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**Financial Ratios as Bankruptcy Indicators:
The case of Financially Distressed Firms in Sweden**

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Graduate School

Master of Science in Accounting
Master Degree Project No. 2009:34
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ACKNOWLEDGEMENTS

We would first of all like to express profound gratitude to our supervisor, Professor Thomas Polesie, for his guidance and enormous contributions that make this piece of work a reality.

We are grateful to Andreas Hagberg for his valuable advice that gave substance to this report. We also wish to acknowledge his assistance in providing us with the financial reports of companies.

We are pleased to express gratitude to the teaching and support staff of the Graduate School for the tolerance, receptiveness and hospitality exercised, creating a favourable atmosphere for acquiring and sharing knowledge.

Last but not least, we are thankful to the entire M.Sc. Accounting students for their constructive criticism during course work and paper presentations which actually helped in shaping this scientific paper.

ABSTRACT

Financial distress and corporate bankruptcy has been a common occurrence back into the century and of late has witnessed a multiplier effect in the global market; firms are running short of cash flows to meet up not only with their debt financing, but also with the cost of daily operations. This study examine some financial ratios using financial reports of groups of Swedish bankrupt and active companies for the period 1996 to 2003 with the aim to determine most significant and reliable ratios for predicting bankruptcy. Cross sectional analysis has been used to compare similar financial ratios for the two groups of companies with the aim to explain the association between the explanatory variables and business failure. Statistical models were also used to test the predictive power of the financial ratios. The empirical results indicate that the ratios of credit sales-total sales and total sales-total assets are not related to financial distress. Four most significant single bankruptcy indicators ratios includes; net profit-total assets, operating profit-turnover, quick ratio and long term debt-total equity.

Keywords: Financial Ratios, Bankruptcy Indicators, Financial Distress, Swedish Firms.

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CHAPTER ONE

1. INTRODUCTION

This chapter provides a background about the keywords of this research paper; financial ratios, financial distress and bankruptcy. It also presents the statement problem, the purpose of the study, the hypotheses, significance and the delimitation of study. The introductory chapter finally presents a brief outline on how the entire report is organized.

1.1 Background

Financial ratios are the most commonly used in understanding and interpreting corporate financial statements and in evaluating company's performance over time. These ratios identify irregularities, abnormalities and surprises that require further investigation to ascertain the current and future financial standing of a company (Barry and Jamie, 2002:638). In order to add meaning to the ratios, a benchmark is required when traditional ratio analysis technique is used in analyzing financial statements. Trend analysis and cross sectional analysis are the most commonly used ratio analysis techniques. In trend analysis, the company's performance is compared over time therefore the benchmark could be its previous years' financial ratios, budgeted financial ratios for the same period or the financial ratios for other profit centres or costs centres (Barry and Jamie, 2002:638). With cross sectional analysis, the benchmark is the financial ratios of another company either in the same industry or in a different industry

However, comparing companies based on their financial ratios may be hindered due to a number of factors¹ (Soffer, 2003; Anne & Ann, 2007). For example, cross sectional analysis will be hampered if the financial statements of companies are prepared using different accounting practices and policies. In spite of its limitations, financial ratios give a broad idea about a company's and provide valuable information about its leverage, operating and financial risk, investment potential amongst others. Nonetheless, the choice of financial ratios used in analyzing a company is of utmost importance since each ratio has a unique

¹ Ratios can only give shallow view of a company's performance; a generalized interpretation could be misleading. Historic information used in its computation may not be the best indication of current financial situation, investment potential or future performance. Short term fluctuations may affects comparability over time. It computation is based on summarized year end information of financial statements which may present better or worse ratios than it has been throughout the year. Intercompany comparison even within the same industry may be misleading due to difference in their financial and risk profile, different size and capital structure. Difference in approach by analysts on how to treat and interpret certain ratios may hinder comparison.

information and interpretation which differ substantially from others. It is important for us to know the constituent part of the ratio; what constitute the numerator and the denominator. For example, different approaches have been used by analysts in dealing with return on capital which is expressed as income on capital. Income can be taken for operating income, income before tax, or net income; some authors include minority interest on total capital (Soffer, 2003).

These different approaches give different results and therefore ratios should be interpreted with care. In other words, “ratios are as good as the individual using it”; our greatest concern is in distinguishing those financial ratios which provide significant information for decision making. The usefulness of the ratios to stakeholders will thus depend on their interest in the company or on the affairs they wish to investigate. Corporate stakeholders, be a creditor, an investor, an employee, the state, management or equity holders has a unique interest and they need to rely on best financial ratios in order to make decisions with a certain degree of confidence. For example; in analyzing the credit worthiness of a company, predicting the likelihood of corporate default or bankruptcy probability.

Bankruptcy has been a common occurrence back into the century and of late has witnessed a multiplier effect with the current credit crunch hitting the entire globe. Many firms are running short of cash flows to meet up, not only with their debt financing, but also with the cost of daily operations. This has therefore forced many to file in for liquidation as the way out. The effects of financial distress are not limited to the large and publicly traded firms. All business entities are subject to bankruptcy regardless of its capital structure and location. It is worth mentioning here that Studies carried out across the globe such as in the UK showed that small businesses have been the most vulnerable to business failure with a record of about 50% occurring in depressed areas in the 1980’s over a five year period (Rees, 1995).

Studies on small business failure in the US, UK, Canada and Austria (Star, 1990) showed that small, newly created and privately owned businesses often get a poor cash flow and ineffective control procedures thus making them more liable to financial distress as against larger, old and well established public entities. Altman (1968) stated that the age of a firm is implicitly considered a measure of cumulative profitability over time. Therefore, young firms with insignificant retained earnings would be more susceptible to financial distress. A lot of factors have equal been attributed to lead bankruptcy and many researchers

emphasized that high interest rates, low profits and heavy debt burdens would easily drive a firm into distress. Notwithstanding, business operation, environment, industry specific features and government regulation cannot be left out; some within and others beyond the control of the affected firm.

This area of analyzing business distress has drawn a lot of attention in recent times with ratios analysis standing out as one of the most valuable techniques but same time a complicated technique used in the analysis. As far back as in the 1930's, the prediction of financial distress and bankruptcy probability emanates from studies using financial ratios. One of the early works on bankruptcy prediction was written by Fitzpatrick (1932). He made use of financial ratios from failed and healthy firms and the results obtained showed poorer results for the failed firms as compared to active firms. Beaver's (1966) univariate analysis was a footprint for multivariate bankruptcy prediction models. Since then, there have been remarkable studies using financial ratios in detecting companies operating and financial difficulties or as an analytical instrument in forecasting bankruptcy. This has thus substantiated the vitality of financial ratios as a key indicator of business failure.

Beaver (1966) perform trend analysis on the financial ratios of distressed companies and indicates inconsistencies and anomalies prior to the year of bankruptcy. He outlined a number of key financial ratios for signaling bankruptcy and concluded that the ratios would discriminate between matched groups of healthy and distressed firms for as long as five years prior to bankruptcy. This special characteristic of key financial ratios also explained why Altman (1983) z-score model is claimed to predict bankruptcy for up to five years before the event (Barry and Jamie, 2002:683). Apart of Beaver univariate analysis for signaling bankruptcy, other statistical models with high predictive ability have been designed for the prediction of corporate failure. These statistical models will be discussed in the subsequent chapter.

1.2 Problem Statement

Since the early 1970's, the global business climate has witness a dramatic increase in financial distress² and corporate bankruptcy³. Financial distressed has blown across the

² Financial distress is a condition when a company cannot meet (or has difficulties paying off) its financial obligations to its creditors. FD chances increases when a company has high fixed cost, illiquid assets or revenues that are sensitive to economic downturns. (www.investopedia.com, accessed April 7, 2009).

global economy with a mark increase in bankruptcy wave living certain stakeholders' in woe. As financial distressed gets common in today's global market, substantial legal reforms have been introduced to govern disputes in cases of bankruptcy. The rate at which companies file for bankruptcy vary broadly from one country to another depending on the duration involved to complete the entire legal proceedings.

In the United States, the filing can fall under one of the several Chapters of the bankruptcy codes; Chapter 7 which involves liquidation of assets, Chapter 11 for individual or company reorganization and Chapter 13 for debt repayment with lower debt covenant or payments plans. Generally, bankruptcy & distressed restructurings is a lengthy and time consuming process. In the U.S., it includes the determinants of successful distressed exchange issues and Chapter 11 proceedings, bankruptcy and liquidation costs and their impact on corporate values, investment opportunities in distressed and defaulted securities, management and competitor behavior related to distress, and an evaluation of investor priorities and market efficiencies (Wruck, 1990; Altman, 1998).

With respect to the Swedish bankruptcy code, any firm has a right to file in for liquidation (irrespective of its claim or company size), as long as it cannot meet up with its short and long term debts obligation and can prove before the court the material reason for its demand. A new administration is set up with the option to either close the operations or continue while the protracted liquidation process goes on. The funds realized from the liquidation (sale of assets) are disbursed strictly on priority basis until the proceeds are completely exhausted. First, priority is given to the administrators for cost or expenses incurred during the liquidation process. Then we have the 3 basic classes of claims⁴; should the funds become insufficient to meet up creditors within a given class, the debts are settled on pro-rata basis (Eisenberg, 1995; *Insolvensutredningen*, 1992)⁵.

³ Bankruptcy is a legal proceeding involving a business that is unable to repay its outstanding debts. It involves a series of processes beginning with a petition filed by the debtor after which their assets are liquidated in to settle the creditors (ibid).

⁴ The first group constitutes the secured claimants who are entitle to claims worth their collaterals to the entity and they are free to get their collaterals back during the liquidation or funds from the disposal. Second is the unsecured claimants with three priority groups; the landlords who receive amounts equivalent to 3 months rent. Next, priority is given to other owners of collateral such as machinery, receivables and inventory other than cash or liquid assets and shareholdings in public traded entities; that is the floating charge claimants (*företagshepotek*). And lastly, the following settlements are made; taxes, audit fee and the wage liabilities. Final group consist of the junior claimants with equally priority, they get whatever is left.

⁵ Eisenberg, T. (1995). *Konkurs eller rekonstruktion*. SNS Förlag.

Insolvensutredningen. (1992). *Lag om Företagsrekonstruktion*. SOU 1992:113.

Since the adoption of the bankruptcy reform act in October 1979, there have been an increase in the number of companies that file for bankruptcy according to Chapter 11. One year after the enactment of the act, bankruptcy petition filing increased by 85% to 5637 (up from 3042 in 1979). As a result of the U.S. banking crisis in 1988 over 2700 firms of the financial sector filed for bankruptcy and the reorganization cost for over 1400 savings and loan institution that composed the 2700 bankruptcy filing cases stood at \$180 billion (Laeven and Valencia, 2008:48). Moreover, there have been more than 20 Chapter 11 filing with liabilities over \$ 1 billion since the act was endorsed. Texaco Chapter 11 filing in April 1987 was the largest with \$ 21.6 billion in liabilities; the second largest was filed by Campeau in January 1990 with liabilities worth \$ 9.9 billion (Wruck, 1990). To sum up the situation between the 70s and 90s in the US, over 400,000 cases were recorded with approximately \$105 billion liabilities (Altman, 1993).

