HE CHARACTERISTICS OF BONUS-ISSUING FIRMS IN ENYA: AN EMPIRICAL STUDY.

UNIVERSITY OF NAIROBI
LOWER KABETE LIBRARY

BY

AGUTU EVELYNE ACHIENG.
REGISTRATION No. D/61/P/7898/97

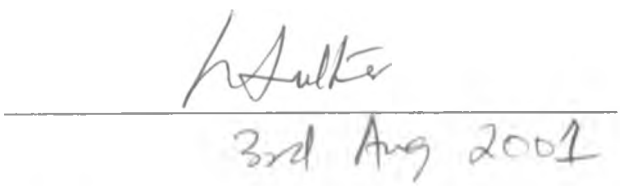
management research paper submitted to the Department of Accounting, Faculty of mmerce, University of Nairobi, in partial fulfilment of the requirements for the degree of sters of Business Administration.

JUNE 2000.

UNIVERSITY OF NAIROBI LIBRARY
0282734 3

AGUTU EVERLYNE ACHIENG.

s research paper has been submitted for examination with my approval as the versity supervisor.



OTIENO ODHIAMBO LUTHER.

DECLARATION.

search paper is my original work and has not been presented for a degree in any other
sity.

AGUTU EVELYNE ACHIENG.

CONTENTS

APTER V: CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH.

ACKNOWLEDGEMENT

titude first and foremost goes to my supervisor, Mr. Otieno Luther Odhiambo, for
; me through this project from its conception to its completion. Through his
agement I realised that it is not because things are difficult that we do not dare, but
s because we do not dare that they are difficult.

titude also goes to my boss, The Head of the Levy Inspectorate, Kenya Bureau of
rds, Mr. S.O. Odongo who realised how much time I needed to put into my studies
erefore allowed me to reschedule my office work accordingly so as to accommodate
am also grateful to him for his constant encouragement and support during the times
got thick'.

I thank my parents and siblings, my friends and colleagues [both in the office and in
for their support and encouragement during my studies. It may not be possible to
ll of them individually but their contribution towards the successful completion of
dies is highly appreciated.

DEDICATION.

hose who knew and believed that I would make it through it all and therefore gave stant encouragement towards that end, and to all those who thought and believed that l not. Both of you triggered a determination I had forgotten I had.

ABSRACT

s such as that conducted by Grinblatt et al., (1984), have proven that Stock dividends ıore than mere cosmetic changes. They appeal to investors because of their ɔlogical value, tax benefits and because they signal prospects of higher profits in the This study, by refining the Lev and Lakonishok's (1987) study, empirically igates the characteristics of the stock dividend firms quoted at the Nairobi Stock nge. It also documents a model for predicting the likelihood of a firm to issue stock nds.

study applies Discriminant Analysis to construct the predictive model. The teristics of the firms are derived from the group means. Classification of the firms group is based on the number of times a firm has made the distributions. Those that never made the issue between 1991 to 1999 are classified in group 0, the ones that ssued once in group 1, twice in group 2 and thrice in group 3.

nodel when expressed in a quadratic function correctly predicts 82% of the firms into true groups. The results, based on an examination of fourteen financial statement d variables, also indicate that the firms that have never made the distributions have dividend payout ratios, dividend yield, return on investments and a higher percentage ital reserves in the total reserves. This is so because these variables are reduced in size event of an issue. The firms that have made the issues twice or more times have the st changes in cash from operations, earnings, growth in earnings, shareholders' funds otal reserves as well as the lowest returns on investments. Re-capitalisation increases ıvestment thus increasing the earnings realised and consequently, the growth in gs.

equency in the issues is related to the firm size. Financial and industrial sectors have ghest concentration of the distributions. Some of the characteristics so established

n the Lev and Lakonishok's (1987) findings.

udy proves that only two (total reserves and dividend yield) out of the fourteen
es are significant for prediction purposes. This means that managers may be using
antitative considerations in deciding whether or not to issue bonus shares and thus
ing that there exists a gap between finance theory and practice in the issue of Stock
nds in Kenya.

TER I: THE PROBLEM.

ckground to the Problem.

mes companies find themselves in need of more funds for investment into profitable or for expansion purposes. In seeking such funds, it is prudent that Finance rs first opt for the cheapest source (this presupposes that they need to be cost us in their search for the funds). There are internal as well as external sources of nternal sources include retained earnings while external sources include debt and

king Order Theory (Myers, 1984), indicates that internal sources are the cheaper of funds. According to Myers, managers will first resort to using retained earnings ncing investments rather than debt or equity, after which they will prefer debt rather uity as external financing. The use of retained earnings is advantageous because it is ost of financing compared to the issuing of new shares. Moreover the management control of the firm. Stock Dividends (also known as a "bonus" issue) fall within the on of the cheaper source of funds for investment. They are a way of raising al equity capital in a cost-effective way.

lividends merely represent a distribution of additional 'fully paid' shares to the shareholders. The new shares are issued in proportion to the shareholders' current s. Since the stock dividends neither cause expense decreases nor increases in the power, the total net worth remains unchanged. Simply and squarely put, there occurs an increase in the number of units through which ownership may be acquired nsed with, causing the value of each unit to decrease. Block and Hirt (1992) put it ock dividends result in the investor having more paper to tell him/her what he/she knew.

ounting terms it involves a transfer on the books, of an amount equal to the market of the distributed shares, from the reserves to the paid up capital. The bookkeeping nvolves debiting (reducing) the reserve account and crediting (increasing) the share account, with the amount involved (McMenamin, 1999). A capitalisation in this s a correction of an imbalance between the nominal value of the share capital and the alue of accumulated reserves (which together make up the total shareholders' funds). owever prudent that the distributions should only be made when managers do not the balance of retained earnings to constrain future cash dividend payments. This is e the inability to pay cash dividends may cause anxiety among the shareholders.

att et al., (1984) report that the Generally Accepted Accounting Principles (GAAPs), l in the U.S.A. classifies stock dividends as distributions of upto 20% or less of the on shares already outstanding. Beyond 25% they are treated as splits and do not affect d earnings. Grinblatt et al., (1984) further indicate that for distributions between 20% %, the accounting principles grant discretion to the manager but are usually treated as lividends. However, the accounting requirements vary in the 25% to 100% range.

nd Lakonishok (1987) established that the characteristics of firms issuing stock nds differ markedly from those of stock split firms. Grinblatt, Masulis and Titman also noted that the market interprets announcements about stock dividends and stock differently. Both studies used these findings to arrive at the inference that stock nds and stock splits are different.

an economic standpoint, stock dividends and stock splits are very similar though for different purposes. Neither stock splits nor stock dividends involve cash payment eholders. Baker (1958) indicates that the difference between stock dividends and splits lies in the accounting treatment. A split has the effect of increasing the number tanding shares through a proportional decrease in the par value of the share but

s no change in the total Capital Account or Surplus Account. The common stock is merely apportioned among the increased shares outstanding after the split up. ividends on the other hand require the transfer of a portion of earned surplus to the Account leaving unaltered the par or stated value of each share. Stock splits are y used after a sharp price increment to reduce the price, while stocks dividends are nes used to keep the stock price relatively constrained. With respect to the income nt, there is no change in the total shilling amount before and after stock dividends or olits.

es differ in their treatment of stock dividends. In some countries there are ons on the payment of stock dividends. In India for instance there is a maximum nit imposed on the bonus shares. The limit is 1:1 (Pandey, 1997). That is, a single hare for one paid-up share held by the existing shareholder. Within the ratio ceiling, eria are to be satisfied: These are the residual reserve and the profitability criteria.

sidual reserve criterion requires that the reserve remaining after the amount sed for bonus issue should be at least equal to 40 per cent of the increased paid-up This means that there needs to be an increase or growth in the reserves before issue can be made. In computing the minimum residual reserve, the redemption and capital reserve on account of assets revaluation are excluded while investment nce reserve is included. The profitability criterion on the other hand requires that 30 t of the previous three years' average pre-tax profit be at least equal to 10 per cent of reased paid-up capital (Pandey, 1997). The other condition is that bonus shares be issued in addition to, and not in lieu of, cash dividends.

re no restrictions in Kenya on the ratio of the bonus payable as yet. The ratios vary 2 by Kenya National Mills (announced on 11th March 1998), 5:1 by Unga Limited nced also on 11th March 1998) 4:1by Dunlop (announced on 9th June 1998), to

on but a few. However, the Capital Markets Authority (henceforth abbreviated as has to approve an issue before it is declared. Other rules by the CMA on isation include; the restriction of the number of bonus shares that can be issued to the r authorised at the NSE. According to the CMA (Amendment) Rules, (1994), Legal No. 232, the board or shareholders must have approved capitalisation. This means e applicant must furnish the CMA with certified copies of the resolutions passed by rd or shareholders as required under the Companies Act, authorising the issue of the nares.

e case of bonus issues capitalised from reserves, the applicant must identify the es from which the bonus shares are to be capitalised and show a three-year schedule movements in the relevant reserve accounts. In a case where any of the reserves are d following a revaluation of the assets, the applicant must submit a copy of the nt appraisal report and a certificate from the auditors that the reserves are sufficient to the capitalisation of the bonus issues (The CMA [Amendment] Rules, 1994, Legal No. 232).

Statement of the Problem.

their tax benefit, prospects of higher future profits and psychological value (Pandey, stock dividends are an appealing phenomenon to investors. In practice it is observed mmediately after the announcement of a bonus issue, the market price of the ny's share changes depending on the investors' expectations (Kaen, 1995). Empirical s support the fact that statistically significant abnormal returns accompany stock nds on the announcement date. McNichols and Dravid (1990) for instance established e issuance of stock dividends is followed by significant earnings increases.

, Barclays Bank (Kenya) Ltd made an issue, immediately after which announcement vas an increment in the stock price, indicating expectations of higher earnings and uently, the significance of the issues. All this goes to prove that Stock dividends are a to investors about the management's expectations and confidence about the firm's nance. They form the premise upon which the investors can draw inferences for nent decision purposes. It is therefore important for investors and managers to e their understanding of the stock dividend phenomenon so as to arrive at sound ns. Investors for instance can capitalise on these distributions.

udy, as an endeavour to give more insight into the stock dividend phenomenon in addresses two research questions: firstly, do the Lev and Lakonishok's (1987) s hold in the Kenyan context? And secondly, is it possible to predict the likelihood of istributions? Investors in Kenya lack a tool useful in predicting the companies that ly to issue the bonus. This study therefore sets out to establish such a model.

Objectives of the Study.

jective of this study was to compare the financial statement-derived variables of the nies that have issued the bonus with those that have hitherto never made an issue. haracteristics of the stock dividend firms in Kenya were arrived at based on these risons.

udy also aimed at establishing whether or not there is sector concentration of the and possibly formulating a model, useful in predicting the issues, for the companies at the Nairobi Stock Exchange.

1.4. Importance of the Study.

The findings of this study is of importance to the prospective investors in the decision making process, and to the corporate managers who recommend the bonus issues. The model provides

investors and managers with information necessary in facilitating their decision making process. For instance, in making inferences about the increased probability of a near-term cash dividend at the announcement of the stock dividends.

The results of the study can also assist investment managers in making informed decisions on stock selection. Studies have indicated that there occurs mis-pricing of stocks due to inability to predict such corporate actions as bonus issues. The bonus issue prediction model will therefore assist in enhancing efficiency in the pricing mechanism of stocks.

1.5. Assumptions.

For the purposes of this study, the following assumptions shall apply:

(i) That the coefficients used in the model are accurate and therefore represent the reality about the firms' operations. The coefficients are assumed accurate having been certified so by the auditors.

(ii) That the limitations of the uses of accounting numbers do not apply and therefore ratios can be used for estimation and prediction purposes.

(iii) That the variables used in the model are the only determinants of the likelihood of

an issue. Other factors (non-quantifiable) such as the tendency of some directors to authorise the issues are held constant.

(iv) Accounting method choice is an important factor affecting reported financial statement numbers, for example, LIFO (last in first out) results in higher cost of goods sold than do other methods during inflationary periods. This study assumes that there is no effect on financial statement numbers of alternative accounting methods.

(v) Where ratio analysis is done from financial statement variables unadjusted for inflation, distortions may arise causing difficulties in comparisons for example the value of the fixed assets will be overstated. For the purposes of this study, the assumption is made that there is no inflation and hence the value of money remains constant.

1.6. Limitations of the Study.

The assumptions made above form some of the limitations of the study. Without them the findings of this study are inaccurate (the validity of the model developed should therefore be assessed based on these assumptions). For instance, the assumption that the quantifiable factors are the only influencing factors in the issuance of stock dividends does not in the least represent the reality. The study therefore fails to incorporate the Baker and Phillip's (1993) findings that the dominant motive for paying the stock dividends is to maintain the firm's historical practice.

Notice should also be made of the fact that the control sample consisted of the 11 firms that have hitherto never made any stock dividend distributions while the test sample had 39 firms. This variance in sizes of the samples may cause biases in the analysis.

1.7 Organisation of the Study.

This paper has the following organisation. Section I presents the background to the problem, statement of the problem, the importance, objectives, limitations and assumptions of the study as well as a brief review of the empirical literature on stock

dividends and the hypotheses put forward to explain their issuance. Section II contains the methodology used in the analysis of the data while Section III presents the findings and their interpretations. Section IV presents the conclusion and the suggestions on areas that need further research.

2.1. LITREATURE REVIEW.

Financial planning, analysis and decision-making are all based on the information derived from financial statements. Financial statement information is of importance especially in improving the quality and speed of the decisions to be made. The availability of competing information sources and the potential of the information to reduce uncertainty both influence whether this improvement is expected to occur (Foster, 1986). From the investors' point of view, predicting the future is what financial statement analysis is all about, while from the management's point of view financial statement analysis is useful both as a way to anticipate future conditions and more importantly as a starting point for planning actions that will influence the future courses of events.

Studies on the uses of financial statements, (for instance, Otieno, 1987, and Beaver, 1966), assume that such statements contain useful information. Based on this assumption, these statements have been used for various purposes, some of which include; forecasting firm performance, estimating or predicting firm specific variables such as risk and dividend yield, predicting corporate failure, and assessing the credit worthiness of firms. Other objectives of financial statements include providing information on the changes in economic resources and variables, as well as providing information on the obligations and performance of the firm.

Financial statements are preferred over other competing sources of information on a firm's operations on various grounds (Foster, 1986). These include:

(i) the fact that financial statements focus directly on the variables of interest,

(ii) that these statements are certified by auditors and hence are reliable,

(iii) that the statements can be produced at a comparatively low cost, particularly from the users point of view,

(iv) And lastly, that financial statement information is a more timely information source.

Analysts have focused on the predictive capability as well as the diagnostic role of the accounting numbers derived from the financial statements and used them extensively as a tool in financial analysis. These numbers are believed to form a critical background on the item(s) of the user's interests. However, there are mixed views on the power of ratios in their use for prediction purposes. Otieno (1987) reports that Beaver (1966), in his support of the power of ratios in predictions (due to their informational content), focused his study on whether ratios discriminate between failed and non-failed firms. Beaver (1966) examined the predictive power of thirty different ratios and established that ratios can be used to predict corporate failure as early as five years prior to the failure.

On the contrary, Johnson (1970) held that ratios do not contain information about alternative strategies and the investing economic conditions, such as mergers and deferrals, confronting management and investors.

Ratios have also been used to determine; the extent to which a firm has used its long term solvency by borrowing funds; the operating efficiency and performance of the firm; the extent to which the firm is utilising its assets in generating sales revenue and the ability of the firm to meet its current obligations. Other practical applications of the ratios have been in credit and security analysis. Security analysis focuses on the long-term profitability of the firm. Credit analysis on the other hand employs the use of current/quick-asset ratio to establish the firm's ability to pay its debts and the debt/equity ratio to determine the firm's survival in the long run.

Altman (1968) focused on credit analysis. He combined a set of ratios to form a single measure important in predicting corporate bankruptcy. His study was based on 66 firms, half of which went bankrupt. He established 5 ratios as being efficient in predicting corporate bankruptcy. These include: net working capital to total assets, retained earnings to total assets, earnings before interests and taxes (henceforth abbreviated as EBIT) to total assets, market value of total equity to book value of debt and sales to total assets. He established the function:

$$Z = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5$$

Where; X_1 to X_5 represent the ratios; net working capital to total assets, retained earnings to total assets, EBIT to total assets, market value of total equity to book value of debt and sales to total assets respectively, and the Z is the discriminant function score of the firm.

To derive meaning from the ratios, it is important to compare a firm's ratios with those of its benchmarks. Ratios would be meaningless without a reference point. Comparisons can be indicative of the extent to which a firm deviates from the norm (where the norm is the reference point, which in this case is the company used as the benchmark, or the industry average). Caution should be taken in using the ratios since there are limitations to their use. These limitations include:

(i) The lack of an appropriate basis of comparison (the industry average may not be an appropriate reference point in the case where the companies use different accounting principles).

(ii) the fact that interpretations are rendered inaccurate due to price changes,

UNIVERSITY OF NAIROBI
DOWER KABETE LIBRARY

or expected increases in earnings.

Woolridge (1983) established a relationship between stock dividend size and the investors' return. His conclusion was that stock dividends but not stock splits might be effective as a signalling device. He concluded so because stock dividend announcements, in his study of the daily returns around 317 stock dividends, were usually accompanied by earnings announcements or cash dividend payments. McNichols and Dravid (1990), also established a correlation that point out that the management's choice of split factor signals private information about future earnings and that investors revise their beliefs about the firm accordingly.

