THE PREDICTION OF CORPORATE FAILURE USING PRICE ADJUSTED ACCOUNTING DATA

BY

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DECLARATION

This Management Research Project is my original work and has not been presented for a degree in any other university

Signed ..... Date 21/11/91

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This Management Research Project has been submitted for examination with my approval as university supervisor.

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DEDICATION

To my family

Dad: John Kiragu Gichohi

Mum: Loise Wanjiku Kiragu

Brothers: Kariuki,Mwai, Ndiritu,Karueru,Ndung'u, Waweru and Muruthi

Sisters: Gathoni and Wangeci

For their continued encouragement throughout all the years I was in school.

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While recognising the contribution of the above, errors contained in this project whether of omission or commission remain my responsibility.

ABSTRACT

This study sought to build a model to predict corporate failure using accounting data adjusted for price level changes. The need to predict failure before its actual happening need not be emphasised given that its a "costly" outcome. The General price level index was used to adjust the historical accounting data.

The sample consisted of 10 failed and 10 non-failed companies. The seemingly small sample was a consequence of lack of data availability particulary on the failed companies. This is surely one of the severe limitations of the study. Important financial ratios were calculated from price-level adjusted financial statements. The discriminant model developed from this data showed that nine ratios had a high corporate failure predictive ability. These ratio's in order of importance were Times interest coverage, Fixed Charge coverage, Quick ratio, Current ratio, Equity to total assets, Working capital to total debt, Retained earning to total assets, Change in monetary liabilities, Total debt to total assets and Inventory turnover.

However the most critical ratios were the liquidity and debt service ratios.

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

One of the well known functions of managers is decision making. Decision making involves choosing a course of action from several alternatives. Finance involves three major decision areas, raising funds, allocating these funds to profitable areas and the distribution of resultant earnings to owners. The first decision is known as financing, the second investment and the third dividend decision.

All decisions affect the future. Knowledge about the future is thus of critical importance if sound decisions are to be made. This knowledge is gained through a search for information which includes accounting information. This information is provided by accountants in form of financial statements namely the balance sheet, the income statement and the statement of sources and application of funds among others. Information contained in the financial statement is of interest not only to the share holders but also to other stakeholders such as managers, tax authorities, the Government, creditors, scholars and potential investors. This is in line with the contemporary view of the nature of the firm (the contractual theory) which views a firm as a network of

contracts, actual and implicit which specify the roles of the various participants in the organisation (workers, managers, owners, lenders) and define their rights, obligations, and pay-offs under various conditions.[1]

The information provided in financial reports could be used for a number of purposes. One of the purposes would be to judge the performance of an entity. This is through comparison with other economic entities or with that of its past performance. Another would be to judge how well the directors and managers have carried on their stewardship function. This is in accordance to the second specific use of accounting information stated by Financial Accounting Standards Board (FASB).

> '' *Financial reporting should provide information about the economic resources of an enterprise, the claims to those resources... and the effects of transactions events and circumstances that change its resources and claims to those resources* (FASB: 1978 p. 20-21)

Accounting information may also be used by management to make various internal decisions. It is however noteworthy that managers have a lot more information available to them other than that contained in the financial statements. Accounting informa-

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1. Weston and Copeland, Managerial Finance 8th edition CBS Publishing Japan ltd Chicago 1986 pp. 6

tion may be used by investors to make investment decisions.

Accounting information have been used to predict corporate failure among other predictions. Prediction of corporate failure is of utmost interest to the stakeholders of the company and it is not surprising that a lot of research effort has been carried out. Some of the leading studies have been summarised in the following paragraphs.

Altman (1968) for example used Financial ratios and came up with a multivariate model which could predict occurrence of bankruptcy 94% and 72% correctly one year and two years respectively before its actual occurrence. His model emerged with the following ratios as the most significant as far as bankruptcy prediction was concerned: Working capital to total assets, Retained earning to total assets, Earnings before interest to total assets, Market value equity to book value of total debt and sales to total assets. In yet another study on prediction of corporate failure, Altman and Mcough (1974), carried out an analysis of the relationship between bankrupt companies and auditors reports prior to bankruptcy. Their work resulted in the conclusion that Altman's model can signal going -concern problems earlier than an auditors' opinion in a company that eventually enters bankruptcy.[2] Koh and Killouch (1990)[3] used Financial

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2. Altman Edward and Mcough p. Thomas '' Evaluation of a Company going concern" *Journal of accounting* DECEMBER 1974 51 pp 50- 57.

ratios and came up with a model which could detect going concern problems.The model proved to be more accurate than auditors value judgment.[4] The model recognised the following ratios as being the most important in detecting going concern problems in order of importance: Retained earning to total assets, Dividends per share, Quick ratio and Earning per share. This model had an overall accuracy of 88.25% when it was tested on a holdout sample.[5]

The above and many other studies in the realm of corporate failure prediction used historical cost accounting data. However, a few studies have attempted to use inflation adjusted data. These includes the studies by Ketz (1978), Norton and Smith (1979), Mensah (1983) and Kimura (1982) just to mention a

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3. Koh and killouch "The use of multiple Discriminant Analysis in the assessment of the going concern status of an audit client," Journal of Business Finance and Accounting 17(2) spring 1990 pp179-191

4. Koh and Carry N. Killouch, "The use of multiple discriminant analysis on assessment of the going concern status and audit client". *Journal of Business and accounting* 17(2) Spring 1990 pp. 179- 191

5. Altman Edward and Mcough p. Thomas '' Evaluation of a Company going concern." *Journal of accounting* DECEMBER 1974 51 pp 50- 57.

few.

The conclusions reached thus far, are far from being finite, and the number of researches into this important area are on the increase.

1.2 STATEMENT OF THE PROBLEM

One often stated advantage of a company over other types of business organisations (i.e Sole proprietorship and partnership) is that, its assumed to have a perpetual life. In reality however companies do fail and the assumption of infinite life collapses. This leads to huge losses not only to the share holders but also to the other stakeholders. The share holders as well as other stakeholders therefore are concerned and will look keenly to any sign of probable failure. If failure could be detected early it would be possible to minimise failure associated costs. For example the shareholders could withdraw their investment, the consumers could look for alternative markets; the manager would make turn-around strategies before it is too late, while suppliers could look for alternative markets. Managers may also arrange for the sale of the corporation or even arrange for a take-over. To be able to predict failure each stakeholder seeks information from various sources, the most important being the annual financial statements.

Financial statements can be based on either historical cost accounting systems (conventional accounting) or price-level

adjusted (inflation) accounting data. In the later case changes in value of money are taken into account.

In an environment of changing value of money it is doubtful whether historical cost accounting information provide adequate information to interested parties. This doubt increases especially in developing countries which suffer from hyper-inflation.

A number of studies aimed at comparing the predictive ability of the two sets of data have been carried out. These studies have reported mixed results. Studies carried out by Ketz (1978), Norton and Smith (1987), Mensah (1983) and Keaey and Watson (1986) concluded that inflation accounting was not superior to historical cost accounting. Beaver (1982), Schaefer (1984) and Ohlsen(1985) used security market prices and concluded the same. In contrast, Kimura (1982), Bublitz (1985) found significant additional explanation power of price-level adjusted accounting data. The conclusions arrived at so far therefore fail to show a clear preference of one accounting framework (i.e Historical or price-level) over the other.

The basic problem of this study is one of coming up with a model to predict corporate failure using price adjusted accounting data for kenyan companies. The rate of inflation in kenya has ranged between 10% and 25% over the last ten years (i.e the official rate), although independent bodies (eg. united nations, world-bank, I.M.F and a number of private consulting

firms[6]) think its much higher than that stated by the monetary authorities.

1.3 OBJECTIVES OF THE STUDY

This study is intended to achieve the following objectives,

1. To develop a model using price adjusted accounting data that can be used to predict corporate failure.

2. To identify critical financial ratios with high corporate failure predictive abilities under inflationary conditions.

1.4 IMPORTANCE OF THE STUDY

This study is likely to be of interest to the following,

1. To accounting policy makers who may be interested to know the ability of inflation accounting data to predict corporate failure in the Kenyan environment.

2. Financial analysts who will be able to provide more

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6. See Nation News paper of may 23rd 1991

useful advise to their clients.

3. Scholars who may use this study as a base for further research in the local environment.

CHAPTER 2

LITERATURE REVIEW

The basic objective of financial accounting is the preparation of financial statements in a way that gives a true and fair view of the operating results and the financial position of a business. Only when financial statements present a true and fair view of the operating and financial position of the company can they be of use to decision makers including the prediction of corporate failure.

Two sets of accounting methods exists presently.

1. Historical accounting (conventional accounting).
2. Price adjusted accounting (inflation accounting).

2.1 HISTORICAL ACCOUNTING

This is the conventional method of accounting and has been in use for a long time. It records transactions at their historical cost and provides no adjustments for price changes. Historical Cost Accounting has been strongly advocated for the reasons explained in the following few paragraphs;

Historical cost valuation is the only valuation method that includes as an integral part of its valuation procedure structure on the double-entry book-keeping system. This is an

essential requirements of equity accounting that every actual change in the resource of the entity be recorded.

Historical cost accounting provides data that are less disputable than that provided under other valuation methods currently proposed which is a requirement in equity accounting.

It has also been argued that in refusing to recognize holding gains and loses historical accounting is in line of maintaining the *status quo* which is essential in solving conflict of prices and maintaining order and stability in society.

It provides data for decision making by insightful managers and investors so far as history is basis for predicting the future.[7]

It is also defended on the basis of cost. It is argued that it is the least costly for society considering the social cost of recording, auditing and that of settling disputes.

The historical cost accounting enables the performance of the custodian function very well. It is good to note that this is the most fundamental purpose of accounting (stewardship role). It is therefore argued that since millions of investors are relying upon the custodian function of accounting when they invest in a firm historical accounting system remains useful.