The U.S. financial unrest exacerbate with the eruption of the subprime mortgage crisis last August 2007; described as the largest financial crisis after the great depression in the 1920's and 30's. The crisis manifested due to liquidity problems in the banking system because of sharp decline in the demand for asset backed security. Therefore, the implementation of fair value accounting and credit rating in valuing assets backed securities and other instruments severely downgrade their original values. Assets write-down and credit losses get worse with declining housing prices. Mortgage foreclosures and provisions for losses increased and the U.S. banking profits reduced by 83.5%, down from \$35.2 billion in the 4th quarter of 2006 to \$5.8 billion in 4th quarter 2007 (Laeven and Valencia, 2008:27).

In April 2008, IMF speculates that the situation would get worse and that the credit crunch would inflict severe damage on the global financial system and may end up with losses worth \$ 1 trillion⁶. Five months later, centre for research on globalization⁷ estimate national debts over \$9 trillion. In the later periods of 2008, many firms, especially those in the financial sector filed according to Chapter 11 of the bankruptcy act. Top four financial collapses recorded in 2008 included; Lehman Brothers which pleaded for \$700 billion in bailout, AIG (\$100 billion in bailout), Detroit three (\$34 billion in bailout) and Citigroup with \$20 billion in bailout after announcing 75000 jobs cuts⁸. Apart of the aforementioned

⁶ www.gardian.co.uk April 9 2008 (accessed March 27, 2009).

⁷ www.globalresearch.ca September 19 2008 (accessed March 28, 2009).

⁸ The time <http://www.time.com/time/specials/2008/top10/article/> (accessed February 28, 2009).

cases in the US, considerable cases of financial turbulence and bankruptcy have also been recorded in other parts of the global market.

In Asia, the 1997 financial crisis left several companies into distress position characterized by high fixed cost, decreasing profits, illiquid assets, with most firms showing huge liabilities and negative equity. Four years after the outbreak of the crisis, institutional changes took place in an attempt to stabilize the situation. In 2001, the regulatory body in Malaysia, Bursa Malaysia emerged with the introduction of PN4 and PN17 classification for listed companies; PN4 firms are in worst financial situation than PN17. Firms classified under PN4 had unfavorable financial conditions (financially distressed) and were required according to Practice Note 4 to regularize their financial affairs (Mohd-Nasir & Abdulah, 2004; Business Times, Malaysia Aug.01 2001; Bursa Malaysia, Practice Note 4/2001).

The cases of Niger and Tanzania in Africa are also worth noting. In 1983 banking and debt crisis (credit crisis or credit crunch) in Niger subsequently resulted to severe currency crisis in 1994. The share of Non-Performing Loan (NPL) was at its peak, 50% while output loss as a percentage of GDP stood at 122.7% resulting to negative growth rate of 16.8%. Similar crisis in Tanzania between 1984 and 1987 left the banking sector with NPL of 70% and fiscal cost up by 10%. The banking and debt crisis in Turkey between 1984 and the late 2000 resulted to stock market bubbles.

The banks were highly vulnerable to market risk due to large holdings of public securities, sizeable maturities and exchange rate risk mismatches. The financial markets experience a drop in the prices of securities triggering a reversal in capital flow, sharp increase in interest rates, and decline in the value of the currency. By year end 2000, GDP stood at -5.7%. Financial distressed between 1995 and 1998 in Ukraine resulted in the liquidation of 32 of the 195 banks while 25 were undergoing financial reorganization. In some commercial banks, bad loan accounted for over 60% of its assets (Laeven and Valencia, 2008:32 - 48)

In Sweden, the banking crisis of 1991 had a devastating effect on its banking system. Five of the six largest Swedish banks with more than 70% of the banking system assets experience financial difficulties. Nordbanken and Gota Bank with 22% of the banking systems assets and Sparbanken Foresta with 24% of the assets were declared insolvent. The share of NPL stood at 13%, output losses increases to 30.6% and GDP shrinks to -1.2% (Source: IMF,

Financial Crisis Episodes Database 2008). The banking crisis provoked the currency crisis in 1993 and in the early 1998, a major financial turmoil which impinges on other business sectors (Laeven and Valencia, 2008:46). The financial unrest between 1998 and 2003 resulted in the liquidation of several Swedish listed and non-listed firms. Some of the listed companies were delisted from the Stockholm Stock Exchange (SSE) due to their unfavorable financial situation and/or non-compliance to statute. According to the Swedish Business and Credit Information Agency known as Upplysningscentralen, 15301 bankruptcy cases were recorded between June 20 2002 and June 1 2006 with small and medium sized companies constituting over 60% of the bankrupt companies.

Considering the current trend in globalization and internationalization of businesses, financial distress and bankruptcy has become more of a global than a national issue. For example, the 2008 credit crunch in the U.S. has affected the global market in different ways. The subprime related and other credit losses by the global financial institution stood at about \$500 billion (Laeven and Valencia, 2008:27). Some effects of the subprime mortgage crisis visible in Sweden include the heavy decline in the stock market due to influence from New York and other markets. Some banks especially Swedbank had invested heavily in the U.S. housing bonds and therefore suffered interest rate fluctuations. In October 2008, Riksbank open credit facilities to maintain liquidity in the banking sector offering loans worth SEK60 billion (\$7.71 million) to financial intermediaries.

The car industry sales meltdown, forcing the Swedish car industry to lay off staff, cutting down production and related cost⁹. Generally, retail sales dropped by 0.6% in October 2008 and household consumption fell by 0.2% in the third quarter of 2008. According to Statistics Sweden, the country witnessed a recession in the second and third quarter of 2008 resulting to a contraction in GDP by 0.1% during both quarters. In March 2009, unemployment rate rose by 2% points to 8.3%, 404000 unemployed persons as against 305000 in March 2008 (ibid). The global money market was also under pressure and the value of the Swedish Kroner plummet. On January 1 2006, 1SEK worth DKK0.79 and €0.11 compared to DKK0.69 and €0.09 on January 1 2009¹⁰.

⁹ Late 2000s recession in Europe <http://en.wikipedia.org/> (accessed April 9, 2009).

¹⁰ Currency and historical rate tables, www.xe.com, (accessed April 8 2009).

In Norway, the government pension fund suffered an investment loss of NOK633 billion in 2008 (source)¹¹. Unlike the Swedish kroner which experience a decline in value, the value of the Norwegian Kroner rose due to oil sales and currency movements¹². The U.S. subprime mortgage crisis also provoked problems in the banking sector in the U.K, Asian and in other parts of the world. For example, the U.K. mortgage lender, Northern Rock received liquidity support from the Bank of England. IMF highlighted problems in the financial sector in U.K. including maintenance of adequate capital by financial institution and banking resolution procedures. Ukraine also suffered banking problems, slumping steel prices and decline in the value of their local currency. In 2008, the currency dropped by 38% against the US dollar. More so, the State Employment Centre anticipates unemployment rate in Ukraine will increase to 9% from 3% at year end December 2008.

In all observed cases of financial distressed, the policy measure adopted by the Authorities was to implement different mechanisms to increase liquidity (Laeven and Valencia, 2008:28). For example, in December 2008, the government of Sweden launched a stability plan to revive the economy while the Swedish central bank reduced interest rate by 2% (Financial Times, October 20 2008 and December 4 2008). Therefore, financial distress also increases the country's political and administrative costs. The circumstances that follow a financial distress and bankruptcy in most parts of the world are basically the same with immediate detrimental impact such as; huge liabilities, legal judgements, products liabilities claim, labour problems (unemployment, fall in real wages), leveraged acquisitions, leveraged buyouts (Wruck, 1990) and related financial distress costs¹³ that impinge on different stakeholders¹⁴.

The business environment today is highly unstable with high rate of corporate bankruptcy. As such, the prediction of corporate operating and financial difficulties are of utmost importance to various stakeholder groups. Considerable work has been done by different researchers on the area of financial distress and bankruptcy prediction using financial ratios.

¹¹ BCC news, www.bbc.co.uk retrieved Wednesday, March 11 2009.

¹² Late 2000s recession in Europe <http://en.wikipedia.org/> (accessed April 9, 2009)

¹³ Examples are the direct costs of bankruptcy (e.g. auditors' fee, legal fees, management fees, etc) and the indirect costs if bankruptcy is avoided (e.g. the increased costs of borrowing additional capital makes it difficult for the company to raise much needed funds. Decreased employees' moral and resulting low productivity in addition to management giving up profitable long-term projects for short term obligations).

¹⁴ The shareholders, creditors, equity holders, corporate management and employees are often seriously affected by failed enterprises. Auditors are equally not left out as they stand high risk of lawsuit charges if they fail to provide warning signals of liquidation in such financially sick firms, in the issue of the audit opinions (Boritz, 1991; Jones 1987; Zavgren, 1983).

The existing bankruptcy models are of course very useful in understanding and predicting companies that are likely to face some financial difficulties. However, it is important to note that financial ratios are numerous and no two previous bankruptcy studies or models have made use of exactly the same set of financial ratios.

In other words, each researcher in his study deduces a set of significant financial ratios for predicting bankruptcy. This suggests two things; that the choice of financial ratios used by an individual research is based on the researcher's objective thinking (subjectivity). Secondly, that each financial ratio has a unique property making it more relevant or irrelevant than the others. Similarly, researchers hold the view that the most important and fundamental statistical nature of financial ratios is collinearity. This means some financial ratios tend to move in the same direction as others and therefore have a high degree of correlation with each other (Altman, 2000; Horrigan, 1965).

Therefore account users will need only a small number of financial ratios to make crucial decisions about a company's state of affairs. Hence, it will be costly and waste of resources for corporate stakeholders to focus on the numerous financial ratios in order to make critical business decisions. There is also the risk of focusing on less important, ambiguous or the wrong type of ratios. In general terms, this univariate study seeks to determine most significant financial ratios for predicting corporate failure. Unlike in previous bankruptcy studies which compromised generalization by using small sample sizes (Grice and Dugan, 2001), this study uses large sample. The Swedish case has been chosen because few studies have been carried out in Sweden and the Nordic region in general.

1.3 Purpose of the study

This study seeks to determine best financial ratios for predicting business failure. This study would therefore indicate a set of most significant and reliable ratios for predicting financial distress. To have a good grasp of this situation, we shall examine the extent to which companies'; liquidity ratios, debt ratios, profitability and operating ratios are associated to bankruptcy. The purpose gives us a sense of direction and serves as a guideline for formulating the study hypotheses.

1.4 Hypotheses

A total of eight assumptions have been made based on generally accepted concepts, theories or on previous research findings. The relationships between eight different financial ratios (from four categories of financial ratios) and the likelihood of corporate bankruptcy are established. Liquidity ratios measure the ability of a company to pay its short term debts obligations. Examples of this financial ratio include current ratio, quick (acid test) ratio, cash ratio and cash conversion ratio. The difference between these ratios is the type of current asset used; a more conservative liquidity ratio (for example, the quick ratio) will exclude those current assets which cannot be easily converted into cash. Stakeholders will normally prefer larger ratios of liquid assets to short term debt since it is an indication that the firm can pay off its short term debts and still fund its operations. We presume that the average liquidity ratios of healthy firms are higher than those of financially distressed firms. Therefore;

- H1: Firms that survive financial distress had higher liquidity ratios than those that went bankrupt.
- H2: Firms with low quick ratios are more likely to go bankrupt than those with high quick ratio.

