

CAN MACROECONOMIC INDICATORS BE USED AS PREDICTORS OF THE STOCK EXCHANGE INDEX TRENDS? A LOOK AT THE NAIROBI STOCK EXCHANGE

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Abstract

The factors influencing the investor's decision to invest in the Stock Exchanges are well documented, yet an investor cannot consistently maximise returns and minimise risks. The literature mainly focuses on the individuals as investors and their reactions to statements from the respective firms or experts or the government projections (political or economic). What is not very certain in literature are the potential effects that macroeconomic Indicators on the stocks exchange index trends. The implication of this is that there are relationships between the stock exchanges index levels and the Macroeconomic Indicators such as inflation rate, money supply among others, that even if they do not directly impact on the index levels of the stock exchanges, they influence individuals to either increase or decrease their portfolios. On this basis, the study investigated the relationships between Nairobi Stock Exchange index trends and the Macroeconomic Indicators in the country. Correlations can either be positive or negative but more importantly when the correlations between the NSE index trends and the Macroeconomic Indicators are either leading, or lagging, they can inform the investors to either increase or decrease their portfolios thus aiding the maximization of returns and the minimisation of risks. The data was gathered from Nairobi Stock Exchange (daily market reports), Kenya National Bureau of Statistics (Statistical Abstracts) and the Central Bank of Kenya (Monthly Economic Reports). The coefficients for the logarithms of treasury bills, money supply, and real exchange rates were positive, while the signs of Inflation Rates and Gross Domestic Product were negative. The 91-Day Treasury Bills and the Inflation rate were the only clear Leading Macroeconomic Indicators on the NSE 20-Share Index. The money supply and real exchange rates showed that they were both leading and lagging Macroeconomic Indicators on the NSE 20-Share index. Hence they cannot be used to proxy the share prices. The gross domestic product showed the weakest relationship with the NSE 20-Share index. The study concludes that the Kenyan stock market and the formed significant relationships with all Macroeconomic Indicators identified, except the gross domestic product.

Key words: Nairobi stock exchange index trends, macroeconomic indicators

1.0 Introduction

Under the Arbitrage Pricing Theory (APT), it is implied that Macroeconomic variables may proxy for pervasive risk factors in the economy, Roll and Ross (1986). However, literature has ignored the potential impact that macro economic variables have on the emerging stocks market. Chen *et al.*, (1986) have argued that stock trends should be affected by any factor that influences future cash flows or the discount rate of those cash flows of which macroeconomic factors are part. Fama (1970) and McDonald (1986) generally in their empirical studies, found a significant relationship between changes in macroeconomic variables such as gross domestic product, inflation, money supply, interest rates yield, foreign exchange rates and the stock trends.

This therefore suggests that a wide range of factors may be relevant in determining the stock trends. Such variables include and not limited to goods and services prices, money supply, real activity, foreign exchange rates, interest rates, political risk, unemployment/employment levels, export earnings, regional stock market indices, broadband internet penetration, regional retail sales, bankruptcies. Krugman (1995) talks of emerging stock markets in which case there is an argument, that not all these variables are either relevant or appropriate. For instance, in emerging stock markets, there is not an active online secondary market for bond issues and government paper trading. Political risk indices, bankruptcy and oil prices have shown to weakly correlate with the emerging stock markets returns; regional influences on retail sales are expected to be incorporated into returns if countries are integrated regionally, but the theoretical justification for the empirical link is limited. Moreover, such a link is likely to be driven by fundamental macro factors and a regional index is only useful to the extent that it captures the underlying fundamentals; the unemployment/employment levels are usually realised after every decade and so is the broad band internet penetration. Hence, at this stage these variables are excluded as the macro economic factors of interest to this study.

In the Kenya's case international investors have been attracted by the good rating of Kenya stock market by the Standard and Poor rating agency which rated Kenyan foreign debt as investment grade B+ and domestic debt as BB- which means that the foreign investors can confidently invest in Kenya equities and bonds (Capital Market Authority, 2006). The implication is that the Nairobi stock exchange is now more vibrant and there is the need to find ways of ensuring it remains attractive to both the domestic and the international visitors. Techniques to help investors get positive returns need to be found. This will create confidence on the investors to trade in stocks thereby mobilizing the necessary funds for development and industrialization. To create this confidence requires an understanding of the macro variables that impact on the wealth creating activities the firms listed in these stock exchanges and if these variables can be utilized to predict the stocks trends.

Can an investor consistently beat the market in an efficient market so as to have positive returns always? The answer is no according to efficient market hypothesis (EMH). According to Fama (1970), share prices reflect all currently available information and that it is impossible for an investor to consistently outperform the market since all information will already have been reflected in the security prices. However, over time investment advisors have been shown to rely not only on fundamental analysis for investment decisions but also on technical analysis. There is no sure method to predict share prices so as to outperform the stock market. Investing involves risks, and so investors should invest their money based on the quality of their investments.

Based on the above analysis, is it then important to investigate the relationship between the NSE 20-Share index trend and trends in the Macroeconomic Indicators such as the exchange rates, gross domestic product, money supply, interest rates and inflation rates? The critical question here is whether an investor can make an investment decision based on the leading or lagging trends of Macroeconomic Indicators on the stock exchange index trend? This study investigated the above questions with the objective of recommending the trends in the local stock market on the basis of which investors and their advisors can make informed stock market investment timing decisions.

2.0 The Stock Exchange Indices and The Economy

This Section aimed to review literature related to the objectives of the research project. It intends to shed light on the research hypothesis. The purpose of this literature review is to examine what other researchers have already written about the NSE 20-sShare index and macroeconomic indicators in general.

The strength that stock trends affect the economy can be seen by the fact that as opposed to other businesses that require huge capital outlay, investing in shares is open to both the large and small stock investors because a person buys the number of shares they can afford. Therefore the stock exchange provides the opportunity for small investors to own shares of the same companies as large investors. Governments at various levels may decide to borrow money in order to finance infrastructure projects such as sewage and water treatment works

or housing estates by selling another category of securities known as bonds. These bonds can be raised through the stock exchange whereby members of the public buy them, thus loaning money to the government. All these activities have effects in the economy.

At the stock exchange, share prices rise and fall depending, largely, on market forces. Share prices tend to rise or remain stable when companies and the economy in general show signs of stability and growth. An economic recession, depression, or financial crisis could eventually lead to a stock market crash. Therefore the movement of share prices and in general of the stock indexes can be an indicator of the general trend in the economy. Therefore the relationship between the Stock trends and the economic trends can be argued to be cyclic. This is summarised in Figure 1.0 below.

