

**THE RELATIONSHIP BETWEEN SELECTED MACROECONOMIC  
VARIABLES AND BOND YIELD: EVIDENCE FROM THE  
NAIROBI SECURITIES EXCHANGE**

**BY**

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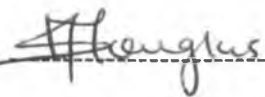
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## DECLARATION

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

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

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## **DEDICATION**

To my Parents, Mr. Richard Nyakeri Marasi and Rebecca Moraa Nyakeri who encouraged, supported and sacrificed all to ensure I got the best education.

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## ABSTRACT

The financial sector plays a crucial role in economic development. A well functioning capital markets increases economic efficiency, investment and growth. Kenya's capital market is described as narrow and shallow. The stock and bond market have been raising less than 1% of growth financing. The vision 2030 development plan targets an annual economic growth rate of 10% with an investment rate of 30% to be financed mainly from mobilization of domestic resources. This has led to significant focus on the capital market with the institutional development of the stock market and introduction of new instruments in the bonds market.

On the other hand, the economic environment is generally unstable and unpredictable. The relationship between macroeconomic variables and capital market development has been a subject of interest to both academicians and practitioners. The price movement of company's securities is dictated by certain fundamentals specific to that organization. However, it is believed that government economic policy and macroeconomic variables such as; interest rates, inflation rates, Gross Domestic Product (GDP), GDP growth rates and exchange rates, that are external to organizations have a significant influence on the movement of security prices.

The study seeks to establish the relationship between bond yield to maturity and selected macroeconomic variables in Kenya for a five year period from January 2007 to December, 2011. The study uses bond yield to maturity as a measure of bonds performance. On the other hand, inflation rates, exchange rates, GDP growth rates and interest rates are the selected macroeconomic variables for the study. The relationship between bond yields to maturity and the selected macro economic variables are analyzed using the multiple regression models.

Data for the study was obtained from: NSE quarterly reports, Central bank of Kenya reports and publications, annual economic survey reports. It is evident from the literature reviews that macroeconomic variables have a significant influence on the performance of bonds. The finding of the study indicates that macroeconomic variables do not a have a significant influence on performance of bonds. However, policy makers should develop

and implement prudent macroeconomic policies that will promote development of the capital market in Kenya particularly the bonds market.

# TABLE OF CONTENTS

DECLARATION.....	ii
DEDICATION.....	iii
ACKNOWLEDGEMENTS.....	iv
ABSTRACT.....	v-vi
TABLE OF CONTENTS.....	vii-viii
LIST OF TABLES.....	ix
LIST OF ABBREVIATIONS .....	x
<b>CHAPTER ONE: INTRODUCTION.....</b>	<b>1</b>
1.1 Background of the Study.....	1-5
1.2 Problem Statement.....	5-6
1.3 Objectives of the Study.....	7
1.4 Significance of the Study.....	7-8
<b>CHAPTER TWO: LITRATURE REVIEW.....</b>	<b>9</b>
2.1 Introduction.....	9
2.2 Theoretical Review.....	9-13
2.3 Capital Market Development in Kenya.....	13
2.4 Development of Bonds Market in Kenya.....	14
2.5 Selected Macroeconomic Variables.....	14-16
2.6 Empirical Studies.....	16-19
2.7 Conclusion.....	20

<b>CHAPTER THREE: RESEARCH METHODOLOGY.....</b>	<b>21</b>
3.1 Introduction.....	21
3.2 Research Design.....	21
3.3 Study Population .....	21
3.4 Data Collection and Sources.....	22
3.5 Data Analysis and Model.....	22-23
<b>CHAPTER FOUR: DATA ANALYSIS AND PRESENTATION.....</b>	<b>24</b>
Introduction.....	24
Data Presentation.....	24-34
Summary and Findings.....	34-39
<b>CHAPTER FIVE: SUMMARY, CONCLUSIONS AND DISCUSSIONS.....</b>	<b>40</b>
Summary .....	40
Conclusions.....	41
Recommendations.....	41
Limitations of Study .....	42
Suggestions for Further Studies.....	42-43
References.....	44-47
<b>APPENDICES</b>	
I	Study Population
II	Independent Variables Values
III	Dependent Variable Values
IV	Market Price of Bonds



## LIST OF TABLES

TABLE A	Summary Statistics
B	Correlation Matrix
C	Variance Inflation Factor
D	Ramsey-Reset Test
E	Shapiro- Wilk Normality Test
F	White's General Heteroscedasticity Test
G	Breusch Godfrey Test
H	Co-intergration Results
I	Link Test
J	Regression Results

## **List of Abbreviations**

CBK - Central Bank of Kenya

CDSC - Central Depository and Settlement Corporation

CMA- Capital Markets Authority

CPI -Consumer Price Index

DFI- Development Financial Institutions

EADB - East African Development Bank

GDP - Gross Domestic Product

GNP - Gross National Product

GOK - Government of Kenya

ICF- Investor Compensation Fund

IFC- International Finance Corporation

IRR- Internal Rate of Return

KLSE - Kuala Lumpur Stock Exchange

KNBS – Kenya National Bureau of Statistics

MEV – Macro Economic Variables

NSE - Nairobi Securities Exchange

OLS- Ordinary Least Square

USD- United States Dollar

VECM - Vector Error Correlation Model

YTM - Yield to Maturity

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background to Study

The relationship between macroeconomic variables and capital market development has been a subject of interest to both academicians and practitioners in equal measure. It is argued that the price movement of company's securities is dictated by certain fundamentals specific to that organization. However, it is believed that government economic policy and macroeconomic variables such as; interest rates, inflation rates, Gross Domestic Product (GDP), GDP growth rates and exchange rates, that are external to organizations have a significant influence on the stock movements. Evidence from the financial press indicates that investors generally believe that monetary policy and macroeconomic events have bigger influence on the volatility of security performance indicators. This implies that macroeconomic variables can influence investor's investment decision and motivates many researchers to investigate relationship between asset returns and macroeconomic variables. Gan et al. (2006).

#### 1.1.1 Macroeconomic Variables

Macroeconomics, Microeconomics and Econometrics are identified as the main branches in the field of economics. In the recent years, increased attention has been given to the area of macroeconomics. Macroeconomics, describes relationships among aggregates and averages of entire economy, such as national income, output, employment, consumption, savings, investment and the overall price level. The field is conventionally divided into the study of national economic growth in the long run, the analysis of short-run departures from equilibrium, and the formulation of policies to stabilize the national economy, that is, to minimize fluctuations in growth and prices. Those policies can include spending and taxing actions by the government or monetary policy, K. Dewett, (1984). Macroeconomic factors are having a growing influence on the securities market. Many investors have become more concerned with overall trends than with individual

company fundamentals, Chernoff, (1989). Even stock market liquidity in the future will be significantly affected by the demand of macro investors who buy and sell diversified portfolios, Gammill, (1989). Although no satisfactory theory argues that the relation between financial markets and the macro economy is entirely in one direction, security prices are usually considered as responding to external forces, Chen and Roll, (1986). Chen, Roll and Ross (1986) identifies the following macroeconomic variables as those that systematically affect asset returns: exchange rates, spread between long and short term interest rates; expected and unexpected inflation; industrial production growth and spread between high and low- grade bonds. Industrial production growth is suggested to proxy for real cash flows, inflation affects returns as nominal cash flow growth rates are not equivalent to expected inflation rates, whilst spread between long and short term interest rates and the high or low grade bond spread affect the choice of discount rate. Inflation, GDP growth rate, exchange rates and interest rates are the selected macroeconomic variables for the study.

### **1.1.2 Bond Yield**

Investment in bonds has become more attractive than stock, Mukherjee and Atsuyuki, (1996). According to Barnes (2009), benefits that accrue to bond investors include: a predictable stream of incomes from regular interest earnings, bonds offer an opportunity to investors to spread their risk, bonds provide profits to investors from capital gains and bonds also provide tax advantages to investors particularly those issued by the central governments. According to Eugene F. B et al, (1999), bond investors expect: periodic coupon payment, capital gains and income from reinvestment of interim cash flows (coupon and/or principal payments received prior to maturity) as a return from investing in bonds. Yield to Maturity (YTM), Current yield (CY), Nominal Yield (NY) and Yield to Call (YTC) are considered as major measures of performance of bonds. Eugene F. B et al, (1999), notes that, the bonds Yield to Maturity (YTM) - interest earned on investment if bond is held to maturity, is the most important interest rate generally discussed by investors. The YTM is generally the same as the market rate of interest. This measure has the following strengths: it considers coupon income, capital income, and the timing of cash flows, it also considers reinvestment income in that it assumes that

interim cash flows will be reinvested at the yield to maturity. Practically speaking however, the measures assumption that the bond's interim cash flows will be successfully invested at a rate equal to the YTM is never guaranteed. The formula for bond yield computation utilizes current market price, interest charges and maturity values. The study will adopt the YTM as a measure of the performance of bonds in relation to the selected macroeconomic variables, that is, inflation, GDP growth rates, exchange rates, and interest rates.

### **1.1.3 Relationship Between Macroeconomic Variables and Bond Yield**

Both stocks and bonds are investment alternatives that compete for the investor's funds and the funds flow from one market to another due to a change in market situation and macroeconomic factors. As the bond rate increases, the stock prices would decrease as the investors perceive the bond investment more attractive than stock, Mukherjee and Atsuyuki, (1996). The dynamic relationships between macroeconomic variables and share returns have been widely discussed and debated. The basis of these studies has been the use of models which state that securities prices can be written as expected discounted cash flow. Thus, the determinants of securities prices are the required rate of return and expected cash flows, Elton and Gruber, (1991). Economic variables which impact future cash flows and required returns can therefore be expected to influence share prices.

