ASSESSING THE APPROPRIATENESS OF CLASSIFICATION OF LISTED COMPANIES BY FINANCIAL RATIOS IN NAIROBI SECURITIES EXCHANGE

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DECLARATION

This research project is my original work and has not been submitted for a degree in any other university.

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This research proposal has been presented for examination with my approval as the University Supervisor.

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DEDICATION

I dedicate this study to my dear wife Josephine and my beloved son Chris.

ABSTRACT

The fact that different groups of companies, whether small, new, big, service or manufacturing receive different classification at the Nairobi Securities Exchange invites the explanation that different groups must differ according to some discriminating characteristics valued and considered in the financial market. This study sought to assess the appropriateness of classification in the Nairobi Securities Exchange using financial ratios as predictor variables and the sector classification as the existing classification with the aid of discriminant analysis. From the results, the study concludes that the classification as done by the NSE is not appropriate and is not adequate as well. The study also concludes that financial ratios that are common to all listed companies at the NSE can be used to discriminate the listed companies into the different groups. Discriminant analysis is also appropriate for classification purposes at the NSE.

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LIST OF ABBREVIATIONS

CDA – Canonical Discriminant Analysis

CMA - Capital Markets Authority

DA - Discriminant Analysis

EBIT – Earnings Before Interest and Tax

EMH - Efficient Market Hypothesis

LDA – Linear Discriminant Analysis

LTD - Limited

MDA- Multivariate Discriminant Analysis

NSE – Nairobi Securities Exchange

PCA – Principal Component Analysis

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

The fact that different groups of companies, whether small, new, big, service or manufacturing receive different classification at the Nairobi Securities Exchange invites the explanation that different groups must differ according to some discriminating characteristics valued and considered in the financial market. In the value judgment, one may first think of all of differences in the type of products, area of operation, resources used in production, process of production, machinery used in production, type of labour in production and many other intrinsic factors that can be value judged on the face of the company. The notion of discrimination involves the additional concept that unique characteristics of the company that are unrelated to the production are also valued on the market. Such unique characteristics can include the number of shareholders, the structure of organization which may be frequently adduced in the same context.

Discrimination of companies in this study is considered only as it appears in the classification of companies at the NSE. In any case, one can discriminate companies in the same sense whenever decisions are made that concern these companies by using their unique characteristics other than those that are properly relevant. The terms unique characteristics that are 'unrelated to production' and not 'properly relevant' are themselves value judgments or at any rate decisions by the scholar or expert. It may as well be admitted that the term discrimination has value implications that can never be completely ignored, though they can be sterilized for specific empirical and descriptive analyses.

In the current century, the aspect of business survival and success has been, is and will continue to be a major and important concern to different companies in the world especially with regards to the vulnerable operational environments. As a result, many companies have devised different strategies to remain relevant and sustainable in the business environments, in order to pro-actively avoid business failure and financial distress which is legal in its sense. These different strategies of survival and success that have been embraced by different companies in the corporate world include but not limited to; mergers and acquisitions, strategic alliances, process re-engineering, business paradigm shift, vertical and horizontal integrations.

In the case of vertical integration as a means of survival tactic and strategy, which can include development of new different products, completely falling away from the original products, the company can therefore find itself crossing and overlapping into completely different industry (the company experience inter-industrial production). A good example of a company with such a case in the NSE is the Sameer Africa ltd, which carries out manufacturing activities, hospitality services, agricultural activities and many others. With such a case it would obviously be impossible to classify this company using value judgment or Principal Component Analysis (PCA), which does more of feature classification.

Furthermore, the efficient market hypothesis (EMH) as put by Fama (1970), defined an efficient market as, “A market in which prices always fully reflect all available information is called efficient”. It is logical then to say that for a financial market like the NSE to be efficient, it must have as one of the EMH requirements, the classification done in a manner that reveals and avails all the relevant information as far as the

discriminating factors are concerned. This is because the use of a more diversified and common factors to discriminate firms will help give a true and fair picture of the firm than the use of only some principal component of the firm to discriminate. After all, a strong form of efficient market requires that all the past information, publicly available information and all information including private are fully reflected in the prices of the stocks.

It is therefore important to carry out classification using some different variables that can act as a common base for discriminating the listed companies without necessarily using the PCA analysis which is more of feature based than data based. In seeking to find out and assess the adequacy of classification of companies listed at the Nairobi Securities Exchange, this research uses the financial ratios that are a common feature and data to all the companies listed at the NSE. In using the financial ratios, this research is then able to discriminate the listed companies on a basis of data which make more sense than value judgment and Principal Component Analysis. These results will be valuable in the future classification of companies at the NSE so that the classification can be as objective as possible and data based as much. In fact, a use of financial ratios to discriminate firms into different groups can help the NSE to carry out a continuous and discrete classification periodically.

1.1.1 Concept of Classification

Jieping et al. (2006) noted that classification and dimensionality reduction is an important pre-processing step in many applications. Classification problems usually occur where there are a number of covariates. Covariates are fundamentally assumed to be dependence in the construction of the classifier. The classification problems also arise

where individuals involved in decision making use value judgment to carry out the classification. A value judgment approach is always skewed towards biasness since many factors, features and data are not put into consideration.

There are many possible techniques for classification. Some of the most commonly used techniques include; Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA). Linear Discriminant Analysis (LDA) is a traditional statistical method which has proven successful on classification problems (Fukunaga, 1990). The major difference between PCA and LDA is that PCA does more of feature classification and LDA does more of data classification.

This study used the Discriminant Analysis (DA), since it aims at the classification of companies into different classes using financial ratios as the predictor variables.

1.1.2 Financial Ratios

Financial ratio is a comparison of one bit of financial information to another. Financial ratios are a traditional way of analyzing the financial performance of business entity and it has existed for quite a long period in the field of financial accounting. Ratio analysis is a useful tool to the management and other stakeholders in understanding the financial results and trends overtime and provide key indicators for organizational performance.

The primary source of financial data needed to construct financial ratios is the annual company's report which consists of Comprehensive Statement of Income, Statement of Financial Position, Statement of Cash flows, Statement of Changes in Equity and Owners' Liabilities as well as footnotes to these statements. Financial ratios can be divided into different groups according to the way they are constructed and their general

characteristics. By construction, ratios can be classified into coverage ratio, return ratio, turnover ratio or a component percentage ratio (Drake, 2011). Commonly, ratios are classified into; Profitability ratios, Liquidity ratios, Leverage ratios, Activity ratios and other ratios.

1.1.3 Listed Companies in the Nairobi Securities Exchange

This study focused on the securities listed at the Nairobi Securities Exchange (NSE). NSE is a market where securities are traded. NSE, then known as the Nairobi Stock Exchange, was established in the year 1954 as a voluntary association of stockbrokers, registered under the societies Act. Since then it has been in operation as such until in the year 2012 when it was demutualised and listed and classified under the Investment Services category. Currently the NSE has 64 listed companies (www.nse.co.ke 26.06.2015). The companies listed are classified into 11 different classes, which include; Agricultural which has 7 listed companies; Automobiles & Accessories which has 3 listed companies; Banking which has 11 listed companies; Commercial Which has 10 listed companies; Construction & Allied which has 5 listed companies; Energy & Petroleum which has 5 companies; Insurance which has 6 listed companies; Investment which has 5 listed companies; Investment Services which has 1 listed company; Manufacturing & Allied which has 10 listed companies; and Telecommunications & Technology which has 1 listed company. NSE is regulated by the Capital Markets Authority of Kenya.

NSE performs different functions key among them include; mobilization of savings for investment, encourages high standard of accounting and resource management, requires

public disclosures that give efficient and effective capital growth process as well as facilitating equity financing.

1.2 Research Problem

Classification of different objects into different classes can always prove to be a challenging concept in all aspects of life and nature, be it in pure sciences, social sciences, biological problems or any other area that discrimination of objects are concerned. The problem arises even more with the adoption of different classification and discrimination criteria by different concerned individuals and institutions. The use of value judgments, identification of some unique characteristics and analysis of some components of the objects being classified have characterized the classification process of many individuals and institutions carrying out the exercise of classification. Nevertheless, there have been developments of more efficient and effective methods of discriminating different objects using different predictor variables to classify the objects into different groups. Discriminant analysis has proven successful on classification problems (Fukunaga, 1990).