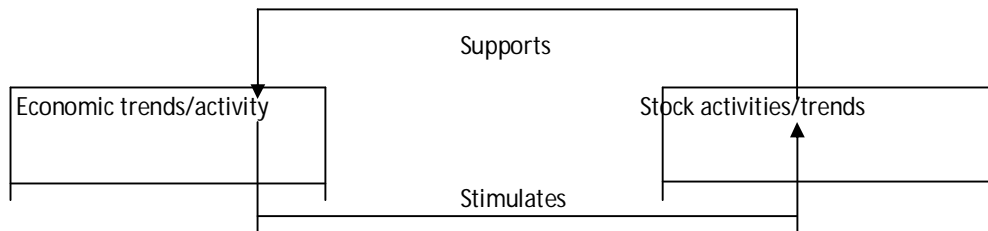


Figure 1: Relationship between stock trends/activities and economic activities/trends

From Figure 1: above, summarizes the relationship between economic trends/activities and the stock trends/activities. The economic trends/activities are usually summarized in macroeconomic indicators while the Stock trends/activities are usually summarized in the stock exchange indices.

The Macroeconomic Indicators selected for this study are deemed to be major according to the Economic Surveys publication of Kenya and the Kenya National Bureau of Statistics both published by the government of Kenya .They are: money supply, inflation rate, treasury bill rate, gross domestic product and the foreign exchange rate. From figure 1 above, the relationship between these Macroeconomic variables and the Stock exchange trends/activities are as shown in the Figure 2.

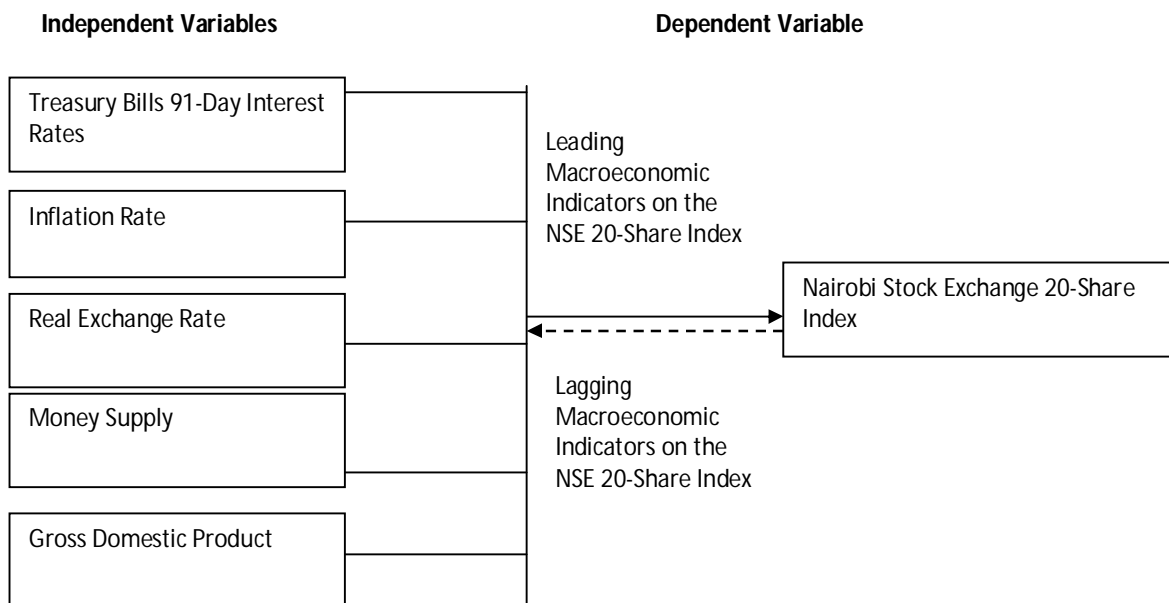


Figure 2: Conceptual framework of the relationship between the macroeconomic indicators and the stock exchange index

As figure 2: above indicates, the objective of this paper was to examine the relationship between the macroeconomic variables and the Nairobi Stock Exchange index trend. The research question was whether the macroeconomic indicators be used as predictors of the stock exchange index trends. To be able to answer this research question, it is necessary to identify the leading and lagging Macroeconomic indicators to the stock exchange index trends. A leading indicator is an economic index intended to forecast future economic activity.

Lagging indicator is an economic indicator that reacts slowly to economic changes, it follows the trends in economic activities.

Even when stock trends do precede economic activity, a question that arises is how much lead or lag time should the market be allowed. For example, do decreases in Stock trends today signal a recession in six months, one year, two years, or will a recession even occur. Traditionally, correlation coefficients have been used to establish leading or lagging indicator properties. Following Fiorito and Kollintzas (1994), a variable is classified as pro-cyclical if the correlation coefficient is statistically significant and positive or negative. In addition, a variable is classified as leading or lagging, if the maximum absolute cross-correlation value corresponds to a lag or lead of the variable relative to stock market index.

Establishing the lead or lag relationship between Stock trends and macroeconomic variables is important. By knowing these relationship, investors can earn profits by exploiting past information of the variables. In addition, they may be used as indicator to formulate current economic stabilization policies.

The Stock Exchange and the Economy

The stock market has traditionally been viewed as an indicator or "predictor" of the economy. Many believe that large decreases in stock trends are reflective of a future recession, whereas large increases in stock trends suggest future economic growth. The stock market as an indicator of economic activity, however, does not go without controversy. Skeptics point to the strong economic growth that followed the 1987 stock market crash as reason to doubt the stock market's predictive ability. Given the controversy that surrounds the stock market as an indicator of future economic activity, it seems relevant to further research this topic.

Theoretical reasons for why stock trends might predict economic activity include the traditional valuation model of stock trends and the "wealth effect." The traditional valuation model of stock trends suggests that Stock trends reflect expectations about the future economy, and can therefore predict the economy. The "wealth effect" contends that stock trends lead economic activity by actually causing what happens to the economy.

The stock exchange provides companies with the facility to raise capital for expansion through selling shares to the investing public. When people draw their savings and invest in shares, it leads to a more rational allocation of resources because funds, which could have been consumed, or kept in idle deposits with banks, are mobilized and redirected to promote business activity with benefits for several economic sectors such as agriculture, commerce and industry, resulting in stronger economic growth and higher productivity levels of firms. Companies view acquisitions as an opportunity to expand product lines, increase distribution channels, hedge against volatility, increase its market share, or acquire other necessary business assets.