The attention and the reputation hypotheses are both offshoots of the signalling hypothesis. The attention hypothesis indicates that stock dividends trigger the reassessments of the firm's future cash flows, and hence attracting attention. Under-priced firms find such reassessments in their interests while overpriced firms do not. Under this hypothesis, there will be a price impact on the announcement date that reflects the average under-pricing of firms that choose to split their shares.

The reputation hypothesis (Ross, 1977) on the other hand postulates that the loss of reputation is one of the indirect costs associated with false signalling. Firms therefore reveal their information truthfully because it is prohibitively costly for low-value firms to mimic the financial decisions of high value firms. Heinkel (1984) indicates that firms maintain their reputation so as to have the opportunity to signal favourable information in the future.

The weakness of the reputation or the attention hypothesis is that they do not explain why firms use stock dividends and splits to convey information rather than straightforward press releases (Lev and Lakonishok, 1987). The use of stock dividends and splits for this purpose is that they are less likely to reveal useful information to competitors and that managers may

be held liable for damages to stockholders should the information that is directly communicated to the market be incorrect. Stock dividends and splits being more ambiguous announcements, will not subject the firm and its management to such risks.

Grinblatt et al (1984) confirmed all the four hypotheses in their study. This confirmation thus disputes the notion about stock dividends and stock splits being mere cosmetic changes. In their examination of the valuation effects of stock dividends and stock splits, they established that, on average, there are post-announcement abnormal returns particularly around the ex-dates of stock dividends and stock splits. They explain that this upward revision of the firm's value cannot be attributed to any other contemporaneous announcements, but may be partially due to forecasts of imminent increases in cash dividends. However, a sub-sample of stocks that paid no dividends in the three years prior to the announcement displayed similar price behaviour. They thus concluded that some of the information content of stock dividends appeared to be directly associated with the firms' future cash flows. Based on their confirmation, the endeavour to establish a bonus-forecasting model is therefore further justified.

Baker and Phillips (1993) points out another hypothesis they term " the 'Cash Substitution' hypothesis", which indicates that managers can conserve cash by issuing a stock dividend as a temporary substitute for either existing or contemplated cash dividends. No study, empirical or otherwise, has hitherto confirmed this position. In fact Baker and Phillips (1993) point out critiques from such scholars as Elgers and Murrey (1985) who in their study established that a poor cash position is not a factor in the decision to issue stock dividends.

Baker and Phillips (1993) also confirm that the dominant motive for paying stock dividends is to maintain the firm's historical practice. Their view is that most managers continue to pay the bonuses because they are apprehensive about the stockholder's reaction to changing

the firm's historical stock dividend practice. They believe that shareholders expect stock dividends to continue once initiated.

Of all the aforementioned hypotheses, the signalling and the trading range hypotheses are most popular having been validated by studies.

More relevant to this study however is the Lev and Lakonishok (1987) study. Lev and Lakonishok (1987) investigated the reasons why firms split their stocks or distribute stock dividends and why the market acts favourably to these distributions. By comparing the operational performance, indicated mainly by growth rate in earnings and dividends, and other characteristics of firms that have split their stock and distributed stock dividends with those of a control group of non-distributing, albeit similar firms, they revealed systematic differences in firm performance and levels of stock prices. They conclude that stock dividends are therefore not just small stock splits. The two are different and hence intended for different purposes.

On comparison between issuing and no-issuing firms, they revealed that stock dividends are distributed by firms that only marginally out-perform similar non- distributing firms. Their evidence of relatively low prices of stock dividend paying firms and relatively small increments of stock prices led them to dismiss the other researchers' findings that stock dividends are intended to adjust stock prices to "normal levels".

The Lev and Lakonishok (1987) findings further indicate that stock dividend firms did enjoy a somewhat higher pre announcement earnings growth than control firms; yet the differences between the test and control firms for stock dividend cases were much smaller compared to those of the stock splits cases. For many sub - periods of stock dividend cases, the earnings differences between test and control were not statistically significant, for instance, the differences in the median earnings growth rates for each of the four quarters

preceding the announcement were not statistically significant. The dividend growth in pre announcement period and the earnings behaviour hardly showed any differences between the test and the control sample. Infact, they note that most times, the dividend growth was higher for the control samples than for the stock dividend test sample. Stock dividend firms experienced, on average, a decline in their dividend yield relative to control firms in the three years prior to the stock dividend announcement. This study is a test of the validity of the Lev and Lakonishok's (1987) study, and hence is an attempt to confirm or dismiss their findings within the Kenyan context.

CHAPTER III: METHODOLOGY-DATA COLLECTION

3.1. The Population and Sample.

The population consisted of all the firms (52) quoted on the Nairobi Stock Exchange for the period 1991 to 1999. The reason for the choice of this period was due to the availability of data. All the firms that have issued the bonus made up the test sample. These total to 39 between 1991 and1999. Another sample, the control sample, was also constructed which consisted of firms that have not yet issued any bonuses. These were 11 by 1999.

3.2. Data Collection.

This was done by extracting the figures of the relevant items from the financial statements of the firms under the study for the period 1991 to 1999. The financial statements were obtained from the Nairobi Stock Exchange as well as from the various firms. The items extracted include; earnings, growth in earnings, reserve revenue, shareholders' funds, changes in cash from operations, earning power (ROI), firm size (asset base), the dividend yield, the dividend pay-out ratio, the percentage of capital reserves in total reserves, growth in capital reserves, growth in long term borrowing, growth in assets, and yearly changes in dividends.

The data available on the firms that have issued the stock dividends was for the period 1993 to 1999. However, the years 1991 and 1992 were included solely for the reason that events leading to the issue of a bonus may commence two or so years prior to the issue. This fact is reflected in the CMA rules (as mentioned in the introduction) which requires that a three-year schedule of the movements in the reserves from which bonus shares are capitalised be shown.

3.3. The Model

The multivariate model used comprised of the aforementioned fourteen variables expressed in linear form thus:

$$F=b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X_5+b_6X_6+b_7X_7+b_8X_8+b_9X_9+b_{10}X_{10}+b_{11}X_{11}+b_{12}X_{12}+b_{13}X_{13}+b_{14}X_{14}.$$

Where:

F is the bonus, (and is represented by 0 for the firms that have never distributed the stock dividends, 1 for a single issue, 2 for twice and 3 for cases of more than two issues).

X_1 is the earnings (as a measure of profitability),

X_2 is the growth rate in earnings,

X_3 is the reserve revenue,

X_4 is the shareholders' funds,

X_5 is the measure of changes in cash from operations,

X_6 is the earning power (ROI),

X_7 is the particular firm's size (asset base),

X_8 is the dividend yield,

X_9 is the dividend payout ratio,

X_{10} is the percentage of capital reserves in total reserves,

X_{11} is the growth in capital reserves,

X_{12} is the growth in long term borrowing,

X_{13} is the growth in assets, and

X_{14} is the yearly changes in dividends.

The above variables were selected based on the fact that they influence the issue of stock dividends. The paid-up share capital and retained earnings together make up the

shareholders' equity.

Shareholders' equity is the owners' claims to the net assets of a business entity. Retained Earnings are the total amount of a company's net incomes less its net losses and dividends declared since its inception. Earnings/accumulated profits arise from the use in the business of funds entrusted to the company, and represent a surplus accruing to the shareholders out of which dividends may be paid to them, and which if so not distributed, is ultimately attributable to the common shareholders. These earnings indicate the financial performance as well as the growth prospects of the company. Retained earnings therefore represent undistributed profits while the paid-up share capital is the amount of funds directly contributed by the shareholders. Stock dividends increase the paid-up capital. Net income increases the retained earnings while net losses and dividends decrease it. Where retained earnings become large relative to total shareholders' equity, stock dividends will be issued.

Dividends (the distributed earnings) represent the return to the investor who puts his/her money at risk in the corporation. They are a function of the level of earnings. A high earning power therefore implies that the earnings will increase, thus increasing the likelihood of a bonus issue. The earnings power for the purposes of this study is represented by the Return on Investments (henceforth abbreviated as ROI). ROI measures the efficiency of operations and is computed as EBIT divided by the capital employed. ROI is based on the earnings before interests and taxes because it indicates the profits as far as operations are concerned.

When investors evaluate whether or not to buy a stock at a given price per share, they take into consideration how much return they expect to receive in the form of dividends. A statistic useful in comparing the dividend paying performance of the different investment opportunities is the Dividend Yield [henceforth abbreviated as DY]. Dividend

Yield is computed as the dividend per share divided by the market value per share and evaluates the shareholders' returns in relation to the market value of the share. It also measures the payment that stockholders receive from their investments. Where dividends are constant and stock prices increase, dividend yield will decrease. Using the dividend yield, the payout ratio can be computed. One minus the dividend payout ratio gives the retention ratio. The Dividend Payout Ratio (henceforth abbreviated as DPR) indicates the percentage of earnings paid out in the form of dividends. The retention ratio when multiplied by the Return on Equity (ROE) gives the growth in owners' equity as a result of the retention policy.

An increase in cash also supports the issue of a bonus because then, the bonus can be followed by a payment of cash dividends thus maintaining the increased share price at that level. Where cash is low, stock dividends may still be issued. Cash flow per share of common stock is an important measure of the company's ability to pay dividends as well as its liabilities.

The other variable that affects the issue of stock dividends is capital reserves. Capital reserves result from the revaluation of assets. The assets of a business are the properties or economic resources owned by the business. Revaluation of Assets, if added to the reserves, leads to growth in capital reserves. An increase or decrease in the asset base can therefore affect the company's performance, growth and consequently the reserves, and hence the chances of a bonus issue.

Accumulated profits contribute to the company's reserves. Reserves may arise in three ways (Lee, 1984):

(i) By the contribution of capital moneys by shareholders over and above the nominal amount of their shares.

(ii) By the accumulated profits, initially in the profit and loss account.

(iii) And as aforementioned, by an upward revaluation of assets, with a countervailing adjustment to the owners' equity.

All reserves are represented in the books by credit balances and appear in the balance sheet as amounts added to the share capital to produce a subtotal of owners' equity. Reserves are alternatively classified as capital reserves and revenue reserves. A capital reserve is one which as a matter of legal requirements, prudence, or business policy, cannot or will not be distributed in dividends to shareholders through the profit and loss account. A revenue account on the other hand is one that is free for distribution. Capital reserves comprise of (i) and (ii) above. Accumulated profits may become capital by law or through company policy.

The principal revenue reserve is the profit and loss account, whose credit balance at any time represent net profits (less losses) after tax accrued since the inception of the company, and not distributed in dividends or otherwise appropriated. Examples of capital reserves are the share premium account and the capital redemption reserve fund. The share premium account can be capitalised by for instance, using the balance to pay up non-issued shares for distribution to the members as bonus shares.

When redeemable preference shares are redeemed, the 1948 Companies Act section 58 requires replacement of the par value of the shares by the proceeds of a fresh issue of shares of any class but not debentures. Or alternatively, by the transfer of an equivalent amount of distributable profits from the profit and loss account, or other revenue reserve, to the credit of a capital reserve. The profits so dealt with are forever undistributable except on liquidation or in a capital reduction scheme. The balance may be capitalised by a bonus issue of shares.

3.4. Measurement of Variables.

Growth in: assets, long term borrowing, capital reserves, and earnings as well as the proportion of capital reserves in the total reserves, yearly changes in dividends, dividend yield and ROI, were measured in percentages. The earnings, reserve revenue, shareholders' funds, and the firm size [asset base], were measured in millions of Kenya shillings. Dividend payout was measured in ratios. Averages were computed for each of the variables for the years 1993 to 1999 to smoothen out variations over the period.

3.5. Methods of Analysis.

Various researchers (indicated in the literature review) have focused on two approaches in their investigation of stock dividends: surveying of managers and the use of market data. This study applied the latter.

Tests were run to establish the nature of correlations among the fourteen variables. Kendall's and Spearman's correlation coefficients were established, the results of which are appended hereunder (appendix 4). To establish the characteristics of the stock dividend paying firms in Kenya, refinements were done on the Lev and Lakonishok's (1987) study so that some of the variables they used were discarded and others incorporated. This was especially so for modelling purposes.

The applicable independent variables in the study included; growth in earnings [GEARN], dividend yield [DY], Return on Investments [ROI], yearly changes in dividends [YCDIV], growth in total assets [GTASS], dividend payout ratio [DPR], percentage of capital reserves in total reserves [CATR], earnings [EARN], changes in cash from operations [CCASHOP], total reserves [TRES], shareholders' funds [SHRF] and total assets [TASS].

With the fifty two firms grouped under; 0 for the firms which have never issued the bonus, 1 for the firms that have made a single issue, 2 for twice, and 3 for more than twice, discriminant analysis was done. This was:

[i] To establish a linear discriminant function, so that the discriminant scores exhibit the property of maximising the ratio of between- and within-groups variability.

[ii] To examine whether the discrimination established by the function can be generalised to the population, that is, establish whether there is a significant difference between the means of the independent variables taken together.

With the classification altered to; 0 for firms that have never made any issue, 1 for a single issue and 2 for more than once, discriminant analysis was repeated. In addition, multiple regression analysis was run to further test the model. The structure of discriminant analysis is similar to that of multiple regression analysis except that the dependent variable Y is in this case dichotomous instead of quantitative.

CHAPTER IV: RESULTS AND INTERPRETATIONS.

4.1. Findings and Implications.

The list of firms used in the analysis is contained in appendix 2. The list of firms as well as the dates the distributions were announced are contained in appendix 3.The summary of statistics for the comparison between the groups as well as the results from the correlation tests is contained in appendix 4.

Pearson's, Kendall's and Spearman's correlation coefficients established strong [near perfect] positive correlations between shareholders' funds, total assets, total reserves, earnings, changes in cash from operations and growth in earnings while indicating low [near perfect] negative correlations between most of the rest of the variables. These correlations meant that some of the variables [growth in total assets and growth in long-term borrowing] be omitted. Twelve variables were therefore used in the analysis.

The means/averages of the various variables are contained in appendix 5. For the entire sample the mean of the growth in earnings for the 51 observations was –22.4 millions, indicating that on average earnings have been on the decline between the years 1993 to 1999. The mean dividend yield was 7.1%, and the average return on investments was 13.8% while earnings averaged 222.6 millions of shillings. The yearly changes in dividends, growth in total assets, dividend payout ratio, the percentage of capital reserves in the total reserves, changes in cash from operations, total reserves, shareholders' funds and total assets averaged 24.4%, 25.6%, 45.16, 51.2%, 434.8, 1145 millions, 141.1 millions, and 5095.1 millions respectively.

TABLE 1: GROUP MEANS.

Class	CART	CCAS HOP	DPR	DY	EARN	GEARN	GTASS	ROI	SHRF	TASS	TRES	YCDIV
0	65.2	205.3	52.2	9.6	164.8	-47.9	27.8	16.8	902.3	1607.05	608.00	19.9
1	49.2	428.7	44.7	6.3	172.1	25.6	27.03	14.8	1347.9	3280.9	1083.9	24.0
2	48.1	208.2	42.4	6.8	232.6	-148.8	19.4	14.7	1240.6	7438.6	1055.0	20.8
3	44.1	1170.6	40.2	6.4	516.3	31.8	24.2	6.8	2780.9	1156.4	2301.1	37.6
Total	51.8	443.7	45.3	7.1	229.6	-21.1	25.5	14.1	1431.2	4821.2	1144.4	24.4

TABLE 2: GROUP STANDARD DEVIATIONS

Class	CATR	CCAS HOP	DPR	DY	EARN	GEARN	GTASS	ROI	SHRF	TASS	TRES	YCDIV
0	23.1	318.3	40.1	5.58	406.9	181.6	20.5	15.0	1682.8	3494.2	1015.2	45.7
1	26.9	625.7	24.8	2.76	252.5	89.6	32.5	13.1	1588.5	5637.2	1382.5	33.45
2	26.8	202.2	21.26	4.18	483.2	559.5	12.05	9.5	1751.7	17270.7	1490.4	13.87
3.	28.86	1715.7	13.56	1.66	647.0	10.16	13.2	2.97	2153.8	1517.4	1880.1	21.24
Total	26.6	813.7	26.8	3.84	407.5	256.98	24.8	12.2	1764.3	10240	1457	32.4

Based on the results of the group averages (as tabled above and also contained in appendix 6), the following characteristics can be inferred; the firms that have hitherto never made a bonus issue [group 0 firms] have higher mean of the percentage of capital reserves in the total reserves, dividend pay-out ratio, dividend yield and return on investments. This is in line with the expectations because in the event that a firm does not issue stock dividends, it should follow of logical necessity that these variables will grow [because they are reduced in the event of a bonus issue].

The firms that have issued stock dividends more than twice [Group 3 firms] have very high changes in cash from operations, earnings, growth in earnings, shareholders' funds, total assets, total reserves, and yearly changes in dividends, while they have the lowest return on investments. This low return on investments is due to the fact that profits cannot be realised in the immediate post investment time. Through reinvestment, the asset base expands while profits almost stagnate especially in the short run. Earnings being a function of the extent of investment, it follows that group 3 firms should register higher earnings. The high changes in cash from operations could be an indicator that these firms issue the bonus shares during the periods when they fall low on cash hence the issuance of stock dividends is for cash conservation purposes. This reason for the payment of bonus shares support the Lev and Lakonishok's [1987] as well as Eisemann and Moses' [1978] position as to why firms make such distributions, to conserve cash probably for reinvestment.

