Predictability of Ordinary Stock Returns at The Nairobi Stock Exchange in Kenya

By

Rioba George

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DECLARATION

I hereby declare that this management research paper is my original work. It has not been presented by any other person whatsoever from the university of Nairobi or any other institution.

Signed ..... Date 13/11/2003
George Onchong'a Rioba.

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

Signed ..... Date 14/11/2003
Mr. Moses N. Anyangu

DEDICATION

To my Late Father Barnabas Rioba

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ABSTRACT

The study sought to determine the predictability of ordinary stock return, for selected securities listed on the NSE using recursive least squares regression.

Monthly closing prices (mode price) for the selected securities were used to obtain dividend yield and earnings price ratio, which were exogenous variables in the model. The other independent variables in the model are Monthly Treasury bill rate, Month -on -month inflation rate, monthly percentage change in broad money supply and monthly percentage change in export earnings from coffee and tea as a measure of agricultural production. The period of study was January 1995 to December 2002

Although there were no significant differences between actual and forecast values generated by the model, we conclude that the predictability evidence for ordinary shares in the NSE is weak and not conclusive. This is due to the fact that only three samples had statistically significant sensitivity measures (coefficients) of the variables used in the model. Besides, the proportion of explained variations (R^2) in ordinary stock return was low ranging from 3.8% to 20.9%. The implication of this finding to financial analysts is that at the end of the day, not all the variations in ordinary stock returns can be explained by changes in various macroeconomic indicators. This in turn confirms the assertion of Shiller (1989) that Short-term changes in stock market indexes may well be influenced by what he termed 'investor psychology'; and what other scholars such as Williamson (1993) have called 'herdlike' behaviour of investors in investment decision-making.

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1.0 INTRODUCTION

1.1 Background To The study

The role of long-term capital in Economic Development of a nation cannot be overemphasised. A capital market is crucial for mobilising domestic and international capital. The reality of a much reduced supply of foreign funds, compels governments in many developing countries to pay increased attention to capital market development as a way of improving domestic resource mobilisation, enhancing supply of long-term capital and encouraging efficient use of existing assets (Dailami and Atkin, 1990). Securities' markets have a very important role to play in financial liberalisation and deepening. They not only provide a means of diversifying risk, but also provide a mechanism of capital allocation and corporate monitoring (Pardy, 1992)

Capital markets enable users to achieve better wealth composition and also permit adjustments to be made in wealth composition with speed and low cost whenever circumstances change. The competition among users of funds, that is, the business, the governments and individuals increases the efficiency with which capital is used.

Stock markets accelerate growth by facilitating the ability to trade ownership of firms without disrupting the production process and allow investors to hold diversified portfolios (Levine, 1990). Markowitz (1952) showed how an investor could reduce the standard deviation of portfolio returns without reducing return by choosing stocks that do not move exactly together.

Optimal Portfolio decisions depend on the details of the environment, that is, the financial assets that are available, their expected returns and risks and the preferences and circumstances of investors (Campbell and Viceira, 2002).

In portfolio construction, investors may be interested not only in expected returns and risks, but also with the way in which expected returns and risks may change over time.

Campbell and Viceira (2002) show that the portfolio share in a risky asset should equal expected excess return (risk premium), divided by conditional variance times the coefficient k that represents aversion to variance i.e.

$$\alpha_{ti} = (E_t R_{t+1} - R_{f,t+1}) / k\ \sigma_{ti}^2$$

Where α_{ti} represent weight of investment held in asset *i* at time *t*

$E_t R_{t+1}$ is the expected return at time t+1 based on information available at time t,

R_{ft+1} is risk free return

σ_{ti}^2 is variance of expected return based on information available at time t and

k represent an investor's risk aversion coefficient

It is thus imperative to estimate expected return and variance of expected return before deciding on the portfolio composition. It is assumed that most investors make investment decisions based on expected return and variance of returns (risk) trade off.

It is well documented that the expected return on holding common stocks and bonds are to some extent predictable (Ferson and Harvey, 1993). Ferson and Harvey (1993) found out that a rational asset-pricing model, which focuses on risk, could explain most of the predictability. Asset pricing models imply that the expected returns of securities are related to their sensitivity to changes in the state of the economy. Sensitivity is measured by the securities' 'beta' coefficients. For each of the relevant state variable, there is a market wide price of beta, measured in the form of an increment to the expected return (a risk premium) per unit of beta. The predictable variation of returns could be driven by changes in the betas and changes in the price of beta, (time varying risk and time varying risk premiums). Previous studies have identified state variables, which are priced, in the sense that their risk premiums are different from zero on average.

It has been shown that predictive power of various economic factors over stock returns changes through time and tends to vary with the volatility of returns (Timmermann and Pesaran 1995). Many recent studies conclude that stock returns can be predicted by means of publicly available information such as time series data on financial and macroeconomic variables with an important business cycle component. This conclusion seems to hold across international stock markets as well as over different time horizons. Variables which have been identified by these studies to be statistically important for predicting stock returns include interest rates, monetary growth rates, changes in industrial production, inflation rates, earnings price ratios and dividend yields (Nyamute, 1998 and Ferson and Harvey, 1993).

Richards (1996) investigated the possibility of long swings in asset prices by testing for long-horizon predictability of returns in emerging markets. The tests of predictability provide evidence that those countries that have performed poorly or well in a quarter are likely to maintain this performance in subsequent quarters. However, there is evidence of return reversals at horizons of a year or more.

Movements in stock returns have been linked to business cycle indicators. Timmermmann and Pesaran (1994) established a benchmark of regressors, which can be used to estimate stock return. The set consists of a constant and 9 other regressors. These are:

- Dividend yield (Dy_{t-1})
- Earnings-price ratio (EP_{t-1})
- One month treasury bill rate—one and two period lag (TBi_{t-1}, TBi_{t-2})
- 12 month treasury bond rate—one and two period lag (TBo_{t-1}, TBo_{t-2})
- Year on year rate of inflation (Π)
- Year on year rate of change in industrial production (ΔIP)
- Year on year growth rate of narrow money (ΔM)

Bekaert and Ang (2001) find that stock returns are predictable on a short time horizon, contrary to the belief on long-term horizon predictability. They find that the strong predictability comes from the short rate and not from yield variables with price in the denominator. Dividend and earning yield predict future cash flow growth rates both in the USA and other countries (Japan, Germany, France and UK) (Bekaert and Ang, 2001). Bekaert and Ang (2001) asked whether stock returns are predictable by three instruments: the dividend yield, earnings yield and the short rate. They used regression analysis, with present value model with earnings growth, payout ratios and the short rates as the state variables.

Sample evidence on predictability plays a major role in the investor's portfolio allocation decision (Tamayo, 2002). The optimal portfolio also depends on his beliefs about the extent to which predictability can be attributed to time variation in the risk premia and betas (Tamayo, 2002). Tamayo (2002) addressed the issue of allocation of funds between a riskless asset and a portfolio of risky assets for a Bayesian investor when returns may be predictable and investor uses asset-pricing models.

It is apparent that most of the empirical studies have been applied to the world's major stock markets, (USA, Japan, UK, France and Germany). It is also evident that there are few formal tests of return predictability using data from Emerging equity markets. Most of the studies done so far are based on data from advanced stock market in the industrialised countries. We are not aware of any studies on predictability that has utilised data from Emerging stock market in Africa. Such markets include the Johannesburg stock exchange, the Ghana stock exchange and the Nairobi stock exchange to name but a few.

The Nairobi Stock exchange (NSE) was established in 1954 as a voluntary association of stockbrokers and is now one of the most active capital markets in Africa. It deals in both variable and fixed income securities. Variable income securities are ordinary shares, which have no fixed rate of dividends payable, as dividend payable is both a function of profitability of the company and what the board of directors decides.
Fixed income securities have a fixed rate of interest, which is not dependent upon profitability.

It is widely documented in investment literature that return prediction or estimation of expected returns is critical in the process of investing in ordinary shares. It is also critical in the process of portfolio construction. It is for this reason that the composition of the best portfolio depends on an investor's assessment of expected returns, standard deviation and correlation. The ability to predict return on ordinary shares is important to Ordinary Share Investors as well as Investment Advisors.

1.2 Statement of the Problem

Available evidence documents a number of studies on the NSE. These include that carried by Omosa (1989), Simiyu (1992), Kerandi (1993), Mwangi (1997), Iminza (1997), and Nyamute (1998). Others include Mwangi (1999) and Muriithi (2001). None of these studies has addressed the issue of ordinary stock return predictability.

The available literature shows that there are few formal studies of return predictability using data from emerging equity markets in the world in general and Africa in particular. Most of the empirical studies have been applied to data from the industrialised world's major stock markets (USA, Japan, UK, France and Germany). More specifically, there is no documented literature on returns predictability of ordinary shares quoted in the NSE. Predictability information is invaluable to us as a country, individual investors, policy makers and academicians. Such information is critical for informed investment and trading decisions and its absence has a snowballing effect that may be manifested at a national level in illiquidity, low turnover and possible investor apathy in NSE.

We are left wondering whether ordinary stock returns for securities listed in the Nairobi Stock Exchange, an Emerging stock market, are predictable in the short and long horizon. In order to confirm this, a thorough analysis of predictability of returns on ordinary shares at the NSE is necessary.

1.3 Objectives of the study

1.3.1 General Objectives of the Study

The study sought to determine the predictability of one period a head ordinary stock return, for securities listed in the NSE.

1.3.2 Specific Objectives

The study sought

1. To develop a model for predicting stock returns for NSE
2. Testing the suitability of the model using in sample and out of sample data.

1.4 Research Questions

The study sought to answer the following questions

1. Are stock returns for securities listed in the NSE predictable?
2. Is the variance of stock returns for securities listed in the NSE constant over time?

1.5 Significance of the Study

The results of the study will be useful in making investment decisions. More specifically, the results will be of particular interest to:

- Fund managers in portfolio construction process for their investment in securities.

- Investment advisors in advising their clients about what stocks to buy sell or hold.
- Individual Investors in making their investment decisions-whether to sell, hold or buy a particular security
- Educationists or Academicians in pursuit of knowledge by adding to the existing body of knowledge on portfolio construction.
- Capital markets Authority, CMA, whose mandate is to facilitate faster development of the capital and money markets in Kenya, will no doubt find the results useful. The study will give invaluable information about the Nairobi stock exchange. This will in turn enhance international capital inflows and mobility. This will increase the number of participants, boost demand for shares, turnover and liquidity of the stock market.

2.0 LITERATURE REVIEW

2.1 Stock exchange market

A stock exchange is a market that facilitates the exchange of shares of publicly quoted companies, government and municipal securities for money. It is a place where investors register their opinion on the future of the economy. It is thus a barometer that reflects important economic changes (Muriithi 2001).

2.1.1 The Nairobi Stock Exchange

The Nairobi Stock exchange (NSE) was established in 1954 as a voluntary organisation of stockbrokers and is now one of the most active capital markets in Africa. It deals in both variable and fixed income securities. Variable income securities are ordinary shares, which have no fixed rate of dividends payable as dividend payable is both a function of profitability of the company and what the board of directors decides.

Fixed income securities have a fixed rate of interest or dividend, which is not dependent upon profitability. Examples include Bonds (corporate or treasury), preference shares and debenture stocks.

The NSE has 53 listed securities, divided into three market segments namely:

- Main market investment market segment
- Alternative investment market segment
- Fixed income securities market segment

The main market investment market segment is divided into four sectors namely

- Agricultural
- Commercial and services

- Finance and investment
- Industrial and allied

2.1.2 Role of Stock Exchange

Evidence on the role of a stock market is well documented. The role of a stock exchange market in Economic Development of a nation cannot be overemphasised. A capital market is crucial for mobilising domestic and international capital. Needless to note that:

- The stock market is essential because it allows competition between various instruments of bank based financial system and non-bank financial intermediaries. This leads to efficient allocation of scarce financial resources amongst competing uses
- It allows risk sharing on an individual basis without need for government guarantee
- The stock market offers instruments, which do not suffer from cash flow mismatch.

Based on the foregoing role, the stock exchange confers the following benefits to the economy:

- It leads to improved financial system
- Leads to improved revenue mobilisation within the financial system
- It leads to efficient allocation of investments. Governments and firms are compelled to compete for funds on a level playing ground, thereby ensuring a more effective allocation of resources.
- Provides access to new firms. Investors access a firm by buying shares of the quoted company.

2.1.3 Emerging Markets

Available literature defines emerging markets as stock exchanges characterized by the following

1. Illiquidity

   They tend to be illiquid. The rate at which shares change hands is low. Shares may not be saleable when the investor wants to dispose his shares due to low demand.

