FORECASTING OF MARKET SHARE PRICES FOR SELECTED COMPANIES AT THE NAIROBI STOCK EXCHANGE BASED ON ECONOMETRIC MODELS

BY

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DECLARATION

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

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ABSTRACT

Share price movements at the Nairobi Stock Exchange market are measured by an index based on 20 representative companies and is calculated on daily basis. The index is a general price movement indicator based on a sample or upon all the stocks markets companies and the sale and purchase decisions are based on its movement. The investors at Nairobi stock exchange are faced with the problem of type of shares to buy, hold and/ or sell and thus their main objective is that of finding a reliable projection tool that will guide them in investment decision making. Predicting the course of stock market prices is essential for planning and control of business operations in a company.

The objective of the study was to fit the econometric models to the Nairobi Stock Exchange 20-share index and the share prices for Barclays Bank of Kenya Ltd., Industrial and Commercial Development Corporation (ICDC) Investment Company, Kenya Commercial Bank (KCB) and the Standard Chartered Bank of Kenya Ltd. The results were compared against time series models. In the analysis, taxes, time and dividends effects were tested on the responses namely; NSE 20-share index and the share prices for the selected companies. The results showed that both dividends and the government taxation had minimal or no effect on the share prices and the NSE 20-share index. The forecasting ability of the econometric models were measured using the mean square error of forecast values and the result showed that the models gave good forecasts for four out of five firms weekly closing share prices analyzed and compared well with forecasts from time series models. However, a closer look at the forecast values showed that the econometric models are appropriate only for short term forecasting as compared to time series which are long term. Thus the models are good investment decision-making tools at the Nairobi Stock Exchange and the investors may rely on them when deciding on the type of shares to buy, sell and/or hold.

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CHAPTER ONE
INTRODUCTION

1.1 Background

A Stock exchange is a market place where shares representing ownership of corporate enterprises or documents in respect of corporation or loans made to the governments can be traded. A security market is not a financial intermediary, for it does not transfer funds from lenders to borrowers. Instead, it is a second hand market that transfers securities from sellers to buyers (Herbert, 1982). According to Simiyu (1992), a stock exchange is a place where investors register their opinions on the future of the economy and it is also a barometer that reflects important economic changes.

The performance in the financial market depends on the existing economic, political and social cultural environment. Frequent changes in the macro-economic variables, which include; interest rates, exchange rates and inflation rates would lead to wide share price fluctuations. The macro-economic variables affect the interaction of the financial market forces of demand and supply and this leads to price fluctuations if the variables are random in nature.

The price at which a security can be bought or sold on the stock exchange will depend, as in other markets, on the relative strength of the demand for and the supply of that particular security at a particular time. The price of ordinary shares can have wide fluctuations within a short period of time. All sorts of influences affect the prices of shares, through supply or demand. If business prospects are good the price of shares will generally be high; if prospects are poor the prices will be low. The publication of a company's balance sheet will affect the price of its shares, favorably or adversely, as the case might be. Other factors which influence stock-exchange prices are changes in bank rates, variations in hire-purchase regulations, the publication of foreign trade figures or even romours of impending political changes, the expectations of dividends, quality of management and fiscal policy such as taxation among others. The weight attached to these different factors vary from time to time, such that the price, which is essentially determined as an equilibrium point between a willing buyer and a willing seller of shares, will fluctuate. The modern investor is always involved in attempts aimed at discovering at any given moment, what the stock exchange prices will be at some other moment in time (Jack, 1976). At present day there are large institutional buyers in this market, and their activities tend to even out price fluctuations and therefore the rate of yield.

Predicting the course of stock prices is essential for planning and control of all business operations. As stock markets become increasingly unstable and subject to fluctuations, it becomes more and more critical for investors. Lacking some form of projection, investors have no reasonable starting point for any form of securities. Therefore, econometric models will be built and compared with Autoregressive Moving Average (ARMA) time series model to provide investors with a more reliable projection tool that will assist them in making an informed decision on investment. Vital as they are, forecasts are estimates at best, and thus a good forecasting method will meet the decisions need, give an adequate time to implement policy, be accurate, cheap and easy to update.

1.2. THE NAIROBI STOCK EXCHANGE (NSE)

The Nairobi Stock Exchange is a market, and commonly known as NSE. As a market it is similar to other retail goods market in Kenya. The main difference about the

Nairobi stock exchange market from other local markets is in the types of products traded and how they are traded and how they are paid for and transferred. The products traded at NSE are Shares and Bonds. Shares and Bonds are 'money' or 'financial products'. Another name for shares is Equities while Bonds are also known as debt instruments. The products traded at NSE are in one name called securities. At the moment, there are over 50 different types of shares and over 60 types of bonds traded at NSE.

The NSE market was started in the 1920's, as an informal market for Europeans only. In 1954, the market was formalized through incorporation into a company. However, trading in shares that started in 1920s as a sideline business among accountants, auctioneers and estate agents was restricted to the residents of white community only. Even after Africans were allowed in the market, they would not own shares in plantation stocks, this was considered tantamount to having an interest in the white highlands, which was then a preserve of the whites.

In 1963, Africans were allowed to join and trade in the market. For many years, the market operated through the telephone with a weekly meeting at the Stanley Hotel. The Capital Market Authority (CMA), a regulatory body, was established and become operational, with the help of United States Agency for International Development (USAID) in 1991. In the same year, with the help of USAID, the Nairobi Stock Exchange (NSE) established a trading floor, thus facilitating a change over from the call over trading system to a more transparent open 'outcry' system (Munge, 1995). In 1994 the market moved to its current location, on the 1st floor of the Nation Center. In 2003, the market is expected to be automated and will change from the current manual trading and payments system to an electronic system. In an electronic market, investors open share accounts and bonds account similar to their bank accounts. Buying and selling of shares and bonds is made much easier and quicker. All the benefits of shares and bonds remain the same. For example, an investor is able to use a share account or bond account as a guarantor for a cooperative loan or as collateral for a bank loan.

1.2.1. IMPORTANCE OF THE NSE MARKET TO THE ECONOMY

For an economy to grow, money needs to shift from less to more productive activities. In other words, idle money and savings should be invested in productive activities for the economy to grow. The Nairobi Stock Exchange makes this possible by enabling idle money and savings to become productive by bringing the borrowers and lenders of money together at a low cost. The lenders (all savers) become the investors. They lend/invest and expect a profit/financial reward. The borrowers also known as issuers in the markets borrow and promise to pay the lenders a profit. Therefore, NSE encourages savings and investments. Secondly, it educates the public about the higher profits in shares and bonds; how to buy and sell and when and why to buy and sell. It also educates the public on how to invest together as a group. Thirdly, it facilitates good management of companies by asking them to give periodic reports of their performance. Fourthly, it provides a daily market report and price list to ensure that the investors know the worth of their assets at all times. Fifthly, it provides financial solutions to common problems, Shares and Bonds are accepted guarantors for cooperative society's and bank loans. These Shares and bonds can be planned, with the help of a money manager, to pay for school fees, medical, car and other insurance schemes, pension or retirement plans. Finally, through shares and bonds, the government, small and big companies, cooperative societies and other organizations can raise money to expand their business activities, make a profit, create employment and generally help the economy.

1.3 STATEMENT OF THE PROBLEM

In a fragile economy like Kenya, investors are faced with problem of proper decision-making at the end of the day. Their investment decisions largely depend on the future expectation of the share prices and the main problems are on type of shares to buy, sell and /or hold. For many investors, flexibility is now emerging as perhaps the most distinguishing feature of their forecasting program and more than ever before, the primary need in the stock market is that of applying an appropriate projection tools to guide in investment decision making.

1.4 OBJECTIVES

The objectives of the study is to

(a). Fit econometric models for NSE 20-share index and the share prices for the selected financial institutions trading at the Nairobi stock exchange market and do forecasting.

(b). Test the effects of each individual input variable namely; time, taxes and the dividends on the response variables namely; stock market index and the share prices for each selected company and for each model.

(c). Compare the quality of forecast values for each model and for each company with time series forecasts using the mean square errors (mse).

1.5 ASSUMPTIONS

First, it is assumed that the mechanism generating the present data will continue to apply in future while keeping all the other factors constant. Secondly, even if we assume a stable generating mechanism, we need to express this mechanism in the form of an econometric model for the data to carry out the analysis. Thirdly, it is assumed that the model being used adequately describes the main structures of the situation, and that these structures will continue to exist for the time covered by the forecast.

