

DO BANKRUPTCY MODELS REALLY HAVE PREDICTIVE ABILITY? EVIDENCE USING CHINA PUBLICLY LISTED COMPANIES.

*Ying Wang, College of Business, Montana State University-Billings, Billings, MT 59101, 406-657-2273
ywang@msubillings.edu*

Michael Campbell, College of Business, Montana State University-Billings, Billings, MT 59101, 406-657-1651, mcampbell@msubillings.edu

ABSTRACT

This study provides ex ante evidence of failure prediction power of various z-score models using China publicly listed companies. The data cover a range of 11 years (1998-2008) and 1,336 companies. The result shows that Wang and Campbell's [19] revised model has the highest overall prediction accuracy while Altman's [3] z-score model has the lowest overall prediction accuracy. The result confirms the usefulness of z-score models in predicting company delisting.

INTRODUCTION

According to the official estimates, China's population has reached 1.32 billion at the end of 2007. Its economy grew by an average of 10% per year between 2000 and 2007[18]. China's gross domestic product stood at US\$3.4 trillion while Germany's GDP was USD \$3.3 trillion for 2007. This made China the world's third largest economy by gross domestic product behind Japan and the United States [10].

Despite the amazing growth of China, the Chinese economy is significantly affected by the 2008-9 global financial crisis due to the export orientated nature of the economy, which depends heavily upon international trade. China is experiencing the hit of business failure. The pearl tri-angle, famous for its shoe production, now is quiet and confused. Thousands of shoe companies there have closed. Huaqiang, the biggest plastic producer in China, has declared bankruptcy in 2008, leaving 7000 people jobless. In 2007, China experienced its first increase since 2002, in the annual number of Bankruptcy cases (3207 cases)[9].

China has launched an economic stimulus plan to specifically deal with the financial crisis. It has primarily focused on increasing affordable housing, easing credit restrictions for home mortgages and SMEs (Small and Medium-Sized Enterprises), lowering taxes, such as those on real estate sales and commodities, and pumping more public investment into infrastructure development, such as the rail network, roads and ports. From an academic point of view, what can we do to help people get through the crisis? In order to fulfill this obligation, this study tests the predictive ability of various bankruptcy prediction z-score models. This study tests whether z-score models have true ex ante predictive ability using 11 years of data from Chinese publicly listed companies from 1998-2008. The results should help investors make wise decisions about their investments and avoid unnecessary losses.

The remainder of this paper is structured as follows: Section II provides a brief review of relevant previous research. Section III describes methodology. Section IV provides results. The final section provides some concluding reflections.

PREVIOUS STUDIES

The prediction of company failure has been well researched using developed country data [6] [3] [20] [11] [13] [17] [7]. A variety of models have been developed in the academic literature using techniques such as multiple discriminant analysis (MDA), logit, probit, recursive partitioning, hazard models, and neural networks. Summaries of the literature are provided in Zavgren [21], Jones [12], O'leary [14], Boritz, Kennedy and Sun [7] and Agarwal and Taffler [2]. Despite the variety of models available, both the business community and researchers often rely on the models developed by Altman [3] and Ohlson [13] [7]. A survey of the literature shows that the majority of international failure prediction studies employ MDA (Altman 1984; Charitou et al. 2004).

Beaver [6] presented empirical evidence that certain financial ratios, most notably cash flow/total debt, gave statistically significant signals well before actual business failure. Altman [3] extended Beaver's [6] analysis by developing a discriminant function which combines ratios in a multivariate analysis. Altman found that his five ratios outperformed Beaver's [6] cash flow to total debt ratio and created the final discriminant function:

$$Z=1.2X_1+1.4X_2+3.3X_3+0.6X_4+0.999X_5$$

Where

X₁=working capital/total assets

X₂=retained earnings/total assets

X₃=earnings before interest and taxes/total assets

X₄=market value of equity/book value of total liabilities

X₅=sales/total assets

Firms with Z-scores less than 2.675 are predicted to be bankrupt and firms with Z-scores greater than 2.675 are predicted to be nonbankrupt.

Boritz et al. [7] re-estimated the model using Canadian company data and obtained the following:

$$Z=2.149X_1-0.624X_2+1.354X_3-0.018X_4+0.463X_5$$

The cutoff point is 0.27.

