FORECASTING ASSET REQUIREMENTS IN PUBLICLY QUOTED COMPANIES

BY

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DECLARATION

This project is my original work and has not been presented for a degree in any other University.

J.M. MUTURI

This project has been submitted for examination with my approval as University Supervisor.

J.K. NJIRAINI

DEDICATION

To my parents.

Isaac Macharia and Phyllis Wairimu.

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CHAPTER 1

INTRODUCTION

Background

A business firm requires both fixed and current assets in order to carry out its operations. Fixed assets are necessary so as to enable it to produce goods for sale while current assets are necessary so as to enable it meet its current obligations (cash most important) and have goods available for sale (inventory most important).

Fixed assets may be divided into several categories, for example, land, buildings, machinery, freehold property. As a firm grows in size its asset requirements are bound to change. As a firm's sales increases it is likely that it will require a larger plant if previously it was operating at full capacity. A decision to expand the plant will therefore involve a forecast of sales in the coming years when the plant will be operational. A failure to forecast accurately will result in overinvestment or underinvestment in fixed assets.

Overinvestment means that a firm incurs unnecessarily high expenses. In a world where resources are scarce this should be avoided. A firm might therefore do well if the investment in fixed assets is optimal. If a firm has underinvested in fixed assets then it may not have a production capacity capable of satis-

fying the market demand. If this is the case then the firm will lose its market share to competitors. Good planning is therefore called for in order to avoid both of these undesirable outcomes.

Turnovsky (1970) explains that a business enterprise must decide on a production plan, that is, how much to produce and the choice of production factors by which this may be optimally achieved. It also must decide on how much money capital it should invest in fixed assets and working capital both of which are necessary in order to sustain production. In deciding how much to produce it has to take into account what the market can buy. The sales forecast figure thus becomes an important input in assessing fixed assets and working capital requirements.

Generally fixed assets are not readily available in the market. Some machinery, for example, is tailor made for a particular industry and there might be a considerable time lag between ordering and acquisition. It may even have to be imported and this may take a long period of time.

Some assets may be readily available in the market. However asset expansion especially of fixed assets involves substantial expenditure. A firm thus has to make proper plans for these expenditures. The funds may not be readily available and the financing may need to be arranged well in advance.

Current assets comprise of cash, marketable securities, inventory and debtors. Cash is held for three primary motives:

(1) the transactions motive

(2) the precautionary motive

(3) the speculative motive

Cash helps a firm to take cash discounts, take advantage of favcurable business opportunities that may arise from time to time and meet any emergencies that may occur.

Marketable securities are held as a substitute for cash and the need for temporary investments. They can be liquidated when cash is needed. A firm may also have excess cash at certain times. Instead of the cash lying idle it can be invested in marketable securities. The two are therefore close substitutes of one another.

The level of accounts receivable is determined by the volume of credit sales and the average period between sales and collections. If a firm sells goods for cash, only then will there be no bad debt losses. Its sales will however be low because it will lose some customers to other firms that sell on credit. As a firm sells on credit it will need to invest in accounts receivable. If a firm generally extends credit to its customers then the level of receivables will be a function of sales.

Inventory is of three kinds:

(1) raw materials

(2) work in process

(3) finished goods

The level of raw materials inventories is influenced by anticipated production, seasonality of production, reliability of sources of supply and efficiency of scheduling purchases and production operations. Work in process inventory is influenced by length of production period. Finished goods inventories depend on production and sales. As goods are completed they increase the stock of finished goods while sales deplete the stock of finished goods. Raw materials and work in process ultimately end up as finished goods and therefore it can be generalized that all inventories are influenced by sales.

In developing a porffolio-balance model of corporate working capital Yardini (1978) came up with the following conclusions. An increase in expected sales induces an increase in the proportion of portfolio held as inventory, net accounts receivable and net interest earning assets. He observed that corporations obtain additional bank loans and decrease their cash holdings in order to finance this increase. It appears that corporations respond to anticipated sales increase by increasing their inventory of interest earning assets as well as goods. Part of the response to expected sales increase is to borrow in excess of goods inven-

tory build-up so that funds are readily available to finance any production expansion should sales prove to be greater than anticipated.

In studying bank asset management decisions Cohen and Hammer (1967) showed that the problem of asset management revolves around the banks balance sheet items. The main issue is how large the banks assets should be. If the bank reduces the liquidity of its assets then it can increase the yield. Excessive liquidity on the other hand means that it is foregoing profitable opportunities. The problem is thus one of finding an appropriate balance between profitability, risk and liquidity. Less liquidity means higher profits and higher risk, while high liquidity means less profits at a lower risk.

Ansoff (1964) explains that a business firm has three basic resources, physical, human and financial. These are continually used up and need to be replenished and the total resources are limited. A firm requires to be efficient in converting these resources. The other problem is whether the present structure is the most potentially profitable allocation of the firms resources.

There is thus a problem of determining the asset levels that are appropriate for a given firm.

STATEMENT OF THE PROBLEM

Business firms need both current and fixed assets in order to carry out their operations. The levels of assets required are different for different levels of output. The assets may not be readily available in the market. Even if the assets are readily available the funds may not be readily available. This needs to be arranged well in advance to avoid a crisis and potentially high costs for emergency funds. The problem is thus one of finding out whether regression analysis can be used to forecast accurately the asset requirement of firms. If this is possible then the firms can begin the acquisition and financing arrangements of the required assets at the right time.

OBJECTIVES OF THE STUDY

This study has the following as the main objectives.

1. To develop a regression model that can be used to forecast various asset requirements.
2. To use the model to predict(forecast) various asset requirements.
3. To test the accuracy of the model developed.

SIGNIFICANCE OF THE STUDY

This study is likely to be of interest to various groups of people.

1. Managers and directors. They will be in a position to know the asset needs of their companies. They can thus plan for their acquisitior and financing in advance.

2. Academics. It will add to the body of knowledge in financial management.

CHAPTER 2

LITERATURE REVIEW

Introduction

The success of any company will largely depend on how well equipped it is to face the future. The future is always uncertain and therefore the management has to predict what it will be like. This is important for several reasons. The business environment is dynamic so even if the firm is not changing it has to adjust itself to fit in the changing environment.

One area where management has to plan ahead is in the acquisition of assets. The assets that a company may be using at present may have been purchased long ago so present managers need to plan ahead and make the necessarily arrangements for acquisitions of assets for present and/or future use.

Due to the dynamic nature of the environment the predictions about the future need to be reviewed from time to time. More information may come light which may necessitate the revision of estimates. Alternatively certain occurrences may invalidate certain assumptions. Management will still need to know whether the prediction is still valid or not.

Importance of Assets

Assets may be defined as things of value owned or held by an entity for use in carrying out its operations. Assets may be divided into two broad categories, fixed assets and current assets. In the category of fixed assets there are things like plant and machinery, equipment and furniture, land and buildings. The plant machinery, equipment and furniture will be used to produce goods for sale, the prime reason why a company is in business. They are thus needed in the right quantities and in proper condition so that they can produce quality goods. The same assets can also be used as collateral when a company is raising debt.

Current assets include cash, short-term securities, accounts receivable and inventories. Cash is the most liquid asset and is used to meet maturing obligations of the firm. It is also used as a hedge against any occurrence that might require an immediate cash outlay. Accounts receivable arise from transactions with outsiders which they do not settle immediately. This may be necessary to induce them do business with the company. Inventories are necessary to enable the company meet the requirements of the customers at all times.

All assets are important in that a company requires all of them in order to do business properly. They also represent the investment of the equity holders and the debt holders. They rely upon these assets to give them a fair return on their investment.

The earnings of a company also depend on the volume of its assets and how efficiently they are used. A high volume of assets if properly utilized is likely to bring in more earnings than a low volume of assets.

Forecasting asset Requirements

Having seen the importance of assets then the need to forecast asset requirements is apparent.Weston[1] in his book explains that asset expansion is related to the expected future sales. As sales increase the asset levels increase. He thus concludes that a decision to buy or construct a fixed asset that is expected to last five years involves an implicit five year sales forecast. In determining the asset requirements the sales figure thus becomes an important input.

Armaly (1972) developed a model that specifies the simultaneity of the decision-making process with respect to fixed capital, cash, marketable securities, trade credit and inventories. Instead of using data of an actual firm a hypothetical one was used whose objective was postulated as maximization of the discounted stream of dividends accruing to shareholders. When

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1. Weston, J.F. and Brigham, E.F. Managerial Finance. The Dryden Press Hinsdale, Illinois 1981 seventh edition pp 395

the objective function was maximized the desired level of each asset was found to be an increasing function of sales. Again the sales figure is seen to be an important variable in predicting the level of assets required.