Debt ratios are ratios of financial leverage which establishes a relationship between a company's total debt and its total assets thus giving an idea of the amount of leverage used by the company. Widely used ratios of financial leverage are gearing ratio, total debts to total equity and total debt to assets ratios. Low debt to equity ratio is better since it indicates that the company's debt burden is lower. Financially distressed firms often suffer from huge debt burden characterized by high interest payments. Gearing concentrates on long term debt financing. The hypothesis H4 could be more pertinent than H3 because some companies rely on high levels of short term interest bearing finances such as overdraft and other short term loans (Berry and Jamie, 2002:644). Hence, we presume that the average debt ratios of bankrupt firms would be higher than the average debt ratio of their counterpart active firms.

- H3: The gearing ratios of bankrupt firms are higher than those of active firms.
- H4: Companies that go bankrupt have higher total debts to total equity ratios than their counterpart active companies.

Profitability ratios give an indication of how effective a company is generating profits given sales and or its capital assets. Profitability ratios measure a company's ability to generate revenue in excess of expenses. Some measures of profitability include; gross margin, net margin, operating margin, return on capital employed, return on equity, and return on assets. Previous studies indicate that profitability ratios are highly significant in financial distress and bankruptcy prediction. We therefore suppose the following hypotheses;

H5: The operating margins of financially distressed firms are lower than those of healthy firms.

H6: That return on capital employed of financially distressed firms are lower than those of healthy firms.

Operating ratio is a measure of how well a company sells its stock and the efficiency with which it convert sales into cash. Some examples of operating ratios (activity ratios) include; assets turnover (sales to total assets), stocks turn over, debtors' day (day's receivable outstanding) and working capital to sales ratio. Debtor day shows the average number of days it takes customers to pay for credit sales. Low debtors' day benefits cash flow; an indication for probable saving for positive cash flows. Higher debtors' day suggests inefficiency or potential bad debts which is usually the case for financially distressed firms. In this regard, we assume that;

H7: Firms with longer debtors' days are more likely to go bankrupt than those with shorter debtors days.

On the other hand, assets turnover ratio is a measure of company's ability to generate sales from its total assets. Higher sales to total assets ratio is an indication of high profitability since smaller investment will be required to generate sales revenue. Since we expect bankrupt firms to have lower and even negative profitability, we therefore presume that their assets turnover ratios are lower than those of active firms. Hence the hypothesis;

H8: The sales to assets ratio of financially distressed firms are lower than those of healthy firms.

1.5 Significance of Study

Different studies in the field of economics and finance, credit risk management and accounting have established models for predicting bankruptcy. Most of these studies are multivariate in the since they incorporated different financial ratios in a single equation in order to predict corporate failure. However, other studies especially the work of Beaver (1966) was a cornerstone¹⁵ for most multivariate models. This study explores the behavior of different financial ratios on groups of bankrupt and active firms. This research study like that of Beaver is univariate since it independently examines the impact of financial ratios on bankruptcy probability with the objective of indicating a set of most significant ratios for predicting business failure.

We applied both didactic and profession approaches giving it dual usefulness in the academic and business practices. The paper could serve as guideline to those who wish to conduct similar studies and may aid students in understanding the meaning behind certain financial ratios. It is useful to business managers in evaluating and ascertaining their position in the market and in determining potential risk such that risk adverse decisions are taken before the situation deteriorates. The study may guide investors in determining the degree to which their investments are susceptible to financial distress for timely intervention. It usefulness may also extend to governments and market regulators in understanding market imperfection such that important economic decisions are taken. It is also valuable to lenders and other financial intermediaries in credit ratings decisions.

1.6 Delimitations

This research focuses on 104 companies selected from two distinct groups of companies; bankrupt and active firms. The duration of this study covers approximately four months. The time frame was dictated by the academic system and therefore, we had to set various boundaries for investigating the issues considered. We were interested in exploring financial distress and bankruptcy situation and to indicate most significant bankruptcy prediction ratios. Nonetheless, the root cause of the financial distress is another storey. Considering that it was a large sample study, we could only investigate eight variables, due to the limited timeframe. The readers should also be aware of the following research limitations:

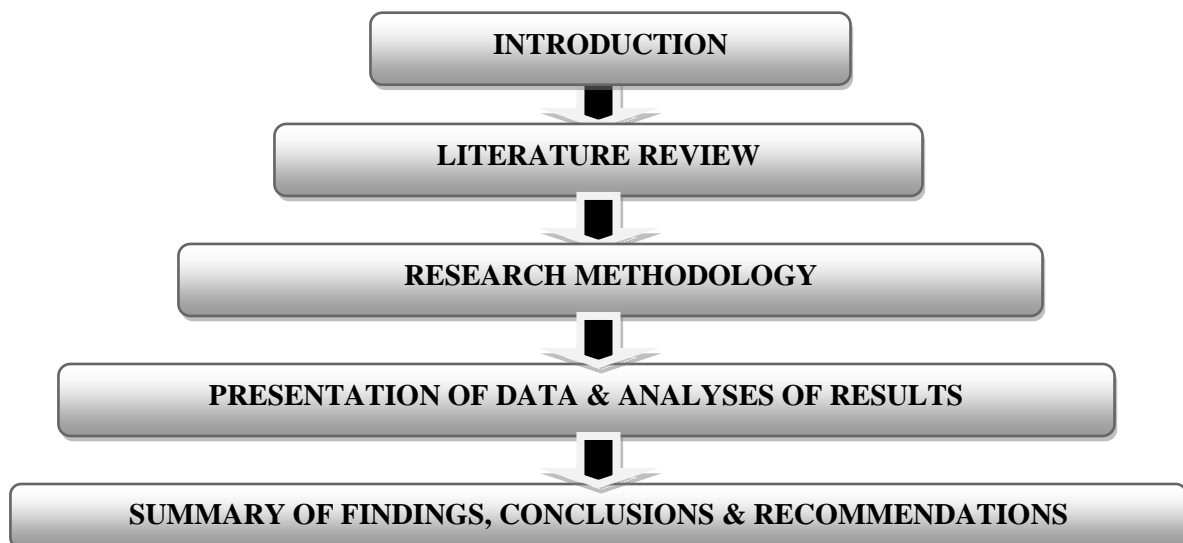
¹⁵ The financial ratios used in any multivariate model must be carefully selected using a univariate study.

We did not obtain secondary data directly from the statistical firm due to language barrier. More so, the financial reports of the companies were all in Swedish and therefore any poor translation of an accounting term may affect the computation of financial ratios. The time frame also dictates the number of financial ratios investigated. May be, there are other significant ratios that this study failed to examine. The results obtained are therefore based on the financial ratios investigated.

1.7 Outline of Study

This research project is will be divided into five chapters. The first chapter will be composed mainly of an introduction of the subject matter, followed by the problem statement, purpose and study hypotheses. Chapter two review prior research studies related to our subject matter. It therefore covers previous literature related to financial ratio analysis, financial distress and bankruptcy. The third chapter will discuss the way the research is conducted and the choice of the methodology used. In the fourth chapter, the empirical data will be presented, analyzed and results interpreted. In the fifth chapter, the entire research findings would be summarized and some conclusions drawn. The fifth chapter would also contain possible source of errors and suggestions for further research.

Figure 1: Outline of research project



CHAPTER TWO

2. LITERATURE REVIEW

This chapter contains an overview of the basic concepts related to this study. The chapter will cover prior literature on financial distress and bankruptcy. Other methods involving the use of financial ratios in corporate analysis will also be discussed. The chapter will also discuss different bankruptcy models formulated or used in prior studies. However, part of the literature used in this study is a revision of bankruptcy literature developed by one of the authors of this project in a descriptive study conducted in June 2008.

2.1 Features of Financially Distressed and Bankruptcy Firms

With today's vulnerable global business environment, market regulators deliberate on dissimilar view points on what measurement techniques and variables to consider in classifying firms' firms in either the healthy or financially distressed group. These difficulties account for the increase creativity, innovation and awareness on bankruptcy laws and predictive models. In this regard, regulatory bodies and individual researchers have put forth alternative criteria and definitions to guide classification of firms as either healthy or financial distressed. However, distressed firms are allowed to file for bankruptcy based on the provisions of the bankruptcy laws which differs from country to country.

Wruck (1990) defined distress firms as those which face declining financial performance as a result of economic crisis and poor management. He indicated that this category of firms usually exhibit declining financial performance to negative return on assets or equity. According to, Bursa Malaysia (2001), distress companies are those with an unfavourable financial condition. Bursa's classification was based on four major criteria including with importance on negative adjusted shareholders' equity. Listed companies classified as distressed were required by Bursa to regularize their financial affairs. Haniffa and Cooke (2002) placed much emphasize on corporate profitability and reiterated that in addition to equity problems, financial distressed firms are also faced with high gearing.

Parker et al. (2002) conducted a survival analysis on distress companies and associated turn over with the likelihood of corporate survival. From their study, companies with decreasing turn over were likely to suffer from financing problems in the future. They added that decreasing turnover, may lead to debts settlement problems and may eventually result to

bankruptcy. In Altman (1968) z-score model, concluded that assets turnover ratio has a unique relationship with other variables in indicating corporate distress. Parker et al (2002) also observed that financially distressed firms that practiced debt restructuring were as likely to go bankrupt as those without a total debt restructuring¹⁶. Beaver (1967) univariate study concluded that cash flow to debt ratio was the best single ratio bankruptcy indicator.

Dun and Bradstreet – D&B (US based international provider of business credit information and reports) carried out a number of studies in the US and put forth a number of reasons for business failure some of which include; high interest rates, increased international competition, increased leverage and deregulation of industries by financial services. In one of their early studies, they define debts of failed companies as failure liabilities - all account and notes payable and all other obligations known to be held by creditors excluding publicly held bonds. According to Altman (1992), their definition of failure liabilities was bias since it omitted publicly held bonds, noting that billions of dollars were often held in the form of bonds. Between 1971 and 1991, they carried out another study and introduced a more representative barometer of corporate distress; the failure rate which measures number of failures recorded per 10,000 firms.

The US bankruptcy code (1978) for protecting the rights of interested parties in case of bankruptcy state conditions when firms should be liquidated and when to reorganize (Altman, 1992). If the firms' intrinsic or economic value is greater than its current liquidation value, the firm was accepted to file in for reorganization and later continue with its operation. On the other hand, where its liquidation value exceeds economic value, liquidation was preferable. Altman (2002) noted that bankruptcy reorganization is not a total solution to the firm's distressed state adding that firms that reorganized are more likely to fail in the nearest future especially if the distressed condition intensifies.

2.2 Bankruptcy Prediction Models

Models for predicting corporate distress has shifted from traditional ratio analysis in the early 1930's to single ratio predictors developed from univariate studies to today's

¹⁶ A method used by companies with outstanding debt obligations to alter the terms of the debt agreements in order to achieve some advantage. For example: replacing long-term debt with short term debts to take advantage of lower interest rates or debt equity swap commonly used by financially distressed firms to cancel part of their debts (<http://en.wikipedia.org/> and www.investopedia.com Accessed April 2 2009).

multivariate predictive models. Basically, models for predicting corporate failure using financial ratios can be classified into two major sub-types; univariate analyses and multivariate models.