Financial ratios have been a traditional way of analyzing the financial performance of companies and institutions over a long period of time. It involves a comparison of one bit of financial information to another (Drake, 2011). Given that all the public and listed companies and institutions carrying out business are required to prepare annual financial reports, one would strongly argue that financial reports are a common feature that touches on all the companies, and if any discrimination were to be done using a common feature of all the companies then predictor variables from financial reports would best fit for such an analysis.

Nairobi Securities Exchange (NSE), being a financial market where securities are traded, has 64 listed companies in its stock market (www.nse.co.ke). These 64 listed companies are classified into 11 classes which include; Agricultural which has 7 listed companies; Automobiles & Accessories which has 3 listed companies; Banking which has 11 listed companies; Commercial Which has 10 listed companies; Construction & Allied which has 5 listed companies; Energy & Petroleum which has 5 companies; Insurance which has 6 listed companies; Investment which has 5 listed companies; Investment Services which has 1 listed company; Manufacturing & Allied which has 10 listed companies; and Telecommunications & Technology which has 1 listed company. The question that one would ask is what criteria has been used to classify the listed companies into these 11 classes and how adequate is the classification criteria. This study, proposes the use of financial ratios as the predictor variables given that it is a common feature to all the listed companies at the NSE.

There are no recent clear research papers that have addressed the issue of classification of listed companies at the NSE in the past few years. However, with the aim of survival and success in business, that renders many companies to seek different strategies that can help them survive in the absolutely vulnerable operational and business environments, and make them meet the needs profitability (Kotler, 2000), many companies have ended up carrying out more than one core business and as such the inter-industrial operation has increased in these companies that no one can absolutely from the onset classify companies using unique features and not properly relevant characteristics. Many companies have redefined their core activities to include such implied connotations as ‘general’ activities or business processes that allow the company to carry out any other

legal activity that can help it raise more revenue and even maximize shareholders' wealth.

In the case where the companies are seeking to become 'multipurpose' the method and way of classifying the companies is an issue of very much concern since any classification done in a wrong manner by using only some specific unique features, characteristics and value judgments will be totally misleading and the companies as classified may give wrong indications and implications to the investors, NSE and other stakeholders in their investment and economic decisions like investment policies in respect to portfolio selection, portfolio construction, portfolio implementation and revision. The use of features and characteristics when there is overlap of activities by the same company might be misleading and so there is need to embrace data that can be a common base for all the listed companies. By using Financial Ratios, this research hopes to overcome the use of features and characteristic in classification of the listed companies.

This study seeks to answer the following question, "Using the financial ratios, is the classification of listed companies at the Nairobi Securities Exchange (NSE) adequately done?"

1.3 Research Objective

This research is set to assess the appropriateness of classification of companies listed at the Nairobi Securities Exchange using Financial Ratios.

1.4 Value of the Study

This study will help to widen the classification criteria of companies listed at the Nairobi Securities Exchange. By using financial ratios, the study is set to demonstrate that the companies can be classified using data based predictor variables that are common to all the listed companies rather than the use of features and characteristics that might be misleading if the company is carrying out more than one core activity.

The other groups to benefit from this study are the financial analysts and fund managers who in their tasks of portfolio management, selection, construction and advisory services might rely on the classification classes as they appear at the Nairobi Securities Exchange. With improved classification criteria and improved classes of companies, the work of these fund managers and financial analysts are set to be more realistic, practical and with possibly better results in terms of returns.

The individual and institutional investors who invest in these companies through construction of portfolio relying on the classes as they exist will also benefit by revising their portfolio based on the results of the improved classification criteria. The revised portfolio can be able to meet more or most of the investment policies and objectives.

This study is also set to add to the existing literature and empirical studies in the field investment and finance in general. This is because the results can further be used by both academic scholars and practice to improve the understanding of classification using financial ratios in the investment field.

The study will also contribute to the development of the economy, by increasing the efficiency component of the stock market with regard to the efficient market hypothesis

which requires all information to be reflected in the stock prices to have an efficient market. This more information will help inform resource allocation decisions in the economy through the NSE.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

In this chapter, the researcher reviews the literature pertinent to classification, with specific focus to discriminant analysis. Another area of focus is the literature on financial ratios. Lastly, the researcher outlines some of the studies that have reported the application of discriminant analysis in the field of finance.

2.2 Theoretical Review

2.2.1 Discriminant Analysis

Fisher (1936), in his seminal paper, introduced the concept of discriminant analysis which involved the determination of a linear equation which will predict which group that a case belongs to. According to Alka (1989), discriminant analysis is computationally equivalent to regression analysis. It involves deriving a variate (linear combinations Discrimination is achieved by calculating the variates weight for each independent variable to maximize the difference between the groups (that is, the between-group variance relative to within-group variance). The variate for a discriminant analysis, also known as the discriminant function, takes the following form;

$$F = C_0 + C_1.X_1 + C_2.X_2 + \ldots + C_i\, X_i$$

Where:

F is the Discriminant F score of the discriminant function

C_0 is the intercept (a constant measuring the unexplained part of the score)

C_i denotes discriminant coefficients (Weights of the independent variables)

X_i is independent (predictor) variables.

In this study the independent (predictor) variables include;

X_1 = (Current Assets – Current Liabilities)/Total Assets

X_2 = Retained Earnings/Total Assets

X_3 = Earnings Before Interest and Tax/Total Assets

X_4 = Market Value of Equity/Book Value of Debt

Discriminant analysis has evolved to include different methods of carrying it out. Some of these methods are explained as follows:

2.2.1.1 Canonical Discriminant Analysis

Fisher (1936), came up with classical canonical discriminant analysis (CDA), where the data consist on scores on *p* observed variables for *n* objects, which are classified in *m* groups (this data set is called the training data set in CDA). The problem is then to find *r* linear combinations of the observed variables that maximize the variations between the groups, relative to the variations within the groups (Rao, 1948). The linear combinations are called canonical variates and the weights discriminant coefficients.

The major objective of CDA is classification. The discriminant coefficients and group means are used to classify new observations (from the classification set), which may be difficult or impossible to classify directly.

2.2.1.2 Linear Discriminant Analysis

Fisher (1936), on discriminant analysis with an aim of classifying of an object into one of *K* given classes based on information from a set of p predictor variables, came up with the Linear Discriminant Analysis (LDA). LDA is a Bayes rule under a normality condition about the predictor distribution. The condition requires that for the *i*th class, $i = 1,\ldots,K$, the p dimensional predictor variable $x = (x1,\ldots,xp)$' follows a multivariate normal distribution with mean μi and a common covariance Σc. Together with the prior probability πi, $i = 1,\ldots,K$ about the relative occurrence frequency for each class, this basic normality assumption leads to a Bayes discriminant rule which coincides with the rule of LDA.

2.2.1.3 Multivariate Discriminant Analysis

Multivariate Discriminant Analysis (MDA), is a statistical analysis where more than one variable is analyzed at the same time (Slotemaker, 2008). MDA computes the discriminant coefficients and selects the appropriate weights (cut-off score) which will separate the average values of each group, while minimizing the statistical distance of each observation and its own group means (Altman 1993). MDA seeks to overcome the weaknesses of the univariate analysis. In the univariate analysis, the use of a single financial ratio might not give the real picture due to: First, accounting variables are very much correlated that an analysis of a single ratio in isolation may give very misleading interpretation of the outcome of the analysis. Secondly, Single ratios calculated by univariate analysis do not usually capture the time variation of financial ratios. Thirdly, single ratios will give inconsistent results if different ratios classifications are applied for the same firm.

2.2.2 Financial Ratios

The theory of financial ratio analysis was first popularized by Benjamin Graham who is considered by many to be the father of fundamental analysis (D'Amato, 2010). As reported in Soekarno et al. (2010), based on the book of "The Analysis and use of Financial Statements" by Gerald I. White, Ashwinmpaul C. Sondhi and Dove Fried, Financial ratio and its analysis are useful to compare the risk and return in comparison with firms of different sizes. Ratio analysis can also give a profile of a firm, its economic characteristics and competitive strategies and its unique operating, financial and investment characteristics. Financial ratios are also tools to help with the interpretation of the results and for comparison to the previous years, other companies and the industry sector.