Cash flow forecasts are very important. Cash flows determine whether a company will be able to meet its maturing obligations comfortably. Icerman (1974) conducted a study to determine and compare the predictive ability of models forecasting future cash flows. The models tested were:

(a) a market index model

(b) a model based on industry sales predictions and past relationship of cash flow to sales

(c) a multiple regression model incorporating financial ratios as predictor variables.

(d) single, double and triple exponential smoothing of the cash flow series of each firm

(e) six naive models (simple extrapolations of cash flows). Each of the models was used to forecast the cash flow of one hundred and seventeen firms for the years 1973 and 1974. The major conclusions were:

(a) the model based on industry sales predictions appeared to be the best prediction model tested when taken across all the sample firms for both years.

(b) the financial ratios were not useful for predicting future cash flows in the context of multiple regression model tested.

(c) none of the models tested performed well enough to be useful in practice.

From the foregoing, the sales figure is not very useful but it might be used in the absence of a better alternative. Its limitations should thus be noted.

In studying the asset structure of manufacturing companies Santos (1976) found that output determines to a large extent the investment demand for each asset category and the adjustment to attain the desired stock of asset covers a period of time. He found that the speed of adjustment is faster for short term assets than for long term assets, that is, short term assets respond to output faster than long term assets.

Marcis and Smith (1973) studied the demand for liquid asset balances by U.S. manufacturing firms. They found the sales variable to be generally significant, that is, it influenced the demand for liquid asset balances. It measures, they concluded, to some extent the firms demand for cash. Sales were found to vary positively with real cash balances for almost all groups of asset sizes. There is thus a positive relationship between sales and cash balance.

In the same area Gallun (1979) tried to develop revenue forecasting models for small municipalities in Texas. The main objective was to investigate if existing revenue forecasting models could be modified to provide useful predictive models for revenues of small Texas municipalities. The revenue forecasting equations were estimated using multiple linear regression. Projections of independent variables were obtained and used to generate forecasts of revenues. The overall accuracy of the model was quite good. The forecasts were generally a significant improvement over the estimates of the cities.

As much as companies are worried about revenues they are also worried about costs. Walton (1972) studied the application of multiple regression analysis in predicting community college costs. He used data for twenty colleges for a period of three years. The multiple linear regression model was used to predict the costs.

There was never sufficient evidence to justify the rejection of the linearity assumption. Many equations were generated but none was precise enough to justify their acceptance as a viable managerial tool. The standard error of estimate was high. However, because of the fact that it was not rejected it could form a good basis as a starting point in predicting costs.

A prediction depends on the variables used. There are various alternative procedures of selecting variables for a predictive regression equation. Chou (1973) conducted a study in

this area as regression is one of the more frequently used statistical tools in obtaining forecasts. The purpose was to find out which variable selection procedure provides the prediction equation that yields the most accurate prediction since different procedures of selecting explanatory variables lead to different sets of regressors. The procedures examined were stepwise regression, the maximized corrected R square regression and the orthogonal factor variable selection procedures. A model for predicting stock prices was used. The predictive performance of the regression equation was measured by the accuracy of the predictions computed from the equations. The degree of accuracy was measured by the mean square error criterion and error coefficients that quantify turning point prediction errors. Stepwise regression predictions proved to be less accurate than those computed from equations derived by other means. The R square regression and orthogonal factor variable selection procedures can be used in selecting variables for a regression model.

A company is said to be bankrupt when its total liabilities exceed a fair valuation of its total assets.[2] The prediction of bankruptcy can thus be viewed as prediction of assets and liabilities. Barn-Niv (1983) undertook a study on insolvency

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2. Weston J.F. and Brigham E.F.: Managerial Finance. The Dryden Press Hinsdale Illinois 1981 Seventh edition pg 961.

prediction for property-liability insurers. The study was designed to develop new statistical methods for predicting insolvencies among property liability insurers. He developed and tested five groups of univariate models. Another group of multivariate models was also developed. The best univariate model could classify 95% of the insurers one year prior to insolvency. On the other hand the best multivariate model could classify correctly 99% of the insurers one year prior to insolvency. The conclusion was that it is better to use many variables while developing a prediction model rather than only one variable.

The researchers cited have tried to determine the asset requirements of companies. Some have considered certain categories of assets. The sales variable has been widely used to predict the asset requirements. The researcher concurs with this method because ideally one should try to establish how much the market can buy and then make decisions on how to produce as opposed to producing a certain quantity and then try to force the market to buy. It is for this reason that sales will be used to predict asset requirements in the local setting. The quantitative technique mostly used is regression analysis and thus multiple linear regression will be used.

FORECASTS AND INFLATION.

As the rate of inflation continues to increase the usefulness of historical cost financial statements has been questioned. Some people advocate that general price-level accounting is more relevant in a period characterized by inflation. Black (1979) conducted a study to find out the usefulness of general price-level information for stock investment decisions. The problem was to find out whether general price-level information is more useful to investors in common stock than historical cost information for the prediction of stock investment rates of return. He developed models using alternative information sets:

(a) general price-level

(b) historical cost

(c) past rate of return data.

Each model was used to predict future rates of return of one, two and three years with the absolute error of forecast used as the evaluation criterion. Multiple linear regression was used to establish the existence of an explanatory relationship between rates of return for both general price-level and historical cost models. The predictive ability of the various prediction models was assessed. The general price-level models did not outperform historical cost prediction models in predictive ability. Black

thus concluded that general price-level information as a replacement for historical cost information was not useful to investors in common stock for predicting future stock rates of return.

On the same problem of inflation the net realizable value has been recommended as a better valuation method than historical cost. It however has a shortcoming in that there are no established used market prices for certain fixed assets like buildings. Baudin (1982) studied the usefulness and predictability of net realizable values. He selected the top one thousand publicly held corporations in the United States in 1980. The top financial executives were asked to provide data on completed transactions for office, warehouse and general purpose buildings. Five specific indices (price) pertaining to buildings and construction were used in developing the predictive model. The least squares regression was performed to test for the "best" index or combination of indices. For one model the results were significant at the 5% level of confidence while for eleven models the results were significant in the short run. As for the predictive ability there was a wide range in selling prices as compared to the predicted values. The application of the model is thus questionable.

The reported net income time series are often assumed to be predictable functions of past net income observations. Such assumptions are implicit in the literature concerning income smoothing and corporate investment, financing and valuation. Em-

pirical evidence has however consistently shown that net income behavior is generally unpredictable, although sales revenues are generally predictable.

Chant (1978) studied the predictability of net income and its components. The components studied were sales revenue, operating costs as well as net income itself. Sales revenue and operating costs were found to be very predictable in their behavior while the others were not. Chant concluded that historical cost accounting procedures probably make net income behavior less predictable, by generating timing differences in components responses to monetary influences.

Buckmaster (1973) did an empirical investigation of the relative predictive ability of three income determination models. The objective was to evaluate which of the three measures of income, that is, historical cost, historical cost adjusted for general price-level changes and current values is better using the predictive ability as the criterion. Forty three companies were included in the sample for the period 1965-1969.

The predictions were obtained using exponential smoothing models and simple linear regression. The average error squared and mean absolute error were used as error measures. It was found out that:

(1) historical cost adjusted for general price-level changes provided predictions inferior to the other two models

(2) there tends to be no significant difference in the predictive ability of the historical cost income determination model and the current value income determination model

(3) the relative predictive ability of the income models is insensitive to reasonable changes in the rates of price change.

The Chi-square test for independence was used to test for differences in the best income prediction model among industries. There was no significant difference in the best predictor among variables. Inflation does not therefore render historical cost redundant in predicting.

In another study Zawati (1977) studied the reliability of appraisal methods in determining asset value. The objective was to empirically test the reliability and predictability of appraisal techniques as a means of estimating current value as compared to historical value. Two hundred and fifty large corporations in the United States were sampled. Their financial executives were asked to provide their views on reliability of appraisal (valuation) values and selling prices and book values.

The executives strongly supported appraisal values as being reliable estimates of current values. There was no difference between appraisal and selling values at 0.05 level of significance. Regression models that used current values had more predictive ability than those which used book values. Multiple regression (prediction) models which used both current and book

values were superior to simple prediction models. However, from the evidence, book values/historical costs cannot be ignored altogether in making predictions.