That group 3 firms have high earnings and growth in earnings stems from their reinvestment decisions and is in order with the Lev-Lakonishok's [1987] findings that stock dividend firms enjoy a somewhat higher earnings growth than those that have never made an issue. It can also be inferred from the findings that such firms issue the bonus shares to make implicit statements about their expected earnings growth. The high values of the shareholders' funds and the total assets indicate that group 3 firms are mainly big in size.

The results indicate therefore that the bigger the firms [the bigger the asset base] the more the number of issues. The growth in total assets has been more or less uniform among all the firms studied. Class 0 and Class 2 firms both registered a decline in their earnings growth whereas Class 3 firms, not surprisingly, had the highest. The total reserves is related to the frequencies in the issues such that the higher the total reserves the more the number of times a company has declared the distributions.

In all, the group 1 firms have means that are closest to the overall means thus making the group the mean group.

TABLE 3: SUMMARY OF CLASSIFICATION (BYDISCRIMINANT ANALYSIS)

Put into groups	Group count	True Group			
		0	1	2	3
0	11	8	5	1	1
1	23	2	12	5	2
2	9	1	2	3	0
3	7	0	4	0	4
Total N	50	11	23	9	7
N correct	50	8	12	3	4
Proportion	1.000	0.727	0.522	0.333	0.571

N = 50 N correct = 27 Proportion correct = 0.540

Table 3 above indicates the classification summary of the discriminant analysis with the firms grouped under 0 [for the firms that have never made the distributions], 1 [for a single distribution], 2 [for twice], and 3 [for more than twice].

The discriminant analysis on groups defined by CLASS established the following function coefficients [the coefficients are hereby abbreviated as indicated on page 25];

[I] Function 1:

CLASS 0 = -12.989 - 0.002 EARN - 0.008 TRES + 0.164 CATR + 0.006 SHRF - 0.001 CCASHOP + 0.001 ROI + 0.1GTASS + 0.829 DY + 0.069 DPR + 0.021 YCDIV.

The variables GEARN and TASS had 0 as coefficients and hence were omitted from the function.

[II] Function 2:

CLASS 1 = -7.7 -0.006 EARN + 0.001 GEARN - 0.006TRES + 0.125 CATR + 0.005 SHRF + 0.071 ROI + 0.095 GTASS + 0.389 DY + 0.051 DPR + 0.025 YCDIV.

The variables CCASHOP and TASS having 0 as their coefficients were omitted from the function.

[III] Function 3:

CLAS 2 = -7.88 -0.003 EARN - 0.003 GEARN - 0.003 TRES + 0.117 CATR + 0.002 SHRF - 0.002 CCASHOP + 0.087 ROI + 0.077 GTASS + 0.468 DY + 0.05 DPR + 0.019 YCDIV.

The variable TASS had a 0 value and hence was omitted from the function.

[IV] Function 4:

CLASS 3= -7.895 + 0.001EARN + 0.001 GEARN - 0.001 TRES + 0.12 CATR + 0.001SHRF + 0.001 CCASHOP - 0.011 ROI + 0.086 GTASS 0.371 DY + 0.046 DPR + 0.043 YCDIV.

54% of the firms were correctly put in their true groups with 72.7%, 52.2%, 33.3%, and 57.1% of the firms in groups 0, 1, 2 and 3 respectively being classified in their true groups. The variable TASS was not important in the classification in this case and was therefore omitted.

Some of the firms that were wrongly predicted include: George Williamson Kenya Ltd, Standard Chartered Bank, BAT Kenya Ltd, and E.A. Breweries Ltd which were predicted to fall under group 3 where as they are group 1 firms. Limuru Tea Co. Ltd was predicted to be a group 2 firm whereas it belongs to group 0. Sasini Tea and Coffee Ltd, CMC Holdings, Diamond Trust Bank Ltd, and Carbacid Investments Ltd were predicted to belong to group 1 though are group 2 firms.

TABLE 4: SUMMARY OF CLASSIFICATION [DISCRIMINANT ANALYSIS]

Put into groups	Group count	True group		
		0	1	2
0	11	8	5	2
1	23	3	15	6
2	16	0	3	8
Total N	50	11	23	16
N correct	50	8	15	8
Proportion	1.000	0.727	0.652	0.5000

N = 50 N correct = 31 Proportion correct = 0.620.

With groups 2 and 3 combined to form one group so that the firms that have issued bonuses more than twice all fall under group 2, 72.7%, 65.2%, and 50% of group 1,2, and 3 firms respectively were correctly predicted into their true groups. In overall, 62% of the 50 firms used in the analysis were correctly predicted. The variable TASS was once more omitted from all the three functions while the variable SHRF was found to be highly correlated with other predictors. The functions in this case are as follows:

[I] Function 1:

CLASS 0 = -13.208 - 0.002EARN + 0.001 GEARN - 0.008 TRES + 0.168 CATR + 0.006 SHRF - 0.001 CCASHOP - 0.007 ROI + 0.103 GTASS + 0.838 DY + 0.071 DPR + 0.023 YCDIV.

[II] Function 2:

CLASS 1 = -7.872 - 0.006 EARN + 0.001 GEARN - 0.006 TRES + 0.128 CATR + 0.005 SHRF + 0.072 ROI + 0.098 GTASS + 0.397 DY + 0.052 DPR + 0.025 YCDIV.

In this function, CCASHOP had the coefficient 0 and therefore was omitted.

[II] Function 3:

CLASS 2 = -7.475 - 0.001EARN - 0.001 GEARN - 0.002 TRES + 0.121 CATR + 0.002 SHRF + 0.043 ROI + 0.083 GTASS + 0.433 DY + 0.05 DPR + 0.031 YCDIV.

TABLE 5: SUMMARY OF CLASSIFICATIONS (QUADRATIC).

Put into group	Group count	True Group		
		0	1	2
0	12	12	1	1
1	23	0	21	6
2	16	0	1	9
Total N	51	12	23	16
N correct	51	12	21	9
Proportion	1.00	1.000	0.913	0.563

N = 51 N correct = 42 Proportion correct = 0.824

The variables were expressed in a quadratic function to further test the model. With the firms grouped under 0, 1, and 2, yearly changes in dividends and total assets were dropped for being highly correlated with other predictors in the group 0. Total reserves and shareholders' funds were revealed to be highly correlated with other predictors in all the groups 1, 2 and 3 firms. Earnings, growth in earnings, total reserves, the percentage of capital reserves in the total reserves, Shareholders' funds, changes in cash from operations, return on investments, growth in total assets, dividend yield, and dividend pay-out ratio were therefore used in the prediction. Group 1, 2 and 3 firms were respectively, 100% 91.3% and 56.3% correctly predicted by the model. In all, 82.4% of the firms used in the analysis were correctly put in their true groups.

UNIVERSITY OF NAIROBI
KABETE LIBRARY

Except for the first case, the firms that have made more than two issues of the bonus since 1993 are difficult to predict into their true groups. This may be because combining groups 2 and 3 into the same group causes variations within the group and consequently causing difficulty in the dichotomy. Sasini Tea and Coffee Ltd, Diamond Trust Bank Ltd, Jubilee Insurance Co. Ltd, Pan African Insurance Co. Ltd, NIC Bank and Carbacid Investments Ltd were once more predicted to fall under group 1 though are group 2 firms. The Standard Newspapers Ltd was predicted to belong to 0 but is a group 1 firm, while I.C.D.C Investments Co. was predicted to belong to 0 while it is in group 2.

Regression analysis shows that the shareholders' funds is highly correlated with other predictor variables. The regression equation thus established was:

Class = 1.93 + 0.00036 EARN –0.000422 gEARN + 0.00110 Tres – 0.00769 CaTR
[4.98] [0.32] [-0.96] [1.71] [-1.68]
- 0.000869 ShrF + 0.000031 CcashOp + 0.0061 RoI + 0.000004 Tass –
[-1.46] [0.14] [0.51] [0.15]
0.00407 gTAss – 0.0606 DY – 0.00339 DPR + 0.001146 ycDIV.
[-0.88] [-1.83] [-0.69] [0.40]

s = 0.6883 R-sq = 33.8% R-sq [adj] = 12.4%

33.8% of the total is the percentage of the variation in the actual class that may be predicted by changes in the values of the independent variables [X's].

Car and General [K] Ltd [class 2], Kenya Airways Ltd [class 0], Housing Finance of Kenya [class 2] and Kenya Commercial Bank [class 2] exhibited unusual observations with earnings of –25, 1386, 180 and 1513 millions of shillings and standard deviations of 0.66, 0.62, 0.29 and 0.67 respectively. Housing Finance of Kenya had a large standard residual of

2.11. The Durbin-Watson statistic of 1.78 indicated the absence of serial correlation.

That total assets was omitted from all the functions is an indicator that the firm size is not a major factor for consideration in predicting the likelihood of a company to issue the distributions (the firm size does not influence a firm's re-investment decision). The only variables proven significant in the regression analysis are Total Reserves and Dividend Yield with t-values of 1.71 and -1.83 and p-values of 0.095 and 0.076 respectively. The rest of the variables incorporated in the model are not significant in explaining the class variations. The significance of total reserves as a variable in the analysis stems from the fact that it is the variable out of which a capitalisation for a bonus issue is made. An issue therefore directly reduces the total reserves. The dividend yield on the other hand indicates the dividend paying performance of the firm.

CHAPTER V: CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH.

5.1. Conclusions.

This study has examined the characteristics of the bonus-issuing firms quoted at the Nairobi Stock Exchange. It has established that, on average, those firms that have hitherto never issued stock dividends have higher dividend payout ratios, dividend yield, return on investments and a higher percentage of capital reserves in the total reserves. Those firms that have made the issues more than twice have the highest changes in cash from operations, earnings, growth in earnings, shareholders' funds and total reserves but also have the lowest return on investments.

Lastly, the frequencies in the issues are related to the firm size (the higher the total assets the more the issues the firm has made). On examination of the concentration of stock dividends in the various sectors, by comparing across industries the frequencies of such distributions, industry concentration could be detected in the financial and industrial sectors. Since 1991, the Agriculture sector has had 7 distributions, Commercial sector 11, Financial sector 25, and Industrial sector, 20 distributions. This may be an indicator that the financial and industrial sectors are high growth sectors.

Out of the 14 variables that influence the decision to make the distribution of bonus shares, only two are significant thus indicating that the managers use variables other than the quantifiable ones to arrive at their decision concerning stock dividends. This space between finance theory and practice questions these managers' use of financial data, and consequently their integrity in their financial planning, analysis and decision making processes. The important question is: what do they base their decisions on whether or not to distribute bonus shares when it is so evident that they are ignorant of the capability of

accounting information to provide background to their analyses. The issue of stock dividends in Kenya is therefore a matter of historical practice (reference to the precedence) as opposed to the firm dynamics.

5.2. Recommendations for Further Research.

The results of this study raise a number of issues that could be addressed in future research. Firstly, prior studies have implied that the distributions of stock dividends are unexpected, at least from the shareholders' point of view. However with a predictive model (indicating that the issues can now be expected), it would be worthwhile to test whether the reaction of the stock prices at the announcement of the issues would be the same (whether the prices would increase).

The study also established that those firms that have issued the stock dividends more than twice have low ROI, (there is an inverse relationship between the number of issues of the stock dividends and the investors' returns on their investments). Woolridge [1983], in his study, established a positive relationship between the stock dividend size and the investors' announcement day returns. It may also be necessary to test the validity of this relationship in the Kenyan context.

Lastly, research should be carried out to explain why some firms were in all the cases predicted in wrong groups. What is it they have in common that makes them difficult to predict into their true groups?

REFERENCES

Altman, E. I., "Financial Ratios, Discrminant Analysis And Prediction of Corporate Bankruptcy", *The Journal of Finance,* September 1968, pp 589-609.

Altman, E. I., Avery R. B., Eisenbeis, R.A., and Sinkey, J.F., *Application Of Classification Techniques In Business Banking And Finance.* Greenwich, Conn. JIA Press, 1981.

Baker, A. C, Evaluation of Stock Dividends, *Harvard Business Review*, 36 July – August, 1958

Baker H. K and Gallagher P. L "Management's View of stock splits" *Financial Management Journal*, summer 1980.

Baker H. K., and Phillips A. L., "Why companies issue Stock Dividends", *Advances in Business Financial Management: A Collection of Readings,* (edition 2), Dryden Press, Fort Worth, 1996.

Block B. S and Hirt G. A *Foundations of Financial Management* 6th Edition, Irwin, Boston, 1992.

Brealey R and Myers S., *Principles of Corporate Finance* New York: Mc Graw-Hill, 1981.

Brigham F. E. & Gapenski L. C. *Intermediate Financial Management* (3rd Edition), Dryden Press, Orlando, 1985

Dale G. B and peppers L. C *Business Fluctuations*: *Forecasting Techniques and*

Applications (2nd Edition) Prentice-Hall international, New Jersey, 1993.

Easterbook F H; "Two Agency-Cost Explanations Of Dividends" *The American Economic Review,* September 1984 Vol. 74 No. 4

Eisemann P. and Moses E. A "Stock Dividends' Management's View" *Financial Analysts Journal* July - August 1978.

Elgers P. T., and Murray D, " Financial Characteristics Related to Managements' Stock Dividends and Stock Split Decisions", *Journal of Finance and Accounting,* Winter 1985.

Fama, E. F., Fisher, L., Jensen, C. M., and Roll, R., "The Adjustment Of Stock Prices To New Information", *International Economic Review,* February 1969,pp 1-21.

Foster, T. W. and Vickrey, D.,"The Information Content Of Stock Dividends Announcements", *The Accounting Review,* April 1978, pp 360-370.

Grinblatt M.S, Masulis R.W, Titman S. "The Valuation effects of Splits and Stock Dividends, *Journal of Financial Economics*, 13 (1984).

Johnson J, *Econometric Methods* (3rd Edition) McGraw-Hill, Singapore 1991.

Kaen F. R. *Corporate Finance*, Blackwell. Cambridge, 1995.

Lakonishok J and Lev B; "Stock Splits And Stock Dividends: Why, Who and When" *Journal of Finance*, 42 (September 1987), pp 913-32.

Lee, G.A., *Modern Financial Accounting*, 3rd edition, Van Nostrand Reinhold co. Ltd,

Berkshire, 1984.

McNichols M., and Dravid J., "Stock Dividends, Stock Splits and signalling" *Journal of Finance* Vol. XLV.No. 3, July 1990

McMenamin, J. *Financial Management; An Introduction,* Routledge, London, 1999.

Miller, M., and Modigliani, F., "Dividend Policy, Growth, and the Valuation of Shares", *Journal of Business,* October 1961, 34, 411-33.

Otieno, O. L., Ratios-Strengths and Weaknesses, *The Accountant,* July/September 1987.

Pandey I. M; *Financial Management*, (7th Ed) Vikas, Delhi 1997.

Ross, S. S., "The Determination Of Financial Structure: The Incentive Signalling Approach", *Bell Journal Of Economics,* Spring 1977, 8, 23-40.

The CMA (Amendment) Rules, 1994, Legal Notice No. 232.

Woolridge J.R "Stock Dividends as Signals", *Journal of Financial Research* Vol. VI No. 1 spring 1983.

APPENDIX I.

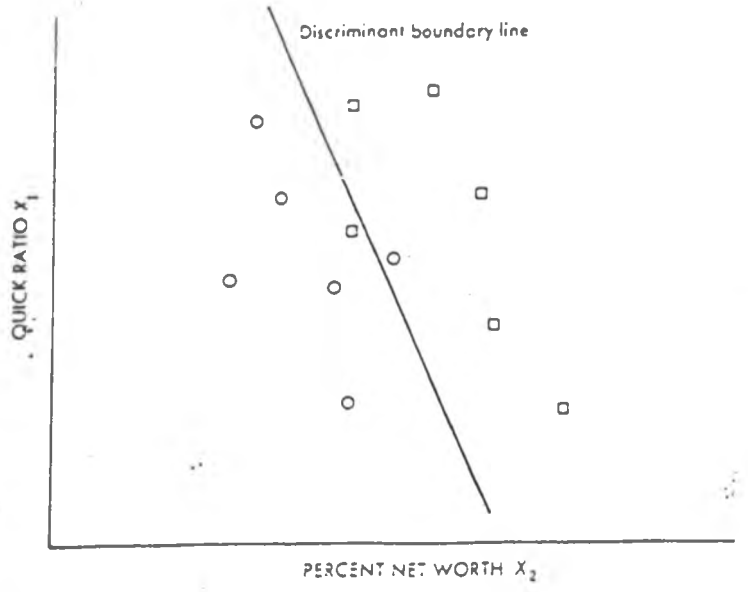
The Application of Discriminant Analysis.

Discriminant analysis is a statistical tool that can help group observations into two or more groupings e.g. in the selection of accounts, it can help decide which prospective accounts to accept or reject on the basis of certain relevant variables. This type of analysis is similar to regression analysis but assumes that the observations come from two different universes i.e. good and bad accounts in the case of accounts selection.