The "wealth effect" is also regarded as support for the stock market's predictive ability. Pearce (1983) argues that since fluctuations in Stock trends have a direct effect on aggregate spending, the economy can be predicted from the stock market. When the stock market is rising, investors are wealthier and spend more. As a result, the economy expands. On the other hand, if Stock trends are declining, investors are less wealthy and spend less this result in slower economic growth.

A takeover bid or a merger agreement through the stock market is one of the simplest and most common ways for a company to grow by acquisition or fusion. Both casual and professional stock investors, through dividends and stock price increases that may result in capital gains, will share in the wealth of profitable businesses. By having a wide and varied scope of owners, companies generally tend to improve on their management standards and efficiency in order to satisfy the demands of these shareholders and the more stringent rules for public corporations imposed by public stock exchanges and the government. Consequently, it is alleged that public companies (companies that are owned by shareholders who are members of the general public and trade shares on public exchanges) tend to have better management records than privately-held companies (those companies where shares are not publicly traded, often owned by the company founders and/or their families and heirs, or otherwise by a small group of investors). Therefore in normal circumstances on the application of good governance perspective and prudent decisions it is possible that the stock crashes when Stock trends are bullish will be an exception rather than a rule.

There are a number of some well-documented and known cases where it is alleged that there has been considerable slippage in corporate governance on the part of some public companies. The dot-com bubble in the early 2000s, and the subprime mortgage crisis in 2007-08, are classical examples of corporate mismanagement. Companies like Pets.com (2000), Enron Corporation (2001), One.Tel (2001), Sunbeam (2001),

Webvan (2001), Adelphia (2002), MCI WorldCom (2002), Parmalat (2003), American International Group (2008), Lehman Brothers (2008), and Satyam Computer Services (2009) were among the most widely scrutinized by the media.

2.2 The Stock Trends and the Macroeconomic Indicators

money supply, inflation rate, treasury bill rate, gross domestic product and the foreign exchange rate as summarized by figure 2 and supported by the discussion in the section above do have a relation with the stock exchange index. The trends in these macroeconomic variables have the effect of acting as motivating or indicators for investors to trade in stocks.

2.3 Inflation

Inflation, along with interest rates are important variables for determining the required rates of return used to derive the value of investments (Reilly, 1994). Thus, one would expect inflation to have some impact on Stock trends. In this connection, Kaul (1990) notes that research evidence from the four major economies (i.e., U.S, Canada, UK and Germany) show a very significant negative relationship between stock trends and changes in the expected inflation. This evidence further revealed that this negative relationship varies systematically depending on whether the monetary authority is using interest rate or money supply as leverage in controlling inflation. The relationship was much stronger during interest rate regime (i.e., when interest rate is used to control inflation) than during money regime (supply is used to control inflation).

Kannianen and Kurikka (1984) supported this theory of negative relationship between Stock trends and inflation, by noting that generally, inflation is taken as "bad news" for the stock market; that is, when inflation rises, Stock trends should fall since inflation erodes people's wealth, hence reduces their propensity to invest. Hasbrouk (1984) reached the same conclusion on the negativity of the relationship between stock trends and inflation, in his empirical study of the relationships between stock trends, inflation and the economic activity. However, Kwon, C. (1997) in his empirical study of the effects of macro economic variables on stock trends in developing markets contradicts this finding and states that inflation and interest rates related variables are not significant factors to the Korean market.

2.4 Interest Rates

Interest rates act as the cost of the capital to companies. They are also returns on the alternative assets, such as savings accounts and treasury bills. As the cost of capital, interest rates influence the profitability and the value of the quoted companies; for if a company pays a very high interest rate on its debt capital, then its earnings potential will be eroded, hence investors will mark down its value. A report in the fortune magazine November, 1997 analyzing the swings in the US stock market note that higher interest rates make a company's potential future earnings to look less attractive, therefore, "the value of the company and the stock price should be adjusted downwards". Interest rates also reported by the Japan Securities Research Institute 1996 to be among the three most important factors affecting the fluctuations in Stock trends in the Japanese market. The other two factors being, corporate earnings and business cycle trends

2.5 Exchange Rates

Ma and Wenchi (1990) on their part examined the reactions of the Stock trends to changes in the exchange rate. They noted that due to the internationalization of the financial markets, there is increasing risk for international investments, and therefore the choice of the currency denomination was important. From their study they concluded that changes in a country's exchange rate had two possible effects on the Stock trends movements: firstly the financial effect of the transaction exposure investors would face if the underlying currency is volatile and secondly the economic effect, which works through making exports competitive or non-competitive. If a country is export-oriented and its currency appreciates, it reduces the competitiveness of its exports, and would, therefore, have a negative impact on the domestic stock market. This is because the quoted companies in the stock market, which are exporters, would be less profitable, thus less attractive to investors. The opposite would be true if the currency depreciates making exports competitive e.g. coffee boom in 1992.

2.6 Gross Domestic Product

It is widely accepted that current stock levels are positively related to future levels of real activities as measured by Gross Domestic Product (GDP) or industrial production. Intuitively this finding seems justified since returns are a function of the future economic conditions. However a number of studies have documented a relationship between past, current production and stock trends, Fama (1970, found a relationship between the concurrent measures of the United States of America (U.S.A.), stock trends and industrial production that was positive and highly significant. Tobin (1985) investigated the relationship

between the lagged change in U.S.A.'s industrial production and the return on the Standard and Poor 500 index using the monthly data 1962 and 1981. They found that current stocks returns were related to industrial production lagged by two periods.

2.7 Money Supply

There are several justifications to expect a relationship to exist between the Macroeconomic Indicators and stock trends. Exploring each indicator in turn; monetary portfolio theory suggests that changes in money supply alters the equilibrium position of money, thereby altering the composition and price of assets in an investor's portfolio. In addition, changes in money supply may impact on real economic indicators thereby having a lagged influence on stock trends, Rogalski and Vinso (1977). Both of these mechanisms suggest a positive relationship between changes in money supply and stock trends.

2.8 The Research Gap

The studies above have failed to uncover the relationship between the NSE 20-Share index trend and the Macroeconomic Indicators. They have also failed explain the leading or lagging Macroeconomic Indicators on then NSE 20-share index trend. This study aimed to fill this gap. Growth performance of developing countries over the past decades has been both unsatisfactory and uneven, often accompanied with sharp declines in investments such declining trends in investments have had great effect on the economy (Jordan, 1991).