Bravo (1976) conducted an empirical analysis of the predictive ability of alternative income measures. The purpose was to determine empirically the comparative ability of three alternative income measures namely:

(a) historical cost

(b) general purchasing power

(c) operating profit

to predict income and cash flows. All the three measures have supporting logic theory and the issue is which one has high predictive ability. The twenty eight largest firms in 1975 Fortune listings selected from four industry types structure in the period 1955-1974 were chosen. The predictive analysis was carried out for the years 1970-1974.

Significant differences were found to exist in the ability of the three measures to project income. Historical cost emerged as the superior method. The results also indicated that it should be complemented by operating profit.

Hammer (1977) used a simulation approach to find out the usefulness of alternative accounting income measures in predicting cash flows. The alternatives were:

(a) historical cost income under LIFO

(b) historical cost income under FIFO

(c) general price-level adjusted historical cost under LIFO

(d) general price-level adjusted historical cost under FIFO

(e) current operating profit and replacement cost

(f) exit value income

(g) general price-level adjusted income.

The data was simulated on the basis of micro-economic theory There was no alternative that performed best in all conditions. In terms of relative performance historical cost performed best. Replacement cost and exit value performed best in a number of experiments but their degree of efficiency over historical cost was quite small. General price-level adjusted income never outperformed unadjusted historical cost income and in most cases they performed substantially worse. From the foregoing published financial statements usefulness would not be enhanced by required disclosure of income computed on a basis other than unadjusted historical cost.

From the foregoing it can be seen that inflation in not likely to invalidate the results of a forecast. The study will therefore use historical cost figures.

METHODS OF FORECASTING

Forecasts play an important role in decision making. It is thus crucial to use the best available technique to minimize forecast inaccuracy. There is no unique method that guarantees the best results. The choice of a method is often dictated by data availability and the urgency with which forecasts are needed. The following statistical methods can all be used to obtain forecasts.

TREND METHOD.

The time series data on the variable under forecast are used to fit a trend line or curve either graphically or by means of a statistical technique, that is, the least squares method. The time series data are chronologically arranged data from a population at different points in time. The data is plotted on a graph and based on this data a curve or line is drawn depicting the variable of interest. The line can be drawn up to the period for which data are available. It can then be extrapolated to the forecast period. An equation is fitted to the time series data with the aid of an estimation method. The trend equation can take a linear or any kind of non-linear form.

The method is quite simple and often yields good forecasts. This is because most time series follow a particular trend in the long-run. Its major limitation is that it assumes that the past rate of change of the variable under forecast will continue in the future.

TIME SERIES ANALYSIS-MOVING AVERAGE.

Under this method the forecast is assumed to be the average of several preceding periods. If several time periods are used then random fluctuations will cancel each other, that is, will be smoothened away.

The method has certain characteristics. In the first instance, the different moving averages produce different forecasts. The greater the number of periods in the moving average, the greater the smoothing effect. If the past trend of data indicates substantial randomness then a greater number of periods should be chosen to smoothen the fluctuations. On the other hand if there is a change in the underlying state of the data fewer periods should be used so that the change is pronounced.

The method has several limitations. Equal weighting is given to each of the values used in moving average calculations, whereas the most recent data might be more relevant to current

conditions. The moving average calculation takes no account of data outside the period of average, so full use of all the data available may not be made. If the data is not adjusted when there is a seasonal variation then the forecast can be misleading.

REGRESSION METHOD.

Under this method the forecaster identifies the variables which determine the variable under forecast. He then estimates the alternative forms of the dependence relationship between the dependent (forecasting) variable and the causal variable, using historical data on them. The least squares method is usually used for estimation purposes. The form of equation (best relation) is selected using statistical inference. The selected equation is supposed to describe the past causal relationship adequately. The statistic R^2 (coefficient of determination) gives the measure of the goodness of fit. The closer it is to unity the better the fit. The forecaster uses the likely values of the causal variables in the prediction variables in the estimated equation to obtain the forecast.

The method is both descriptive and prescriptive. It gives the forecasts and at the same time explains why the forecast is at that level through variations in the causal variables. Its major limitation is that it requires the use of some other

forecasting method to estimate the values of the explanatory (causal) variables in the prediction period. If the forecasts of the values of explanatory variables are wrong, the forecasts based on this method will be wrong. The method is also based on the past average relationship and so to the extent that the future relationship deviates from the past average the forecast will be wrong.

LEADING INDICATOR METHOD.

There are three kinds of time series:

(a) leading series where data on the variables moves up or down ahead of some other series

(b) coincident series move along with some other series

(c) lagging series move up or down behind some other series.

If the variable under forecast is such that its movements lag behind the movements of some other variable, called leading variable or indicator, its values in future could be forecast through a measure of this lead-lag relationship.

The leading indicator is simple and it overcomes the regression techniques problem of forecasting the values of the independent variables in the prediction period. Since there is a lead relationship, the exact values of the independent variable for

the lead period are known. It is not always possible to find a leading indicator for the variable under forecast. The lead period may change over time. Through the estimation of the lead-lag, we find out the best fitted lag period on the past data but the same may not be true for the future.

SIMULTANEOUS EQUATIONS METHOD.

This is also called the complete system approach and is quite sophisticated. It involves the development of a complete model which can explain the behavior of all the variables which the decision unit can control. The number of equations in such a model equals the number of dependent (controllable) variables.

After the model is developed it is solved for each of the endogenous variables in terms of the exogenous variables. The values of the lagged endogenous variables are known and those of the exogenous variables will have to be estimated. The corresponding values of lagged endogenous variables are fed into the equation corresponding to the value variables whose forecasts are needed to generate the required forecasts.

The principal advantage of this method is that the forecaster needs to estimate the future values of only the exogenous variables affecting the forecast. Its limitations include the fact that it assumes that past statistical relation-

ships will hold good in the prediction period. It is however theoretically better than any other statistical method but its rather severe limitations are responsible for its unpopularity.

CHAPTER THREE.

RESEARCH DESIGN.

As mentioned in chapter one, this study sought to find out whether regression analysis can be used to predict the asset requirements of firms. The population of interest comprised all the companies quoted on the Nairobi Stock Exchange.

Instead of sampling, a census was carried out. This was because of several reasons. The total population was small (58 companies) and it was therefore feasible to deal with all of them. In addition most of the firms are located in Nairobi and it was thus feasible to visit all of them. Lastly, the data required could be got from a central place, that is, Africa Registrars Ltd (Secretaries to the Nairobi Stock Exchange) or from the Registrar of Companies.

DATA COLLECTION METHOD.

The study utilized secondary data from the published annual accounts. A data collection form was used for this exercise (Appendix 1). Among the pertinent data that were extracted included:

1. Turnover (Sales)
2. Fixed assets - machinery and equipment
   - Land and buildings

3. Current assets - cash and near cash

- debtors

- inventory

It was necessary to combine some of the assets since they are very much related. For this reason machinery and equipment are combined, land and buildings are combined and cash is also combined with near cash. The companies also used different names when classifying the assets so a general classification was better than a detailed one as would have had problems trying to get the figures for specific assets. This also reduced the data analysis in that there were fewer equations to be analyzed.

The data was collected for a period of fifteen (15) years. Some companies were not quoted throughout this period while others had financial problems and had been placed under receivership. Others did not disclose information on critical variables like turnover in the accounts. Consequently twenty six firms were eliminated for these reasons and the results in this study reflect findings from thirty two companies.

TECHNIQUES OF ANALYSIS.

Regression analysis was used in analyzing the data. Specifically the multiple linear regression of the form:

$$Y = a + bX_1 + cX_2 + dX_3$$

were used where:

Y is the asset being predicted (cash, inventory, debtors, machinery e.t.c.)

a, b, c and d are constants

X_1 is the sales figure for the current year

X_2 is the sales figure for the preceding year

X_3 is the sales figure for the preceding year but one.

Equations were developed for each asset for each company. There were therefore five equations for each company. The equations were developed using the data collected for the first ten years. The data for the other five years were used to test the predictive ability of the equations developed. The actual data of the last five years was compared to the predicted data. The Chi-square test was to test for differences between these two sets of data.

$$\text{Test Statistic} \quad X^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

where:

n = number of observations

O_i = ith observation

E_i = ith expectation.

The hypothesis tested were:

H_o: There is no significant difference between the observed

(actual) and the predicted (expected) figure.

H_1: There is a significant difference between the actual and the expected figure.

The hypothesis were tested at 95% level of confidence.

The coefficient of determination (R^2) was also used. The distribution of R^2 for each of the assets was analyzed. The results were tabulated to reflect the firms with very high, high, moderate and insignificant explanatory power.