Fama and Gibbon, (1982), examined the relationship between inflation, real returns and capital investment. Their findings indicated that expected real returns on bills and expected inflation rates are negatively correlated. The authors suggest that this relationship arises with share returns due to a positive relationship between expected real returns on financial assets and real activity. Darrat A.F, (1990) examined the effects of monetary and fiscal policy on share returns in the Canadian share market and concludes that budget deficits, long-term bond rates, interest rate volatility and industrial production determine share returns. French et al, (1987) documented theoretically, that stock returns responded negatively to both the long term and short term interest rates. However, Allen and Jagtianti, (1997) pointed out that the interest rate sensitivity to stock returns has decreased dramatically since the late 80's and the early 90's because of the invention of

interest rate derivative contracts used for hedging purposes. When the domestic currency depreciates against foreign currencies, export product prices will decrease and, consequently, the volume of the country's exports will increase, assuming that the demand for this product is elastic, Mukherjee and Naka, (1995).

#### 1.1.4 Nairobi Securities Exchange

The securities market is the focus of economists and policy makers because of its perceived benefits to the economy. It is deemed to be the fulcrum for capital market activities and often it is cited as barometer of business direction. An active securities market may be relied upon to measure changes in general activity using security indices Obadan, (1998). In a modern economy, economic growth hinges on an efficient securities market sector that pools domestic savings and mobilizes private and foreign capital for productive investments while providing investors with adequate liquidity and risk diversification alternatives, Barnes (2009).

In Kenya, the Nairobi Securities Exchange (NSE) is the only body that performs the functions of the Stock market. The key role of the NSE is promotion of and enhancement of the culture of thrift and savings. It provides alternative avenues for investment and assists in the transfer of these savings to investment in productive enterprises and quoted stocks. Indeed, Demirguc- Kent and Levine, (1996) point out that mobilization and allocation of resources for national development has long been central focus of development economists. The NSE also promotes higher standards of accounting, resource management and transparency in the management of business through the agency arrangements. Without doubt, the ability of to effect changes in the management of listed companies is expected to ensure that managerial resources are used efficiently Kumar, (1984). The NSE is one of the most important avenues for both new and growing companies to raise capital at lower cost and also for the government to divest from public corporations through privatization. This in turn allows greater growth and increase in supply of assets available for long term investment.

It is on the bases of the perceived benefits of the NSE to the economy of Kenya that the Government of Kenya (GOK), the capital market authority (CMA) and the Central Bank of Kenya (CBK) have over the years played a principal role in developing and strengthening the NSE to enable it take up these various roles and functions. Measures taken include enactment of legislation, rules, policies, guidelines, adjustments in macroeconomic variables such as taxation, interest rates, exchange rates and working towards managing inflation in the economy, setting up institutions such as Central Depository and Settlement Corporation( CDSC) and investor compensation fund (ICF) among others. The government has also set out to privatize various state corporations with a view to make the NSE more liquid through the provision of alternative investment opportunities and also divest from business and instead concentrate more on provision of public services (Country Fact Sheet- Privatization in Kenya- by MIGA and Africa Region of World Bank- August 2001 and parastatal reform Programme).

## **1.2 Statement of Problem**

Long term capital is deemed crucial for economic development as evidenced by the positive relationship between long term capital and economic growth, Demirguc- Kunt and Levine, (1996). Barnes, (2009) notes that all companies need capital and the challenge that managers face is finding innovative ways to fund their projects at lower costs. In the recent past, the financial sector in Kenya has experienced development with the strengthening of regulatory systems, rejuvenated trading systems and structural and policy reforms. Despite these initiatives, the stock market is still shallow, narrow and thin. The bonds market that is seen to play a crucial role in promoting partnership in development process between government and private sector is also in its infancy stage attracting more of government bonds. Successful development of bonds market requires a developed money market, favorable macroeconomic policies, significant market participation, appropriate trading system and sound legal and regulatory framework, Ngugi, R.W (2003).

The economic climate is major factor in determining the trend in the bonds market. Macroeconomic stability plays a crucial role in economic development of a country.

Macroeconomic variables such as: interest rates, inflation rates, GDP, GDP growth rates and exchange rates affect either positively or negatively the bonds market. High rates of inflation increase the cost of living with the resultant effect of shifting resources from securities to consumption. High interest rates tend to shift resources from consumption to investment. A stable and predictable exchange rate builds confidence in investors and thus promotes investment in Securities. High GDP growth rates imply increased economic activity inspires confidence in investors which in turn promote investment in stocks and bonds, Ngugi, R.W (2003). The selected macroeconomic variables for study are; inflation, GDP growth rate, exchange rates and interest rates. Quarterly mean/average rates of these variables will be used. The United States Dollar will be used as measure of volatility of exchange rate against the Kenya Shilling.

A vast number of studies have been conducted to in an attempt to explain the relationship between macroeconomic variables and securities market performance. However, no clear or definite answers have obtained. Studies conducted by: Carlstom (2002) and Wongbangpo and Sharma (2002) indicates that the relationship between macroeconomic variables and stock market in not clear. Studies by Krereboah- Coleman and Agriye-Tetty (2008), Gan et al (2006) Murheje and Naka (1995), Chong and Koh, (2003) Ibrahim, (1999), Leigh (1997) and Islam (2003) provide evidence of existence of a bidirectional causality relationship between various macroeconomic indicators such as money supply, exchange rates, stock market fluctuations, inflation, interest rates and Gross National Product ( GNP). Other researchers like: Verma and Ozunab (2005), Harvey (2000), Shiller, (2000) have noted that stock movements are a result of speculation or irrational behavior of investors. And as such, stock price movements cannot be related to macroeconomic variables both in developed and developing markets.

Inspite of all these alternative studies, it is clear, many of the studies in respect of NSE and the economy have concentrated much on equity as opposed to bonds. The study therefore seeks contribute to debate by examining relationship between the state of economy and bond yield at the NSE.



### **1.3.1 Main Objective**

The objective of the study is to investigate the relationship between yields of bonds traded at NSE and; inflation, interest rates, exchange rates, and GDP growth rates for five year period from January 2007 to December, 2011.

### **1.3.2 Specific Objectives**

The specific objectives of the study are:

- (i) Establish the nature of the relationship between bond yields and: inflation, exchange rates, GDP growth rate and interest rates
- (ii) Determine the extent of the relationship between bond yields and: inflation, exchange rates, GDP growth rate and interest rates

### **1.3.3 Research Hypothesis**

H<sub>01</sub>: Inflation, exchange rates, GDP growth rates and interest rates have no effect on bond yields

H<sub>02</sub>: Inflation, exchange rates, GDP growth rates and interest rates have no correlation with bond yield

## **1.4 Significance of Study**

The findings of this study will be of interest to the following parties;

Managers - The management of firms are responsible for deploying capital to maximize shareholders wealth. This study will benefit them by providing information on how changes in macroeconomic variables will affect their financing decisions.

Owners of firms- Owners of firms are interested in maximizing their wealth would benefit immensely by gaining an understanding how changes in micro economic variables can influence their noble objective.

Prospective investors- Investment decisions are affected by changes in the macro economy and therefore this study would significantly shed some leading lights on the part of the prospective on investment opportunities and influence of macroeconomic variables on investment decisions.

Government of Kenya- The study findings will be useful to the Government in order to formulate timely and appropriate regulatory framework and policies for the sector.

Scholars and academicians- Scholars and academicians may also use the findings of this study as a basis for further research in this area and other related areas.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Introduction

This chapter will review the previous theoretical and empirical literature on the role of the capital market performance a barometer of the state of the economy: highlight the linkage between the various variables that affect the performance of the capital markets and consequently, the state of the economy. Theories of expectation, Liquidity and segmented market of interest rates together with demand pull, cost push and structural inflation theory of inflation are discussed. The chapter also, highlights selected macroeconomic variables reviews related studies on NSE and other emerging markets.

#### 2.2 A Review of Theories

##### 2.2.1 The Expectation Theory

The key assumption behind this theory is that buyers of bonds do not prefer bonds of one maturity over another, so they will not hold any quantity of a bond if its expected return is less than that of another bond with a different maturity. The only thing that makes long term bonds different from the short term bonds is the inflation and interest rate risks. The expectations theory supports the upward sloping yield curve since investors always expect the short term rates to increase in future. This implies that the long term rates will be higher than the short term rates. But in the present value terms, the return from investing in a long-term security will equal to return from investing in a series of short term security. The theory implies that given their investment horizon, investors will earn the same average expected returns on all maturity combinations. Hence a firm will not be able to lower its interest cost in the long run by the maturity structure of debt. However, this theory does not explain the reason for this behavior, I.M. Pandey (2004).

### **2.2.2 The Liquidity Premium Theory**

The liquidity premium theory provides explanation for the investors' expectations. Prices of long term bonds are more sensitive than prices of short term bonds to changes in market rates of interest. Hence investors prefer short term bonds to long term bonds. The investors will be compensated for this risk by offering higher return on long term bonds. This extra return which is called liquidity premium, gives the yield curve an upward bias. However, the yield curve could still be inverted if the declining expectations and other factors have more effect than the liquidity premium. The liquidity premium theory means that the rates on long term bonds will be higher than on short term bonds. From the firms point of view, the liquidity premium theory suggest that as the cost of short term debt is less, the firm could minimize the cost of its borrowing by continuously refinancing in short term debt. , I.M. Pandey (2004).

### **2.2.3 The Segmented Markets Theory**

The segmented markets theory assumes that the debt market is divided into several segments based on the maturity of debt. In each segment, the yield of debt depends on the demand and supply. Investor's preferences of each segment arise because they want to match the maturities of the assets and liabilities to reduce the susceptibility to interest rate changes. For instance, the liabilities of pension funds are long term and they would like to ensure they have sufficient funds to service these liabilities. Therefore, they will invest their funds in long term maturity investments to ensure certainty of returns. On the other hand, the deposits of commercial banks are mostly short term in nature. Hence they match their liabilities by lending for short term or investing in short term securities.