1.6 JUSTIFICATIONS

The prediction of share price is important in investment analysis and in financial statement analysis. The most important single factor determining a stock value is its average future earning power. Intrinsic value would then be found by forecasting this earning power. Stock markets are sensitive to any number of extraneous and intangible factors, which reflects, almost immediately in the stock prices. This has made the investors to view the stock market as a risky place where amateurs trade at their own risk. Obviously, a feared market is an inefficient market. Therefore to prosper and survive in stock market investment, an investor needs to know the share price movement in advance. To achieve this, an investor needs to do projection of share prices.

1.7. DEFINITION OF TERMS

20-share index - This is an equi-weighted geometric mean of twenty large ordinary stocks traded at the NSE. For a company to include in the index, 20% of its share capital must be quoted on the NSE and must have been continuously quoted for at least three years. In addition it must also have a minimum market capitalization of Kshs. 20million (Munyao, 1998).

Bonds – This is a promise to pay a stated rate of interest for a defined period and then to repay the principal at a specific date of time.

Company Assets - These are company properties, which includes both capital and liabilities.

Debt securities - These includes bonds and mortgages.

Dependent variables - These are components that the model explains.

Dividends - These are the returns from the security.

Equities - A Company's ordinary shares which carry no fixed interest.

Equity ratio - ratio of what a shareholder earns in relation to what he owes.

Ex ante - forward looking assessment of the likely future effect.

Externalities – (spill over benefit or costs) - This is the costs or benefits additional to those which are immediate concern of the parties to a transaction and which are not provided for directly in the market place.

Externally efficient market – This means that new information is widely, quickly and cheaply available to investors that this information includes what is knowable and relevant for judging securities and is rapidly reflected in their prices.

Independent variables - These are the predictor variables not determined by the model and are explained outside the econometric system.

Liability - An obligation for payment such as in debt.

Model - This is a simplified representation of reality that leaves out enough of the confusing detail to be understandable and manipulatable and yet retains enough reality to reflect the real event

Ordinary shares - Shares sold to a shareholder.

Portfolios - The securities held by an investor or an investment organization.

Preference shares - Business shares that give the owners the right to be paid interest before any money is paid to the owners of ordinary shares

Private owned companies - These are companies where the government does not have any shareholding directly or otherwise. Therefore the government cannot influence the management of such companies.

Privatization - This is the transfer of government owned shareholding in designated enterprises to private shareholding comprising of individuals and corporate bodies.

Public companies (PC) - This is where the government has share holding in a company. The ownership may be direct or indirect. Direct ownership occurs when the government has a share in a company, while indirect is when the government has shares through statutory boards. The major statutory boards that the government has invested through are industrial and credit development company (ICDC) Investment, Kenya Tea Development Corporation (KTDC), Kenya Tea Development Authority (KTDA) and Agricultural Development Corporation. (ADC)

Risk - This refers to the possibility that some unfavorable event will occur. Investment risk is associated with the probability of low returns.

Secondary markets - This is a market where all listed stocks and shares are traded. Without an efficient secondary market, the primary market cannot function because investors will not be willing to buy securities that they cannot easily sell on their own.

Securities - These refers to stocks and shares traded on the NSE.

Utility underlying assets - capability of securities to serve as a substitute in profit making.

Volatility - Ability of the security prices to change in a short time interval

CHAPTER TWO

LITERATURE REVIEW

2.1. Models for stock market prices

A number of studies have attempted to explore the most successful technique for forecasting a company's earnings a year ahead. Fama (et al, 1969) found that there is a dependency between successive price changes over time and thus concluded that neither a skilled analyst nor corporate management personnel could on average make forecasts that follow a simple random walk. These findings, however, were curiously at odds with other studies for example according to Andrew and Whitney (1986); stock markets do not follow random walks. They tested the random walk hypothesis for weekly stock market returns by comparing variance estimators derived from data sampled at different frequencies. The random walk model was strongly rejected for the entire sample period from 1962 to 1985 and for all sub-periods for a variety of aggregate returns indexes and size sorted portfolios. Although the rejection was largely due to the behavior of small stocks, they concluded that it couldn't be attributed completely to the effects of infrequent trading or time-varying volatility. Moreover, the rejection of the random walk for weekly returns does not support a revertible model of asset prices.

Andrew and MacKinlay (1997) constructed portfolios of stock and of bonds that are maximally predictable with respect to a set of ex ante observable economic variables and showed that the levels of predictability was statistically significant, even after controlling for data snooping biases. They disaggregated the sources for predictability by using several asset groups-sector portfolios, market - capitalization portfolios, and stock/bond/utility portfolios and found that the sources of maximal predictability shift considerably across asset classes and sectors as the return - horizon changes. They concluded that the predictability of the maximally predictable portfolio is genuine and economically significant.

Hutchinson, et al, (1994), proposed a nonparametric method for estimating the pricing formula of a derivative assets using learning networks. Although not a substitute for the more traditional arbitrage-based pricing formulas, network-pricing formulas were found to be more accurate and computationally more efficient alternatives when the underlying asset's price dynamics are unknown, or when the pricing equation associated with no arbitrage condition cannot be solved analytically. For purposes of comparison, they performed similar simulation experiments for four other methods of estimation: Ordinary least squares, kernel regression, projection pursuit, and multilayer perceptron networks to illustrate the practical relevance of their model.

Runyenje (1985) attempted to determine whether the introduction of capital gains tax had any impact on the ordinary share prices. He also aimed at establishing the trend of prices in the Nairobi stock exchange between 1973 to 1983. According to his findings, there was a significant trend in the movement of ordinary share prices. He concluded that the capital gains tax had only temporary rather than a permanent impact on the prices of ordinary shares in the Nairobi stock exchange.

Omosa (1989) forecasted share prices using time-series analysis and specifically the autoregressive integrated moving average (ARIMA) model. Future share prices were predicted and then compared with the actual prices. A t-test was carried out to determine whether the future share prices were significantly different from the actual prices. The test showed that out of the 12 companies studied, 3 sets of companies had no significant differences between the actual prices and the predicted values. He went on to conclude that the model was not a good predictor of share prices.

Kibicho (1998) and Muhanji (2000) both studied the efficiency of the Nairobi stock exchange. They both concluded that the Nairobi Stock Exchange has a weak form of efficiency implying that there is no insider trading on the market. The efficiency of the Nairobi stock exchange, just like many other stock exchange markets in the world, is characterized by time dependence, meaning that the market is efficient at a particular period and then becomes inefficient at another time. This inefficiency is brought about by the inability of the market to communicate important economic changes to investors in advance.

In the short run, the investor's reaction to market signals will cause the market to move in unpredictable manner. According to efficient market hypothesis, new events occur randomly and are discounted immediately to the extent that forecasting of prices is impaired. This information flows to investors in an unsystematic manner and thus their market activity work towards creating random price fluctuation around an average value (McMahon, 1965). These short - term changes in share prices in an unstable economy like that of Kenya can be as a result of many influences operating in different directions. The resulting pattern is well described by a statistical model of a normal curve where there are many observations clustered about an average value with a tailing-off as the values increase either side of this average (Eugene at el., 1989).

2.2. Econometric modeling approach

Econometrics is concerned with the application of statistical methods to economic data. Economists often apply statistical methods to data in order to quantify or test their theories or to make a forecast. However, traditional statistical methods are not always appropriate for application to economic data, in the sense that the assumptions underlying these methods may fail to be satisfied. Furthermore, the nature of the economist's view of the world is such that the mechanism viewed as generating the data creates some statistical problems which are distinctly "econometric," and whose solution constitutes a large portion of econometric theory (Johnston, 1963).

Econometric models typically specify the structure between demand and it's underlying causes. Strictly speaking, multiple-regression equations fall in the realm of econometrics, although econometrics generally refers to sets of two or more regression equations (Maddala, 1987). The usual assumptions underlying the linear regression models are that the regressors have fixed (non random) values and are linearly independent, and that the disturbances are uncorrelated and have a zero mean and constant variance (Butler, 1974).

2.2.1. The simple regression model

This takes the form

$$Y_i = \alpha + \beta x_i + e_i,$$

where x_i is a fixed concomitant variable whose values are assumed to be known before an experiment is performed and is not subject to chance. Let E denote the expectation operator and let var. and cov. represent the population variances and covariances, respectively.