3.0 Methodology

3.1 Research Design

This study used available data namely the Nairobi Stock Exchange (NSE) 20 share index and the macroeconomic Indicators as provided by the Central Bank of Kenya and the Kenya National Bureau of Statistics economic surveys publications. These data's were organized on a yearly basis and the included macroeconomic indicators are considered as the major ones for the Kenyan economy. The study was quantitative involving the use of statistical and quantitative techniques to answer the study hypotheses. The NSE 20 share index incorporates 20 companies cutting across all the 5 sectors in the economy namely the industrial and allied sector, agricultural sector, commercial and services sector, alternative investment sector and the financial sector in its calculations.

3.2 Data Source and Description

For the purposes of observing the relationship between the performance of the stock market index trend and the macro-economic indicators of inflation, exchange rates, interest rates, industrial production and money supply, the data was organized into yearly basis. This was found suitable because all the variable trends as provided by the Central Bank of Kenya and the Kenya National Bureau of Statistics are organized into yearly averages. For consistency purposes, the returns from the NSE are also to be computed on a monthly and yearly basis. The yearly data statistics covers the period December 1976 to December 2008. This was deemed a long time enough to observe consistent trends in the variables. The period was also relevant because it incorporated the periods when NSE has seen mixed performances. During this period it performed both poorly as well as excellently. The long span data were exposed to various policy changes and economic shocks that may induce structural shifts and therefore the period will entail 33 years from December 1976 to December 2008. This data organization gave 33 data points for each of the six variables in the study (i.e. the NSE Share index, the Inflation Rate, the Treasury bill, Gross Domestic Product, Money Supply and the Real Exchange Rate). For evaluation purposes, the data points exceeded 30 hence considered to be normally distributed for statistical examination. This data sources are summarized in Table 1.

Table 1: Data source

Description	Units	Source
Nairobi stock exchange 20 - share index	points base Jan 1966=100	Nairobi Stock Exchange
Principal rate composite currency)	(percentage per annum	Kenya National Bureau of Statistics
91-day Treasury Bill rate	percentage per annum	Kenya National Bureau of Statistics
Gross domestic product	percentage per annum	Kenya National Bureau of Statistics
Money supply	Millions of Kenya Shillings	Central Bank of Kenya
Inflation rate	percentage per annum	Kenya National Bureau of Statistics

3.3 Data Analysis

The analysis involved two stages; the first stage established the relationship between the stock market index trend (NSE 20-share) and the individual macroeconomic indicators of real exchange rates, treasury bill 91-day interest rates, money supply, gross domestic product and inflation rates. The data was collected, input in an excel spreadsheet coded and exported to a spss 12.0 where it involved computation of a correlation coefficient between the NSE 20 share index trend and each of the macroeconomic indicators. This involved the use of Pearson product moment correlation analysis for each of the macroeconomic indicators against the NSE 20-share index. The reason for using Pearson product moment correlation technique was because the secondary data collected was continuous.

Correlation analysis helps to identify any existing relationships between two variables and also determining the strength and directions of association between two variables is very important because this piece of information forms the basis for selecting the variables for further statistical analysis, e.g. regression analysis (Mugenda, 2003). The next stage involved plotting graph between the NSE 20-share index and all the five Macroeconomic Indicators against time to determine any leading or lagging Macroeconomic Indicators on the NSE 20-share index trend. The Z-test was to be used due to the fact that the data was more than 30 with a significance level of 1%. The following hypotheses were formulated to act as guidelines in the analysis of data:

Research question

Can the macroeconomic indicators be used as clear predictors of the stock trends?

To answer this research question, the following hypotheses were formulated;

H₀₁: There is no relationship between the NSE 20-Share index and the macroeconomic indicators.

H_{A1}: There is a relationship between the NSE 20-Share index and the macroeconomic indicators.

H₀₂: There are no leading macroeconomic indicators on the trends of the NSE 20-share index.

H_{A2}: There are leading macroeconomic indicators on the trends of the NSE 20-share index.

H₀₃: There are no lagging macroeconomic indicators on the trends of the NSE 20-share index.

H_{A3}: There are lagging macroeconomic indicators on the trends of the NSE 20-share index.

Statistical Conventions

These were used interchangeably throughout the rest of this section. Statistical package for the social sciences (SPSS 12.0) was used to run the correlation analysis. It was done in four stages, namely:

- (i) With time period of zero ($n=0$), meaning that changes in the explanatory variables impact on the stock index concurrently that is $S_{(t)} = M_{(t)}$
- (ii) With a time period of one (i.e. $n=1$); Base year being 1976 hence one year before i.e. ($S_{(t)} = M_{(t-1)}$) and one year after 1976 i.e. $S_{(t)} = M_{(t+1)}$.
- (iii) With a time period of two (i.e. $n=2$); Base year being 1976 hence two years before i.e. ($S_{(t)} = M_{(t-2)}$) and two years after 1976 i.e. $S_{(t)} = M_{(t+2)}$.
- (iv) With a time period of three (i.e. $n=3$); Base year being 1976 hence three years before i.e. ($S_{(t)} = M_{(t-3)}$) and three years after 1976 i.e. $S_{(t)} = M_{(t+3)}$.

The Z-test was to be used due to the fact that the data is more than 30 with a significance level of 1%. The null hypothesis is rejected when the correlation coefficient is zero at 1% significance level. The decision of whether to use a one- or a two-tailed test was important because a test statistic that falls in the region of rejection in a one-tailed test may not do so in a two-tailed test, even though both tests use the same probability level.

Whereby $S_{(t)}$ means the Nairobi Stock Exchange 20-Share Index at a time period which is 1976.

$M_{(t)}$ means the macroeconomic indicators at a time period t starting 1976-2008.

$M_{(t-1)}, M_{(t-2)}, M_{(t-3)}$; shows that the NSE 20-Share index that correlate with the macroeconomic indicators hence showing leading trends.

$M_{(t+1)}, M_{(t+2)}, M_{(t+3)}$; shows that the NSE 20-Share index that correlate with the macroeconomic indicators hence showing lagging trends.

4.0 Results and Discussion

4.1 Test of Hypotheses

To assess the relationship between the stock market index trend (NSE 20-share index) and the individual macro-economic variables of exchange rates, interest rates, money supply, gross domestic product and inflation rates; a computation of a correlation coefficient between the NSE 20-Share Index trend and each of the macroeconomic variables on spreadsheet software was done. Usually a correlation coefficient yields a statistic that ranges from -1 to +1. It applies to 1% significance level. A strong relationship is detected when the correlation coefficient yields a statistic that is close to -1 or +1, while a weaker or no relationship is detected when the correlation coefficient yields a statistic that is close to zero or zero. Generally, the null hypothesis in this study for instance indicating no relationship between the NSE 20 share index and macroeconomic indicators is rejected if the p-value is less than 0.05 or 0.01, corresponding to a 5% or 1% chance respectively of an outcome not occurring. The lags are computed to check the point at which the leading macroeconomic indicators denoted by $S_{(t)} = M_{(t-n)}$ or the lagging Macroeconomic Indicators denoted by $S_{(t)} = M_{(t+n)}$ have a relationship with the stock index.