Example:

In the case of the selection of accounts, two characteristics of trade credit applicants may be considered: the quick, or acid test, ratio and the ratio of net worth to total assets. For purposes of experiment, open book credit is extended to all new credit applicants for a sample period. The quick ratio of each account, its net-worth-to-total-assets ratio as well as whether it defaults payment is recorded. If the account defaults, it is classified as a bad account; if it pays in a reasonable period of time, it is classified as a good account. The next step then is to determine a linear discriminant analysis with two independent variables and to determine the predictive value of these variables for the behaviour of the dependent variable, whether the account is good or bad.

The quick ratios and net worth/total assets ratios for each account is plotted on a scatter diagram as follows:



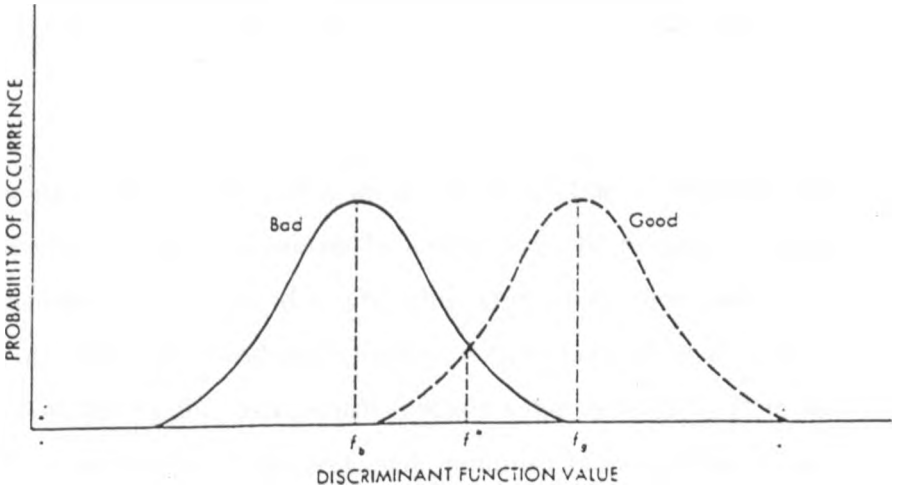
Discriminant analysis of accounts receivable

The circles represent bad accounts and the squares represent good accounts. Using the two independent variables, the linear boundary line that best discriminates between good and bad accounts can then be found. The parameters or weights of the following discriminant function need be found:

$$f_i = a_i (X_1) + a_2 (X_2)$$

Where X_1 is the quick ratio of the firm, X_2 is its net-worth-to-total-assets ratio, and a_1 and a_2 are the parameters or weights to be computed. The aim is to obtain parameter values such that the average or mean value of f_g for the above equation for good accounts will be significantly larger than the average value of f_b for bad accounts. This notion is illustrated in the diagram below, where the discriminant function value is along the horizontal axis, and the probability of occurrence is along the vertical.

UNIVERSITY OF NAIROBI
JOWER KABETE LIBRARY



Universes of good and bad accounts

In the figure, two universes of credit applicants are shown: good to the right and bad to the left. The average value, f_b, for bad accounts is much lower than the average value, f_g, for good accounts, but the two universes overlap. The smaller the overlap, the better the ability of the Discriminant Analysis to predict good and bad accounts i.e., it is desirable that the averages or means of the two distributions, f_b and f_g, be as apart as possible.

The coefficients; a_1 and a_2 in the disciminant function can be computed mathematically from the sample data by;

$$a_1 = \frac{Szzdx - Sxzdz}{SzzSxx - Sxz^2}$$

$$a_2 = \frac{Sxxdz - Sxzdx}{SzzSxx - Sxz^2}$$

Where Sxx and Szz represent the variances of variables X_1 and X_2, respectively, and Sxz is the covariance of the variables X_1 and X_2 The difference between the average of X_{1s} for good accounts and the average for X_{1s} for bad accounts is represented by dx. Similarly, dz represents the difference between the average of the X_{2S} for good accounts and the $X_{2s,}$ for bad accounts.

Solving for a_1 and a_2, the parameters of the linear discriminant function is obtained. The ratio a_1/a_2 determines the slope of the discriminant boundary line. The minimum cut-off value of the function is then determined. The idea is to refuse credit to those accounts with values of f below the cut-off value and extend credit to those with f values above the cut-off value. In theory this involves finding the discriminant function value denoted by f* in the second diagram. Using this value for cut-off purposes will minimise the prediction of good accounts when they are bad and the prediction of bad accounts when they are good. To determine the cut-off value in practice, one would begin by calculating the f_i , for each account given the parameters in the equation:

$$\mathbf{f_i = a_1 (X_1) + a_2 (X_2)}$$

(SOURCE: Altman, E.I., 1968).

APPENDIX 2: QUATED FIRMS AND VARIABLE VALUES

mpany	Ind	Class	Earn	gEarn	TRes	CaTR	ShrF	CcashOp	RoI	TAss	gTAss	DY	DPR	ycDIV
ooke Bond Kenya Ltd.	A	1	266.3	243.1	3999.3	74.81	4444	745.0	15.31	5811	35.55	4.55	70.39	2.
agads Ltd	A	0	17.3	-156.4	135.1	67.11	120	70.4	24.98	167	31.19	21.95	31.89	89.
orge Williamson Kenya Ltd	A	1	91.9	147.8	1011.7	64.65	1080	161.6	11.26	1384	24.67	3.46	37.83	72.
ruzi Ltd	A	1	130.6	54.9	1337.5	50.94	1483	255.7	10.95	1753	37.65	2.70	34.69	24.
chorua Tea Company Ltd*	A	1	28.0	65.5	324.3	67.76	340	44.8	10.70	402	20.59	3.52	21.46	67.
uru Tea Company Ltd.	A	0	16.0	56.5	18.4	40.00	22	19.0	56.97	41	23.10	12.81	85.65	56.
Rejeta Ranching Ltd	A	0	15.3	-509.5	553.5	92.24	616	50.8	2.94	594	77.39	5.17	-16.49	13.
a Vipingo Plantations	A	1	56.8	17.7	160.2	51.91	435	66.1	13.84	765	5.78	3.86	30.37	36.
ni Tea & Coffee Ltd.	A	2	113.2	45.1	1238.5	56.28	1393	190.9	21.49	1521	44.44	8.52	78.50	21.
Baumann & Co Ltd	C	1	15.0	-9.7	277.2	35.28	296	13.5	5.07	405	17.24	6.81	19.58	11.
r & General (K) Ltd	C	2	-24.5	-1640.5	367.3	107.78	467	47.9	5.46	804	-0.56	0.21	54.64	-3.
MC Holdings	C	2	107.0	43.6	860.2	33.87	927	117.0	8.39	2717	17.00	5.78	21.52	10.
press Kenya Ltd	C	0	32.7	19.7	219.3	61.64	243	73.9	11.30	668	19.10	8.45	57.59	12.
tchings Biemer Ltd	C	1	2.9	-36.0	41.6	13.90	49	6.2	-0.17	66	163.84	9.67	12.42	-16.
nya Airways Ltd.*	C	0	1385.6	-6.8	3592.9	80.49	5901	1032.3	12.05	12085	22.18	5.89	15.15	-33.
ohro Motors (E.A) Ltd	C	0	139.9	-105.3	800.6	10.19	984	581.8	13.69	907	46.01	10.51	51.13	12.
rshalls E.A Ltd	C	1	9.8	-27.5	866.6	94.83	912	101.4	8.07	1797	11.32	8.52	28.89	11.
ation Printers and Publishers Ltd	C	2	157.5	45.2	776.0	39.10	850	310.3	22.15	1291	22.22	6.28	24.13	23.
ard Dry Cleaners Ltd	C	0	-2.2	-109.3	37.2	79.32	46	0.6	0.93	72	14.14	5.93	44.21	-13.
he Standard Newspaper Ltd	C	1	0.1	-195.8	18.4	73.98	67	24.9	5.28	254	18.74	2.56	3.46	-42.
PS (Serena Ltd)	C	0	54.8	16.2	347.5	74.54	541	201.5	16.65	963	-1.79	7.02	114.26	-31.
chumi Super Markets Ltd	C	1	244.7	13.8	370.5	48.26	604	507.0	28.53	1020	15.07	11.73	81.90	7.
rclays Bank of Kenya Ltd	F	2	1881.4	35.0	3194.4	17.71	4319	4916.1	6.50	44871	19.48	8.79	54.86	33.
FC Bank Ltd.	F	1	166.0	44.8	487.0	27.61	814	299.5	6.11	4465	23.28	2.88	24.48	34.
ty Trust Ltd*	F	1	21.9	88.2	100.5	7.31	120	6.8	22.17	142	22.19	5.34	34.48	26.
amond Trust Bank Ltd	F	2	81.4	38.9	627.7	44.40	896	392.3	3.16	6406	11.72	3.19	23.22	14.
ousing Finance Company Of Kenya	F	2	180.1	35.4	519.4	55.36	1074	420.8	4.41	7160	20.12	6.29	47.70	31.
C.D.C Investments Co.	F	2	83.1	26.9	295.8	46.29	387	75.9	17.82	489	13.35	10.97	71.57	19.
bilee Insurance Company Ltd	F	2	86.7	18.9	1987.4	80.39	2126	92.3	4.76	2861	22.01	4.80	51.28	14.
nya Commercial Bank Ltd.	F	2	1512.9	34.3	4915.3	21.69	5792	632.9	5.00	53205	21.31	9.11	36.55	25.
ational Bank Of Kenya Ltd	F	0	-125.0	-87.1	1205.4	21.77	1940	-11.0	1.99	18791	16.45	8.38	38.39	
C Bank Ltd	F	2	235.4	39.0	657.8	18.74	840	388.4	7.54	5166	18.52	5.49	32.65	38.
n African Insurance Co. Ltd.	F	2	41.3	33.5	1214.6	36.38	1292	34.3	3.91	1857	18.41	6.15	42.00	16.
andard Chartered Bank	F	1	864.9	31.2	1609.9	36.58	2280	2762.1	5.16	26520	13.52	8.03	63.00	29.
thi River Mining Ltd.	I	0	25.3	-19.6	293.3	83.13	630	69.5	9.21	1043	14.15	1.66	39.99	-27.
mburi Cement Ltd.	I	2	464.3	44.0	5929.3	82.46	6792	1120.2	12.57	5396	53.95	4.72	37.94	54.
T Kenya Ltd	I	1	636.4	28.2	2420.9	48.41	3035	1114.8	23.51	2384	12.91	9.11	69.25	14.
OC Kenya Ltd	I	1	84.3	27.6	650.4	68.36	729	150.2	15.33	518	15.37	6.30	55.45	24.
rbacid Investments Ltd.	I	2	50.9	50.2	366.5	64.18	397	90.4	18.69	438	23.30	3.69	30.66	47.
rown Berger Ltd.	I	0	38.7	178.7	300.3	71.20	396	51.8	16.56	835	32.88	10.95	116.11	88
unlop Kenya Ltd.	I	2	11.5	17.2	47.9	18.91	57	16.3	30.18	78	22.22	13.64	40.92	28.
A Breweries Ltd.*	I	1	515.4	72.8	5741.0	29.45	6710	1323.8	11.44	11003	13.17	10.07	98.27	25.
A Cables Ltd.	I	1	57.2	17.3	143.1	44.18	231	72.8	34.08	289	11.68	6.92	59.83	20.
A Packaging Industies Ltd.*	I	1	34.5	-157.5	284.7	29.40	321	80.7	15.40	685	69.45	4.91	23.04	-43.
A Portland Cement Ltd.*	I	1	-21.0	55.0	553.2	0.00	793	267.3	4.52	3734	12.93	2.59	20.36	91.
restone East Africa (1969) Ltd.	I	1	632.4	0.4	487.9	66.17	1394	863.6	60.63	2064	25.04	9.12	67.33	7.
nya Natoinal Mills Ltd*	I	1	-92.9	-54.4	1598.5	92.33	1777	291.3	4.87	3394	13.12	6.58	43.00	25.
nya Oil Co. Ltd	I	0	89.4	108.4	389.8	57.05	426	106.7	19.84	302	27.75	14.94	34.54	51.
nya Power & Lighting Co. Ltd.	I	2	725.3	16.7	2605.0	17.99	3023	1221.7	7.66	13662	17.14	8.55	14.81	74.
al Kenya Ltd.	I	1	236.2	58.5	554.0	17.99	738	460.0	22.20	2895	18.62	9.06	64.21	45.
Group Ltd	I	1	-22.6	102.2	1891.3	86 765	2349	241.8	5.50	3708	20.01	6.94	64.21	78.

Shares Issue																								
Code	Sector	1999				1998				1997				1996				1995				19		
		Rate	AnnD	RegC	PayD	Rate	AnnD	RegC	PayD	Rate	AnnD	RegC	PayD	Rate	AgmD	RegC	PayD	Rate	AnnD	RegC	PayD	Rate	AnnD	
Bbond	Agri.																							
Eaag	Agri.																							
GWK	Agri.																					1:1	8th July	
Kakuzi	Agri.																	1:2	18th M	16th Ju	30th Jun			
Kapch	Agri.																					1:1	8th July	
Ltea	Agri.																							
Pejeta	Agri.																							
Rea	Agri.					1:14	19th Jan	8th Feb																
Sasini	Agri.					1:2	13th Feb	12th Ma														2:1	11th Ma	
Baum	Comm									1:2	11th Fe	31st Mar												
C&G	Comm													1:10	15th J	23rd Au	24th Sep					1:5	15th Fe	
CMC	Comm					1:1	19th Jan	27th Feb										1:10	11th Ja	17th Fe	17th Mar			
Express	Comm																							
Hutch	Comm																	4:1	26th Nov					
KQ	Comm																							
Lonhro	Comm														2:1									
Marsh	Comm					1:2																1:2	5th Aug	
NMG	Comm					1:1	3rd April	4th June		1:2								1:4	23rd M	6th Jun				
Pearl	Comm																							
Sasws	Comm					1:2	27th Mar	20th April																
TPS	Comm																							
Uchumi	Comm													1:2	9th Oct									
BBK	Financial					1:5	19th Feb	20th Mar						1:5	28th F	28th Mar						1:4	10th Ma	
CFC	Financial																	22:3	27th Fe	29th M	28th April			
CTrust	Financial																					1:5	6th May	
DTB	Financial																	1:4	9th Ma	30th Ju	21st Ju	1:2	18th Fe	
HFCK	Financial					1:4	12th Mar	11th Jun	30th June					1:3	6th M	9th April						1:2	18th Ma	
ICDC	Financial									1:2	11th July							1:5				1:5	7th Oct	
Jubilee	Financial					1:5	8th April		20th June					1:1	4th Ap	29th M	11th Jun					1:4	28th Ma	
KCB	Financial													1:3	5th M	23rd April								
NBK	Financial																							
NIC	Financial	1:4	2nd Mar							1:4	7th Mar	18th J	7th Au	1:4	13th F	3rd May						1:1	10th Ma	
Pan	Financial	1:2	7th	30th Nov						3:10	23rd M	29th Ju	6th Aug					3:7	10th M	23rd Ju	14th July			
SCB	Financial																					1:1	2nd Au	
Athi	Indistrial																							
Bamb.	Indistrial									1:2	19th Fe	4th Ap	6th M	1:1	16th F	11th Mar		1:1	8th Ma	12th M	30th Jun			
BOC	Indistrial																	1:5				1:4	20th Jan	
BAT	Indistrial																					1:1	14th Fe	
Carb	Indistrial													1:1	24th O	22nd N	13 th Dec							
Berger	Indistrial																							
Dun	Indistrial					4:1	8th June			4:1	18th Oc	31th Oct												
Cables	Indistrial																	1:4	23rd Ja	24th M	1st April			
EAPac	Indistrial																					1:5	18th No	
Port	Indistrial													2:1	16th Feb		26th April							
Fire	Indistrial					1:2	20th Feb	18th Ma	6th April															
EAB	Indistrial																					1:4	14th Sep	
Kenmill	Indistrial					3:2	11th Mar	30th Apr	25th May															
Kenol	Indistrial																							
Orchard	Indistrial																							
KPLC	Indistrial					1:2	7th Oct	19th Nov		2:1	15th Jan	6th Feb						1:1	19th D	23rd Fe	30th April			
Total	Indistrial													1:1	11th	10th M	31st May							
Unga	Indistrial					5:1	11th Mar	30th Apr	25th May															

APPENDIX 3: ISSUE DATES AND THE RATIOS OF ISSUES

APPENDIX 4: CORRELATION COEFFICIENTS

19 May 80 SPSS for MS WINDOWS Release 6.0

- - Correlation Coefficients - -

	CATR	CCASHOP	DPR	DY	EARN	GEARN
YCDIV	-.1712	.0614	.0844	.2889	-.0369	.2611
	(50)	(50)	(50)	(50)	(50)	(50)
	P= .234	P= .672	P= .560	P= .042	P= .799	P= .067