Further more

$$E(e_i)=0, \text{var}(e_i)=\sigma^2, \text{cov}(e_ie_j)=0, \quad \text{i.e.} \quad E(y_i)=\alpha+\beta x_i$$

if we write

$$\begin{aligned} y_1 &= \alpha+\beta x_1+e_1 \\ y_2 &= \alpha+\beta x_2+e_2 \\ &\vdots \\ y_n &= \alpha+\beta x_n+e_n \end{aligned}$$

we can write , in matrix form as

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} = \begin{bmatrix} 1 & x_1 \\ 1 & x_2 \\ \vdots & \vdots \\ 1 & x_n \end{bmatrix} \begin{bmatrix} \alpha \\ \beta \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \\ \vdots \\ e_n \end{bmatrix}$$

Symbolically,

$$\underset{-}{y} \quad = \quad A \underset{-}{\varepsilon} + \underset{-}{e}, \ \underset{-}{e}=(e_1,\ldots\ldots\ldots,e_e) \text{ and } \underset{-}{\varepsilon}=(\alpha,\beta)$$

Where A is the design matrix and can be also written in the form

$$A=\left[\underset{(1)}{J}, \underset{(1)}{X}\right](n).$$

The numbers in the parentheses denote the order of the matrix.

J is a column vector containing all ones.

X is a column vector of all concomitant observations.

The simple regression model is frequently written in the form

$$y_i=\mu+\beta(x_i-\bar{x})+e_i,$$

where $\mu=\alpha+\beta\bar{x}$

This, too, can be written in the general linear model form as:

$$\begin{bmatrix} y_1 \\ y_2 \\ \cdot \\ \cdot \\ \cdot \\ y_n \end{bmatrix} = \begin{bmatrix} 1 & (x_1 - \bar{x}) \\ 1 & (x_2 - \bar{x}) \\ \cdot & \cdot \\ \cdot & \cdot \\ \cdot & \cdot \\ 1 & (x_n - \bar{x}) \end{bmatrix} \begin{bmatrix} \mu \\ \beta \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \\ \cdot \\ \cdot \\ \cdot \\ e_n \end{bmatrix} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

or

$\underset{-}{y} = A\underset{-}{\varepsilon} \;+\; \underset{-}{e}$

Where, $A = \begin{bmatrix} \underset{(1)}{j}, & (\underset{(1)}{x_i} - \underset{(1)}{\bar{x}j}) \end{bmatrix} .(n)$

$\underset{-}{\varepsilon}$ = represents the column vector of α and β and $\underset{-}{e}$ represents the column vector of the residuals.

2.2.2. Multiple Regression model

This takes the form

$$y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \ldots + \beta_k x_{ki} + e_i$$

where i = (1,...................,n) and represents the row vector.

Assumptions:

$E(e_i) = 0,$

$Var(y_i) = Var(e_i) = \sigma^2,$

$Cov(y_i \;, y_j) = 0$

If we write;

$$
\begin{array}{l}
y_1 = \beta_0 + \beta_1 x_{11} + \beta_2 x_{21} + \beta_3 x_{31} + \ldots + \beta_k x_{k1} + e_1 \\
y_2 = \beta_0 + \beta_1 x_{12} + \beta_3 x_{22} + \beta_3 x_{32} + \ldots + \beta_k x_{k2} + e_2 \\
\vdots \\
y_n = \beta_0 + \beta_1 x_{1n} + \beta_2 x_{2n} + \beta_3 x_{3n} + \ldots + \beta_k x_{kn} + e_n
\end{array}
$$

we can write in matrix form as

$$
\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} = \begin{bmatrix} 1 & x_{11} & x_{21} & x_{31} & \cdots & x_{k1} \\ 1 & x_{12} & x_{22} & x_{32} & \cdots & x_{k2} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 1 & x_{1n} & x_{2n} & x_{3n} & \cdots & x_{kn} \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_k \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \\ \vdots \\ e_n \end{bmatrix} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)
$$

or $\underline{y} = A\underline{\varepsilon} + \underline{e}$

Where $\underline{\varepsilon}$ and $\underline{e}$ are as given in (1) above.

$A = = [\underset{(1)}{j} \;,\; \underset{(k)}{x}](n),$ and χ denotes the matrix of all observations on all concomitant variables. In practice $\underline{\varepsilon}$ will be unknown and the estimates $\tilde{\alpha}$ and $\tilde{\beta}$ will have to be obtained for them using the existing data (Sengupta, 1986).

The econometric model was chosen for analysis because

1. It eliminates the need for repeated juggling of estimates, since the use of simultaneous equations automatically provides consistency in the various sectoral forecasts.
2. It improves our understanding of economic relationships and can be used to perform sensitivity analyses, evaluate the effects of alternative policy decisions and derive conditional forecasts.
3. It permits the introduction of outside information, where the impact of unusual events such as strikes or wars can be estimated.

Econometric models differ from one another in the sense that a model, which may produce a perfectly satisfactory result for one group's needs, may be unsatisfactory for another group. This would be especially true if a model did not estimate certain crucial variables, which turn out to be important in future (Maddala, 1987).

2.3. Model components

2.3.1 Deterministic time components

These include a constant μ, a linear trend βt, a quadratic trend γt^2, exponential growth $e^{\alpha t}$, (sometimes introduced by a log transformation of other variables), other forms of growth, regular and seasonal oscillations and less regular long-term oscillations (cycles). These are usually combined additively. A forecast of a future value of these components is obtained by direct substitution of an appropriate value for t. Thus βt at time t becomes a future $\beta(t+h)$ at time $t+h$.

2.3.2 Stochastic components

Almost all models include at least one component, ε_t, which represents the unpredictable element in a situation. The ε_t, are commonly assumed to be representable by a sequence of independent identically distributed random variables with mean zero and usually, constant variance σ^2. In some situations, the current value of a variable may not only contain the contribution from ε_t, but it may also be influenced by previous values $\varepsilon_{t-1}, \varepsilon_{t-2}, \dots$ Thus the stochastic element may take the more general moving average form:

$$y_t = \varepsilon_t - \theta_1 \varepsilon_{t-1} - \theta_2 \varepsilon_{t-2} - \dots - \theta_k \varepsilon_{t-k}$$

Forecasting using these components is based on

1. Forecasting future unpredictable ε 's by their mean value of zero.

2. Using past data to estimate previous values $\varepsilon_t, \varepsilon_{t-1},\ldots$ and substituting these in the model.

2.3.3 Regressive components

Many models depend on identifying relationships between the variable being forecasted χ and other variables, say y and z. If the relations were linear, the model would be a linear regression at time t of the form

$$x = \alpha + \beta y + \gamma z + e_t$$

Where ε_t is the random error term with mean zero and constant variance (σ^2)

If good forecasts of future values of y and z are available, the relation may be used to forecast x. Often, relations involve time delays and the linear relations might be

$$x_t = \alpha + \beta y_{t-1} + \gamma z_{t-1} + e_t.$$

Such a relation will enable y_t and z_t to be used to forecast x_{t+1} and such a model is said to involve *lagged variables* y_{t-1} and z_{t-1}. Sometimes an important lagged variable is x itself, the current value x_t depending on previous values $x_{t-1}, x_{t-2},\ldots$. Thus

$$x_t = \phi_1 x_{t-1} + \phi_2 x_{t-2} + \phi_3 x_{t-3} + \ldots + \phi_h x_{t-h} + e_t.$$

Such a relation is referred to as an autoregression. To forecast with autoregressive components, $x_t, x_{t-1},\ldots$ are used in the model to forecast $x_{t+1,}$ by $\tilde{x}_{t+1}$. That is

$$\tilde{x}_{t+1} = \phi_1 x_t + \phi_2 x_{t-1} + \ldots + \phi_h x_{t+1-h}$$

We then repeat the process to get $\tilde{x}_{t+2}$ from $\tilde{x}_{t+1}, \tilde{x}_t, \tilde{x}_{t-1},\ldots$.

2.4. Time series modeling

A time series is a set of numbers that measures the status of some activity over time. It is the historical record of some activity, with measurements taken at equally spaced intervals (exception: monthly) with a consistency in the activity and the method of measurement. Autoregressive Moving Average (ARMA) time series modeling is a technique, which uses a variable's past behavior to select the best forecasting model from a general class of models. It is assumed that any time series pattern can be represented by either of the models given as

1. Autoregressive (AR) models: forecasts of a variable based on a linear function of its past values.
2. Moving average (MA) models: forecasts based on linear combination of past errors.
3. Autoregressive-Moving Average (ARMA) models: combination of the previous two models.
4. Autoregressive integrated moving average (ARIMA) models: A time series, which needs to be differenced for it to be stationary, is said to be an "integrated" version of a stationary series. Random walk and random-trend models, autoregressive models, and exponential smoothing models (i.e., exponential weighted moving averages) are all special cases of ARIMA models. ARIMA models are the most general class of models for forecasting a time series, which can be stationarized by transformations such as differencing and logging.