2.21 Univariate Analyses

The use of financial ratios in bankruptcy studies became popular after Beaver's (1966) univariate studies. Univariate analyses assume that single ratios can be used as the best indicators of business failure (Cook and Nelson, 1998). Beaver (1966) used explanatory variables such as cash flow, income, debt, current assets and working capital of firms. He conducted his study on bankrupt firms and indicated cash flow to debt ratio to be the best bankruptcy indicator. Beaver's treatment of financial ratios as independent variables reduces their predictive ability since the ratios are often related to each other. Beaver's single ratio predictors therefore failed to provide measures of relevant risk (Stickley, 1996:509). To improve the predictive ability of single financial ratios, Altman (1968) and other researchers developed multivariate statistical models for predicting corporate failure.

2.22 Multivariate Models

Unlike univariate analyses which rely on single ratio predictors, multivariate models combine a set of well selected ratios in a single model. It is based on the argument that some financial ratios are related with one another. Therefore a set of best single predictor ratios would yield better results when combined in a single model. Some statistical models that use a combination of different financial ratios for predicting bankruptcy are classified thus:

- 1.Linear Probability (LP) Models.
- 2.Multiple Discriminant Analysis (MDA)
- 3.Non-linear (NL) models. E.g. logit and probit models
- 4.Non Parametric (NP) Models. E.g. Artificial Neural Networks (ANNs)

Altman (1968) improved Beaver's (1966) univariate analysis by introducing multivariate analysis that incorporates five different financial ratios for predicting bankruptcy. The five predictive ratios were obtained after conducting univariate analysis on a group of bankrupt and non-bankrupt firms. Predictive ratios were assigned different weights based on their

observed statistical significance, relative contribution, inter-correlations among different variables and their predictive accuracy. The weighted ratios were then combined in a single equation to obtain what is known as the z-score model. This model discriminates z-values between healthy firms and bankrupt firms since the ratios and the financial trend of the two groups of firms can easily be distinguished. The model further discriminates z-values for public and private companies.

After Altman (1968) z-score model, considerable studies for predicting business failure were conducted. Meyer and Pifer (1970) used LP models for predicting bankruptcy of banks that happened between 1948 and 1965. Deakin (1972) employed the fourteen ratios used in Beaver (1966) univariate analysis to establish a linear combination with a greater predictive accuracy. Wilcox (1971) also made use of Beaver's model with the aim of developing a theoretical model to better explain Beaver's results and to improve its predictive propensity. Edmister (1972) indicated seven variable financial ratios for predicting the failure of small businesses. Deakin extended his previous (1972) study model in 1977 to provide an indication of the frequency and misclassification of non-failing companies thereby improving its predictive aptitude.

Altman, et al (1974) conducted a study in France in order to determine the credit worthiness of commercial loan applicants in a cotton and wool textile industry. Altman, Halderman and Narayanan (1977) also carried out another study on manufacturing and retail firms and revised the original z-score model to produce a new model known as the zeta model. According to them, the new model uses more current data and is effective in classifying bankrupt firms up to five years prior to failure. Taffler (1982) used linear discriminant analysis to conduct bankruptcy prediction studies in the UK. He derived four¹⁷ best significant financial ratios and assigned different weights to the four ratios based on their significance. He also assigned different z-values for businesses likely to fail and those unlikely to fail.

However, the LP models and MDA were criticized due to their linearity, restrictive assumptions and for treating financial ratios as independent variables (Eisenbeis, 1977). A series of studies were carried out in order to improve on the restrictive discriminant models

¹⁷ Profit before tax/current assets (53%), current assets/current liabilities (13%), current liabilities/total assets (18%) and the company's no credit interval less length of time which the company can continue to finance its operations using its own assets with no revenue inflow (16%) (Barry and Jamie, 2002:683).

using logit models (Martin, 1977; Olsson, 1980; Zavgren, 1983) and probit models (Press and Wilson, 1978; Wigton, 1980; Amemiya and Powell, 1983). Ohlson (1980) used different financial ratios in a logit regression model and a non-matched sample of firms to predict bankruptcy. Logit regression requires less restrictive statistical assumptions than multiple discriminant analysis used in earlier studies. Zmijewski (1984) also used probit models to assess more directly the impact of specific variables on business failure. Like the discriminant analysis, NL models have certain shortcomings. The choice of the regression function creates a bias that restrict outcome. Secondly, the models are sensitive to exceptions which are common during bankruptcy (Neves and Vieira, 2006:254).

Altman (1983)¹⁸ improved his 1968 z – score by using a more current and generalized data thus eliminating specific industry effects. For these reasons, the 1983 z-score model is applicable to both public and private companies. This new model comprised of four most significant financial ratios compared to five financial ratios in the earlier¹⁹ (1968) model. In his 1983 model, he substituted market value of equity in the previous model with the book value of equity. He also eliminated the ratio of sales to total assets because it is the least significant bankruptcy indicator when compared with the other four financial ratios. Some authors suggest that NP models like the Artificial Neural Networks (ANNs) should be used as a complementary tool for classifying credit risk (Barker, 1990; Marose, 1990).

In a later period, other authors claimed that the ANNs would outperform discriminant analysis in bankruptcy prediction (Coats and Fant, 1993; Wilson and Sharda, 1994; Yang, Platt and Platt, 1999; Tan and Dihadjo, 2001). O’leary (1998) surveyed ANNs application in the prediction of business failure and concluded that the results were at least as good as those generated by other models. Nevertheless, this technique for predicting corporate failure was criticized for its poor generalization (Altman et al., 1994). Due to the weaknesses of ANNs, Neves and Vieira (2006) used another NP model known as the training algorithm (HLVQ-C) for predicting bankruptcy. They claim that their new model can use larger set of variables without compromising generalization. They also indicated that the model would improve prediction for difficult cases.

¹⁸ Altman (1983) z-score: $z = 6.56 X1 + 3.26X2 + 6.72X3 + 1.05X4$

¹⁹ Where X1 = working capital to total assets (TA), X2 = retained earnings to TA, X3 = EBIT to TA, X4 = BV of equity to BV of debt (1983) or X4 = MV of equity to BV of debt (1968) & X5= sales to TA

2.3 Corporate Identity and Change

Some researchers hold the view that instead of performing a trend analysis of the ratios of companies, a similar and less costly method would be to periodically observe how corporate financial statements items change over time. In other words, observing the constituent parts of the ratios over time. That companies operating and financial difficulties could be determined by a mere observation of the periodic balances of the various items of its financial reports (Polesie, 1991). Companies should be regarded as organisms in motion that are subject to change and transformation (Kilmann and Covin, 1988).

According to Polesie (1999), when a company's conditions change, we see more clearly where its managers can and can't cope; the ability to survive with its available resources becomes very visible. In his study, he observed how 18 companies in the Scandinavian market have developed over a five year period. He set up a scheme for an overview of companies operating and financing resources, containing year end balances of the balance sheets and income statements items presented in the form of a square (hence, the name square model). The companies' square models were prepared annually, observed and changes of financial statements items analyzed.

However, much time and in-depth information about a company may be required to better understand the development and changes of the individual financial statements items otherwise reasonable judgement may not be reached. That notwithstanding, the square model would present a company more clearly and gives a general picture of its operating and financing activities. Like a typical ratio analysis, great disparity exist between individual financial statements items of bankrupt and active firms.

CHAPTER THREE

3. METHODOLOGY

In this chapter, we shall explain and motivate the various methodological choices used in conducting this study. The scientific approaches and the research designs will be explained. Also, the systematic methods used in sample selection and data collection shall be motivated. The choices of our variables and the analytical models would also be discussed.

3.1 Scientific Approach

Generally, two main research approaches have been indicated by researchers; inductive and deductive approach. However, (Bryman & Bell, 2007; Richards, 1993) pointed out that it is unlikely that any researcher could genuinely separate the processes of induction and deduction. That both approaches are always used more or less simultaneously, and that it is impossible for a study to be free of the two. Since most social science studies are small sample, the use of the inductive approach in these studies would yield lower validity. For this reason, most studies especially small sample studies principally make use of the deductive than inductive approach (Perry, 1998). According to Bryman and Bell (2007), the deductive and inductive approach could be explained in terms of the objectivism and interpretivism.

Objectivism entails elements of both the deductive and inductive approaches used in positivist (mainstream) research. The mainstream researchers make rational and objective suggestions in order to explain and predict the phenomenon under investigation. On the other hand, the interpretative approach in research considers critical application of scientific models or concepts (Richard and Mark, 1997; Bryman and Bell, 2007). Interpretivism is based on the researchers' subjective view to gain in-depth knowledge about the problem under investigation (ibid).

Therefore interpretivism (subjectivity) gives room for findings that differ from those of "pure" objective approaches thus contributing new ideas in field of study. Due to their usefulness, we employed both the mainstream and interpretative approaches through-out this study beginning with the generally accepted theories used in hypotheses formulation. Like in other mainstream bankruptcy studies, bivariate analyses have been used to analyze matched

pair of variables (from bankrupt and active firms) at a point in time in order to determine collinearity or non-collinearity between variables.

3.2 Research Design

A research design is a framework that guides the research procedures in data collection and analysis. It relates to the criteria employed in evaluating a business research (Bryman and Bell, 2007:39). The techniques employed in data collection, sample and variable selection must be carefully thought-out. If the technique is not well planned, it is very likely that we collect data that is not in-line with our research interest thus, rendering analysis and results faulty.

We used cross sectional design in this study to ensure a satisfactory level of validity and reliability. This type of research design is used for studies that collect data for more than one variable at a single point in time with the purpose to detect and explain correlation between the explanatory variables and the condition under investigation. There are four main points to note about this study that necessitates the use of a cross sectional design (Bryman and Bell, 2007:55). Firstly, we examine financial ratios on more than one case study (bankrupt and active group) because we are interested in variation. Since financial ratios are quantitative, variation between the two groups could easily be gauged. Thirdly, data from both groups were collected at a single point in time. That is, at a particular bankruptcy year in order to minimize externality effects which arise with changes in time. Finally, we intend to establish association of variables and to minimize ambiguity in conclusions.

3.21 Sample and Data

The sample was obtained from the database of MM partners, a statistical firm that collects corporate financial statements from the Swedish company's registration office called Bolagsverket. The initial sample consisted of financial statements of both bankrupt and active firms between the periods 1996 to 2003. This period was chosen to cover the 1999 financial distressed in Sweden, taking into account the pre and post distressed periods. To create homogeneous samples, bankrupt and active firms were initially selected based on the following criteria;

1. The initial samples composed of firms with 50 or more employees as a control variable for size. More so, firms with over 50 employees were under pressure to fully comply with statutory requirements. Hence those with less than 50 employees were eliminated from the sample. Furthermore, financial ratios by nature have the effect of deflating data by size hence; size effect is eliminated to a greater extent (Altman, 2000).
2. In order to minimize industry effect, certain categories of firms were excluded from the initial samples. Public companies, unit trust, insurance companies, banks and others financial intermediaries were also excluded because their financial structure and bankruptcy environment differs from that of other companies (Ohlson, 1980).
3. The initial sample of bankrupt firms were then adjusted thus;

Table 1: Sample selection

	<i>No. of bankrupt firms</i>					
	1999	2000	2001	2002	2003	Total
Initial sample	25	33	58	59	28	203
Less: firms without consolidated reports	-	-	7	2	-	9
Less: financial reports with missing data	1	2	3	5	4	15
Final sample	24	31	48	52	24	179

Based on selection criteria (1) and (2) above, we obtained 560 active firms. We then excluded 6 active firms due to incomplete financial reports to obtained 534 active firms. Since no two years of bankruptcy are the same (the economic conditions under which certain firms went bankrupt in (t-2) or (t-1) year would certainly differ from the conditions in the year, t. In order to minimize externality effects associated with changes in time, we limited our study to a specific bankruptcy year, t (t = year 2002). We collected data for the reporting year 2002 because it recorded the highest bankruptcy cases as indicated in table 1 above.