The segmented markets theory approach assumes investors do not shift from one maturity to another in their borrowing – lending activities and therefore, the shift in yields are caused by changes in demand and supply for bonds of different maturities. Overall, it implies that investors strongly prefer to invest in assets with maturities matching their

liabilities, and borrowers prefer to issue liabilities that match the maturity of their assets. , I.M. Pandey (2004).

### **2.2.4 Demand Pull Theory**

John Maynard Keynes (1883-1946) and his followers emphasized the increase in aggregate demand as the source of demand-pull inflation. The aggregate demand comprises consumption, investment and government expenditure. When the value of aggregate demand exceeds the value of aggregate supply at the full employment level, the inflationary gap arises. The larger the gap between aggregate demand and aggregate supply, the more rapid is the inflation. Keynesian (Keynes and his followers) do not deny this fact that even before reaching full employment production factors and various appearing constraint can cause increase in public price. This inflation constraint that appears quickly during prosperity is originally resulting from non proportioned section, branches and or various economic resources that are accounted from natural properties of discipline based on market. Therefore, in one period of prosperity it is completely natural. According to demand-pull inflation theory of Keynes, policy that causes decrease in each component of total demand is effective in reduction of pressure demand and inflation. One of the reductions in government expenditure is tax increase and to control volume of money alone or together, can be effective in reducing effective demand and inflation control. In difficult conditions, e.g. hyperinflation during war that control of volume of money or decrease in general expenditure may not be practical increase in tax can get along with direct action for control on demand, T.M. Humphrey, (1998).

### **2.2.5 Cost Push Theory**

Cost-push inflation is caused by wage increases enforced by unions and profit increases by employers. The type of inflation has not been a new phenomenon and was found even during the medieval period. But it was reviewed in the 1950s and again in the 1970s as the principal cause of inflation. It also came to be known as “New Inflation”. The basic cause of Cost-Push inflation is the rise in money wages more rapidly than the productivity of labor. The labor unions press employers to grant wage increases

considerably, thereby raising the cost of production of commodities. Employers in turn, raise prices of their products. Higher wages enable workers to buy as much as before, in spite of higher prices. On the other hand, the increase in prices induces unions to demand still higher wages. In this way, the wage-cost spiral countries, thereby, leading to cost-push or wage-push inflation. Cost-push inflation may be further aggravated by upward adjustment of wages to compensate for rise in cost of living. A few sectors of the economy may be affected by increase in money wages and prices of their products may be rising. In many cases, their products are used as inputs for the production of commodities in other sectors. As a result, cost of production of other sectors will rise and thereby push up the prices of their products. Thus wage-push inflation in a few sectors of the economy may soon lead to inflationary rise in prices in the entire economy. Further, an increase in the price of imported raw materials may lead to cost-push inflation. Another cause of Cost-Push inflation is profit-push inflation. Oligopolist and monopolist firms raise the price of their products to offset the rise in labor and cost of production to earn higher profits. There being imperfect competition in the case of such firms, they are able to administered price of their products. Profit-push inflation is therefore called administered-price inflation or price-push inflation, T.M. Humphrey, (1998).

### **2.2.6 Structural Inflation Theory**

Structural inflation is related to the effect of structural factors on inflation. Structural analysis attempts to recognize how economic phenomena and finding the root of the permanent disease and destruction such as inflation that evaluates lawful relationship between the phenomena. In the economic structural factor causes, supply increase related to demand-push, even if abundant unemployment production factor is impossible or slow. Therefore, reasoning of less developed countries, till the time not successful to change in the form of lagging behind structure or not to make attempt for immediate self-economic growth or should compromise with the inflation that is very severe sometimes.

This inflation, giving the structural improvement, results as a cost in fact that is given for immediate economic growth. Structuralism, even the group that does not fine necessary for changing the present policy foundation for eradicating inflation, with the control of

inflation through government intervention in the market structure and also, by adopting decisive plans for justly division of inflation pressure there is no opposition and in fact stress is done on these arrangement. But, common anti inflation measures especially contraction monetary and budget policy from their point of view, is nothing but only a prescription for stopping the economic growth of non-developing countries, that also through experts that or rationing developed investment countries and world organization under their supremacy (rule) and or by understanding less developed economy features are disabled (crippled). Rapid and faster growth of the service sector that is related to population growth and immigration is another inflationary factor, which is more emphasized by the structuralism. Remaining structure of distribution network, exclusive quasi and structure some of the developed industry, obstacle structure and heavy cost of works and ten's of other small and big factors additionally to all these structuralism from the aspect of inflationary social policy structure is unaware. It should be noticed that level competition and various society crust for large possession share from National income is one of the main factors of the hidden inflation in the developed investment countries. Structuralism type from this competition in hyperinflation of less developed countries is effective. Competition specially intensifies in condition of fast economic growth and increase social movement. New social group open its way to political grounds and economic activity and with resorting to inflation, attempt is made to strengthen the power and change distribution of income. From this viewpoint, inflation is manifestation change of economic and society is chosen from the fast dynamic growth of economy, P. Beckerman, (1992).

### **2.3 Capital Market Development in Kenya**

The capital market in Kenya is made up of stock market, bonds, development financial institutions, and pension funds. While the stock market has been in existence since 1920s, it failed to pick the growth momentum and currently, the market has just about 50 listed firms which are less than what the country inherited at independence. The bonds market is in its infancy stage almost getting to its youthful stage. Development Financial Institutions (DFIs) have faced various problems from managerial to financial making it difficult for them to perform their initially desired role. A study by IFC and CBK in 1984

study recommended the need to develop capital markets in order to facilitate mobilization of long term capital. In Sessional Paper No. 1 1986 the government indicated its commitment in facilitating growth of the capital market and this saw the kick-off of the capital market reform in late 1980s which saw institutional and policy reforms.

## **2.4 Development of Bonds Market in Kenya**

Corporate bonds<sup>1</sup> were introduced into the market on November 22 1996 when the EADB bond was issued at a price of 99% raising Kshs 600 Million. The bond was traded in denominations of Kshs 1 Million with an interest of 1.2 % points above the prevailing 91-day Treasury bill rate. Further the EADB launched a Kshs 2 billion medium term note, which was listed on the NSE Fixed Income securities market segment on 2nd May 2001, which was viewed as a break from the long-term debt instruments. Proceeds from the issue were intended for mobilization and lending in local currencies and for the development of a sustainable tool for alleviating the exchange risk associated with long and medium term borrowing in foreign currencies. The Shelter Afrique made a medium term note of Kshs 350M to be issued in three tranches, the first issued on the 8th December 2000, through a private placement to institutional investors. Proceeds from the sale were used for housing development in Kenya. The first locally controlled firm to offer bond was Safaricom whose proceeds were to be used to expand Safaricom and network coverage and capacity aiming to improve both the availability and reliability of their networks.

## **2.5 Macroeconomic Variables**

Selected macroeconomic variables for the study, that is, GDP growth rate, inflation, exchange rates and interest rates are highlighted below.

### **2.5.1 GDP Growth Rate**

GDP growth rate is the speed at which the economy/ market size of the country is growing. GDP growth rate is the overall phenomenon explaining the entire economy and it is used by investors to study suitability of economic environment in terms of



market size and returns. A positive GDP growth rate indicates a growing economy and bigger market size and may signal high investment returns and consequently attract more investment in all sectors of the economy including the capital and stock markets. When the GDP is positive, the overall stock market reacts positively as there will be a boost in investors' confidence encouraging them to invest in the stock market. On the other hand, a negative trend in GDP causes consumers to trade cautiously and reduces their spending. This will in turn negatively affect the performance of companies, thus exerting more downward pressure on the capital market, Leon et al, (2008).

### **2.5.2 Rate of Inflation**

Economic survey of Kenya (2002) describes inflation as a sustained rise in money prices generally. The consumer price index (CPI) is the main measure of the rate of inflation. It is a macro- economic indicator for general economic and social analysis and it is a tool used in wage and negotiation. High inflation rates increase the cost of living and a shift of resources from investment to consumption. This leads to a fall in the demand for market instruments. This subsequently reduces the volume of securities traded in the market. Inflation is therefore expected to have a negative impact on the stock index and performance of stock exchange, Mayasami et al, (2000).

### **2.5.3 Exchange Rate**

Exchange rate (also known as foreign exchange rate, forex rate or FX rate) measures the worth of one currency against another. It is the value of a foreign nation's currency in terms of the home nation's currency.

### **2.5.4 Interest Rates**

Interest rates generally refer to the cost of borrowing. Interest rates have been long recognized as important for the economy because during periods of stable interest rates encourage both local and foreign investment. Interest rates are expected to

moderate and cool down inflation, they are not supposed to compromise the secondary trading of government securities. An increase in interest rates will increase the opportunity cost of holding money and investors substitute holding interest bearing securities for share hence falling of stock prices, Mayasami et al, (2000).

### **2.5.5 Gross Domestic Product**

The Gross Domestic Product (GDP) is commonly defined as the total market value of all finished goods and services produced in a county in a given year. GDP is measured regularly and consistently in almost all countries of the world to allow a direct comparison of the standard of living in individual countries. The frequent measuring also makes it possible to quickly recognize changing trends. When GDP is calculated in relation to population of a country, it provides the average GDP per capita. This is often used as an indicator of country's standard of living, Leon et al, (2008).