An ARIMA model of order p, d, q is denoted as an ARIMA (p, d, q) model, where p is the number of autoregressive terms, d is the number of non-seasonal differences and q is the number of lagged forecast errors in the prediction equation. To identify the appropriate ARIMA model for a time series, one begins by identifying the order(s) of differencing needed to stationarize the series and remove the gross features of seasonality. If one stops at this point and predicts that the differenced series is constant, then a mere random walk or random trend model has been fitted. The random walk model predicts the first difference of the series to be constant, the seasonal random walk model predicts the seasonal difference to be constant, and the seasonal random trend model predicts the first difference of the seasonal difference to be constant which is usually zero. However best the random walk or random trend model may be, the said model could still have autocorrelated errors, suggesting that additional factors of some kind are needed in the prediction equation.

The key issue in the ARMA time series modeling is on how many past values (the focal variable and /or its errors) should be included in the model. The underlying goal is to find an appropriate formula so that the residuals are as small as possible and exhibit no pattern. The model building process involves four steps, namely; identification, estimation, diagnostic checking and forecasting. These steps are repeated as necessary, to end up with a specific formula that replicates the patterns in the series as closely as possible and also produces accurate forecasts. The seasonality pattern and non-stationarity are removed by differencing.

2.5 Linear and Non-linear models

A linear model is one in which the independent variable is added or multiplied together with the parameters. A non-linear model has exponents, logarithms, or other complicated functions of the independent variables and parameters.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The purpose of this chapter is to explain the techniques of analyzing the selected companies weekly share prices data of the Nairobi stock exchange. The main features of the relationships hidden or implied will be established. In any system in which variable quantities change, it is of interest to examine the effects that some variables exert (or appear to exert) on others. There may in fact be simple functional relationships between variables; in most physical processes this is the exception rather than the rule (Draper and Smith, 1966). Often there exists a functional relationship, which is too complicated to grasp or to describe in simple terms. In this case, approximation of functional relationships will be by polynomial mathematical method, which contains the appropriate variables and which approximates to the true function over some limited ranges of the variables involved.

Two types of variables will be considered and these are the independent and the dependent/response variables. Independent variables are variables that can either be set to a desired value as in our case dividends and taxes or else take values that can be observed but not controlled (time). As a result of changes that take place in the independent variables, an effect is transmitted to other variables; the response variables i.e. share prices. In general, we shall be interested in finding out how changes in the independent variables (time, dividends and taxes) affect the values of the share prices (response variables) for the selected companies.

This study will attempt to test the effects of time, taxes and dividends on the share prices and the NSE 20-share index. The independent variables Taxes and dividends have negative correlation, but they were selected because the two variables are some of the major determinants in the investment market forces of demand and supply. The two affect the investment behaviors, that is to say that the higher the taxes, the lesser the investors and consequently the lower the prices. The equity ratio was not used as an input variable because it is usually difficult to get hidden information of a company. Other factors such as politics are not constant in nature and are complex to model.

Econometric models will thus be used to forecast share prices at the Nairobi Stock Exchange and consequently guiding investors in making informed decisions. The job of predicting the state of price expectations tomorrow or next year or five years from now is a good deal more complex for investors than projecting the earnings or interest rates that will be at some point in future. The method of least squares will be used to examine the data and to draw meaningful conclusions about dependency relationships that may exist.

3.2. Model specification

Let y_i be the weekly closing share prices of company j at time i, (j = 1,2,3,4; i= 1,2,...,n), and let it be assumed that the prices depend on the input variables; Time (x), Dividend (D_{i-1}) at time (t-1) and government taxation (Z_{i-1}) at time (t-1). It is also assumed that all the companies listed at the Nairobi stock exchange declare dividend or loss twice a year; that is at the end of June and December every year. Also the government taxation is once a year and that is at the end of every financial year (i.e. June). We will introduce both the dividends and taxation as dummies in our model. That is

$$D_{i-1} = \begin{Bmatrix} 1, & when \quad the \quad dividend \quad is \quad declared \\ 0, & otherwise \end{Bmatrix}$$

$$Z_{i-1} = \begin{Bmatrix} 1, & when \quad there \quad is \quad governemt \quad taxation \\ 0, & otherwise \end{Bmatrix}$$

Therefore the model takes the form

$$y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 D_{i-1} + \beta_5 z_{i-1} + e_i \qquad (3)$$

where;

β_0, β_1, β_2, β_3, β_4 and β_5 are the parameters to be estimated

x_1, x_2, x_3 are the functions of input variable time

D_{i-1} - dummy variables for dividends at time i-1

Z_{i-1} - dummy variables for government taxation at time i-1

y_i - represents both the weekly closing share prices for NSE 20-share index, Barclays Bank of Kenya, ICDC Investment Company, Kenya Commercial Bank and the Standard Chartered Bank at time i.

e_i - Residual at time i.

A forecast or a prediction is generally defined as a statement about an unknown, but not necessarily, a future event i.e. forward or backward prediction. If time is involved, a prediction (or forecast) is an assertion about a future outcome that is based on observed regularities among consecutive events in the past. In this study, we are confined to only quantitative economic predictions. Broadly speaking, there are two methods of forecasting, the Naive and the regression methods.

Our concern is regression methods and this particular method is divided into two:

1. Regression on related variables or more generally econometric methods
2. Time series autoregressive moving average (ARMA) methods.

3.4 Econometric Forecasting Method

For the given values of explanatory variables in equation (3) we will predict the corresponding response variable (weekly closing share prices) for each firm and also the Stock share index. This prediction is assumed to be unbiased and has the smallest prediction error variance among all linear unbiased predictions (Montgomery, 1990). This is a minimum mean square error prediction. The mean square error of the residuals will be calculated for the forecast values and then the econometric forecast values will be compared against the ARMA time series forecast values in terms of forecasting ability.

3.5 Time Series Modeling

First, consideration will be given to the forecasting problem of the ARMA (p,q) process in the form

$$\phi(B)x_t = \theta(B)w_t, \qquad (4)$$

where the roots are polynomial in the lag operator B where B is defined as $Bx_t = x_{t-1}$ and are assumed to be stationary. The model (4) can also be written in the form

$$x_t = \sum_{k=1}^{p} \phi_k x_{t-k} + w_t - \sum_{k=1}^{q} \theta_k w_{t-k} \qquad (5)$$

which again suggests the possibility of forecasting future values in terms of the past. The l-step forecast will have the smallest mean -square error, where the mean square error is given by the l-step forecast variance as

$$p'_{t+l} = E\left[(x_{t+l} - x'_{t+l})^2 / x_t, x_{t-1}, x_{t-2}, \ldots\right]$$

3.6 Quality of forecasts

To measure the forecast accuracy for each model, the prediction of the weekly closing share prices ($\tilde{y}_i$) for each firm will be compared with the actual realization y_i for each model and the associated forecast error is determined, that is $e_i = y_i - \tilde{y}_i$, $i = 1, \ldots, n$

Secondary data will be collected from the Nairobi Stock Exchange for the period January 1993 to December 2002, the data will be divided into two parts, derive estimates for the parameters that are necessary to construct the forecasts from the first part and evaluate the accuracy of the ex ante forecasts from the observations in the holdout period for each model and for each firm. To determine the model with the best forecast and also to measure the effectiveness of the input variables in describing the response, the mean square error of the residuals and square multiple correlation coefficient for each model and for each firm will be calculated for comparison.

Therefore, on the basis of the Mean Square Error (MSE) of the residuals obtained, an appropriate model will be selected to use in forecasting 52 weeks ahead forecast for the weekly closing share prices for each firm and the NSE stock 20-share index. Finally conclusion will be drawn on the models.

3.7 ALTERNATIVE MODELS

Alternatively, models such as Capital Asset Pricing Model (CAPM) and lagged regression models could be fitted for such a complex econometric data. CAPM is a model describing the relationship between risks and expected return that is used in the pricing of risky securities. CAPM says that the expected return of a security or a portfolio equals the rate on a risk-free security plus a risk premium. If this expected return does not meet or beat the required return then the investment should not be undertaken, i.e,

$\bar{r}_a = r_f + \beta_a(\bar{r}_m - r_f)$ where r_f = *risk* free rate, β_a = Beta of security and

$\bar{r}_m$ = Expected market return.

The models were not selected due to the complexities involved and inadequate informations.

CHAPTER FOUR

RESULTS AND DISCUSSION

MODELS FOR THE QUOTED FIRMS SHARE PRICES DATA

4.1. NAIROBI STOCK EXCHANGE WEEKLY CLOSING 20- SHARE INDEX

The Nairobi Stock Exchange share index has its base year as 1966 at 100. It was based on 17 companies at first and was calculated on weekly basis. However, in 1992, the sample companies were increased to the current 20 to represent nearly 90% of the NSE market capitalization and the computation changed from weekly to daily basis.

An index generally represents a measure of the relative change from one point to another. A stock index is constructed to measure the general price movement in the listed shares of the stock exchange (Munyao, 1998).