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7. Note: History may, however, have little or no relationship with the future

This is so because it offers very little room if any, for manipulation and the information so prepared is objective and can be relied upon.

Critics of historical accounting point out several weakness.

They contend it does not provide relevant information, it overstates profit leading to over-taxation, and it fails to properly match revenues with their relevant costs, hence distorting the accounting information. These weaknesses were noticed as early as 1920. For example Patron in consideration to this problem concluded that,

> "...it is perhaps not unreasonable to argue that the accountant should prepare supplementary statements at the end of the period to show , by making proper allowance for the change in the value of money the true comparative status of the enterprise....")[8]

In fact, considering the above argument, other types of accounting systems offer good supplements rather than substitutes to historical cost accounting as they are more subject to manipulation and personal judgment.

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8. Littleton and Zimmerman(1920) pp 177.

2.2 ACCOUNTING ADJUSTED FOR PRICE CHANGES

There are two methods of accounting for price changes:

(a) The current purchasing power method or general purchasing power method (CPP).

(b) Current cost accounting method (CCA).

2.2.1 CURRENT PURCHASING POWER

The CPP method uses conversion factors to transform accounts prepared under historical cost basis to price adjusted accounts. Again distinction is made between monetary items and non-monetary items. Under this method only non-monetary items need to be transformed since monetary items are already in current prices at the end of the period. The CPP suffers from the following weakness:

1. It is based on index numbers which are statistical averages. It cannot therefore be applied with precision to individual firms.

2. The selection of the index number is a problem. Different indices have different characteristics. Hoh Katherine (1977) found out that gross method procedure deflator approximates specific price indices in the case of firms with diversified assets while consumer price index was the appropriate index for other.

3. The CPP method deals with general price level and not with changes in individual items except in cases where individual prices happen to move in step with general price index.

2.2.2 CURRENT COST ACCOUNTING

This method requires each item in the financial statement to be restated in the current value. Unlike CPP method no cognizance is taken of general purchasing cost of money. Asset items in the balance sheet are shown at prices in which they would cost at the balance sheet date:

This method has also been found to suffer from the following weaknesses

1. Though CCA takes care of current year's depreciation it fails to provide adequately for backlog depreciation.

2. Also although CCA provides funds for replacing of existing assets it fails to provide for replacement of new type of assets.

3. It ignores gains or losses on monetary items that arise as a result of holding monetary assets and liabilities during a period of changing price levels.

4. CCA is based on the presumption that firms use uniform accounting methods and practice and therefore fails to recognize valuation in accounting method

5. CCA has too much subjectivity. For example it does not

mand any single method of valuation be used. Replacement lue, market price, and net realizable value all qualify to be e current cost of an asset under this method.[9]

Edward and Bell (1962) advocated for the use of placement cost accounting as the primary method of account- g, Chamber (1966) demonstrated and advocated the use of exit ice or the current cost equivalent while Sterling (1970) vocated for the use of exit price model based on realizable lue.

Recognition that the problem of choosing the right model ıld not be solved on apriori grounds only lead to much effort ng put in empirical research.

ARE THE SETS OF ACCOUNT DIFFERENT (HC VS. GPLA)?

IRICAL STUDIES

The main aim of this section is to investigate whether the sets of accounts are the same or different.

Empirical studies in this area were directed to finding out ther adjusting historical accounting data for inflation akes a difference ". They also addressed the question of the

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2.3 ARE THE SETS OF ACCOUNT DIFFERENT (HC VS. GPLA)? EMPIRICAL STUDIES

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significance of the differences .

The following are some of the notable studies:-

Jones (1949) investigated nine steel companies for the period between 1941 -1947. When adjustments were made on the actual historical records to determine the restated values in the financial statements, it was found that in real terms the companies might have been paying dividend out of capital and that recorded decrease in fixed assets were much less than was actually the case when inflation was taken into account. A replication of this study by Jones (1955) came up with similar results . This gives empirical evidence that adjustment for price changes may make a difference in dividend decisions. It is important to remember that this is one of the most important decisions that managers are required to make from time to time.

Dyckman (1969) used simulated financial data for two companies in a field study to assess the magnitude of the difference in investment decision. He divided his subjects into three groups and gave them historical cost(HC), general price level adjusted (GPLA) data and a combination of HC and GPLA respectively. When subjects were asked to estimate the price range of the security's stock using the information provided, the three types of information resulted in different estimates. Dyckman concluded that the statements appeared to make a difference.

Dyckman's findings supports the idea that the sets of

accounting may make a difference in an investment decision. However a laboratory experiment by Heintz (1973) came with contradicting results to those of Dyckman's. Heintz supplied HC, GPLA and both data of three companies to subjects who were required to make estimates of company's end year security prices. In addition the subjects were required to make an hypothetical investment decision in the companies. He found no evidence to support superiority performance of either HC or GPLA data. He found the different sets of data made no difference.

Petersen (1973), reported a study of its kind. He used a computer program developed for the purpose, to adjust financial statements of 65 companies whose information were publicly available for general price level changes. He then calculated the average financial ratios, net income, return on equity and their respective standard deviations. He found that there was significant difference between return on equity, its standard deviation and the standard deviations of income of the two sets of data (HC and GPLA). This study supported the idea that general price adjustments tend to result in a displacement in financial parameters. Petersen however was unable to determine whether the displacement was significant from a decision making point of view or not.

Mckenzie (1975) conducted a similar inquiry to that of Petersen for the airline industry. He calculated seven ratios which he used to rank the nine firms in his sample. He found that

the two sets of data did not lead to significant difference in the ranking. Deninies (1976) tested magnitudes of the difference between HC and GPLA based ratios. He found significant difference between nineteen ratios out of the twenty he had selected. This has been supported by recent studies.

For example Baran, Lakonishok and Ofer (1980) concluded that :

> *"The result obtained appear to support the hypothesis that the price level adjusted data contain information which is not included in the financial report currently provided"*[10]

This may be a reason why the two sets of accounts should be considered as complementary rather than substitutes as they may contain completely different information.

Davidson and Weil (1974) studied the effect of FASB'S exposure draft on price-level adjustments.[11]

By comparing the result with those obtained with HC he reported that the effect of adjusting for purchasing power on

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10. Baran, Aron, J. , Lakonishok and A. R. Ofer. " The information Content of General Price Level Adjusted Earnings: Some Empirical Evindence," *The Accounting Review*, January (1980) pp.34

11. Note The above refers to the " Financial reporting in units of general purchasing power" proposed statement by the financial accounting standard board 1974 .

various financial measures eg. profitability , liquidity and return on capital were mixed and were likely to depend on the capital and financial structure of the firm. Studies by Davidson and Weil (1975) and Stickney (1976) included many types of firms (24 utilities, 12 steel companies, 12 pharmaceuticals, 6 motor vehicles and 44 other industries) reported that although GPLA net income after recognizing gain or loss or net monetary items was surprisingly high in relation to conventionally reported net income, in general the rate of return calculated from GPLA amount were less than those calculated from statements whether the measure was return on equity or return on total assets.

From the studies so far reviewed, a number of conclusions can be made.

1. The results produced by the two sets of accounts may be different as evidenced by the studies .

2. The price adjusted accounting data may contain additional information, if not different information from that contained in historical cost accounts.

3. The effect of adjustment for the price level changes on accounts may be affected by the internal and external environment of a firm. Managers decide the financial and capital structure of the firm which affects the result of price level adjustment.

4. It might be difficult to decide which set of accounting is better suited for what situation, for example, making future decisions.

5. To get maximum benefit of accounting information it may be necessary to use both sets of accounting systems

2.5 EMPIRICAL EVIDENCE OF CORPORATE FAILURE PREDICTIVE ABILITY OF ACCOUNTING DATA.

Numerous studies investigating the ability to predict Business failure have been carried out in the last three decades.

One of the first scholars to be interested with the predictive ability of accounting data was Beaver (1966) who conducted a number of studies. Beaver set a study to find out whether accounting ratios could be used to predict failure. Using a univariate model he found that certain accounting ratios could very well discriminate between failed and non-failed firms. He identified the following ratios as better discriminators:

(a) Cash flow to total debts[12]
(b) Net income to total assets
(c) Total debt to total assets
(d) Working capital to total assets and
(e) Current assets to current debt .

Five years before failure according to Beaver, the above ratios of failed firms differed significantly from those of non-failed firms. In 1968 Beaver set a study to find out whether

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12. Note This was the best ratio

liquid ratios were superior to non liquid ratios in discriminating between failed and non-failed firms. He found out that non-liquid ratios were more accurate in discriminating between failed and non-failed firms than were the liquid ratios. From the above two studies one message is very clear. Accounting information can be used to discriminate between failed and non-failed firms.

A study that has remained a landmark in this area is that done by Altman in 1968. Altman, using a mathematical method (multivariate discriminant analysis) came up with a discriminant function which could predict bankruptcy 95% and 72% correctly one year and two years before the occurrence of bankruptcy respectively (correct here is referring to the ability of the model to correctly classify firms into their apriori groups). In this model the following ratios emerged as the most important:

(a) Working capital to total assets
(b) Retained earnings to total assets
(c) Earning before interest and taxes to total assets
(d) Market value of equity to book value of debt and
(e) Sales to total assets.

Another study concerned with predictive ability of accounting data is that of Norton (1976). He had a sample of 60 companies (30 bankrupt and 30 non-bankrupt). After adjusting for

price level changes using a computer program developed by Petersen (1971) ratios were computed from both sets of data.

Although the predictive ability of the two models did not differ significantly (being 81%-90% for the best HC model and 81%- 88% for the best GPLA model), Norton observed that GPLA ratios did show higher levels of significance in terms of univariate discriminant ability when partial F-ratios were observed.Thus it can be concluded that GPLA data is not inferior to HC data.

