

DETECTING FINANCIAL DISTRESS: DISCRIMINANT VERSUS LOGISTIC REGRESSION ANALYSIS

A thesis submitted to the Graduate School in partial fulfillment for the requirements for
the degree
Master of Science (Finance)
Universiti Utara Malaysia

by
Abd Halim @ Hamilton bin Ahmad



Sekolah Siswazah
(Graduate School)
Universiti Utara Malaysia

PERAKUAN KERJA KERTAS PROJEK
(Certification of *Project Paper*)

Saya, yang bertandatangan, memperakukan bahawa
(I, the undersigned, certify that)

ABD. HALIM @ HAMILTON AHMAD

calon untuk Ijazah MSc (Finance)
(candidate for the degree of)

telah mengemukakan kertas projek yang bertajuk
(has presented his/her project paper of the following title)

DETECTING FINANCIAL DISTRESS : DISCRIMINANT VERSUS LOGISTIC

REGRESSION ANALYSIS

seperti yang tercatat di muka surat tajuk dan kulit kertas projek
(as it appears on the **title page** and **front cover** of project paper)

bahawa kertas projek tersebut boleh diterima dari segi bentuk serta kandungan dan meliputi bidang ilmu dengan memuaskan.
(that the **project paper** acceptable in form and content and that a **satisfactory** knowledge of the field is covered by the project paper).

Nama Penyelia : Prof. Madya Dr. Nur Adiana Hiau Abdullah
(Name of Supervisor)

Tandatangan :
(Signature)

Tarikh :
(Date)

8 Jun 2003

PERMISSION TO USE

In presenting this thesis in partial fulfillment for the requirements of post graduate degree from Universiti Utara Malaysia. I agree that the University Library may make it freely available for inspection. I further agree that permission for copying of this thesis in any manner, in whole or in part, for scholarly purposes may be granted by my supervisor or, in their absence, by the Dean of the Graduate School. It is understood that any copying or publication or use of this thesis or parts thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to Universiti Utara Malaysia for any scholarly use which may be made of any material from my thesis.

Requests for permission to copy or to make other use of materials in this thesis, in whole or in part, should be addressed to:

Dean of Graduate School
Universiti Utara Malaysia
060 10 Sintok
Kedah Darul Aman

ABSTRACT (BAHASA MALAYSIA)

Kajian ini menguji dua ujian statistik iaitu analisis diskriminan dan model *logit* untuk mengenalpasti kebarangkalian sesebuah syarikat berada di dalam ketidakstabilan kewangan. Kajian ini juga menggunakan nisbah kewangan sebagai petunjuk kepada ketidakstabilan kewangan. Keputusan daripada kajian ini menunjukkan model *logit* memberikan ketepatan yang lebih tinggi berbanding analisis diskriminan. Model *logit* memberikan ketepatan klasifikasi sebanyak 0.15 peratus dalam keseluruhan sampel dan 90 peratus dalam sampel kawalan. Manakala untuk analisis diskriminan, ketepatan klasifikasi adalah 84.5 peratus untuk keseluruhan sampel dan 80 peratus untuk sampel kawalan. Untuk analisis diskriminan terdapat tiga petunjuk di dalam model yang memisahkan di antara syarikat yang stabil dan syarikat yang tidak stabil dalam kewangan iaitu nisbah semasa, pendapatan bersih kepada jumlah aset dan jualan kepada aset semasa. Model *logit* juga menunjukkan tiga faktor atau petunjuk dalam model terakhirnya iaitu ekuiti pemegang saham kepada jumlah liabiliti, aliran tunai daripada aktiviti pembiayaan kepada jumlah liabiliti dan pendapatan bersih kepada jumlah aset. Dapatan daripada kajian ini diharap dapat memberikan pemahaman tentang faktor atau penentu kepada ketidakstabilan kewangan dan seterusnya syarikat dapat mengambil langkah tertentu untuk mengelakkan kegagalan.

ABSTRACT (ENGLISH)

This study examines two statistical tests, which are discriminant analysis and the logit model to predict the probability of financially distress companies. In addition, this study also utilizes the usage of financial ratios as a predictor of a company in a state of financially distressed. The findings show that the logit model shows better prediction accuracy than the discriminant analysis. The logit model correctly classified 91.5 percent of the companies in the estimation sample and 90 percent for the holdout sample. However, for discriminant model, the overall accuracy rate for the estimation and the holdout samples are 84.5 percent and 80 percent respectively. For discriminant analysis, there are three factors found to have significant discriminating power: current ratio, net income to total assets, and sales to current assets. Similarly, logit model also identified three factors but two of the factors (shareholders' equity to total liabilities and cash flow from financing to total liabilities) are different from those found in discriminant analysis. The only factor which is identified in both models is net income to total assets. The findings give clear understanding of the relevant factors that can cause financial distress. Hence, companies could take immediate actions to avoid failure to the company.