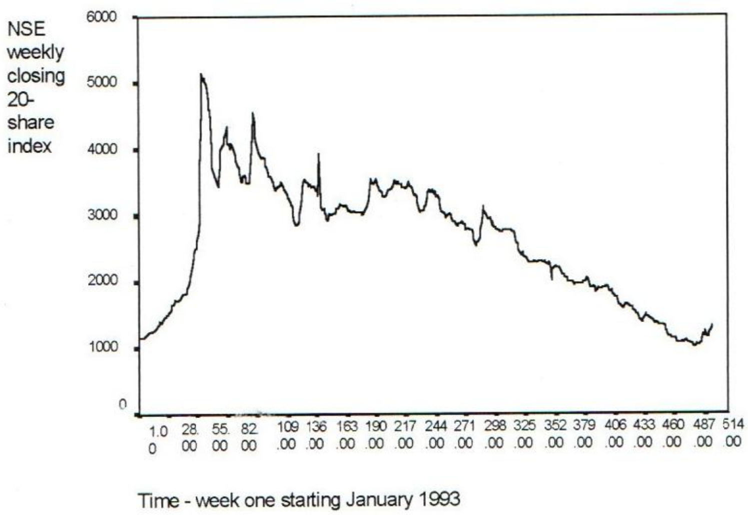

Fig 4.1: The Nairobi Stock Exchange weekly closing stock 20-share index data

Figure 4.1 shows the time plot for the NSE index from the year 1993 to 2002. Due to the fluctuating nature of the mean level, there is the presence of non-stationary in the data.

The sharp fluctuation between week 45 and week 163 can be attributed to the high share prices realized by the NSE 20 - share index representative companies between the November 1993 to February 1996.

The simple and multiple regression models were fitted for the data. Where the variables entered are the predictor Nairobi stock exchange weekly closing 20-share index (y_i) and the independent variables namely; time (x_1), dividends (d_{i-1}) and taxation (z_{i-1}). The variable (y_i) was regressed on each of the variable x_1, d_{i-1} and z_{i-1}.

The results showed that both dividends and taxation had no effect on the stock share index and were eliminated from the analysis. . Transformation was done on the variable time (t) to make it a quadratic function i.e. $t = x_1, t^2 = x_2$ and $t^3 = x_3$ to obtain an appropriate model. The model obtained was of the form.

$$\tilde{y}_i = 1400.0 + 29.5x_1 - 0.12x_2 + 0.00011x_3 \qquad (4.1a)$$

On the basis of 95% confidence interval, the least squares equation given in (4.1a) is a good predictor, since the calculated F= 573.14 is greater than the tabulated value of $F_{(3,516,0.95)}$=2.71 and also the said regression equation explains 76.8% of the total variation.

The ARIMA (2, 1, 0) time series model was chosen from among various time series models plotted. The selected model was of the form,

$$\tilde{y}_i(k) = (1.31)y_{i-1} + 0.33(y_{i-1} - y_{i-2}) + 0.095(y_{i-2} - y_{1-3}) \qquad (4.1b)$$

Model 4.1b above gave the least mean square error for forecast values as compared to the actual Nairobi Stock Exchange 20- Share Index using other time series process.

The 52 weeks ahead forecast for the Nairobi stock exchange weekly closing 20-share index was estimated using both econometric and time series models. The forecast values for the models is as given in Table 4.1. In order to determine the model with the best forecasts, the mean square error of the residuals for both models were calculated. The mean square error of the residuals for econometric model was 9644.2 and that of time series was 8509.5. Therefore, on the basis of the Mean Square Error (MSE) of the residuals, the time series process had the best forecast and thus it is the most appropriate model to use in predicting the Nairobi Stock Exchange weekly closing 20-share index.

From the forecast values in Table 4.1 the NSE share index seems to show a sign of rising trends. This will tempt investors by indicating the return of bullish market. In the short run, the rising trend may fluctuate due to the introduction of interest rate and bank charge controls, coupled with the diminishing returns on government securities. However, in the long run, a full adjustment and stable share prices may be obtained owing it to economic recovery.

Table: 4.1: Forecast values for NSE 20-share index for the period January 2003 - December 2003

Observations (Time in weeks)	Econometric forecast values	Time series forecast values
521.00	1319.0	1329.0
522.00	1321.0	1335.0
523.00	1323.0	1338.0
524.00	1326.0	1340.0
525.00	1328.0	1341.0
526.00	1331.0	1342.0
527.00	1333.0	1342.0
528.00	1336.0	1343.0
529.00	1339.0	1343.0
530.00	1342.0	1343.0
531.00	1346.0	1344.0
532.00	1349.0	1344.0
533.00	1353.0	1344.0
534.00	1356.5	1344.5
535.00	1360.0	1345.0
536.00	1364.5	1345.0
537.00	1369.0	1345.0
538.00	1373.0	1346.0
539.00	1378.0	1346.0
540.00	1382.0	1346.0
541.00	1387.0	1347.0
542.00	1392.0	1347.0
543.00	1397.0	1347.0
544.00	1403.0	1348.0
545.00	1408.0	1348.0
546.00	1414.0	1348.0
547.00	1419.0	1349.0
548.00	1425.0	1349.0
549.00	1431.5	1349.0
550.00	1438.0	1349.5
551.00	1444.0	1350.0
552.00	1451.0	1350.0
553.00	1458.0	1350.0
554.00	1464.5	1351.0
555.00	1472.0	1351.0
556.00	1479.0	1351.0
557.00	1486.0	1352.0
558.00	1494.0	1352.0
559.00	1502.0	1352.0
560.00	1510.0	1353.0
561.00	1518.0	1353.0
562.00	1526.0	1353.0
563.00	1534.0	1353.5
564.00	1543.0	1354.0
565.00	1552.0	1354.0
566.00	1561.0	1354.0
567.00	1570.0	1355.0
568.00	1579.0	1355.0
569.00	1589.0	1355.0
570.00	1598.0	1356.0
571.00	1608.0	1356.0
572.00	1618.0	1356.0

4.2 BARCLAYS BANK KENYA LIMITED

Barclay's Bank of Kenya was listed at the Nairobi Stock exchange in 1986. The bank has about 15% and 16% share of all assets and deposits in the banking sector and is the second largest bank in Kenya. It has one of the largest customer deposit bases and one of the most profitable banks in the country.

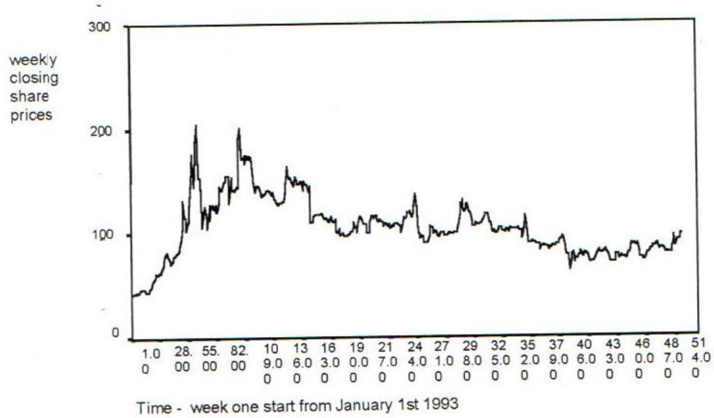

Fig 4.2: Time plot for Barclays Bank weekly closing share price movement

Figure 4.2 shows the time plot for the share price movement for barclays bank from January 1993 to December 2002. The movement indicates non-stationarity due to the fluctuating nature of the mean level of the weekly closing share prices. The lowest share price experienced during the first week could be associated with the aftermath of 1992 multiparty general election which increased uncertainity among investors and thus increased investors preference for cash. The sharp fluctuation between observation 49 and 115 is due to high share prices experienced between December 1993 and March 1995. This favourable share price was as a result of the increasing banks interest rates, the high rates of inflation in the Kenyan economy, the government reforms and liberalization of the financial sector and the companies balance sheet which reflected profits for the previous two years.

The simple and multiple regression models were fitted for the Barclay's Bank data and the most appropriate model obtained. Where the predictor variable, the weekly closing share price (y_i) was regressed on the independent variables namely; time (x), dividends (d_{i-1}) and taxes (z_{i-1}). Each of the independent variables effect was tested on the share price. It was noted that both taxes and dividends had no effect on the share prices and so were eliminated from the analyses. Transformation was done on the variable time (t) to make it a quadratic function i.e. $t = x_1, t^2 = x_2$ and $t^3 = x_3$ to obtain an appropriate model. The model obtained was of the form

$$\tilde{y}_i = 55.35 + 1.2x_1 - 0.005x_2 + 0.000006x_3 \quad (4.2a)$$

On the basis of 95% confidence interval, the least squares equation (4.2a) above is a good predictor, since the calculated F=247.60 is greater than the tabulated value of $F_{(3,516,0.95)}=2.60$.