(Coefficient / (Cases) / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed

	GTASS	ROI	SHRF	TASS	TRES	YCDIV
CATR	-.1451	-.0487	.0131	-.2995	.0153	-.1712
	(51)	(51)	(51)	(51)	(51)	(50)
	P= .310	P= .734	P= .927	P= .033	P= .915	P= .234
CCASHOP	-.0846	-.0650	.5574	.6952	.5106	.0614
	(51)	(51)	(51)	(51)	(51)	(50)
	P= .555	P= .650	P= .000	P= .000	P= .000	P= .672
DPR	-.2952	.4142	.1194	.0069	.1274	.0844
	(51)	(51)	(51)	(51)	(51)	(50)
	P= .035	P= .003	P= .404	P= .962	P= .373	P= .560
DY	.1123	.4348	-.0258	.0720	-.0247	.2889
	(51)	(51)	(51)	(51)	(51)	(50)
	P= .433	P= .001	P= .857	P= .616	P= .864	P= .042
EARN	-.0770	-.0052	.7114	.8243	.6400	-.0369
	(51)	(51)	(51)	(51)	(51)	(50)
	P= .591	P= .971	P= .000	P= .000	P= .000	P= .799
GEARN	.0127	.1597	.1629	.0880	.1677	.2611
	(51)	(51)	(51)	(51)	(51)	(50)
	P= .929	P= .263	P= .253	P= .539	P= .239	P= .067
GTASS	1.0000	-.1016	-.0346	-.1085	-.0121	-.1419
	(52)	(51)	(51)	(51)	(51)	(50)
	P= .	P= .478	P= .810	P= .448	P= .933	P= .326
ROI	-.1016	1.0000	-.1605	-.2517	-.1853	.1078
	(51)	(51)	(51)	(51)	(51)	(50)
	P= .478	P= .	P= .261	P= .075	P= .193	P= .456

(Coefficient / (Cases) / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed

- - - - K E N D A L L C O R R E L A T I O N C O E F F I C I E N T S - - -

CCASHOP	-.0792					
	N(51)					
	Sig .412					
DPR	.0847	.1522				
	N(51)	N(51)				
	Sig .380	Sig .115				
DY	-.1639	.0745	.3186			
	N(51)	N(51)	N(51)			
	Sig .090	Sig .440	Sig .001			
EARN	-.1906	.6878	.1506	.1043		
	N(51)	N(51)	N(51)	N(51)		
	Sig .048	Sig .000	Sig .119	Sig .280		
GEARN	-.1216	.1733	.1616	-.0463	.2282	
	N(51)	N(51)	N(51)	N(51)	N(51)	
	Sig .208	Sig .073	Sig .094	Sig .632	Sig .018	
GTASS	-.0337	-.0118	-.1240	.0510	.0902	.1624
	N(51)	N(51)	N(51)	N(51)	N(51)	N(51)
	Sig .727	Sig .903	Sig .199	Sig .598	Sig .350	Sig .093
ROI	-.0494	.0729	.2919	.2894	.1718	.1624
	N(51)	N(51)	N(51)	N(51)	N(51)	N(51)
	Sig .609	Sig .450	Sig .003	Sig .003	Sig .075	Sig .093
SHRF	.0306	.5984	.1193	-.0165	.4620	.1420
	N(51)	N(51)	N(51)	N(51)	N(51)	N(51)
	Sig .751	Sig .000	Sig .217	Sig .865	Sig .000	Sig .142
TASS	-.0902	.6031	.0361	-.0714	.4541	.1247
	N(51)	N(51)	N(51)	N(51)	N(51)	N(51)
	Sig .350	Sig .000	Sig .709	Sig .460	Sig .000	Sig .197
TRES	.0165	.5467	.0957	-.0149	.4353	.1843
	N(51)	N(51)	N(51)	N(51)	N(51)	N(51)
	Sig .865	Sig .000	Sig .322	Sig .877	Sig .000	Sig .056
	CATR	CCASHOP	DPR	DY	EARN	GEARN

(Coefficient / (Cases) / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed

19 May 80 SPSS for MS WINDOWS Release 6.0

- - Correlation Coefficients - -

	GTASS	ROI	SHRF	TASS	TRES	YCDIV
SHRF	-.0346	-.1605	1.0000	.6099	.9850	.0213
	(51)	(51)	(51)	(51)	(51)	(50)
	P= .810	P= .261	P= .	P= .000	P= .000	P= .883
TASS	-.1085	-.2517	.6099	1.0000	.5759	.0631
	(51)	(51)	(51)	(51)	(51)	(50)
	P= .448	P= .075	P= .000	P= .	P= .000	P= .664
TRES	-.0121	-.1853	.9850	.5759	1.0000	.0633
	(51)	(51)	(51)	(51)	(51)	(50)
	P= .933	P= .193	P= .000	P= .000	P= .	P= .662
YCDIV	-.1419	.1078	.0213	.0631	.0633	1.0000
	(50)	(50)	(50)	(50)	(50)	(50)
	P= .326	P= .456	P= .883	P= .664	P= .662	P= .

(Coefficient / (Cases) / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed

- - - - K E N D A L L C O R R E L A T I O N C O E F F I C I E N T S - - - -

	CATR	CCASHOP	DPR	DY	EARN	GEARN
YCDIV	-.1478	.0971	.0163	.0890	.0661	.4759
	N(50)	N(50)	N(50)	N(50)	N(50)	N(50)
	Sig .130	Sig .320	Sig .867	Sig .362	Sig .498	Sig .000
ROI	.1090					
	N(51)					
	Sig .259					
SHRF	-.0086	-.1404				
	N(51)	N(51)				
	Sig .929	Sig .146				
TASS	-.1075	-.2612	.7380			
	N(51)	N(51)	N(51)			
	Sig .266	Sig .007	Sig .000			
TRES	.0086	-.1420	.8824	.6580		
	N(51)	N(51)	N(51)	N(51)		
	Sig .929	Sig .142	Sig .000	Sig .000		
YCDIV	.1086	.0857	.0531	.0939	.0939	
	N(50)	N(50)	N(50)	N(50)	N(50)	
	Sig .266	Sig .380	Sig .587	Sig .336	Sig .336	

	GTASS	ROI	SHRF	TASS	TRES

(Coefficient / (Cases) / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed

--- S P E A R M A N C O R R E L A T I O N C O E F F I C I E N T S ---

	CATR	CCASHOP	DPR	DY	EARN	GEARN
CCASHOP	-.1077 N(51) Sig .452					
DPR	.1361 N(51) Sig .341	.2243 N(51) Sig .114				
DY	-.2638 N(51) Sig .061	.1062 N(51) Sig .458	.4491 N(51) Sig .001			
EARN	-.2463 N(51) Sig .081	.8243 N(51) Sig .000	.2196 N(51) Sig .122	.1704 N(51) Sig .232		
GEARN	-.1817 N(51) Sig .202	.2710 N(51) Sig .054	.2439 N(51) Sig .085	-.0374 N(51) Sig .795	.3307 N(51) Sig .018	
GTASS	-.0569 N(51) Sig .692	-.0271 N(51) Sig .850	-.1670 N(51) Sig .242	.0868 N(51) Sig .545	.1357 N(51) Sig .342	.1964 N(51) Sig .167
ROI	-.0369 N(51) Sig .797	.1157 N(51) Sig .419	.4166 N(51) Sig .002	.4099 N(51) Sig .003	.2719 N(51) Sig .054	.2417 N(51) Sig .087
SHRF	.0459 N(51) Sig .749	.7669 N(51) Sig .000	.1542 N(51) Sig .280	-.0604 N(51) Sig .674	.6071 N(51) Sig .000	.2284 N(51) Sig .107
TASS	-.1201 N(51) Sig .401	.7535 N(51) Sig .000	.0803 N(51) Sig .576	-.1123 N(51) Sig .433	.5662 N(51) Sig .000	.2120 N(51) Sig .135
TRES	.0405 N(51) Sig .778	.7381 N(51) Sig .000	.1236 N(51) Sig .388	-.0354 N(51) Sig .805	.5801 N(51) Sig .000	.2720 N(51) Sig .053

(Coefficient / (Cases) / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed

- - - S P E A R M A N C O R R E L A T I O N C O E F F I C I E N T S - - -

	CATR	CCASHOP	DPR	DY	EARN	GEARN
YCDIV	-.2219	.1401	.0347	.1385	.0856	.6150
	N(50)	N(50)	N(50)	N(50)	N(50)	N(50)
	Sig .121	Sig .332	Sig .811	Sig .337	Sig .554	Sig .000
ROI	.1684					
	N(51)					
	Sig .237					
SHRF	-.0230	-.2127				
	N(51)	N(51)				
	Sig .873	Sig .134				
TASS	-.1676	-.3439	.8964			
	N(51)	N(51)	N(51)			
	Sig .240	Sig .013	Sig .000			
TRES	.0081	-.2162	.9700	.8443		
	N(51)	N(51)	N(51)	N(51)		
	Sig .955	Sig .128	Sig .000	Sig .000		
YCDIV	.1321	.1211	.0869	.1378	.1296	
	N(50)	N(50)	N(50)	N(50)	N(50)	
	Sig .360	Sig .402	Sig .549	Sig .340	Sig .370	

	GTASS	ROI	SHRF	TASS	TRES

(Coefficient / (Cases) / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed

APPENDIX 5: VARIABLES STATISTICS.

19 May 80 SPSS for MS WINDOWS Release 6.0

Number of valid observations (listwise) = 50.00

Variable GEARN

Mean	-22.409	S.E. Mean	35.646
Std Dev	254.566	Variance	64803.888
Kurtosis	33.984	S.E. Kurt	.656
Skewness	-5.450	S.E. Skew	.333
Range	1883.632	Minimum	-1640.5
Maximum	243.1		

Valid observations - 51 Missing observations - 1

- -

Variable CLASS

Mean	1.192	S.E. Mean	.135
Std Dev	.971	Variance	.943
Kurtosis	-.582	S.E. Kurt	.650
Skewness	.532	S.E. Skew	.330
Range	3.000	Minimum	.00
Maximum	3.00		

Valid observations - 52 Missing observations - 0

- -

Variable DY

Mean	7.158	S.E. Mean	.532
Std Dev	3.803	Variance	14.460
Kurtosis	3.438	S.E. Kurt	.656
Skewness	1.251	S.E. Skew	.333
Range	21.747	Minimum	.21
Maximum	21.95		

Valid observations - 51 Missing observations - 1

- -

Variable ROI

Mean	13.854	S.E. Mean	1.710
Std Dev	12.213	Variance	149.165
Kurtosis	5.697	S.E. Kurt	.656
Skewness	2.104	S.E. Skew	.333
Range	60.801	Minimum	-.17
Maximum	60.63		

Valid observations - 51 Missing observations - 1

19 May 80 SPSS for MS WINDOWS Release 6.0

Number of valid observations (listwise) = 50.00

Variable YCDIV

Mean	24.456	S.E. Mean	4.577
Std Dev	32.367	Variance	1047.609
Kurtosis	.127	S.E. Kurt	.662
Skewness	.070	S.E. Skew	.337
Range	135.417	Minimum	-43.8
Maximum	91.7		

Valid observations - 50 Missing observations - 2

- -

Variable GTASS

Mean	25.640	S.E. Mean	3.394
Std Dev	24.477	Variance	599.106
Kurtosis	20.059	S.E. Kurt	.650
Skewness	3.939	S.E. Skew	.330
Range	165.624	Minimum	-1.79
Maximum	163.84		

Valid observations - 52 Missing observations - 0

- -

Variable DPR

Mean	45.162	S.E. Mean	3.717
Std Dev	26.545	Variance	704.638
Kurtosis	.745	S.E. Kurt	.656
Skewness	.625	S.E. Skew	.333
Range	132.597	Minimum	-16.49
Maximum	116.11		

Valid observations - 51 Missing observations - 1

- -

Variable CATR

Mean	51.198	S.E. Mean	3.733
Std Dev	26.657	Variance	710.585
Kurtosis	-.936	S.E. Kurt	.656
Skewness	.032	S.E. Skew	.333
Range	107.782	Minimum	.00
Maximum	107.78		

Valid observations - 51 Missing observations - 1

19 May 80 SPSS for MS WINDOWS Release 6.0

Number of valid observations (listwise) = 50.00

Variable EARN

Mean	222.623	S.E. Mean	56.912
Std Dev	406.435	Variance	165189.369
Kurtosis	7.177	S.E. Kurt	.656
Skewness	2.655	S.E. Skew	.333
Range	2006.362	Minimum	-125.0
Maximum	1881.4		

Valid observations - 51 Missing observations - 1

- -

Variable CCASHOP

Mean	434.826	S.E. Mean	113.149
Std Dev	808.047	Variance	652940.176
Kurtosis	19.811	S.E. Kurt	.656
Skewness	4.073	S.E. Skew	.333
Range	4927.103	Minimum	-11.0
Maximum	4916.1		

Valid observations - 51 Missing observations - 1

- -

Variable TRES

Mean	1145.606	S.E. Mean	201.978
Std Dev	1442.409	Variance	2080543.452
Kurtosis	3.678	S.E. Kurt	.656
Skewness	2.033	S.E. Skew	.333
Range	5910.932	Minimum	18.4
Maximum	5929.3		

Valid observations - 51 Missing observations - 1

- -

Variable SHRF

Mean	1441.149	S.E. Mean	244.774
Std Dev	1748.035	Variance	3055627.820
Kurtosis	2.976	S.E. Kurt	.656
Skewness	1.926	S.E. Skew	.333
Range	6769.277	Minimum	22
Maximum	6792		

Valid observations - 51 Missing observations - 1

19 May 80 SPSS for MS WINDOWS Release 6.0

Number of valid observations (listwise) = 50.00

Variable TASS

Mean	5095.069	S.E. Mean	1445.657
Std Dev	10324.055	Variance	106586114.66
Kurtosis	12.944	S.E. Kurt	.656
Skewness	3.503	S.E. Skew	.333
Range	53163.043	Minimum	41
Maximum	53205		

Valid observations - 51 Missing observations - 1

ositional Index

APPENDIX 6:DISCRIMINANT ANALYSIS (FIRMS CLASSIFIED INTO 4 GROUPS).

19 May 80 SPSS for MS WINDOWS Release 6.0

- - - - - - - - D I S C R I M I N A N T A N A L Y S I S - - - - - - - -

On groups defined by CLASS

52 (Unweighted) cases were processed.
2 of these were excluded from the analysis.
0 had missing or out-of-range group codes.
2 had at least one missing discriminating variable.
50 (Unweighted) cases will be used in the analysis.

Number of cases by group

CLASS	Number of cases Unweighted	Weighted	Label
0	11	11.0	
1	23	23.0	
2	9	9.0	
3	7	7.0	
Total	50	50.0	

Group means

CLASS	CATR	CCASHOP	DPR	DY
0	65.17385	205.29880	52.18350	9.56994
1	49.16852	428.74583	44.69153	6.31458
2	48.05732	208.19593	42.41263	6.81920
3	44.14592	1170.55698	40.17786	6.39760
Total	51.78651	443.74206	45.29765	7.13321

CLASS	EARN	GEARN	GTASS	ROI
0	164.79157	-47.95377	27.82784	16.82962
1	172.11354	25.57500	27.03283	14.77161
2	232.55741	-148.79111	19.44443	14.70560
3	516.34290	31.79575	24.23429	6.76589
Total	229.57471	-21.11632	25.45003	14.09169

CLASS	SHRF	TASS	TRES	YCDIV
0	902.29210	1607.05327	607.98897	19.93724
1	1347.92244	3280.91676	1083.89300	24.03938
2	1240.59383	7438.56422	1055.02251	20.80337
3	2780.86846	11567.44154	2301.13451	37.62489
Total	1431.17706	4821.15680	1144.41124	24.45640

Group standard deviations

CLASS	CATR	CCASHOP	DPR	DY
0	23.13723	318.33682	40.14186	5.58451
1	26.88002	625.73983	24.82942	2.76028
2	26.78021	202.22112	21.26069	4.18303
3	28.85741	1715.70774	13.56373	1.66462
Total	26.59059	813.71274	26.79670	3.83725

CLASS	EARN	GEARN	GTASS	ROI
0	406.89781	181.60507	20.50813	15.01158
1	252.51405	89.64704	32.51043	13.17124
2	483.21622	559.50119	12.04887	9.48351
3	647.03752	10.16173	13.19411	2.96959
Total	407.48655	256.98135	24.79258	12.21795

CLASS	SHRF	TASS	TRES	YCDIV
0	1682.78840	3494.23420	1015.23209	45.71833
1	1588.52944	5637.19554	1382.51704	33.45378
2	1751.69441	17270.66146	1490.44267	13.87062
3	2153.76954	15177.41571	1880.07059	21.24450
Total	1764.31660	10239.96232	1457.02753	32.36678

Pooled within-groups covariance matrix with 46 degrees of freedom

	CATR	CCASHOP	DPR	DY
CATR	695.2833			
CCASHOP	-3965.5491	600359.9106		
DPR	30.4552	4321.2731	747.7540	
DY	-31.9991	507.7987	30.1706	13.8282
EARN	-2135.2968	251361.0493	832.9033	236.6596
GEARN	-2424.6517	12085.4500	1174.0378	267.7235
GTASS	-120.4000	-1909.0076	-218.4015	10.4019
ROI	-40.9186	184.9390	134.5177	20.1707
SHRF	4002.0890	671928.4794	7888.8771	213.5841
TASS	-62640.5286	5618810.8213	15665.7923	4859.8409
TRES	3597.9542	484349.3991	7028.5454	263.1087
YCDIV	-130.4176	-162.7567	93.4622	41.9299

	EARN	GEARN	GTASS	ROI
EARN	161703.9249			
GEARN	12980.0605	65468.7225		
GTASS	-765.1666	-88.1382	644.8730	
ROI	261.8393	598.7990	-38.2099	148.7496
SHRF	483852.4750	62442.7235	-1123.4370	-1690.1184
TASS	3474960.5702	297412.7321	-19886.3437	-21062.7329
TRES	347838.6150	53443.7567	8.0873	-1860.9846
YCDIV	-1172.4258	2096.6702	-120.2777	63.6207