The primary source of financial data needed to construct financial ratios is the annual company's report which consists of Comprehensive Statement of Income, Statement of Financial Position, Statement of Cash flows, Statement of Changes in Equity and Owners' Liabilities as well as footnotes to these statements. Further financial ratios can be divided for convenience into five basic categories which are liquidity ratios, activity ratios, debt/leverage ratios, profitability ratios and market ratios (Soekarno et al. 2010)

In this study the financial ratios that are used include: (Current Assets – Current Liabilities)/Total Assets; Retained Earnings/Total Assets; Earnings Before Interest and Tax/Total Assets; and Market Value of Equity/Book Value of Debt

The ratios rely on Working capital, Total Assets, Retained Earnings, Earnings Before Interest and Tax (EBIT), Book value of Equity and Total Liabilities. Working capital

equals to Current Assets minus Current Liabilities (Milkkete, 2001). Total Assets is the total of the assets section of the balance sheet (Statement of Financial Position). Retained Earnings is found in the Equity side of the Balance Sheet (Statement of Financial Position). EBIT (Earnings Before Interest and Tax) is the income or loss from operations excluding the tax effects and interest. It can be calculated by; finding the Net Income, add back any tax expense, subtract any tax benefit, then add back any interest expense. Market value of Equity is the total value of common stock and preferred stock. The dates these values are chosen need not to correspond exactly with the date of the financial statements to which the market value is compared (Milkkete, 2001). Book value of debt is found on the Liabilities side of the Balance Sheet (Statement of Financial Position).

2.2.2.1 Working Capital/Total Assets

Working Capital/ Total Assets is defined as (Current Assets – Current Liabilities)/Total Assets. This ratio is Liquidity ratio and it measures the working capital to the total Assets. It is based on Balance Sheet items.

2.2.2.2 Retained Earnings/Total Assets

Retained Earnings to Total Assets is a ratio showing the relationship between the retained earnings and the Total Assets. It measures the amount of reinvested earnings or losses, which shows the extent of the company's leverage.

2.2.2.3 Earnings Before Interest and Tax/Total Assets

EBIT/Total Assets is a Profitability ratio which measures the return on total assets. It is a ratio that shows the relationship between the company's return and the company's total assets. It measures how efficiently and effectively a company utilizes its assets to

generate profit. It is a common ratio that helps a company to compare how it is performing against its peers in the industry.

2.2.2.4 Market Value of Equity/Book Value of Debt

This is a ratio that shows the relationship between the company's Market value of Equity (also known as the market capital) to the total liabilities. It is a ratio that shows how a company is dependent on debt financing as compared to owners equity. It shows how much of a business is owned and how much is owed.

2.3 Edward Altman's Z-score Model

Altman (1968), came up with a MDA model that uses financial ratios. In his opinion, the ratios measuring profitability, liquidity and solvency are the most significant ratios. This however might not be easy to tell because different studies as indicators of potential problems. He combined different financial ratios and developed a bankruptcy prediction model, the Z – score model for public manufacturing firms.

From about 1985, the Z-scores gained wide acceptance by auditors, management, accountants, courts, and database systems used for loan evaluation (Eidleman, 2003).

Altman (1968) model took the following form;

$$Z = 1.2A + 1.4B + 3.3C + 0.6D + 0.999E$$

Where:

A = (Current Assets – Current Liabilities)/Total Assets

B = Retained Earnings/Total Assets

C = Earnings Before Interest and Tax/Total Assets

D = Book Value of Equity/Total Liabilities

E = Sales/Total Assets

This study borrows the first four financial ratios from the Altman (1968) model and leave out the fifth financial ratio of Sales/Total assets because sales might not apply to all the companies.

2.4 Empirical Studies

2.4.1 Discriminant Analysis

Walter (1959), carried out a study on high and low price/earnings ratios, on 50 large firms with high and low price/earnings ratios. Using discriminant analysis, he concluded that financial variables such as dividend payout, stock price variability and many others were able to classify firms into high and low Price/Earnings ratio category.

Altman (1968), on bankruptcy prediction, carried out a study on 33 bankrupt manufacturing firms and 33 healthy firms with asset size in excess of US$ 1 Million, using linear discriminant analysis using financial ratios which included (Current Assets – Current Liabilities)/Total Assets, Retained Earnings/Total Assets, Earnings Before Interest and Tax/Total Assets, Book Value of Equity/Total Liabilities, and Sales/Total Assets. He concluded 95% classification rate using data one year prior to bankruptcy and 72% - 2 years prior to bankruptcy.

Simkowitz and Monroe (1968), carried out a study on Acquired versus Non-Acquired firms. Using the 1968 data and discriminant analysis, they concluded that smaller firms with low Price/Earnings ratios, lower dividend pay-out and lower growth in equity were most likely to be acquired.

Pinches and Mingo (1973), carried out a study on Bond Ratings on 180 industrial bonds rated B or above and listed in the new issue section of the moody's bond survey (1-1-67 to 12-31-68). With 35 variable financial data that were screened using factor analysis to select six variables that can predict industrial bond ratings, they used discriminant analysis and concluded that there was a 69.7% accuracy, however the model performed poorly for Baa rated bonds .

Martin and Scott (1974), carried out a study on liquidity, leverage and dividend policy on 62 industrial firms issuing only debt and 50 industrial firms issuing only common stock during the year 1972. With the use of discriminate analysis, they concluded that 78% of the sample was correctly classified based on financial ratios in the category of liquidity, leverage, dividend policy and others.

Daigler and Fielitz (1977), carried out a study on prediction of change in Standard & Poor's 500 index. They used two sets of variables designated as regular (volume) and percentage were employed to see if daily technical indicators can correctly predict direction of change in Standard & Poor's 500 index. Using discriminant analysis, they concluded that 65-80% of observations were correctly classified in bull and bear markets.

2.4.2 Financial Ratios

Several studies have been done using financial ratios as predictors to bankruptcy, financial health and financial distress. These previous studies have identified many financial ratios in their work. Among the most famous works done using financial ratios include; Beaver (1966) who estimated a univariate financial distress model, Altman (1968) on Bankruptcy prediction using a MDA model, Martin (1977) and Ohlson (1980) analyzed the profitability under Logit model and Casey (1980) on the usefulness of

accounting ratios for prediction of corporate failure. Many other applications have since followed the above works on bankruptcy prediction using financial ratios.

2.5 Summary of the Literature Review

A look at the studies done on discrimination and classification of different objects into different classes and groups, indicate that discriminant analysis is an efficient method of determination of a linear equation which help predict which group that a case belongs to. This method has been used in a number of studies cutting across various research fields and on different research issues.

A look at these studies also indicates that the accounting data are potential variables that can be used as predictor variables in analysis and model development. They are capable to predict various issues and concerns in a firm. However, there is no consensus about the kind or set of financial ratios which are best predictor variables. The different yielded results are according to different financial ratios and different methods of research. This study uses: (i) (Current Assets – Current Liabilities)/Total Assets, (ii) Retained Earnings/Total Assets, (iii) Earnings Before Interest and Tax/Total Assets, (iv) Market Value of Equity/Book Value of Debt.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents an outline of the research methodology in this study. It covers the research design, target population of the study, data collection procedure and the sources of the data, and the data analysis tools.

3.2 Research Design

The research design adopted was the explanatory research design. This design was deemed appropriate as this study was intended to explain rather than simply descriptive, the study is quantitative in nature and the data are analyzed using statistical techniques.

3.3 Population of the Study

The population of the study includes all the listed companies at the Nairobi Securities Exchange as at December 31, 2014. As at this date, there were 64 listed companies at the NSE. The year 2014 is relevant to the study since the study uses the financial statements/annual report (data) for the year ended 2014 of all the listed companies at the Nairobi Securities Exchange.

3.4 Data Collection

This study used secondary data consisting of financial annual reports and financial statements for the year ended 2014 of all companies listed at the Nairobi Securities Exchange, obtained from the individual companies' website, the Nairobi Securities Exchange website and the Capital Markets Authorities website. The secondary data was

in the form of; Current Assets, Current Liabilities, Total Assets, Retained Earnings, Earnings Before Interest and Tax, Market Value of Equity, and Book Value of Debt.