CHAPTER FOUR.

DATA ANALYSIS AND RESULTS.

This chapter presents and discusses the findings of the study. The data collected is presented and analyzed by use of tables and the Chi-square test.

The Chi-square test was applied to test whether the equations generated are statistically significant in generating predictions. For some companies data was available for less than fifteen years (in some cases fourteen and others thirteen). The data for ten years thus was used to generate the equation while data for four or three years was used to test the predictive ability. The null hypothesis was that there is no significant difference between the observed (actual) and the predicted (expected) asset figures. A rejection of the hypothesis means that the equation developed cannot be used to predict asset levels accurately.

RESPONSE RATE.

The findings of the study are based on the data obtained from thirty two (32) companies quoted on the Nairobi Stock Exchange. Some companies that are quoted at present have been quoted for less than fifteen (15) years and the study required

data for fifteen years. In other cases the companies did not disclose turnover figures even when requested to do so by the Nairobi stock Exchange. The turnover figure was a very important variable in this study. As a result the population dropped from the current number of quoted companies (58) to thirty two (32).

RESULTS.

TABLE 1: AFRICAN TOURS AND HOTELS LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	47.89	Significant
Land & Buildings	39.6	Significant
Cash	290.07	Significant
Debtors	411.68	Significant
Inventory	5.47	Not significant

The predictive equations developed for the assets of African Tours and Hotels Ltd appear on Appendix II. These equations were used to predict the asset requirements of African lours and Hotels Ltd. The Chi-square test was performed to test whether

the predictions were significantly different from the actual figures. For machinery, land and buildings, cash and debtors the calculated Chi-square values were greater than the critical value (5.991). This means that these predictions are significantly different from the actual figures. The equations thus fail to provide accurate forecasts o the sset requirements. The Chi-square value calculated for i entory is lower than the critical value (5.991). The equation thus predicts accurately the inventory requirements of this company.

TABLE 2: A BAUMAN AND COMPANY LTD.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	0.61	Not significant
Land & buildings	23.14	Significant
Cash	5568.3	Significant
Debtors	12.09	Significant
Inventory	28.28	Significant

The predictions using the equations developed (Appendix II) were tested for accuracy. The calculated Chi-square value of machinery was less than the critical value (5.991). The equation thus predicts accurately the machinery requirements of this company. The calculated Chi-square values for the other assets were greater than the critical value (5.991) and are thus not useful for purposes of predictions.

TABLE 3: BAMBURI PORTLAND CEMENT CO. LTD.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	92020.74	Significant
Land & Buildings	14022.74	Significant
Cash	13969.32	Significant
Debtors	642.65	Significant
Inventory	2202.1	Significant

The predictions using the equations developed (Appendix II) are significantly different from the actual figures. The calculated Chi-square values for all the assets are greater than the critical value (7.82). These equations are thus not useful as far as prediction of asset levels for this company is concerned.

TABLE 4: BROOKE BOND KENYA LTD.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	2894.42	Significant
Land & Buildings	674.93	Significant
Cash	23986.25	Significant
Debtors	3189.52	Significant
Inventory	3974.56	Significant

In the case of Brooke Bond Kenya Ltd the calculated Chi-square values are much higher than the critical Chi-square value (7.82). The equations developed (Appendix II) for all the assets cannot be used to predict asset levels for this particular company accurately.

TABLE 5: CAR AND GENERAL (KENYA) LTD.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	47.04	Significant
Land & Buildings	457.97	Significant
Cash	1372.6	Significant
Debtors	270.03	Significant
Inventory	1441.87	Significant

All the calculated Chi-square values are much higher than the critical Chi-square value (5.991). The value for machinery is a bit lower compared to the others but it is still higher than the critical value at 0.05 level of significance. The equations developed (Appendix II) cannot therefore predict the asset requirements of this company accurately.

TABLE 6: CITY BREWERY INVESTMENTS LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Debtors	604.37	Significant
Cash	2985.54	Significant

City Brewery is an investment company. It does not have assets like machinery, land and buildings and inventory. The only assets analyzed are debtors and cash. For these two assets the Chi-square values calculated are much higher than the critical Chi-square value (7.82). The equations developed (Appendix II) for predicting these two asset levels cannot be used.

TABLE 7: CONSOLIDATED HOLDINGS LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	1453.89	Significant
Land & Buildings	1639.9	Significant
Cash	60.92	Significant
Debtors	32947.38	Significant
Inventory	866.82	Significant

All the predictions of the assets of Consolidated Holdings Limited are significantly different from the actual. The calculated Chi-square values are greater than the critical Chi-square value (5.991). The prediction of cash is the best among all the assets. However, the Chi-square value is still high. All the equations developed (Appendix II) cannot be used to forecast the asset requirements of this company.

TABLE 8: C. M. C. HOLDINGS LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	486.87	Significant
Land & Buildings	641.96	Significant
Cash	10754.00	Significant
Debtors	1044.1	Significant
Inventory	2558.3	Significant

The calculated Chi-square values of the assets of C.M.C. Holdings Limited are greater the than critical Chi-square value (9.488). This means that the equations developed (Appendix II) to predict the asset levels for this particular company perform poorly and thus their usefulness is limited.

TABLE 9: DUNLOP (KENYA) LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	56.6	Significant
Land & Buildings	45.7	Significant
Cash	803.3	Significant
Debtors	41.4	Significant
Inventory	324.4	Significant

The calculated values of the Chi-square test for Dunlop (Kenya) Limited are lower than for the companies dealt with so far. This is despite the fact that they are all significantly higher than the critical Chi-square value (5.991). This means that the predictions are still significantly different from the actual figures. Consequently the equations developed (Appendix II) for predicting asset requirements for this particular company cannot be used.

TABLE 10: EAAGADS LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	157.5	Significant
Land & Buildings	1846	Significant
Cash	1511.4	Significant
Debtors	228.9	Significant
Inventory	184.3	Significant

The calculated Chi-square values for all the assets of Eaagads Limited are much higher than the critical Chi-square value (5.991). This means that the equations developed (Appendix II) to predict the assets requirements of Eaagads Limited come up with poor predictions.

TABLE 11: E. A. CABLES LIMITED.

Asset	X^2	Chi-square test of statistical Significance at 0.05 level
Machinery	365.6	Significant
Land & Buildings	571.1	Significant
Cash	1940.5	Significant
Debtors	1595.6	Significant
Inventory	400.5	Significant

From the calculated values of Chi-square test statistic shown above the predictions of asset levels of E. A. Cables Limited are significantly different from the actual levels. The calculated values are all greater than the critical value (7.82). The equations thus developed in this study (Appendix II) cannot be used as predictors of asset requirements by this company.

TABLE 12: E. A. PORTLAND CEMENT CO. LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	2526	Significant
Land & Buildings	120.4	Significant
Cash	1055	Significant
Debtors	13780.8	Significant
Inventory	1795	Significant

The predictions of all the asset levels differ significantly from the actual levels. The calculated Chi-square values are greater than the critical value (7.82). The equations developed (Appendix II) cannot be used to predict the asset requirements for this company.

TABLE 13: KENYA POWER AND LIGHTING CO. LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	18760	Significant
Land & Buildings	3947	Significant
Cash	25271.8	Significant
Debtors	3753.5	Significant
Inventory	1140.7	Significant

All the predictions of the asset levels of Kenya Power and Lighting Company Limited are significantly different from the actual asset levels. The calculated Chi-square values are greater-than the critical Chi-Square value (7.82). The equations developed (Appendix II) cannot be used to predict accurately the asset levels of the company.

TABLE 14: EAST AFRICA ROAD SERVICES LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	16.4	Significant
Land & Buildings	848.3	Significant
Debtors	93.8	Significant
Inventory	559.3	Significant

In some of the years analyzed East African Road Services had an overdraft. This is a liability and thus cash is not analyzed. For the other assets the calculated Chi-square value is greater than the critical Chi-square value (5.991). The equations developed (Appendix II) cannot be used to predict the asset requirements of this company accurately.

TABLE 15: ELLIOT'S BAKERIES LIMITED

Assets	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	1621.8	Significant
Land & Buildings	340.2	Significant
Cash	2714.9	Significant
Debtors	374.4	Significant
Inventory	1614.9	Significant

The predictions of asset levels made using the equations developed (Appendix II) are significantly different from the actual asset levels. This is because the calculated Chi-square values are greater than the critical Chi-square value (5.991). The equations are thus not useful in predicting the asset levels of Elliot's Bakeries Limited.