	SHRF	TASS	TRES	YCDIV
SHRF	2961150.8831			
TASS	10053315.1425	99772648.0374		
TRES	2387584.2080	7702228.3700	1985567.0362	
YCDIV	-2131.1895	6818.9246	206.1748	1081.9610

Pooled within-groups correlation matrix

	CATR	CCASHOP	DPR	DY	EARN	GEARN
CATR	1.00000					
CCASHOP	-.19410	1.00000				
DPR	.04224	.20395	1.00000			
DY	-.32634	.17624	.29670	1.00000		
EARN	-.20138	.80674	.07575	.15826	1.00000	
GEARN	-.35938	.06096	.16780	.28138	.12615	1.00000
GTASS	-.17981	-.09702	-.31451	.11015	-.07493	-.01356
ROI	-.12724	.01957	.40334	.44474	.05339	.19188
SHRF	.08820	.50395	.16765	.03338	.69923	.14182
TASS	-.23783	.72599	.05735	.13084	.86513	.11637
TRES	.09684	.44362	.18241	.05021	.61387	.14823
YCDIV	-.15037	-.00639	.10391	.34280	-.08864	.24912

	GTASS	ROI	SHRF	TASS	TRES	YCDIV
GTASS	1.00000					
ROI	-.12337	1.00000				
SHRF	-.02571	-.08053	1.00000			
TASS	-.07840	-.17289	.58489	1.00000		
TRES	.00023	-.10829	.98466	.54723	1.00000	
YCDIV	-.14399	.15859	-.03765	.02075	.00445	1.00000

Wilks' Lambda (U-statistic) and univariate F-ratio
with 3 and 46 degrees of freedom

Variable	Wilks' Lambda	F	Significance
CATR	.92314	1.2766	.2935
CCASHOP	.85120	2.6805	.0578
DPR	.97759	.3515	.7883
DY	.88163	2.0587	.1188
EARN	.91423	1.4385	.2438
GEARN	.93066	1.1424	.3420
GTASS	.98490	.2351	.8715
ROI	.93545	1.0581	.3761
SHRF	.89304	1.8365	.1538
TASS	.89326	1.8323	.1545
TRES	.87803	2.1299	.1093
YCDIV	.96956	.4814	.6968

Covariance matrix for group 0,

	CATR	CCASHOP	DPR	DY
CATR	535.3314			
CCASHOP	-1282.0624	101338.3331		
DPR	-249.0468	-2965.0411	1611.3692	
DY	-53.3295	-304.9080	24.8865	31.1868
EARN	1389.8012	116865.4052	-4813.9829	-460.5379
GEARN	-1145.2448	2825.9401	5215.8347	172.9522
GTASS	-27.3834	9.5589	-472.5489	9.6161
ROI	-164.0987	-680.0010	242.0200	44.7190
SHRF	6768.5455	490357.4615	-21895.1386	-2592.6436
TASS	17950.0946	980851.0790	-39317.8741	-5299.0969
TRES	3269.5659	300355.0753	-14284.0729	-1425.8615
YCDIV	-300.7317	-6125.7391	365.3648	209.9324

	EARN	GEARN	GTASS	ROI
EARN	165565.8309			
GEARN	7103.4075	32980.4001		
GTASS	-657.9453	-2591.7842	420.5836	
ROI	-657.1532	1048.6730	-50.6991	225.3477
SHRF	679690.0356	11352.3552	-1000.1420	-4374.2901
TASS	1413117.0106	52546.2386	-6736.8465	-7804.1860
TRES	407918.5740	577.0070	682.4129	-2852.3665
YCDIV	-7190.4729	1464.9344	296.8423	342.2124

	SHRF	TASS	TRES	YCDIV
SHRF	2831776.7950			
TASS	5844487.2099	12209672.6241		
TRES	1702534.6201	3490877.0553	1030696.1976	
YCDIV	-33702.9579	-68143.8346	-19251.2182	2090.1659

ovariance matrix for group 1,

	CATR	CCASHOP	DPR	DY
CATR	722.5356			
CCASHOP	-1418.9918	391550.3293		
DPR	69.2436	9053.1540	616.5003	
DY	-2.5145	662.0152	43.2220	7.6192
EARN	-760.9052	143018.0531	3981.6954	318.2039
GEARN	-37.1359	10980.8024	1025.5309	-11.2751
GTASS	-262.2603	-3968.2402	-268.5951	11.7568
ROI	9.8740	790.0482	155.9776	12.9453
SHRF	5686.1378	582803.7592	27550.0865	1196.2596
TASS	-15918.1757	3245177.2300	54767.0342	2988.9344
TRES	5521.7538	448739.6288	22497.4065	885.3232
YCDIV	-35.3108	609.7501	110.1987	-19.2419

	EARN	GEARN	GTASS	ROI
EARN	63763.3434			
GEARN	4333.2353	8036.5917		
GTASS	-1419.5686	-561.6909	1056.9278	
ROI	1354.1505	76.3600	-88.4297	173.4817
SHRF	215502.9118	64582.8251	-9495.0685	-359.4144
TASS	986752.4944	96498.6804	-31330.5289	-14009.8407
TRES	156701.0308	57605.4092	-7243.6866	-1743.9396
YCDIV	-618.4771	1877.4499	-439.3276	-59.3846

	SHRF	TASS	TRES	YCDIV
SHRF	2523425.7704			
TASS	4528530.8808	31777973.5488		
TRES	2176565.9045	3591594.8715	1911353.3733	
YCDIV	4442.2025	24014.8946	3567.1334	1119.1556

ovariance matrix for group 2,

	CATR	CCASHOP	DPR	DY
CATR	717.1794			
CCASHOP	-2160.2346	40893.3802		
DPR	189.3059	-1344.0687	452.0171	
DY	-83.1570	-14.1920	26.9828	17.4977
EARN	-5414.1378	80819.0417	-1243.9180	448.9152
GEARN	-12427.4020	33979.9995	-2618.7548	1358.2154
GTASS	-126.0316	308.8742	70.9544	23.7014
ROI	-70.9722	-924.5022	53.3479	25.1087
SHRF	-16670.4398	302357.1644	-2940.5147	1077.5208
TASS	-176503.1826	2921355.6212	-55172.7288	11696.0829
TRES	-14367.3456	253971.7359	-2447.6910	968.1386
YCDIV	-153.2248	202.1901	-48.4004	21.1388

	EARN	GEARN	GTASS	ROI
EARN	233497.9198			
GEARN	53579.3015	313041.5812		
GTASS	676.8112	4225.5066	145.1752	
ROI	-1686.0622	1912.9566	62.6247	89.9370
SHRF	833894.1308	162759.3210	3600.0774	-7157.8176
TASS	8269293.0232	1374855.1714	8460.2757	-73800.7806
TRES	708554.6044	144860.2968	3466.8477	-5807.9867
YCDIV	1048.2875	5077.6585	89.4966	69.5173

	SHRF	TASS	TRES	YCDIV
SHRF	3068433.2916			
TASS	29664492.3283	298275747.3850		
TRES	2608459.4589	25091441.6176	2221419.3625	
YCDIV	1980.6754	24934.5249	1893.9699	192.3941

Covariance matrix for group 3

	CATR	CCASHOP	DPR	DY
CATR	832.7503			
CCASHOP	-20182.4893	2943653.0454		
DPR	142.2669	6668.6896	183.9748	
DY	-36.3480	1992.8371	-4.6274	2.7710
EARN	-8678.1084	1100167.4521	1467.9047	816.6520
GEARN	25.7792	2375.6081	39.2914	-5.3191
GTASS	252.2357	-513.2747	3.4123	-10.9896
ROI	18.2136	887.0270	-15.1124	-.8343
SHRF	20779.8545	1794099.2369	-123.0088	135.5710
TASS	-216456.6563	25648673.8262	58385.3773	19536.4050
TRES	21045.0697	1228745.9809	-1534.5991	-143.4343
YCDIV	-164.8762	6456.4268	-231.9259	13.9434

	EARN	GEARN	GTASS	ROI
EARN	418657.5539			
GEARN	347.1867	103.2608		
GTASS	-467.0319	69.4387	174.0845	
ROI	385.5549	12.4086	32.2981	8.8185
SHRF	674682.7311	5990.8348	23069.0341	5194.5190
TASS	9642352.8433	5618.4921	-37635.6527	1296.4811
TRES	467588.5061	4406.8938	20862.3687	4624.8232
YCDIV	3865.5562	-21.2805	74.6730	42.4582

	SHRF	TASS	TRES	YCDIV
SHRF	4638723.2320			
TASS	11177334.4090	230353947.7211		
TRES	4008566.9657	6607852.3924	3534665.4296	
YCDIV	20903.5004	44550.8328	18061.2548	451.3286

Total covariance matrix with 49 degrees of freedom

	CATR	CCASHOP	DPR	DY
CATR	707.0595			
CCASHOP	-5052.9203	662128.4208		
DPR	57.5941	3285.6101	718.0631	
DY	-20.6928	289.2443	33.0274	14.7245
EARN	-2443.7013	269490.0871	486.7927	178.5047
GEARN	-2384.5384	23470.9840	1076.3438	220.5135
GTASS	-102.3869	-1796.9583	-197.7331	10.9317
ROI	-23.4448	-764.9283	135.3536	20.9066

	CATR	CCASHOP	DPR	DY
SHRF	927.2372	808070.9474	5725.8465	-187.6558
TASS	-75728.5347	6044921.6850	3855.3037	2536.0548
TRES	638.5674	607805.6639	4987.5821	-139.5811
YCDIV	-147.3734	1617.3819	73.1773	35.8777

	EARN	GEARN	GTASS	ROI
EARN	166045.2877			
GEARN	13414.0228	66039.4136		
GTASS	-848.6866	69.2661	614.6719	
ROI	-112.1270	490.7727	-33.3088	149.2783
SHRF	519354.2601	74652.8586	-1423.0094	-3372.2836
TASS	3628301.9781	254426.3218	-25587.6627	-29005.3843
TRES	383314.2952	62916.8783	-426.0038	-3316.7053
YCDIV	-486.2037	2171.5941	-113.8934	42.6215

	SHRF	TASS	TRES	YCDIV
SHRF	3112813.0477			
TASS	11088754.0338	104856828.3889		
TRES	2533619.9943	8733287.1439	2122929.2182	
YCDIV	1219.0754	20898.6581	2985.6199	1047.6086

APPENDIX 7: DISCRIMINANT ANALYSIS (II)

19 May 80 SPSS for MS WINDOWS Release 6.0

- - - - - - - - D I S C R I M I N A N T A N A L Y S I S - - - - - - - -

On groups defined by CLASS

Analysis number 1

Direct method: all variables passing the tolerance test are entered.

Minimum tolerance level..... .00100

Canonical Discriminant Functions

Maximum number of functions..... 3
Minimum cumulative percent of variance... 100.00
Maximum significance of Wilks' Lambda.... 1.0000

Prior probabilities

Group	Prior	Label
0	.22000	
1	.46000	
2	.18000	
3	.14000	
Total	1.00000	

Classification function coefficients
(Fisher's linear discriminant functions)

CLASS =	0	1	2	3
CATR	.1640812	.1251779	.1172317	.1201333
CCASHOP	-.0010856	.0004587	-.0015726	.0011670
DPR	.0694173	.0505491	.0504096	.0461966
DY	.8285907	.3891945	.4683444	.3706393
EARN	-.0018138	-.0055591	-.0027517	.0010478
GEARN	.0004412	.0012331	-.0025092	.0007641
GTASS	.0999025	.0954018	.0767697	.0857959
ROI	.0012756	.0711813	.0867632	-.0109715
SHRF	.0062832	.0046186	.0024312	.0010703
TASS	.0002035	.0002408	.0003399	.0000679
TRES	-.0081222	-.0055066	-.0031514	-.0013258
YCDIV	.0207861	.0245627	.0191773	.0428472
(Constant)	-14.5026296	-8.4819063	-9.5943350	-9.8613313

Canonical Discriminant Functions

Fcn	Eigenvalue	Pct of Variance	Cum Pct	Canonical Corr	After Fcn	Wilks' Lambda	Chi-square	df	Sig
					0	.375753	40.132	36	.2920
1*	.6869	57.07	57.07	.6381	1	.633873	18.692	22	.6643
2*	.3351	27.84	84.91	.5010	2	.846279	6.843	10	.7402
3*	.1816	15.09	100.00	.3921					

* Marks the 3 canonical discriminant functions remaining in the analysis.

Standardized canonical discriminant function coefficients

	Func 1	Func 2	Func 3
CATR	.50372	.39424	.17178
CCASHOP	-.72117	.83767	-.47328
DPR	.26914	.11859	.08444
DY	.77152	.24668	.52713
EARN	-.02808	.31251	2.27421
GEARN	-.07280	.54797	-.39091
GTASS	.11321	.28658	-.23483
ROI	-.11134	-.60507	-.77375
SHRF	2.94602	1.82868	-3.66540
TASS	.31979	-1.17381	-.82555
TRES	-3.26900	-1.81563	3.17665
YCDIV	-.22535	.22667	.25803

Structure matrix:

Pooled within-groups correlations between discriminating variables and canonical discriminant functions
(Variables ordered by size of correlation within function)

	Func 1	Func 2	Func 3
CCASHOP	-.40028*	.33717	.38305
DY	.39669*	.16094	.31026
TRES	-.39345*	.12612	.38726
CATR	.33004*	.15232	.06022
YCDIV	-.17249*	.12922	.17184
DPR	.16992*	.09234	-.03559
GEARN	-.14768	.37618*	-.25812
GTASS	.04067	.18005*	-.13542
TASS	-.30007	-.12336	.53786*
EARN	-.24259	.10080	.52458*
SHRF	-.34935	.16845	.38145*
ROI	.25842	-.10659	-.32615*

* denotes largest absolute correlation between each variable and any discriminant function.

Unstandardized canonical discriminant function coefficients

	Func 1	Func 2	Func 3
CATR	.0191035	.0149515	6.51448433E-03
CCASHOP	-9.30751882E-04	1.08110375E-03	-6.10816498E-04
DPR	9.84223519E-03	4.33668543E-03	3.08792115E-03
DY	.2074737	.0663360	.1417528
EARN	-6.98350180E-05	7.77154626E-04	5.65548439E-03
GEARN	-2.84538133E-04	2.14161052E-03	-1.52776711E-03
GTASS	4.45794212E-03	.0112850	-9.24729657E-03
ROI	-9.12877196E-03	-.0496110	-.0634412
SHRF	1.71200418E-03	1.06269248E-03	-2.13005740E-03
TASS	3.20154427E-05	-1.17514828E-04	-8.26493345E-05
TRES	-2.31991740E-03	-1.28849931E-03	2.25438075E-03
YCDIV	-6.85109133E-03	6.89099553E-03	7.84447884E-03
(Constant)	-2.2589038	-1.2932377	-.7434565

Canonical discriminant functions evaluated at group means (group centroids)

Group	Func 1	Func 2	Func 3
0	1.31583	.39276	.22592
1	-.26888	.09481	-.41495
2	.04811	-1.13320	.25413
3	-1.24614	.52825	.68166

Test of Equality of Group Covariance Matrices Using Box's M

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

Group Label	Rank	Log Determinant
0	< 11	(Too few cases to be non-singular)
1	12	97.039107
2	< 9	(Too few cases to be non-singular)
3	< 7	(Too few cases to be non-singular)
Pooled within-groups covariance matrix	12	108.777028

No test can be performed without at least two non-singular group covariance matrices.