2. Volatility of returns

   Returns tend to be uncertain, because changes in share prices are unpredictable. They tend to be unpopular because of uncertainty of returns.

3. Size

   Emerging capital markets tend to be small because of few securities that are traded and most of them are ordinary shares. Thus investor choice for investment assets is limited. Few quoted companies limits supply of securities in the market

4. Turnover

   They are characterised by low turnover i.e. number of shares that change hands.

5. Low activity

   This is as a result of few shares that are sold. Characterised by investors who do not sell their shares (Buy and hold strategy)

6. Foreign Participation

   There is limited foreign participation in quoted shares. Foreign investors jointly are not supposed to own more than 40% of shares.

7. Cross border listing.

   Limited cross border listing is evident

8. High market concentration

Shares of a few companies trade in the market. Some shares remain dormant

9. Electronic trading

   Characterised by absence of electronic trading.

Based on the foregoing characteristics, the Nairobi stock exchange is classified as an emerging market.

2.2 Ordinary Shares and Risk Diversification: Portfolio Choice

An investment refers to a commitment of funds in an asset in the expectation of realising a periodic return and or appreciation in value. Examples of investments include ordinary shares, Bonds, real estate savings accounts and cash. Investment return refers to sum of the change in value of an investment over a specific timeframe and the periodic earnings over the same time.

Symbolically,

$$R_{it+1} = \{(P_{it+1} - P_{it}) + D_{it+1}\} / P_{it}$$

Where

$R_{i,t+1}$ is return of asset *i*, between time t and t+1

P_{it+1} is the price of asset *i* at time t+1

P_{it} is the price of asset *i* at time t and

D_{it+1} is dividend paid between time t and t+1

A portfolio refers to two or more investments held at the same time for example a savings account and ordinary shares. Portfolio management is the process of putting together a portfolio, evaluating it and revising it in order to meet changing investor objectives.

The return of a portfolio at time t, $R_{pt,}$ is the weighted average of the component securities' investment return.

$$R_{pt} = \Sigma^{n}_{i} \alpha_i R_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

Where α_i represent weight of investment held in asset *i*, *i*= *1,2,3...n*

R_{it} is return from asset *i* in period t

The risk of a portfolio is measured by the square root of the variance of returns σ_p^2,

$$\sigma_p^2 = \Sigma\alpha_i^2 \sigma_i^2 + 2\Sigma\alpha_i\alpha_j \rho_{ij} \sigma_i\sigma_j \text{ for } i\neq j \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$

Markowitz (1952) showed how an investor could reduce the standard deviation of portfolio returns by choosing stocks that do not move exactly together i.e. $\rho_{ij} < 0$.

Optimal Portfolio decisions depend on the details of the environment i.e. the financial assets that are available, their expected returns and risks and the preferences and circumstances of investors (Campbell and Viceira, 2002). In portfolio construction, investors may be interested not only in expected returns and risks, but also with the way in which expected returns and risks may change over time

Campbell and Viceira (2002) have shown that for an investor faced with two assets, a risk-free asset and a risky asset, will put a share, α_t of his portfolio into a risky asset. As follows: From equation 1

$$R_{p,t+1} = \alpha_t R_{t+1} + (1 - \alpha_t) R_{f,t+1}$$

$$= R_{f,t+1} + \alpha_t (R_{t+1} - R_{f,t+1})$$

The mean portfolio return is

$$E_t R_{p,t+1} = R_{ft+1} + \alpha_t (E_t R_{t+1} - R_{f,t+1})$$

And from equation 2, variance of the portfolio is

$$\text{Var p, } \sigma_{pt}^2 = \alpha_t^2 \sigma_t^2$$

The investor maximizes a linear combination of mean and variance i.e.

$$\max_{\alpha_t} (E_t R_{p,t+1} - K/2 \sigma_{pt}^2) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3$$

Where k represents an investor's aversion to variance.
Substituting in the mean and variance of portfolio returns, and subtracting $R_{f,t+1}$ equation 2 becomes

$$\max_{\alpha_t} \{\alpha_t (E_t R_{t+1} - R_{f,t+1}) - K/2 \alpha_t^2 \sigma_t^2\}$$

$$\alpha_t = (E_t R_{t+1} - R_{f,t+1}) / k \sigma_t^2 \ldots\ldots\ldots\ldots\ldots\ldots 4$$

From equation 4, the portfolio share in the risky asset, α_t, should equal expected excess return (risk premium) divided by conditional variance times the coefficient k that represents an investor's aversion to variance.

Equation 4 can be written as

$$\alpha_t$$

$$\alpha_t = S_t / k\sigma_t$$

Where S_t is the sharpe ratio, $S_t = (E_t R_{t+1} - R_{f,t+1}) / \sigma_t$

Thus, from equation 4, it is evident that an investor will require to know the expected return and variance of the risky asset in order to decide how much of his wealth, α_t, he will invest in the risky asset.

Equation 4 can be easily extended to a case with many risky assets as follows

$$\underset{\alpha_t}{\text{Max}}\ \boldsymbol{\alpha}_t' (E_t \mathbf{R}_{t+1} - R_{f,t+1'}) - K/2\ \alpha_{t'}\ \boldsymbol{\Sigma}_t \alpha_t$$

Where

$\mathbf{R}_{t+1}$ Vector of risky returns with N elements

$E_t \mathbf{R}_{t+1}$ Mean vector

$\boldsymbol{\Sigma}_t$ Variance covariance matrix

$\boldsymbol{\alpha}_t$ Vector of allocations to the risky assets

The allocation solution becomes

$$\boldsymbol{\alpha}_t = 1/_k \, \boldsymbol{\Sigma}_t^{-1} (E_t \mathbf{R}_{t+1} - R_{f,t+1'}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 5$$

Equation 5 represents a straightforward generalisation of the solution with a single risky asset. The single excess return is replaced by a vector of excess returns and the reciprocal of variance is replaced by $\boldsymbol{\Sigma}_t^{-1}$ the inverse of the variance covariance matrix of returns. The investor's preference enters the solution only through $1/_k$ term. Note that equation 3 or 4 use conditional mean and Variance. That is, mean and variance conditional on an investor's information at time t.

2.3 Implication of Predictability of Returns on Market Efficiency Hypothesis (EMH)

The term 'efficiency' has a very precise meaning that is somewhat different from the conventional economic concept relating to the efficiency with which inputs to a production process are transformed into outputs. In financial economics, the term efficiency relates to the use of and response to information in the formation of stock prices. According to Fama (1970), a market is efficient if prices always fully reflect available information. Prices will then act as a signal for the allocation of capital among different

firms and sectors in an economy according to their relative profitability. This conclusion is based on two important assumptions, (Jefferis et al, 2001). These are:

- Stock prices accurately reflect the expected future profitability of firms and
- The expectations about profitability are themselves based on economic fundamentals (relating to individual firms, particular sectors of economy or the economy as a whole) and not arbitrary guesses.

Fama's proposition is usually termed as the efficient market hypothesis (EMH)

The fundamental idea underlying the EMH is that prices accurately reflect available information and respond rapidly to new information as soon as it becomes available. The EMH comes in three flavours corresponding to different definitions of "available information". Based on available information, a market can be in the Weak Form Efficiency, the Semi-Strong Form or the Strong Form Efficiency.

In a Weak form efficiency market, current prices reflect all historical information about share prices; changes in share prices cannot therefore be predicted from past trends in prices. While, a Semi-strong form efficient market, current prices also reflect all current public information relating to profit expectations, and prices should therefore adjust speedily to public announcements of such relevant information. Lastly, in a strong form efficient market, Prices reflect private information relating to profit expectations.

The EMH specifically states:

- Securities are typically in equilibrium, meaning they are fairly priced and their *expected returns equal their required returns.*
- At any point in time, security prices fully reflect all publicly available information about the firm and its securities, and these prices react swiftly to new information.
- Since stocks are fully and fairly priced it follows that investors should not waste their time trying to find and capitalise on mis-priced securities.

The EMH doesn't say that there are no costs or taxes; it does not say that there aren't clever people and some stupid ones. It merely implies that competition in capital markets is very tough-there are no money machines and security prices reflect true underlying values (Brealy & Myers, 2000 edition, pg 1007).

Thus ability to predict one-period ahead return using available information (conditional asset pricing model) on a given stock and business cycle indicators should not be construed to mean that a market is inefficient, especially if predictable component reflects time-varying expected returns (Timmermann and Pesaran, 1995).

2.4 Influence of Economic Fundamentals on Stock Returns and Volatility

The standard model of share valuation holds that the equilibrium price of a share at time t is equal to the discounted present value of the expected future cash (dividend) flows from that share.

$$P_t = \sum_{K=1}^{\infty} D_{t+K} / (1+R_{t+k}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 7$$

Where k=1,2,3... ∞

D_{t+K} is the expected value at time t of the dividend in period t+k

$1/(1+R_{t+k})$ is the discount factor and R is the expected real interest (discount) rate.

From equation 7, it can be inferred that anything, which affects the future profits (and hence dividends), or the discount rate, will affect the share valuation. Thus in an efficient market, share prices respond to information about economic fundamentals because of their impact on expected profitability of firms (Jefferis et al, 2001) and (Nyamute 1998). The price of individual company should be influenced by four sets of economic factors: those relating to individual firms, to particular sectors of the economy, to the national economy as a whole and to the international economy.

It is much more conceivable that changes in stock price indexes and economic fundamentals are closely linked only over longer periods. Available evidence indicates that changes in variables such as exchange rates or interest rates cannot be interpreted as changes in fundamentals at the high frequencies represented by daily price changes. Fama (1990) and Fama (1981) find that changes in rate of growth of production (as a proxy for the changing economic conditions that would affect dividend growth) have a significant impact on returns on the NYSE. Short-term (daily and weekly) changes in stock market indexes may well be influenced by "investor psychology" (Shiller 1989). Over the long-term economic

fundamentals are more important although even in the longer period, a larger proportion of the stock market return variation is unexplained by real activity variables.

Chen et al (1986) examine a range of economic factors that change expected cash flows and or the discount rate. These are the dividend yield, the spread between long and short-term interest rates, inflation and real output.

Nyamute (1998) studied the relationship between NSE 20 share index and major economic variables namely inflation rate, money supply, treasury bills rate and exchange rate. Nyamute (1998) finds that macroeconomic variables do indeed impact on the performance of the stock prices.

Many researchers have studied movements in aggregate stock market volatility. Officer (1973) relates these changes to the volatility of macroeconomic variables. Schwert (1990) surveys the academic evidence on stock market volatility in an attempt to put policy debate in perspective. There has been an attempt to relate changes in stock market volatility to changes in expected returns to stocks. Change in the volatility of cash flows or discount rates causes a change in the volatility of returns. Stock volatility is higher at some times than at others (Schwert 1989). Thus stock market volatility is related to the time-varying volatility of a variety of economic variables.

Studies have attributed volatility of stock returns to financial leverage, operating leverage, personal leverage and the condition of the economy Schwert (1990). Other examples of early studies that emphasise the systematic variation of stock returns over the business cycle include Prime

(1946), Dowrie and Fuller (1950), Rose (1960), and Morgan and Thomas (1962). Variables suggested by these studies to be systematically linked with stock returns include: short and long term interest rates, dividend yields, industrial production, company earnings, liquidity measures and the inflation rate.

It is well documented in financial theory that financial and operating leverage affect the volatility of the returns. For instance, if a firm buys half of its stock by issuing debt, the volatility of its stock returns will increase, because the stockholders still have to bear most of the risk of the assets, yet the value of their investment is only half as large. Thus by increasing financial leverage, the firm increases volatility of its stock returns.

Large amounts of the operating leverage will make the value of the firm more sensitive to economic conditions. If demand falls off unexpectedly, the profits of the firm with large fixed costs will fall more than the profits of a firm that avoids large capital investments or long-term supply contracts. Firms with large fixed costs will thus have higher stock return volatility.

Schwert (1989) shows that aggregate financial leverage is correlated with stock return volatility, as financial leverage predicts. He further shows that stock return volatility is higher during economic recessions than during expansions, just as operating leverage theory predicts. Schwert (1987) further indicates that stock return volatility increases after a large drop in stock prices.

There is strong evidence that stock volatility increases during economic recessions. This relationship may in part reflect operating leverage, as

recessions are typically associated with excess capacity and unemployment. Fixed cost for the economy would have the effect of increasing the volatility of stock returns during periods of low demand, Schwert (1987).