ACKNOWLEDGEMENTS

Bismillahirrahmanirrohim

Thanks to Allah s.w.t for providing me the guidance and blessing to succeed in completing this research. It was prepared to fulfill the requirement of Master of Science in Finance.

While it is not possible to mention all who contributed to this effort, I wish to express my gratitude for the ample assistance received from many individuals. Foremost among these is Prof Madya Dr. Nur Adiana Hiau Abdullah, my advisor, lecturer, mentor, and friend. In the original conception of the study, in the development of the proposal, and through several working drafts, she has provided continual guidance, counsel, wisdom, and encouragement. Her selfless commitment of substantial time and effort to this research is sincerely appreciated.

Also thanks to any members that provided insight and constructive commentary, offered careful critique, review and suggestion. Their cooperation and support have been of substantial value.

Most important of all has been the prayer, assistance, understanding, tolerance, and support given by my family. Their effort during these years of study has been as great as my own.

Thank you.

TABLE OF CONTENTS

	PAGE
PERMISSION TO USE	i
ABSTRACT (BAHASA MALAYSIA)	ii
ABSTRACT (ENGLISH)	iii
ACKNOWLEDGEMENTS	iv
LIST OF TABLES	viii
LIST OF FIGURES	viii
LIST OF APPENDICES	viii

CHAPTER 1: INTRODUCTION

1.1 Introduction	1
1.2 Asian financial crisis	1
1.3 Defining corporate distress	4
1.4 Problem statement	7
1.5 Objectives of the study	7
1.6 Significance of the study	8
1.7 Scope of the study	9
1.8 Outline of the thesis	10
1.9 Summary	11

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction	12
2.2 Theory of capital structure	12
2.3 Bankruptcy and reorganization theory	14
2.4 Traditional ratio analysis	15
2.5 Corporate failure models	17
2.5.1 Multiple discriminant analysis	18

2.5.2 Logistic regression model	23
2.6 Comparison between discriminant analysis and logistic regression analysis	26
2.7 Summary	28

CHAPTER 3: METHODOLOGY

3.1 Introduction	30
3.2 Sample	30
3.3 Model specification	35
3.3.1 Multiple discriminant analysis	35
3.3.1.1 Model evaluation	37
3.3.2 Logistic regression model	37
3.3.2.1 Model evaluation	39
3.4 Variables for multiple discriminant analysis and logistic regression analysis	40
3.4.1 Dependent variables	41
3.4.2 Independent variables	42
3.5 Summary of methodology	42

CHAPTER 4: DATA ANALYSIS

4.1 Introduction	44
4.2 Profile analysis	44
4.2.1 Descriptive statistics	45
4.2.2 Mean difference	48
4.3 Correlation	50
4.4 Findings	53
4.4.1 Discriminant analysis	53

4.4.2 Logistic regression analysis	56
4.5 Comparison between multiple discriminant analysis and logistic regression analysis	59
4.6 Summary	60

CHAPTER 5: CONCLUSION

5.1 Introduction	61
5.2 Restatement of objectives	61
5.3 Conclusion	62
5.4 Recommendation for future research	63

LIST OF REFERENCES	65
---------------------------	-----------

APPENDICES

LIST OF TABLES

Table 1: Companies with negative shareholders' fund	31
Table 2: List of transformed variables used in the analysis	42
Table 3: Descriptive statistics of distressed and non-distressed companies	46
Table 4: Means difference between distressed and non-distressed companies	49
Table 5: Correlations	52
Table 6: Tolerance statistics	53
Table 7: Discriminant analysis	55
Table 8: Stepwise logistic regression: analysis of maximum likelihood estimates	58

LIST OF FIGURES

Figure 1: Financially distressed companies	33
Figure 2: Financially distressed companies according to industry	34

LIST OF APPENDICES

Appendix 1: Companies with negative shareholders' fund release by Surf88.com
Appendix 2: Total assets of distressed and non-distressed companies
Appendix 3: Result of discriminant analysis
Appendix 4: Result of logistic regression analysis
Appendix 5: Result of t-test

CHAPTER 1

INTRODUCTION

1.1 Introduction

This paper investigates the accuracy of using the logistic regression model in order to detect financially distress firms in Malaysia. In 2001, Kuala Lumpur Stock Exchange announced Practice Note 4/2001 (PN4) and companies, which were identified, as PN4 companies are required to restructure its financial condition between six to twelve months period. This chapter explains in detail the Asian Financial Crisis in 1997, which led to the collapsed of many listed companies in Malaysia. It becomes the basis of the financial distress study in this dissertation. The problem statement, objectives and the significance of the study are also stated in this chapter.