Taffler [17] developed a UK-based Z-score model as follows:

$$Z=3.20+12.18x_1+2.50X_2-10.68X_3+0.029X_4$$

Where

X₁=profit before tax/current liabilities

X₂=current assets/total liabilities

X₃=current liabilities/total assets

X₄=(quick assets-current liabilities)/daily operating expenses with the denominator proxied by (sales-PBT-depreciation)/365

Sandin and Porporato [15] use data from a developing country, Argentina, and retain 2 out of 13 ratios after stepwise selection and come up with the final model:

$$A_s=15.06R_5+16.11S_3-4.14$$

Where R₅=operative income/net sales

S₃=shareholder's equity/total assets

Wang and Campbell [19] used data from Chinese publicly listed companies for the period 2000-September 2008 to test the accuracy of Altman's Z-score model in predicting failure of Chinese companies. Prediction accuracy was tested for three Z-score variations: Altman's original model, a re-estimated model for which the coefficients in Altman's model were re-calculated and a revised model which used different variables. All three models were found to have significant predictive ability. The re-estimated model had higher prediction accuracy for predicting non-failed firms, but Altman's model had higher prediction accuracy for predicting failed firms. The revised Z-score model had higher prediction accuracy compared with both the re-estimated model and Altman's original model. The study indicated that the Z-score model is a helpful tool in predicting failure of a publicly listed firm in China.

IMETHODOLOGY

The first task for this research is to define failure. As we mentioned before, Agarwal and Taffler [2] did ex ante prediction tests for the UK-based z-score model Taffler developed in 1982 [16]. Agarwal and Taffler [2] defines failure as "administration, receivership, or creditors' voluntary liquidation." This paper defines failure from the investor's point of view. We treat a firm as failed if it was delisted during the research period.[1]

Since the primary function of z-score models is to predict future business failure, ex ante predictive ability testing is the best way to measure the effectiveness of the models. We collected data from www.sina.com.cn for all the publicly listed firms from 1998-2008. Although Agarwal and Taffler [2] excluded the financial industry, this study uses the full population of listed companies without excluding any industry. A total of 11,188 firm year data were collected, including 11,122 non-delisted firm years, 27 one year prior to delisting firm years, and 39 two years prior to delisting firm years. The total number of companies involved was 1,336.

This study compares Altman's [3] z-score model, Wang and Campbell's [19] re-estimated z-score model, Wang and Campbell's [19] revised z-score model, and the simple accounting based PBT (profitability before taxation) model.[4]

CONCLUSION

This paper performed ex ante examination of various z-score models on China publicly listed companies and compared the prediction accuracy of the models with the simple accounting based model, profitability before taxation (PBT). The results are encouraging in that all the z-score models we examined and the PBT model have significant ability to predict firm delisting. However, Altman's [3] z-score model tends to have a very high Type II error rate and performs poorly on predicting non-delisted firms. Wang and Campbell's [19] revised model has the highest overall prediction accuracy of 90%, followed by the PBT model of 87%, then Wang and Campbell's [19] re-estimated model of 85%, and finally Altman's [3] z-score model of 51%. Altman's [3] z-score model has much lower overall prediction accuracy compared with other models mostly because of the much higher Type II error.

Although the above results confirmed the usefulness of z-score models in predicting company delisting, they also show that the PBT model might be a convenient and powerful substitute for the more complicated z-score models in predicting company delisting in China stock market. The result might be due to the immaturity of the China stock market. Also, it might be due to the delisting rules of China stock market. As we mentioned before, this paper considers two situations in which Chinese companies are delisted: failure to disclose financial information or financial fraud; and being unprofitable for three consecutive years. Since being unprofitable for three consecutive years will lead to delisting, PBT being a powerful tool for predicting delisting is very logical. We can compare our conclusion with Agarwal

and Taffler [2] which shows that the PBT model has higher overall prediction accuracy compared with the Taffler [16] z-score model based on UK companies data. Future follow up studies comparing z-score models with the PBT model using data from countries other than China and UK will provide further insights.

REFERENCES:

- [1] According to the “Public Listing Regulation” published in 2000 by China Securities Regulatory Committee, four situations will lead to the delisting of a publicly listed company. The first situation is privatization or other changes of shareholders composition. The second situation is failing to disclose financial information or financial fraud. The third situation is illegal activities by the listing firm. The fourth one is being unprofitable for three consecutive years. This study selected only those firms that were delisted either for situation two or four. For firms delisted because of situation one, the company is not considered failed, only that the shareholders have decided to privatize the company or the company is merged into another company. For situation three, this study believes that firms delisted because of illegal activities are different from firms delisted because of financial problems. Firms delisted because of illegal activities might still be financially sound and thus cannot be predicted with financial ratios.
- [2] Agarwal, Vineet and Richard J. Taffler. 2007. Twenty-five Years of the Taffler Z-score Model: Does It Really Have Predictive Ability? *Accounting and Business Research* 37(4): 285-300.
- [3] Altman, Edward I. 1968. Financial Ratios, Discriminant Analysis and the Prediction of Corporation Bankruptcy. *The Journal of Finance* 23: 589-609.
- [4] Altman’s (1968) z-score model: $Z=1.2X_1+1.4X_2+3.3X_3+0.6X_4+0.999X_5$. Firms with $z<2.675$ are predicted to be bankrupt and firms with $z>2.675$ are predicted to be non-bankrupt.
- Wang and Campbell’s (2010) re-estimated z-score model: $Z=0.8059X_1-0.2898X_2+0.0440X_3+0.1971X_4+6.3327X_5$. Firms with Z-scores less than 2.2373 are predicted to be delisted and firms with Z-scores greater than 2.2373 are predicted to be non-delisted.
- Wang and Campbell’s (2010) revised z-score model: $Z=0.2086X_4+4.3465X_5+4.9601X_6$. Firms with a Z-score smaller than 1.5408 are predicted to be delisted, while firms with a Z-score larger than 1.5408 are predicted to be non-delisted.
- PBT model: a simple accounting-based model that classifies firms with negative PBT as potential failures and those with positive PBT as non-failures.
- X_1 =working capital/total assets
 X_2 =retained earnings/total assets
 X_3 =earnings before interest and taxes/total assets
 X_4 =market value of equity/book value of total liabilities
 X_5 =sales/total assets
 X_6 =(Total assets one year prior to delisting - Total assets two years prior to delisting)/Total assets two years prior to delisting.
- [5] Altman, Edward I. 1984. The Success of Business Failure Prediction Models: An International Survey. *Journal of Banking & Finance* 8: 171-98.
- [6] Beaver, William H. 1966. Financial Ratios as Predictors of Failure. *Journal of Accounting Research* 4: 71-111 .
- [7] Boritz, J. Efrim, Duane B. Kennedy, and Jerry Y. Sun. 2007. Predicting Business Failure in Canada. *Accounting Perspectives* 6(2): 141-65.
- [8] Charitou, Andreas, Evi Neophytou, and Chris Charalambous. 2004. Predicting corporate failure: Empirical Evidence for the UK. *European Accounting Review* 13(3): 465-97.
- [9] China Experiencing Bankruptcy Surge? news.QQ.com, 3/27/2008.

- [10] China passes Germany in economic rankings.
<http://edition.cnn.com/2009/WORLD/asiapcf/01/15/china.economy/index.html?iref=topnews> CNN.
January 15, 2009.
- [11] Deakin, Edward B. 1972. A Discriminant analysis of Predictors of Business Failure. *Journal of Accounting Research* 10: 167-79.
- [12] Jones, F. 1987. Current Techniques in Bankruptcy Prediction. *Journal of Accounting Literature* 6: 131-64.
- [13] Ohlson, J.A. 1980. Financial Ratios and the Probabilistic Prediction of Bankruptcy. *Journal of Accounting Research*. 18(1):109-31.
- [14] O'Leary, D. 1998. Using Neural Networks to Predict Corporate Failure. *International Journal of Intelligent Systems in Accounting, Finance and Management* 7(3): 187-97.
- [15] Sandin, Ariel and Marcela Porporato. 2007. Corporate Bankruptcy Prediction Models Applied to emerging Economies: Evidence from Argentina in the Years 1991-1998. *International Journal of Commerce and Management* 17(4):295-311.
- [16] Taffler, Richard J. 1982. Forecasting company failure in the UK using discriminant analysis and financial ratio data. *Journal of the Royal Statistical Society* 145(3): 342-358.
- [17] Taffler, Richard J. 1983. The Assessment of Company Solvency and Performance Using a Statistical Model. *Accounting and Business Research* 15(52): 295-308.
- [18] The Economist Intelligence Unit Limited 2009.
- [19] Wang, Ying and Michael Campbell. 2010. Business Failure Prediction for Publicly Listed Companies in China. *Journal of Business and Management* 16(1).
- [20] Wilcox, Jarrod W. 1973. A Prediction of Business Failure Using Accounting Data. *Journal of Accounting Research* 11: 163-79.
- [21] Zavgren, C. 1983. The Prediction of Corporate Failure: The State of the Art. *Journal of Accounting Literature* 2: 1-38.