3.5 Data Analysis

This study used the Discriminant Analysis. Discriminant Analysis aims to identify characteristics which are important for differentiating units between groups and their classification accuracy (Rozga and Kundid, 2013). Each unit can be classified in only one category or group according to some predictor variables.

Discriminant analysis has the same assumptions as linear regression analysis (like normality, stationarity) but discriminant analysis is more robust to these assumptions. However, discriminant analysis is sensitive to outliers of the independent variables. (Burns & Burns, 2008)

Statistical model of MDA was given by the following equation:

$$F = C_0 + C_1.X_1 + C_2.X_2 + \ldots + C_i\, X_i$$

Where:

F is the Discriminant F score of the discriminant function

C_0 is the intercept (a constant measuring the unexplained part of the score)

C_i denotes discriminant coefficients (Weights of the independent variables)

X_i is independent (predictor) variables.

In this study the independent (predictor) variables included;

X_1 = (Current Assets – Current Liabilities)/Total Assets

X_2 = Retained Earnings/Total Assets

X_3 = Earnings Before Interest and Tax/Total Assets

X_4 = Market Value of Equity/Book Value of Debt

These financial ratios were calculated and/or extracted from the publicly available data (financial annual reports) of listed companies disclosed by the Nairobi Securities Exchange website.

In estimation of the discriminant model and assessing overall fit, this study employed a stepwise regression to develop an optimal MDA model. The overall fit of the discriminant function involved three tasks: First, Calculating Discriminant F scores for each observation. Second, Evaluating group differences in discriminant F scores and Third, assessing the accuracy of the predictions for group membership (Hair et al. 2000)

CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter outlines the data collected, data processing, data analysis, the results and discussions of the study. Data was collected from the audited financial statements of the companies listed at the Nairobi Stock Exchange as presented in the appendix.

4.2 Data Presentation

Table 1: Predictor Variables

No.	Name of the listed company at the NSE	X_1=(Current Assets-Current Liabilities)/Total Assets	X_2=Retained Earnings/Total Assets	X_3=Earnings Before Interest and Tax/Total Assets	X_4 = Book Value of Equity/Total Liabilities	G Status
1	Eaagads Ltd	-0.0111	0.0939	-0.1316	0.4710	1
2	Kapchorua Tea Co. Ltd	0.2591	0.6273	0.0922	0.0357	1
3	Kakuzi	0.2602	0.7283	0.0588	0.1123	1
4	Limuru Tea Co. Ltd	0.3416	0.6690	0.0061	0.2762	1
5	Rea Vipingo Plantations	0.3404	0.6946	0.1667	0.4172	1
6	Sasini Ltd	0.0476	0.0918	0.0058	0.0812	1
7	Williamson Tea Kenya Ltd	0.2807	0.6654	0.1210	0.0224	1
8	Car and General (K) Ltd	0.1025	0.2648	0.0856	0.0765	2
9	Sameer Africa Ltd	0.4496	0.3248	-0.0067	1.0536	2
10	Marshalls (E.A.) Ltd	-0.2058	0.1007	0.0188	0.2219	2
11	Barclays Bank Ltd	-0.4048	0.1280	-0.0324	0.0145	3
12	CFC Stanbic Holdings Ltd	-0.6920	0.0996	-0.0042	0.0137	3
13	I&M Holdings Ltd	-0.6540	0.0415	0.0123	0.0026	3
14	Diamond Trust Bank Kenya Ltd	-0.6493	0.0945	-0.0202	0.0054	3
15	Housing Finance Co Lt	-0.4026	0.0476	-0.0265	0.0213	3

No.	Name of the listed company at the NSE	X_1=(Current Assets-Current Liabilities)/Total Assets	X_2=Retained Earnings/Total Assets	X_3=Earnings Before Interest and Tax/Total Assets	X_4 = Book Value of Equity/Total Liabilities	G Status
16	Kenya Commercial Bank Ltd	-0.6465	0.0815	-0.0248	0.0073	3
17	National Bank of Kenya Ltd	-0.7329	0.0274	-0.0355	0.0638	3
18	NIC Bank Ltd	-0.5953	0.1098	-0.0121	0.0261	3
19	Standard Chartered Bank Ltd	-0.7225	0.0935	-0.0160	0.0082	3
20	Equity Bank Ltd	-0.5875	0.1250	-0.0229	0.0066	3
21	The Co-operative Bank of Kenya	-0.6536	0.1128	-0.0325	0.0202	3
22	Express Ltd	-0.1079	-0.3132	-0.1303	0.5946	4
23	Kenya Airways Ltd	-0.2295	0.0677	0.0236	0.0621	4
24	Nation Media Group	0.3564	0.5664	0.3034	0.1484	4
25	Standard Group Ltd	0.0654	0.3741	0.1084	0.2158	4
26	TPS Eastern Africa (Serena) Ltd	-0.0396	0.1878	0.0273	0.0552	4
27	Scangroup Ltd	0.4880	-0.0111	0.0500	0.0799	4
28	Uchumi Supermarket Ltd	-0.1597	0.0307	0.0751	0.3762	4
29	Hutchings Biemer Ltd					4
30	Longhorn Kenya Ltd	0.3152	0.5057	0.1959	0.1868	4
31	Atlas Devpt. and Support services	0.2332	0.0611	0.2393	0.0025	4
32	Athi River Mining Ord	-0.2515	0.2156	0.0547	0.0180	5
33	Bamburi Cement Ltd	0.0297	0.5164	0.1762	0.1529	5
34	Crown Berger Ltd	0.0950	0.2692	0.0393	0.0466	5
35	E.A.Cables Ltd	0.0701	0.1173	0.0732	0.0264	5

No.	Name of the listed company at the NSE	X_1=(Current Assets-Current Liabilities)/Total Assets	X_2=Retained Earnings/Total Assets	X_3=Earnings Before Interest and Tax/Total Assets	X_4 = Book Value of Equity/Total Liabilities	G Status
36	E.A.Portland Cement Ltd	-0.0120	0.2368	-0.0036	0.0499	5
37	KenolKobil Ltd Ord	-0.0339	0.0865	0.1167	0.0044	6
38	Total Kenya Ltd Ord	0.2248	0.1378	0.0780	0.6189	6
39	KenGen Ltd	0.0097	0.1642	0.0253	0.0317	6
40	Kenya Power & Lighting co.	0.0071	0.1241	0.0641	0.0331	6
41	Umeme Ltd	0.0014	0.0192	0.0095	0.0309	6
42	Jubilee Holdings Ltd	0.3160	0.1541	0.0537	0.0052	7
43	Pan Africa Insurance Holdings	0.1307	0.0539	0.0537	0.0231	7
44	Kenya Re-Insurance Corporation Ltd	0.1107	0.4178	0.1218	0.1436	7
45	Liberty Kenya Holding Ltd	0.7734	0.0925	0.0406	0.0198	7
46	Britam (Kenya) Ltd	0.1168	0.0477	0.0184	0.0038	7
47	CIC Insurance Group Ltd	0.5945	0.1414	0.0587	0.1587	7
48	Olympia Capital Holdings ltd	0.0325	0.0319	0.0354	0.4920	8
49	Centum Investment Co Ltd	-0.1013	0.4363	0.1514	0.0357	8
50	Trans Century Ltd	0.1578	0.0657	-0.0722	0.0176	8
51	Home Afrika Ltd	0.1243	-0.0498	0.0162	0.1202	8
52	Kurwitu ventures	0.1201	-0.0263	-0.0673	0.7340	8
53	Nairobi Securities Exchange Ltd	0.3914	0.2889	0.2707	5.4808	9
54	B.O.C Kenya Ltd	0.2739	0.5980	0.0873	0.1765	10
55	British American Tob	0.0986	0.3512	0.3512	0.0999	10

No.	Name of the listed company at the NSE	X_1=(Current Assets-Current Liabilities)/Total Assets	X_2=Retained Earnings/Total Assets	X_3=Earnings Before Interest and Tax/Total Assets	X_4 = Book Value of Equity/Total Liabilities	G Status
56	Carbacid Investments Ltd	0.3257	0.7044	0.2006	0.6773	10
57	East African Breweries Ltd	-0.1217	0.3579	0.2333	0.0294	10
58	Mumias Sugar Co. Ltd	-0.2666	0.1914	-0.1302	0.2368	10
59	Unga Group Ltd	0.3441	0.2294	0.0740	0.1134	10
60	Eveready East Africa Ltd	0.2503	0.0092	-0.2509	0.2951	10
61	Kenya Orchards Ltd	0.2537	-1.6058	0.0304	0.7836	10
62	A.Baumann CO Ltd					10
63	Flame Tree Group Holdings Ltd	0.2724	0.1083	0.1903	0.2065	10
64	Safaricom Ltd	-0.0739	0.5067	0.2613	0.0462	11

Source: Author's Calculation

Table 1 above show the predictor variables as calculated from the data found in the audited financial statements of the listed companies for the financial year ended 2014 (see Appendix 2).