Generally, if we think of the stock price, P_t, as the discounted present value of expected future cash flows to stockholders, then

$$E_t P_t = E_t \sum_{K=1} D_{t+K}/(1+R_{t+k}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 8$$

Where: E_t is conditional expectation (based on information available at time t, which relates to t-1)

D_{t+K} is the capital gain plus dividends paid to shareholders in period t+k

$1/(1+R_{t+k})$ is the discount factor for period t+k based on information available at time t

K= 1,2,3 ...∞

It is plausible that the conditional variance of the stock price at time t, $Var_t(P_t)$, depends on the conditional variance of expected future cash flows and future discount rates and on the conditional covariance between these series. It is not a simple function of the variances and covariances of the variables in the ratio (Schwert, 1989)

Schwert (1989) shows that volatility is high during recessions. The relationship between stock volatility and either dividend yield or earning yield are sometimes positive and sometimes negative (schwert, 1989)

2.5 Studies on Predictability of Returns

There is a void on local literature on predictability of returns. However there are numerous studies on predictability of stock returns for developed stock markets in industrialised countries. Many recent studies on these markets conclude that stock returns can be predicted by means of publicly available information such as time series data on financial and macroeconomic variables with an important business cycle component, (Timmermann and Pesaran, 1995). Such studies include articles by Balvers, cosimano, and McDonald (1990), Breen, Glosten and Jagannathan (1990), Campbell (1987), Cochrane (1991), Fama and French (1989), French, Schwert, and Stambaugh (1987), Glosten, Jagannathan and Runkle (1993), Timmermann and Pesaran (1994a)

Timmermann and Pesaran (1995) assessed the economic significance of predictability of U.S stock returns. They found that the predictive power of various economic factors over stock return changes through time and tends to vary with the volatility of returns. They further found out that the degree to which stock returns were predictable seemed quite low during the relatively calm markets in the 1960s, but increased to a level where, net of transaction costs, it could have been exploited by investors in the volatile markets of the 1970s.

Timmermann and Pesaran (1994c) established a benchmark set of regressors over which the search for a satisfactory prediction model could be conducted by a potential investor. The set consists of a constant, β_0, and 9 other regressors. These are:

$$R_{it} = \beta_0 + Dy_{t-1,} + EP_{t-1,} + TBi_{t-1} + TBi_{t-2} + TBo_{t-1} + TBo_{t-2} + \Pi + \Delta IP + \Delta M + \epsilon_{t-1}$$

Where:

- Dy_{t-1}- Dividend yield
- EP_{t-1}-Earnings-price ratio
- TBi_{t-1}, TBi_{t-2} -One month treasury bill rate—one and two period lag
- TBo_{t-1}, TBo_{t-2} 12 month treasury bond rate—one and two period lag
- Π -Year on year rate of inflation
- ΔIP - Year on year rate of change in industrial production
- ΔM -Year on year growth rate of narrow money

Timmermann and Pesaran, (1995) used a recursive prediction model to predict US stock return.

Ferson and Harvey (1993) provide an analysis of the predictable components of monthly common stock and bond portfolio returns. They aver that most of the predictability is associated with sensitivity to economic variables in a rational asset pricing model with multiple betas. They also confirmed that the market risk premium is the most important for capturing predictable variation of the stock portfolios; while premiums associated with interest rate risks capture predictability of the bond returns.

Ferson and Harvey (1993) used a conditional version of the asset-pricing model:

$$E(R_{it}|Z_{t-1})=\gamma_0(Z_{t-1})+b_{im,t-1}\gamma_m(Z_{t-1})$$

Where

R_{it} is the rate of return for asset i between times t-1 and t

$b_{im,t-1}$ is the market beta.

Z_{t-1} is the conditioning information, assumed to be publicly available at time t-1.

$\gamma_m(Z_{t-1})$ is the price of market beta and

$\gamma_0(Z_{t-1})$ is the expected return of all portfolios with market beta equal to zero.

Rational expectations imply that the actual return differs from the conditional expected value by an error term $u_{it,}$ which is orthogonal to the information at time t-1. Therefore if the actual returns are predictable using information in Z_{t-1} the model implies that either the betas or the premiums, $\gamma_0(Z_{t-1})$ and $\gamma_m(Z_{t-1})$ are changing function of Z_{t-1}.

The cross sectional regression approach

Ferson and Harvey (1993) used a cross sectional method similar to that of Fama and MacBeth (1973). It is a two step procedure.

First, instruments for the Betas are obtained using time series methods. The second step is to estimate cross sectional regression, for each month t, of the actual asset returns on the betas. Their analysis used excess returns,

$r_{it} = R_{it} - R_{ft,}$ where R_{ft} is the return of a one month treasury bill. They used excess return because the Treasury bill return is known at the beginning of the month and therefore it makes sense to study excess return. They used the following cross-sectional regression equation for month t:

$$r_{it} = \lambda_{0t} + \lambda_{mt}\,\beta_{im,t-1} + e_{it};\ i=1,\ldots,\ N,$$

Where λ_{0t} is the intercept,

λ_{mt} is the slope coefficient, and

$\beta_{im,t-1}$ is the instrument for conditional beta of the excess return for asset i in month t ($\beta_{im,t-1} = b_{im,t-1} - b_{fm,t-1}$ and $b_{fm,t-1}$ is the beta of the treasury bill). The conditional beta is formed using only information available at time t-1.

The regression equation used provides a decomposition of each excess return each month into two components namely: $\lambda_{mt}\,\beta_{im,t-1}$, return of asset i that is related to the cross sectional structure of risk as measured by the betas and $\lambda_{0t} + e_{it}$, the sum of the residual for the asset and the intercept for the month t. The later is uncorrelated with the measure of risk. The asset-pricing model implies that the predictability of returns should be due to the component that is related to risk. The return that is unrelated to risk should be unpredictable.

Ferson and Harvey (1993) model generalises easily to models with multiple betas. A multiple-beta model asserts the existence of expected premiums $\gamma_j(Z_{t-1})$, $j= 0,\ldots,k$, such that expected returns, conditional on the information Z_{t-1}, can be written as:

$$r_{it} = \lambda_{0t} + \Sigma_{j=1}\,\lambda_{jt}\,\beta_{ij,t-1} + e_{it}\quad i= 1, \ldots, N$$

Where $\beta_{ij,t-1}$ are the conditional betas of the excess returns. A slope coefficient in this regression λ_{jt} $j =1, \ldots, K$ is a " mimicking portfolio" return whose conditional expected value is an estimate of the risk premium or price of beta, $\gamma_I\,(Z_{t-1})$

Ferson and Harvey (1993) studied a number of proxies for the economic risks that influence security returns. The variables used were

representative of earlier studies, which found that the average price of beta for such variables was non-zero. Such studies include that of Chen, Roll and Ross (1986), "Economic Forces and the stock market". The variables used by Ferson and Harvey (1993) model are listed below:

Variable	Definition
XVW	Value weighted NYSE index return less one-month treasury bill return
CGNON	Monthly real per capita growth of personal non-durable consumption expenditures seasonally adjusted.
PREM	Monthly return of corporate bonds rated Baa by Moody's investor services, less the long-term US government bond return.
ΔSLOPE	Change in the difference between the average monthly yield of ten-year Treasury bond and a three-month Treasury bill.
UI	Unexpected inflation rate is the difference between the actual and the forecasted inflation rate, formed from a time series model for percentage changes in the consumer price index for all urban consumers, not seasonally adjusted.
REALTB	One –month Treasury bills return less the monthly rate of inflation, as measured by the CPI.

2.6 Studies on NSE

Studies on the NSE include, Munga (1974), Omosa (1989), Kerandi (1993), Mwangi (1997), Iminza (1997), Simiyu (1992) and Nyamute (1998). Others include Mwangi (1999) and Muriithi (2001).

Munga (1974) studied the history, organisation and role of NSE in the Kenyan economy. He found the NSE to be characterised by illiquidity and low turnover. Thirty years down the line, many things may have changed in the NSE.

Omosa (1989) studied the predictive ability of asset pricing models on the NSE and found that the models were not generally good predictors of prices due to what she argued to be inefficiency of the models or imperfections in the market.

Kerandi (1993) tested the predictive ability of the dividend valuation model in the NSE. He finds that the models have less predictive ability in the NSE. Kerandi (1993) collected data in form of share prices, market indices and dividend per share. These were used to predict price for the companies studied. Predicted prices were compared with actual prices and tested for significance of differences. Kerandi (1993) was interested in confirming whether share price can be predicted, implying that investors could be interested in correctly priced shares. It is argued in finance literature that a price can be mis-priced and still generate attractive return for investors. A necessary condition is that the price be consistently mis-priced.

Mwangi (1997) analysed price movements for some selected stocks at the NSE. He wanted to determine factors that affect share price movements in addition to developing a model that could be used to predict price movements. He concluded that it was not always possible to develop

models that accurately predict prices at the NSE because the parameters used in forecasting vary over time due to changes in the underlying earnings' generating process. Thus, Mwangi (1997) remotely advocated for conditional asset pricing models that reflect time varying risk premiums and risk betas.

Iminza (1997) analysed the share prices in the NSE, focusing on their relationship with dividend payments. She used correlation analysis to establish whether there is a relationship between changes in prices with changes in dividend payouts. She concludes that dividends have a significant impact on share price. Iminza (1997) used Chi-square distribution to test for independence of two variables she constructed on share prices 5 days before and after dividend announcement for companies quoted in the NSE. The study aimed at establishing whether there were significant differences in stock prices relative to expectations soon after release of information on dividend information. A limitation of the study is that even though dividends have a significant impact on share prices, it definitely isn't the only factor that does so. It is on this basis that most studies on predictability include dividend yield as a conditioning explanatory variable amongst others.

Nyamute (1998) sought to analyse whether or not macroeconomic factors affect the performance of the NSE. The macroeconomic variables taken into account by Nyamute (1998) were inflation, money supply, interest rates and exchange rates. Nyamute (1998) finds that macroeconomic variables do indeed impact on the performance of the stock prices. This is in line with the rationale for application of multifactor conditional asset pricing models in return or volatility prediction.
Nyamute (1998) specifically sought to:

- Determine whether or not there is a relationship between performance of NSE, as measured by movement of the NSE-20 share index and the movement on the inflation rate, money supply and interest rates in the economy.
- To measure the magnitude or strength of the relationship
- To develop a regression model that can be used to predict the movement of the stock index vis-à-vis the movement of the four variables of economic indicators.

He used the following regression equation:

$$S_t = b_i + b_i P_{t-n} + b_i M_{t-n} + b_i I_{t-n} + b_i R_{t-n} + \epsilon_t$$

Where S_t is the NSE 20 share index at period t

b_i are the coefficients of the predictor variables to be estimated, i= 1, 2, 3, and 4.

P_{t-n} is the month on month inflation at period t-n

M_{t-n} is the money supply at period t-n

I_{t-n} is the 3-month Treasury bill rate at period t-n

R_{t-n} is the shilling exchange rate against the US$ at t-n

n represents lag period

We will advance the study by Nyamute to determine whether macro economic factors can be used to determine return predictability at the NSE for individual stocks.

Mwangi (1999) studied the Nairobi Stock exchange to identify the relationship between price earnings ratio and the growth rate of earnings,

the dividend payout ratios at the NSE and the variations in the earnings growth of the companies at the NSE. He also Sought to determine the significance of the relationship between the P/E ratio and the three factors i.e. growth rate of earnings, dividend payout ratio and earnings growth variation. He used a multiple regression technique to show that a relationship exists between P/E ratio and three indicators. He thus arrived at the conclusion that investors can improve their investment portfolio performance if they use P/E ratios as the earnings growth is positively related to P/E. The other two factors, that is Dividends and Earnings variations had unclear relationship with the P/E ratio.

Muriithi (2001) sought to establish whether interim dividends could be used to predict final earnings. The study used data from the NSE and was analysed using regression analysis. It was found that there is no relationship between interim earnings and eventual year-end earnings. However, there were exceptions in the commercial and services as well as the industrial and allied sectors. The study by Muriithi also suffers limitation that interim dividends only measure what has already happened in the past and can by no means predict what is likely to occur in the subsequent period. This is so because the model used also ignores factors that are indicators of business cycle trends. Even worse still is the fact that a firm's dividend policy is strictly a financing decision; the payment of cash dividend (interim or annual) is a passive residual. The amount of dividend paid will fluctuate from period to period in keeping with fluctuations in the amount of acceptable investment opportunities available to the individual firm in question. If these opportunities abound, then percentage of dividend pay out is likely to be zero. It is with these limitations in mind, that I wish to explore whether ordinary stock return can be predicted using a multifactor conditional asset-pricing model.

We wish to establish whether returns in the NSE can be predicted using macroeconomic factors that have been used in advanced capital markets internationally and some of those identified by Nyamute (1998). We will incorporate business cycle indicators to address the limitations inherent in Mwangi (1997) research.