The ARIMA (1, 2, 1) time series model was chosen from among various time series models to be compared with econometric model. The selected model was of the form,

$$\tilde{y}_i\,(k) = y_{i-1} - 0.018(y_{i-1} - y_{i-2}) + 0.97\varepsilon_{i-1} \quad (4.2b)$$

Model 4.2b above gave the least mean square error for the forecast values as compared to the other time series models.

The 52 weeks ahead forecasts were estimated for the Barclay's Bank weekly closing share prices using both econometric and time series methods is as given in Table 4.2. In order to determine the model with the best forecasts, the mean square error of the residuals for the econometric and time series models were calculated. The mean square error of the residuals for econometric model was 45.0 while that of time series model was

47.0 Therefore, on the basis of the Mean Square Error (MSE) of the residuals, the econometric model had the best forecast. This anomaly could be attributed to the exemption of the constant term in the 4.2b model above. Therefore, both models are appropriate in predicting the Barclays bank's weekly closing share prices, despite the anomaly, which puts the econometric model above the time series model in terms of MSE.

The forecast share prices in Table 4.2 shows an increasing trend. This could lure investors because it indicates better than expected earnings at the end of the last quarter of 2003. This could mean a positive turn in the Kenya economy. However, this might not be the case due to the introduction of the central bank Acts, which puts control on the Bank's interest rates and regulate charges. These factors will gravely affect the share price since the investors might opt for a non-banking sector.

Table: 4.2: Forecast values for Barclays Bank of Kenya for the period January 2003 - December 2003

Observations (Time in weeks)	Econometric model forecast values	Time series Forecast values
521.00	99.0	98.0
522.00	99.0	99.0
523.00	100.0	99.0
524.00	100.0	99.0
525.00	101.0	100.0
526.00	101.0	100.0
527.00	102.0	100.0
528.00	103.0	101.0
529.00	104.0	101.0
530.00	104.0	101.5
531.00	104.5	102.0
532.00	105.0	102.0
533.00	106.0	103.0
534.00	106.0	103.0
535.00	107.0	103.0
536.00	108.0	104.0
537.00	108.5	104.0
538.00	109.0	104.0
539.00	110.0	105.0
540.00	110.5	105.0
541.00	111.0	105.0
542.00	112.0	106.0
543.00	113.0	106.0
544.00	113.5	106.0
545.00	114.0	106.5
546.00	115.0	107.0
547.00	116.0	107.0
548.00	116.5	107.5
549.00	117.0	108.0
550.00	118.0	108.0
551.00	119.0	108.0
552.00	120.0	109.0
553.00	120.5	109.0
554.00	121.0	109.0
555.00	122.0	110.0
556.00	123.0	110.0
557.00	124.0	110.0
558.00	125.0	111.0
559.00	126.0	111.0
560.00	127.0	111.0
561.00	128.0	111.5
562.00	128.0	112.0
563.00	129.0	112.0
564.00	130.0	112.0
565.00	131.0	113.0
566.00	132.0	113.0
567.00	133.0	113.0
568.00	134.0	114.0
569.00	135.0	114.0
570.00	136.0	114.0
571.00	137.0	115.0
572.00	138.0	115.0

4.3 ICDC INVESTMENT COMPANY

Industrial and Commercial Development Corporation (ICDC) promoted the company to join the Nairobi stock Exchange market in 1967, with the objective of enabling Kenyan citizens to acquire assets in a wide range of industrial and commercial companies on a collective investment basis. Foreign investors were not allowed to invest in the company. ICDC has a substantial portfolio of listed securities at the Nairobi Stock Exchange and a number of unquoted shares. In 1999, the portfolio comprised of minority shareholdings in 28 listed companies and 15 unlisted companies. These companies are dominant players in their respective industries and many of them have strong multinational partners. The company attracts a very low tax rate because most of its income is derived from dividends and interest which attracts a low withholding tax, that is a final tax. ICDC pursues a very passive investment policy. Therefore, investors have not been able to realize some significant capital gains.

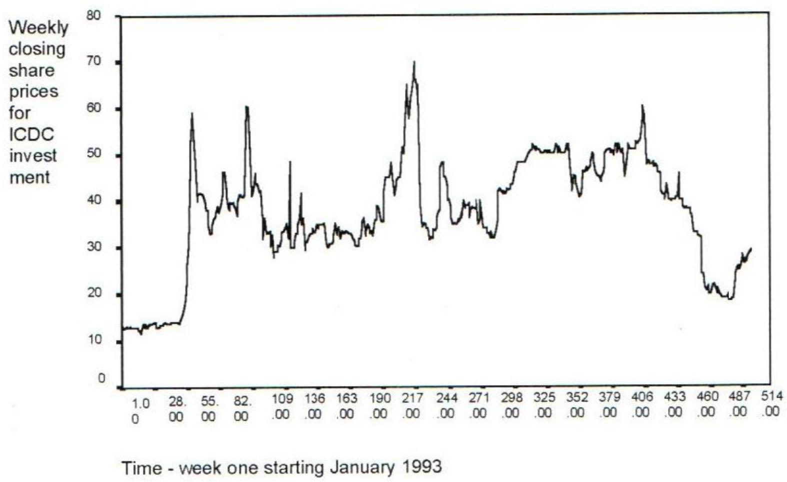

Fig: 4.3: Time plot for ICDC Investment weekly closing share price movement

Figure 4.3 shows the time plot for the share price movement for ICDC Investment from January 1993 to December 2002. The movement indicates non-stationarity due to the fluctuating nature of the mean level of the weekly closing share prices for ICDC Investment. The lowest share price experienced during the first week could be associated with the aftermath of 1992 multiparty general election which increased uncertainity among investors and thus increasing investors preference for cash. The sharp fluctuation between observation 59 and 433 is due to high share prices experienced between February 1994 and March 1999. This favourable share price was as a result of the high rates of inflation in the Kenyan economy, the government reforms and liberalization of the financial sector and the companies balance sheet which reflected profits for the previous two years.

The simple and multiple regression models were fitted for the ICDC investment data and the most appropriate model obtained. Where the predictor variable weekly closing share prices (y_i) was regressed on the independent variables namely; time (x_1), dividends (d_{i-1}) and government taxation (z_{i-1}). Each of these independent variables effect on the dependent variable (y_i) was tested. In the analysis, both dividends and government taxation were found to have a very insignificant effect on the share prices and hence eliminated from the analysis. Transformation was done on the variable time (t) to make it a quadratic function i.e. $t = x_1, t^2 = x_2$ and $t^3 = x_3$ to obtain an appropriate model. The model obtained was of the form

$$\tilde{y}_i = 18.5 + 0.12x_1 + 0.00009x_2 - 0.0000006x_3 \quad (4.3a)$$

On the basis of 95% confidence interval, the least square equation given in (4.3a) is a good predictor, since the calculated F = 148.60 is greater than the tabulated value of $F_{(3,516,0.95)}=2.71$.

The ARIMA (0, 2, 1) time series model was chosen from among various time series models to be compared with the econometric model. The selected model was of the form,

$$\tilde{y}_i(k) = 0.9993y_{i-1} + 0.8\varepsilon_{i-1} \quad (4.3b)$$

Model 4.3b above gave the least mean square error for the forecast values as compared to other time series models in analyzing ICDC investment data.

The 52 weeks ahead forecast for ICDC investment weekly closing share prices using both econometric and time series models were calculated. The forecast values for the two models were as given in Table 4.3. In order to determine the model with the best forecasts, the mean square error of the residuals for econometric and time series models were calculated. The mean square errors of the residuals for the two models were 7.7 and 7.9 respectively. Therefore, on the basis of the Mean Square Error (MSE) of the residuals, the difference is minimal and thus both models are appropriate in predicting the ICDC Investment company's weekly closing share prices.