Altman (1977) used a new data base adjusted to take into account the latest financial accounting standards used Multivariate Discriminant Analysis with both linear and quadratic structures. He came up with a model which he named the Newer Zeta Model which was far more accurate than his 1968 model. This new Zeta model had the following ratios in it: Return on total assets, stability of earnings (measured by the normalised measure of standard error of estimate around some ten year trend in return on assets), debt service ratio (earnings before interest and taxes to total interest payment), retained earnings to total assets , current assets to current liabilities, equity to total capital and size measured by the firm's total assets.[13]

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13. Since the new model improved due to taking adjustments required by the latest financial standards one may conclude that financial standards improve predictive ability of accounting data.

Dambolena and Khoury (1980) collected data for 68 firms (34 failed and 34 non failed). They came up with a ratio based model which classified firms 91.3% , 84.8%, 82.6% , 89.1% and 78% accuracy one year, two years, three years, four years and five years respectively prior to failure. The high accuracy was achieved as a result of incorporating stability variables into the model. This may indicate that accounting information posses corporate failure predictive power if appropriate (other unknown) variables still available in the accounting statements are incorporated in the models.

Kimura (1982) used a sample of 45 firms (21 bankrupt and 24 non-bankrupt firms). He adjusted the financial statements for general price level using a Fortran program developed by Petersen (1971). By using stepwise discriminant analysis he developed a linear discriminant function for both historical as well as GPLA data. He concluded thus:

"A cursory examination of the accuracy achieved indicates that GPLA data are marginally more accurate, that is, they are either more accurate or at least as accurate as HC ratios".[14] This finding once again may lead to the conclusion that GPLA accounting data may contain additional information not otherwise available in historical accounting data.

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14. op sit pp.66

The following ratios were found to be most significant in predicting bankruptcy in Kimura's (1982) study :-

1. Monetary assets to monetary liabilities,
2. Total liabilities to total assets,
3. Net income to Average owners equity,
4. Earning before interest and taxes to total assets,
5. Change in the net book value of fixed assets and
6. Net sales to Total assets.

In a recent study Koh and Killough (1987) used stepwise discriminant analysis and came up with a historical cost model for predicting corporate failure. The model had an overall accuracy of 92.65%. The following ratios emerged as the most important.

1. Quick ratio
2. Retained earnings to Total assets
3. Earnings per share
4. Dividend per share.

Though accounting information (specifically accounting ratios) may be inappropriate predictors in some situations[15] the

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15. Accounting ratios are poor discriminators between non-failed firms and failed firms that are only financially distressed for a while.

above studies provide evidence that accounting data provide useful information for prediction of failure. To date, it is difficult to establish which set of accounts are better in predicting corporate failure. However there is much evidence to support the thesis that GPLA is not inferior to historical cost accounting. To get maximum benefits from accounting information and recognising that the two sets of accounts are most likely complimentary rather than substitutes it may be recommended that both sets of accounts be used simultaneously.

CHAPTER 3

RESEARCH DESIGN

3.1 POPULATION OF STUDY

The population of interest consists of those limited liability companies that were in the register of Registrar of Companies any time between 1980 and 1990. The population was split into two groups. The first group consisted of those companies that failed during the 1980 - 1990 period while the second group those that did not fail.[16]

3.2 THE SAMPLE

The original intention was to select a sample of 30 companies from each group. However only ten failed companies had a complete set of financial statements available from any imaginable source. The sources explored and from which financial statements were sought included the registrar of companies official receiver, the Nairobi stock exchange and the offices of the leading public accounting firms which are also involved in receivership work.

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16. Failed companies referred here are those that went into receivership during the period of interest.

This meant that no sampling of failed companies could be undertaken and hence a census for all the 10 firms was done. Each failed firm was then matched with a similar firm whose financial statements were available and which did not fail during the period. The matching was based on size measured in terms of the value of total assets.[17]

3.3 DATA COLLECTION

Annual accounts for four years prior to failure were collected for the failed companies. The same was done for the non-failed companies included in the sample. The financial statements for two years prior to failure were then adjusted for price level changes using the Gross Domestic Product Deflator. The GDP deflator index numbers were provided by the central bureau of statistic. The GDP deflator index numbers were used for the simple reason that they were readily available. While the GDP deflator may not be correct it nevertheless approximates the correct index.

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17. Equal numbers for the two groups were used because this would improve the reliability of the results(Lehmann, 1985)

The following financial ratios were calculated from the price-level adjusted financial statements (See appendex C):

1. Current Ratio
2. Quick ratio
3. Working Capital to Total Debt
4. Equity to Total Liabilities
5. Total Debt to Total Assets
6. Times interest earned
7. Fixed Charge coverage
8. Retained earnings to Total assets
9 Profit margin on sales
10. Return on Total assets
11. Return on Net worth
12. Inventory Turnover
13. Average Collection Period
14. Fixed asset turnover
15. Sales to Total Assets
16. Monetary Asset to Monetary liabilities
17. Monetary liabilities to Total assets
18. Monetary asset to Total assets
19. Change in monetary Liabilities (Year t to Year t+1)

The above ratios were selected on the basis of being common ratios or having been used elsewhere in business failure prediction related studies.

Some of the studies in which the above ratios were found to be significant are listed bellow.

RATIO	STUDY
Current ratio	Beaver (1966) , Altman (1977)
Working Capital to Total debt	Altman (1968)
Equity to Total Liabilities	Altman (1977), Beaver (1966),and Kimura(1982)
Retained earning to Total assets	Altman (1977)
Return on Total assets	Beaver (1966),Altman(1968) Kimura (1982)
Return on net worth	Kimura (1982)
Fixed asset turnover	Kimura (1982)
Sales to Total assets	Kimura (1982), Altman (1968)
Monetary assets to Monetary liabilities.	Kimura (1982)
Monetary liabilities to Total assets.	,,
Monetary assets to Total assets.	,,
Change in monetary liabilities.	,,

Quick Ratio, Times interest earned, Fixed charge turnover and the Profit margin on sales were also included in the sample as they are common ratios and are well known to students of finance.

3.4 DATA ANALYSIS

The statistical tool that was used is Multivariate Discriminant Analysis (MDA). This was used to identify the ratios which can accurately discriminate between failed companies and non-failed one's. Specifically two-Group Discriminant variable was used. The same tool was used to build the model. The two were however done simultaneously. The package used for the analysis was the STATGRAPHICS Package.

Seven discriminant functions were developed using the financial data for one year before failure. The first model had fifteen variables, the second had ten, the third nine, the fourth eight, the fifth six, the sixth four and the seventh two. The first model was referred to as the full model while the others were referred to as partial models 1 to 6 respectively. The model that classified the most companies in their respective class (failed and non-failed), using the smallest number of independent variables (ratios) while leaving out as little discriminating power as possible was taken to be the best. The discriminant statistical tool was used because of the following reasons:

1. The criterion variable is dichotomy (Failed and non failed) which makes discriminant analysis quite appropriate.
2. MDA helps to accomplish the main objective of the study which is to build a model that can predict failure. That is to develop a classification function and

a cut-off point for the two groups (failed and non failed firms). This is possible because

> " the mathematical objective of discriminant analysis is to weight and linearly combine the discriminating variables in some fashion so that the groups are forced to be as statistically distinct as possible".
> (Klecka, 1975:435).

CHAPTER 4

DATA ANALYSIS AND FINDINGS

This chapter details how the analysis was carried out and the findings.To start with, preliminary tests were carried out. These included:

1. A "T" test carried out for all the financial ratios between the two groups aimed at assessing the equality of the financial ratios means between the groups.

2. A correlation analysis aimed at determining which ratios were highly correlated to each other. This was found necessary because the statgraphic package could not take more than fifteen variables at the same time. Since there is high possibility that highly[18] correlated ratios contain the same information and they need not enter into the model at the same time. The above two tests were done for one and two years prior to failure.[19]

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18. Variables are assumed to be highly correlated if the correlation factor between them is more or equal to 0.75.

19. See correlation matrix in the appendix

The following symbols were used to represent the variable

RATIO	YEAR 1	YEAR 2
1. Current ratio	Onemw.var1	Twomw.var1
2. Quick ratio	''.var2	Twomw.var2
3. Working capital to Total debt	.var3.	Twomw.var3
4. Equity to Total liabilities	.var4	Twomw.var4
5. Total debt to Total Assets	.var5	.var5
6. Times interest earned	.var6	.var6
7. Fixed charge coverage	.var7	.var7
8 Retained earning to Total assets	.var8	.var8
9. Profit margin on sales	.var9	.var9
10. Return on Total assets	.var10	.var10
11. Return on Networth	.var11	.var11
12 Inventory Turnover	.var12	.var12
13. Average Collection period	.var13	.var13
14. Fixed assets turnover	.var14	.var14
15. Sales To Total Assets	.var15	.var15
16. Monetary Assets to Monetary Liabilities	.var16	.var16
17. Monetary liabilities to Total Assets	.var17	.var17
18. Monetary assets to Total assets	.var18	.var18
19. Change in monetary liabilities (year t to year t+1).	.var19	.var19

For the purpose of data Analysis the firms were labeled as follows:

1. GROUP 1.--- Failed firms.
2. GROUP 2.----Non-failed firms.

4.1 THE TWO SAMPLE ANALYSIS OF EQUALITY OF MEANS

To test for the equality of means across the two groups the the following hypothesis was tested.

Null Hypothesis (Ho): The means of the financial ratios of the two groups are equal.

Alternative Hypothesis(H1): There is a difference between the means of the two groups.

The hopotesis was tested at 95% confindence level.

The results of this exercise are sumarised in the tables 4.1 and 4.2 below.