APPENDIX 8: DISCRIMINANT ANALYSIS (III).

```
Worksheet size: 100000 cells


MTB > # Opening worksheet from file: C:\AGUTUPRO\MBAPR.XLS
MTB > # File was last modified on 5/19/80
MTB > Name c16 = 'FITS1'
MTB > Discriminant 'Class' 'Earn'-'ycDIV';
SUBC>   Brief 4;
SUBC>   Fits 'FITS1'.
```

Discriminant Analysis

```
After subtracting group means,
ShrF    is highly correlated with other predictors

Linear Method for Response:   Class
Predictors:  Earn  gEarn  TRes  CaTR  ShrF  CcashOp  RoI  TAss  gTAss  DY  DPR  y
V

Group        0        1        2        3
Count       11       23        9        7

   50 cases used   2 cases contain missing values

Summary of Classification

Put into      ....True Group....
Group            0        1        2        3
0                8        5        1        1
1                2       12        5        2
2                1        2        3        0
3                0        4        0        4
Total N         11       23        9        7
N Correct        8       12        3        4
Proport.     0.727    0.522    0.333    0.571

N =   50     N Correct =   27     Prop. Correct = 0.540

Squared Distance Between Groups
               0        1        2        3
0        0.00000  3.01081  3.93649  6.78978
1        3.01081  0.00000  2.05617  2.34548
2        3.93649  2.05617  0.00000  4.61830
3        6.78978  2.34548  4.61830  0.00000

       Linear Discriminant Function for Group
               0        1        2        3
Constant  -12.989   -7.705   -7.880   -7.895
Earn       -0.002   -0.006   -0.003    0.001
gEarn       0.000    0.001   -0.003    0.001
TRes       -0.008   -0.006   -0.003   -0.001
CaTR        0.164    0.125    0.117    0.120
ShrF        0.006    0.005    0.002    0.001
CcashOp    -0.001    0.000   -0.002    0.001
RoI         0.001    0.071    0.087   -0.011
TAss        0.000    0.000    0.000    0.000
gTAss       0.100    0.095    0.077    0.086
DY          0.829    0.389    0.468    0.371
DPR         0.069    0.051    0.050    0.046
ycDIV       0.021    0.025    0.019    0.043

Variable   Pooled    Means for Group
             Mean        0        1        2        3
Earn       229.57   164.79   172.11   232.56   516.34
gEarn     -21.116  -47.954   25.575 -148.791   31.796
TRes       1144.4    608.0   1083.9   1055.0   2301.1
CaTR       51.787   65.174   49.169   48.057   44.146
ShrF       1431.2    902.3   1347.9   1240.6   2780.9
CcashOp    443.74   205.30   428.75   208.20  1170.56
```

RoI	14.092	16.830	14.772	14.706	6.766
TAss	4821.2	1607.1	3280.9	7438.6	11567.4
gTAss	25.450	27.828	27.033	19.444	24.234
DY	7.1332	9.5699	6.3146	6.8192	6.3976
DPR	45.298	52.183	44.692	42.413	40.178
ycDIV	24.456	19.937	24.039	20.803	37.625

Variable	Pooled Stdev	Stdev for Group 0	1	2	3
Earn	402.1	406.9	252.5	483.2	647.0
gEarn	255.9	181.6	89.6	559.5	10.2
TRes	1409	1015	1383	1490	1880
CaTR	26.37	23.14	26.88	26.78	28.86
ShrF	1721	1683	1589	1752	2154
CcashOp	774.8	318.3	625.7	202.2	1715.7
RoI	12.20	15.01	13.17	9.48	2.97
TAss	9989	3494	5637	17271	15177
gTAss	25.39	20.51	32.51	12.05	13.19
DY	3.719	5.585	2.760	4.183	1.665
DPR	27.35	40.14	24.83	21.26	13.56
ycDIV	32.89	45.72	33.45	13.87	21.24

Pooled Covariance Matrix

	Earn	gEarn	TRes	CaTR	ShrF	CcashOp	RoI
Earn	161704						
gEarn	12980	65469					
TRes	347839	53444	1985567				
CaTR	-2135	-2425	3598	695			
ShrF	483852	62443	2387584	4002	2961151		
CcashOp	251361	12085	484349	-3966	671928	600360	
RoI	262	599	-1861	-41	-1690	185	149
TAss	3474960	297413	7702228	-62641	10053315	5618811	-21063
gTAss	-765	-88	8	-120	-1123	-1909	-38
DY	237	268	263	-32	214	508	20
DPR	833	1174	7029	30	7889	4321	135
ycDIV	-1172	2097	206	-130	-2131	-163	64

	TAss	gTAss	DY	DPR	ycDIV
TAss	99772648				
gTAss	-19886	645			
DY	4860	10	14		
DPR	15666	-218	30	748	
ycDIV	6819	-120	42	93	1082

Covariance Matrix for Group 0

	Earn	gEarn	TRes	CaTR	ShrF	CcashOp
Earn	165566					
gEarn	7103	32980				
TRes	407919	577	1030696			
CaTR	1390	-1145	3270	535		
ShrF	679690	11352	1702535	6769	2831777	
CcashOp	116865	2826	300355	-1282	490357	101338
RoI	-657	1049	-2852	-164	-4374	-680
TAss	1413117	52546	3490877	17950	5844487	980851
gTAss	-658	-2592	682	-27	-1000	10
DY	-461	173	-1426	-53	-2593	-305
DPR	-4814	5216	-14284	-249	-21895	-2965
ycDIV	-7190	1465	-19251	-301	-33703	-6126

	RoI	TAss	gTAss	DY	DPR	ycDIV
RoI	225					
TAss	-7804	12209672				
gTAss	-51	-6737	421			
DY	45	-5299	10	31		
DPR	242	-39318	-473	25	1611	
ycDIV	342	-68144	297	210	365	2090

Covariance Matrix for Group 1

	Earn	gEarn	TRes	CaTR	ShrF	CcashOp

Earn	63763					
gEarn	4333	8037				
TRes	156701	57605	1911353			
CaTR	-761	-37	5522	723		
ShrF	215503	64583	2176566	5686	2523426	
CcashOp	143018	10981	448740	-1419	582804	391550
RoI	1354	76	-1744	10	-359	790
TAss	986753	96499	3591595	-15918	4528531	3245177
gTAss	-1420	-562	-7244	-262	-9495	-3968
DY	318	-11	885	-3	1196	662
DPR	3982	1026	22497	69	27550	9053
ycDIV	-618	1877	3567	-35	4442	610

	RoI	TAss	gTAss	DY	DPR	ycDIV
RoI	173					
TAss	-14010	31777974				
gTAss	-88	-31331	1057			
DY	13	2989	12	8		
DPR	156	54767	-269	43	617	
ycDIV	-59	24015	-439	-19	110	1119

Covariance Matrix for Group 2

	Earn	gEarn	TRes	CaTR	ShrF	CcashOp
Earn	233498					
gEarn	53579	313042				
TRes	708555	144860	2221420			
CaTR	-5414	-12427	-14367	717		
ShrF	833894	162759	2608460	-16670	3068433	
CcashOp	80819	33980	253972	-2160	302357	40893
RoI	-1686	1913	-5808	-71	-7158	-925
TAss	8269293	1374855	25091442	-176503	29664492	2921355
gTAss	677	4226	3467	-126	3600	309
DY	449	1358	968	-83	1078	-14
DPR	-1244	-2619	-2448	189	-2941	-1344
ycDIV	1048	5078	1894	-153	1981	202

	RoI	TAss	gTAss	DY	DPR	ycDIV
RoI	90					
TAss	-73801	298275744				
gTAss	63	8460	145			
DY	25	11696	24	17		
DPR	53	-55173	71	27	452	
ycDIV	70	24935	89	21	-48	192

Covariance Matrix for Group 3

	Earn	gEarn	TRes	CaTR	ShrF	CcashOp
Earn	418658					
gEarn	347	103				
TRes	467589	4407	3534666			
CaTR	-8678	26	21045	833		
ShrF	674683	5991	4008567	20780	4638723	
CcashOp	1100168	2376	1228746	-20182	1794099	2943653
RoI	386	12	4625	18	5195	887
TAss	9642353	5618	6607852	-216457	11177334	25648674
gTAss	-467	69	20862	252	23069	-513
DY	817	-5	-143	-36	136	1993
DPR	1468	39	-1535	142	-123	6669
ycDIV	3866	-21	18061	-165	20903	6456

	RoI	TAss	gTAss	DY	DPR	ycDIV
RoI	9					
TAss	1296	230353952				
gTAss	32	-37636	174			
DY	-1	19536	-11	3		
DPR	-15	58385	3	-5	184	
ycDIV	42	44551	75	14	-232	451

Summary of Classified Observations

Observation		True Group	Pred Group	Group	Sqrd Distnc	Probability
1		1	1	0	17.39	0.015
				1	10.21	0.555
				2	14.72	0.058
				3	11.01	0.372
2		0	0	0	19.90	0.986
				1	31.01	0.004
				2	29.18	0.010
				3	33.89	0.001
3	**	1	3	0	11.808	0.035
				1	6.998	0.392
				2	10.120	0.082
				3	6.546	0.491
4		1	1	0	9.219	0.021
				1	2.831	0.508
				2	5.452	0.137
				3	3.670	0.334
5		1	1	0	9.924	0.066
				1	6.088	0.452
				2	8.520	0.134
				3	6.618	0.347
6	**	0	2	0	17.66	0.175
				1	16.46	0.319
				2	15.55	0.503
				3	26.03	0.003
7		0	0	0	13.07	0.373
				1	13.66	0.277
				2	13.87	0.249
				3	15.69	0.101
8		1	1	0	5.958	0.104
				1	2.564	0.570
				2	4.389	0.229
				3	6.125	0.096
9	**	2	1	0	3.995	0.353
				1	3.723	0.404
				2	5.290	0.185
				3	7.611	0.058
10		1	1	0	6.038	0.128
				1	3.888	0.374
				2	4.146	0.329
				3	5.474	0.169
11		2	2	0	46.29	0.012
				1	47.44	0.007
				2	37.47	0.979
				3	49.64	0.002
12	**	2	1	0	7.644	0.043
				1	3.261	0.386
				2	3.386	0.363
				3	4.500	0.208
13		0	0	0	1.635	0.577
				1	3.558	0.220
				2	4.222	0.158
				3	6.745	0.045
14	**	1	0	0	31.88	0.593
				1	32.98	0.341
				2	37.70	0.032
				3	37.64	0.033
15		0	0	0	34.35	0.960
				1	41.71	0.024
				2	45.36	0.004
				3	43.12	0.012
16	**	0	1	0	8.100	0.179
				1	6.332	0.434
				2	7.764	0.212
				3	8.147	0.175
17	**	1	0	0	5.987	0.624
				1	8.435	0.183
				2	8.950	0.142

			3	11.001	0.051
18 **	2	1	0	8.476	0.033
			1	3.131	0.479
			2	4.021	0.307
			3	5.086	0.180
19	0	0	0	4.649	0.641
			1	7.338	0.167
			2	7.584	0.148
			3	9.991	0.044
20 **	1	2	0	10.938	0.128
			1	8.601	0.410
			2	8.589	0.413
			3	12.826	0.050
21	0	0	0	10.99	0.747
			1	14.27	0.145
			2	14.97	0.102
			3	20.79	0.006
22 **	1	0	0	2.983	0.695
			1	5.900	0.162
			2	6.418	0.125
			3	10.220	0.019
23	3	3	0	45.58	0.000
			1	38.38	0.005
			2	43.14	0.000
			3	27.62	0.995
24	1	1	0	9.279	0.032
			1	3.488	0.570
			2	5.876	0.173
			3	5.338	0.226
25	1	1	0	12.143	0.014
			1	4.913	0.527
			2	5.547	0.384
			3	8.827	0.075
26 **	2	1	0	9.601	0.043
			1	4.280	0.617
			2	6.452	0.208
			3	7.362	0.132
27 **	3	0	0	6.940	0.518
			1	7.661	0.361
			2	10.651	0.081
			3	12.034	0.041
28 **	2	0	0	2.299	0.652
			1	5.208	0.152
			2	4.971	0.171
			3	8.832	0.025
29 **	3	1	0	6.059	0.143
			1	4.125	0.375
			2	5.239	0.215
			3	4.809	0.267
30	2	2	0	54.37	0.001
			1	53.10	0.001
			2	39.25	0.997
			3	52.18	0.002
32	3	3	0	8.428	0.033
			1	3.670	0.351
			2	4.429	0.240
			3	3.529	0.377
33 **	3	1	0	6.501	0.073
			1	3.210	0.376
			2	3.635	0.304
			3	4.051	0.247
34 **	1	3	0	18.24	0.036
			1	14.22	0.267
			2	18.29	0.035
			3	12.41	0.662
35 **	0	1	0	7.897	0.254
			1	6.305	0.563
			2	8.824	0.160
			3	12.666	0.023

36		3	3	0	30.80	0.001
				1	21.68	0.101
				2	27.80	0.005
				3	17.32	0.893
37	**	1	3	0	12.937	0.118
				1	12.022	0.187
				2	14.184	0.063
				3	9.580	0.632
38		1	1	0	2.955	0.275
				1	2.261	0.388
				2	3.439	0.216
				3	4.584	0.122
39	**	2	1	0	8.381	0.058
				1	3.838	0.561
				2	5.807	0.209
				3	6.203	0.172
40		0	0	0	17.36	0.925
				1	23.18	0.050
				2	26.10	0.012
				3	25.98	0.012
41		2	2	0	8.206	0.274
				1	8.346	0.255
				2	7.184	0.456
				3	13.978	0.015
42	**	1	3	0	28.91	0.011
				1	22.66	0.242
				2	25.48	0.059
				3	20.58	0.688
43	**	1	2	0	7.576	0.080
				1	4.154	0.444
				2	4.096	0.457
				3	10.549	0.018
44		1	1	0	12.999	0.055
				1	8.492	0.523
				2	9.055	0.395
				3	14.430	0.027
45		1	1	0	26.33	0.003
				1	16.00	0.502
				2	19.01	0.111
				3	16.53	0.384
46	**	1	0	0	20.43	0.538
				1	21.27	0.354
				2	23.72	0.104
				3	30.35	0.004
47		1	1	0	8.656	0.291
				1	7.714	0.466
				2	9.981	0.150
				3	10.956	0.092
48		0	0	0	4.675	0.850
				1	9.588	0.073
				2	10.168	0.055
				3	11.947	0.022
50		3	3	0	20.235	0.002
				1	14.706	0.028
				2	14.457	0.031
				3	7.659	0.939
51		1	1	0	6.145	0.121
				1	3.679	0.414
				2	4.414	0.287
				3	5.361	0.179
52	**	1	0	0	11.38	0.436
				1	11.48	0.414
				2	16.05	0.042
				3	14.17	0.108

MTB >

UNIVERSITY OF NAIROBI

APPENDIX 9: DISCRIMINANT ANALYSIS (FIRMS GROUPED INTO 3 CLASSES).

```
Worksheet size: 100000 cells


MTB > # Opening worksheet from file: C:\AGUTUPRO\MBAPR2.XLS
MTB > # File was last modified on 5/20/80
MTB > Discriminant 'Class' 'Earn'-'ycDIV';
SUBC>   Brief 4.
```

Discriminant Analysis

```
After subtracting group means,
ShrF    is highly correlated with other predictors

Linear Method for Response:   Class
Predictors:  Earn  gEarn  TRes  CaTR  ShrF  CcashOp  RoI  TAss  gTAss  DY  DPR
V

Group        0        1        2
Count       11       23       16

   50 cases used   1 cases contain missing values

Summary of Classification

Put into     ....True Group....
Group             0        1        2
0                 8        5        2
1                 3       15        6
2                 0        3        8
Total N          11       23       16
N Correct         8       15        8
Proport.      0.727    0.652    0.500

N =   50     N Correct =   31     Prop. Correct = 0.620

Squared Distance Between Groups
               0        1        2
0        0.00000  2.97324  4.05510
1        2.97324  0.00000  1.06765
2        4.05510  1.06765  0.00000

        Linear Discriminant Function for Group
                0        1        2
Constant  -13.208   -7.872   -7.475
Earn       -0.002   -0.006   -0.001
gEarn       0.001    0.001   -0.001
TRes       -0.008   -0.006   -0.002
CaTR        0.168    0.128    0.121
ShrF        0.006    0.005    0.002
CcashOp    -0.001    0.000   -0.000
RoI        -0.007    0.072    0.043
TAss        0.000    0.000    0.000
gTAss       0.103    0.098    0.083
DY          0.838    0.397    0.433
DPR         0.071    0.052    0.050
ycDIV       0.023    0.025    0.031

Variable   Pooled    Means for Group
             Mean         0        1        2
Earn       229.57   164.79   172.11   356.71
gEarn     -21.116  -47.954   25.575  -69.784
TRes       1144.4    608.0   1083.9   1600.2
CaTR       51.787   65.174   49.169   46.346
ShrF       1431.2    902.3   1347.9   1914.5
CcashOp    443.74   205.30   428.75   629.23
```

DPR	45.298	52.183	44.692	41.435
ycDIV	24.456	19.937	24.039	28.163

Variable	Pooled Stdev	Stdev for Group 0	1	2
Earn	406.2	406.9	252.5	559.6
gEarn	258.5	181.6	89.6	419.0
TRes	1440	1015	1383	1734
CaTR	26.11	23.14	26.88	26.83
ShrF	1760	1683	1589	2028
CcashOp	815.6	318.3	625.7	1201.0
RoI	12.28	15.01	13.17	8.25
TAss	9954	3494	5637	15991
gTAss	25.16	20.51	32.51	12.37
DY	3.681	5.585	2.760	3.238
DPR	27.06	40.14	24.83	17.78
ycDIV	32.90	45.72	33.45	18.91

Pooled Covariance Matrix

	Earn	gEarn	TRes	CaTR	ShrF	CcashOp	RoI
Earn	165010						
gEarn	16997	66808					
TRes	370064	71159	2073409				
CaTR	-2183	-2432	3113	682			
ShrF	510177	84417	2497581	3412	3096903		
CcashOp	268893	26388	574510	-4197	781814	665175	
RoI	68	466	-2650	-37	-2679	-459	151
TAss	3499188	353550	7969386	-62661	10372201	5832145	-23361
gTAss	-635	-14	508	-119	-481	-1482	-41
DY	222	256	213	-31	155	463	20
DPR	762	1115	6646	31	7433	4049	133
ycDIV	-748	2307	1958	-133	85	1197	51

	TAss	gTAss	DY	DPR	ycDIV
TAss	99078016				
gTAss	-17806	633			
DY	4611	10	14		
DPR	14559	-215	30	732	
ycDIV	12492	-111	40	88	1083