Since they are more active firms (534) than bankrupt firms (52), we used systematic random sampling with a sampling fraction of 1:10 to select an equivalent number of active firms. According to Lennox (1999) equal sample size for bankrupt and active firms minimize error rates. Our study sample is therefore composed of 104 Swedish firms divided into two groups; group 1 and group 2 containing 52 bankrupt and 52 active firms respectively. The

minimum and maximum ages for both group 1 and 2 firms prior to the year of bankruptcy (t) were approximately 3 years and 31 years and their average age were approximately 15 and 19 years respectively. Other information used in this study were also gotten through secondary sources such as; business journals, textbooks, the press and corporate websites.

3.22 Variable Selection

Considering the short timeframe, we decided to limit our investigations to eight financial ratios selected from five classes (Loth, 1999). He classified financial ratios into the following categories; liquidity ratios, debts ratios, profitability ratios, investment ratios and operating ratios. However, investment ratios (such as price per earnings ratio, price-to-book value ratio and dividend yield) were not included in our investigation because they are driven by the market speculations; they are very sensitive to market bubbles. The eight financial ratios based on their categories include;

Table 2: List of explanatory variables

Categories	Selected financial ratios
1. Liquidity ratios	Current ratios labeled as CACL Quick ratios labeled as LACL
2. Debt ratios	Debt to equity ratio labeled as TDTE Gearing ratio labeled as LTDTE
3. Profitability ratios	Operating margin labeled as OPTO Return on capital employed labeled as NPTE
4. Operating or activity ratios	Days receivable outstanding labeled as CSTS Sales-total assets ratio labeled as TSTA

These explanatory variables were also selected because they have been found significant in previous studies dealing with corporate failure. Some of them were used in Beaver's (1966) univariate study and in Altman (1983) z-score multivariate study. The choices of variables were also based on the researchers' value judgement. The ratios were then computed using relevant data extracted from the corporate financial reports.

3.3 Model Specification

The dependent variables used in the analytical models have been computed using the following mathematical formulae;

Table 3: Definition of explanatory variables

- | | |
|---|---|
| 1. $CACL = \text{Current Assets} \div \text{Current Liabilities}$ | 5. $OPTO = \text{Operating Profit} \div \text{Turn-Over}$ |
| 2. $LACL = \text{Liquid Assets} \div \text{Current Liabilities}$ | 6. $NPTA = \text{Net Profit} \div \text{Total Assets}$ |
| 3. $TDTE = \text{Total Debts} \div \text{Total Equity}$ | 7. $CSTS = (\text{Credit Sales} \div \text{Total Sales}) * 365 \text{days}$ |
| 4. $LTDTE = \text{Long-Term Debt} \div \text{Total Equity}$ | 8. $TSTA = \text{Total Sales} \div \text{Total Assets}$ |
-

BK is a dummy variable, also used as a dependent variable; defined as one if a statistical claim is true, zero otherwise. In other words, BK is defined as one if a test indicates bankruptcy for a bankrupt firm and zero otherwise.

Group 1 and Group 2 represent groups of bankrupt and active firms respectively.

Three statistical tests were performed on Group 1 and Group 2 companies in order to deduce different relationships between variables.

3.31 Contingency table

We used contingency tables (CT) to simultaneously analyzed variables such that their relationships could be examined (Bryman and Bell, 2007:361). The CTs would help us identify the pattern of association between each financial ratio and the likelihood of bankruptcy. The results obtained would be used to complement results of other models in ranking variables according to importance.

We expressed BK as a probability function (F) of an explanatory variables (X). We used the mean of the corresponding financial ratio of active firms as a benchmark for evaluating the financial ratios of individual bankrupt firms. Their probabilities were calculated using the sum of the distribution that group 1 will have if F(X) is true.

For hypotheses:

$$H1, H2, H5, H6 \cap H8, \quad BK = F(X) = \begin{cases} 1: X_1 i < \bar{X}_2 \\ 0 \end{cases}$$

$$H3, H4 \cap H7, \quad BK = F(X) = \begin{cases} 1: X_1 i > \bar{X}_2 \\ 0 \end{cases}$$

$$p = \frac{1}{n_1} \sum_{i=1}^{n_1} BK$$

where, $0 \leq p \leq 1$

$X_1 i$ = the value of a financial ratio of i^{th} firm in group 1

\bar{X}_2 = the mean value of a financial ratio of group 2 firms

n_1 = number of bankrupt firms (n_2 = number of active firms and $n_1 = n_2 = 52$)

As $p \rightarrow 1$, Association between the variable, X and bankruptcy, F(X) increases. Hence, we expect most significant variables to have higher P-values.

As $p \rightarrow 0$, Association between X and F(X) decreases. Based on the CTs; variables with probability values less than 0.5 are considered insignificant.

3.32 Correlation Coefficient

Pearson Product Moment Correlation (simply Pearson's Correlation) Coefficient– PMCC is used to examine the linear relationship between the explanatory variables of group 1 and group 2 firms. This correlation or collinearity test is used to substantiate the fact that the financial ratios of bankrupt and active firms differ significantly in their behaviour (Ohlson, 1980; Horrigan, 1965).

We calculated Pearson correlation coefficients, r using the built-in functions of Microsoft Excel and performed test for the significance of r to obtain their corresponding level of significance.

Moore (2006) expressed the correlation coefficient as;

$$r = \frac{\sum_{i=1}^n (X_1 i - \bar{X}_1)(X_2 j - \bar{X}_2)}{\sqrt{\sum_{i=1}^n (X_1 i - \bar{X}_1)^2} \sqrt{\sum_{j=1}^n (X_2 j - \bar{X}_2)^2}}$$

where, $-1 \leq r \leq 1$

r = coefficient of correlation between variables X_1 and X_2

$X_1 i$ = the value of a financial ratio of an i^{th} firm in group 1

\bar{X}_1 = the mean value of a financial ratio of group 1 firms

$X_2 j$ = the value of a financial ratio of an j^{th} firm in group 2

\bar{X}_2 = the mean value of a financial ratio of group 2 firms

$\sum_{i=1}^n (X_1 i - \bar{X}_1)^2$ = sum of deviations from mean

$n = n_1 = n_2$ = the sample size of group 1 = sample size of group 2

As $r \rightarrow 0$, Correlation between variables X_1 and X_2 gets weaker and $r = 0$, indicate that variables are not correlated. Therefore as r approximate to zero, correlation between the variables become insignificant and the variables are said to be non-collinear.

More so, r values are statistically significant if and only if their critical values do not exceed the basic 5% level. Therefore, non-collinearity could also be explained in terms of the critical values of r ; with non-related variables having critical values greater than the fundamental 5% level.

3.33 The Mann-Whitney U Test

The Mann-Whitney U (MWU) test (also known as the rank sum test) is the most valuable test that we used in either rejecting or accepting our hypothesis. The test is often used when the assumptions required for the parametric tests are not met; usually a normal distribution. According to the central limit theorems, convergence to normal approximation is of no consequence for large samples (Billingsley, 1995) with both n_1 and n_2 greater than 10 (Amir, 1999).

The computational procedure of the large sample test statistics is as follows:

The U statistics is given as

$$U = n_1 n_2 + \frac{n_1(n_2 + 1)}{2} - R_1$$

Where,

R_1 = Sum of ranks of a financial ratio of group 1 firms

The mean of the distribution of U is given as

$$E(U) = \frac{n_1 n_2}{2}$$

The standard deviation of U is

$$\sigma_U = \sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}}$$

The large sample test statistics is given as;

$$Z = \frac{U - E(U)}{\sigma_U}$$

Source: (Amir, 1999)

Decision rule:

1. The level of significance of the test is often at $\alpha = 0.01$ or 0.05
2. For a right tailed test, we reject the null hypothesis, H_0 if $Z > Z_\alpha$

3. If test is left tailed, reject H_0 if $Z < Z_{\alpha}$

The P - values linked to the various test statistics Z represent mere chance probability of ending up with a value of Z falling beyond the rejection region. For example, we expect most significant variables to have $P \leq 0.01$. This means we are prepared to accept H_0 with a risk level of 1 in 100, that the results may have occurred by chance (Bryman and Bell, 2007). It represents the risk of accepting H_0 when it is false. The smaller the level of significance, α , the smaller the P - value and the better the test result. Hence, most significant variables would have lower P - values.

Therefore in addition to the decision rules listed above, a major criteria for selecting most significant explanatory variables would be based on their P - values.

3.4 Evaluation of Research

The qualitative characteristics of this research study would be evaluated using the accuracy of the methodological approaches. Two important criteria that would be evaluated are reliability and validity.

3.41 Reliability

Reliability is concerned with replication and consistency. That is, would similar results be obtained if the study is repeated by another researcher? For a study to be reliable, it must be replicable by another researcher. However, replication is only possible if the research procedures are spelt out in details. Our study is replicable, consistent and reliable since the scientific procedures employed have been motivated and explained in details. Moreover, our source of data is secondary (archival) which is a more stable data not affected by time fluctuation. Conversely, studies that use primary data (especially if gathered using questionnaires) are often faced with replication and reliability problems since there is high probability that the measures for a sample of respondents fluctuate over time.

3.42 Validity

The validity is concerned with the integrity of the conclusions generated from a study (Bryman and Bell, 2007). We distinguished between internal and external validity. Internal validity is concerned mainly with issues of causality; how confident are we that a financial ratio is related to the likelihood of bankruptcy? Therefore internal validity is satisfied if the results obtained from this study actually indicate significant financial ratios for predicting bankruptcy. Internal validity will be evaluated using the predictive accuracy or level of significance of our statistical test; type I and type II errors.

External validity is concerned with generalization; if the results obtained from this study could be generalized beyond our study sample. Unlike internal validity, external validity is evaluated based on the sample selection criteria. We used different measures in selecting our sample which is composed of firms of different industrial sectors (exception of the financial intermediaries for obvious reasons). We therefore used representative samples which necessitate generalization of our research findings.

		Type I α	Type II β
P-level	0.05	Greater Risk	Lower Risk
	0.01	Lower Risk	Greater Risk

Figure 2: Type I and type II errors

Source: Bryman & Bell (2007:370)

Where α = risk of rejecting the null hypothesis when it should be confirmed

β = risk of confirming the null hypothesis when it should be rejected

CHAPTER FOUR

4. PRESENTATION OF DATA AND ANALYSES OF RESULTS

In this chapter, the descriptive statistics of explanatory variables for both bankrupt and active firms will be presented and discussed. Empirical results obtained from statistical models will also be tabulated and analyzed.

4.1 Descriptive Statistics of Explanatory Variables

Table 4 reports the descriptive statistics of explanatory variables for group 1 and group 2 firms. It shows the general relationship and differences in the financial ratios of bankrupt and active firms.