TABLE 4.1
CONFIDENCE INTERVAL FOR RATIO OF MEANS FOR YEAR1

VARIABLES		STATISTICAL DECISION
ONMAS.vari	ONMAF.vari	
1. ONMAS.var1	ONMAF.var1	Reject Ho
2. ONMAS.var2	ONMAF.var2	Do not reject Ho
3. ONMAS.var3	ONMAF.var3	,,
4. ONMAS.var4	ONMAF.var4	,,
5. ONMAS.var5	ONMAF.var5	,,
6. ONMAS.var6	ONMAF.var6	,,
7. ONMAS.var7	ONMAF.var7	,,
8. ONMAS.var8	ONMAF.var8	,,
9. ONMAS.var9	ONMAF.var9	Reject Ho
10. ONMAS.var10	ONMAF.var10	Do not reject Ho
11. ONMAS.var11	ONMAF.var11	,,
12. ONMAS.var12	ONMAF.var12	,,
13 ONMAS.var13	ONMAF.var13	,,
14. ONMAS.var14	ONMAF.var14	,,
15. ONMAS.var15	ONMAF.var15	,,
16. ONMAS.var16	ONMAF.var16	,,
17. ONMAS.var17	ONMAF.var17	,,
18. ONMAS.var18	ONMAF.var18	,,
19. ONMAS.var19	ONMAF.var19	,,

ONMWAS.vari: Represent value of ratios for non-failed companies, one year before the failed companies failed.

ONMWAF.vari: Represent value of ratio for failed firms one year before they actually failed.

Table 4.2

CONFIDENCE INTERVAL FOR RATIO OF MEANS FOR 2 YEARS BEFORE FAILURE:

TWOMWAS.VARi	TWOMWAF.VARi	STATISTICAL DECISION	
1	1	do not reject	Ho
2	2	,,	
3	3	reject	Ho
4	4	do not reject	Ho
5	5	,,	
6	6	,,	
7	7	,,	
8	8	,,	
9	9	,,	
10	10	,,	
11	11	reject	Ho
12	12	do not reject	Ho
13	13	,,	
14	14	,,	
15	15	,,	
16	16	,,	
17	17	,,	
18	18	,,	
19	19	,,	

Note:TWOMWAS.vari represent variables values (ratio) for non-failed firm two years before the failed firms failed (i takes values from 1 to 18).
TWOMWAF.vari represent variables values (ratio) for failed firms two years before they failed.

The results for one year failure are different from those of the two years before failure. In the case of one year prior to failure , the ratios that were found to be significantly different between the two groups were the current ratio (var1) and profit margin on sales (var9). However two years before it was working capital to Total assets (var3) and return on networth (var11) that were statistically different between the two groups.

Other than the the ratios mentioned above the others were

found not to be significantly different between the two groups. This is an obvious indication that a mere comparison of ratios may be insufficient to discriminate between the failed and non-failed firms.

This exercise was useful in determining important ratios that differ between the two groups and hence may help in their discrimination. Again the results indicate that model building may be a better way of discriminating between failed and non-failed firms.

4.2 MODEL DEVELOPMENT

Discriminant analysis was used in model development.The ratios for one year before the failed firms failed were used to develop the models. It was assumed that the firms characteristics (as measured by ratios) would differ most between failing and non-failing companies one year before failure.

The following guide-lines were used in selecting the entering variables,

1. As many variables as possible were incorporated in the first model.

2. Ratios whose means were found to be statistically different in the preliminary tests were given first priority. Hence (based on data for one year before failure) current ratio & profit margins were given the first priority.

3. Variables that were not highly correlated to any other were given second priority the reason being they were assumed to contain different information.

4. For the variables that were highly correlated(See appendix D) to others priority was given to those that had been found to be significant in discriminating failed firms in previous studies.

4.3 DEVELOPMENT OF MODELS

4.3.1 THE DEVELOPMENT OF THE FULL MODEL

The full model contained fifteen financial ratios(these were the maximum number of variables that the statgraphic package could take).

The model included the following variables selected on the basis of guidelines enumerated in section 4.2.

Table 4.3

1.	ONEMW.var1 .....current ratio
2.	ONEMW.var2 .....quick ratio
3.	ONEMW.var3.....Working capital to total debt
4.	ONEMW.var4.....Equity to total liabilities
5.	ONEMW.var5.....Total debt to total assets
6.	ONEMW.var6.....Times interest earned
7.	ONEMW.var7 .....Fixed Charge coverage
8.	ONEMW.var8.....Retained Earning to Total assets
9.	ONEMW.var9.....Profit margin on sales
10.	ONEMW.var10.....Return on total assets
11.	ONEMW.var11.....Return on Net worth
12.	ONEMW.var12.....Inventory Turnover
13.	ONEMW.var13.....Average collection
14.	ONEMW.var18.....Monetary Assets to monetary liabilities
15.	ONEMW.var19.....change in monetary liabilities

Since there were two groups only, a single discriminant function was developed.[20]

The statistics were very impressive . The wilks lambda associated with the function was 0.0489815. This would indicate that the discriminant model was almost perfect. The Canonical correlation was very high being o.97520. The eigenvalue was also impressive(19.415866)[21] The model was able to classify companies in their respective classes 100% correctly. The resulting discriminant functions are as follows:

1. With standardised coefficients
   Z= 6.294462var1 - 7.07647var2 + 7.90108var3 - 12.9083var4
   - -2.45675var5 - 60.4844var6 + 58.9216var7 + 5.14276var8
   -1.17486var9 + 0.08290var10 + 0.60747var11 + 1.20046var12
   - 0.54801var13 + 0.02162var18 + 2.85340var19

---

20. The number of discriminant functions is equal to the number of groups minus one or the number of independent variables whichever is small(Peterson,1982:541). In this case the number of groups 2-1= 1

21. Wilk lambda is a measure of dicriminating power not already accounted for by the model(the smaller it is the better). Canonical correlation is a statistical measure of discriminating power already in the model (the bigger it is the better). The eigenvalue is a measure of relative importance of a function(The bigger it is the better).

2. With unstandardised coefficients

$$Z = 1.65451var1 - 1.92102var2 + 4.26715var3 - 6.52455var4 - 9.12535var5 - 1.67719var6 + 1.89460var7 + 34.2580var8 - 7.80731var9 + 0.4961var10 + 0.07733var11 + 0.26294var12 - 0.00268var13 + 0.07661var18 - 4.87930var19 + 7.60642$$

Where Z-represents the discriminant score

vari- represent the ith financial ratio for the year before failure occurred.

$i = 1,2,..., 19.$

It can be observed from the disciminant function that the ratios can be ranked as follows in order of discriminating power(based on the standardised coefficients).

TABLE 4.4

THE FULL MODEL RANKS BASED ON DISCRIMINANT POWER

RANK POSITION	RATIO	VARIABLE
1.	Times interest earned	var6
2.	Fixed Charge coverage	var7
3.	Equity to total liabilities	var4
4.	Working capital to total debt	var3
5.	Quick ratio	var2
6.	Current ratio	var1
7.	Retained earning to total assets	var8
8.	Change in monetary liabilities	var19
9.	Total debt to total assets	var5
10.	Inventory Turnover	var12
11.	Profit margin on sales	var9
12.	Return on net worth	var11
13.	Average collection period	var13
14.	Return on total assets	var10
15.	Monetary assets to monetary liabilities	var18

4.3.2 THE DEVELOPMENT OF PARTIAL MODELS

The objective in developing these model was to reduce the number of variables since some would obviously have little discriminating power . Such six partial models were developed. These were:-

1. The first partial model contained ten variables. The variables with the least discriminating power (i.e 5 variables) in the full model as per the raking , table 4.4) were excluded. The variables that were removed were.

Table 4.5

RATIOS	RANKING	RATIO SYMBOLS
1. Monetary assets to monetary liabilities	15	var.18
2. Return on total assets	14	var.10
3. Average collection period	13	var.13
4. Return on net worth	12	var.11
5. Profit margin on sales	11	var.9

Thus the models developed were:

1. WITH STANDARDIZED COEFFICIENTS

$$Z = -47.8165var.6 + 46.6394var.7 - 7.89333var.4 + 4.79806var.3 - 3.38476var.2 + 3.19260var.8 + 2.66982var.1 - 1.89847var5 + 2.03880var.19 + 0.66612var.12$$

2. WITH UNSTANDARDISED COEFFICIENTS

$$Z = 0.70177var.1 - 0.91885var.2 + 2.59130var.3 - 3.98972var.4 -7.05168var.5 \_- 1.32592var.6 + 1.49967var.7 + 21.2672var.8 + 0.14590var.12 + 3.48635var.19 + 5.57331$$

This model was a good one as is indicated by the model statistics.

Table 4.6

THE SIGNIFICANT STATISTICS		
STATISTICS		VALUE
WILKS LAMBDA		0.1005057
EIGENVALUE		8.9496796
CANONICAL CORRELATION		0.94842
CHI-SQUIRE		29.868025
GROUP CENTROIDS:	GROUP 1	2.83808
	GROUP 2	-2.83808

This function again classified the companies that had been used to develop it, in their respective groups 100% correctly. The wilks lambda is still very small, 0.1005057. This means that the discriminant power not explained by the variables in the discriminant function is very little. Again canonical correlation and eigenvalue are quite impressive at 0.94842 and 8.9496796 respectively. This would imply that Return on total assets, Monetary assets to monetary liabilities, Average collection period , Retained earning to total assets and Return on Net worth not important in discriminating between the firms.