4.2.1 Results for Discriminant Analysis

The discriminant analysis was done on the dependent variable G (Group that a company belongs to) and the independent variables; X_1 (working capital/total assets), X_2 (retained earnings/total assets), X_3 (earnings before interest and tax, EBIT/total assets) and X_4 (total book value of equity/total liabilities). This discriminant analysis was therefore summarized as: Discriminant Analysis: G versus X_1, X_2, X_3, X_4. The linear method for response is therefore G and the predictors were X_1, X_2, X_3, X_4.

Table 2: Case Summary

Group	1	2	3	4	5	6	7	8	10
Count	7	3	11	9	5	5	6	5	9

Source: Author's Analysis

Table 2 above shows the case summary of the cases analyzed, it shows the group and the number of cases (counts) in the group. The groups are: 1- Agricultural, 2- Automobiles and Accessories, 3- Banking, 4- Commercial and Services, 5- Construction and Allied, 6- Energy and Petroleum, 7- Insurance, 8- Investment, 9- Investment Services, 10- Manufacturing and Allied, and 11- Telecommunication and Technology. It can however be noted that groups 9 and 11 are not appearing in the table, this is because these groups initially contained only one case each therefore could not be analyzed as such. In the table group 3 which is Banking sector having the highest number of companies at 11 listed companies and group 2 which is Automobiles and Accessories having the least number of count at 3

Table 3: Summary of Classification

	True Group								
Put into Group	1	2	3	4	5	6	7	8	10
1	5	0	0	0	0	0	0	0	2
2	1	1	0	0	0	1	0	2	1
3	0	0	11	0	0	0	0	0	0
4	0	0	0	4	1	0	1	0	1
5	0	1	0	2	3	1	0	1	1
6	1	1	0	0	1	3	2	1	0
7	0	0	0	1	0	0	3	1	1
8	0	0	0	2	0	0	0	0	1
10	0	0	0	0	0	0	0	0	2
Total N	7	3	11	9	5	5	6	5	9
N correct	5	1	11	4	3	3	3	0	2
Proportion	0.714	0.333	1.000	0.444	0.600	0.600	0.500	0.000	0.222

N = 60 N Correct = 32 Proportion Correct = 0.533

Source: Author's Analysis

Table 3 above shows the summary of classification. In the classification it is noted that only 60 cases were used in the analysis, 2 cases contain missing values hence were left out of the analysis while another 2 were also left out of analysis because they only had one case each and could not be analyzed as such.

From the table 3 above, group 1 (Agricultural) had 5 cases out of the initial total 7 cases classified correctly giving group 1, 71.4% original correct classification rate. Group 2

(Automobiles and Accessories) had 1 case out of the initial 3 cases correctly classified, giving group 2, a 33.33% original correct classification rate. Group 3 (Banking) had all the total 11 cases correctly classified, giving group 3 a 100% original correct classification rate. Group 4 (Commercial and Services) had 4 cases out of the initial 9 cases correctly classified, giving group 4, a 44.4% original correct classification rate.

Group 5 (Construction and Allied) had 3 cases out of the initial 5 cases correctly classified, giving group 5, a 60% original correct classification rate. Group 6 (Energy and Petroleum) had 3 cases out of the initial 5 cases correctly classified, giving group 6, a 60% original correct classification rate. Group 7 (Insurance) had 3 cases out of the initial 6 cases correctly classified, giving group 7, a 50% original correct classification rate. Group 8 (Investment) had 0 cases out of the initial 5 cases correctly classified, giving group 8, a 0% original correct classification rate. Group 10 (Manufacturing and Allied) had 2 cases out of the initial 9 cases correctly classified, giving group 10, a 22.2% original correct classification rate.

Out of the total 60 cases analyzed, 32 of them are correctly classified giving a general 53.3% rate of original correct classification. Therefore 28 listed companies (cases) are wrongly classified. Group 3 (Banking) have registered the highest rate of correct classification at 100% while Group 8 (Investment) has registered the worst/poorest rate of correct classification at 0.00%.

Table 4: Squared Distance Between Groups

	1	2	3	4	5	6	7	8	10
1	0.0000	2.4467	19.5283	2.8748	2.7578	3.1375	3.6110	2.3263	2.9721
2	2.4467	0.0000	16.0977	2.2886	3.6320	2.8669	7.1070	1.1557	1.5706
3	19.528	16.098	0.000	14.0038	9.7632	11.612	25.307	12.674	16.4962
4	2.8748	2.2886	14.0038	0.0000	0.9198	0.2909	3.2061	0.8043	0.2672
5	2.7578	3.6320	9.7632	0.9198	0.0000	0.4359	4.1466	1.2836	1.9828
6	3.1375	2.8669	11.6123	0.2909	0.4359	0.0000	3.1927	0.5859	0.8242
7	3.6110	7.1070	25.3072	3.2061	4.1466	3.1927	0.0000	3.9843	3.3650
8	2.3263	1.1557	12.6744	0.8043	1.2836	0.5859	3.9843	0.0000	0.7471
10	2.9721	1.5706	16.4962	0.2672	1.9828	0.8242	3.3650	0.7471	0.0000

Source: Author's analysis

Table 4 above shows the squared distance between the groups, these distances show how near or far a group is from another group. From the table, the squared group distances are fairly significant showing that the groups can be significantly be distinguished from one another.

Table 5: Linear Discriminant Function for Groups

	1	2	3	4	5	6	7	8	10
Constant	-2.600	-3.287	-5.746	-1.202	-0.668	-0.560	-1.590	-1.132	-1.739
X1	3.491	-0.772	-18.364	0.104	-2.169	-0.749	8.749	-0.446	1.288
X2	6.419	4.241	2.580	1.283	2.776	1.051	0.752	2.090	1.036
X3	-2.596	3.724	3.987	10.489	5.115	6.604	1.302	2.210	10.206
X4	6.364	12.349	5.282	5.982	3.515	4.533	0.217	7.410	7.813

Source: Author's analysis

Table 5 above shows the linear discriminant coefficients for the groups which can then be used to establish the group functions for each group, for instance function 1 can be established as $F_1 = -2.6 + 3.491X_1 + 6.419X_2 – 2.596X_3 + 6.364X_4$. Such a function can be used to find the scores that would predict a case falling under group 1. Each function will give a unique score that will be used to predict the group membership of the listed companies based on the four outlined predictor variables.

Table 6: Means for Group

Variable	Pooled Mean	1	2	3	4	5	6	7	8	10
X1	-0.0001	0.2169	0.1154	-0.6128	0.1024	-0.0137	0.0418	0.3404	0.0667	0.1589
X2	0.1815	0.5100	0.2301	0.0874	0.1632	0.2711	0.1064	0.1512	0.0916	0.1049
X3	0.0487	0.0456	0.0325	-0.0195	0.0992	0.0680	0.0587	0.0578	0.0127	0.0873
X4	0.1677	0.2023	0.4507	0.0173	0.1913	0.0588	0.1438	0.0590	0.2799	0.2909

Source: Author's analysis

Table 6 above shows the group means of the four predictor variables, these means are descriptive statistics describing the data analyzed in this study. They generally show the overall predictor variable ratios for the whole NSE as at the data of analysis and the with the data used.