TABLE 16: EXPRESS KENYA LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	540	Significant
Land & Buildings	2246.2	Significant
Cash	388.1	Significant
Debtors	585	Significant
Inventory	18.3	Significant

When the equations developed (Appendix II) to predict the asset levels of Express Kenya Limited were used to predict the various asset levels all of them performed poorly. This is because for each asset the calculated Chi-square value is much higher than the critical value (9.488). All the equations are therefore not useful as far as predicting asset levels for Express Kenya Limited is concerned.

TABLE 17: GEORGE WILLIAMSON KENYA LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	594	Significant
Land & Buildings	18415.8	Significant
Cash	270.7	Significant
Debtors	1519.6	Significant
Inventory	496.2	Significant

The calculated Chi-square values of all the assets of George Williamson Kenya Limited are much higher than the critical value (9.488). This means that the predicted values are significantly different from the actual values. The equations developed (Appendix II) are thus not useful in predicting the asset levels of this company.

TABLE 18 HUTCHINGS BIEMER LIMITED.

Asset	X2	Chi-square test of statistical significance at 0.05 level
Machinery	115.3	Significant
Land & Buildings	1975	Significant
Cash	355.2	Significant
Debtors	437.3	Significant
Inventory	527.9	Significant

For all the predictions of asset levels attempted for Hutchings Biemer Limited the calculated Chi-square value is much higher than the critical Chi-square value (7.82). It therefore follows that the predicted values are significantly different from the actual values. The equations (Appendix II) thus fail to predict the asset levels accurately.

TABLE 19 ICDC INVESTMENT COMPANY LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	120.1	Significant
Land & Buildings	4569.5	Significant
Cash	47628.8	Significant
Debtors	807.9	Significant

ICDC did not report any inventory during the period under review. As such only four assets namely land and buildings, machinery, cash and debtors were analyzed. Predictions were performed for each of the four assets. When tested whether they are significantly different from the actual levels all were found to be significantly different. The calculated Chi-square values were greater than the critical value (7.82). The four equations (Appendix II) developed to predict the asset levels for this company do not work.

TABLE 20: KAPCHORUA TEA COMPANY LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	4959.6	Significant
Land & Buildings	1398.4	Significant
Cash	15703.2	Significant
Debtors	171.6	Significant
Inventory	527.9	Significant

The calculated values of the Chi-square test are all much higher than the critical value of Chi-square (7.82). The predictions thus differ significantly from the actual levels. In this case the equations (Appendix II) fail in providing accurate predictions of the asset levels.

TABLE 21: KAKUZI LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	624.8	Significant
Land & Buildings	26321	Significant
Cash	12012	Significant
Debtors	16692	Significant
Inventory	843.7	Significant

The predictions of asset values of Kakuzi Ltd differ significantly from the actual values since the calculated values of Chi-square are much higher than the critical Chi-square value (9.488). The equations (Appendix II) for predicting asset levels developed for Kakuzi Limited are thus not useful.

TABLE 22: KENYA NATIONAL MILLS LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	16982.6	Significant
Land & Buildings	774	Significant
Cash	127.2	Significant
Debtors	889.9	Significant
Inventory	26559.1	Significant

There were five predictive equations developed for predicting asset levels of Kenya National Mills Limited. The results were as tabulated above. The calculated values of Chi-square were higher than the critical Chi-square value (7.82). The predictions obtained using these equations (Appendix II) are thus significantly different from the actual figures. The equations developed thus failed in predicting the asset levels of this company.

TABLE 23: KENSTOCK LTD.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Cash	55.8	Significant
Debtors	70.6	Significant

Kenstock Ltd did not report any assets like machinery, land and buildings and inventory during the period under review. Attention was therefore focused on cash and debtors. For these two assets an equation was developed for each to predict asset requirements (Appendix II).Predictions were performed and tested for significance. In the two cases there was a significant difference between the predicted values and the actual values meaning that the equations developed did not predict accurately the asset levels. The calculated Chi-square values were higher than the critical value (7.82).

TABLE 24: LIMURU TEA CO. LTD.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	4.9	Not significant
Land & Buildings	11.6	Significant
Cash	144.2	Significant
Debtors	4734.6	Significant
Inventory	181.3	Significant

The Chi-square values of machinery and land and buildings are quite low when compared to the values for the other assets. The value for machinery is lower than the critical value (7.82) so there is no significant difference between the predicted and actual figures for machinery. The equations developed (Appendix II) to predict the requirements of machinery is thus a good predictor. For the other assets the predictions are significantly different from the actual so their equations cannot be used to predict the asset requirements.

TABLE 25 MARSHALLS (E. A.) LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	3582.4	Significant
Land & Buildings	147398.6	Significant
Cash	5978.8	Significant
Debtors	20061	Significant
Inventory	17545	Significant

The calculated Chi-square values for all the assets are much higher than the critical value (7.82). All the equations (Appendix II) developed for the five assets for this particular company cannot be used to predict accurately the asset requirements for this company.

TABLE 26: MOTOR MART GROUP LTD.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	74022	Significant
Land & Buildings	19428	Significant
Cash	8197	Significant
Debtors	3972.6	Significant
Inventory	14554.3	Significant

The results above indicate that the predicted values of all the assets are significantly different from the actual values. This is because the calculated Chi-square values are all higher than the critical Chi-square (7.82). The predictive equations (Appendix II) thus developed for predicting asset requirements for this company thus fail to predict the asset requirements accurately.

TABLE 27 NATION PRINTERS AND PUBLISHERS LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	50.76	Significant
Land & Buildings	3252.7	Significant
Cash	24677	Significant
Debtors	1358	Significant
Inventory	1801.4	Significant

The predictions of asset levels of Nations Printers and Publishers differ significantly from the actual asset levels. This means that the asset requirements for this particular company cannot be estimated using equations developed in this study (Appendix II). The calculated Chi-square values exceed the critical value (7.82).

TABLE 28: PEARL DRY CLEANERS LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	388.8	Significant
Land & Buildings	0.6	Not significant
Cash	19.3	Significant
Debtors	5.4	Not significant
Inventory	2086	Significant

The results of Pearl Dry Cleaners Limited fall into two groups. On one hand the Chi-square values are significant. The Chi-square values of land and buildings and debtors are not significant. In other words the predicted values are not significantly different from the actual figures. The predictive equations developed (Appendix II) for these two assets might then be useful in predicting the asset levels. In the other three cases the equations developed are not useful in predicting asset requirements.

Table 29: PAN AFRICA INSURANCE CO. LIMITED

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	57.1	Significant
Land & Buildings	74.6	Significant
Cash	9227	Significant
Debtors	128.02	Significant
Inventory	70.6	Significant

The predictions of all the five assets for this company are significantly different from the actual. The equations developed (Appendix II) to predict each asset requirement are thus not useful in this respect. As can be seen from the table above the calculated Chi-square values are much higher than the critical Chi-square value (5.991).

TABLE 30: PHILLIPS INTERNATIONAL LIMITED

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	198.1	Significant
Cash	758	Significant
Debtors	906	Significant
Inventory	1306.7	Significant

Phillips International did not report any values for land during the period under review. The calculated Chi-square values of the other assets are greater than the critical value of Chi-square (5.991). The equations developed (Appendix II) for predicting asset levels for this company are not useful.

TABLE 31: SASINI TEA AND COFFEE LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	11,440.9	Significant
Land & Buildings	277,635.4	Significant
Cash	6,842.7	Significant
Debtors	11,382.2	Significant
Inventory	17,371	Significant

The predicted asset levels for this company are significantly different from the actual levels. This is because the calculated Chi-square values are greater than the critical value (5.991). The equations developed (Appendix II) to predict the asset levels for these companies are thus not useful.

TABLE 32: TIMSALES LIMITED.

Asset	X^2	Chi-square test of statistical significance at 0.05 level
Machinery	346.6	Significant
Land & Buildings	143.8	Significant
Cash	476.2	Significant
Debtors	11	Significant
Inventory	81.4	Significant

As in the majority of the previous cases, the predicted values of the assets for Timsales Limited are significantly different from the actual values. The calculated Chi-square values are greater than the critical value (5.991). The equations (Appendix II) that have been developed cannot be used to predict the asset requirements of Timsales Limited.

The next stage of analysis involved the coefficient of determination (R^2). This sheds light on the distribution of R^2 for every asset investigated.