The ranking of the ratios in the model were as follows (using standised coefficients):

TABLE 4.7

RATIO RANKING FROM 1TH PARTIAL MODEL

RANKING POSITION	RATIO	VARIABLE
1.	Times interest earned	var6
2.	Fixed charge coverage	var7
3.	Equity to total liabilities	var4
4.	Working capital to total debt	var3
5.	Quick ratio	var2
6.	Retained earning to total assets	var8
7.	Current ratio	var1
8.	Change in monetary liabilities	var19
9.	Total debt to total assets	var5
10.	Inventory turnover	var12

2. The second partial model was developed after eliminating one ratio from the first partial model. The model therefore contained nine variables. Since the inventory turnover (var.12) ratio had the least discriminating power it was eliminated. The new standardised function generated became:

a. WITH STANDARDISED COEFFICIENTS

$$Z = -58.2441var.6 + 57.0336var.7 - 6.88207var.4 - 4.47006var.2 + 4.13685var.1 + 3.73863var.3 + 3.07489var.8 + 2.09699var.19 - 1.15254var.5$$

b. WITH UNSTANDARDISED COEFFICIENTS

$$Z = -1.61507var.6 + 1.83389var.7 - 3.47857var.4 - 1.21347var.2 + 1.08738var.1 + 2.01913var.3 + 20.4831var.8 + 3.58584var.19 - 4.28099var.5 + 4.12855$$

The ratios in the model ranked as follows:

TABLE 4.8

RANKING POSITION	RATIO	VARIABLE
1	Times interest earned	var.6
2.	Fixed charge coverage	var.7
3.	Equity to total liabilities	var.4
4.	Quick ratio	var.2
5.	Current ratio	var.1
6.	Working capital to total debt	var.3
7.	Retained earning to total assets	var.8
8.	Change in monetary liabilities	var.19
9.	Total debt to total assets	var.5

The significant statistic were as shown in the table below.

Table 4.9

THE SIGNIFICANT STATISTICS		
STATISTICS		VALUE
WILKS LAMBDA		0.1201845
EIGENVALUE		7.3205411
CANONICAL CORRELATION		0.93798
CHI-SQUIRE		28.602818
GROUP CENTROIDS:	GROUP 1 2.56680	
	GROUP 2 -2.56680	

Again this function like the earlier two could classify the firms in their respective groups given first year data 100% correctly. This can be interpreted to mean that the inventory turnover has little if any discriminating power between the the two groups.

3. The third partial function contained eight variables (i.e one variable less). Since the total debt to total assets had the least coefficient in partial model 2 it was removed. This resulted in the following functions:-

a. WITH STANDARDISED COEFFICIENTS

$$Z = -46.8678var.6 + 46.0036var.7 - 3.73995var.4 - 4.56090var.2 + 4.73446var.1 + 2.40509var.3 + 1.90088var.8 - 0.65400var.19$$

b. WITH UNSTANDARDISED COEFFICIENT

$$Z = -1.29961var.6 + 1.47923var.7 - 1.89038var.4 - 1.23815var.2 + 1.24446var.1 + 1.29892var.3 + 12.6625var.8 - 1.11834var.19 + 0.27218$$

The significant statistic were as shown in the table below.

Table 4.10

THE SIGNIFICANT STATISTICS		
STATISTICS		VALUE
WILKS LAMBDA		0.1827951
EIGENVALUE		4.470653
CANONICAL CORRELATION		0.90399
CHI-SQUIRE		23.791450
GROUP CENTROIDS:	GROUP 1	2.00588
	GROUP 2	-2.00588

The removal of variable 5 from the model did not change predictive ability of the model. It remained at 100% accuracy hit

rate. The significant statistics however did change slightly as can be observed in the above table. The above shows that variable 5 (Total debt to total assets) contains little if any discriminating power between the groups.

The variables were now ranked as follows in terms of discriminant power.

TABLE 4.11

RANKING POSITION	RATIO	VARIABLE
1.	Times interest earned	var.6
2.	Fixed charge coverage	var.7
3.	Current ratio	var.1
4.	Quick ratio	var.2
5.	Equity to total liabilities	var.4
6.	Working capital to total debt	var.3
7.	Retained earning to total assets	var.8
8.	Change in monetary liabilities	var.19

4. The fourth partial model had six variables (i.e two variables were removed from the 3rd model). The variables that were removed based on the standardised discriminant function were change in monetary liabilities(var.19) and retained earning to total assets(var.8)

The functions and the corresponding statistic that emanated were as follows:-

a. WITH STANDARDISED COEFFICIENTS

$$Z = -49.4950var.6 + 49.6708var.7 - 0.69921var.4 - 3.71875var.2 + 4.74995var.1 - 0.05728var.3$$

b. WITH UNSTANDARDISED COEFFICIENT

$$Z = -1.37246var.6 + 1.57785var.7 - .35342var.4 - 1.00951var.2 + 1.24853var.1 - 0.03093var.3 - 0.94933$$

The significant statistic were as shown in the table below.

Table 4.12

THE SIGNIFICANT STATISTICS

STATISTICS		VALUE
WILKS LAMBDA		0.311163
EIGENVALUE		2.212557
CANONICAL CORRELATION		0.82989
CHI-SQUIRE		17.506008
GROUP CENTROIDS:	GROUP 1 1.41113	
	GROUP 2 -1.41113	

The variables were now ranked as follows in terms of discriminant power.

TABLE 4.13

RANKING POSITION	RATIO	VARIABLE
1.	Fixed charge coverage	var.7
2.	Times interest earned	var.6
3.	Current ratio	var.1
4.	Quick ratio	var.2
5.	Equity to total liabilities	var.4
6.	Working capital to total debt	var.3

The removal of the variables 8 and 19 had two significant effects.

Firstly the model predictive ability dropped from 100% to 95%. This imply that change in monetary liabilities(var.19) and Retained earning to total assets ratio (var.8) have significant discriminating power.

Secondly, for the first time var.6 (Times interest earned) and var.7 (Fixed charge coverage) exchanged their positions with var.7 being ranked as the first overall. Except for variable 6 and seven the other were ranked the same. This indicate there was some shared discriminating power between the dropped variables and variables six and seven.

5. The fifth partial function contained four variables. Variables 3 and 4 (i.e Working capital to total debt and Equity to total liabilities) were removed from the fourth partial model on ground of having the lowest coefficients in the standardised

model.

The resulting functions and the significant statistics were:

a. WITH STANDARDISED COEFFICIENTS

$$Z = -51.7997var.6 + 51.3734var.7 - 1.36090var.2 + 2.16996var.1$$

b. WITH UNSTANDARDISED COEFFICIENT

$$Z = 1.65189var.6 - 1.02301var.7 - 0.43637var.2 + 0.57038var.1 - 1.02301$$

Table 4.14

THE SIGNIFICANT STATISTICS

STATISTICS		VALUE
WILKS LAMBDA		0.355911
EIGENVALUE		1.891258
CANONICAL CORRELATION		0.80251
CHI-SQUIRE		16.525973
GROUP CENTROIDS:	GROUP 1	1.27601
	GROUP 2	-1.27601

The variables were now ranked as follows in terms of discriminant power.

TABLE 4.15

RANKING POSITION	RATIO	VARIABLE
1.	Times interest earned	var.6
2.	Fixed charge coverage	var.7
3.	Current ratio	var.1
4.	Quick ratio	var.2

6. The sixth and the final partial model contained only two variables. Current ratio and Quick ratio were removed from the fourth partial model on ground of having low relative discriminanting power.

The resulting models, significant statistic and ranking were as follows:-

a. WITH STANDARDISED COEFFICIENTS

$$Z = -53.3178var.6 + 53.0270var.7$$

b. WITH UNSTANDARDISED COEFFICIENT

$$Z = -1.478447var.6 + 1.70506var.7 - 0.33630$$

Table 4.16

THE SIGNIFICANT STATISTICS		
STATISTICS		VALUE
WILKS LAMBDA		0.583763
EIGENVALUE		0.6967088
CANONICAL CORRELATION		0.64080
CHI-SQUIRE		8.9877361
GROUP CENTROIDS:	GROUP 1 0.79186	
	GROUP 2 -0.79186	

TABLE 4.17

RANKING POSITION	RATIO	VARIABLE
1.	Times interest earned	var.6
2.	Fixed charge coverage	var.7

The above models had a hit rate 95% . This is higher than the one achieved by the previous model. This unexpected behavior may be an indication that the two variables Working capital and Quick ratio had negative discriminating power. Their being dropped from the model increased the model discriminating power.

It is interesting that the times interest earned and fixed charge coverage taken together could successfully classify 95% correctly, companies in their respective class given the first year financial ratios. This was the final model. Any attempt to remove any of the variables 6 and 7 reduced the hit rate to 65%. It is however good to note that variable 6 and 7 (times interest earned and fixed charge coverage) had almost equal discriminatory

power. Each alone when used could correctly classify companies in their respective class 65% correctly.

Though the rate looks very impressive the test statistics indicate it is a weak model. Wilks lambda which measures the discriminatory power not already in the model is quite high 0.583763 and canonical correlation quite low 0.64080.

The resulting partial models show that,

1. Some financial ratios would be able to discriminate between failing firms and non-failing firms correctly.

2.The partial models 4 and 6 had 95% success rate while 5 had 90% success rate. These result indicate that the ratios possessing significant discriminating power were:

a. Change in monetary liabilities and Retained earning to total assets,

b. Quick ratio and current ratios(Liquidity ratios) and

c. Times interest earned and Fixed charge coverage(Debt ratio).

4.4 VALIDATION OF THE MODEL.

Since the sample of failed firm available was only ten, it was not possible to split the sample into two so as to have a holdout sample. The same sample was therefore used to evaluate the models. Hit rate were calculated and compared to the hit

rates of the other models and chance[22]. The higher the hit rate the better the model.