4.2 Relationship between the NSE 20-Share Index and the Macroeconomic Indicators

Concentrating primarily on the US stock exchanges, such early studies attempted to capture the effects of economic forces in a theoretical framework based on the Arbitrage Pricing Theory (APT) developed by Ross (1976). The APT essentially seeks to measure the risk premia attached to various factors that influence the returns on assets, whether they are significant, and whether they are "priced" into stock market returns. Accordingly, Chen, Roll and Ross (1986), having first illustrated that economic forces affect discount rates, the ability of firms to generate cash flows, and future dividend payouts, provided the basis for the belief that a long-term equilibrium existed between Stock trends and macroeconomic variables.

Generally, it can be the case that the relationship between the macroeconomic indicators and the stock exchange are not necessary linear as a correlation analysis may require. To overcome this shortcoming the data was transformed to natural logarithms so that to make the data have homogeneity on all the variables. In inferential statistics, the logarithm of the data in a dataset can be used for parametric statistical testing if the original data do not meet the assumption of normality and linearity.

After the data was transformed to natural logarithms the trend of the relationship between the Nairobi Stock Exchange 20-share index and the macroeconomic indicators was visible, figure 3. The figure shows the plots of the relations between the NSE 20-Share index and the macroeconomic indicators. The claim that there is a relationship between the Stock trends and the macroeconomic indicators can be deduced from the figure

below where the behavior of the NSE 20-Share index and the macroeconomic indicators seem to be correlating.

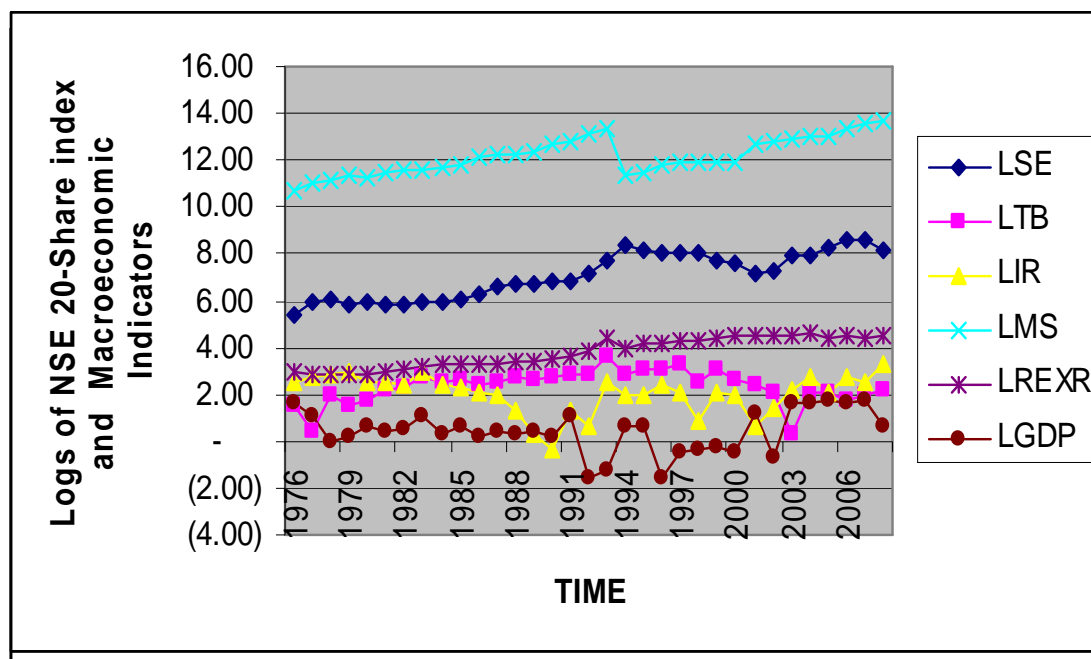


Figure 3: Relationship between the NSE 20-Share index and macroeconomic indicators

On the relationship between the NSE 20-Share index and the macroeconomic indicators, the following hypothesis guided the study:

H_{01} : There is no relationship between the NSE 20-Share index and the macroeconomic indicators.

H_{A1} : There is a relationship between the NSE 20-Share index and the macroeconomic indicators.

Where H_0 means the null hypothesis and H_A means alternative hypothesis.

The p-Value approach to Hypothesis testing was used. The p-values returned to the tests were compared to the significance level (α) which was set at 0.01. The statistical decision rule is; if p-value is greater than or equal to the significance level ($p\text{-value} \geq \alpha$) the Null Hypothesis is not rejected. Else, if the p-value is less than the significance level ($p\text{-value} < \alpha$), the null hypothesis is rejected.

Table 2: Relationship between the NSE 20-Share Index and the macroeconomic indicators with a period time of zero

		LSE	LTB	LIR	LMS	LREXR	LGDP
LSE	Pearson Correlation	1	.227	-.064	.618(**)	.913(**)	-.014
	SSig. (1-tailed)	.	.102	.363	.000	.000	.470

** Correlation is significant at the 0.01 level (1-tailed).

a Listwise N=33

From the above table, the relationship between the Nairobi Stock Exchange 20 share index and inflation rate, treasury bills and the gross domestic product were not significant at 1% being -0.064, 0.227 and 0.014 respectively. The relationship of the NSE 20-share index and money supply was significant at 1% significance level with 0.618 coefficients. At 1%, the Real exchange rate showed the greatest relationship with the NSE 20-Share index at 0.913 coefficients. The highest and significant relationship was between the NSE 20-Share index and real exchange rate. Therefore only the money supply and the real exchange rates had a relationship with the NSE 20-Share index.

The strong, significant positive correlation between the exchange rate and the NSE 20-share index can be interpreted from the perspective that Kenya is an export dependent country. This can be understood from the fact that the biggest foreign exchange earners and wealth creating products are exports such as tea, coffee, horticultural products among others in addition to tourism. These products are sensitive to the exchange value of the currency relative to other currencies. The positive correlation confirms that when the NSE 20-share index rises the currency will depreciate thereby supporting exports. This basically means that the country will have extra incomes that can be put used for investment.