TABLE 33: DISTRIBUTION OF R^2 FOR MACHINERY

R^2	No. of firms	Percentage	Explanatory Power
>0.8	19	63.3	Very High
0.6-0.79	5	16.7	High
0.4-0.59	5	16.7	Moderate
<0.4	1	3.3	Insignificant
Total	30	100.0	

As noted in the previous section some two companies did not report any machinery in their accounts. As such the total number of companies that reported machinery was thirty. The equations developed to predict the levels of machinery in most cases show a very strong relationship between sales and machinery. In 63.3% of the cases R^2 is greater than 0.8. This contrasts sharply with the previous analysis where the same equations performed very poorly when used to predict the levels of machinery. As the table above shows there is a strong relationships between sales and the levels of machinery.

TABLE 34: DISTRIBUTION OF R^2 FOR LAND AND BUILDINGS

R^2	No. of firms	Percentage	Explanatory Power
>0.8	16	55.2	Very high
0.6-0.79	8	27.6	High
0.4-0.59	4	13.8	Moderate
<0.4	1	3.4	Insignificant
Total	29	100.0	

Some three companies did not have any land and buildings during the period under review. The total number of firm is thus twenty nine in the above table. The distribution of R^2 for land and buildings is not very different from that of machinery. A high percentage (82.8%) lies in the category of very high and high. This is in contrast to the predictions obtained using the same equations. Like in the case of machinery there is a strong relationship between sales and land and buildings.

TABLE 35: DISTRIBUTION OF R^2 FOR CASH.

R^2	No. of firms	Percentage	Explanatory Power
>0.8	7	22.6	Very High
0.6-0.79	10	32.2	High
0.4-0.59	3	9.7	Moderate
<0.4	11	35.5	Insignificant
Total	31	100.0	

The R^2 distribution of cash is different from that one of machinery and land and buildings, 54.8% of the coefficients of determination lie in the category of very high and high. On the other hand 35.5% lie in the category of insignificant. One company had an overdraft in some years and so the total number of firms appearing in the table is thirty one (31).

TABLE 36: DISTRIBUTION OF R^2 FOR DEBTORS.

R^2	No. of firms	Percentage	Explanatory Power
0.8	18	56.2	Very High
0.6-0.79	5	15.6	High
0.4-0.59	3	9.4	Moderate
<0.4	6	18.8	Insignificant
Total	32	100.0	

A high proportion (71.8%) of the coefficients of determination lie in the category of very high and high. One would therefore expect that a good portion of the predictions obtained using these equations would be useful. This is however not the case because in the majority of cases the equations were poor predictors of asset levels.

TABLE 37: DISTRIBUTION OF R^2 FOR INVENTORY.

R^2	No. of firms	Percentage	Explanatory Power
>0.8	11	39.3	Very High
0.6-0.79	6	21.4	High
0.4-0.59	5	17.9	Moderate
<0.4	6	21.4	Insignificant
Total	28	100.0	

Some firms do not have any inventory because of the nature of their operations. The companies reporting inventory were thus twenty eight. The coefficient of determination is well distributed throughout all the categories. A high proportion however lies in the category of high and very high (60.7%). These results contradict with those of the previous section where the predictive equations performed poorly.

CHAPTER 5.

SUMMARY AND CONCLUSION.

This study used multiple linear regression to predict the asset requirements for companies. Predictive equations were developed and then they were tested for accuracy in obtaining predictions.

One major finding of the study is that there is a strong relationship between the level of sales and the level of assets. This is demonstrated in the last part of the analysis where for the various assets the proportion of R^2 in the category of high and very high is high.

In almost all cases the predictive equations developed using the methodology of this study did not predict the asset levels accurately. When tested for statistical significance the majority were found to give predictions that are significantly different from the actual figures. The usage of the equations developed using this methodology to predict asset requirements is therefore not recommended as one might get predictions that are clearly irrelevant.

The results of the Chi-square test contradict the results of R^2. Several factors may have contributed to this. Whereas there is a strong relationship between sales and assets the relationship may not be one of cause and effect. One variable may thus not determine the other and if it does then it only does so in a small way.

The other factor is that there could be random fluctuations in either of the variables. Whenever the random fluctuation occurs then the value of the test statistic will increase. This will lead to a significant difference between the estimate and the actual.

The other factor that could explain the results is multicollinearity. This is the situation where some or all of the independent variables in an analysis have a significant relationship to each other as well as to the dependent variable. When multicollinearity exists between the independent variables themselves as well as between the independent variables and the the dependent variable, a multiple regression equation correctly shows the relationship to the dependent variable. The equation may have a high R^2 but if multicollinearity is high then when it comes to predictions it will not be efficient. To reduce the problem of multicollinearity one can increase the data items used to generate the equation. Another alternative is to find other independent variables that do not have multicollinearity and add them in the equation.

In the current case the sales of one year are related to the sales of the next year. The sales are also related to the asset levels. The problem in this study thus seems to be one of multi-collinearity.

There could also be an error term that was not captured by the predictive equations. This means that there are other independent variables that are not included in the current equations. Their exclusion thus makes the equations fail once a prediction is attempted.

The equations do not take into account things like the changing environment. The state of technology is changing and economic conditions are also changing. The equations may thus fail to predict accurately because of changed environmental circumstances during the test period.

LIMITATIONS OF THE STUDY.

This study had several limitations. The first was the unavailability of data. There were instances where some companies did not disclose the turnover figures in the accounts. Some companies responded positively to the Nairobi Stock Exchange when requested to submit their turnover figures. Others did not and this led to their exclusion in this study.

The other limitation in the study is that the equations developed used the sales figure of the year when the prediction is required as one of the independent variable. If one is faced with the task of estimating asset levels of a company in real life then one would then have to obtain the forecast of the sales figure. This might invalidate the results in that if the sales forecast is not accurate then the prediction of the assets will not be accurate.

The study utilized historical cost figures. Although inflation may not be an issue a high rate of inflation might invalidate the results.

A firm might be operating under excess capacity. If the demand increases such a firm might increase its sales without increasing the level of its assets. The study assumed that the companies were operating at full capacity.

The study utilized the balance sheet figures at the year end. The figures thus reflect the position in only one day of the year. The inflows of assets and outflows during the year are thus not captured. The inflows and outflows of assets like cash and inventory are important but this is not taken into account.

SUGGESTIONS FOR FURTHER RESEARCH.

The first suggestion is for a similar study to be undertaken but using a different model from the one used. The multiple regression model gives results that are contradictory. Another model might give results that are consistent.

The second suggestion is for a similar study to be undertaken for private companies. The results may be compared with those of public companies. It can thus be established whether the model is consistent among the two groups of companies.

The third suggestion is to undertake a similar study but using current cost accounts instead of historical cost account figures. The performance of the current cost accounts can then be compared with the historical cost accounts figures.

APPENDIX I.

DATA COLLECTION FORM.

COMPANY NAME: _____

YEAR:	1974	75	76	77	78	79	80	81	82	83	84	85	86	87	88
SALES															
FIXED ASSETS:															
MACHINERY															
LAND & BUILDINGS															
TOTAL															
CURRENT ASSETS:															
CASH															
INVENTORY															
DEBTORS															
TOTAL															

APPENDIX II.

LIST OF PREDICTIVE EQUATIONS.

AFRICAN TOURS AND HOTELS LIMITED.

Machinery:	$Y = -64.42 + 0.27X_1 - 0.19X_2 + 0.31X_3$
Land & Buildings:	$Y = 412.1 + 0.11X_1 - 0.11X_2 + 0.09X_3$
Cash:	$Y = 140.68 - 0.02X_1 - 0.003X_2 - 0.001X_3$
Debtors:	$Y = 152.71 - 0.02X_1 + 0.34X_2 - 0.14X_3$
Inventory:	$Y = 39.5 + 0.015X_1 + 0.03X_2 - 0.009X_3$

A. BAUMAN AND CO. LTD.

Machinery:	$Y = 105.69 + 0.27X_1 - 0.03X_2 - 0.13X_3$
Land & Buildings:	$Y = -2224.17 + 1.97X_1 + 0.32X_2 - 0.79X_3$
Cash:	$Y = 734.93 - 0.08X_1 - 0.15X_2 + 0.25X_3$
Debtors:	$Y = -663.44 + 0.27X_1 + 0.13X_2 + 0.24X_3$
Inventory:	$Y = 442.13 - 0.03X_1 + 0.29X_2 - 0.06X_3$

BAMBURI PORTLAND CEMENT CO. LTD.