In total 7 models were developed. These were:

1. full model (with 15 variables)
2. partial model 1 (with 10 variables)
3. partial model 2 (with 9 variables)
4. partial model 3 (with 8 variables)
5. partial model 4 (with 6 variables)
6. partial model 5 (with 4 variables)
7. partial model 6 (with 2 variables)

---

22. Since the sample sizes are equal the probability of a company belonging to any group is 50%

Their classification rate were as follows:-

Table 4.18

CLASSIFICATION RESULTS IN %

MODEL	ACTUAL GROUP	PREDICTED GROUP 1	2	TOTAL	HIT RATE
MODEL 1	1	100	0	100	100
	2	0	100	100	
PARTIAL 1	1	100	0	100	100
	2	0	100	100	
PARTIAL 2	1	100	0	100	100
	2	0	100	100	
PARTIAL 3	1	100	0	100	100
	2	10	90	100	
PARTIAL 4	1	90	10	100	95
	2	0	100	100	
PARTIAL 5	1	80	20	100	90
	2	0	100	100	
PARTIAL 6	1	90	10	100	95
	2	0	100	100	

NOTE:PARTIAL represent partial model x where x is equal to 1 - 6.

The whole rage of models are good models as far as the classification is concerned. In fact use of one ratio 6 or 7 is already far much better than chance.

The results are however over-rated since the same sample used to develop the models was also used to validate it. However the results gives us insight of how well a model developed using inflation adjusted rate would do.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

Stake holders in firms are interested in corporate survival. However corporations do fail leading to untold suffering to all the stake holders. This has brought about the concern for corporate failure. The study set to investigate the ability of the inflation adjusted accounts to predict corporate failure.

The following ratios are ranked in the order of discriminating power, beginning with the best:-

1. Times interest coverage.
2. Fixed charge coverage.
3. Equity to total liabilities.
4. Quick ratio .
5. Current ratio.
6. Working capital to total debt.
7. Retained earning to total assets.
8. Change in monetary liabilities.
9. Total debt to total assets.

The best predictive model using inflation adjusted accounting contained nine predicting variables and was as follows:-

Table 5.1

a. WITH STANDARDISED COEFFICIENTS

$$Z = 4.13685X1 - 4.47006X2 + 3.73863X3 - 6.88207X4 - 1.15254X5 - 58.2441X6 + 57.0336X7 + 3.07489X8 + 2.09699X9$$

b. WITH UNSTANDARDISED COEFFICIENTS

$$Z = 1.08738X1 - 1.21347X2 + 2.01913X3 - 3.47857X4 - 4.28099X5 - 1.61507X6 + 1.83389X7 + 20.4831X8 + 3.58584X9 + 4.12855$$

WHERE; Z, is the discriminant score.

X1, is the current ratio.

X2, is the quick ratio.

X3, is the working capital to total debt.

X4, is the equity to total liabilities.

X5, is the total debt to total assets.

X6, is the times interest earned.

X7, is the fixed charge coverage.

X8, is Retained earning to total assets.

X9, is Change in monetary liabilities.

The findings provides evidence that;

1. Inflation adjusted accounting can be used for predicting failure.
2. One Should concentrate on the above ratios if there was need to forecast firm's survival.
3. Most firms in kenya fail due to the poor funds flow management and unwise debt policies. The most critical ratios were the liquidity ratios (i.e current and quick ratios) and debt coverage ratios (i.e Times interest earned and Fixed charge coverage ratios. The results are thus consistent with finance theory relating to the firms risk. The firm must maintain sufficient liquidity if it is to avoid insolvency problems. It must also generate sufficient earnings to meet its fixed finance charges (specifically interest). Inadequate liquidity and low earning relative to fixed finance charges are the best signals for impending failure in the kenyan environment.

The results however differ from earlier studies into the subject by Altman (1968) and kimura (1982) who had concluded that liquidity ratios were not of any significance in bankruptcy prediction. Both concluded that efficiency and profitability ratios were most crucial.

The results of this study thus gives support to the existing finance theory that risk considerations are of immense importance in mode rporate management. Though accounting data may be

manipulated by the management, when adjusted for price-level changes it provides fantastic forecasting capabilities.

5.2 RECOMMENDATIONS OF THE STUDY

The results of this study indicate that most companies in kenya fail due to poor funds flow management and unwise debt decisions.

Managers therefore should intelligently manage funds or working capital ensuring that sufficient liquidity is available all the time. Most important, managers should realise that failure results from inability to service debt and other related fixedfinancial charges. This is a clear indicator that the managers are not investing in high return projects and therefore calls for either a more careful evaluation of investments before plugging in more resource or more efficient utilization of resources.

Managers should therefore be willing to adopt modern management techniques which impinge on efficiency. Otherwise they should avoid using debt finance and opt for more expensive but less risky equity finance. Since the capital structure ratios were not found to be significant then the problem of inability to service debt cannot be attributed to excessive use of debt, the truth is that investment returns are simply not satisfactory.

5.3 LIMITATIONS OF THE STUDY

Results of this study should be interpreted in the light of the following limitations;

1. The validation results from the confusion matrix are biased upwards because the same observations used to develop the model were used to test the model.
2. The sample size used here is small and therefore the model is not stable. The coefficient would most probably change if a large sample was used. The sample size is no doubt this study's severest drawback.
3. It was not possible to calculate some ratios from the available financial statements owing to the fact that most companies give the minimum legal disclosures which have been found wanting. The publicly available information was inadequate to provide the data needed for this kind of study.
4. Financial ratios generated from financial statements cannot be better than data from which they are based. The study is therefore constrained by the limitations of financial statement preparation.
5. Financial data is only one source of signal about corporate failure. In reality other non-quantifiable circumstances and reasons could lead to failure. Examples are the catastrophes and exogenous considerations.

5.4 DIRECTIONS FOR FUTURE RESEARCH

i. This study used the GDP deflator for adjustment purposes. Other price adjustment study index numbers like the specific price index could be used to develop a similar model.

ii. This study considered only price adjusted data. A study testing the superiority of Historical cost and price level adjusted data ought to be done.

iii. This study could be varied so as to enable the use of Stepwise discriminant analysis.

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APPENDIX A

SAMPLE OF THE NON-FAILED COMPANIES

1. AFRICAN TOURS AND HOTELS
2. EAST AFRICAN PORTLAND CEMENT CO. LIMITED
3. KENYA OIL COMPANY LIMITED
4. KENYA FINANCE CORPORATION LIMITED
5. KENSTOCK LIMITED
6. BABURI PORTLAND CEMENT COMPANY LIMITED
7. MALEVE AUTOMABILE AND GENERAL EQUIPMENT LIMITED
8. EAST AFRICAN CABLES LIMITED
9. ELIOTS BAKERIES LIMITED
10 MUTETI TRANSPORTERS

NOTE: The sample names of the failed companies is withheld.

APPENDIX B

The following were the index numbers that were used to adjust historical data to inflation adjusted one.

INDEX

YEAR	END OF THE YEAR INDEX	MID-RATE
1975	0.5	0.545
1976	0.59	0.645
1977	0.655	0.690
1978	0.82	0.745
1989	0.79	0.745
1980	0.82	0.805
1881	0.9	0.86
1982	1.00	0.95
1983	1.10	1.05
1984	1.22	1.16
1985	1.33	1.275
1986	1.46	1.139
1887	1.54	1.5
1988	1.70	1.62

Note: The ratios were calculated from Central Bureau of Statistics record collected from the central bank of kenya.

APPENDIX C

FINANCIAL RATIOS CACULATED AFTER ADJUSTMENT FOR PRICE LEVEL CHANGES

X1	X2	X3	X4	X5	X6	X7	X8
0.875	0.769	-0.097	0.271	1.172	-18.831	-15.616	0.045
1.925	0.580	0.502	0.597	0.626	3.235	3.132	0.011
0.977	0.753	-0.022	0.295	0.772	2.548	2.548	0.007
11.400	7.945	8.413	8.447	0.106	1.535	1.535	0.014
13.957	13.957	0.900	0.645	0.605	1.495	1.495	0.161
1.554	0.463	0.342	0.708	0.235	0.548	0.548	-0.024
10.616	10.616	0.904	0.814	0.551	1.748	1.748	0.150
1.569	0.841	0.569	1.027	0.493	-18.831	-15.616	0.103
0.444	0.142	-0.386	0.537	0.651	-3.319	-2.528	-0.115
0.026	0.026	-0.257	0.526	0.561	17.321	17.321	0.069
0.703	0.646	-0.221	0.953	0.512	-0.545	-0.838	-0.192
0.993	0.492	-0.005	0,004	0.996	0.307	-0.002	-0.145
0.398	0.190	-0.395	4.422	0.184	-0.862	-0.862	0.497
0.424	0.089	-0.266	0.967	0.629	1.393	1.393	-0.037
0.792	1.373	-.086	0.967	0.772	1.558	-0.002	0.106
0.751	0.381	0.000	0.994	0.410	-0.611	-0.611	-0.052
0.799	0.460	-0.192	0.526	0.655	0.307	-0.002	-0.076
1.013	0.013	0.013	0.145	0.957	0.907	0.907	-0.003
0.762	0.300	-0.190	0.567	0.567	0.307	-0.002	-0.090

X9	X10	X11	X12	X13	X14	X15	X16
0.063	0.008	0.023	23.709	90.463	2.430	2.297	0.597
0.016	0.043	0.052	3.578	57.151	3.578	1.236	0.315
0.002	0.004	0.020	10.752	110.253	7.379	1.840	0.745
0.014	0.079	0.031	6.474	127.902	82.286	1.916	7.945
0.220	0.008	0.046	9.318	78.886	3.359	0.082	1.652
-0.054	-0.011	-0.146	2.843	53.602	0.587	0.451	0.325
0.225	0.057	0.042	9.318	74.936	11.252	0.083	0.998
0.099	0.008	0.285	4.043	99.924	6.428	1.452	0.841
-0.081	-0.120	-0.346	10.980	6.000	2.028	1.498	0.099
0.078	0.075	0.234	9.318	1.401	4.439	0.880	0.007
-0.339	-0.123	-0.164	2.002	172.121	0.164	0.120	0.383
-0.030	-0.137	-35.751	8.156	29.871	20.181	4.604	0.383
-0.263	-0.038	-0.047	5.775	47.177	0.152	0.145	0.125
0.044	0.038	-4.586	6.083	13.944	1.483	0.591	0.141
0.083	0.042	-4.586	2.686	13.983	0.671	0.500	0.088
0.119	0.152	0.373	6.911	53.539	2.053	1.281	0.467
-0.248	-0.150	-0.435	2.843	114.425	1.211	0.604	0.440
-0.414	-0.049	-0.414	1.547	22.961	0.498	0.366	0.032
-0.053	-0.049	-0.068	4.860	951.980	1.892	0.054	1.013
-0.056	-0.217	-0.183	7.683	77.319	2.460	1.610	0.266

X17	X18	X19	X20
1.172	0.700	- 0.037	1
0.626	0.197	0.155	1
0.772	0.575	0.471	1
0.088	0.697	2.300	1
1.000	0.042	0.009	1
0.207	0.067	-0.286	1
0.551	0.550	0.004	1
0.493	0.415	-0.216	1
0.651	0.064	-0.055	1
0.561	0.004	-0.356	1
0.996	0.382	0.572	2
0.996	0.382	0.572	2
0.184	0.023	-0.009	2
0.629	0.026	-0.055	2
0.772	0.068	0.231	2
0.410	0.191	0.120	2
0.655	0.289	-0.072	2
0.815	0.263	0.108	2
0.957	0.970	-0.381	2
0.511	0.136	0.102	2

Xi - represents financial ratios calculated.