3.0 RESEARCH METHODOLOGY

3.1 Population

The population of interest was companies listed in the Nairobi stock exchange over the period of study. The period of study was taken to be January 1995 to December 2002.

3.2 Sampling

A sample of ten companies was used. A stratified sampling approach was used to select the sample. Each sector in the main market investment segment was taken as a stratum. Random proportional samples of companies in each stratum, which have remained listed in the NSE throughout the study period, were obtained.

3.3 Model Specification

In studying predictions of stock returns, one has to establish the sort of variables to be used in modelling stock returns, the criteria of selecting a particular forecasting model and estimation procedure to be applied. For the purpose of this study we adapted the model used by Timmermann and Pesaran (1995). The variables used by Timmermann and Pesaran have been identified by many other studies

Timmermann and Pesaran, (1995) used a recursive prediction model to predict US stock return. They assessed the performance of the following model in return prediction.

$$R_{it} = \beta_0 + Dy_{t-1,} + EP_{t-1} + TBi_{t-1} + TBi_{t-2} + TBo_{t-1} + TBo_{t-2} + \Pi + \Delta IP + \Delta M + \epsilon_{t-1}$$

Where:

- Dy_{t-1}- Dividend yield
- EP_{t-1}-Earnings-price ratio
- TBi_{t-1}, TBi_{t-2} -One month treasury bill rate—one and two period lag
- TBo_{t-1}, TBo_{t-2} 12 month treasury bond rate—one and two period lag
- Π -Year on year rate of inflation
- ΔIP - Year on year rate of change in industrial production
- ΔM -Year on year growth rate of narrow money

We replaced Industrial production as a measure of real economic activity with change in earnings from Agricultural exports as a measure of Agricultural production because Kenya is an agricultural country. We also dropped the lagged variables on Treasury Bills and 12-month Bond to avoid serial correlation and because government stock was dominated by short-term securities over the study period respectively

We will thus estimate the following model

$$\mathbf{R_{it+1} = \beta_0 + \beta_1 Dy_{t,} + \beta_2 EP_t + \beta_3 TBi_t + \beta_4 \Pi_t + \beta_5 \Delta AP_t + \beta_6 \Delta M_t + \epsilon_t}$$

Where

- β_i represents a constant and return sensitivity to state variable, i=0,1,2,3,4,5 and 6
- Dy_t -Dividend yield
- EP_t- Earnings-price ratio

- TBi_t - 91 days Treasury bill rate
- Π –Month on month rate of inflation
- ΔAP % change in Earnings from Agricultural Exports as a measure of Agricultural production
- ΔM % change in broad money supply.

Return data was derived using the following formula

$$R_{it} = \{(P_{it+1} - P_{it}) + D_{it+1}\} / P_{it}$$

Where

R_{it} is the actual return in period t

P_{it+1} is the price of asset *i* at time t+1

P_{it} is the price of asset I at time t and

D_{it+1} is dividend paid between time t and t+1 divided by 12

Assumption of the model

We assumed that transaction costs are negligible.

3.4 Data Definition, Measurement and Sources

The research made use of monthly data of various variables in the model. Jefferis et al (2001) concur that changes in stock price indexes and economic fundamentals are closely linked only over longer periods. They also point out that changes in variables such as exchange rates or interest rates cannot be interpreted as changes in fundamentals at the high frequencies represented by daily price changes. Fama (1990) and Fama (1981) find that real economic activity explains larger fractions of the variations in stock market returns for longer return horizons.

Dividend yield is defined as dividends over the previous twelve months divided by the stock price at the end of the month. This regressor is widely used to model expected returns (see Keim and stambaugh (1986), Fama and French (1988), and Kandel and Stambaugh (1990)) and has been associated with slow mean reversion in stock returns across several economic cycles. It also proxies for time variation in the unobservable risk premium since a high dividend yield indicates that dividends are being discounted at a higher rate. We computed the dividend yield, using monthly closing prices and dividend paid in a period of one financial year. The same applied to earnings price ratio.

The growth in money supply, ΔM, measures changes in the economy's liquidity. This regressor was included because Fama (1981) finds that it is important to control for money supply when establishing the inflation-future real economic activity. We used CBK's figures on Broad money supply. This variable was also identified to impact NSE-20 share index (Nyamute 1998)

Change in agricultural production and inflation

Based on the quantity theory of money, Fama (1981) argues persuasively that an unobserved negative shock to the growth in real economic activity induces a higher nominal T-bill rate through an increase in the current and expected future inflation rate. Expected real economic growth rates and stock prices should be positively correlated. It also predicts a negative correlation between interest rates and stock returns. Since Kenya is an agricultural based economy, we used change in monthly earnings from agricultural production instead of the industrial production. This was obtained from the CBS Leading economic indicators. The CBK month on month inflation figures were used in the research.

The Treasury bill rate is also an indicator of the market-wide interest rate; it serves as a proxy for firms' interest costs. The variable was identified to impact the NSE-20 share index (Nyamute 1998). We thus followed the standard practice and included the 91 days Treasury-bill as a state variable proxying for investors' (unobserved) expectations of future economic activity.

3.5 Data Analysis

Different computer applications were used in data analysis. Initially data was captured in excel spreadsheet and basic derived data generated. We then used PCGIVE software to estimate parameters or coefficients of the multiple linear regression function. The coefficients measured each share's sensitivity to the respective variable. A recursive modelling approach was used to make one period a head prediction of return. The recursive initialisation point was the 36^{th} data point.

A recursive linear regression works as follows: The system estimates the model parameters up the initialisation point, say 1997_{12} The system then uses the model to predict return for the next point, say 1998_{01}. It then re-estimates the coefficients using the 1995_{01} to 1998_{01} data and predicts 1998_{02} returns for the selected shares. By the time you predict the 2001_{12} return, you have generated a distribution of one period a head predicted returns that can be compared with the actual returns for the same period (in sample). An out of sample forecast were made for three sets of predictions namely; 1-month, 4-months and 12-Months one period a head predictions for 2002 data. These forecast figures were compared to the 2002 actual figures.

Tests carried include:

- Evaluation volatility using Autoregressive Conditional Heteroscedasticity (ARCH) model for the fitted values.
- Tested for significance of the differences between the forecast values and actual returns.
- Computation and Evaluation of R^2.
- Cross-plotted graphs of the actual and predicted returns to see the trend.
- Tested for significance of the sensitivity coefficients of the variables in the model

The results are discussed in detail in the next chapter.

4.0 DATA ANALYSIS AND FINDINGS

4.1 Introduction

A random sample of 10 companies was selected. The sample was such that it ensured proportional representation of the various sectors. The securities selected were:

	SECURITY	SECTOR
1.	Brooke Bond limited (**BBOND**) Ord. 10.00	Agricultural
2.	CMC Holdings (**CMC**) ltd Ord 5.00	Commercial & Services
3.	Nation media Group (**NMG**) ltd Ord. 5.00	Commercial & Services
4.	Barclays Bank (**BBK**)ltd Ord. 10.00	Finance & Investment
5.	Jubilee Insurance (**Jubilee**) ltd Ord. 5.00	Finance & Investment
6.	Standard chartered Bank (**SCBL**) ltd Ord. 5.00	Finance & Investment
7.	Crown Berger (**CBERG**) ltd Ord. 5.00	Industrial & Allied
8.	Total Kenya (**TOTAL**)ltd. Ord. 5.00	Industrial & Allied
9.	British American Tobacco (**BAT**) ltd Ord. 10.00	Industrial & Allied
10.	East African Breweries (**EABL**)ltd Ord. 10.00	Industrial & Allied

The period of study was January 1995 to December 2002. We used monthly data and in total we had 96 data points.

4.2 Test of Regression Assumptions on the error term and model form

Econometric tests (including graphical approach) were carried out to establish whether the model violated basic assumptions of linear regression. This was made possible by the capability of the data analysis PCGIVE.

Specifically, the residual terms were tested for normality, absence of serial correlation, appropriateness of linear regression specification form using RESET in PC-GIVE, variance of random term using ARCH with 6 lags. The results of the diagnostic tests are shown in table 1 below, While DW values are shown in table 3.

Table 1: Test of Regression Assumptions on the error term and model form.

Security\Variable	**Serial correlation (Residual correlogram) F(10,71) For 10 lags**		**Normality**		**RESET test (Regression specification Test)**	
Test and probability for computed value\ Security	*F test value*	*Probability*	*Chi^2 (2)*	*Probability*	*F(1, 84)*	*Probability*
BAT	1.27849	0.2592	33.718	0.000	0.023872	0.8776
BBK	1.24227	0.2800	6.4009	0.0407*	1.2641	0.0.2641
BBOND	2.5803	0.0100*	38.976	0.000**	0.14697	0.7024
CBERG	0.64150	0.7734	17.504	0.0002**	0.86451	0.3551
CMC	1.3849	0.2050	239.49	0.000**	4.1866	0.0439*
EABL	1.82804	0.0710	11.994	0.0025**	0.65922	0.4191
JUBILEE	1.69263	0.0994	7.1679	0.0278*	1.5718	0.2134
NATION MG	0.822054	0.6086	28.533	0.0000**	12.54	0.0007**
SCBK	1.47383	0.1674	26.298	0.0000**	5.4559	0.0219*
TOTAL	1.13472	0.3494	22.722	0.000**	4.9321	0.0291*

Table 1 Continued

Security\Variable	**ARCH For lags 1 to 6 (Variance of residuals)**		**ARCH For lags 1 to 6**	
Test and probability for computed value	*Chi^2 (6)*	*Probability*	*F-Form (6, 73)*	*Probability*
BAT	7.4495	0.2813	1.1539	0.3405
BBK	6.1013	0.4119	0.92909	0.4794
BBOND	16.141	0.0130*	2.811	0.0162*
CBERG	2.1283	0.9075	0.30874	0.9305
CMC	41.348	0.000**	11.267	0.000**
EABL	3.6558	0.7231	0.54352	0.7734
JUBILEE	7.9277	0.2434	1.2354	0.2983
NATION MG	23.638	0.0006**	4.6118	0.0005**
SCBK	20.956	0.0019**	3.92	0.0019**
TOTAL	4.4074	0.6217	0.65721	0.6842

Notes: Critical values

Level	Residual correlogram F(10, 71)	RESET F(1, 84)	Normality $Chi^2(2)$	ARCH terms $Chi^2(2)$	ARCH terms F(6, 73)
5%	1.9753	3.968	5.99	12.59	2.234
1%	2.690	6.988	9.21	16.81	3.08

* Represent cases where null is rejected at 5% level of significance & ** Represent cases where null is rejected at 1% level of significance.

For Residual Correlation test (Non-Autocorrelation), we failed to reject the null hypothesis of serial independence of the error term in all samples except one (Brooke Bond) at 5% level of significance. The DW values shown in table 3 below are within an acceptable range.

Diagnostic test for normality distribution of the error term using chi-square test rejected all samples at 5% level of significance. At 1% level of significance, we failed to reject the null hypothesis of normal distribution, N (0,1) of the error term in two samples (Jubilee & BBK). However this outcome does not affect the reliability of the parameters of the model because of the sample size of 96 data points that was used. This follows the central limit theorem that as the sample size increases, the distribution approximates standard normal. This is clearly manifested in the shape of the fitted residual curves for all samples in figures 1 to 10 attached herein

For the functional form of the model, we failed to accept the null hypothesis of a correct form for four cases at 5% level of significance (These are CMC, NMG, SCBK, and TOTAL). However, only one company (NMG) was rejected at 1% level of significance.

For the presence of ARCH terms in the fitted residuals, we tested an ARCH (Autoregressive conditional Heteroscedasticity) distribution of the fitted residuals with six lags i.e. ε_t, ε_{t-1}, ε_{t-2} ... ε_{t-6}. This test was meant to establish whether the conditional and conditional variances of the error term are constant. We failed to accept the null hypotheses that there are no ARCH terms (Conditional/ unconditional variance of error term is constant) in fitted residual in four samples at 5% level of significance. We

also carried an F-test to test the suitability of the functional form of the ARCH test with six lags. The test also returned four cases where we could not accept the null of a proper form. These were the same samples where we failed to accept the null of no ARCH terms using Chi^2 test. Thus variance of residuals was constant for the remaining five samples.

Overall, the results indicate that there are no serious violations of the linear regression assumptions and hence the model can be used to estimate return of the sampled securities.