Table 7: Standard Deviation for Group

Variable	Pooled StDev	1	2	3	4	5	6	7	8	10
X1	0.1937	0.1409	0.3279	0.1127	0.2550	0.1390	0.1038	0.2826	0.1047	0.2148
X2	0.3190	0.2866	0.1160	0.0343	0.2783	0.1484	0.0562	0.1377	0.1981	0.6788
X3	0.1034	0.0977	0.0477	0.0141	0.1310	0.0668	0.0427	0.0346	0.0913	0.1869
X4	0.2135	0.1856	0.5272	0.0171	0.1879	0.0543	0.2659	0.0719	0.3182	0.2626

Source: Author's analysis

Table 7 shows the standard deviation for the groups, with standard deviation being a measure of risk, the higher the standard deviation of a group the more risky the group while the lower the standard deviation the less risky the group with respect to either the particular predictor variable or the pooled for the whole market.

Table 8: Pooled Covariance Matrix

	X1	X2	X3	X4
X1	0.037529			
X2	0.006872	0.101753		
X3	0.003895	0.014622	0.010689	
X4	0.008159	-0.020295	-0.005364	0.045592

Source: Author's analysis

Table 8 above shows the pooled covariance matrix for the whole analysis, the results from the table show that the covariance are significant since most of them are below 0.05.

Table 9: Covariance Matrix for Specific Groups

Covariance matrix for Group 1

	X1	X2	X3	X4
X1	0.0199			
X2	0.0388	0.0822		
X3	0.0108	0.0211	0.0095	
X4	-0.0046	-0.0128	-0.0070	0.0345

Covariance matrix for Group 2

	X1	X2	X3	X4
X1	0.1075			
X2	0.0364	0.0135		
X3	-0.0047	-0.00004	0.0023	
X4	0.1399	0.036858	-0.0202	0.2779

Covariance matrix for Group 3

	X1	X2	X3	X4
X1	0.0127			
X2	0.0008	0.0012		
X3	-0.0004	-0.0001	0.0002	
X4	-0.0003	-0.0003	-0.0001	0.0003

Covariance matrix for Group 4

	X1	X2	X3	X4
X1	0.0650			
X2	0.0313	0.0774		
X3	0.0202	0.0287	0.0172	
X4	-0.0189	-0.0228	-0.0134	0.0353

Covariance matrix for Group 5

	X1	X2	X3	X4
X1	0.0193			
X2	0.0027	0.0220		
X3	0.0013	0.0072	0.0045	
X4	0.0024	0.0077	0.0029	0.0029

Covariance matrix for Group 6

	X1	X2	X3	X4
X1	0.0108			
X2	0.0021	0.0032		
X3	0.0005	0.0005	0.0018	
X4	0.0274	0.0048	0.0024	0.0707

Covariance matrix for Group 7

	X1	X2	X3	X4
X1	0.0799			
X2	-0.0091	0.0190		
X3	-0.0024	0.0045	0.0012	
X4	0.0020	0.0066	0.0017	0.0052

Covariance matrix for Group 8

	X1	X2	X3	X4
X1	0.0120			
X2	-0.0181	0.0392		
X3	-0.0090	0.0144	0.0083	
X4	0.0062	-0.0303	-0.0109	0.1013

Covariance matrix for Group 10

	X1	X2	X3	X4
X1	0.046124			
X2	-0.014178	0.460733		
X3	0.003436	0.034931	0.034938	
X4	0.020481	-0.101037	-0.008603	0.068948

Source: Author's analysis

Tables 9 show the covariance matrix for each of the groups, the covariance values are generally significant given their values that are below 0.05.

4.3 Summary and Interpretation of the Findings

A discriminant analysis was conducted to predict the appropriateness of classification of the listed company at the Nairobi Securities Exchange using financial ratios. The financial ratios which were the predictor variables included X_1 = (Current Assets – Current Liabilities)/Total Assets, X_2 = Retained Earnings/Total Assets, X_3 = Earnings

Before Interest and Tax/Total Assets, and X_4 = Market Value of Equity/Book Value of Debt.

From the results, out of the total 64 cases in the NSE only 60 cases were used for analysis given that 2 were having missing values while the remaining 2 were having only one case in each group and such could not be analyzed with a single group in each. Out of the 60 that were analyzed only 32 were correctly classified originally while 28 were wrongly classified, giving an overall rate of 53.3% of original correct classification.

Out of the 11 groups, only group 3 (Banking) was 100% correctly classified, with all the 11 cases/counts in that group having been correctly classified into it. The investment group (group 8) had been fully misclassified with all the 5 cases in that group having been misclassified. The covariance values of the predictor variables were significant indicating that these predictor variables could be used for predicting the group membership of the all the listed companies into the 11 outlined groups.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter discusses the summary of the study, the conclusion of the study from the findings, the limitations of the study and the recommendations to future studies on the topical issue.

5.2 Summary of the Study

This study involved the assessing of the appropriateness of classification of listed companies by financial ratios in the Nairobi Securities Exchange. The data were collected from the annual audited financial statements for the year ended 2014. These audited financial statements were obtained from the Nairobi Securities Exchange website, Capital Markets Authority website and individual company websites. The target population was all the listed companies at the Nairobi Securities Exchange, the number being 64, however the data were only obtained from 62 listed companies.

Financial ratios were used as the predictor variables. These financial ratios included X_1 = (Current Assets – Current Liabilities)/Total Assets, X_2 = Retained Earnings/Total Assets, X_3 = Earnings Before Interest and Tax/Total Assets, and X_4 = Market Value of Equity/Book Value of Debt. These ratios were calculated using the extracted data from the annual audited financial statements.

A discriminant analysis was carried out from the data collected to establish the appropriateness of classification for the listed companies at the Nairobi Securities Exchange. In the analysis, out of the total 64 cases in the NSE only 60 cases were used for analysis given that 2 were having missing values while the remaining 2 were having

only one case in each group and such could not be analyzed with a single group in each. Out of the 60 that were analyzed only 32 were correctly classified originally while 28 were wrongly classified, giving an overall rate of 53.3% of original correct classification.

Out of the 11 groups, only group 3 (Banking) was 100% correctly classified, with all the 11 cases/counts in that group having been correctly classified into it. The investment group (group 8) had been fully misclassified with all the 5 cases in that group having been misclassified; other groups had also not met the 100% mark for correct classification. The covariance values of the predictor variables were significant indicating that these predictor variables could be used for predicting the group membership of the all the listed companies into the 11 outlined groups.

5.3 Conclusions

According to data calculation and data analysis in this study, the results of the various tests carried out with the aid of discriminant analysis based on the chosen financial ratios as predictor variables on the classification of listed companies at the Nairobi Securities Exchange, the study concludes that classification of the listed companies at the NSE is not appropriately done. The classification is not adequate as well since there are some listed companies that are misclassified from the results of this study.

According to the results of this study with the aid of Discriminant Analysis based on the chosen financial ratios, the study also concludes that discriminant analysis on financial ratios is appropriate to discriminate significantly the total 64 listed companies at the Nairobi Securities Exchange into the 11 groups as outlined in the NSE and also to assess the appropriateness of classification in the NSE.

Based on data analysis using Discriminant Analysis and the four chosen financial ratios, the four financial ratios are considered to be influential ratios in predicting the group into which a case belonged to. These ratios included X_1 = (Current Assets – Current Liabilities)/Total Assets, X_2 = Retained Earnings/Total Assets, X_3 = Earnings Before Interest and Tax/Total Assets, and X_4 = Market Value of Equity/Book Value of Debt.

These Discriminant Functions established in this study can be used to calculate the scores that are used to classify listed companies into the specific groups. They are applicable in the classification of the 64 listed companies into the 11 groups at the Nairobi Securities Exchange.

5.4 Recommendations

On policy, the study recommends that the Nairobi Securities Exchange should adopt a multivariate factor system to discriminate the listed companies into different groups. This is because the use of a single component factor to discriminate may be misleading and as such the groupings might be wrong leading to wrong investment decisions, process and results both to corporate investors and individual investors.

5.5 Limitation of the Study

This study has some limitations which may affect the accuracy of the MDA including: The data analyzed in this study was obtained from public financial statements which may be subject to creative accounting. Some companies facing various challenges like failure and other distress may distort their published accounts and this will skew the results of the model.