The forecast values in Table 4.3 shows a high decline in the trend, which might scare the investors' away. Over the years however, the ICDC shares have proved to be stable even during harsh economic times in Kenya. The last quarter of the year 2002, showed increasing trend which was actually the case and thus the selected model fail to capture some other factors which might influence the ICDC's share price

Table: 4.3: Forecast values for ICDC Investment Company for the period January 2003 - December 2003

Observations (Time in weeks)	Econometric model forecast values	Time series model Forecast value
521.00	29.0	29.0
522.00	28.0	29.0
523.00	28.0	29.0
524.00	28.0	28.0
525.00	27.5	28.0
526.00	27.0	28.0
527.00	27.0	28.0
528.00	27.0	28.0
529.00	26.0	28.0
530.00	26.0	27.0
531.00	26.0	27.0
532.00	25.5	27.0
533.00	25.0	27.0
534.00	25.0	27.0
535.00	25.0	27.0
536.00	24.0	26.0
537.00	24.0	26.0
538.00	24.0	26.0
539.00	24.0	26.0
540.00	23.0	26.0
541.00	23.0	26.0
542.00	23.0	25.0
543.00	23.0	25.0
544.00	22.0	25.0
545.00	22.0	25.0
546.00	22.0	25.0
547.00	21.5	25.0
548.00	21.0	24.0
549.00	21.0	24.0
550.00	21.0	24.0
551.00	20.0	24.0
552.00	20.0	24.0
553.00	20.0	24.0
554.00	20.0	23.0
555.00	19.0	23.0
556.00	19.0	23.0
557.00	19.0	23.0
558.00	19.0	23.0
559.00	18.0	22.0
560.00	18.0	22.0
561.00	18.0	22.0
562.00	18.0	22.0
563.00	18.0	22.0
564.00	17.0	22.0
565.00	17.0	21.0
566.00	16.5	21.0
567.00	16.0	21.0
568.00	16.0	21.0
569.00	16.0	21.0
570.00	15.0	20.0
571.00	15.0	20.0
572.00	15.0	20.0

4.4 KENYA COMMERCIAL BANK LIMITED

The Kenya Commercial Bank is one of the oldest and the largest bank in Kenya. It was established in 1896 and first listed at the Nairobi stock exchange in 1989 under the commercialization process. The Kenyan government currently has a stake of 35% shares in the bank. In 1999, the bank returned a prehistoric pre-tax loss of Ksh. 2.2 billion as a result of non-performing loans that continue to bedevil the local banking industry.

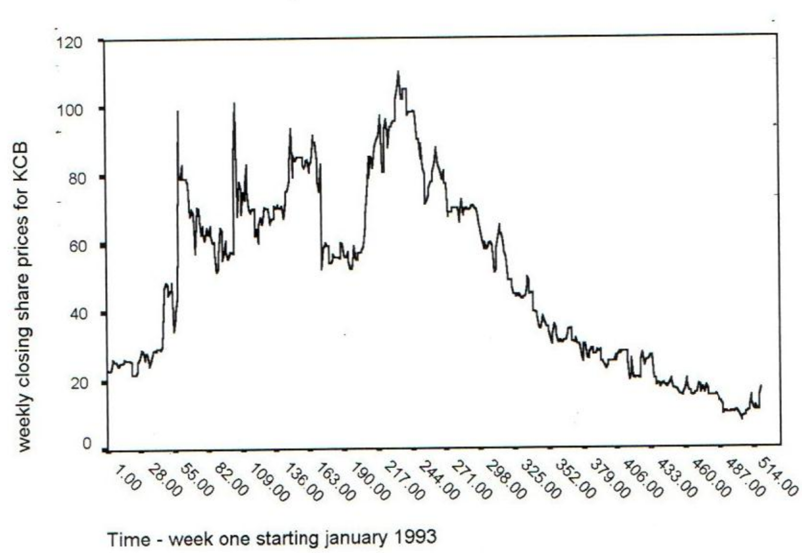

Fig 4.4: Time plot for Kenya commercial bank weekly closing share price movement

Figure 4.4 shows the time plot for share price movement for Kenya Commercial Bank from January 1993 to December 2002. The movement indicates non-stationarity due to the fluctuating nature of the mean level of the weekly closing share prices for KCB. The drastic fall of share prices between observation 376 and 520 is as a result of company's losses incured between 1999 and the year 2002, which increased uncertainity among investors and thus increased investors' preference for shares of other companies than that of KCB. The sharp fluctuation between observation 58 and 172 is due to high share prices experienced between January 1994 and April 1996. This favourable share price was as a result of the increasing banks interest rates, the high rates of inflation in the Kenyan economy, the government reforms and liberalization of the financial sector and the companies balance sheet which reflected profits for the previous two years.

The simple and multiple regression models were fitted for the KCB data. Where the predictor variables weekly closing share prices for KCB (y_i) was regressed on the independent variables namely; time (x_1), dividends (d_{i-1}) and taxation (z_{i-1}). The results showed that both dividends and taxation had no effect on the share price and were eliminated from the analysis. Transformation was done on the variable time (t) to make it a quadratic function i.e. $t = x_1, t^2 = x_2$ and $t^3 = x_3$ to obtain an appropriate model. The model obtained was of the form.

$$\tilde{y}_i = 9.85 + 0.9 x_1 - 0.0034 x_2 + 0.0000033 x_3 \qquad (4.4a)$$

On the basis of 95% confidence interval, the least squares equation given in (4.4a) is a good predictor, since the calculated F = 787.20 is greater than the tabulated value of $F_{(3,516,0.95)} = 2.71$ and also the said regression equation explains 82% of the total variation.

The ARIMA (1, 2, 1) time series model was chosen from among various time series models. The selected model was of the form,

$$\tilde{y}_i(k) = y_{i-1} - 0.06(y_{i-1} - y_{i-2}) + 0.94\varepsilon_{i-1} \qquad (4.4b)$$

Model 4.4b above gave the least mean square error for the forecast values for KCB data as compared to other time series models.

The 52 weeks ahead forecast for Kenya commercial bank's weekly closing share prices using both econometric and time series models were as given in Table 4.4. In order to determine the model with the best forecasts, the mean square error of the residuals for both econometric model and time series model were calculated. The mean square errors of the residuals for the models are 21.2 and 23.0 respectively. Therefore, on the basis of the Mean Square Error (MSE) of the residuals, the difference is minimal and thus both models are appropriate in predicting the Kenya commercial bank's weekly closing share prices.

The forecast values in Table 4.4 shows an increasing trend that was inherent from the first quarter of year 2003. The increasing trend might attract more investors in the long run. This KCB's investor attractive behavior may be attributed to the change in the government which is also the main shareholder in the bank.

Table:4.4: Forecast values for KCB for the period January 2003 - December 2003

Observations (Time in weeks)	Econometric model forecast values	Time series model forecast values
521.00	16.0	17.0
522.00	16.0	18.0
523.00	15.0	18.0
524.00	15.0	18.0
525.00	15.0	19.0
526.00	14.0	19.0
527.00	14.0	19.0
528.00	14.0	20.0
529.00	13.0	20.0
530.00	13.0	20.0
531.00	13.0	21.0
532.00	13.0	21.0
533.00	13.0	21.0
534.00	13.0	22.0
535.00	13.0	22.0
536.00	12.0	22.0
537.00	12.0	23.0
538.00	12.0	23.0
539.00	12.0	23.0
540.00	12.0	24.0
541.00	12.0	24.0
542.00	12.0	24.0
543.00	12.0	25.0
544.00	12.0	25.0
545.00	12.0	25.0
546.00	12.0	26.0
547.00	12.0	26.0
548.00	12.0	26.0
549.00	12.0	27.0
550.00	12.0	27.0
551.00	12.0	27.0
552.00	12.0	28.0
553.00	12.0	28.0
554.00	12.5	28.0
555.00	13.0	29.0
556.00	13.0	29.0
557.00	13.0	29.0
558.00	13.0	30.0
559.00	13.0	30.0
560.00	13.0	30.0
561.00	13.0	31.0
562.00	13.0	31.0
563.00	13.5	31.0
564.00	14.0	32.0
565.00	14.0	32.0
566.00	14.0	32.0
567.00	14.0	33.0
568.00	14.0	33.0
569.00	14.0	33.0
570.00	15.0	34.0
571.00	15.0	34.0
572.00	15.0	34.0

4.5 THE STANDARD CHARTERED BANK LIMITED

The standard chartered bank was listed at the Nairobi stock exchange in 1989. It is one of the top banks in Kenya and controls about 10% of the total asset and deposit in the banking industry. In 1999, the bank recorded a 21% increase in profits attributed to ordinary shareholders and as a result the bank was able to increase dividends by 48%.