4.3 Estimation Results

We used recursive linear regression to estimate the coefficients of the model for all securities in the samples selected. The recursive initialization point was at the 36th data point (i.e. a period of three years). We also made three sets of forecasts i.e. for the last one month of 2002, last 4 months of 2002 and 12 months of 2002. It is generally believed that the shorter the forecast period, the more accurate the results.
The coefficients of the variables in the model, together with their standard errors are summarized in table 2 below. The reported coefficients are for the model with 12 forecast points.

The forecast values, their deviation from the actual return, standard error and t-values are shown in the tables 4 to 13 below while graphs where the actual and fitted values are cross-plotted are also shown in the figures I to 10 herein.

Table2: Summary of coefficient estimates

Variable\ Security\	**Dividend Yield**	**Earning Price Ratio**	**Inflation**	**Treasury Bill**	**Agric production**	**% change Money supply**	**Constant**
BAT Coefficient (SE)	-0.1107 (0.6442)	0.7252 (0.3497)	0.003625 (0.00279 5)	-0.008439 (0.004014)	0.03822 (0.04847)	-0.004569 (0.004963)	0.1466 (0.0954)
BBK Coefficient (SE)	-1.067 (1.329)	0.7185 (0.6618)	0.003279 (0.00292 6)	-0.001592 (0.003027)	0.02936 (0.03817)	-0.000462 (0.004872)	0.05149 (0.05832)
BBOND Coefficient (SE)	2.237 (1.28)	-1.919 (1.453)	0.003925 (0.00310 7)	0.0006839 (0.003727)	-0.002424 (0.05379)	0.004755 (0.00665)	0.08846 (0.07665)
CBERG Coefficient (SE)	0.6026 (0.39391)	0.348 (0.31)	0.002294 (0.00350 1)	-0.001069 (0.002857)	0.01306 (0.0445)	0.003147 (0.007732)	-0.00668 (0.05956)
CMC Coefficient (SE)	- 0.047408 (2.459)	-1.082 (0.7559)	-0.00587 (0.01151)	-0.0005328 (0.007526)	-0.001245 (0.1343)	0.005985 (0.01159)	0.3288 (0.2933)
EABL Coefficient (SE)	-0.5453 (0.9453)	-0.01792 (0.1658)	0.004569 (0.00219 5)	-0.007808 (0.002635)	-0.01793 (0.03791)	0 (0.003487)	0.2585 (0.1248)
JUBILEE Coefficient (SE)	0.4269 (0.2785)	0.1911 (0.1431)	- 0.002244 (0.00293 1)	0.001409 (0.001831)	0.04405 0.04094)	0.005361 (0.004269)	-0.02188 (0.03906)
NATION Coefficient (SE)	1.225 (2.051)	1.099 (0.8415)	0.01148 (0.007)	-0.005836 (0.006535)	0.01655 (0.6277)	-0.01585 (0.01266)	-0.02735 (0.09378)
SCBK Coefficient (SE)	0.05482 0.4396	-0.3872 (0.4267)	0.002955 (0.00277 3)	-0.009324 (0.003824)	0.03812 (0.04924)	0.0008512 (0.04396)	0.3379 (0.1352)
TOTAL Coefficient (SE)	0.9809 (1.407)	0.2898 (0.2891)	0.001628 (0.00421)	-0.001511 (0.002629)	-0.05052 (0.05633)	-0.000175 (0.006766)	-0.01615 (0.05465)