The positive correlation between the NSE 20-share index and money supply can also explained in terms of exports. As the country exports there resultant profits increases money supply in the economy. This implies that there is excess money in the economy which is used now for investment purposes (see Sakwa 1996). However, at present or since the 1990s it can be argued that money supply in Kenya is not only a factor of export earning but also due to the possibilities of individuals' ability to raise funds through the liberalized financial system. This was for example seen during the launch of the Safaricom IPO. This subsequently implies that trade in stocks is well embraced in Kenya where people hope to cash in on dividends from their stocks.

The practicality of establishing this relationship between the NSE 20-Share index and the macroeconomic indicators is that the Kenyan investors behave in a 'herding behavior' where they invest in regard to what other investors are doing instead of examining the economy to make a decision on their investments. This was evident in huge buying Safaricom shares, then followed the decline in the investment of Cooperative bank shares (under-subscription) since most investors suffered loses in the oversubscription of the Safaricom shares, then when the Kengen bond offer came it was again over-subscribed. This means that the investors need to be enlightened on how the economy is performing in order to maximize returns and minimize risks.

4.3 Leading macroeconomic Indicators on the Nairobi Stock Exchange 20-share Index at a Time Period $(s(t) = m(t-n))$

A Leading indicator is an American economic index intended to forecast future economic activity. The procedure for testing statistical causality between Stock trends and the economy is direct "Granger-causality" test (Granger, 1986). Granger causality may have more to do with precedence, or prediction, than with causation in the usual sense. It suggests that while the past can cause/predict the future, the future cannot cause/predict the past. According to Granger, X causes Y if the past values of X can be used to predict Y more accurately than simply using the past values of Y. In other words, if past values of X statistically improve the prediction of Y, then we can conclude that X "Granger-causes" Y.

Islam (2003) also investigated the dynamic interactions between the Kuala Lumpur Stock Exchange (KLSE) composite index, and seven macroeconomic variables (industrial production index, money supply, consumer price index, foreign reserves, credit aggregates and exchange rate). Observing that macroeconomic variables led the Malaysian stock indices, he concluded that Malaysian stock market was informational inefficient. For the leading macroeconomic indicators on the Nairobi Stock Exchange 20-Share Index, the following hypothesis was formulated:

H₀: There are no leading macroeconomic indicators on the trends of the NSE 20-share index.

H_A: There are leading macroeconomic indicators on the trends of the NSE 20-share index.

Where **H₀** means the null hypothesis and **H_A** means alternative hypothesis.

The p-value approach to Hypothesis testing was used. The p-values returned to the tests were compared to the significance level (α) which was set at 0.01. The statistical decision rule is; if p-value is greater than or equal to the significance level ($p\text{-value} \geq \alpha$) the Null Hypothesis is NOT rejected. Else, if the p-value is less than the significance level ($p\text{-value} \leq \alpha$), the Null Hypothesis is rejected.

4.4 Leading Macroeconomic Indicators on the Nairobi Stock Exchange 20-Share Index at Different Time Periods

Table 3: Leading macroeconomic indicators on the Nairobi Stock Exchange 20-share index at time period one ($S_{(t)} = M_{(t-1)}$)

		LSE	LTB	LIR	LMS	LREXR	LGDP
LSE	Pearson Correlation	1	.226	-.114	.579(**)	.910(**)	.002
Listwise N=32	S Sig. (1-tailed).	.107	.268	.000	.000	.495	.072

Table 4: Leading macroeconomic indicators on the Nairobi Stock Exchange 20-share index at time period two ($S_{(t)} = M_{(t-2)}$)

		LSE	LTB	LIR	LMS	LREXR	LGDP
LSE	Pearson Correlation	1	.728(**)	-.736(**)	.812(**)	.819(**)	-.491(**)
Listwise N=30	Sig. (1-tailed)	.	.007	.000	.000	.000	.072

Table 5: Leading macroeconomic indicators on the Nairobi Stock Exchange 20-share index at time period three ($S_{(t)} = M_{(t-3)}$)

		LSE	LTB	LIR	LMS	LREXR	LGDP
LSE	Pearson Correlation	1	.728(**)	-.736(**)	.812(**)	.819(**)	-.491(**)
A Listwise N=30	S Sig. (1-tailed)	.	.000	.000	.000	.000	.003

** Correlation is significant at the 0.01 level (1-tailed).

At time period (t-1) One (Table 3), the relationship between the Nairobi Stock Exchange 20 share index and treasury bills, inflation rate, and the gross domestic product at 1% were not significant. The relationship between the NSE 20-Share index with money supply and Inflation rate with correlation coefficient of 0.579 and -0.114 were significant respectively. These two can be considered leading macroeconomic indicator for the NSE 20-share index although for inflation with a very low correlation coefficient it can be considered a weak leading indicator.

At time period (t-2) two (Table 4), the relationship between the Nairobi Stock Exchange Index and the macroeconomic variables were significant at 1%. Since most of the p-values were less than 0.01 i.e. $p < 0.01$, the null hypotheses was rejected and therefore we conclude that there are leading macroeconomic indicators on the NSE 20-share index except for the gross domestic product.

At time period (t-3) Three, (see Table 5 above), the relationship between the Nairobi stock Exchange Index and the macroeconomic variables were significant at 1%. The relationship of the NSE 20-share index with the treasury bills, inflation rate, money supply, real exchange rate and the gross domestic product were significant at 0.728, -0.736, 0.812, 0.819 and -0.491 respectively.

Only two macro economic indicators inflation rate and money supply are significant in all the periods (t-1, t-2 and t-3). Inflation is inversely related to the NSE 20-share index. The implication of this especially at t-1 is that anticipation of good or reduced earnings from exports can be the possible reason for this significant correlation with the NSE 20-share index. Money supply from bank loans although it can be factored into the explanation it may not be of significant amounts as there are limited number of persons who can access this loans. For inflation the correlation is low although it can also be explained by the fact that if the agricultural sector's output is reduced that leads to inflation which in turn reduces the possibility of invest in stocks. From the correlation

coefficient perspective money supply can be a good leading short run indicator although one needs in addition to anticipate which among the sector one should invest the stocks in.

For the periods t-2 all except gross domestic product can be used as leading indicators their trends being positively correlated with the NSE 20-share index. It is the case that for period t-3 all the Macro economic indicators are leading. However, these two period t-2 and t-3 the respective macroeconomic indicators can be considered as leading indicators for long run investment decisions although the gross domestic product may not be a good leading indicator. To be able to do this it calls for application of forecasting techniques before making the decision to invest in stock and which stocks to invest in.