<i>Table 4: Descriptive statistics of explanatory variables</i>												
VAR.	Bankrupt firms ($n_1 = 52$)					Active firms ($n_2 = 52$)					Sample ($N = 104$)	
	Mean	S.D	Median	Min.	Max.	Mean	S.D	Median	Min.	Max.	Mean	S.D
CACL	1.179	0.503	1.133	0.292	2.474	1.787	2.021	1.422	0.131	14.236	1.483	0.43
LACL	0.928	0.425	0.923	0.221	2.352	1.477	1.937	1.11	0.013	14.219	1.203	0.388
TDTE	118.813	154.41	60.205	3.075	639.8	96.416	197.309	33.505	0.954	1046.43	107.616	15.835
LTDTE	35.017	72.089	9.02	0	337.025	92.998	513.543	1.412	0	3684.571	64.008	40.999
OPTO	-0.118	0.273	-0.018	-1.254	0.118	0.059	0.104	0.048	-0.111	0.549	-0.03	0.125
NPTA	-0.264	0.625	-0.006	-3.353	0.192	0.053	0.095	0.032	-0.258	0.323	-0.106	0.224
CSTS	50.175	39.131	45.341	0.148	245.381	43.513	28.394	38.617	0.009	125.54	46.844	4.711
TSTA	2.601	1.517	2.522	0.456	8.613	2.284	1.195	2.187	0.133	5.946	2.443	0.224

The mean of liquidity ratios CACL and LACL are 1.179 and 0.928 for bankrupt firms and 1.787 and 1.477 for active firms. These values of CACL are fairly good for both group 1 and group 2 firms. However, they indicate that on average, healthy firms are more likely to repay their short term debts obligations using cash or near cash assets than firms that are likely to go bankrupt. The value of LACL for bankrupt firms is less than 1.00, indicating that they cannot pay their current debts with their most liquid assets.

The mean of the debt ratio TDTE is 118.813 and 96.416 for group 1 and group 2 firms respectively. These values indicate that both bankrupt and active firms were predominantly financed by debt. The median shows values of 60.205 and 33.505 and also corroborate the fact that the operations of both groups of firms were more or less financed with debt than shareholders' fund. The mean of the debt ratio LTDTE for bankrupt firms (35.017) is lower than that of active firms (92.998).

Like TDTE, LTDTE also indicate high debt compared to shareholders' equity for both groups of firms. Comparing the values of TDTE and LTDTE showed that the liabilities of most firms that went bankrupt were short term. Based on these values, we suggest that most financially distressed firms had practiced debt restructuring by replacing their long term interest bearing debt with short term (interest bearing) obligations. If we go by their medians, we realized the results are contrary to those shown by their mean values; group 2 firms show better results (1.412) than group firms (9.020). This difference is accounted for by the skewed nature of financial ratios.

Table 4 also showed that the mean of profitability ratios OPTO and NPTA are -0.118 and -0.264 for group 1 firms and 0.059 and 0.053 for group 2 firms. Negative values for group 1 firms indicate that they were unable to break even their operating costs; that their operating expenses were in excess of revenue. The positive values of active firms indicate that despite the difficult economic situation of distressed periods, they managed to generate revenue in excess of costs. However, profitability ratios such as OPTO may depend on the type of industry or on the growth stage of the firm. Note that some industries have high profit margin than others.

The mean of CSTS ratio for bankrupt and active firms are 50.175 and 43.513 respectively. These values indicate that on average, financially distressed firms take approximately 50 days to recover cash from credit sales as supposed to 44 days for healthy firms. The values for both groups of firms are fairly high. The lower value for group 2 firms also showed that their risk associated with bad debts is lower and therefore benefits from cash flow than group 1 firms. Lower CSTS may also be implied that group 2 firms have better debt control measures than group 1 firms.

The mean of TSTA ratio of bankrupt firms (2.601) is lower than that of active firms (2.284). This signifies that group 2 firms are more profitable than group 1 firms. It also indicates that smaller investments are needed for group 2 firms than in group 1 firms to generate sales from its total assets. Despite the usefulness of this operating ratio, it could give misleading results and therefore should be interpreted with care. If TS and TA decrease proportionately, the ratio TSTA may still indicate plausible performance. More so, the increase in TSTA may also be caused by a decrease in the capital assets base; for example failure to maintain fixed assets or significant drop in inventory levels (Barry and Jamie, 2002:642).

4.2 CT Test for Explanatory Variables

Table 5: CT test for explanatory variables

Variables	No. Predicted	Observed P-value	Percent Correct	Percent Error
CACL	46	0.885	88.5	11.5
LACL	47	0.904	90.4	9.6
TDTE	4	0.077	7.7	92.3
LTDTE	21	0.404	40.4	59.6
OPTO	47	0.904	90.4	9.6
NPTA	46	0.885	88.5	11.5
CSTS	29	0.558	55.8	44.2
TSTA	21	0.404	40.4	59.6

Table 5 reports results of Contingency Table test for the significance of financial ratios. Test using CACL and NPTA showed that of the 52 bankrupt firms, 46 were predicted as bankrupt while 6 were classified as active recording a percentage error of 11.5. The test yield better results for LACL and OPTO since they indicated bankruptcy for 47 bankrupt firms with error of 9.6 percent. The independent variable CSTS predicted 29 bankrupt firms as bankrupt with error of up to 44.2 percent.

Conversely, the test rejects three explanatory variables as not associated to financial distress. The financial ratios; LTDTE, TSTA and TDTE failed to classify 50 percent (less than 26 firms) of bankrupt firms into group 1. LTDTE and TSTA indicated bankruptcy for 21 bankrupt firms with high error of 59.6 percent. Based on the CT test, we rank the ratios in order of importance thus; OPTO, LACL, NPTA, CACL, CSTS, LTDTE, TSTA and TDTE.

4.3 Collinearity Test between Explanatory Variables

Table 6 shows bivariate correlations between independent variables of bankrupt and active firms. The diagonal reports Pearson's correlation coefficient (r) between the financial ratios of group 1 and group 2 firms. The horizontal and vertical axes represent the financial ratios of group 1 and group 2 firms. The extreme right end reports their p-values.

Table 6: PMCC – Collinearity test between explanatory variables

VAR.	CACL	LACL	TDTE	LTDTE	OPTO	NPTA	CSTS	TSTA	<i>p-values</i>
<i>CACL</i>	-0.038								(0.789)
<i>LACL</i>		-0.037							(0.794)
<i>TDTE</i>			0.081						(0.568)
<i>LTDTE</i>				-0.067					(0.637)
<i>OPTO</i>					0.133				(0.347)
<i>NPTA</i>						-0.201			(0.153)
<i>CSTS</i>							-0.089		(0.530)
<i>TSTA</i>								-0.008	(0.955)

The correlation coefficient of all eight variables approximate to zero and their p-values are greater than the upper limit of the basic significant (0.05) level. The p-values indicate high risk level of accepting that variables of group 1 and group 2 firms are correlated when they are not actually correlated. For example, p-value of 0.789 means there is approximately 79% chance of accepting that the explanatory variable CACL of group 1 and group 2 firms are correlated when they are not. These results indicate insignificant correlation or non-collinearity between the financial ratios of groups 1 and 2 firms. The non-collinearity test also signifies that there were no external effect on the financial ratios of group 1 and group 2

firms. That the financial ratios were responsible for the distressed and healthy status of group 1 and group 2 firms.

4.4 Univariate Test of Explanatory Variables

Table 7 reports Mann-Whitney Univariate test for continuous variables; p- values are one tailed. The test rejects two of the eight null hypotheses indicating that neither CSTS nor TSTA are related to bankruptcy. The other six explanatory variables are significant at 0.01 levels. In details, the results²⁰ indicate that the financial ratios NPTA, OPTO and LACL are significant below the basic 0.01 level. This means that we prepared to accept the null hypotheses with a risk level of less than 1 percent that the results may have occurred by chance. The other single predictor ratios; LTDTE, CACL and TDTE are significant a bit above 0.01 levels.

Table 7: MWU- Univariate test of explanatory variables

VAR.	Ho	Predicted sign	Test statistics Z	p-value
CACL	H1	+	2.041	(0.0206)
LACL	H2	+	2.633	(0.0042)
TDTE	H3	+	-1.931	(0.0267)
LTDTE	H4	+	-2.178	(0.0147)
OPTO	H5	+	-4.726	(0.0000)
NPTA	H6	+	-5.191	(0.0000)
CSTS	H7	-	0.8	(0.2119)
TSTA	H8	-	-0.965	(0.1673)

Based on the degree of significance of the financial ratios as reported by MWU-test, we rank the six significant ratios thus; NPTA, OPTO, LACL, LTDTE, CACL and TDTE.

²⁰ P-values reported on table 7 have been approximated to four decimal places. The test gives lower p-value for NPTA than OPTO. This explains why the former is ranked first.

4.5 Ranking Single Financial Ratios

Since the CT-test has lower validity (greater risk) than MWU-test, the final ranks of the financial ratios would be principally based on the results obtained from the MWU-test. However, the CT would give valuable results when used to test established multivariate models. Note that the best three single predictor ratios for both MWU and CT-test are the same. The only difference is in the order of their ranks.

Table 8: Ranking significant single predictor financial ratios

Ranks	MWU	CT	Most significant
1 st	NPTA	OPTO	NPTA
2 nd	OPTO	LACL	OPTO
3 rd	LACL	NPTA	LACL
4 th	LTDTE	CACL	LTDTE
5 th	CACL	CSTS	CACL
6 th	TDTE	-	TDTE

From table 7, MWU- test showed that activity ratios CSTS and TSTA are insignificant indicators of corporate distress. On the contrary, the results of the CT- test as shown on table 5 indicate that debt ratios TDTE and LTDTE are insignificant indicators of corporate failure. The difference in results is because in constructing the contingency tables we evaluated the financial ratio of each group 1 firm against the mean values of the same financial ratio of group 2 firms. This benchmark is not as good as we expected since some firms in group 2 like those in group 1 were highly leveraged. This creates extreme values for debts ratios which affects the benchmark and hence the test results.

More so, the CT test is less valid than the MWU-test when used in univariate studies though it may give results similar to those of MWU-test as observed for the three best bankruptcy indicators. Because of this limitation of the CT-test, we therefore used a more scientific MWU-test in ranking significant bankruptcy indicators.

CHAPTER FIVE

5.1 SUMMARY AND CONCLUSIONS

This study seeks to examine the extent to which financial ratios are associated to financial distress and to deduce most significant bankruptcy prediction single ratios. The 1998 financial distress in the Swedish market was exploited and matched pair of bankrupt and active firms were selected and investigated during the 2002 post distress period. We used equal number of bankrupt and active firms in order to minimize type I errors of the statistical models.

The study reveals that profitability ratios, liquidity ratios and financial leverage ratios are the most significant ratios for predicting the probability of bankruptcy. The significant financial ratios are ranked based on their predictive ability with the ratios of net profit to total assets ranked first, operating profit to turnover second, liquid assets to current liabilities (quick ratio) third, long term debt to total equity, current assets to current liabilities and total debts to total equity ranked fourth, fifth and sixth respectively.

These results are consistent with those of previous studies that explained business failure using financial ratios. Prior studies indicate that companies are more likely to go bankrupt if it suffers depleting profitability, high leverage, and liquidity problems. Leverage, profitability and liquidity ratios are highly associated to corporate failure (Wruck, 1990; Haniffa and Cooke, 2002; Parker et al., 2002; Zororo, 2006). Other univariate and multivariate studies also indicated that different profitability, leverage and liquidity ratios are highly associated to bankruptcy.