The data was only available for 62 companies out of the total number of 64 listed companies at the Nairobi Securities Exchange and also out of this only 60 were analyzed.

The missing data in one way or another could have interfered with the quality of the findings of this study. The coefficients would probably change if all the data was found and included in the analysis.

Financial data is only one source out of the numerous factors that can be considered as options for predictor variables. These many other factors can as well be combined to the financial data, however, in this study only financial data in this case four financial ratios were chosen. The findings could change if other factors and considerations are incorporated.

Another limitations was on the part of the data from some companies especially the banks and the insurance companies where specific separation and distinction of Non-Current Assets, Current Assets, Non-Current Liabilities and Current Liabilities were not done by the said companies leaving the discretion of separation to the researcher, if an error could arise out of this discretion then the coefficients could probably have changed.

5.6 Suggestions for further study

This study limited itself to only one annual financial year in its data, future studies could analyze changes in the size of financial ratios over a number of series. This could improve the findings of such a study.

This study limited itself to four ratios only many more financial ratios could be incorporated as predictor variables in the future study. This as well could improve the findings and the conclusions thereof in such a study.

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APPENDICES

Appendix 1: Firms Listed on the NSE

AGRICULTURAL
Eaagads Ltd Ord 1.25
Kapchorua Tea Co. Ltd Ord Ord 5.00
Kakuzi Ord.5.00
Limuru Tea Co. Ltd Ord 20.00
Rea Vipingo Plantations Ltd Ord 5.00
Sasini Ltd Ord 1.00
Williamson Tea Kenya Ltd Ord 5.00
AUTOMOBILES AND ACCESSORIES
Car and General (K) Ltd Ord 5.00
Sameer Africa Ltd Ord 5.00
Marshalls (E.A.) Ltd Ord 5.00
BANKING
Barclays Bank Ltd Ord 0.50
CFC Stanbic Holdings Ltd ord.5.00

I&M Holdings Ltd Ord 1.00
Diamond Trust Bank Kenya Ltd Ord 4.00
Housing Finance Co Ltd Ord 5.00
Kenya Commercial Bank Ltd Ord 1.00
National Bank of Kenya Ltd Ord 5.00
NIC Bank Ltd 0rd 5.00
Standard Chartered Bank Ltd Ord 5.00
Equity Bank Ltd Ord 0.50
The Co-operative Bank of Kenya Ltd Ord 1.00
COMMERCIAL AND SERVICES
Express Ltd Ord 5.00
Kenya Airways Ltd Ord 5.00
Nation Media Group Ord. 2.50
Standard Group Ltd Ord 5.00
TPS Eastern Africa (Serena) Ltd Ord 1.00
Scangroup Ltd Ord 1.00
Uchumi Supermarket Ltd Ord 5.00

Hutchings Biemer Ltd Ord 5.00
Longhorn Kenya Ltd
Atlas Development and Support Services
CONSTRUCTION AND ALLIED
Athi River Mining Ord 5.00
Bamburi Cement Ltd Ord 5.00
Crown Berger Ltd 0rd 5.00
E.A.Cables Ltd Ord 0.50
E.A.Portland Cement Ltd Ord 5.00
ENERGY AND PETROLEUM
KenolKobil Ltd Ord 0.05
Total Kenya Ltd Ord 5.00
KenGen Ltd Ord. 2.50
Kenya Power & Lighting Co Ltd
Umeme Ltd Ord 0.50
INSURANCE
Jubilee Holdings Ltd Ord 5.00

Pan Africa Insurance Holdings Ltd 0rd 5.00
Kenya Re-Insurance Corporation Ltd Ord 2.50
Liberty Kenya Holdings Ltd
British-American Investments Company (Kenya) Ltd Ord 0.10
CIC Insurance Group Ltd Ord 1.00
INVESTMENT
Olympia Capital Holdings ltd Ord 5.00
Centum Investment Co Ltd Ord 0.50
Trans-Century Ltd
Home Afrika Ltd Ord 1.00
Kurwitu Ventures
INVESTMENT SERVICES
Nairobi Securities Exchange Ltd Ord 4.00
MANUFACTURING AND ALLIED
B.O.C Kenya Ltd Ord 5.00
British American Tobacco Kenya Ltd Ord 10.00
Carbacid Investments Ltd Ord 5.00

East African Breweries Ltd Ord 2.00
Mumias Sugar Co. Ltd Ord 2.00
Unga Group Ltd Ord 5.00
Eveready East Africa Ltd Ord.1.00
Kenya Orchards Ltd Ord 5.00
A.Baumann CO Ltd Ord 5.00
Flame Tree Group Holdings Ltd Ord 0.825
TELECOMMUNICATION AND TECHNOLOGY
Safaricom Ltd Ord 0.05

Source: www.nse.co.ke

Appendix 2: Sample Data

No.	Name of the listed company at the NSE	Total Assets	Total Liabilities	Retained Earnings	EBIT	Book Value of Equity	Current Assets	Current Liabilities
		Shs' 000	Shs'000	Shs'000	Shs'000	Shs'000	Shs'000	Shs'000
1	Eaagads Ltd	445,793	85,341	41,854	-58,676	40,196	33,001	37,938
2	Kapchorua Tea Co. Ltd	1,929,161	548,496	1,210,202	177,781	19,560	621,620	121,855
3	Kakuzi	3,857,454	872,726	2,809,247	226,794	98,000	1,181,085	177,421
4	Limuru Tea Co. Ltd	338,600	86,885	226,515	2,078	24,000	132,007	16,331
5	Rea Vipingo Plantations	3,203,131	719,158	2,224,852	533,993	300,000	1,288,318	198,051
6	Sasini Ltd	14,929,577	2,808,609	1,370,695	87,331	228,055	1,245,083	534,840
7	Williamson Tea Kenya Ltd	8,539,200	1,958,673	5,681,819	1,033,286	43,782	2,719,443	322,353
8	Car and General (K) Ltd	8, 152,812	2,620,414	2,159,223	697,857	200,516	5,026,058	4,190,457
9	Sameer Africa Ltd	3,857,390	1,320,950	1,252,707	-25,920	1,391,712	2,872,112	1,137,997
10	Marshalls (E.A.) Ltd	603,935	324,316	60,793	11,346	71,966	181,340	305,644
11	Barclays Bank Ltd	225,845,434	187,659,344	28,914,996	-7,310,090	2,715,768	82,940,919	174,368,408
12	CFC Stanbic Holdings Ltd	180,998,985	144,103,792	18,021,196	-761,699	1,976,608	10,110,246	135,358,111
13	I&M Holdings Ltd	176,464,451	148,358,309	7,317,648	-2,174,190	392,362	18,202,984	133,606,921
14	Diamond Trust Bank	211,539,412	179,275,854	19,986,040	-4,270,876	968,440	29,644,501	166,988,627

No.	Name of the listed company at the NSE	Total Assets	Total Liabilities	Retained Earnings	EBIT	Book Value of Equity	Current Assets	Current Liabilities
16	Kenya Commercial Bank Ltd	490,338,324	414,704,767	39,963,539	(12,161,266)	3,025,213	84,959,173	401,969,612
17	National Bank of Kenya Ltd	123,091,996	110,867,973	3,378,423	(4,365,766)	7,075,000	19,652,812	109,871,395
18	NIC Bank Ltd	145, 780,505	122,429,792	16,012,992	(1,767,469)	3,199,728	21,292,372	108,071,312
19	Standard Chartered Bank Ltd	222,495,824	181,837,650	20,814,449	(3,558,740)	1,825,798	20,613,380	181,369,313
20	Equity Bank Ltd	344,571,649	280,795,953	43,054,995	(7,874,441)	1,851,388	48,448,266	250,887,995
21	The Co-operative Bank of Kenya	285,396,067	241,983,157	32,206,653	(9,288,115)	4,889,317	37,184,319	223,713,670
22	Express Ltd	477,922	297,714	(149,702)	(62,276)	177,019	75,023	126,591
23	Kenya Airways Ltd	148,657,000	120,428,000	10,070,000	3,504,000	7,482,000	29,636,000	63,756,000
24	Nation Media Group	11,944,300	3,176,200	6,765,400	3,624,000	471,400	7,374,900	3,118,300
25	Standard Group Ltd	4,101,749	1,893,707	1,534,490	444,499	408,654	1,491,018	1,222,942
26	TPS Eastern Africa (Serena) Ltd	13,711,998	3,299,509	2,575,064	374,520	182,174	0	543,579
27	Scangroup Ltd	113,284,104	4,741,473	(147,545)	664,024	378,865	10,923,159	4,440,009
28	Uchumi Supermarket	6,884,853	3,527,539	211,074	517,389	1,327,133	2,250,436	3,350,169