1.2 Asian financial crisis

Asian Financial Crisis in 1997, which led to the sharp depreciation in currency and stock market upheaval had adversely affected large corporation in Malaysia. The main factor of distress for many companies is largely related to its financing (Ariff, 1998). Before the financial crisis occurred, many of the large companies expanded their business through the used of debt, which was obtained from the banking sector. According to Ariff (1998), most corporate structures of

The contents of
the thesis is for
internal user
only

LIST OF REFERENCES

- Altman E. I. (1993) Corporate Financial Distress and Bankruptcy 2nd Edition John Wiley New York.
- Altman, E. I. (1968) Financial ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. *Journal of Finance* 23: 589-609.
- Altman, Haldeman, R. G. and Narayanan, P. (1977) Zeta Analysis: A new Model to Identify Bankruptcy Risk of Corporations. *Journal of Banking and Finance* 1: 9-24.
- Ariff M., Shamsheer M. and Annuar M.N. (1998) Stock Pricing in Malaysia: Corporate Financial & Investment Management Universiti Putra Malaysia, Malaysia.
- Ariff, M. (1998) Financial Fragility and the 1997 Asian Financial Crisis. Working Paper of Monash Asia Institute.
- Barnes, P. (1987) The Analysis and Use of Financial Ratios: A Review Article. *Journal of Business Finance and Accounting* 14(4): 449-461.
- Barniv, Ran and Raveh, Adi (1989) Identifying Financial Distress: A New Nonparametric Approach. *Journal of Business Finance and Accounting* (Summer 1989): 361-383.
- Beaver, William H. (1966) Financial Ratios as Predictors of Failure. *Empirical Research in Accounting, Supplement to Journal of Accounting Research* 4(3): 71-111.
- Chatterjee, Sris and Dhillon, Upinder S. (1996) Debt Restructuring via Chapter 11, prepackaged, bankruptcies, and workouts. *Financial Management* 25(1): 5-19.
- Chen, K. and Shimerda, T. (1981) An Empirical Analysis of Useful Financial Ratios. *Financial Management* 10: 167-179.
- Coates, P. K. and Fant, L. F. (1992) A neural network approach to forecasting financial distress. *Journal of Business Forecasting* (Winter): 9-12.
- Cybinski, Patti (2001) Description, Explanation, Prediction – the Evolution of Bankruptcy Studies? *Managerial Finance* 27(4):29-44.
- Dambolena, Ismael G. and Khoury, Sarkis J. (1980) Ratio Stability and Corporate Failure. *Journal of Finance* 35(4): 1017-1026.
- Deakin, E. B. (1972) A Discriminant Analysis of Predictors of Failure. *Journal of Accounting Research* 10: 167-179.

- Edmister, R. O. (1972) An Empirical Test of Financial Ratio Analysis for Small Business Failure Prediction. *Journal of Financial and Quantitative Analysis* 7: 1477-1493.
- El Hennawy, R.H.A. and R. Morris (1983) The Significance of Base Year in Developing Failure Prediction Model. *Journal of Business Finance and Accounting* 10: 209-223.
- Frydman, H., Altman, E. I. and Kao, D. L. (1985) Introducing Recursive Partitioning for Financial Classification: The case of financial distress. *Journal of Finance* 40:269-291.
- Ganesalingam, S. and Kumar, K. (2001) Detection of Financial Distress via Multivariate Statistical Analysis. *Managerial Finance* 27(4): 45-55.
- Gilbert, L.R., Menon, K. and Schwartz, K.B. (1990) Predicting Bankruptcy for Firms in Financial Distress. *Journal of Business Finance and Accounting* 17: 161-171.
- Gordon, M. J. (1971) Towards A Theory of Financial Distress. *Journal of Finance* 26: 347-356.
- Gujerati, Damodar N. (1995) *Basic Econometrics*. McGraw-Hill International Editions, 3rd Edition. Singapore.
- Hair, Joseph F., Anderson, Rolph E. and Tatham, Ronald L. (1987) *Multivariate Data Analysis*. Macmillan Publishing Company, 2nd Edition. New York.
- Hall, S. C. (2002) Predicting Financial Distress. *Journal of Financial Service Professionals*: 12-15.
- Heine, Max L. 2000. 'Predicting Financial Distress of Companies: Revisiting the Z-Score and Zeta Model', Stern School of Business, New York University.
- Houghton, K. A. and Woodliff, D. R. (1987) Financial Ratios: The Prediction of Corporate 'Success' and Failure. *Journal of Business Finance and Accounting* 14(4): 537-554.
- Joo, Ha Nam and Jin Taehong (2000) Bankruptcy Prediction: Evidence from Korea Listed Companies during the IMF Crisis. *Journal of International Financial Management and Accounting* 11(3): 178-197.
- Latinen, E.K. (1994) Traditional Versus Operating Cash Flow in Failure Prediction. *Journal of Business Failure and Accounting* 21(2): 195-217.
- Libby, R. (1975) Accounting ratios and the Prediction of Failure: Some Behavioral Evidence. *Journal of Accounting Research* (Spring): 150-161.
- Lincoln, M. (1984) An Empirical Study of the Usefulness of Accounting Ratios to Describe Levels of Insolvency Risk. *Journal of Banking and Finance* 8: 321-340.