Figure 1-Total Kenya

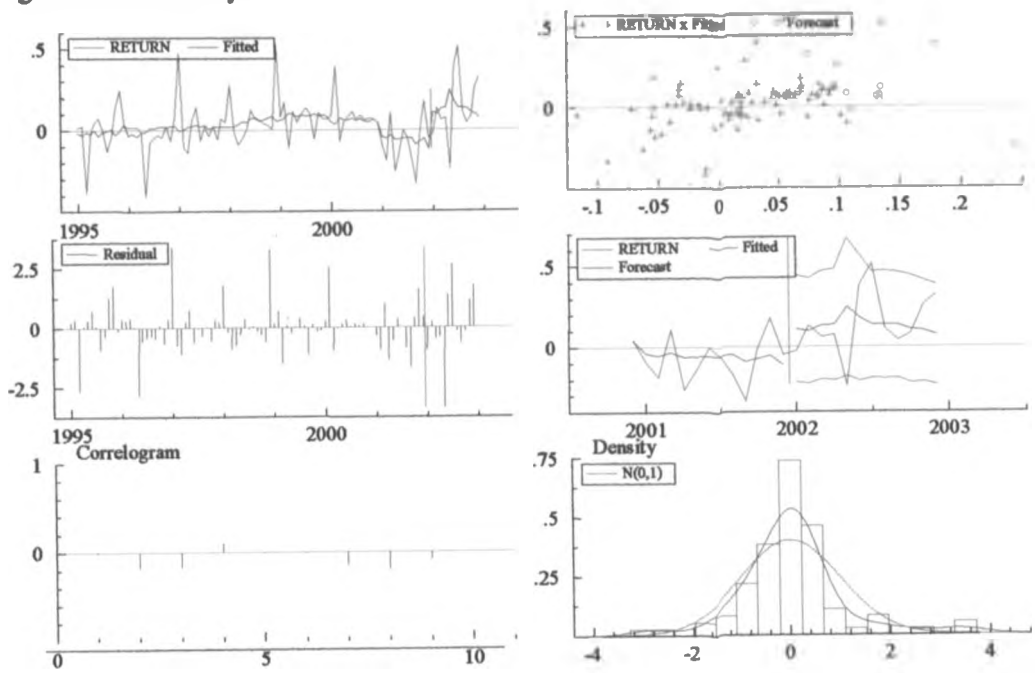


Figure2- Nation media

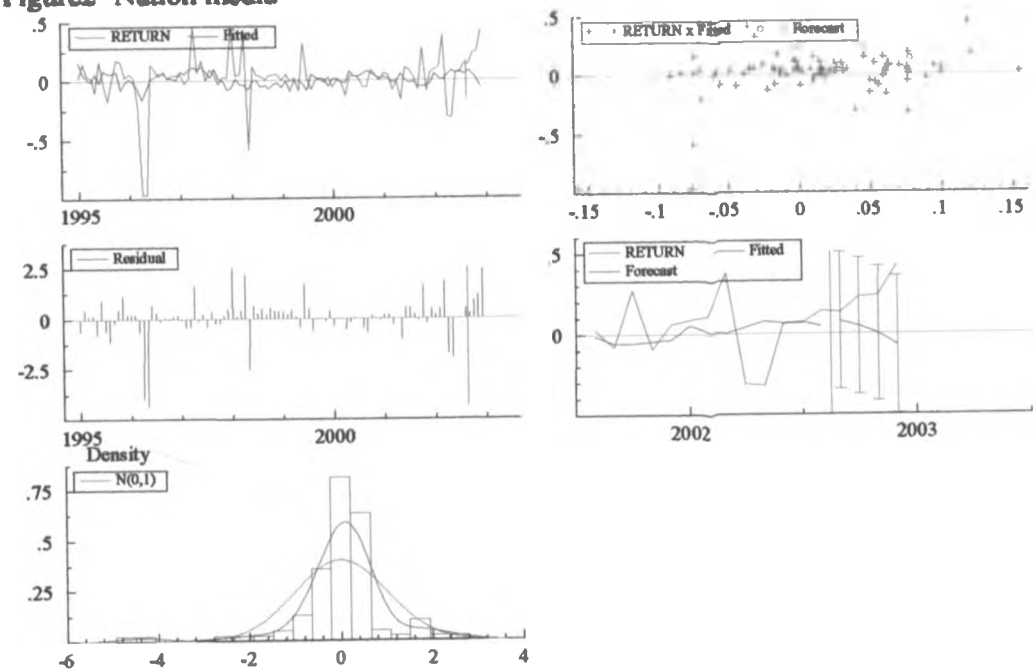


Figure 3-Jubilee Insurance

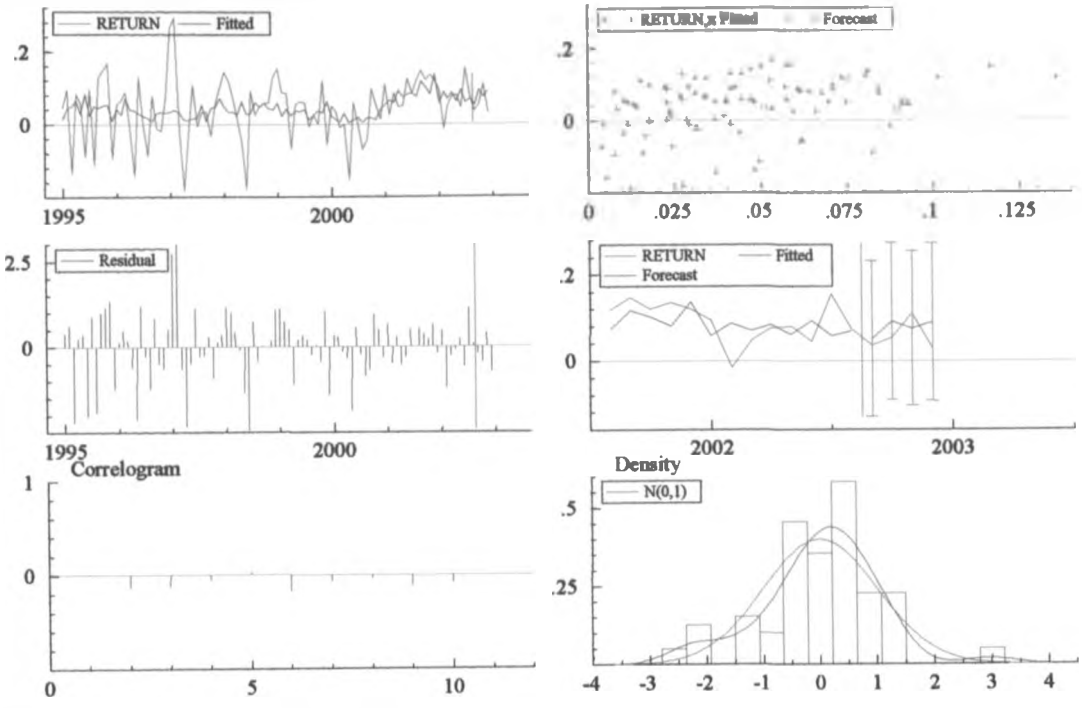


Figure 4: East African Breweries

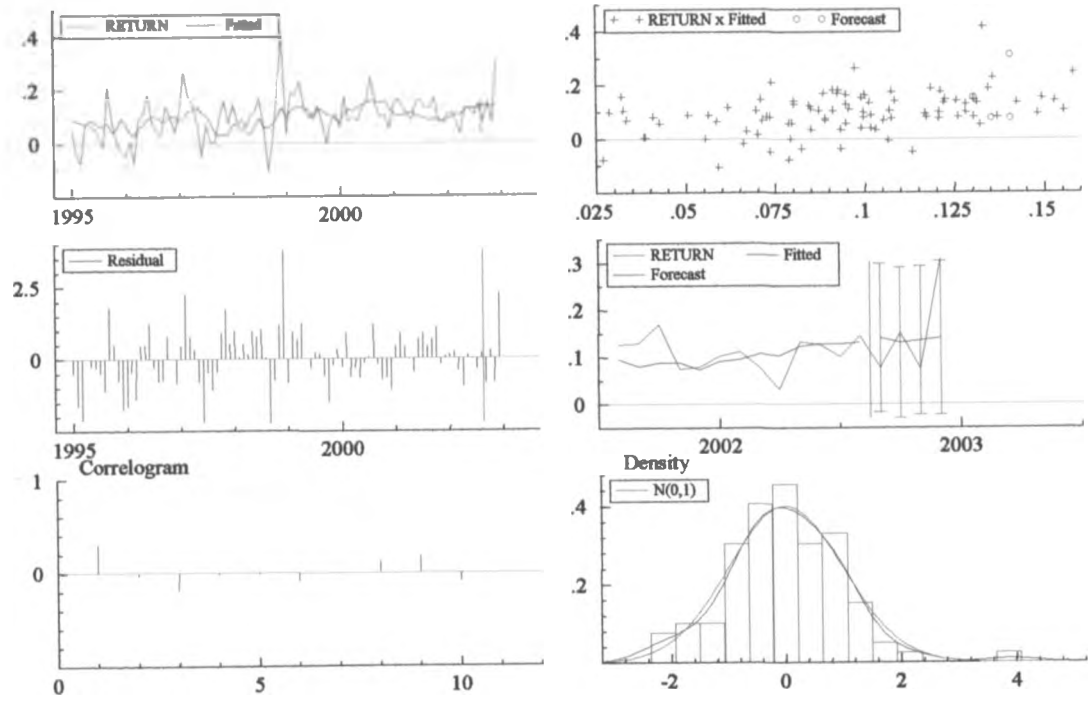


Figure 5- CMC Holding

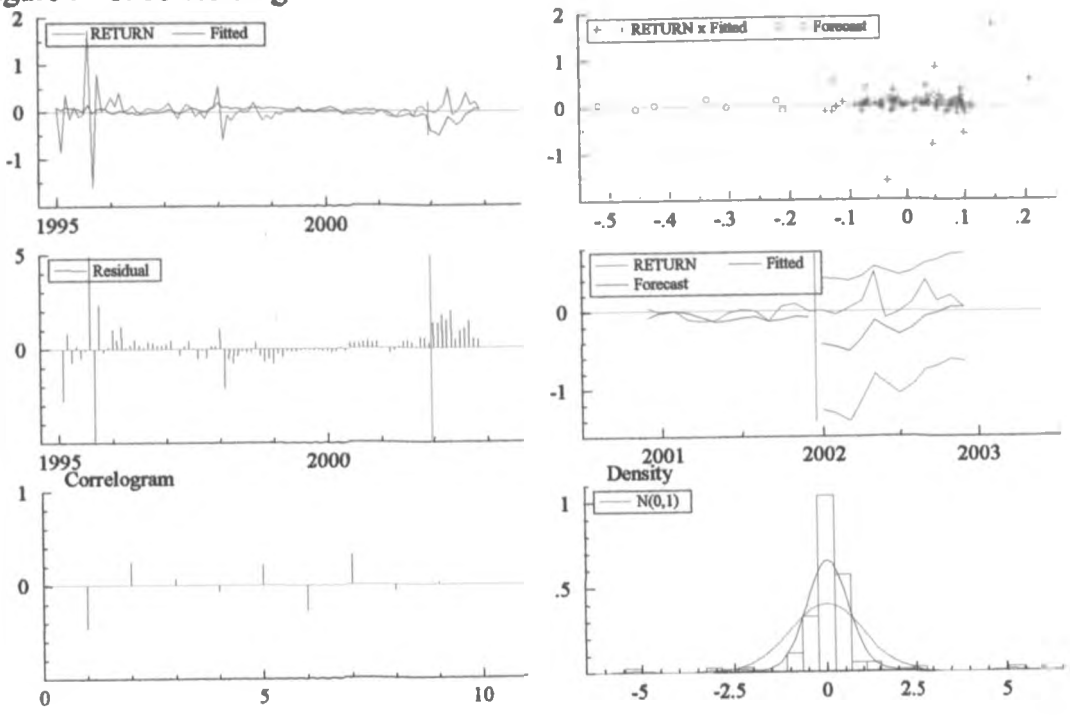


Figure 6- Crown Berger

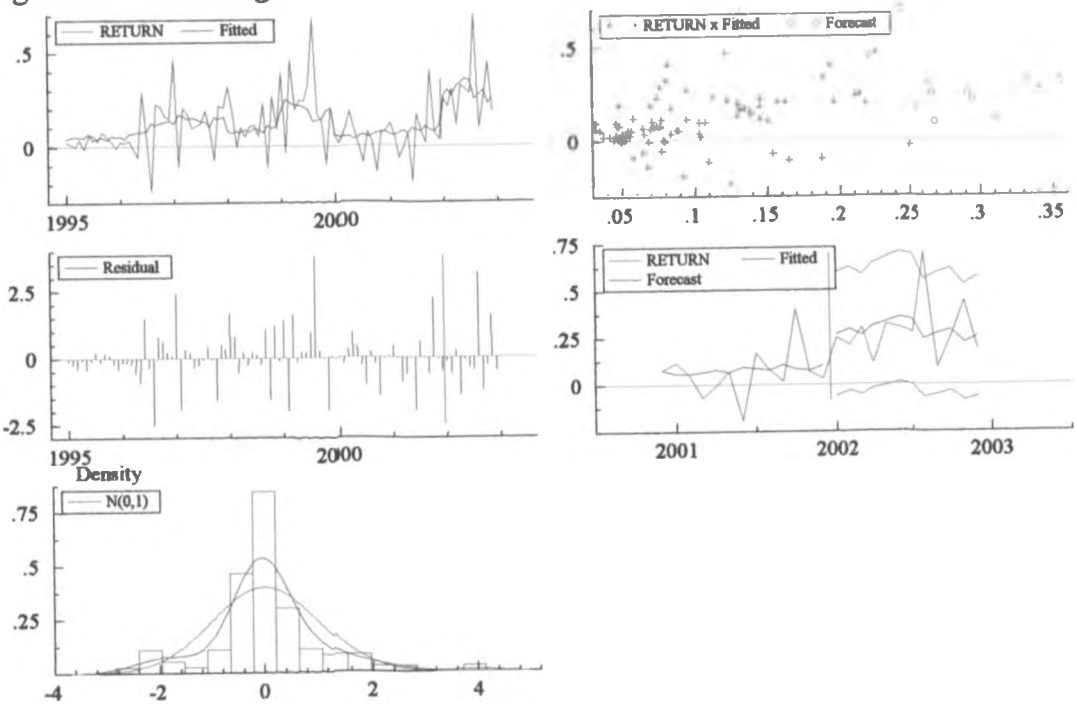


Figure 7- Brooke Bond

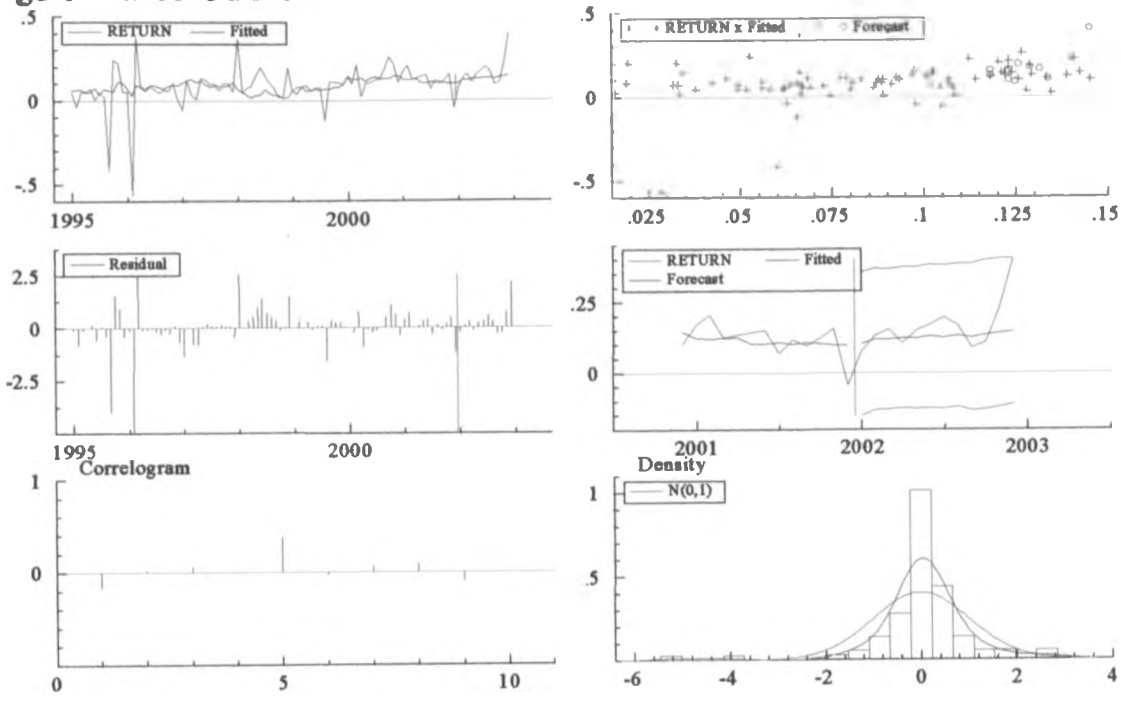


Figure 8- Standard Chartered Bank.

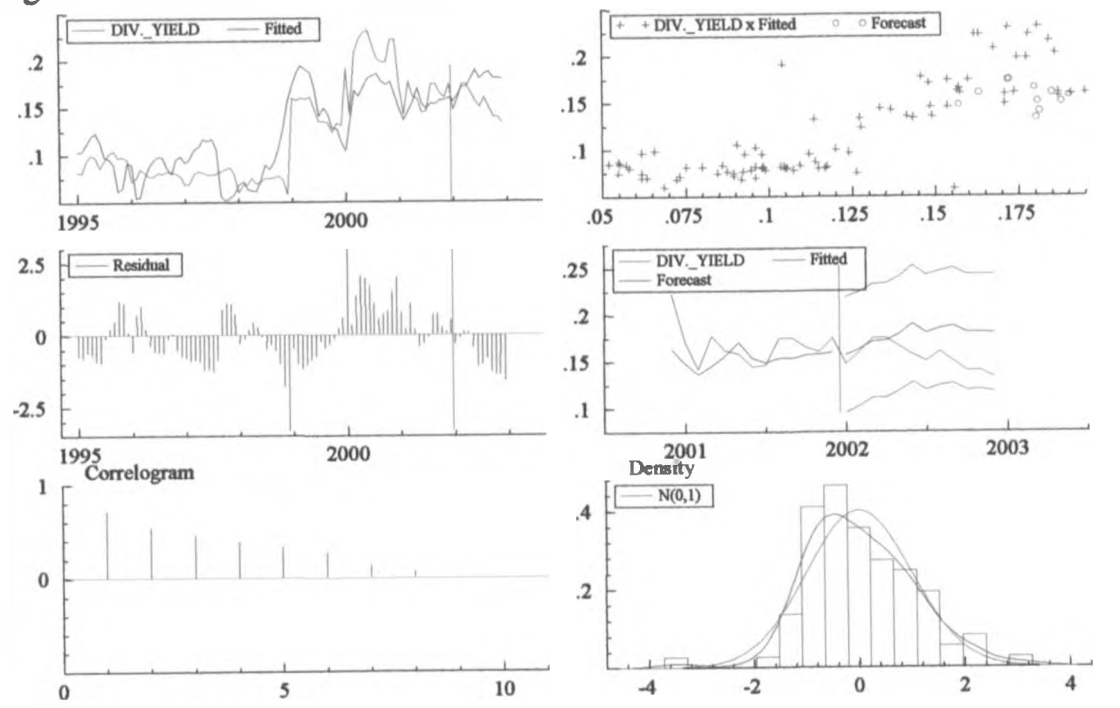


Figure 9-Barclays Bank (K)