Findings also showed that debtors' collection period (CSTS) and sales-total assets (TSTA) ratios are not related to bankruptcy. Hence, the assumption that companies with high CSTS are more likely to go bankrupt is refuted. Therefore high debtors' collection period does not necessarily mean a company is inefficient or that it has potential bad debts. Increasing CSTS might mean that a company has adopted a strategy for attracting new customers (Barry and Jamie, 2002:646) by allowing longer collection period.

More so, the claim that companies with low or decreasing sales to total assets (TSTA) ratio are more likely to go bankrupt is rejected. Altman (1968) also found out that based on univariate test, the ratio of TSTA is insignificant in predicting the probability of bankruptcy. Increase in TSTA does not necessarily mean a company has credible performance. The increase might be caused by decrease in total assets as a result of written down obsolete inventories which is a loss to the company.

We arrived at the following conclusions; firstly, that financial ratios are useful and will provide valuable decision making information about a business if used intelligently and with good judgement. Further investigations may be required to determine why certain ratios fluctuate. Secondly, the predictive ability of financial ratios is discriminative; some financial ratios are more powerful indicators of bankruptcy than others irrespective of their categorization. Thirdly, univariate statistical test is crucial in generating most significant single bankruptcy ratios. Last but not least, financial ratios are related to each other and a combination of financial ratios will do a better job than a single predictive bankruptcy ratio. These explains why Altman (1968) and other researchers of the multivariate model assigned different weights to financial ratios in their bankruptcy models.

5.2 RECOMMENDATIONS

We should be aware of the fact that at times the signs of a major financial distress and the bankruptcy events manifest within a very short time (12 months or even less) such that the predictive ability of financial ratios become temporarily redundant. This situation is common during an unexpected recession. Nonetheless, financial ratios would give vital information to different stakeholders under normal operating and financing business atmosphere.

If used in credit rating or in evaluating companies' performance, financial ratios should be complemented with other non-financial measures. Studies indicate that financial measures encourage corporate management to give up long term profitable projects for short term financial results. Management tends to use creative accounting to prop up financial ratios when results are poor and predefined targets difficult to achieve.

5.3 SUGGESTIONS FOR FURTHER RESEARCH

As limitations; we did not take into account industry differences in our analyses. Moreover, the sample sizes were composed of more small and medium sized firms which characterized the Swedish market. This may affect generalization of results. Also, our prediction was based on a single year financial reports and therefore could be misleading as some ratios may show large annual variations. A few firms had extreme values of financial ratios which may have impede on the test results.

Subsequent studies should attempt to get rid of the aforementioned limitations. This study could be extended by increasing the number of financial ratios investigated and also by including about two to three years in the analysis so as to incorporate annual fluctuations of certain financial ratios. Parametric statistical tests such as the t-test could be performed to see if similar results would obtain. More so, this univariate study could be extended into a multivariate bankruptcy study either by using multiple discriminant analysis or non-linear models.

Using multiple discriminant analysis, one could assign different coefficient to the set of most significant ratios obtained from the univariate statistical test. Further analysis could then be performed on the weighted financial ratios in order to develop a potential multivariate bankruptcy model. Non-linear models such as logit and probit models could also be used in deriving different variables which are associated to the likelihood of bankruptcy.

We noticed that during the financial distress periods, a good number of mergers and acquisition transactions were recorded in addition to high rate of liquidation and delisted firms at the Stockholm Börsen (Stockholm Stock Exchange - SSE). According to SSE statistics of delisted firms in 2001, over 22 M&A transactions were recorded in 2001. Another study may investigate the relationship between financial distress and M&A deals. That is, if firms operating and financing difficulties are related to M&A transactions.

REFERENCES

- Altman, E. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. *Journal of Finance*, vol. 23 No. 4, pp.589-609.
- Altman, E. et al. (1974). Financial and Statistical Analysis for Commercial Loan Evaluation: A French Experiment. *Journal of Financial and Quantitative Analysis*, vol. 9 No. 2, pp.195–211.
- Altman, E., Halderman, R., and Narayanan, P. (1977). Zeta Analysis: A New Model to identify Bankruptcy of Corporations. *Journal of Banking and Finance*, vol. 1 pp. 29–54.
- Altman, E. (1983). *Corporate Financial Distress: A Complete Guide to Predicting, Avoiding & Dealing with Bankruptcy*. John Wiley & Sons Inc.
- Altman, E. (1992). *Corporate Financial Distress and Bankruptcy: A Complete Guide to Predicting & Avoiding Distress and Profiting from Bankruptcy*. 2nd edn. John Wiley & Sons Inc.
- Altman, E. et al. (1994). Corporate Distress Diagnosis: Comparison using Linear Discriminant Analysis and Neural Networks (the Italian experience), *Journal of Banking and Finance*, vol.18, pp. 505–529.
- Altman, E. (1998). *Bankruptcy and Distressed Restructurings: Analytical Issues and Investment Opportunities*. Beard Books.
- Altman, E. (2000). *Predicting Financial Distress of Companies: Revisiting the Z-Score and Zeta ® Models*. (Supplement: Altman, E., 1968: Altman, E., Halderman, R., and Narayanan, P., 1977). Stern School of Business, New York University.
- Amemiya, T. and Powell, L. (1983). A Comparison of the Logit Model and Normal Discriminant Analysis when Independent Variables are Binary, in: Karlin et al. (eds) *Studies in Econometric, Time Series, and Multivariate Statistics*, pp. 3-30 (New York Academic Press).
- Amir, A. (1999). *Complete Business Statistics*. 4th edn. McGraw Hill
- Barker, D. (1990). *Analysing Financial Health: Integrating Neural Networks and Expert Systems*, PC AI, vol. 4, No.3, pp. 24-27.
- Barry, E. and Jamie, E. (2002). *Financial Accounting, Reporting and Analysis*. Prentice Hall. International Edition. Pp. 637–685.
- Beaver, W. (1966). Financial Ratios as Predictors of Failure. *Empirical Research in Accounting. Journal of Accounting Research (selected Studies)*, vol. 4, pp. 71-111.
- Bergevin, P. (2002). *Financial Statement Analysis: an Integrated Approach*. Prentice Hall.
- Billingsley, P. (1995). *Probability and Measure*. 3rd edn. John Wiley & sons.
- Bryman, A. & Bell E. (2007). *Business Research Methods*. 2nd edn. Oxford University Press.
- Coats, P. and Fant, L. (1993). Recognising Financial Distress Patterns using the Neural Network Tool. *Financial Management*, vol. 22, pp. 142-155.
- David, A, Anne B, & Ann, J. (2007). *International Financial Reporting and Analysis*. 3rd edn. Thompson learning.

Deakin, E. (1972). A Discriminant Analysis of Predictors of Business Failure. *Journal of Accounting Research*, vol. 10 No.1, pp. 167-179.

Edmister, R. (1972). An Empirical Test of Financial Ratio Analysis for Small Business Failure Prediction. *Journal of Financial and Quantitative Analysis (Suppl.)*, vol.7, No. 2, pp.1477-1493.

Eisenbeis, R. (1977). Pitfalls in the Application of Discriminant Analysis Business, Finance, and Economics. *Journal of Finance*, vol. 32 No. 3, pp. 875-900.

Grice, J. S. and Dugan, M. T. (2001). The Limitation of Bankruptcy Prediction Models: Some Cautions for the Researchers. *Review of Quantitative Finance and Accounting*, vol. 17 No. 2, pp. 151-166.

Haniffa, R. M. and Cooke, T.E. (2002). Culture, Corporate Governance and Disclosure in Malaysian Corporations. *Abacus*, vol. 38 No. 3, pp. 317-349.

Horrigan, O.J. (1965). Some Empirical Bases of Financial Ratio Analysis. *The Accounting Review*, Vol. 40 No. 3. American Accounting Association. pp. 558-568.

Kilman, R. H. and Coven, T. J. (1988). *Corporate Transformation. Revitalizing Organisations for a Competitive World*. Jossey-Bass, St. Francisco, USA.

Laeven, L. and Valencia, L. (2008). Systemic Banking Crises: A New Database, IMF Working Paper No. 08/224. pp. 26-48

Lennox, C. (1999). Identifying Failing Companies: A Re-evaluation of the Logit, Probit and DA Approaches. *Journal of Economics and Business*, vol. 51 No. 4, pp. 347-364.

Loth, R. (1993). *How to Profit from Reading Annual Reports*. Chicago: Dearborn.

Loth, R. (1999). *Select Winning Stocks using Financial Statements*. Chicago: Dearborn.

Marose, R. (1990). A Financial Neural-Network Application. *AI Expert*, vol. 5 No. 5, pp.50-53.

Martin, D. (1977). Early Warning of Bank Failure: A Logit Regression Approach. *Journal of Banking and Finance*, vol. 1 pp. 249-276.

Meyer, P. and Pifer, H. (1970). Prediction of Bank Failures. *Journal of Finance*, vol. 25, No. 4, pp. 853-868.

Mohd-Nasir, N. and Abdulah, S.N. (2004). Voluntary Disclosure and Corporate Governance among Financially Distressed Listed Firms in Malaysia. *Financial Reporting, Regulation and Governance*, vol. 1 No.1, pp.95-139.

Moore, David (2006). *Basic Practice of Statistics*. 4th edn. WH Freeman Company.

Neves, J. C. and Vieira, A. (2006). Improving Bankruptcy Prediction with Hidden Layer Learning Vector Quantization *European Accounting Review*, vol. 15 No.2, pp. 253-271.

Ohlson, J. (1980). Financial Ratios and the Probabilistic Prediction of Bankruptcy. *Journal of Accounting Research*, vol. 18 No. 1, pp. 109-131.

Parker, S., Peters, G.F. and Turetsky, H.F. (2002). Corporate Governance and Corporate Failure: A survival Analysis. *Corporate Governance: International Journal of Business in Society*, Vol. 2 No. 2, pp. 4-12.

- Perry, C. (1998). Processes of a Case Study Methodology for Postgraduate Research in Marketing. *European Journal of Marketing*. pp. 785-802.
- Polesie, T. (1991). Continuity and Change: Corporate Identity in a Scandinavian Perspective. BAS, Gothenburg School of Economics. Pp. 15 – 27.
- Press, S. and Wilson, S. (1978). Choosing Between Logistic Regression and Discriminant Analysis. *Journal of the American Statistical Association*, vol. 73 No. 364, pp. 699-705.
- Rees, W. (1995). *Financial Analysis*. 2nd edn. Prentice Hall.
- Richard, C. B. & Mark, S. B. (1997). Interpretive and Critical Research in Accounting: A Commentary on its Absence from Mainstream Accounting Research. *Critical Perspectives on Accounting*. Vol. 8 No. 4, pp. 293-310
- Richards, L. (1993). Writing a Qualitative Thesis or Grant Application. In *So Where's Your Research Profile? A Resource Book for Academics*. K. Beattie edn. South Melbourne: Union of Australian College Academics.
- Soffer, L. & Soffer, R. (2003). *Financial Statement Analysis: A Valuation Approach*. Prentice Hall.
- Stickney, C. P. (1996). *Financial Reporting and Statement Analysis. A Strategic Perspective*. 3rd Edition. Ft. Worth, TX: The Dryden Press.
- Taffler, R. (1982). Forecasting Company Failure in the UK Using Discriminant Analysis and Financial Ratio Data. *Journal of the Royal Statistical Society. Series A (General)*, vol. 145 No. 3, pp. 342-358.
- Tan, C. and Dihadjo, H. (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*, vol. 27 No. 4, pp. 56–77.
- Wigton, J. (1980). A Note on the Comparison of Logit and Discriminant Models of Consumer Credit Behavior. *Journal of Financial and Quantitative Analysis*, vol. 15 No. 3 pp. 757-770.
- Wilson, R. and Sharda, R. (1994). Bankruptcy Prediction using Neural Networks. *Decision Support Systems*, vol. 11 No. 5, pp. 545–557.
- Wruck, K. H. (1990). Financial Distress Reorganisation and Organisation Efficiency. *Journal of Financial Economics*, vol. 27 No. 2, pp. 419–444.
- Yang, Z. R., Platt, M., and Platt, H. (1999). Probabilistic Neural Networks in Bankruptcy Prediction. *Journal of Business Research*, vol. 44 No. 2, pp. 67–74.
- Zavgren, C. (1983). The prediction of Corporate Failure: The State of the Art. *Journal of Accounting Literature*, vol. 2, pp. 1–38.
- Zmijewski, E. (1984). Methodological Issues Related to the Estimation of Financial Distress Prediction Models. *Journal of Accounting Research*, vol. 20, pp. 59-82.
- Zororo, M. (2006). Financial Distress and Corporate Governance in Zimbabwean Banks. *Journal of Corporate Governance*, vol. 6 No. 5, pp. 643 - 654.