Machinery:	$Y = 4824.95 + 0.35X_1 + 0.07X_2 + 0.32X_3$
Land & Buildings:	$Y = 3859.98 - 0.02X_1 + 0.09X_2 + 0.08X_3$
Cash:	$Y = 1.44 + 0.0004X_1 - 0.0004X_2 + 0.0006X_3$
Debtors:	$Y = - 572 + 0.31X_1 - 0.15X_2 + 0.03X_3$
Inventory:	$Y = -1413.71 + 0.36X_1 + 0.08X_2 + 0.03X_3$

BROOKE BOND KENYA LIMITED.

Machinery: $Y = -1080.65 + 0.12X_1 - 0.07X_2 + 0.11X_3$

Land & Buildings: $Y = 18785.43 + 0.18X_1 - 0.14X_2 + 0.29X_3$

Cash: $Y = -4543.28 + 0.07X_1 + 0.19X_2 - 0.12X_3$

Debtors: $Y = -1812.23 + 0.15X_1 + 0.03X_2 + 0.02X_3$

Inventory: $Y = -4654.86 + 0.24X_1 - 0.05X_2 + 0.08X_3$

CAR AND GENERAL (K) LTD.

Machinery: $Y = -710.14 + 0.08X_1 + 0.04X_2 + 0.17X_3$

Land & Buildings: $Y = -180.35 + 0.06X_1 + 0.07X_2 + 0.02X_3$

Cash: $Y = -1.1 + 0.21X_1 - 0.06X_2 - 0.15X_3$

Debtors: $Y = -125.52 + 0.07X_1 + 0.27X_2 - 0.12X_3$

Inventory: $Y = -64.37 + 0.25X_1 - 0.17X_2 + 0.33X_3$

CITY BREWERY INVESTMENTS LTD.

Debtors: $Y = -3.42 + 0.25X_1 + 0.4X_2 - 0.04X_3$

Cash: $Y = -39.98 + 0.99X_1 - 0.36X_2 + 0.53X_3$

CONSOLIDATED HOLDINGS LIMITED.

Machinery: $Y = 4147.03 - 0.03X_1 + 0.24X_2 - 0.36X_3$

Land & Buildings: $Y = -1017.32 + 0.01X_1 + 0.26X_2 + 0.12X_3$

Cash: $Y = 133.13 + 0.001X_1 - 0.01X_2 - 0.0001X_3$

Debtors: $Y = -4221.01 + 0.05X_1 + 0.09X_2 + 0.57X_3$

Inventory: $Y = 3457.42 - 0.02X_1 + 0.14X_2 - 0.28X_3$

C.M.C. HOLDINGS LTD.

Machinery: $Y = 651.58 - 0.01X_1 - 0.01X_2 + 0.06X_3$

Land & Buildings: $Y = 1199.97 + 0.02X_1 - 0.08X_2 + 0.14X_3$

Cash: $Y = -1334.95 - 0.04X_1 + 0.02X_2 + 0.16X_3$

Debtors: $Y = 1310 + 0.02X_1 - 0.03X_2 + 0.13X_3$

Inventory: $Y = 1139.57 + 0.31X_1 - 0.38X_2 + 0.58X_3$

DUNLOP (K) LTD.

Machinery: $Y = -55.51 + 0.07X_1 + 0.15X_2 + 0.09X_3$

Land & Buildings: $Y = -250 - 0.12X_1 + 0.17X_2 + 0.34X_3$

Cash: $Y = 100.31 - 0.04X_1 - 0.03X_2 + 0.004X_3$

Debtors: $Y = 135.57 + 0.15X_1 - 0.11X_2 + 0.09X_3$

Inventory: $Y = 423.22 + 0.24X_1 + 0.2X_2 - 0.3X_3$

EAAGADS LTD.

Machinery: $Y = 97.7 + 0.11X_1 - 0.01X_2 + 0.11X_3$

Land & Buildings: $Y = 285.82 + 0.09X_1 - 0.02X_2 - 0.003X_3$

Cash: $Y = 62.45 + 1.2X_1 - 0.58X_2 - 0.06X_3$

Debtors: $Y = -0.67 + 0.001X_1 - 0.001X_2 + 0.04X_3$

Inventory: $Y = 3.23 - 0.01X_1 + 0.13X_2 + 0.002X_3$

EAST AFRICAN CABLES LTD.

Machinery: $Y = 147.75 + 0.17X_1 - 0.01X_2 + 0.1X_3$

Land & Buildings: $Y = -29.13 + 0.07X_1 + 0.06X_2 + 0.02X_3$

Cash: $Y = 31.4 + 0.01X_1 + 0.02X_2 + 0.02X_3$

Debtors: $Y = 197.22 + 0.11X_1 + 0.01X_2 - 0.01X_3$

Inventory: $Y = 255.11 + 0.18X_1 - 0.11X_2 + 0.08X_3$

E. A. PORTLAND CEMENT CO. LTD.

Machinery: $Y = 728.28 + 0.83X_1 - 0.1X_2 - 0.03X_3$

Land & Buildings: $Y = 855.34 + 0.1X_1 - 0.05X_2 + 0.02X_3$

Cash: $Y = 1.8 + 0.003X_1 + 0.003X_2 - 0.01X_3$

Debtors: $Y = -799 + 0.04X_1 - 0.07X_2 + 0.3X_3$

Inventory: $Y = -549 + 0.1X_1 + 0.22X_2 + 0.2X_3$

KENYA POWER AND LIGHTING CO. LTD.

Machinery: $Y = -1.3 - 0.9X_1 - 1.5X_2 + 5.1X_3$

Land & Buildings: $Y = 848 - 0.2X_1 + 0.25X_2 - 0.2X_3$

Cash: $Y = 5951 + 0.15X_1 - 0.002X_2 - 0.3X_3$

Debtors: $Y = -2835 + 0.25X_1 - 0.16X_2 + 0.23X_3$

Inventory: $Y = -1369 + 0.27X_1 + 0.21X_2 - 0.25X_3$

E. A. ROAD SERVICES LTD.

Machinery: $Y = -1009 + 0.7X_1 + 0.1X_2 + 0.08X_3$

Land & Buildings: $Y = -928 + 0.2X_1 + 0.3X_2 + 0.03X_3$

Debtors: $Y = -208 + 0.1X_1 - 0.02X_2 + 0.04X_3$

Inventory: $Y = -50 + 0.02X_1 - 0.01X_2 + 0.08X_3$

ELLIOT'S BAKERIES LTD.

Machinery: $Y = -2821 + 0.1X_1 - 0.04X_2 + 0.6X_3$

Land & Buildings: $Y = -126 + 0.04X_1 - 0.01X_2 + 0.1X_3$

Cash: $Y = -1113 + 0.02X_1 - 0.12X_2 + 0.3X_3$

Debtors: $Y = 187 + 0.01X_1 - 0.03X_2 \quad 0.02X_3$

Inventory: $Y = 159 + 0.03X_1 + 0.03X_2 - 0.03X_3$

EXPRESS KENYA LIMITED.

Machinery: $Y = 51 + 0.03X_1 - 0.02X_2 + 0.4X_3$

Land & Buildings: $Y = 61 - 0.2X_1 + 0.2X_2 + 0.4X_3$

Cash: $Y = -88 + 0.2X_1 + 0.06X_2 - 0.23X_3$

Debtors: $Y = 264 + X_1 - 0.7X_2 + 0.5X_3$

Inventory: $Y = 17.8 - 0.01X_1 - 0.002X_2 + 0.02X_3$

GEORGE WILLIAMSON KENYA LTD.

Machinery: $Y = 74 + 0.1X_1 + 0.2X_2 + 0.04X_3$

Land & Buildings: $Y = 402 - 0.2X_1 + 1.2X_2 + 0.2X_3$

Cash: $Y = 67 + 0.02X_1 - 0.01X_2 - 0.03X_3$

Debtors: $Y = 138 + 0.1X_1 - 0.05X_2 + 0.1X_3$

Inventory: $Y = 308 + 0.02X_1 + 0.02X_2 + 0.07X_3$

HUTCHINGS BIEMER LTD.

Machinery: $Y = 72 + 0.2X_1 - 0.1X_2 + 0.1X_3$

Land & Buildings: $Y = -16 + 0.7X_1 - 3.5X_2 + 4.2X_3$

Cash: $Y = 114 - 0.1X_1 + 0.4X_2 - 0.3X_3$

Debtors: $Y = -83 + 0.3X_1 - 0.1X_2 + 0.3X_3$

Inventory: $Y = 44 + 0.2X_1 - 0.05X_2 - 0.1X_3$

ICDC INVESTMENT CO. LTD.