## **2.6 Empirical Studies**

Emerging stock markets have been identified as being at least partially segmented from global capital markets. As a consequence, it has been argued that local risk factors rather than world risk factors are the primary source of equity return variation in these markets. Accordingly, Bilson, Brailsford, and Hooper (1999) aimed to address the question of whether macroeconomic variables may proxy for local risk sources. They found moderate evidence to support this hypothesis. Further, they investigated the degree of commonality in exposures across emerging stock market returns using a principal components approach, and found little evidence of commonality when emerging markets are considered collectively. At the regional level, however, considerable commonality was shown to exist. Maysami and Sims (2002, 2001) employed the Error-Correction Modelling technique to examine the relationship between macroeconomic variables and stock returns in Hong Kong and Singapore (Maysami and Sim, 2002), Malaysia and Thailand (Maysami and Sim 2001), and Japan and Korea (Maysami and Sim 2001).

Through the employment of Hendry's (1986) approach which allows making inferences to the short-run relationship between macroeconomic variables as well as the long-run adjustment to equilibrium, they analyzed the influence of interest rate, inflation, money supply, exchange rate and real activity, along with a dummy variable to capture the impact of the 1997 Asian financial crisis. The results confirmed the influence of macroeconomic variables on the stock market indices in each of the six countries under study, though the type and magnitude of the associations differed depending on the country's financial structure.

Islam (2003) replicated the above studies to examine the short-run dynamic adjustment and the long-run equilibrium relationships between four macroeconomic variables (interest rate, inflation rate, exchange rate, and the industrial productivity) and the Kuala Lumpur Stock Exchange (KLSE) Composite Index. His conclusions were similar: there existed statistically significant short-run (dynamic) and long-run (equilibrium) relationships among the macroeconomic variables and the KLSE stock returns. Ibrahim (1999) also investigated the dynamic interactions between the KLSE stock indices. Observing that macroeconomic variables led the Malaysian stock indices, he concluded that Malaysian stock market was informational inefficient. Chong and Koh's (2003) results were similar: they showed that stock prices, economic activities, real interest rates and real money balances in Malaysia were linked in the long run both in the pre- and post capital control sub periods.

Mukherjee and Naka (1995) applied Johansen's (1998) VECM to analyze the relationship between the Japanese Stock Market and exchange rate, inflation, money supply, real economic activity, long-term government bond rate, and call money rate. They concluded that a cointegrating relation indeed existed and that stock prices contributed to this relation. Maysami and Koh (2000) examined such relationships in Singapore. They found that inflation, money supply growth, changes in short- and long-term interest rate and variations in exchange rate formed a co integrating relation with changes in Singapore's stock market levels. Islam and Watanapalachaikul (2003) showed a strong, significant long-run relationship between stock prices and macroeconomic factors (interest rate,

bonds price, foreign exchange rate, price earnings ratio, market capitalization, and consumer price index) during 1992-2001 in Thailand.

Hassan (2003) employed Johansen's (1988, 1991,1992) and Johansen and Juselius' (1990) multivariate cointegration techniques to test for the existence of long-term relationships between share prices in the Persian Gulf region. Using a vector-error-correction model, he also investigated the short-term dynamics of prices by testing for the existence and direction of inter temporal Granger-causality. The analysis of weekly price indices in Kuwait, Bahrain, and Oman stock markets showed that: (1) share prices were cointegrated with one cointegrating vector and two common stochastic trends driving the series, which indicates the existence of a stable, long-term equilibrium relationship between them; and (2) prices were not affected by short-term changes but were moving along the trend values of each other. Therefore, information on the price levels would be helpful for predicting their changes.

Omran (2003) focused on examining the impact of real interest rates as a key factor in the performance of the Egyptian stock market, both in terms of market activity and liquidity. The cointegration analysis through error correction mechanisms (ECM) indicated significant long-run and short-run relationships between the variables, implying that real interest rates had an impact upon stock market performance. Vuyyuri (2005) investigated the cointegrating relationship and the causality between the financial and the real sectors of the Indian economy using monthly observations from 1992 through December 2002. The financial variables used were interest rates, inflation rate, exchange rate, stock return, and real sector was proxied by industrial productivity. Johansen (1988) multivariate cointegration test supported the long-run equilibrium relationship between the financial sector and the real sector, and the Granger test showed unidirectional Granger causality between the financial sector and real sector of the economy.

Maghyereh (2002) investigated the long-run relationship between the Jordanian stock prices and selected macroeconomic variables, again by using Johansen's (1988) cointegration analysis and monthly time series data for the period from January 1987 to December 2000. The study showed that macroeconomic variables were reflected in stock

prices in the Jordanian capital market. Gunasekarage, Pisedtasalasai and Power (2004) examined the influence of macroeconomic variables on stock market equity values in Sri Lanka, using the Colombo All Share price index to represent the stock market and (1) the money supply, (2) the treasury bill rate (as a measure of interest rates), (3) the consumer price index (as a measure of inflation), and (4) the exchange rate as macroeconomic variables. With monthly data for the 17-year period from January 1985 to December 2001 and employing the usual battery of tests, which included unit roots, cointegration, and VECM, they examined both long-run and short-run relationships between the stock market index and the economic variables. The VECM analysis provided support for the argument that the lagged values of macroeconomic variables such as the consumer price index, the money supply and the Treasury bill rate have a significant influence on the stock market.

Nyamute (1998) examined the relationship between share prices and major macroeconomic variables in Kenya for period of six years from (January 1992 to December 1997). The study analyzed whether or not five macro economic factors affect the performance of NSE which included; money supply, interest rates, inflation rates and exchange rates. The study used regression analysis and conducted eight tests, where all variables were found to have an impact on the performance of the stock exchange( as measured by stock index) However, the treasury bill rate and exchange rate were found to be positive and more significant than either inflation or money supply. However, he performed a regression analysis on non stationary series which violates the classical theory of regression analysis with stationary time series and will also lead to spurious relations that include serial correlation which violates basic assumptions for estimating for regression equation.

Murithi (2000) examined the relationship between effects of macroeconomic variables on more than one stock return indicator at the NSE using canonical correlation analysis model which allows for correlation of more than one dependent variable. The study found out that macroeconomic indicators do exert significant level of influence on stock market activity.

## **2.7 Conclusion**

The association of the capital market and macro economic activity exists irrespective of the direction and magnitude of the association. From the literature reviewed, there exists no standardized set of macroeconomic variables. The macroeconomic variables used differ slightly across the studies. In general, inflation rates, GDP and GDP growth rates, interest rates, exchange rates, money growth were the most commonly used macroeconomic variables. Over all a significant part of the existing literature has established the relation between macroeconomic variables and asset movements

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter contains the research methodology; the methodology is categorized into the following classes; research design, study population, data collection and analysis. In general, identification, definition, explanations and justifications, where applicable, are provided /discussed in the respective categories.

#### **3.2 Research Design**

This study seeks to explore the relationship between bond yield and selected macroeconomic variables: interest rates, inflation, GDP growth rates and exchange rates. The study adopts descriptive research design to describe the direction and magnitude of relationship between bond yield and selected macroeconomic variables. Mugenda and Mugenda (2003), defines descriptive study as a scientific study done in order to describe phenomenon or an object. According to Cohen and Lawrence (1995) a descriptive study gathers data at a particular point in time with intention of describing the nature of existing conditions or identifying standards against which existing ones can be compared or determining relationships that exist between specific events. This method is; effective source of data, relatively cheap and takes a short time, Verna and Beads, (1981).

#### **3.3 Study Population**

The study population consists of all treasury bonds consistently traded at the NSE for a five year period, from January 2007 to December, 2011. Kisilu and Tromp (2006) define population as entire group of objects which provides a sample for a study. Records maintained at the NSE indicate that a total of 16 treasury bonds; were consistently traded over the five year period. The five year period is considered sufficient to monitor trend for bond yields against selected macroeconomic variables. The entire population (census) was used for the study.

### **3.4 Data collection and sources**

This study used secondary data. Time series data on bond yield was computed for a five year period from January 2007 to December 2011, thus making use of 20 data points. The Internal Rate of Return (IRR) formula was applied in computation of bond yield. The market prices of bonds were obtained from the NSE. Interest cash flows based bond par values and coupon interest rates were computed for entire term of each bond on quarterly basis from data obtained from NSE. The selected macroeconomic variables are: interest rates, inflation, GDP growth rates and exchange rates. Mean rates for the selected macroeconomic variables were be used. Interest rate was based on CBK lending rates while the United States Dollar (USD) was used for exchange rates. Data on interest and exchange rates was obtained from the central bank of Kenya (CBK) reports and publications. Inflation and GDP growth rates were extracted from the Government of Kenya Economic survey reports prepared by Kenya National Bureau of Statistics (KNBS). Time series data on all the selected macroeconomic variables was extracted on a quarterly basis over the five year period.

### **3.5 Data Analysis and Model**

The study aims at exploring the relationship between bond yield and selected macroeconomic variables, that is, interest rates, inflation, GDP growth rates and exchange rates. This study used econometric model of multiple linear regression where bond yield was regressed against: GDP growth rate, inflation, interest rates, and exchange rates. Multiple regression models are most appropriate for studies involving two or more independent variables, Johnson and Divardo, (1997). Data analysis was done using STATA package. Descriptive statistics such as frequencies and percentages is used to summarize data on closed-ended items. The data is organized on themes pertinent to the study and presented using descriptions. The link test will be used to test the goodness of fit and the significance of association. The analysis was performed at a 0.05 level of significance. The regression model adopted is summarized below.



