.e., nondefault and default: bankrupt and non bankrupt in line with the type of errors of used classification:figure-1). All bankrupt companies (i.e., 35 in total) are included in the parent sample together with an equal number of randomly generated non-bankrupt firms (35). The random generation has been performed in order to avoid any selection bias that may affect the accuracy of estimates of the probability of correct classification.

7 Conclusion

An analysis of the bankruptcy prediction modeling was presented in the paper. Statistical model was used based on the MDA, financial ratio calculations and both results as merged and integrated for BP modeling and analysis. Given that the power of the models lies on the statistical sample itself, the sample created by the 70 private companies that was used for simulation, modeling and results presentment. The detail data presentation and statistical sampling and analysis of the results has been topic for the paper to be published soon. The key result was the ratio selection and test calculation based on the balance sheet and the income statement, for the firms being chosen and analyzed. The future work can be augmented and improved in order to create more robust models for default bankruptcy prediction.

References:

- [1] Atiya, A.F., Bankruptcy Prediction for Credit Risk Using Neural Networks: A Survey and New Results, *IEEE Transactions on Neural Networks*, Vol. 12, No.4, 2001, pp. 33-52.
- [2] Tam, K., Kiang, M., Managerial applications of the neural networks: The case of bank failure predictions, *Management Science*, Vol. 38, 1992, pp. 416-430.
- [3] Zhi, D., Cash Flow, Consumption Risk, and the Cross-Section of Stock Returns, *The Journal of Finance*, Vol. 64, No. 2, 2009, pp. 923-956.
- [4] McKee, T. E., Developing a Bankruptcy Prediction Model via Rough Sets Theory, *International Journal of Intelligent Systems in Accounting, Finance & Management*, Vol. 9, No. 3, 2000, pp. 159-173.
- [5] Givoly, D., Hayn, C., Lehavy, R., The Quality of Analysts' Cash Flow Forecasts, *The Accounting Review*, Vol. 84, No 6, 2009, pp. 1877-1911.
- [6] Hansen, M. E., Hansen, A. B., Crisis and Bankruptcy: The Mediating Role of State Law, 1920—1932, *The Journal of Economic History*, Vol. 72, No 2, 2013, pp. 448-468.
- [7] Zhu, N., Household Consumption and Personal Bankruptcy, *The Journal of Legal Studies*, Vol. 40, No 1, 2011, pp. 1-37.
- [8] Fiore, F., Uhlig, H., Bank Finance versus Bond Finance, *Journal of Money, Credit and Banking*, Vol. 43, No 7, 2011, pp. 1399-1421.
- [9] Greenwood, R., Scharfstein, D., The Growth of Finance, *The Journal of Economic Perspectives*, Vol. 27, No 2, 2013, pp. 3-28,
- [10] Brevoort, P. K., Credit Card Redlining Revisited, *The Review of Economics and Statistics*, Vol. 93, No 2, 2011, pp. 714-724.
- [11] Martin, A., Parigi B. M., Bank Capital Regulation and Structured Finance, *Journal of Money, Credit and Banking*, Vol. 45, No 1, 2014, pp. 87-119.
- [12] Benmelech, E., Bergman, N. K., Credit Traps, *The American Economic Review*, Vol. 102, No 6, 2012, pp. 3004-3032.
- [13] Carlson, M., Alternatives of Distressed Banks during the Great Depression, *Journal of Money, Credit and Banking*, Vol. 42, No 2/3, 2013, pp. 421-441.
- [14] Ognjan S. Arlov Računovodstvo, *Megatrend univerzitet*, ISBN 978-86-7747-379-2, 2010.