4.5 Lagging Macroeconomic Indicators on the NSE 20-Share index at Time Period (S(t) =M(t-n)

Lagging indicator is an economic indicator that reacts slowly to economic changes. Lagging indicators demonstrate how well an economy has performed in the past few months, giving economists a chance to review their predictions and make better forecasts. Theoretical reasons for why stock trends might predict economic activity include the traditional valuation model of stock trends and the "wealth effect." The traditional valuation model of stock trends suggests that stock trends reflect expectations about the future economy, and can therefore predict the economy. The "wealth effect" contends that Stock trends lead economic activity by actually causing what happens to the economy.

For the lagging macroeconomic indicators on the Nairobi Stock Exchange 20-share index, the following hypothesis was formulated:

H₀: There are no lagging macroeconomic indicators on the trends of the NSE 20-share index.

H_A: There are lagging macroeconomic indicators on the trends of the NSE 20-share index.

Where **H₀** means the null hypothesis and **h_a** means alternative hypothesis.

The p-Value approach to Hypothesis testing was used. The p-values returned to the tests were compared to the significance level (α) which was set at 0.01. The statistical decision rule is; if p-value is greater than or equal to the significance level ($p\text{-value} \geq \alpha$) the null hypothesis is not rejected. Else, if the p-value is less than the significance level ($p\text{-value} < \alpha$), the null hypothesis is rejected.

4.6 Lagging Macroeconomic Indicators on the Nairobi Stock Exchange 20-Share Index at Different Time Periods

Table 6: Lagging Macroeconomic Indicators on the Nairobi Stock Exchange 20-Share index at Time Period Two ($S_{(t)} = M_{(t+1)}$)

		LSE	LTB	LIR	LMS	LREXR	LGDP
LSE	Pearson Correlation	1	.244	-.042	.546(**)	.907(**)	.021
Listwise N=32	S Sig. (1-tailed)	.	0.089	.409	.001	.000	.454

Table 7: Lagging macroeconomic indicators on the Nairobi Stock Exchange 20-Share index at Time Period ($S_{(t)} = M_{(t+2)}$)

		LSE	LTB	LIR	LMS	LREXR	LGDP
LSE	Pearson Correlation	1	.101	-.039	.502(**)	.902(**)	-.029
Listwise N=31	S Sig. (1-tailed)	.	.295	.417	.002	.000	.438

Table 8: Lagging macroeconomic indicators on the Nairobi Stock Exchange 20-Share index at Time Period Three
 $(S_{(t)} = M_{(t+3)})$

		LSE	LTB	LIR	LMS	LREXR	LGDP
LSE	Pearson Correlation	1	.018	-.025	.466(**)	.913(**)	-.048
	S Sig. (1-tailed)	.	.462	.448	.005	.000	.401

** Correlation is significant at the 0.01 level (1-tailed).

At time period (t+1) One (Table 6), the relationship between the Nairobi Stock Exchange 20 share index and treasury bills, inflation rate, and the gross domestic product at 1% level were not significant. The relationship of the NSE 20-share index with money supply and real exchange rate were significant at 1% significance level with 0.579 and 0.907 respectively. These two macro economic variables were the only ones that were significant in the rest of the period (t+2 and t+3), see Tables 7 and 8. Basically they can be considered that they are lagging variables both in the short run (t=0 and t+1) and in the long run (t+2 and t+3).

4.7 Can the Macroeconomic Indicators be used as Clear predictors of the Stock Trends?

From the results and discussions above the overall question can this lead to a better understanding of trends in NSE 20- share index? Can these results be used to guide the invest decision in the Nairobi Stock exchange? And if this is possible are the macroeconomic variables clear predictors of the stock trends? The results above in conjunction with the evidences in Figure 1 and Figure 2 can be summarized in Figure 4.