- Lo, A. (1986) Logit versus Discriminant Analysis: A Specification Test and Application to Corporate Bankruptcies. *Journal of Econometric* 31:151-178.
- Lu, Wei Ping (2000) An Empirical Study of Asian Financial Crisis by Debt Service Capacity Comparison. *Managerial Finance* 26(4): 16-27.
- Mackenzie, A. (1978) Quantitative Methods for Predicting Company Bankruptcy. Unpublished Phd Dissertation.
- Mahani Z. A. (1999) Malaysia's Economy: Crisis and Recovery. Institute of Southeast Asian Studies.
- McFadden, D. (1976) A Comment on Discriminant Analysis 'versus' logit analysis. *Annals of Economic and Social Measurement* 5: 511-523.
- Menard, S. (1995) Applied Logistic Regression Analysis. Sage University Paper series on Quantitative Applications in the Social Sciences, 07-106. Thousand Oaks, CA: Sage.
- Miller, R.E. and F. Modigliani (1961) Dividend Policy, Growth and Valuation of Shares. *Journal of Business* 34(2): 411-433.
- Modigliani, F. and Miller, M. H. (1958) The Cost of Capital, Corporation Finance and the Theory of Investment. *The American Economic review* 48: 261-297.
- Mohamed S., Ang Jili and Ahmadu U.S. (2001) Predicting Corporate failure in Malaysia: An Application of the logit model to Financial Ratio Analysis. *Asian Academy of Management Journal* 6(1): 99-118.
- Nash, M., Anstis, M., and Bradbury, M. (1989) Testing Corporate Model Prediction Accuracy. *Australian Journal of Management* 14(2): 211-221.
- Ohlson, James A. (1980) Financial Ratios and the Probabilistic Prediction of Bankruptcy. *Journal of Accounting Research* 18: 109-131.
- Platt, H. D. and Platt M. B. (1990) Development of A Class of Stable Predictive Variables: The Case of Bankruptcy Prediction. *Journal of Business Finance and Accounting* 17: 31-51.
- Scott, J. (1981) The Probability of Bankruptcy: A Comparison of Empirical Predictions and Theoretical Models. *Journal of Banking and Finance* 5: 317-344.
- Shamsher M., Zulkarnain M. S. and Mohamad Ali A. H. (2001) Why Companies Fail? An Analysis of Corporate Failures. *Akauntan Nasional*: 5-8.
- Shirata, Cindy Yoshiko (1998) Financial ratios as Predictors of Bankruptcy in Japan: An Empirical Research, Tsukuba College of Technology Japan: 1-17.

Soo Wah Low, Fauzias M.N. and Puan Yatim (2001) Predicting Corporate Financial Distress using the Logit Model: The case of Malaysia. *Asian Academy of Management Journal* 6(1): 49-61.

Taffler, R. J. (1984) Empirical Models for the Monitoring of UK Corporations. *Journal of Banking and Finance* 8: 199-227.

Takahashi, K. and Kurokawa, J. (1984) Corporate Bankruptcy Prediction in Japan. *Journal of Banking and Finance* 8: 229-247.

Tan, Clarence N. W. and Dihadjo, Herlina (2001) A Study on Using Artificial Neural Networks to Develop an Early Warning Predictor for Credit Union Financial Distress with Comparison to the Probit Model. *Managerial Finance* 4: 56-77.

Titman, S. (2002) The Modigliani and Miller Theorem and the Integration of Financial Markets. *Financial Management*: 101-115.

Ward, T.J. and Foster, B.P. (1997) A Note on Selecting a Response Measure for Financial Distress. *Journal of Business Finance and Accounting* (24): 869-879.

Whittington, G (1980) Some Basic Properties of Accounting Ratios. *Journal of Business Finance and Accounting Research* (Summer 1980): 219-223.

Wruck, K. H. (1990) Financial Distress, Reorganization, and Organizational Efficiency. *Journal of Financial Economics* 27: 419-444.

Zulkarnain M.S., Mohamad Ali A.H., Annur M.N. and Zainal Abidin M. (2001) Forecasting Corporate Failure in Malaysian Industrial Sector Firms. *Asian Academy of Management Journal* 6(1): 15-30.

Zulkarnain M.S., Shamsheer M., Mohamad Ali A.A. H. and Annur M. N. (2002) Determinants of Corporate Success and Failure: The Malaysian Case. *Akauntan Nasional*: 23.