In variable X20 1 and 2 represents non-failed and failed firms respectively.

Sample Correlations

	var1	var2	var3	var4	var5	var6
var1	1.0000	.9800	.6377	.4232	-.2926	.1295
	(20)	(20)	(20)	(20)	(20)	(20)
	.0000	.0000	.0025	.0630	.2106	.5864
var2	.9800	1.0000	.4908	.2876	-.1938	.1311
	(20)	(20)	(20)	(20)	(20)	(20)
	.0000	.0000	.0280	.2189	.4129	.5817
var3	.6377	.4908	1.0000	.8480	-.4654	.1070
	(20)	(20)	(20)	(20)	(20)	(20)
	.0025	.0280	.0000	.0000	.0386	.6534
var4	.4232	.2876	.8480	1.0000	-.6679	.0828
	(20)	(20)	(20)	(20)	(20)	(20)
	.0630	.2189	.0000	.0000	.0013	.7285

Coefficient (sample size) significance level

Press Esc, Cursor keys or Page Number: Page 1.1 of 5.4

1Help 2Edit 3Savscr 4Prtscr 5Prtopt 6Go 7Vars 8Cmd 9Device 10Quit

INPUT 9/16/91 17:59 STATGRAPHICS Vers. 2.6 Display CORR

	var7	var8	var9	var10	var11	var12
var1	.1303	.2638	.4818	.3021	.1191	.1080
	(20)	(20)	(20)	(20)	(20)	(20)
	.5841	.2612	.0315	.1954	.6170	.6504
var2	.1313	.2953	.4875	.2790	.1216	.1292
	(20)	(20)	(20)	(20)	(20)	(20)
	.5810	.2062	.0292	.2336	.6096	.5872
var3	.1080	.0450	.1926	.3178	.0810	-.0200
	(20)	(20)	(20)	(20)	(20)	(20)
	.6504	.8504	.4160	.1721	.7342	.9333
var4	.0821	.3575	-.0467	.2652	.1519	-.0949
	(20)	(20)	(20)	(20)	(20)	(20)
	.7309	.1218	.8449	.2586	.5227	.6908

Press Esc, Cursor keys or Page Number: Page 1.2 of 5.4

1Help 2Edit 3Savscr 4Prtscr 5Prtopt 6Go 7Vars 8Cmd 9Device 10Quit

INPUT 9/16/91 18:04 STATGRAPHICS Vers. 2.6 Display CORR

	var13	var14	var15	var16	var17	var18
var1	-.0186	.5385	-.1465	.6514	-.1083	.1738
	(20)	(20)	(20)	(20)	(20)	(20)
	.9380	.0143	.5377	.0019	.6496	.4638
var2	-.0108	.3907	-.2206	.5142	.0097	.1353
	(20)	(20)	(20)	(20)	(20)	(20)
	.9638	.0885	.3501	.0204	.9677	.5697
var3	.0275	.9627	.1528	.9873	-.4442	.3592
	(20)	(20)	(20)	(20)	(20)	(20)
	.9085	.0000	.5200	.0000	.0497	.1198
var4	-.0740	.8176	.0068	.8339	-.6399	.1297
	(20)	(20)	(20)	(20)	(20)	(20)
	.7565	.0000	.9774	.0000	.0024	.5857

Press Esc, Cursor keys or Page Number: Page 1.3 of 5.4
1Help 2Edit 3Savscr 4Prtscr 5Prtopt 6Go 7Vars 8Cmd 9Device 10Quit
INPUT 9/16/91 18:05 STATGRAPHICS Vers. 2.6 Display CORR

	var19	var20
var1	.4270	-.4486
	(20)	(20)
	.0604	.0472
var2	.2970	-.3972
	(20)	(20)
	.2035	.0829
var3	.8523	-.3369
	(20)	(20)
	.0000	.1464
var4	.7665	-.1110
	(20)	(20)
	.0001	.6413

Press Esc, Cursor keys or Page Number: Page 1.4 of 5.4
1Help 2Edit 3Savscr 4Prtscr 5Prtopt 6Go 7Vars 8Cmd 9Device 10Quit
INPUT 9/16/91 18:06 STATGRAPHICS Vers. 2.6 Display CORR

Sample Correlations

	var1	var2	var3	var4	var5	var6
var5	-.2926	-.1938	-.4654	-.6679	1.0000	-.0793
	(20)	(20)	(20)	(20)	(20)	(20)
	.2106	.4129	.0386	.0013	.0000	.7397
var6	.1295	.1311	.1070	.0828	-.0793	1.0000
	(20)	(20)	(20)	(20)	(20)	(20)
	.5864	.5817	.6534	.7285	.7397	.0000
var7	.1303	.1313	.1080	.0821	-.0804	.9998
	(20)	(20)	(20)	(20)	(20)	(20)
	.5841	.5810	.6504	.7309	.7362	.0000
var8	.2638	.2953	.0450	.3575	-.3236	.1920
	(20)	(20)	(20)	(20)	(20)	(20)
	.2612	.2062	.8504	.1218	.1640	.4174

Coefficient (sample size) significance level

Press Esc, Cursor keys or Page Number: Page 2.1 of 5.4

1Help 2Edit 3Savscr 4Prtscr 5Prtopt 6Go 7Vars 8Cmd 9Device 10Quit

INPUT 9/16/91 18:06 STATGRAPHICS Vers. 2.6 Display CORR

	var7	var8	var9	var10	var11	var12
var5	-.0804	-.3236	.0350	-.2458	-.3637	.4312
	(20)	(20)	(20)	(20)	(20)	(20)
	.7362	.1640	.8835	.2963	.1150	.0577
var6	.9998	.1920	.0629	.2724	-.0632	-.2551
	(20)	(20)	(20)	(20)	(20)	(20)
	.0000	.4174	.7922	.2453	.7914	.2777
var7	1.0000	.1946	.0696	.2794	-.0585	-.2465
	(20)	(20)	(20)	(20)	(20)	(20)
	.0000	.4111	.7707	.2328	.8063	.2947
var8	.1946	1.0000	.2268	.3725	.2573	.1096
	(20)	(20)	(20)	(20)	(20)	(20)
	.4111	.0000	.3362	.1058	.2735	.6454

Press Esc, Cursor keys or Page Number: Page 2.2 of 5.4

1Help 2Edit 3Savscr 4Prtscr 5Prtopt 6Go 7Vars 8Cmd 9Device 10Quit

INPUT 9/16/91 18:07 STATGRAPHICS Vers. 2.6 Display CORR

	var13	var14	var15	var16	var17	var18
var5	.2589	-.3614	.3355	-.4084	.8819	.3487
	(20)	(20)	(20)	(20)	(20)	(20)
	.2704	.1174	.1481	.0739	.0000	.1319
var6	.1099	.0844	-.1339	.0978	-.0385	.1259
	(20)	(20)	(20)	(20)	(20)	(20)
	.6446	.7235	.5735	.6816	.8721	.5969
var7	.1092	.0857	-.1327	.0987	-.0406	.1260
	(20)	(20)	(20)	(20)	(20)	(20)
	.6468	.7195	.5770	.6790	.8652	.5966
var8	-.0610	-.0300	-.3369	.0417	-.3360	-.1448
	(20)	(20)	(20)	(20)	(20)	(20)
	.7984	.9001	.1464	.8614	.1475	.5424

Press Esc, Cursor keys or Page Number: Page 2.3 of 5.4
1Help 2Edit 3Savscr 4Prtscr 5Prtopt 6Go 7Vars 8Cmd 9Device 10Quit
INPUT 9/16/91 18:08 STATGRAPHICS Vers. 2.6 Display CORR

	var19	var20
var5	-.3144	.1404
	(20)	(20)
	.1770	.5548
var6	.0976	.2425
	(20)	(20)
	.6821	.3030
var7	.0931	.2293
	(20)	(20)
	.6962	.3309
var8	-.1443	-.1784
	(20)	(20)
	.5437	.4517

Press Esc, Cursor keys or Page Number: Page 2.4 of 5.4
1Help 2Edit 3Savscr 4Prtscr 5Prtopt 6Go 7Vars 8Cmd 9Device 10Quit
INPUT 9/16/91 18:08 STATGRAPHICS Vers. 2.6 Display CORR