No.	Name of the listed company at the NSE	Total Assets	Total Liabilities	Retained Earnings	EBIT	Book Value of Equity	Current Assets	Current Liabilities
29	Hutchings Biemer Ltd							4
30	Longhorn Kenya Ltd	747,531	313,211	378,050	146,450	58,500	548,820	313,211
31	Atlas	20,794	19,268	1,271	4,976	49	13,663	8,814
32	Athi River Mining Ord	36,912,580	27,491,773	7,956,969	2,018,133	495,275	8,205,777	17,490,596
33	Bamburi Cement Ltd	33,347,000	11,872,000	17,220,000	5,877,000	1,815,000	7,901,000	6,909,000
34	Crown Berger Ltd	3,852,814	2,545,483	1,036,998	151,481	118,635	2,866,643	2,500,558
35	E.A.Cables Ltd	7,889,496	4,797,619	925,556	577,157	126,563	3,846,795	3,293,689
36	E.A.Portland Cement Ltd	15,717,257	9,012,582	3,721,953	(56,186)	450,000	3,324,061	3,512,289
37	KenolKobil Ltd Ord	23,915,166	16,584,670	2,067,743	2,791,079	73,588	15,488,019	16,298,922
38	Total Kenya Ltd Ord	32,541,800	16,116,377	4,483,132	2,539,800	9,974,771	22,240,137	14,924,210
39	KenGen Ltd	250,205,524	173,495,851	41,071,239	6,329,313	5,495,904	27,630,643	25,196,229
40	Kenya Power & Lighting co.	220,109,000	147,223,000	27,305,000	14,103,000	4,878,000	50,412,000	48,848,000
41	Umeme Ltd	1,121,939	898,227	215,672	106,547	27,748	485,474	469,467
42	Jubilee Holdings Ltd	74,505,374	58,026,343	11,484,875	3,999,030	299,475	26,920,116	3,376,196
43	Pan Africa Insurance Holdings	24,599,410	20,821,777	1,325,159	1,152,598	480,000	4,452,553	1,236,409
44	Kenya Re-Insurance	32,174,251	12,182,847	13,441,918	3,919,732	1,749,873	9,086,784	5,523,770

No.	Name of the listed company at the NSE	Total Assets	Total Liabilities	Retained Earnings	EBIT	Book Value of Equity	Current Assets	Current Liabilities
45	Liberty Kenya Holding Ltd	33,194,053	27,036,864	3,070,838	1,346,569	535,707	27,555,605	1,884,905
46	Britam (Kenya) Ltd	72,977,666	51,187,455	3,478,012	1,341,777	193,841	11,393,993	2,870,001
47	CIC Insurance Group Ltd	23,690,387	16,482,947	3,350, 083	1,390,314	2,615,578	15,225,011	1,140,274
48	Olympia Capital Holdings ltd	1,576,337	406,493	50,319	55,843	200,000	354,807	303,527
49	Centum Investment Co Ltd	29,597,220	9,324,383	12,912,168	4,480,806	332,721	2,125,612	5,123,354
50	Trans Century Ltd	19,463,658	7,981,960	1,278,346	(1,404,597)	140,142	8,234,663	5,162,953
51	Home Afrika Ltd	3,718,636	3,370,253	(185,170)	60,351	405,255	2,967,988	2,505,595
52	Kurwitu ventures	120,676	13,933	(3,177)	(8,122)	10,227	15,642	1,145
53	Nairobi Securities Exchange Ltd	1,685,104	142,042	487,377	416,587	778,500	788,067	128,506
54	B.O.C Kenya Ltd	2,300,320	553,132	1,375,638	200,850	97,627	1,183,157	553,132
55	British American Tobacco Kenya	18,141,000	10,014,000	5,681,000	6,371,000	1000,000	8,860,000	7,071,000
56	Carbacid Investments	2,533,163	376,280	1,784,246	508, 239	254,852	2,533,163	155,757

No.	Name of the listed company at the NSE	Total Assets	Total Liabilities	Retained Earnings	EBIT	Book Value of Equity	Current Assets	Current Liabilities
57	East African Breweries Ltd	62,865,943	53,765,095	22,501,939	14,665,546	1,581,547	19,807,154	27,460,650
58	Mumias Sugar Co. Ltd	23,563,086	12,921,281	4,510,363	(3,067,669)	3,060,000	4,353,304	10,635,149
59	Unga Group Ltd	8,026,578	3,339,335	1,840,932	593,738	378,535	4,934,209	2,172,393
60	Eveready East Africa Ltd	763,357	711,594	6,992	(191,530)	210,000	763,357	572,293
61	Kenya Orchards Ltd	50,202,177	73,037,273	(80,612,264)	1,524,135	57,228,746	29,197,374	16,460,677
62	A.Baumann CO Ltd							10
63	Flame Tree Group Holdings Ltd	1,054,454	646,668	114,181	200,709	133,540	805,722	518,494
64	Safaricom Ltd	134,600,946	43,364,967	68,201,917	35,171,376	2,003,271	28,321,468	38,262,687

Sources: Audited Financial Statements for the year ended 2014

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Appendix 3: Summary of Classified Observations

Observation	True Group	Predicted Group	Squared Group Distance	Probability
1**	1	2	5.055	0.113
2	1	1	0.7844	0.403
3	1	1	0.6399	0.605
4	1	1	1.269	0.682
5	1	1	3.281	0.332
6**	1	6	3.0186	0.062
7	1	1	1.147	0.395
8**	2	6	2.0391	0.082
9	2	2	16.43	0.047
10**	2	5	6.441	0.023
11	3	3	11.356	0.005
12	3	3	23.3455	0.000
13	3	3	22.3964	0.000
14	3	3	21.1225	0.000
15	3	3	11.935	0.003
16	3	3	21.0287	0.000
17	3	3	25.4374	0.000
18	3	3	18.6848	0.000
19	3	3	24.7003	0.000
20	3	3	18.1572	0.000

Observation	True Group	Predicted Group	Squared Group Distance	Probability
21	3	3	21.0197	0.000
22**	4	8	10.896	0.014
23**	4	5	7.492	0.015
24	4	4	7.371	0.090
25	4	4	1.8659	0.099
26**	4	5	3.2344	0.057
27**	4	7	7.694	0.028
28**	4	8	8.555	0.012
30	4	4	2.721	0.166
31	4	4	10.892	0.010
32	5	5	7.414	0.018
33**	5	4	3.527	0.088
34	5	5	1.7295	0.114
35**	5	6	3.8810	0.040
36	5	5	2.5302	0.099
37	6	6	6.5125	0.016
38**	6	2	5.754	0.047
39**	6	5	3.1312	0.061
40	6	6	4.0298	0.037
41	6	6	4.6459	0.036
42	7	7	4.0300	0.072
43**	7	6	4.2057	0.041

Observation	True Group	Predicted Group	Squared Group Distance	Probability
44**	7	4	1.4919	0.123
45	7	7	15.441	0.010
46**	7	6	4.197	0.050
47	7	7	6.984	0.060
48**	8	2	5.2559	0.031
49**	8	5	5.137	0.045
50**	8	7	4.435	0.110
51**	8	6	4.1914	0.039
52**	8	2	7.889	0.037
53**	10	1	0.2252	0.421
54**	10	4	14.151	0.009
55**	10	2	9.884	0.121
56**	10	5	9.784	0.013
57**	10	8	7.885	0.069
58**	10	7	2.4233	0.121
59**	10	1	9.235	0.355
60	10	10	55.16	0.000
62	10	10	6.378	0.026

Source: Author's analysis