$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + e$$

$\ln Y$  – logarithm of the Bond yield

$\beta_0$  - Constant

$\beta_1, \beta_2, \beta_3$  and  $\beta_4$  - Coefficients

$\ln X_1$  - Inflation rate change

$\ln X_2$  – Foreign exchange rate change

$\ln X_3$  - GDP growth rate change

$X \ln_4$  – CBK base lending rate change

$e$  - Stochastic disturbance (error) term

## CHAPTER FOUR

### DATA ANALYSIS AND PRESENTATION OF FINDINGS

#### 4.1 Introduction

Data analysis and presentation of findings chapter provides an analysis of data using STATA package. The analysis includes summary statistics, regression analysis, correlation analysis, causality tests, and goodness of fit test. A summary of finding from the analysis is also provided.

#### 4.2 Data Presentation

The analysis of data is summarized and presented in tabular or graphical form. The results of the various tests and finding are discussed as well.

##### 4.2.1 Summary Statistics

Table A below summarizes the following statistics: mean, median, count, minimum value, maximum value, standard deviation, skewness and kurtosis for all the variables under consideration.

**Table A Summary Statistics**

stats	Y	X1	X2	X3	X4
mean	2.402375	9.6725	76.5125	8.2125	4.447368
p50	2.6875	9.4	77.245	8.125	5.6
sd	.7084083	5.488467	9.47444	2.527838	2.418762
N	20	20	20	20	19
min	.9375	2.7	62.54	6	.1
max	3.25	18.93	99.83	18	8.2
skewness	-.9744511	.2900126	.4470897	2.99811	-.5377776
kurtosis	2.499328	1.680638	3.097595	12.56236	2.015132

SOURCE: STATA

## 2.2 Correlation.

Table B Correlation Matrix

	lnY	lnX1	lnX2	lnX3	lnX4
lnY	1.0000				
lnX1	0.4126	1.0000			
lnX2	-0.3714	0.2505	1.0000		
lnX3	-0.3403	-0.4262	0.1758	1.0000	
lnX4	0.6245	0.3910	-0.2258	-0.0970	1.0000

SOURCE: STATA

Table C Variance Inflation Factor

Variable	VIF	1/VIF
lnX1	1.91	0.522665
lnX3	1.44	0.695059
lnX2	1.44	0.695814
lnX4	1.43	0.697062
Mean VIF	1.56	

SOURCE: STATA

## 2.3 Model Specification Tests

order to justify the use of the linear regression model as opposed to a non-linear one or any other one, the Ramsey-reset test is conducted. This test examines whether non-linear combinations of the fitted values provide sensible inferences. If they do so, then the linear model is not correctly specified. The regression entailed in the Ramsey-reset test is;

$$\ln y = \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \beta_5 \text{yhat}^6 + \beta_6 \text{yhat}^7 + e$$

where yhat = the fitted values of ln y (dependent variable)  
 e=random error term.

Table D shows these regression results.

**Table D Ramsey-Reset Test Containing Powers of Fitted Values**

Source	SS	df	MS			
Model	1.95747054	6	.326245091	Number of obs =	19	
Residual	.662135842	12	.055177987	F( 6, 12) =	5.91	
Total	2.61960639	18	.145533688	Prob > F =	0.0045	
				R-squared =	0.7472	
				Adj R-squared =	0.6209	
				Root MSE =	.2349	

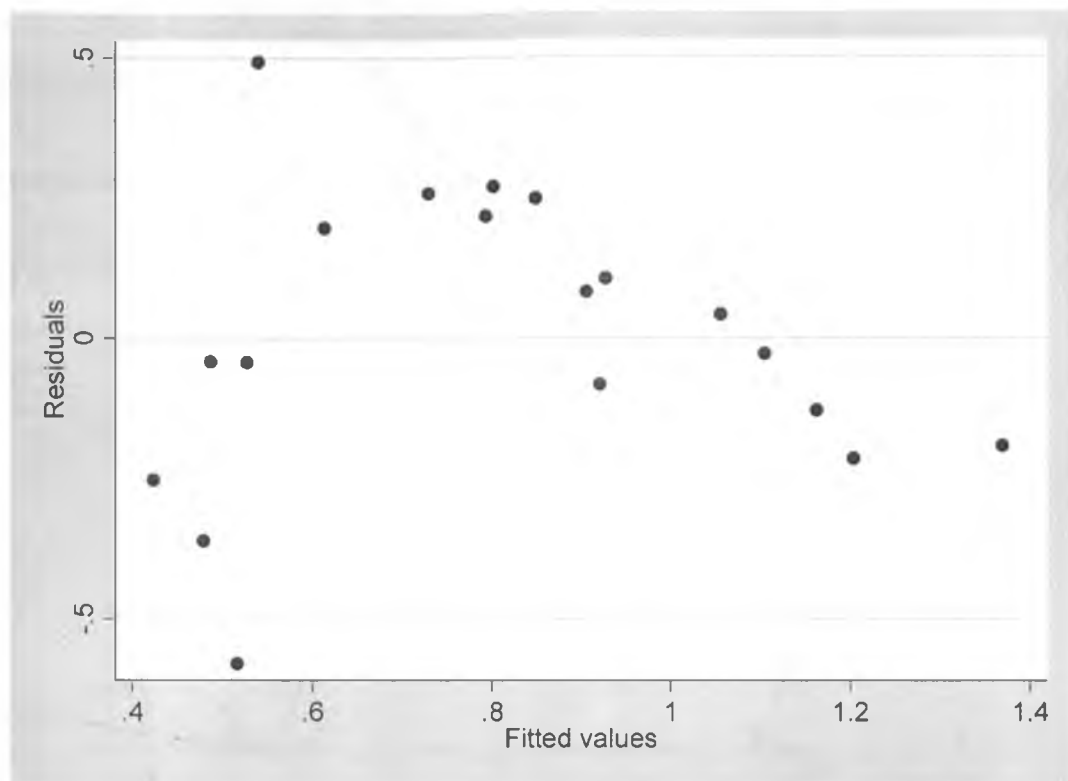
  

lnY	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
lnx1	.4325496	.2160019	2.00	0.068	-.038078	.9031773
lnx2	-2.188501	1.465055	-1.49	0.161	-5.380582	1.003579
lnx3	-.0971899	.0818245	-1.19	0.258	-.2754702	.0810903
lnx4	2.149001	.5517762	3.89	0.002	.9467843	3.351219
yhat6	-1.503136	1.510761	-0.99	0.339	-4.794802	1.78853
yhat7	.8898912	1.08051	0.82	0.426	-1.464338	3.24412
_cons	5.499217	6.331805	0.87	0.402	-8.296601	19.29503

**SOURCE: STATA**

Linearity test is also conducted so as to determine if there is a linear relationship between the dependent and independent variables. If a linear model is fitted to data which are non-linearly related, the predictions are likely to be seriously in error when you extrapolate beyond the sample data.

**Graph 1 Scatter plot of the residuals against the fitted values.**



**SOURCE:STATA.**

Upon conducting the augmented dickey fuller test for non-stationarity, the following results are found;

H<sub>0</sub>: The variable is non – stationary

**Table D-Augmented Dickey Fuller unit Root Tests.**

Variable	Test Statistic	5% Critical Value
lnY	-1.964	-3.000
lnX1	-1.281	-3.000
lnX2	-1.070	-3.000
ln X3	-3.218	-3.000

lnX4	-0.773	-3.000
------	--------	--------

**SOURCE: STATA.**

**Table D-Augmented Dickey Fuller unit Root Tests with lagged value of lnX3.**

Variable	Test Statistic	5% Critical Value
lnY	-1.964	-3.000
lnX1	-1.281	-3.000
lnX2	-1.070	-3.000
L. ln X3	-1.657	-3.000
lnX4	-0.773	-3.000

**SOURCE: STATA.**

Test of normality of the residuals is also conducted so as to determine if the normality assumption of OLS is upheld.

**Table E Shapiro-Wilk Normality Test.**

Shapiro-wilk w test for normal data

Variable	Obs	W	V	z	Prob>z
uhat	19	0.98320	0.384	-1.925	0.97288

**SOURCE: STATA.**

#### **4.2.4 Time Series Data Characteristics.**

Time series data refers to variable measures of observations being obtained for a specific defined time period. The data used is time series in nature because it consists of the variable measures of; the bond yield, inflation rates, exchange rates, interest rates and GDP growth rates for 20 quarters covering the period 2007 to 2011.

Time series data is normally characterized by autocorrelation i.e. the correlation between the error terms for different pairs of observations. This is because successive economic time series observations are likely to be interdependent. Heteroscedasticity which is the variation in the variances of the error terms for different observations is not normally expected in time series data but has to be tested so as to confirm if it is indeed absent.

#### **4.2.5 Test for Heteroscedasticity.**

Some of the reasons why the variance of the errors may vary across the observations include; following the error-learning models, as people learn, their errors of behaviour become smaller over time, as incomes grow, people have more discretionary income and hence more scope for choice about their disposition of their income-therefore the variance is likely to increase with increase in income, skewness in the distribution of one or more regressors included in the model (skewness is expected in education and income) and the presence of outliers (observations that are very different in relation to other observations in the study). Therefore, OLS (ordinary least squares) estimation in the presence of heteroscedasticity will render the estimators as inefficient since they do not have minimum variance in the class of unbiased estimators. Due to this, correction of heteroscedasticity if present is necessary in order to obtain correct standard errors that would be used in hypotheses testing. The test used to detect heteroscedasticity is the white's general heteroscedasticity test. This test involves testing of hypothesis.