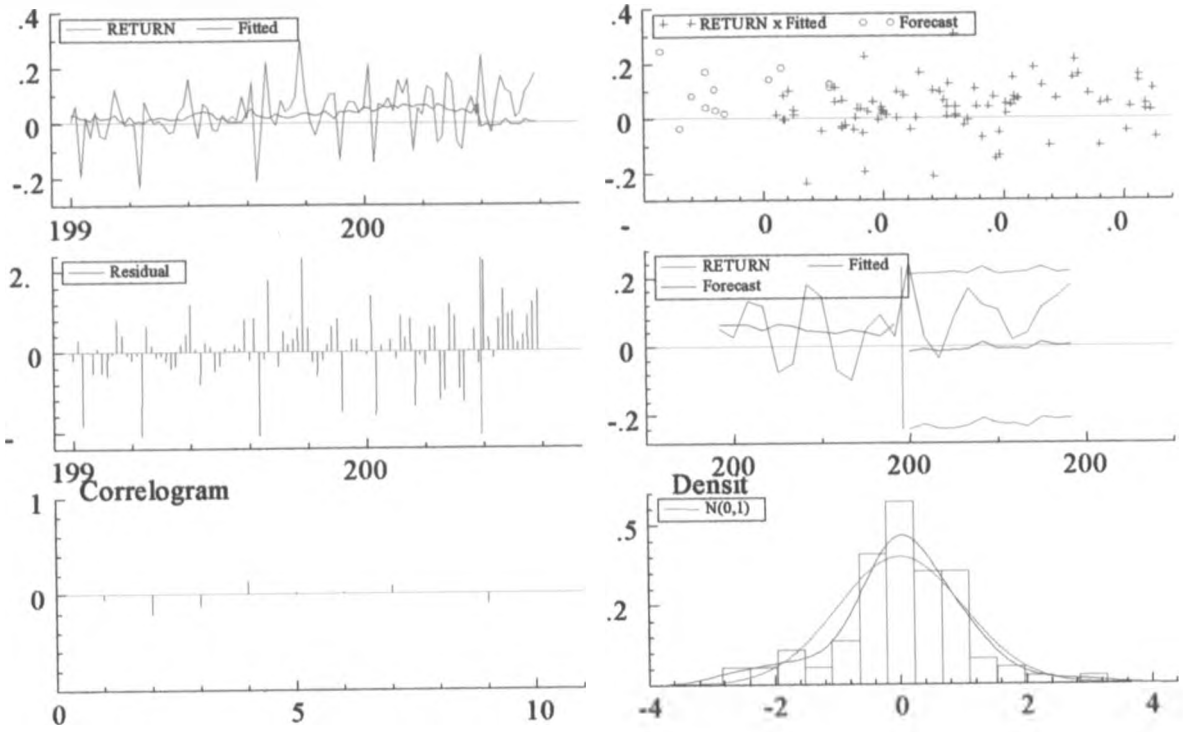
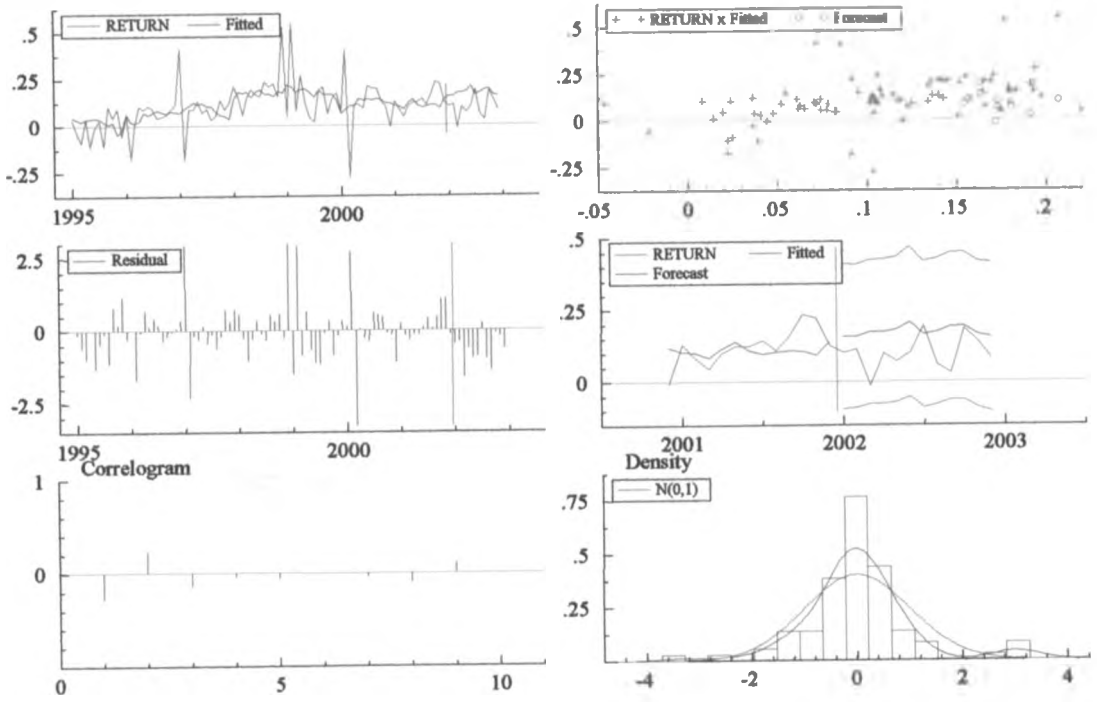


Figure 10-BAT



4.4 Test of goodness of fit

Values for selected test statistics of goodness of fit of the model that were used are summarized in table 3 below

4.4.1 Test of overall significance of the coefficients using F-Test

The F-test was used to test for the overall significance of the coefficients of the model. The following hypothesis was tested

H_0: $\beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$

H_1: At one β_i is not equal to Zero.

We failed to reject the null hypothesis in 7 out of the 10 samples. That is, only in 3 cases were the coefficients of the variables in the model considered significantly different from zero. The samples where the coefficients of the variables were significant are BAT, EABL and SCBL.

4.4.2 Coefficient of Determination (R^2)

The computed R^2 figures were obtained for all samples. In all the cases, the highest R^2 was 20.9 %. This represents a low proportion of the explained variations in the return of the selected ordinary share. Thus we may conclude that the model does not provide a good fit.

However, the analysis of forecast values, their deviation from the actual values yielded a different perspective.(table 4-13)

Table 3: Summary of Test statistics for goodness of fit

Test \ Security	**R-squared %**	**F (6, 77) (Prob.)**	**DW* (For serial correlation)**
BAT Coefficient (SE)	20.955	6.4023* (0.005)	2.55
BBK Coefficient (SE)	3.88104	0.51818 (0.7929)	2.09
BBOND Coefficient (SE)	7.634	1.0607 (0.3935)	2.29
CBERG Coefficient (SE)	12.4293	1.8215 (0.1058)	2.32
CMC Coefficient (SE)	4.7408	0.63868 (0.6989)	2.98
EABL Coefficient (SE)	16.4096	2.5193* (0.0280)	1.35
JUBILEE Coefficient (SE)	10.6384	1.5278 (0.1803)	1.98
NATION Coefficient (SE)	10.76	1.5475 (0.1741)	1.68
SCBK Coefficient (SE)	0.2045	3.3001* (0.0061)	2.26
TOTAL Coefficient (SE)	0.116433	1.6911 (0.1345)	2.02

Notes

* We reject the null hypothesis that the $\beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$ and conclude that at least one β_i is different from zero.

$F_{0.05}, 6, 77 = 2.19$

4.4.3 Testing for Significance of difference between the forecast and actual return

Student t-test was used to test the significance of the deviations of the predicted values from the actual return values for the 1-Period, 4-periods and 12 months 1-step forecasts. The null hypothesis of no significant differences between forecast and actual values was rejected in only 13 predictions out of the 172 forecasts. See tables 4 to 13 below. More specifically we were only able to reject the null in the case of 1-Period forecast in three samples i.e. Brooke Bond, East African Breweries and Nation Media group.

The forecasts, their deviation from actual values Standard errors and t-values are shown in the following tables

Analysis of 12 month 1 step –forecast

Table 4 Barclays Bank
Analysis of 12-Period 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
Jan-02	0.2432	-0.0171	0.2603	0.1126	2.3122*
Feb-02	0.0284	-0.0078	0.0363	0.1099	0.3298
Mar-02	-0.0353	-0.0141	-0.0212	0.1129	-0.1875
Apr-02	0.0811	-0.0119	0.0930	0.1137	0.8182
May-02	0.1667	-0.0096	0.1763	0.1106	1.5948
Jun-02	0.1186	0.0111	0.1076	0.1099	0.9792
Jul-02	0.1059	-0.0084	0.1142	0.1089	1.0490
Aug-02	0.0171	-0.0066	0.0238	0.1097	0.2164
Sep-02	0.0366	-0.0096	0.0462	0.1126	0.4102
Oct-02	0.1125	0.0110	0.1015	0.1096	0.9263
Nov-02	0.1412	0.0010	0.1402	0.1067	1.3134
Dec-02	0.1778	0.0030	0.1748	0.1061	1.6476

Analysis of 4-Period 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 9	0.036585	0.072485	-0.0359	0.0983179	-0.365133

2002	10	0.1125	0.077707	0.034793	0.0983928	0.353615
2002	11	0.141176	0.064923	0.076253	0.0965165	0.790054
2002	12	0.177778	0.056759	0.121019	0.0978447	1.23684

Analysis of 1-period 1-step forecast

Date		Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002	12	0.177778	0.062647	0.115131	0.0960325	1.19887

Table 5 BRITISH AMERICAN TOBACCO

Analysis of 12-Period 1-step forecasts

Date		Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002	1	0.102041	0.157296	-0.05526	0.125825	-0.43914
2002	2	0.111111	0.157384	-0.04627	0.124633	-0.37127
2002	3	-0.01471	0.171918	-0.18662	0.12476	-1.49586
2002	4	0.098901	0.173253	-0.07435	0.124993	-0.59485
2002	5	0.069149	0.181163	-0.11201	0.125991	-0.88907
2002	6	0.101604	0.207218	-0.10561	0.129496	-0.81558
2002	7	0.19171	0.163656	0.028054	0.12697	0.220951
2002	8	0.058824	0.173345	-0.11452	0.126896	-0.90248
2002	9	0.029703	0.191066	-0.16136	0.127949	-1.26115
2002	10	0.183673	0.193596	-0.00992	0.128252	-0.07737
2002	11	0.138889	0.163482	-0.02459	0.126774	-0.19399
2002	12	0.081818	0.154837	-0.07302	0.12937	-0.56442

Analysis of 4-Period 1-step forecasts

Date		Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002	9	0.029703	0.143184	-0.11348	0.119758	-0.94758
2002	10	0.183673	0.146571	0.037103	0.120643	0.307543
2002	11	0.138889	0.115961	0.022928	0.118912	0.192815
2002	12	0.081818	0.105672	-0.02385	0.12119	-0.19683

Analysis of 1-Period 1-step forecasts

Date		Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002	12	0.081818	0.104015	-0.0222	0.118984	-0.18656

Table 6:BROOKE BOND

Analysis of 12 Period 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 1	0.075758	0.101785	-0.02603	0.126687	-0.20545
2002 2	0.130435	0.118219	0.012216	0.124695	0.097968
2002 3	0.153226	0.117935	0.035291	0.12424	0.284058
2002 4	0.104	0.122988	-0.01899	0.124562	-0.15243
2002 5	0.149123	0.122367	0.026756	0.12517	0.213756
2002 6	0.169643	0.128496	0.041147	0.126777	0.324564
2002 7	0.196262	0.125761	0.0705	0.12621	0.558594
2002 8	0.166667	0.131452	0.035214	0.126008	0.27946
2002 9	0.088235	0.124572	-0.03634	0.129171	-0.28131
2002 10	0.106383	0.133441	-0.02706	0.131134	-0.20634
2002 11	0.226744	0.139998	0.086746	0.130251	0.665993
2002 12	0.4	0.14502	0.25498	0.128662	1.98178*

Analysis of 4 Period -step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 9	0.088235	0.136554	-0.04832	0.120818	-0.39993
2002 10	0.106383	0.144905	-0.03852	0.122877	-0.3135
2002 11	0.226744	0.153488	0.073257	0.121598	0.60245
2002 12	0.4	0.157064	0.242936	0.120801	2.01105*

Analysis of 1-Period 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 12	0.4	0.158359	0.241641	0.118335	2.04201*

Table 7: CROWN BERGER

Analysis of 12-month 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 1	0.25	0.266938	-0.016938	0.164646	-0.102875
2002 2	0.208333	0.295044	-0.0867106	0.164498	-0.527121
2002 3	0.3	0.264732	0.0352678	0.160259	0.220067
2002 4	0.111111	0.311521	-0.200409	0.166445	-1.20406
2002 5	0.32	0.333129	-0.0131293	0.170999	-0.0767801
2002 6	0.3	0.355455	-0.0554551	0.173086	-0.32039
2002 7	0.27451	0.341152	-0.0666421	0.173064	-0.385072

2002	8	0.7	0.244125	0.455875	0.157226	2.89948*
2002	9	0.0921986	0.268839	-0.176641	0.161943	-1.09076
2002	10	0.25	0.291739	-0.0417395	0.163066	-0.255967
2002	11	0.445313	0.222153	0.223159	0.154198	1.44723
2002	12	0.180556	0.254907	-0.0743518	0.160154	-0.464252

Analysis of 4-Period 1-step forecasts

Date		Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002	9	0.0921986	0.26871	-0.176512	0.154358	-1.14352
2002	10	0.25	0.278276	-0.0282756	0.155791	-0.181496
2002	11	0.445313	0.223216	0.222097	0.151741	1.46366
2002	12	0.180556	0.256747	-0.076191	0.155433	-0.490186

Analysis of 1-Period 1-step forecasts

Date		Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002	12	0.180556	0.261699	-0.081143	0.155318	-0.522432

Table 8: CMC HOLDINGS

Analysis of 12 Period 1-Step forecasts

Date		Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002	1	0.0000	-0.4250	0.4250	0.4194	1.0134
2002	2	-0.0449	-0.4574	0.4125	0.4295	0.9603
2002	3	0.0390	-0.5184	0.5573	0.4489	1.2416
2002	4	0.1299	-0.3395	0.4694	0.3892	1.2062
2002	5	0.5000	-0.1260	0.6260	0.3422	1.8297
2002	6	-0.0849	-0.2110	0.1261	0.3602	0.3501
2002	7	-0.0183	-0.3035	0.2852	0.3785	0.7537
2002	8	0.1091	-0.2218	0.3309	0.3592	0.9212
2002	9	0.3911	-0.0731	0.4642	0.3393	1.3680
2002	10	0.1276	-0.0291	0.1567	0.3388	0.4624
2002	11	0.1929	0.0470	0.1459	0.3368	0.4331
2002	12	0.0357	0.0387	-0.0029	0.3443	-0.0086