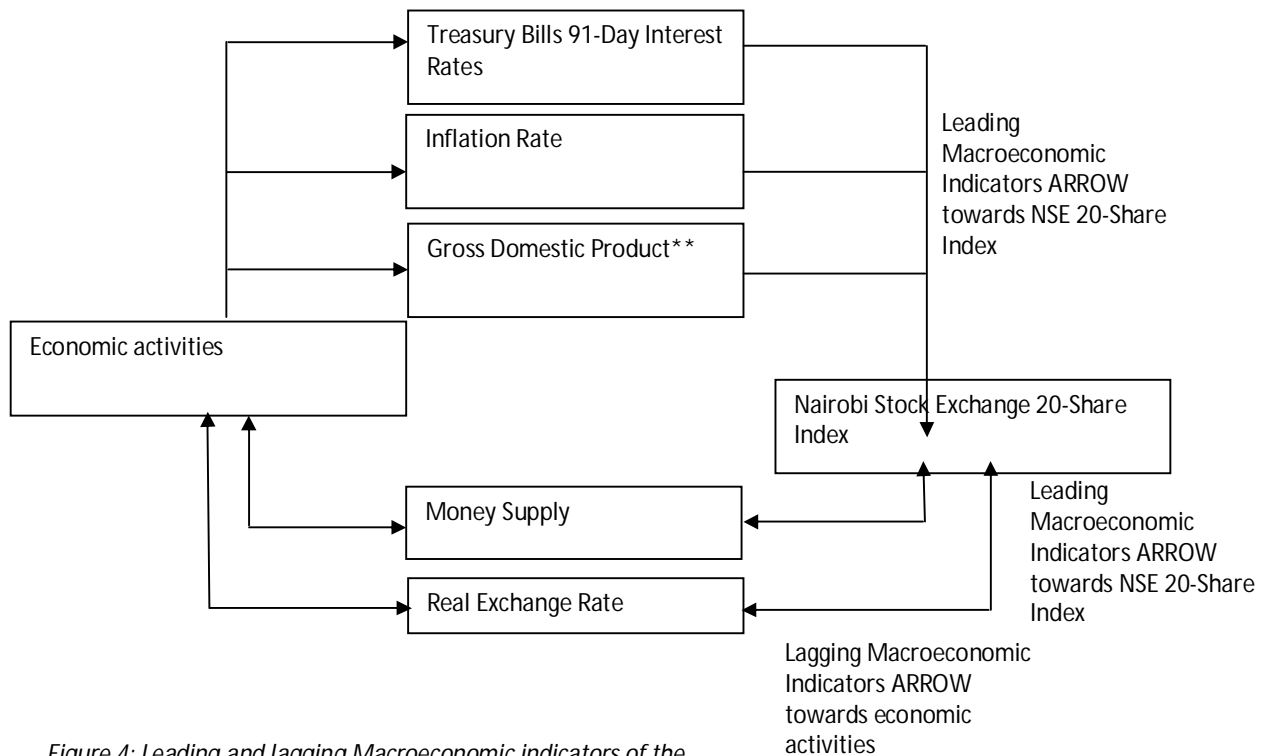


Figure 4: Leading and lagging Macroeconomic indicators of the NSE 20-share index

** it is a weak leading indicator only significant at t-3

The results (as summarised in Figure 4 above) indicated that the clear leading indicators were mainly treasury bills and inflation rate. The gross domestic product was equally leading but because it only became significant at period t-3 it is a weak leading indicator. Therefore one can utilise treasury bills which can be considered as a proxy for interest rates and inflation rate to predict the future trends in the NSE 20-share index. Basically interest rates and inflation rates are competitors for funds that would otherwise be invested in stocks. There is a positive correlation between NSE 20-share index and treasury bills (interest rates). This implies when the interest rates are high the private sector would then prefer to borrow from the general public through issuance of cooperative bonds or the floating of shares. This can imply that shares may be looked at as a more logical and cheaper investment opportunity for the general public as it avoids the high money investments that are required for treasury bills. In addition since banks peg their interests on treasury bills interest rates it implies many business people find it difficult to go on with their own activities and probably prefer the stocks instead as it would be cheaper.

For inflation rate since it is negatively correlated to the NSE 20-share index when it is high it implies investors have limited funds to invest and when low they have some excess to invest. The implication of this can be that inflation in Kenya may be more demand push type rather than the monetary based definition of inflation.

Money supply and exchange rate can be considered to be both leading and lagging. They are therefore not good predictors of NSE 20-share index as they are not unidirectional. Exchange rate on the other hand as discussed above may be a proxy of increasing money supply from exports. On this basis it is therefore logical that the two Macroeconomic variables behaved almost the same way in this correlation analysis. The implication for prediction is that the trends in these two macroeconomic variables can be considered as the proxy of what would be happening in the NSE 20-share index on a week to week or month to month basis.

5.0 Conclusions

On the basis of the overall objective whether the macroeconomic variables can predict NSE 20-share index the results indicates that they can be good predictors. It was noted that treasury bills (interest rates) and inflation rates are clear leading indicators for NSE 20-share index. The other macroeconomic were not clear whether they were leading or lagging.

It was also noted from the results that exchange rate and money supply exhibited both leading and lagging tendencies towards the NSE 20-share index. The conclusion here was that they can be argued to be the proxy for the NSE 20-share index trends that is their behavior parallel those of the share index. This may be particularly true for the exchange rate which has very high correlation with the share index in the leading and the lagging correlations. This is also the case with money supply although correlation is lower in comparison to exchange rate.

6.0 Recommendations for Further Research

On the basis of the conclusion and evidences above it is recommended if such as study could be done using data from the other East African countries so as to understand what forces really correlate with the stock indices of the different countries in the context of economic integration.

Money supply and exchange rate seem to be highly correlated with the NSE 20-share index. The ways in which these two macroeconomic indicators relate with stocks share is important to be clarified. They may provide the basis on which day to day trading in the stock exchange and be understood.

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Appendices

Appendix I: Raw Project Data

Year	NSE 20-Share Index	Treasury Bill 91- DAY	Inflation Rate	Money Supply	Real Exchange Rate	Gross Domestic Product
1976	213.99	4.37	12.55	42,273.30	18.31	5.10
1977	385.60	1.52	15.86	62,065.50	17.95	2.90
1978	431.64	6.80	16.86	70,589.00	17.40	1.00
1979	356.55	4.60	19.02	81,981.10	17.33	1.20
1980	379.12	6.03	12.85	81,040.10	17.57	1.90
1981	355.85	8.56	12.28	91,822.20	20.27	1.50
1982	350.31	9.62	11.48	106,621.30	22.73	1.61
1983	382.23	15.12	18.74	111,826.70	23.76	2.98
1984	386.55	12.50	10.54	126,210.10	25.78	1.40
1985	420.28	14.14	9.64	134,645.20	26.28	1.90
1986	505.30	11.15	8.40	178,427.50	26.04	1.20
1987	729.49	13.00	6.90	198,330.80	26.52	1.60
1988	856.59	15.00	3.56	214,085.30	28.60	1.40
1989	814.95	14.00	1.41	241,765.00	31.60	1.50
1990	895.76	15.93	-0.70	307,468.30	34.08	1.20
1991	959.97	16.77	-3.66	371,631.40	38.07	2.80
1992	1,246.65	16.96	-1.85	496,459.30	46.22	0.20
1993	2,207.11	39.34	12.55	624,142.20	78.16	0.30
1994	4,559.40	17.90	6.90	81,363.00	54.84	1.80
1995	3,468.88	20.90	6.89	96,489.00	65.94	1.90
1996	3,114.11	21.61	10.80	134,240.00	65.02	0.20
1997	3,115.14	26.36	8.30	147,030.00	72.63	0.60
1998	2,962.06	12.56	2.50	152,895.00	71.83	0.70
1999	2,303.18	20.47	8.00	156,060.00	82.93	0.80
2000	1,913.35	13.47	7.50	157,340.00	88.04	0.60
2001	1,355.10	10.81	1.80	322,320.00	88.60	3.20
2002	1,362.85	8.38	4.10	349,856.00	87.07	0.50
2003	2,737.50	1.41	9.30	395,116.00	91.64	5.20
2004	2,945.58	8.04	16.30	427,798.00	100.39	5.30
2005	3,973.00	8.07	7.60	463,920.00	83.17	5.90
2006	5,646.00	5.73	15.60	653,036.00	88.45	5.20
2007	5,444.80	6.87	12.00	777,596.00	82.13	5.60
2008	3,521.20	8.59	27.70	900,351.00	89.57	1.80

Source: Nairobi Stock Exchange (daily market reports), Kenya National Bureau of Statistics (statistical abstracts) and the Central Bank of Kenya (monthly economic reports).

Appendix II: Transformed Raw Data into Natural Logarithms

Variables	Transformation of Variables	Definitions of Transformations
NAIROBI STOCK EXCHANGE 20-SHARE INDEX (NSE)	LSE	Natural logarithm of the index of market value weighted average of year end closing prices for all the shares listed at the Nairobi Stock Exchange
91-DAY TREASURY BILLS (TB)	LTB	Natural logarithm for the year end yields on the Treasury Bills. This measures the interest rates
INFLATION RATE	LIR	Natural logarithm for the year end Inflation Rates
MONEY SUPPLY	LMS	Natural logarithm for the year end Money Supply
REAL EXCHANGE RATES	LREXR	Natural logarithm for the year end Real Exchange Rates of all major currencies as provided by the Central Bureau of Statistics
GROSS DOMESTIC PRODUCT	LGDP	Natural logarithm for the year end Gross Domestic Product