Sample Correlations

	var1	var2	var3	var4	var5	var6
var9	.4818	.4875	.1926	-.0467	.0350	.0629
	(20)	(20)	(20)	(20)	(20)	(20)
	.0315	.0292	.4160	.8449	.8835	.7922
var10	.3021	.2790	.3178	.2652	-.2458	.2724
	(20)	(20)	(20)	(20)	(20)	(20)
	.1954	.2336	.1721	.2586	.2963	.2453
var11	.1191	.1216	.0810	.1519	-.3637	-.0632
	(20)	(20)	(20)	(20)	(20)	(20)
	.6170	.6096	.7342	.5227	.1150	.7914
var12	.1080	.1292	-.0200	-.0949	.4312	-.2551
	(20)	(20)	(20)	(20)	(20)	(20)
	.6504	.5872	.9333	.6908	.0577	.2777

Coefficient (sample size) significance level

Press Esc, Cursor keys or Page Number: Page 3.1 of 5.4
1Help 2Edit 3Savscr 4Prtscr 5Prtopt 6Go 7Vars 8Cmd 9Device 10Quit
INPUT 9/16/91 18:09 STATGRAPHICS Vers. 2.6 Display CORR

	var7	var8	var9	var10	var11	var12
var9	.0696	.2268	1.0000	.5821	-.0122	.4185
	(20)	(20)	(20)	(20)	(20)	(20)
	.7707	.3362	.0000	.0071	.9594	.0663
var10	.2794	.3725	.5821	1.0000	.2808	.1086
	(20)	(20)	(20)	(20)	(20)	(20)
	.2328	.1058	.0071	.0000	.2304	.6484
var11	-.0585	.2573	-.0122	.2808	1.0000	-.0208
	(20)	(20)	(20)	(20)	(20)	(20)
	.8063	.2735	.9594	.2304	.0000	.9307
var12	-.2465	.1096	.4185	.1086	-.0208	1.0000
	(20)	(20)	(20)	(20)	(20)	(20)
	.2947	.6454	.0663	.6484	.9307	.0000

Press Esc, Cursor keys or Page Number: Page 3.2 of 5.4
1Help 2Edit 3Savscr 4Prtscr 5Prtopt 6Go 7Vars 8Cmd 9Device 10Quit
INPUT 9/16/91 18:09 STATGRAPHICS Vers. 2.6 Display CORR

	var13	var14	var15	var16	var17	var18
ır9	-.0662	.1488	.1498	.1751	-.0213	.0451
	(20)	(20)	(20)	(20)	(20)	(20)
	.7817	.5312	.5284	.4603	.9291	.8501
r10	-.1121	.2276	-.1749	.2744	-.2816	.0264
	(20)	(20)	(20)	(20)	(20)	(20)
	.6380	.3345	.4608	.2416	.2291	.9121
r11	.1199	-.1352	-.7284	.0926	-.2895	-.0108
	(20)	(20)	(20)	(20)	(20)	(20)
	.6146	.5697	.0003	.6977	.2158	.9639
-12	-.0995	.0352	.4094	.0315	.3390	.2638
	(20)	(20)	(20)	(20)	(20)	(20)
	.6765	.8829	.0731	.8952	.1437	.2610

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elp 2Edit 3Savscr 4Prtscr 5Prtopt 6Go 7Vars 8Cmd 9Device 10Quit
UT 9/16/91 18:10 STATGRAPHICS Vers. 2.6 Display CORR

	var19	var20
)	-.0490	-.5206
	(20)	(20)
	.8375	.0186
0	.1120	-.3813
	(20)	(20)
	.6383	.0971
1	-.1619	-.2955
	(20)	(20)
	.4953	.2059
!	-.0401	-.4345
	(20)	(20)
	.8668	.0556

Esc, Cursor keys or Page Number: Page 3.4 of 5.4
2Edit 3Savscr 4Prtscr 5Prtopt 6Go 7Vars 8Cmd 9Device 10Quit
9/16/91 18:10 STATGRAPHICS Vers. 2.6 Display CORR

Sample Correlations

	var1	var2	var3	var4	var5	var6
var13	-.0186	-.0108	.0275	-.0740	.2589	.1099
	(20)	(20)	(20)	(20)	(20)	(20)
	.9380	.9638	.9085	.7565	.2704	.6446
var14	.5385	.3907	.9627	.8176	-.3614	.0844
	(20)	(20)	(20)	(20)	(20)	(20)
	.0143	.0885	.0000	.0000	.1174	.7235
var15	-.1465	-.2206	.1528	.0068	.3355	-.1339
	(20)	(20)	(20)	(20)	(20)	(20)
	.5377	.3501	.5200	.9774	.1481	.5735
var16	.6514	.5142	.9873	.8339	-.4084	.0978
	(20)	(20)	(20)	(20)	(20)	(20)
	.0019	.0204	.0000	.0000	.0739	.6816

Coefficient (sample size) significance level

Press Esc, Cursor keys or Page Number: Page 4.1 of 5.4

1Help 2Edit 3Savscr 4Prtscr 5Prtopt 6Go 7Vars 8Cmd 9Device 10Quit

INPUT 9/16/91 18:11 STATGRAPHICS Vers. 2.6 Display CORR

	var7	var8	var9	var10	var11	var12
var13	.1092	-.0610	-.0662	-.1121	.1199	-.0995
	(20)	(20)	(20)	(20)	(20)	(20)
	.6468	.7984	.7817	.6380	.6146	.6765
var14	.0857	-.0300	.1488	.2276	-.1352	.0352
	(20)	(20)	(20)	(20)	(20)	(20)
	.7195	.9001	.5312	.3345	.5697	.8829
var15	-.1327	-.3369	.1498	-.1749	-.7284	.4094
	(20)	(20)	(20)	(20)	(20)	(20)
	.5770	.1464	.5284	.4608	.0003	.0731
var16	.0987	.0417	.1751	.2744	.0926	.0315
	(20)	(20)	(20)	(20)	(20)	(20)
	.6790	.8614	.4603	.2416	.6977	.8952

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	var13	var14	var15	var16	var17	var18
var13	1.0000	-.0071	-.2274	.1174	.2520	.6706
	(20)	(20)	(20)	(20)	(20)	(20)
	.0000	.9763	.3350	.6221	.2837	.0012
var14	-.0071	1.0000	.3566	.9522	-.3877	.3920
	(20)	(20)	(20)	(20)	(20)	(20)
	.9763	.0000	.1227	.0000	.0912	.0874
var15	-.2274	.3566	1.0000	.1473	.1563	.2005
	(20)	(20)	(20)	(20)	(20)	(20)
	.3350	.1227	.0000	.5355	.5104	.3967
var16	.1174	.9522	.1473	1.0000	-.3665	.4336
	(20)	(20)	(20)	(20)	(20)	(20)
	.6221	.0000	.5355	.0000	.1120	.0562

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	var19	var20
var13	-.1228	.2011
	(20)	(20)
	.6060	.3953
var14	.8976	-.2624
	(20)	(20)
	.0000	.2636
var15	.3554	-.0879
	(20)	(20)
	.1241	.7124
var16	.8480	-.3060
	(20)	(20)
	.0000	.1894

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Sample Correlations

	var1	var2	var3	var4	var5	var6
var17	-.1083	.0097	-.4442	-.6399	.8819	-.0385
	(20)	(20)	(20)	(20)	(20)	(20)
	.6496	.9677	.0497	.0024	.0000	.8721
var18	.1738	.1353	.3592	.1297	.3487	.1259
	(20)	(20)	(20)	(20)	(20)	(20)
	.4638	.5697	.1198	.5857	.1319	.5969
var19	.4270	.2970	.8523	.7665	-.3144	.0976
	(20)	(20)	(20)	(20)	(20)	(20)
	.0604	.2035	.0000	.0001	.1770	.6821
var20	-.4486	-.3972	-.3369	-.1110	.1404	.2425
	(20)	(20)	(20)	(20)	(20)	(20)
	.0472	.0829	.1464	.6413	.5548	.3030

Coefficient (sample size) significance level

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	var7	var8	var9	var10	var11	var12
var17	-.0406	-.3360	-.0213	-.2816	-.2895	.3390
	(20)	(20)	(20)	(20)	(20)	(20)
	.8652	.1475	.9291	.2291	.2158	.1437
var18	.1260	-.1448	.0451	.0264	-.0108	.2638
	(20)	(20)	(20)	(20)	(20)	(20)
	.5966	.5424	.8501	.9121	.9639	.2610
var19	.0931	-.1443	-.0490	.1120	-.1619	-.0401
	(20)	(20)	(20)	(20)	(20)	(20)
	.6962	.5437	.8375	.6383	.4953	.8668
var20	.2293	-.1784	-.5206	-.3813	-.2955	-.4345
	(20)	(20)	(20)	(20)	(20)	(20)
	.3309	.4517	.0186	.0971	.2059	.0556

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	var13.	var14	var15	var16	var17	var18
var17	.2520	-.3877	.1563	-.3665	1.0000	.2788
	(20)	(20)	(20)	(20)	(20)	(20)
	.2837	.0912	.5104	.1120	.0000	.2340
var18	.6706	.3920	.2005	.4336	.2788	1.0000
	(20)	(20)	(20)	(20)	(20)	(20)
	.0012	.0874	.3967	.0562	.2340	.0000
var19	-.1228	.8976	.3554	.8480	-.2467	.3117
	(20)	(20)	(20)	(20)	(20)	(20)
	.6060	.0000	.1241	.0000	.2944	.1810
var20	.2011	-.2624	-.0879	-.3060	.1407	-.1082
	(20)	(20)	(20)	(20)	(20)	(20)
	.3953	.2636	.7124	.1894	.5542	.6499

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	var19	var20
var17	-.2467	.1407
	(20)	(20)
	.2944	.5542
var18	.3117	-.1082
	(20)	(20)
	.1810	.6499
var19	1.0000	-.0721
	(20)	(20)
	.0000	.7626
var20	-.0721	1.0000
	(20)	(20)
	.7626	.0000

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