Analysis of 4-Periods 1-step forecasts

Date		Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002	9	0.391129	0.03724	0.353889	0.327816	1.07953
2002	10	0.127596	0.024835	0.102761	0.330007	0.311391
2002	11	0.192893	0.071127	0.121766	0.329352	0.369715
2002	12	0.035714	0.078035	-0.04232	0.335959	-0.12597

Analysis of 1- Period 1-step forecasts

Date		Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002	12	0.035714	0.106455	-0.07074	0.330945	-0.21376

EABLTable 9: East African Breweries

Analysis of 12-month 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 1	0.101351	0.117194	-0.01584	0.0911097	-0.17389
2002 2	0.111842	0.120169	-0.00833	0.0888081	-0.09377
2002 3	0.076923	0.132022	-0.0551	0.0886407	-0.6216
2002 4	0.031646	0.127411	-0.09577	0.0883538	-1.08388
2002 5	0.131579	0.146701	-0.01512	0.0889094	-0.17008
2002 6	0.126582	0.151397	-0.02481	0.0894396	-0.27745
2002 7	0.100629	0.153045	-0.05242	0.0895381	-0.5854
2002 8	0.14375	0.155244	-0.01149	0.0892367	-0.1288
2002 9	0.076923	0.166063	-0.08914	0.0907319	-0.98246
2002 10	0.151351	0.153564	-0.00221	0.090272	-0.02451
2002 11	0.075	0.160003	-0.085	0.0900104	-0.94437
2002 12	0.308824	0.166303	0.14252	0.0931873	1.529

Analysis of 4-month 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 9	0.076923	0.140621	-0.0637	0.0790324	-0.80597
2002 10	0.151351	0.130372	0.020979	0.0799587	0.262375
2002 11	0.075	0.135103	-0.0601	0.0788407	-0.76233
2002 12	0.308824	0.14054	0.168283	0.0816004	2.06228*

Analysis of 1-Period 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 12	0.308824	0.130699	0.178125	0.0794554	2.24182*

Table 10: JUBILEE INSURANCE

Analysis of 12-month 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 1	0.095238	0.086894	0.008344	0.131767	0.063323
2002 2	-0.01515	0.124729	-0.13988	0.133967	-1.04414
2002 3	0.048387	0.102441	-0.05405	0.132947	-0.40659
2002 4	0.076923	0.120647	-0.04372	0.133865	-0.32663
2002 5	0.07947	0.092212	-0.01274	0.132006	-0.09653
2002 6	0.044444	0.133321	-0.08888	0.130724	-0.67988
2002 7	0.154386	0.08739	0.066996	0.131825	0.50822

2002	8	0.073955	0.099533	-0.02558	0.130428	-0.19611
2002	9	0.035032	0.07917	-0.04414	0.131972	-0.33445
2002	10	0.053333	0.132284	-0.07895	0.132799	-0.59451
2002	11	0.109272	0.108261	0.001011	0.12964	0.007795
2002	12	0.028125	0.126051	-0.09793	0.133008	-0.73624

Analysis of 4-month 1-step forecasts

Date		Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002	9	0.035032	0.050851	-0.01582	0.090398	-0.175
2002	10	0.053333	0.091871	-0.03854	0.091532	-0.42103
2002	11	0.109272	0.07496	0.034312	0.089712	0.382468
2002	12	0.028125	0.089974	-0.06185	0.091579	-0.67536

Analysis of 1-Period 1-step forecasts

Date		Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002	12	0.028125	0.088799	-0.06067	0.088995	-0.68177

Table 11: NATION MEDIA GROUP

Analysis of 12-month 1-step forecasts

Date		Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002	1	0.087442	0.105123	-0.01768	0.213412	-0.0828522
2002	2	0.108182	0.063802	0.04438	0.209562	0.211775
2002	3	0.375873	0.025193	0.35068	0.204473	1.71504
2002	4	-0.31436	0.108532	-0.42289	0.215013	-1.9668
2002	5	-0.31951	0.15064	-0.47015	0.2178	-2.15863*
2002	6	0.06275	0.136187	-0.07344	0.220252	-0.333424
2002	7	0.064359	0.146816	-0.08246	0.218999	-0.376519
2002	8	0.141282	0.11248	0.028802	0.214913	0.134015
2002	9	0.13119	0.136482	-0.00529	0.213965	-0.0247292
2002	10	0.224944	0.087541	0.137403	0.210834	0.651712
2002	11	0.23549	0.029305	0.206186	0.20601	1.00085
2002	12	0.426393	-0.06424	0.490637	0.209442	2.3426*

Analysis of 4-month 1-step forecasts

Date		Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002	9	0.13119	0.077715	0.053476	0.211917	0.252343
2002	10	0.224944	0.045314	0.17963	0.211643	0.848737
2002	11	0.23549	-0.0001	0.235592	0.208129	1.13195
2002	12	0.426393	-0.07011	0.496504	0.213395	2.32669*

Analysis of 1-Period 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 12	0.426393	-0.05274	0.479138	0.211779	2.26244*

Table 12: STANDARD CHARTERED

Analysis of 12-month 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 1	0.34555	0.170403	0.175147	0.105373	1.66216
2002 2	0.0669643	0.178452	-0.11149	0.103449	-1.07771
2002 3	0.11	0.172924	-0.06292	0.103236	-0.60952
2002 4	0.193548	0.178344	0.015205	0.103332	0.147142
2002 5	0.234043	0.185294	0.048749	0.103798	0.469649
2002 6	0.221106	0.225582	-0.00448	0.106466	-0.04205
2002 7	0.216346	0.191553	0.024793	0.10524	0.235589
2002 8	0.116822	0.194747	-0.07793	0.104456	-0.74601
2002 9	0.265	0.203023	0.061977	0.106012	0.584624
2002 10	0.24537	0.227151	0.01822	0.106752	0.170674
2002 11	0.159483	0.207649	-0.04817	0.105544	-0.45636
2002 12	0.221739	0.207288	0.014451	0.108293	0.133446

Analysis of 4-month 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 9	0.265	0.208517	0.056484	0.103212	0.547256
2002 10	0.24537	0.224806	0.020564	0.104152	0.197441
2002 11	0.159483	0.206836	-0.04735	0.102837	-0.46047
2002 12	0.221739	0.202411	0.019328	0.105324	0.183509

Analysis of 1-Period 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 12	0.221739	0.20253	0.019209	0.103222	0.186098

Table 13: TOTAL KENYA

Analysis of 12-month 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 1	-0.0262467	0.109627	-0.135873	0.16413	-0.827841
2002 2	0.129909	0.0960707	0.0338387	0.161655	0.209326

2002 3	0.0578778	0.13091	-0.0730321	0.167127	-0.436984
2002 4	0.0726644	0.133359	-0.060695	0.171718	-0.353458
2002 5	-0.242857	0.243787	-0.486645	0.21288	-2.28601*
2002 6	0.377143	0.179151	0.197992	0.19543	1.01311
2002 7	0.513158	0.135467	0.377691	0.164273	2.29916*
2002 8	0.113333	0.134821	-0.0214879	0.165699	-0.129681
2002 9	0.0411765	0.132654	-0.0914779	0.162492	-0.562968
2002 10	0.0806452	0.106737	-0.0260921	0.166129	-0.157059
2002 11	0.258567	0.0986402	0.159927	0.15663	1.02105
2002 12	0.321622	0.0742225	0.247399	0.15499	1.59623

Analysis of 4-month 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 9	0.0411765	0.0997089	-0.0585324	0.158926	-0.368299
2002 10	0.0806452	0.0863866	-0.0057414	0.160721	-0.0357229
2002 11	0.258567	0.0837194	0.174848	0.157046	1.11335
2002 12	0.321622	0.0744511	0.247171	0.159647	1.54823

Analysis of 1-Period 1-step forecasts

Date	Actual	Forecast	Y-Yhat	Forecast SE	t-value
2002 12	0.321622	0.0822932	0.239328	0.157766	1.51698

5% level of significance Critical value for $t_{0.025}$ =1.988 or Incase of $Z_{0.025}$ =1.96
* Represent cases where the deviation between the actual and predicted value is significant at 5% level of significance.

5.0 SUMMARY AND CONCLUSIONS,

5.1 Summary

The objectives of this study were to develop and test a model for predicting ordinary stock returns in the Nairobi Stock Exchange. We used a recursive linear regression model with return as the Endogenous variable. The exogenous variables used were the Treasury bill rate, inflation rate, dividend price ratio, earnings-price ratio, percentage change in broad money supply and percentage change in earnings from major agricultural product exports as a proxy of the economic condition in the country. We used agricultural production because Kenya is an agricultural based economy. Our study period was January 1995 to December 2002 and we used monthly data. Secondary data from the Nairobi stock exchange, the Central bank of Kenya and the Central bureau of statistics was used. The secondary data from the Nairobi stock exchange was used to derive actual stock returns, the dividend price ratio and the earnings price ratio. We used monthly closing prices for the selected securities. The closing price was taken to be the 'mode price' on the last trading day of the month.

From the results of our analysis in the previous chapter, it was noted that the R^2 values were low, that is, below 20.9%. Besides, only in three samples were the model coefficients significantly different from Zero. These are **BAT**, **SCBL** and **EABL** securities with corresponding R^2 values of 20.9%, 20.45% and 16.4%. The analysis of the various sets of forecasted values, showed that in a majority of cases, there was no significant difference between the forecast and actual values of return hence their possible use in return prediction and portfolio construction.

Besides, the nature of relationship between the various explanatory variables conformed to the predictions in financial theory. There was a direct relationship between stock return and: dividend yield, earning price ratio, inflation, Earnings from agricultural production and change in money supply in at least 6 out of ten companies for these variables. There was also an inverse relationship between Treasury bill rate and stock return in almost all the ten companies analysed. This finding is significant in the sense that an investor can make inferences on the expected return based on the direction of movements in these variables.

5.2 Conclusions

The low level of R^2 of the model may be confirming the assertion of Shiller (1989) that Short-term changes in stock market indexes may well be influenced by "investor psychology". However, in a study by Leitch and Tanner (1991), it was found that traditional measures of forecasting performance such as the R^2 were not as strongly correlated with profits from a trading strategy based on a set of predictions as were a measure of the directional accuracy of the forecasts. Thus, we may not entirely dismiss the performance of our model on the basis of low R^2.

Given that there are no serious violations of the ordinary least squares assumptions, and given that there are no significant differences between the forecast values and the actual return values, we may conclude that the predictability evidence for ordinary shares in the NSE is weak and not conclusive. This is due to the fact that only three samples had statistically significant sensitivity measures (Variable coefficients) of the macroeconomic variables used in the model.

5.3 Limitation of the Study

The research was faced with a number of limitations. These include:

- There was the problem of data availability. Complete price data on daily deals for the selected samples for the period prior to 1995 was not available at the Nairobi stock exchange. This led to a shorter period of study.
- Absence of a monthly representative price for each security quoted in the stock Exchange. We used the mode price for deals in the last trading day of the month. This may not have picked all publicly available information throughout the month.
- Even though our Regression Specification test failed to reject the null hypothesis of a proper model specification, we may not have included all possible macroeconomic variables that are bound to influence ordinary stock returns. This may include inclusion of lagged variables of the same exogenous variables that were used. Thus the problem of model uncertainty still remains.

5.4 Suggestions for Further Research

The objective of the study was to test the predictability of ordinary stock returns in the NSE using a recursive linear regression model with selected macroeconomic variables as the explanatory variables. The predictability evidence of the model used is weak and inconclusive. We thus suggest further research along the following lines:

- Inclusion of lagged values of the variables used. This may capture the delayed effect of such variables in security prices and impending earnings as well as earning payout ratio. This may be appropriate depending on the level of efficiency of the NSE. Besides,

macroeconomic indicators are normally announced at the end of the period to which they relate and not at the beginning

- We may need to adopt the approach used by Ferson and Harvey (1993) in their bid to study predictability of ordinary stock returns. Ferson and Harvey (1993) used a conditional version of the capital asset-pricing model (CAPM). Other approaches that may be tested at the NSE are those by Guo (2002) and Bekaert and Ang (2001)
- Another approach that may be used to conclusively study the predictability of ordinary stock returns is by tracking the 'real time' performance of various portfolio constructed on the basis of predicted/forecast values of return and confirm whether they generate excess returns or not.

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