Machinery: $Y = -52 + 0.02X_1 + 0.04X_2 + 0.03X_3$

Land & Buildings: $Y = 162 + 0.9X_1 + 0.08X_2 - 0.8X_3$

Cash: $Y = 561 + 0.08X_1 - 0.16X_2 - 0.02X_3$

Debtors: $Y = - 342 + 0.6X_1 + 0.01X_2 - 0.3X_3$

KAPCHORUA TEA CO. LTD.

Machinery: $Y = 165 + 0.05X_1 + 0.07X_2 + 0.07X_3$

Land & Buildings: $Y = 17 + 0.3X_1 + 0.07X_2 + 0.2X_3$

Cash: $Y = -13 + 0.08X_1 + 0.07X_2 - 0.1X_3$

Debtors: $Y = -71 + 0.3X_1 - 0.02X_2 + 0.002X_3$

Inventory: $Y = 48 + 0.01X_1 + 0.02X_2 - 0.02X_3$

KAKUZI LTD.

Machinery: $Y = 421 + 0.1X_1 - 0.07X_2 + 0.09X_3$

Land & Buildings: $Y = -7017 + 1.5X_1 + 1.1X_2 + 2.1X_3$

Cash: $Y = -621 + 0.6X_1 - 0.2X_2 + 0.1X_3$

Debtors: $Y = 1 + 0.03X_1 - 0.02X_2 + 0.02X_3$

Inventory: $Y = 345 + 0.2X_1 - 0.1X_2 + 0.05X_3$

KENYA NATIONAL MILLS LTD.

Machinery: $Y = -8289 + 0.01X_1 + 0.34X_2 + 0.2X_3$

Land & Buildings: $Y = 441 + 0.02X_1 + 0.1X_2 + 0.01X_3$

Cash: $Y = -2685 + 0.14X_1 - 0.1X_2 + 0.09X_3$

Debtors: $Y = 28 + 0.03X_1 - 0.02X_2 + 0.02X_3$

Inventory: $Y = 229 + 0.11X_1 - 0.09X_2 - 0.02X_3$

KENSTOCK LIMITED.

Cash: $Y = -78 + 0.6X_1 + 0.2X_2 + 0.2X_3$

Debtors: $Y = 97 + 0.4X_1 - 0.2X_2 - 0.7X_3$

LIMURU TEA COMPANY LTD.

Machinery: $Y = 2 + 0.02X_1 - 0.002X_2 + 0.04X_3$

Land & Buildings: $Y = 251 + 0.8X_1 + 0.06X_2 + 0.07X_3$

Cash: $Y = 23 - 0.002X_1 - 0.02X_2 - 0.05X_3$

Debtors: $Y = -32 + 0.5X_1 - 0.5X_2 + 0.3X_3$

Inventory: $Y = -2 + 0.08X_1 - 0.08X_2 + 0.1X_3$

MARSHALLS (E. A.) LTD.

Machinery: $Y = -220 + 0.02X_1 - 0.04X_2 + 0.1X_3$

Land & Buildings: $Y = 244 + 0.1X_1 - 0.3X_2 + 0.3X_3$

Cash: $Y = -1323 + 0.14X_1 - 0.11X_2 + 0.12X_3$

Debtors: $Y = 54 + 0.01X_1 - 0.06X_2 + 0.2X_3$

Inventory: $Y = 4090 + 0.3X_1 - 0.1X_2 + 0.5X_3$

MOTOR MART GROUP LTD.

Machinery: $Y = 2444 + 0.02X_1 - 0.06X_2 - 0.04X_3$

Land & Buildings: $Y = 13955 - 0.14X_1 - 0.18X_2 - 0.04X_3$

Cash: $Y = 789 + 0.3X_1 - 0.2X_2 - 0.06X_3$

Debtors: $Y = 6284 + 0.03X_1 - 0.2X_2 - 0.03X_3$

Inventory: $Y = 4728 + 0.3X_1 - 0.25X_2 - 0.02X_3$

NATION PRINTERS AND PUBLISHERS LTD.

Machinery: $Y = -798 + 0.14X_1 + 0.2X_2 + 0.16X_3$

Land & Buildings: $Y = -577 + 0.12X_1 + 0.08X_2 + 0.02X_3$

Cash: $Y = -1 - 0.006X_1 - 0.4X_2 + 0.06X_3$

Debtors: $Y = -201 + 0.09X_1 + 0.06X_2 + 0.13X_3$

Inventory: $Y = 682 + 0.11X_1 - 0.16X_2 + 0.18X_3$

PEARL DRY CLEANERS LTD.

Machinery: $Y = 156 + 0.33X_1 + 0.05X_2 - 0.19X_3$

Land & Buildings: $Y = 64 - 0.03X_1 + 0.08X_2 + 0.08X_3$

Cash: $Y = -30 + 0.09X_1 - 0.09X_2 + 0.04X_3$

Debtors: $Y = 18 + 0.6X_1 - 0.53X_2 - 0.02X_3$

Inventory: $Y = 257 + 0.74X_1 + 0.4X_2 - 1.47X_3$

PAN AFRICA INSURANCE CO. LTD.

Machinery: $Y = 1085 + 0.07X_1 - 0.06X_2 - 0.03X_3$

Land & Buildings: $Y = 38 - 0.004X_1 + 0.02X_2 + 0.08X_3$

Cash: $Y = 7820 - 1.4X_1 - 0.46X_2 - 0.14X_3$

Debtors: $Y = -423 + 0.6X_1 + 0.1X_2 + 0.2X_3$

Inventory: $Y = -93 + 0.07X_1 + 0.04X_2 - 0.06X_3$

PHILLIPS INTERNATIONAL LTD.

Machinery: $Y = 175 + 0.009X_1 - 0.003X_2 - 0.006X_3$

Cash: $Y = 126 - 0.04X_1 + 0.05X_2 - 0.03X_3$

Debtors: $Y = 421 - 0.06X_1 + 0.06X_2 + 0.04X_3$

Inventory: $Y = 774 + 0.3X_1 - 0.15X_2 - 0.2X_3$

SASINI TEA AND COFFEE LTD.

Machinery: $Y = 812 + 0.27X_1 + 0.1X_2 - 0.3X_3$

Land & Buildings: $Y = 7187 + 1.1X_1 + 0.3X_2 - 2.06X_3$

Cash: $Y = -2719 + 0.04X_1 + 0.2X_2 + 0.7X_3$

Debtors: $Y = 796 + 0.3X_1 - 0.05X_2 - 0.23X_3$

Inventory: $Y = 948 + 0.2X_1 + 0.06X_2 - 0.3X_3$

TIMSALES LTD.

Machinery: $Y = -1098 + 0.36X_1 + 0.35X_2 + 0.23X_3$

Land & Buildings: $Y = 552 + 0.22X_1 + 0.09X_2 - 0.08X_3$

Cash: $Y = -1983 + 0.12X_1 + 0.38X_2 + 0.16X_3$

Debtors: $Y = 55 + 0.004X_1 + 0.04X_2 + 0.07X_3$

Inventory: $Y = 869 + 0.1X_1 - 0.06X_2 + 0.02X_3$

APPENDIX III

LIST OF COMPANIES

1. African Tours and Hotels
2. A. Bauman and Co. Ltd
3. Bamburi Portland Cement Co. Ltd
4. Brooke Bond Kenya Ltd
5. Car and General (Kenya) Ltd
6. City Brewery Investments Limited
7. Consolidated Holdings Ltd
8. C.M.C. Holdings Ltd
9. Dunlop (Kenya) Ltd
10. Eaagads Ltd
11. E.A. Cables Ltd
12. E.A. Portland Cement Co. Ltd
13. Kenya Power and Lighting Co. Ltd
14. E.A. Road Services Ltd
15. Elliot's Bakeries Ltd
16. Express Kenya Ltd
17. George Williamson Kenya Ltd
18. Hutchings Biemer Ltd
19. I.C.D.C. Investment Co. Ltd
20. Kapchorua Tea Co. Ltd

21.Kakuzi Ltd

22.Kenya National Mills Ltd

23.Kenstock Ltd

24.Limuru Tea Co. Ltd

25.Marshalls (E.A.) Ltd

26.Motor Mart Group Ltd

27.Nation Printers and Publishers Ltd

28.Pearl Dry Cleaners Ltd

29.Pan Africa Insurance Co. Ltd

30.Phillips International Ltd

31.Sasini Tea and Coffee Ltd

32.Timsales Ltd

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