**Table F White's General Heteroscedasticity Test**

Source	SS	df	MS			
Model	.086332424	9	.009592492	Number of obs =	19	
Residual	.054257343	9	.006028594	F( 9, 9) =	1.59	
Total	.140589767	18	.007810543	Prob > F =	0.2499	
				R-squared =	0.6141	
				Adj R-squared =	0.2281	
				Root MSE =	.07764	

uhat2	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
lnx1	-.0247169	.6109147	-0.04	0.969	-1.406702	1.357268
lnx2	-16.45617	11.34161	-1.45	0.181	-42.11267	9.200324
lnx3	.0374831	.3648555	0.10	0.920	-.7878775	.8628437
lnx4	.0201154	1.403759	0.01	0.989	-3.155408	3.195639
lnx1_square	.0131609	.1182263	0.11	0.914	-.2542856	.2806073
lnx2_square	1.932168	1.320167	1.46	0.177	-1.054258	4.918594
lnx3_square	.0026318	.0395978	0.07	0.948	-.0869448	.0922083
lnx4_square	-.0213891	.3093188	-0.07	0.946	-.7211169	.6783388
j	-.0008669	.0155022	-0.06	0.957	-.0359353	.0342015
_cons	35.07037	24.52453	1.43	0.186	-20.40798	90.54872

**SOURCE; STATA**

**4.2.6 Test for Autocorrelation.**

Some of the causes of autocorrelation include inertia-i.e. successive time series observations are likely to be interdependent, lags in the observations and non-stationarity of the error terms. Ordinary Least Squares estimation (OLS) in the presence of autocorrelation would render the estimators as inefficient since the standard errors obtained are spurious. These standard errors would yield wrong inferences if used in the t and f tests.

There are two major tests for autocorrelation namely; the Durbin Watson d test and the Breusch Godfrey test. Since the nature of the disturbances of the error terms of the observations can't be easily determined, the Breusch Godfrey test is preferred to the Durbin Watson d test. This is because the Breusch Godfrey test is a general test that caters for all cases of disturbances of the error terms while the Durbin Watson d test has certain limitations.



The Breusch Godfrey test involves testing the hypotheses;

$$H_0: \rho_k = 0, \text{ where } k = 1 \text{ to } 5$$

$H_1$ : At least one  $\rho$  is different

The lag length of 1 is determined from the Akaike information criterion. The Akaike information criterion is obtained by means of generalized linear models. This means allows the obtaining of AIC whose log likelihood and penalty term have been adjusted by the number of observations.

The test statistic is obtained from the auxiliary regression in table G. This statistic is  $\gamma = R^2 * (n - \rho) = 0.0159 * 17 = 0.2703$

The tabulated statistic is chi-square at 5 degrees of freedom and 5% level of significance. This statistic is 5.99146.

**Table G Breusch Godfrey Test for Serial Autocorrelation**

Source	SS	df	MS			
Model	.017577039	5	.003515408	Number of obs =	17	
Residual	1.08616434	11	.098742213	F( 5, 11) =	0.04	
Total	1.10374138	16	.068983836	Prob > F =	0.9991	
				R-squared =	0.0159	
				Adj R-squared =	-0.4314	
				Root MSE =	.31423	

uhat	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
lnX1	.0379028	.1993575	0.19	0.853	-.4008801	.4766858
lnX2	-.076649	.851108	-0.09	0.930	-1.949925	1.796627
lnX3	-.0073385	.0827562	-0.09	0.931	-.1894838	.1748068
lnX4	-.0270996	.5177078	-0.05	0.959	-1.166567	1.112368
uhat_1	-.0577434	.4463031	-0.13	0.899	-1.04005	.924563
_cons	.3096175	3.868789	0.08	0.938	-8.205529	8.824764

SOURCE: STATA

### 4.2.7 Granger Causality Tests (Co-integration results).

Since determination of the bond yield does not necessarily imply causation, it is necessary to determine if the explanatory variables cause the bond yield in the securities market or vice-versa. When determining if whether any of the explanatory variables causes bond yield, the bond yield is regressed against all its lagged values and the independent variables. This regression constitutes the restricted model. The unrestricted model on the other hand includes all the lagged terms of bond yield, the lagged terms of the independent variable under consideration and the other independent variables.

The test statistic is;

$$f = \frac{(RSS_R - RSS_{UR})/m}{RSS_{UR}/n - k}$$

Where  $m$  = lagged terms of the variable claimed to have caused another variable,  $k$  = number of estimated parameter coefficients in the unrestricted model and  $n$  = the sample size.

The tabulated statistic is  $F(m, n - k, 0.05)$ .

The length of the lag is determined from the Akaike information criterion.

The null hypothesis is;

$$H_0: \alpha_j = 0.$$

The lagged  $m$  terms do not belong in the regression (The variable is not responsible for causation). Since the Granger causality tests assume that there is no correlation between the error terms of the variables under consideration, the log-linear functional form of the model, which does not exhibit serial autocorrelation, is used.

## 4.2.8 Goodness of Fit of the Model

The most ideal way of testing for the goodness of fit of OLS models-which do not have binary outcomes is by using the link test. This test shows how well the model fits the dataset.

**Table I Link Test**

Source	SS	df	MS			
Model	1.81977356	2	.909886781	Number of obs =	19	
Residual	.799832824	16	.049989551	F( 2, 16) =	18.20	
Total	2.61960639	18	.145533688	Prob > F =	0.0001	
				R-squared =	0.6947	
				Adj R-squared =	0.6565	
				Root MSE =	.22358	

lnY	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
_hat	4.417216	1.23013	3.59	0.002	1.809456	7.024976
_hatsq	-2.005374	.7134774	-2.81	0.013	-3.517878	-.4928692
_cons	-1.302023	.490208	-2.66	0.017	-2.341217	-.2628284

SOURCE:STATA

## 4.2.9 Regression Results.

Since auto correlation is not present, OLS estimates are provided. Table J demonstrates this.

The fitted model is;

$$\ln Y = 3.61 + 0.18 \ln X_1 - 1.03 \ln X_2 - 0.08 \ln X_3 + 0.67 \ln X_4 + e$$

**Table J Regression Results**

Source	SS	df	MS			
Model	1.51734957	4	.379337391	Number of obs =	18	
Residual	1.01038716	13	.07772209	F( 4, 13) =	4.88	
				Prob > F =	0.0126	
				R-squared =	0.6003	
				Adj R-squared =	0.4773	
Total	2.52773673	17	.148690396	Root MSE =	.27879	

lnY	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
lnX1	.1767298	.1429188	1.24	0.238	-.1320276	.4854871
lnX2	-1.032658	.6766413	-1.53	0.151	-2.494453	.4291366
g_1	-.0800398	.0660359	-1.21	0.247	-.2227017	.0626221
lnX4	.6694555	.3342859	2.00	0.067	-.0527252	1.391636
_cons	3.614056	3.120782	1.16	0.268	-3.127985	10.3561

SOURCE: STATA.

### 4.3 Summary and Interpretation of Findings

From the summary statistics, the following deductions are made; the mean represents the average values for the variables, the median is the central value of the distribution, count shows the number of observations for each variable, the minimum and maximum represent the highest and lowest values respectively, the standard deviation shows the degree of variability in the measures of the distributions, kurtosis is a measure of how sharp the peak of a normal distribution is while skewness indicates the extent of asymmetry of the distributions. The bond yield is moderately negatively skewed since its skewness value of -0.9744511 lies between -0.5 and -1 while the other variables are approximately symmetric since their skewness values lie between -0.5 and 0.5. The exchange rate exhibits the greatest variability in its distribution measures since its standard deviation of 9.47444 is the largest. This implies that the exchange rate has been volatile during the time under investigation. The distributions of bond yield, inflation and GDP growth rates are platykurtic since their kurtosis values are less than 3. The distribution of exchange rate is mesokurtic because its kurtosis value is approximately 3 while the distribution of interest rate is leptokurtic since its kurtosis value exceeds 3. Platykurtic distributions have low and broad central peaks with short thin tails,

mesokurtic distributions are almost perfectly bell shaped while leptokurtic distributions have high and sharp central peaks with long fatter tails.

Multicollinearity exists when there is perfect linear relationship between the independent variables. The correlation results (Table B) show that there is no perfect linear relationship between any two independent variables and all the correlation coefficients are considerably small. Also upon testing for multicollinearity using the variance inflation factor, which tests if the standard errors are inflated, all the variance inflation factors (VIF) are less than 10 and their reciprocals are greater than 0.01 (Table C). These results rule out multicollinearity since there is no perfect linear correlation between the explanatory variables.

The results of the Ramsey rest test reveal that the higher order fitted values i.e.  $\hat{y}_6$  and  $\hat{y}_7$  are not significant determinants of the bond yield (since their P values are above 0.05)-implying that the linear model has been specified correctly (Table D).

The linearity results in the graph 1 show that the data are linearly related since the distribution of the plots (residuals versus the fitted values) is approximately symmetric along the 45 degree diagonal line. The Augmented Dickey Fuller unit root tests show that all the test statistics except for the GDP growth rate component are greater than the interpolated dickey fuller 5% critical value. This means that these variables are stationary except from the GDP growth rate component. In order to correct the existing non-stationarity, the first difference of the non-stationary variable is obtained and the model is now re-specified using this first difference. The normality test results reveal that the p value is greater than 0.05. Therefore, the null hypothesis that the residuals are normally distributed is not rejected (Table E). Since 11.668 (Test statistics) is less than 16.919 (Critical value), the null hypothesis is not rejected implying that heteroscedasticity is absent. Table F demonstrates this. From the Breusch Godfrey test, the test statistic is less than the critical value and thus the null hypothesis is not rejected indicating that there is no serial autocorrelation.

Table H summarizes the co-integration results.

Key;

- $b$  is the logarithm of the bond yield in the securities market.
- $i$  is the logarithm of the inflation rate.
- $e$  is the logarithm of the exchange rate.
- $n$  is the logarithm of the interest rate and  $g$  is the logarithm of the GDP growth rate.