Covariance Matrix for Group 0

	Earn	gEarn	TRes	CaTR	ShrF	CcashOp
Earn	165566					
gEarn	7103	32980				
TRes	407919	577	1030696			
CaTR	1390	-1145	3270	535		
ShrF	679690	11352	1702535	6769	2831777	
CcashOp	116865	2826	300355	-1282	490357	101338
RoI	-657	1049	-2852	-164	-4374	-680
TAss	1413117	52546	3490877	17950	5844487	980851
gTAss	-658	-2592	682	-27	-1000	10
DY	-461	173	-1426	-53	-2593	-305
DPR	-4814	5216	-14284	-249	-21895	-2965
ycDIV	-7190	1465	-19251	-301	-33703	-6126

	RoI	TAss	gTAss	DY	DPR	ycDIV
RoI	225					
TAss	-7804	12209672				
gTAss	-51	-6737	421			
DY	45	-5299	10	31		
DPR	242	-39318	-473	25	1611	
ycDIV	342	-68144	297	210	365	2090

Covariance Matrix for Group 1

	Earn	gEarn	TRes	CaTR	ShrF	CcashOp
Earn	63763					
gEarn	4333	8037				
TRes	156701	57605	1911353			
CaTR	-761	-37	5522	723		

p	143018	10981	448740	-1419	582804	391550
	1354	76	-1744	10	-359	790
	986753	96499	3591595	-15918	4528531	3245177
	-1420	-562	-7244	-262	-9495	-3968
	318	-11	885	-3	1196	662
	3982	1026	22497	69	27550	9053
	-618	1877	3567	-35	4442	610

	RoI	TAss	gTAss	DY	DPR	ycDIV
	173					
	-14010	31777974				
	-88	-31331	1057			
	13	2989	12	8		
	156	54767	-269	43	617	
	-59	24015	-439	-19	110	1119

ance Matrix for Group 2

	Earn	gEarn	TRes	CaTR	ShrF	CcashOp
	313135					
	42167	175557				
	657759	138092	3006232			
	-6650	-6803	-524	720		
	829357	162217	3498436	-2160	4114754	
p	554860	64693	941742	-10213	1268001	1442383
	-1336	649	-3845	-22	-4950	-2144
	8574806	931229	17375818	-184957	21961392	12860562
	531	2508	11761	29	13084	1169
	535	702	321	-58	458	683
	-243	-1487	-2650	160	-2521	1386
	3358	3497	13737	-165	16219	6940

	RoI	TAss	gTAss	DY	DPR	ycDIV
	68					
	-47447	255696976				
	36	-5351	153			
	14	13596	8	10		
	27	-8493	36	13	316	
	19	49350	99	15	-128	357

y of Classified Observations

vation	True Group	Pred Group	Group	Sqrd Distnc	Probability
1	1	1	0	17.09	0.022
			1	10.18	0.690
			2	11.93	0.288
2	0	0	0	20.28	0.990
			1	31.37	0.004
			2	30.49	0.006
3	1	1	0	11.417	0.055
			1	6.917	0.519
			2	7.311	0.426
4	1	1	0	9.083	0.025
			1	2.826	0.572
			2	3.525	0.403
5	1	1	0	9.785	0.083
			1	6.145	0.510
			2	6.597	0.407
6 **	0	1	0	17.14	0.231
			1	15.19	0.610
			2	17.87	0.159
7	0	0	0	13.34	0.394
			1	13.92	0.294
			2	13.80	0.312
8	1	1	0	6.068	0.106
			1	2.587	0.606
			2	4.078	0.288
9 **	2	1	0	4.077	0.364

			2	5.233	0.204
10 **	1	2	0	6.133	0.135
			1	3.956	0.401
			2	3.660	0.465
11	2	2	0	45.93	0.058
			1	46.26	0.049
			2	40.45	0.893
12	2	2	0	7.762	0.045
			1	3.322	0.415
			2	2.792	0.540
13	0	0	0	1.669	0.599
			1	3.557	0.233
			2	4.221	0.167
14 **	1	0	0	32.44	0.617
			1	33.70	0.329
			2	37.33	0.054
15	0	0	0	34.69	0.972
			1	42.52	0.019
			2	44.06	0.009
16 **	0	1	0	8.180	0.192
			1	6.469	0.452
			2	6.942	0.356
17 **	1	0	0	6.107	0.648
			1	8.569	0.189
			2	8.866	0.163
18 **	2	1	0	8.611	0.034
			1	3.190	0.511
			2	3.420	0.455
19	0	0	0	4.746	0.666
			1	7.427	0.174
			2	7.611	0.159
20	1	1	0	11.146	0.139
			1	8.544	0.511
			2	9.299	0.350
21	0	0	0	11.09	0.772
			1	14.10	0.171
			2	16.31	0.057
22 **	1	0	0	3.034	0.720
			1	5.835	0.177
			2	6.933	0.103
23	2	2	0	41.29	0.008
			1	35.30	0.154
			2	31.92	0.838
24	1	1	0	9.300	0.034
			1	3.553	0.605
			2	4.583	0.361
25	1	1	0	12.404	0.014
			1	4.879	0.611
			2	5.858	0.375
26 **	2	1	0	9.750	0.044
			1	4.367	0.646
			2	5.836	0.310
27 **	2	0	0	7.057	0.532
			1	7.809	0.365
			2	10.329	0.104
28 **	2	0	0	2.333	0.687
			1	5.122	0.170
			2	5.475	0.143
29	2	2	0	6.022	0.160
			1	4.206	0.397
			2	3.983	0.443
30	2	2	0	53.96	0.003
			1	51.75	0.009
			2	42.33	0.988
32	2	2	0	8.391	0.038
			1	3.728	0.386
			2	2.928	0.576
33	2	2	0	6.550	0.078

APPENDIX 10: DISCRIMINANT ANALYSIS (QUADRATIC).

```
MTB > # Opening worksheet from file: C:\AGUTUPRO\MBAPR2.XLS
MTB > # File was last modified on 5/20/80
MTB > Name c16 = 'FITS1'
MTB > Discriminant 'Class' 'Earn'-'ycDIV';
SUBC>   Quadratic;
SUBC>   Brief 4;
SUBC>   Fits 'FITS1'.
```

Discriminant Analysis

```
* ERROR *
ycDIV    is highly correlated with other predictors in group    0
Calculations for discriminant analysis cannot be done.

MTB > Name c17 = 'FITS2'
MTB > Discriminant 'Class' 'Earn'-'DPR';
SUBC>   Quadratic;
SUBC>   Brief 4;
SUBC>   Fits 'FITS2'.
```

Discriminant Analysis

```
* ERROR *
TAss     is highly correlated with other predictors in group    0
Calculations for discriminant analysis cannot be done.

MTB > Name c18 = 'FITS3'
MTB > Discriminant 'Class' 'Earn'-'RoI' 'gTAss'-'DPR';
SUBC>   Quadratic;
SUBC>   Brief 4;
SUBC>   Fits 'FITS3'.
```

Discriminant Analysis

```
TRes     is highly correlated with other predictors in group    0
ShrF     is highly correlated with other predictors in group    0
TRes     is highly correlated with other predictors in group    1
ShrF     is highly correlated with other predictors in group    1
TRes     is highly correlated with other predictors in group    2
ShrF     is highly correlated with other predictors in group    2

Quadratic Method for Response:   Class
Predictors:  Earn  gEarn  TRes  CaTR  ShrF  CcashOp  RoI  gTAss  DY  DPR

Group        0        1        2
Count       12       23       16

Summary of Classification

Put into      ....True Group....
Group             0        1        2
0                12        1        1
1                 0       21        6
2                 0        1        9
Total N          12       23       16
N Correct        12       21        9
Proport.      1.000    0.913    0.563

N =   51     N Correct =   42     Prop. Correct = 0.824

From    Generalized Squared Distance to Group
Group             0        1        2
0             75.48    83.25    98.46
1            135.40    77.68    80.01
2            222.30    84.70    78.95
```

Variable	Pooled Mean	Means for Group 0	1	2
Earn	222.62	140.64	172.11	356.71
gEarn	-22.409	-51.212	25.575	-69.784
TRes	1145.6	657.8	1083.9	1600.2
CaTR	51.198	61.557	49.169	46.346
ShrF	1441.1	988.7	1347.9	1914.5
CcashOp	434.83	187.28	428.75	629.23
RoI	13.854	15.593	14.772	11.232
gTAss	25.274	26.880	27.033	21.540
DY	7.1577	9.4707	6.3146	6.6347
DPR	45.162	51.034	44.692	41.435

Variable	Pooled Stdev	Stdev for Group 0	1	2
Earn	404.0	396.9	252.5	559.6
gEarn	255.8	173.5	89.6	419.0
TRes	1427	983	1383	1734
CaTR	26.52	25.37	26.88	26.83
ShrF	1747	1632	1589	2028
CcashOp	807.6	309.9	625.7	1201.0
RoI	12.33	14.94	13.17	8.25
gTAss	24.95	19.83	32.51	12.37
DY	3.646	5.336	2.760	3.238
DPR	26.84	38.48	24.83	17.78

Pooled Covariance Matrix

	Earn	gEarn	TRes	CaTR	ShrF	CcashOp	RoI
Earn	163176						
gEarn	16860	65445					
TRes	359048	69230	2037027				
CaTR	-1897	-2349	2553	704			
ShrF	493807	81883	2457383	2481	3052938		
CcashOp	264488	26000	560074	-3930	761242	652211	
RoI	148	467	-2764	-24	-2917	-388	152
gTAss	-559	-5	368	-107	-697	-1404	-37
DY	224	251	195	-30	128	458	20
DPR	823	1102	6350	41	7004	4022	134

	gTAss	DY	DPR
gTAss	622		
DY	10	13	
DPR	-207	29	721

Covariance Matrix for Group 0

	Earn	gEarn	TRes	CaTR	ShrF	CcashOp	RoI
Earn	157512						
gEarn	7402	30110					
TRes	356410	-1422	966733				
CaTR	2312	-900	812	644			
ShrF	592848	6940	1599403	2401	2664032		
CcashOp	111464	3274	262284	-383	427082	96024	
RoI	-239	1002	-3332	-96	-5260	-351	223
gTAss	-323	-2319	54	16	-1893	214	-32
DY	-390	161	-1355	-44	-2460	-256	42
DPR	-4043	4787	-13672	-177	-21097	-2447	237

	gTAss	DY	DPR
gTAss	393		
DY	10	28	
DPR	-417	24	1481

Covariance Matrix for Group 1

	Earn	gEarn	TRes	CaTR	ShrF	CcashOp	RoI
Earn	63763						
gEarn	4333	8037					
TRes	156701	57605	1911353				
CaTR	-761	-37	5522	723			

ShrF	215503	64583	2176566	5686	2523426		
CcashOp	143018	10981	448740	-1419	582804	391550	
RoI	1354	76	-1744	10	-359	790	173
gTAss	-1420	-562	-7244	-262	-9495	-3968	-88
DY	318	-11	885	-3	1196	662	13
DPR	3982	1026	22497	69	27550	9053	156

	gTAss	DY	DPR
gTAss	1057		
DY	12	8	
DPR	-269	43	617

Covariance Matrix for Group 2

	Earn	gEarn	TRes	CaTR	ShrF	CcashOp	RoI
Earn	313135						
gEarn	42167	175557					
TRes	657759	138092	3006232				
CaTR	-6650	-6803	-524	720			
ShrF	829357	162217	3498436	-2160	4114754		
CcashOp	554860	64693	941742	-10213	1268001	1442383	
RoI	-1336	649	-3845	-22	-4950	-2144	68
gTAss	531	2508	11761	29	13084	1169	36
DY	535	702	321	-58	458	683	14
DPR	-243	-1487	-2650	160	-2521	1386	27

	gTAss	DY	DPR
gTAss	153		
DY	8	10	
DPR	36	13	316

Summary of Classified Observations

Observation		True Group	Pred Group	Group	Sqrd Distnc	Probability
1		1	1	0	2376.30	0.000
				1	90.09	1.000
				2	140.02	0.000
2		0	0	0	85.35	1.000
				1	199.24	0.000
				2	516.42	0.000
3		1	1	0	220.19	0.000
				1	82.54	0.756
				2	84.80	0.244
4		1	1	0	237.52	0.000
				1	81.81	0.994
				2	91.88	0.006
5		1	1	0	99.57	0.000
				1	80.96	1.000
				2	98.16	0.000
6		0	0	0	85.50	1.000
				1	117.50	0.000
				2	251.38	0.000
7		0	0	0	85.56	1.000
				1	127.32	0.000
				2	1070.01	0.000
8		1	1	0	94.74	0.001
				1	81.45	0.999
				2	110.31	0.000
9	**	2	1	0	182.62	0.000
				1	88.76	0.708
				2	90.53	0.292
10		1	1	0	100.39	0.000
				1	84.05	1.000
				2	101.96	0.000
11		2	2	0	490.37	0.000
				1	929.17	0.000
				2	93.01	1.000
12		2	2	0	149.48	0.000
				1	85.20	0.164

			2	96.10	0.005
36	2	2	0	4452.40	0.000
			1	123.03	0.000
			2	92.64	1.000
37	1	1	0	446.02	0.000
			1	86.42	1.000
			2	166.00	0.000
38	1	1	0	122.37	0.000
			1	82.60	0.923
			2	87.57	0.077
39 **	2	1	0	99.98	0.000
			1	80.71	0.963
			2	87.21	0.037
40	0	0	0	85.52	1.000
			1	143.09	0.000
			2	101.51	0.000
41	2	2	0	105.10	0.000
			1	119.74	0.000
			2	88.77	1.000
42	1	1	0	3544.47	0.000
			1	93.94	1.000
			2	490.32	0.000
43	1	1	0	84.62	0.466
			1	84.35	0.534
			2	190.97	0.000
44	1	1	0	122.79	0.000
			1	87.43	1.000
			2	308.17	0.000
45	1	1	0	98.06	0.006
			1	87.95	0.994
			2	144.42	0.000
46	1	1	0	257.00	0.000
			1	96.91	1.000
			2	353.22	0.000
47	1	1	0	595.98	0.000
			1	86.52	1.000
			2	106.70	0.000
48	0	0	0	84.57	1.000
			1	134.46	0.000
			2	214.96	0.000
49	2	2	0	531.71	0.000
			1	134.45	0.000
			2	86.05	1.000
50	1	1	0	88.03	0.059
			1	82.49	0.941
			2	120.04	0.000
51	1	1	0	499.64	0.000
			1	90.01	0.965
			2	96.64	0.035

MTB >

APPENDIX 11: REGRESSION ANALYSIS.

```
Worksheet size: 100000 cells


MTB > # Opening worksheet from file: C:\AGUTUPRO\MBAPR2.XLS
MTB > # File was last modified on 5/20/80
MTB > Name c16 = 'FITS1'
MTB > Regress 'Class' 12 'Earn'-'ycDIV';
SUBC>   Fits 'FITS1';
SUBC>   Constant;
SUBC>   VIF;
SUBC>   DW;
SUBC>   Pure;
SUBC>   XLOF.
```

Regression Analysis

```
* NOTE *     ShrF is highly correlated with other  predictor variables

The regression equation is
Class = 1.93 + 0.00036 Earn -0.000422 gEarn + 0.00110 TRes - 0.00769 CaTR
           -0.000869 ShrF +0.000031 CcashOp + 0.0061 RoI +0.000004 TAss
           - 0.00407 gTAss - 0.0606 DY - 0.00339 DPR + 0.00146 ycDIV

50 cases used 1 cases contain missing values

Predictor       Coef        Stdev    t-ratio        p       VIF
Constant      1.9280       0.3941       4.89    0.000
Earn        0.000359     0.001126       0.32    0.751      21.8
gEarn     -0.0004224    0.0004397      -0.96    0.343       1.3
TRes       0.0010973    0.0006409       1.71    0.095      90.2
CaTR       -0.007690     0.004580      -1.68    0.102       1.5
ShrF      -0.0008687    0.0005950      -1.46    0.153     114.0
CcashOp    0.0000311    0.0002297       0.14    0.893       3.6
RoI          0.00608      0.01181       0.51    0.610       2.2
TAss      0.00000436   0.00002833       0.15    0.879       8.7
gTAss      -0.004074     0.004605      -0.88    0.382       1.3
DY           -0.06062      0.03318      -1.83    0.076       1.7
DPR        -0.003392     0.004901      -0.69    0.493       1.8
ycDIV       0.001456     0.003601       0.40    0.688       1.4

s = 0.6883      R-sq = 33.8%     R-sq(adj) = 12.4%

Analysis of Variance

SOURCE       DF          SS          MS         F        p
Regression   12      8.9696      0.7475      1.58    0.141
Error        37     17.5304      0.4738
Total        49     26.5000

SOURCE       DF      SEQ SS
Earn          1      0.9273
gEarn         1      0.1563
TRes          1      0.8653
CaTR          1      2.5122
ShrF          1      1.2370
CcashOp       1      0.0033
RoI           1      0.1743
TAss          1      0.0364
gTAss         1      0.7277
DY            1      1.9562
DPR           1      0.2961
ycDIV         1      0.0774

Unusual Observations
Obs.     Earn       Class         Fit   Stdev.Fit    Residual     St.Resid
 11       -25      2.0000      1.6187      0.6579      0.3813       1.88 X
 15      1386      0.0000      0.2370      0.6237     -0.2370      -0.81 X
 27       180      2.0000      0.6798      0.2870      1.3202       2.11R
```

```
R denotes an obs. with a large st. resid.
X denotes an obs. whose X value gives it large influence.

Durbin-Watson statistic = 1.78

No evidence of lack of fit (P > 0.1)
Cannot do pure error test

MTB >
```