APPENDIX

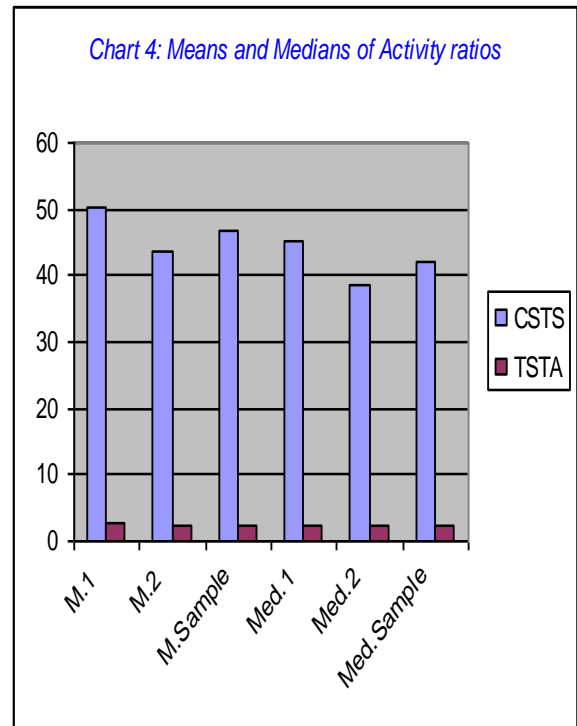
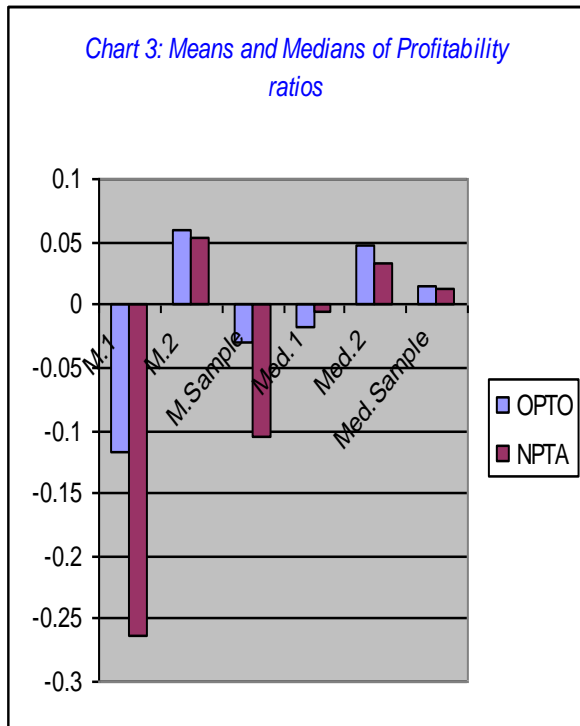
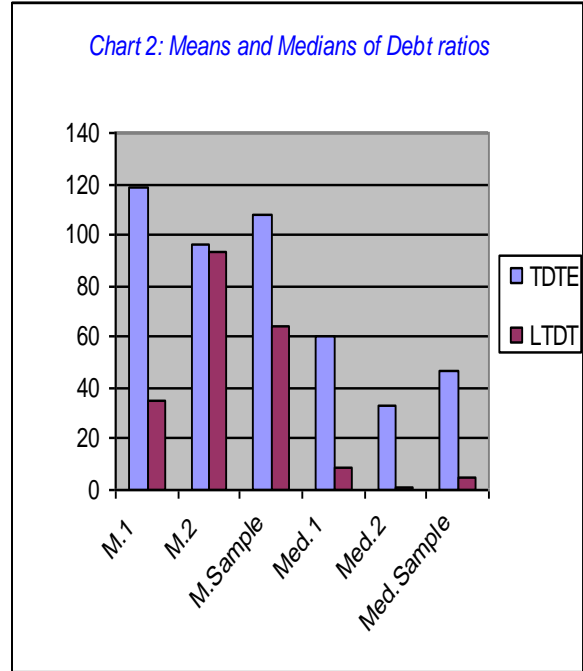
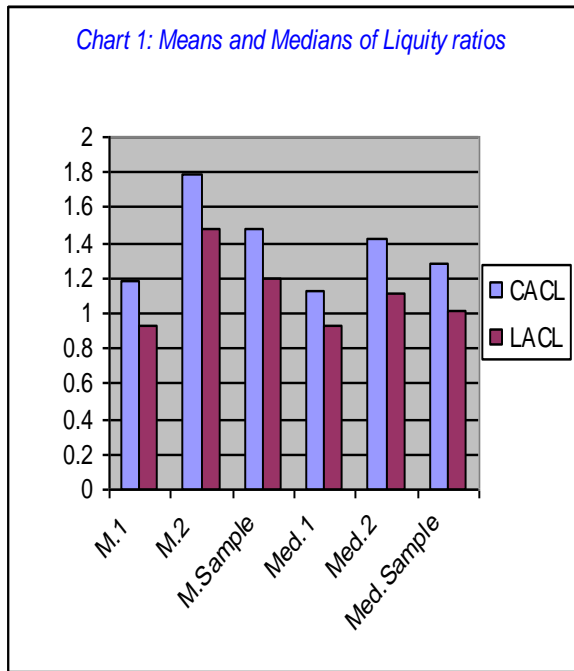


Table 9: List of sampled active and bankrupt firms

#	Org. Num.	Active Firms	Org.Num	Bankrupt Firms
1	5564678760	Akademiska Hus i Göteborg AB	5564470960	Ansvar Bemanning AB
2	5562259951	Alab Aluminiumsystem AB	5561444075	Arete Systemering AB
3	5560514571	Amadeus Scandinavia AB	5565805651	Colony101 Sverige AB
4	5565364469	Asplunds Bygg i Örebro AB	5560946823	Eckerud Exhibits AB
5	5561520916	ALcontrol AB	5563291417	Eiknes SI AB
6	5565203105	Bygg och Miljö i Östergötland AB	5562874239	Fagerö Konsult AB
7	5562365568	Byggnadsingenjör Nils Skoglund AB	5563251767	FT Formtech AB
8	5564840303	Carmen Systems AB	5564445145	Gremo Svenska AB
9	5563078517	Computer Associates Sweden AB	5564784451	Halogen Sverige AB
10	5560663196	Arcona AB	5560726886	HÅJO Manskap & Maskiner AB
11	5562859370	Bengt Dahlgren AB	5565562237	IKUSE Konsult AB
12	5564476140	BTH Bygg AB	5565429163	INSITE Interactive Simulation Technologies i Göteborg AB (publ).
13	5560113465	F.O. Peterson & Söner Byggnadsaktiebolag	5562355197	INVID Drift AB
14	5562152024	C.L.C. Installationsconsult AB	5561014159	Isku Svenska AB
15	5564421435	Dabus Dataprodukter AB	5565607008	JeBa Personal i Malmö AB
16	5560571811	Erasteel Kloster AB	5565331773	Jomed i Helsingborg International AB
17	5564701943	Holmbo Production AB	5565720975	Karabao AB
18	5562068741	Hotel Scandic Ariadne AB	5563031722	Kollin & Ström AB
19	5560050121	Höganäs AB	5563060325	Kurt Jonssons Åkeri AB
20	5562548452	Ingram Micro AB	5563075653	Landvetter Buss i Björred AB
21	5563093433	JK Bygg i Göteborg AB	5562121805	Lipperts Mekaniska AB
22	5560937244	KL Industri AB	5560522285	Lundqvist Inredningar AB
23	5565477816	Laholmen Hotell AB	5565395760	Manamind AB
24	5563101889	Ljungsarps Verkstads AB	5565644654	Meridium Sverige AB
25	5563149102	Midroc Engineering AB	5564968278	Modig Machine Tool AB
26	5561315770	Nitro Consult AB	5560243551	Märkes-Kompaniet G-Marknad AB
27	5561677260	Océ Svenska AB	5565051801	Netch Technologies AB
28	5560691924	Outokumpu Nordic AB	5565432746	Norrköping Printed Circuit Board AB
29	5565696043	PIC Engineering AB	5562063387	Onsala Åkeri AB
30	5565260592	ProTang AB (publ)	5563618783	Oxelö Steel AB
31	5561145938	Restaurang Baldakinen i Göteborg AB	5560455346	P A Carlmark, AB
32	5562038637	Rotik AB	5565033247	Razorfish AB
33	5562419134	Sapa Profilbockning AB	5560640608	RemaControl AB
34	5560063637	Scandinavian Service Partner AB	5565794913	Rönaks Kommunikation AB
35	5562291004	Sjölin's Smide AB	5564116118	Satisfactory International AB
36	5560843897	SkansTornet AB	5565126298	Sequenom AB
37	5560996869	SMEKAB AB	5564464344	Sib-tryck AB
38	5563963015	Sofelet Jonathan AB	5562143056	Steens Glas i Forserum AB
39	5565817532	SSRS Stora Hotellet Stadshotellet Örebro AB	5565242418	Strykjärnet IT-Partner AB
40	5564370400	Sturehof AB	5564706645	Swedlam AB
41	5563412476	Sweco Pic AB	5563161842	Svenska Bearing AB
42	5561153601	Svenska Mässan Möten och Hotell AB	5563133916	Svenska Glasbruk AB
43	5563160703	Texor AB	5565125159	TELiTEL AB
44	5564285806	Fastighetsförvaltningsaktiebolag i Haninge	5563010155	Tommy Hellbergs Plåt AB
45	5564859824	Uppsalatolkarna AB	5563617579	TREEAB BYGG AB
46	5563914091	Veidekke Stockholm AB	5564689122	TT-Trans AB
47	5564807401	Winn Hotels Solna AB	5560847609	Töcksfors Verkstads AB
48	5560602921	Wohléns Holding AB	5565397873	Upright Communication AB
49	5566097837	Västsvenska Teater och Dans AB	5565192258	Vadebron AB
50	5560924044	ÅF - System AB	5564094893	Västra Frölunda Byggbemanning AB
51	5560784489	ÅF-Teleplan AB	5563361038	Yngve Nilssons Karosserifabrik AB
52	5565534442	Överums Bruk AB	5563123016	Öresundsvarvet AB