**Table H-Co-integration Results**

NOTION	TEST STATISTIC	TABULATED VALUE	NULL HYPOTHESIS	NATURE OF CAUSALITY
$i \rightarrow b$	0.98	4.75	Do not reject	No causality
$e \rightarrow b$	0.15	4.75	Do not reject	No causality
$n \rightarrow b$	0.39	4.75	Do not reject	No causality
$g \rightarrow b$	2.05	4.75	Do not reject	No causality
$b \rightarrow i$	10.12	4.75	reject	Bi-lateral causality
$b \rightarrow e$	0.62	4.75	Do not reject	No causality
$b \rightarrow e$	2.59	4.75	Do not reject	No causality
$b \rightarrow e$	1.10	4.46	Do not reject	No causality

**SOURCE: STATA.**

The Granger causality test results reveal that bond yield causes inflation. Moreover, the causality is bi-lateral because the coefficients of the lagged terms are different and statistically different from zero in both regressions. Upon conducting the link test, the coefficient of the slope of the predicted value,  $\hat{\beta}$  is way greater than 1. In addition, the predictor of the squared residuals is not significant. This shows that the model is well specified but the model does not perfectly fit the observations because the slope of the predicted value deviates from 1. (Table I).

The fitted model can be interpreted as; when all the macroeconomic variables in the regression model are held constant, the bond yield increases by 3.61. This means that the bond yield increases even when the other macroeconomic variables expected to affect it are held constant.

For every unit increase in the logarithm of inflation rate, the log of the bond yield increases by 0.18, when all the other macroeconomic variables are held constant. This finding contradicts with other findings. Murkherjee and Naka (1995; Maysami and Koh (2000); Islam and Watanpalachaikul (2003) found that high inflation rates increase cost of living with the resultant effect of shifting resources from securities to consumption.

For every 1 unit increase in the log of exchange rate, the log of the bond yield reduces by 1.03 when all the other macroeconomic variables are held constant. The positive relationship between exchange rate and bond yield is consistent with other findings; (Wongbongpo and Shama (2002); Murkherjee and Naka (1995); Maysami and Koh (2000). This is because an increase in exchange rate implies that the local currency has depreciated relative to the US dollars. Moreover, the standard deviation of exchange rate indicates that there is greater variability in the distribution. This variability translates to volatility in the exchange rate for the period under investigation. When the exchange rate is depreciating and exhibits varying fluctuations, the investors shy away from investing using that currency. This is because a stable and predictable exchange rate builds confidence in investors and thus promotes investments in securities.

For every unit increase in log of interest rate, the bond yield increases by 0.67 when all the other macroeconomic variables are held constant. This finding is consistent with other literature. Omran (2003); Nyamute (1998) examined the impact of real interest rate as a key factor in the performance of Egyptian and Nairobi securities exchange. They found that high interest rates tend to shift resources from consumption to investment. When the interest rates are high, there is an incentive for investors to hold bonds as they generally have better returns than stocks (Mukherjee and Atsuyuki (1996); Barnes (2009).

For every unit increase in GDP growth rate, the bond yield reduces by 0.08 when all the other macroeconomic variables are held constant. This finding contradicts with Ngugi RW (2003) who found out that high GDP growth rates imply increased economic activity which inspires confidence in investors.

The regression results also show that all the predictors are insignificant. This is because their test statistics are less than the critical t value, their p values exceed 0.05 and 0 is contained in their 95% confidence intervals. These findings are consistent with Allen and Jagtianti (1997) who found that interest rate sensitivity has been reducing since late 80's and early 90's. On the other hand, Islam and Watanpalachaikul (2003) found the predictor to be significant. His research showed a strong, significant long-run relationship between the stock price and macroeconomic factors.

From the Granger causality results, bi-lateral causality from bond yield to inflation is evidenced. This is consistent with Hassan (2003) who found evidence of bidirectional causality between various macroeconomic indicators and demand in the securities market.

The link test which measures goodness of fit in OLS models reveals that the model does not perfectly fit the data observations. Carlstom (2002); Wongabangngpo and Sharma (2002) indicate that the relationship between macroeconomic variables and the stock market is not clear. Other researchers like Verma and Ozunab (2005) have noted that the stock movements are as a result of speculations or irrational behaviour of investors, and



as such, stock price movements cannot be related to macroeconomic variables both in developed and developing markets. Thus it can be seen that the findings are consistent with the literature mentioned above.

## CHAPTER FIVE

### SUMMARY, CONCLUSION AND DISCUSSIONS

#### 1 Summary

The background of the study is summarized in chapter one and the existing problem outlined. All companies need capital and the challenge that managers face is finding innovative ways to fund their projects at lower costs. The relationship between the macroeconomic variables and capital market development is explained. The advantages of bond market compared to stock market are outlined. The justification of using bond yields is explained. Also, the relationship between macroeconomic variables and bond yields is discussed. The main objective is to investigate the relationship between bond yields traded at NSE and the macroeconomic variables for the period 2007 to 2011.

In chapter two, the literature is reviewed. The review covers both the theoretical and empirical literature. Various research findings are discussed and compared. In chapter three, the research methodology employed is explained and justified together with the model used. The OLS method is used in the estimation process. The tests performed are elaborated. In chapter four, the findings and presentations are discussed in detail. Various diagnostic tests for multi-collinearity, stationarity, normality of the residuals, heteroscedasticity, autocorrelation, linktest to determine goodness of fit and Granger causality tests are conducted before actual estimation so as to rid the model of any bias.

#### 2 Conclusion

The overall objective of the research is to investigate the relationship between yields of bonds traded at NSE and inflation, interest rates, exchange rates and GDP growth rates for the five year period from January 2007 to December 2011. Time series data obtained from economic and statistical surveys and CBK quarterly publications for various years

is tested for multi-collinearity, stationarity, linearity, normality, heteroscedasticity and autocorrelation before being used to estimate the model.

The regressions results show that inflation rate and exchange rate are negatively related to bond yield. This relationship between exchange rate and bond yield is consistent with other findings: Wongbongpo and Shama (2002); this is because an increase in exchange rate implies that the local currency has depreciated relative to the US dollars. Moreover, the standard deviation of exchange rate indicates that there is greater variability in the distribution. This variability translates to volatility in the exchange rate for the period under investigation. When the exchange rate is depreciating and exhibits varying fluctuations, the investors shy away from investing using that currency. However, the negative relationship between growth rate, and bonds yield contradicts the literature. From the regression results, it can be seen that none of the macroeconomic variables is a significant predictor of the bond yield. All their p values exceed 0.05, their test statistics are less than the critical t value at 0.05 margin of error and 0 is contained in all the 95% confidence intervals (Table J). This may yet explain why these results are inconsistent with findings from other studies. Also, the overall significance of the model is ascertained. This is because the p value for the whole regression as shown in the regression results is almost 0. Therefore, the inferences that the model provides in terms of coefficients of the predictors are valid.

### **5.3 Recommendations**

Since increase in the interest rate is found to boost the bond yield, monetary policy should be geared towards raising interest rates in the event that the sale of more bonds is desired. This is because the high interest rates discourage consumption in favour of investments and investments in bonds are considered to be worthwhile than stocks due to their lucrative returns. The individuals who hold bonds may sell them at these high interest rates hence making money out of it.

There can be more awareness on investment in bonds if it is decided that more individuals hold bonds. Since bonds are seen to be more advantageous than other

security investments, a proper awareness of these benefits will see to it that the bond yield increases.

Since an increase in the exchange rate i.e. depreciation is seen to reduce the bond yield, the policy makers should strive at improving or stabilize the exchange rate. There is empirical evidence Mukherjee and Naka (1995) that shows that stable currencies boost investments.

The exchange rate can be stabilized by the implementation of effective monetary policy that will see to it that inflation rates as well as other economic shocks decline.

#### **5.4 Limitations of the Study**

The population of 16 might not be large enough to capture the effect of macroeconomic variables on the bond yields. A larger population would have given better picture. The impact of the macroeconomic variables on individuals' behavior may take time to manifest itself. Some individuals take longer time to respond to incentives and shocks than others. Since the study covers only 5 years, it may be possible that the change in behavior of some people is not captured in the analysis as some people may respond after 6 to 10 years.

The conceptualized model utilizes only a few macroeconomic variables yet in practice, many more other variables may affect the bond yield. The macroeconomic variables used in the study are susceptible to numerous negative economic shocks at any point in time and hence the numerous shocks may make individuals in the economy to adapt to the shocks rather than respond appropriately. Therefore, individuals may soon learn to cope with the existing economic conditions and not be compelled to hold bonds if they were not doing so.

#### **5.5 Suggestions for Further Studies**

Since many studies have focused on the effect of macroeconomic variables on the bond yields, it is also appropriate to study the effect of bond yields on the macroeconomic variables. The strengths of the predictors of the bond yields can be, examined and

appropriate analysis undertaken. Studies on the effect of non-economic shocks on bond yields may also be undertaken. A good example of a non-economic shock is political interventions and corruption. Studies on the causal relationships should also be undertaken to determine if causality exists and if it does, the type it is and what are its implications on policy. Studies should also be undertaken to determine if the sensitivity of the macroeconomic variables has been changing with time.