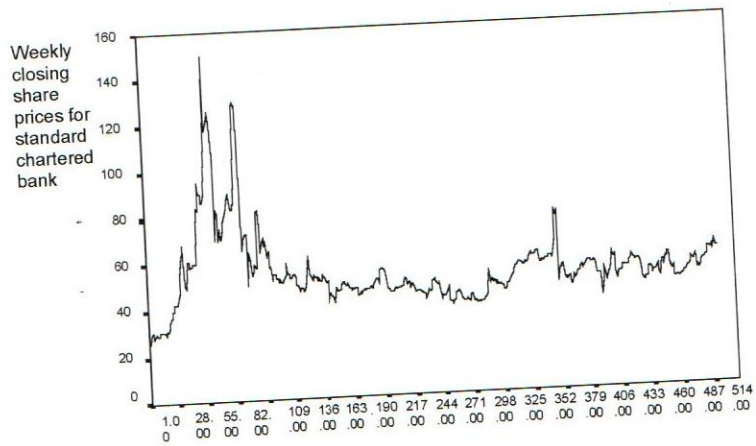

Fig 4.5 Standard chartered bank weekly closing share price movement

Figure 4.5 shows the time plot for the share price movement for Standard chartered bank from January 1993 to December 2002. The movement indicates non-stationarity due to the fluctuating nature of the mean level of the weekly closing share prices for Standard chartered bank. The low share prices experienced between January 1993 and March 1993 was due to political uncertainity which increased fears among investors and thus increasing investors preference for cash. The sharp fluctuation between observation 48 and 113 is due to high share prices experienced between November 1993 and March 1995. This favourable share price was as a result of the increasing banks interest rates, the high rates of inflation in the Kenyan economy, the government reforms and liberalization of the financial sector and the companies balance sheet for the previous years which reflected profits and dividends.

The simple and multiple regression models were fitted for the data. Where the predictor variable; the weekly closing share prices for standard chartered bank (y_i) was regressed on the independent variables namely; time (x_1), dividends (d_{i-1}) and taxation (z_{i-1}). The result showed that both dividends and taxation had no effect on the share price and were eliminated from the analysis. Transformation was done on the variable time (t) to make it a quadratic function i.e. $t = x_1, t^2 = x_2$ and $t^3 = x_3$ to obtain an appropriate model. The model obtained was of the form

$$\tilde{y}_i = 56.96 + 0.103\,x_1 - 0.00081\,x_2 + 0.0000012\,x_3 \qquad (4.5a)$$

On the basis of 95% confidence interval, the least squares equation given in (4.5a) is a good predictor, since the calculated F = 23.25 is greater than the tabulated value of $F_{(3,516,0.95)} = 2.71$.

The ARIMA (1, 0, 1) time series model was chosen from among various time series models. The selected model was of the form,

$$\tilde{y}_i\,(k) = 52.78 + 0.94y_{i-1} + 0.06\varepsilon_{i-1} \qquad (4.5b)$$

Model 4.5b above gave the least mean square error for the forecast values as compared to the other time series models for the standard chartered bank's data. This model was then compared against econometric models in terms of mean square errors.

The 52 weeks ahead forecast for the Standard chartered bank's weekly closing share prices using both econometric and time series method is as given in Table 4.5. In order to determine the model with the best forecasts, the mean square error of the residuals for both econometric model and time series model were calculated. The mean square errors of the residuals for the models are 31.0 and 31.0 respectively. Therefore, on the basis of the Mean Square Error (MSE) of the residuals, the difference is critical and thus both models are appropriate in predicting the Standard chartered bank's weekly closing share prices.

The forecast values in Table 4.5 shows a downward trend in the next last two quarters of the year 2003 which could only be explained by internal factors. However, the price change shows signs of stability towards the last quarter of the year 2003. This has been the characteristic of the standard chartered banks share price over the years and thus the investors need market information before acting otherwise.

Table:4.5: Forecast values for Standard Chartered Bank of Kenya for the period January 2003 - December 2003

Observations (Time in weeks)	Econometric model forecast values	Time series model forecast values
521.00	59.0	58.0
522.00	60.0	58.0
523.00	60.0	58.0
524.00	61.0	57.0
525.00	62.0	57.0
526.00	62.0	57.0
527.00	63.0	57.0
528.00	63.0	56.0
529.00	64.0	56.0
530.00	64.0	56.0
531.00	65.0	56.0
532.00	65.0	56.0
533.00	66.0	56.0
534.00	66.0	55.0
535.00	67.0	55.0
536.00	67.0	55.0
537.00	67.5	55.0
538.00	68.0	55.0
539.00	68.0	55.0
540.00	69.0	55.0
541.00	69.0	55.0
542.00	70.0	54.0
543.00	70.0	54.0
544.00	71.0	54.0
545.00	71.0	54.0
546.00	71.0	54.0
547.00	72.0	54.0
548.00	72.0	54.0
549.00	73.0	54.0
550.00	73.0	54.0
551.00	74.0	54.0
552.00	74.0	54.0
553.00	74.5	54.0
554.00	75.0	54.0
555.00	75.0	54.0
556.00	76.0	54.0
557.00	76.0	53.5
558.00	77.0	53.0
559.00	77.0	53.0
560.00	78.0	53.0
561.00	78.0	53.0
562.00	78.0	53.0
563.00	79.0	53.0
564.00	79.0	53.0
565.00	80.0	53.0
566.00	80.0	53.0
567.00	81.0	53.0
568.00	81.0	53.0
569.00	82.0	53.0
570.00	82.0	53.0
571.00	83.0	53.0
572.00	83.0	53.0

CHAPTER FIVE
CONCLUSIONS AND RECOMMENDATIONS

In this research, both simple and multiple econometric modeling techniques were applied to the Nairobi Stock Exchange weekly closing share index and the weekly closing share prices data for Barclays Bank, ICDC Investment Company, Kenya Commercial Bank and the Standard Chartered Bank. The effects of input variables such as time, dividends and taxation were tested on the share prices for each company and the index. The results showed that both dividends and taxation have minimal or no effect on all the selected firm's shares and also on the NSE stock share index.

The dividends and taxes were eliminated from the analysis, and a quadratic transformation was done on time to come up with an adequate econometric model to be used in forecasting the share prices. Finally, this model was compared against time series forecasting models in terms of mean square errors of the residuals. From the analysis, the best models selected for each firm are as given here below in Table 5.

Table: 5

Company	Selected model
The Nairobi Stock Exchange 20- share index	Time series model
Barclays Bank Kenya Limited	Econometric model
Kenya Commercial Bank	Econometric/Time series model
ICDC Investment Company	Econometric/Time series model
Standard Chartered Bank	Econometric/Time series Model

The selected models gave a reliable 52 weeks ahead forecast for the selected firm's share prices. Therefore, looking at each selected firm, econometric models gave good forecasts but less appropriate as compared to time series model except for the case of Barclays Bank of Kenya, the anomaly in this situation could be attributed to the exclusion of constant term in the time series analysis. The NSE 20-share index and Barclays Bank of Kenya showed an increasing trend while that of ICDC investment, Kenya Commercial Bank and the Standard Chartered Bank showed a fluctuating behavior.

Therefore, the econometric models compared well with the forecasts from the time series models in forecasting market share prices and the 20-share index. The investors at the Nairobi Stock Exchange may rely on them in making decisions on what type of shares to buy, sell and/or hold. But however, a closer look at the forecast values showed that econometric models are appropriate only for short term forecasting as compared to time series models which are long term. The two models are not the only available time series models and therefore further research should be carriedout using the alternative models of analysis for forecasting share prices and the Stock 20-share index. i.e. Capital Assets Pricing Models (CAPM) and the lagged regression models.

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APPENDIX

ANOVA FOR NAIROBI STOCK EXCHANGE 20-SHARE INDEX
(January 1993-December 2002)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression Residual Total	346859609.985 104092742.337 450952352.322	3 516 519	115619869.995 201730.121	573.141	.000

Predictors: (Constant), Time, cubic time, time squared
Dependent Variable: NSE Weekly closing 20-share Index

ANOVA FOR BARCLAYS BANK OF KENYA LIMITED
(January 1993-December 2002)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression Residual Total	254022.023 176438.302 430460.324	3 516 519	84674.008 341.935	247.632	.000

Predictors: (Constant), cubic time, time, time squared
Dependent Variable: barclays bank weekly closing share price

ANOVA FOR ICDC INVESTMENT COMPANY
(January 1993-December 2002)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression Residual Total	34742.693 40212.726 74955.419	3 516 519	11580.898 77.932	148.603	.000

Predictors: (Constant), Time,cubic time, time squared
Dependent Variable: weekly closing share prices for ICDC investment

ANOVA FOR KENYA COMMERCIAL BANK (KCB)
(January 1993-December 2002)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	300084.762	3	100028.254	787.193	.000
Residual	65567.907	516	127.070		
Total	365652.669	519			

Predictors: (Constant), Time, cubic time, time squared
Dependent Variable: weekly closing share prices for KCB

ANOVA FOR STANDARD CHARTERED BANK OF KENYA
(January 1993-December 2002)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	15475.161	3	5158.387	23.249	.000
Residual	114485.575	516	221.871		
Total	129960.735	519			

Predictors: (Constant), Time, cubic time, time squared
Dependent Variable: Weekly closing share prices for Standard Chartered Bank