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## Appendix I

### STUDY POPULATION

	Type bond		Issue Date	Maturity period	Coupon Rate %	Par Value Kshs
1	Treasury	FXD 1/ 2007/5	29/01/2007	5	11.25	100
2	Treasury	FXD 2/ 2006/6	27/11/2006	6	11.50	100
3	Treasury	FXD 1/ 2007/6	30/04/2007	6	11.50	100
4	Treasury	FXD 1/ 2006/6	26/06/2006	6	11.75	100
5	Treasury	FXD 1/ 2006/7	30/01/2006	7	13.25	100
6	Treasury	FXD 1/ 2006/8	27/02/2006	8	13.25	100
7	Treasury	FXD 1/ 2007/8	26/02/2007	8	12.75	100
8	Treasury	FXD 1/ 2006/9	24/04/2006	9	13.50	100
9	Treasury	FXD 1/ 2003/10	23/01/2003	10	13.25	100
10	Treasury	FXD 2/ 2003/10	25/08/2003	10	8.50	100
11	Treasury	FXD 1/ 2006/10	27/03/2006	10	14.00	100
12	Treasury	FXD 2/ 2006/10	29/05/2006	10	14.00	100
13	Treasury	FXD 1/ 2006/11	25/09/2006	11	13.75	100
14	Treasury	FXD 1/ 2006/12	28/08/2006	12	14.00	100
15	Treasury	FXD 1/ 2007/12	28/05/2007	12	13.00	100
16	Treasury	FXD 1/ 2007/15	26/03/2007	15	14.50	100

Source: NSE

## APPENDIX II

### Independent Variables Values

#### (A) Inflation Rate X1

MONTH/ QUARTER / YEAR	MARCH Q1	JUNE Q2	SEPTEMBER Q3	DECEMBER Q4
2007	3.4	2.7	5.3	5.6
2008	10.5	17.4	15.9	16.6
2009	14.1	10.6	9.8	8.0
2010	5.5	3.7	3.3	3.8
2011	9.0	12.0	17.32	18.93

Source: KNBS

Base period February 2009

## USD Exchange Rate X2

MONTH/ QUARTER YEAR	MARCH Q1	JUNE Q2	SEPTEMBER Q3	DECEMBER Q4
2007	68.78	66.56	66.97	62.54
2008	62.85	64.69	73.22	77.71
2009	80.43	77.16	74.99	75.82
2010	77.33	81.92	80.78	80.75
2011	82.99	89.86	99.83	85.07

Source: CBK Quarterly Publications

## ( C ) GDP Growth Rate X3

MONTH/ QUARTER YEAR	MARCH Q1	JUNE Q2	SEPTEMBER Q3	DECEMBER Q4
2007	7.0	8.2	6.3	6.5
2008	-1.3	2.4	2.7	-0.1
2009	5.6	0.9	0.5	3.6
2010	4.8	5.4	6.1	5.6
2011	5.1	4.1	4.6	4.4

Source: KNBS

## (D)Interest Rate X4

MONTH/ QUARTER YEAR	MARCH Q1	JUNE Q2	SEPTEMBER Q3	DECEMBER Q4
2007	8.5	8.5	8.75	8.75
2008	8.75	9	9	8.5
2009	8.25	8	7.75	7
2010	6.75	6.75	6.75	6
2011	6	6.25	7	18

Source: CBK

Dependent Variable values - Bond Yield Values

	Bond	Date of issue	MP	CR %	Par Value	2007				2008				2009				2010				2011			
						Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	FXD 1/2007/5	29/1/2007	5	11.25	100	3	2	2	3	2	3	2	3	3	2	2	2	2	1	1	0	1	0	4	4
2	FXD 2/2006/6	27/11/2006	6	11.5	100	3	3	2	3	3	3	3	3	3	3	3	2	2	2	1	3	1	3	3	
3	FXD 1/2007/6	30/04/2007	6	11.5	100		3	2	3	3	3	3	3	3	2	3	2	3	1	1	1	1	0	4	1
4	FXD 1/2006/6	26/6/2006	6	11.75	100	2	3	3	3	3	3	3	3	3	2	2	2	2	2	1	1	1	0	3	7
5	FXD 1/2006/7	30/1/2006	7	13.25	100	3	2	2	2	3	3	3	3	3	3	2	3	3	1	1	1	2	3	4	5
6	FXD 1/2006/8	27/2/2006	8	13.25	100	3	2	2	2	3	3	3	3	3	3	4	3	2	1	1	1	1	1	1	4
7	FXD 1/2007/8	26/2/2007	8	12.75	100	3	3	2	3	3	3	3	2	3	3	3	3	2	2	1	1	2	2	2	2
8	FXD 1/2006/9	24/4/2006	9	13.5	100	3	3	2	3	3	3	3	3	3	3	3	3	2	2	1	1	2	2	2	2
9	FXD 1/2003/10	23/1/2003	10	13.25	100	3	3	2	2	2	3	3	3	2	2	2	2	1	-1	-2	-3	-1	-6	1	1
10	FXD 2/2003/10	25/08/2003	10	8.5	100	3	2	1	1	2	3	3	3	3	3	3	3	2	1	2	2	2	1	3	5
11	FXD 1/2006/10	27/3/2006	10	14	100	3	3	2	3	3	3	3	3	3	3	3	3	2	2	1	1	2	1	4	4
12	FXD 2/2006/10	29/5/06	10	14	100	3	3	3	3	3	3	4	3	3	3	3	3	2	2	1	1	2	3	4	3
13	FXD 1/2006/11	25/9/2006	11	13.75	100	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	2	2	2	2
14	FXD 1/2006/12	28/8/2006	12	14	100	3	3	3	3	3	3	3	3	4	3	3	3	2	2	2	3	2	2	3	2
15	FXD 1/2007/12	28/5/2007	12	13	100		3	3	3	3	3	3	3	3	2	3	3	3	2	2	2	2	1	3	4
16	FXD 1/2007/15	26/3/2007	15	14.5	100		3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	2	2	2	3

Key

MP Maturity Period

CR Coupon Rate

Market Values of bonds

Bond	Date of issue	MP	CR %	Par Value	2007				2008				2009				2010				2011			
					Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1 FXD 1/2007/5	29/1/2007	5	11.25	100	97.86	110.46	107.46	98.35	104.70	101.20	103.82	100.25	100.87	106.33	102.87	102.28	105.72	111.31	110.21	109.77	106.41	106.41	98.45	98.45
2 FXD 2/2006/6	27/11/2006	6	11.5	100	99.76	104.61	108.97	104.27	105.08	101.74	103.32	103.32	104.19	103.52	99.97	103.69	103.69	108.64	108.74	114.68	99.96	107.24	100.31	100.31
3 FXD 1/2007/6	30/04/2007	6	11.5	100	-	102.49	110.99	105.07	105.04	101.61	103.00	101.19	103.23	106.70	102.81	104.46	102.62	119.31	116.70	117.36	112.54	114.79	95.76	108.56
4 FXD 1/2006/6	26/6/2006	6	11.75	100	112.69	102.92	105.68	102.86	105.01	102.68	103.75	102.14	101.98	195.13	104.10	106.02	104.93	108.64	112.80	110.50	108.43	107.84	100.76	96.41
5 FXD 1/2006/7	30/1/2006	7	13.25	100	101.03	115.09	114.15	115.47	108.35	107.85	99.95	107.98	109.45	99.97	109.34	105.82	104.79	121.69	120.07	118.66	109.37	102.79	99.08	93.43
6 FXD 1/2006/8	27/2/2006	8	13.25	100	108.52	117.06	115.18	115.65	111.46	108.76	111.31	106.80	105.67	106.18	87.35	109.53	117.17	123.98	123.98	127.36	119.06	119.06	119.06	95.26
7 FXD 1/2007/8	26/2/2007	8	12.75	100	104.70	113.36	114.18	111.87	109.82	107.27	109.82	112.71	107.48	99.12	106.98	108.95	119.15	126.19	126.19	130.47	119.27	119.27	114.24	114.24
8 FXD 1/2006/9	24/4/2006	9	13.5	100	99.50	112.78	121.32	103.88	114.43	110.85	109.54	108.95	101.82	109.44	110.21	109.92	116.54	130.08	139.53	139.53	125.89	117.33	117.33	117.33
9 FXD 1/2003/10	23/1/2003	10	13.25	100	110.46	101.02	115.28	115.28	111.31	108.16	99.95	108.12	109.26	109.32	109.74	108.01	113.32	124.27	125.28	125.28	112.02	119.37	101.94	92.94
10 FXD 2/2003/10	25/08/2003	10	8.5	100	84.71	94.26	117.10	117.10	111.41	90.11	91.25	89.96	91.36	91.36	92.82	94.63	103.82	111.88	99.99	104.13	104.13	110.45	92.81	85.72
11 FXD 1/2006/10	27/3/2006	10	14	100	110.14	114.47	124.67	117.59	117.73	114.14	117.16	110.49	115.71	114.92	113.67	115.95	119.38	135.55	142.66	140.63	131.78	138.09	99.97	99.97
12 FXD 2/2006/10	29/5/06	10	14	100	101.19	120.04	120.86	107.47	114.73	114.32	96.22	110.68	109.42	112.69	113.85	116.78	125.90	135.83	143.51	144.76	132.94	115.22	97.96	103.24
13 FXD 1/2006/11	25/9/2006	11	13.75	100	104.48	113.92	119.44	114.96	115.63	114.08	111.85	110.40	113.18	113.48	106.07	105.95	105.95	147.29	109.43	128.95	128.95	128.95	128.95	128.95
14 FXD 1/2006/12	28/8/2006	12	14	100	103.00	120.19	117.59	113.43	117.64	114.77	114.91	114.91	95.59	115.16	112.52	117.66	127.30	140.52	149.34	112.01	129.97	133.48	102.16	122.32
15 FXD 1/2007/12	28/5/2007	12	13	100	-	109.53	113.19	107.10	109.76	107.53	109.69	107.37	108.81	112.37	109.81	109.40	99.96	139.24	138.42	125.27	122.75	140.01	95.33	87.09
16 FXD 1/2007/15	26/3/2007	15	14.5	100	-	113.70	113.62	109.26	112.35	109.43	110.44	109.31	111.31	110.16	111.78	109.01	119.24	146.89	167.23	129.56	133.63	140.40	163.88	117.82

Key

MP

CR

Maturity Period

Coupon Rate