

**UNIVERSITY OF NAIROBI**

**CHIROMO CAMPUS**

**COLLEGE OF PHYSICAL & BIOLOGICAL SCIENCES**

**YIELD CURVE ANALYSIS FOR 2,5,10,12,15-YEAR TREASURY BONDS FROM 2007 TO 2014**

**BY**

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THIS RESEARCH PROJECT IS SUBMITTED TO THE COLLEGE OF PHYSICAL & BIOLOGICAL SCIENCES IN THE UNIVERSITY OF NAIROBI IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE POSTGRADUATE DIPLOMA DEGREE OF ACTUARIAL SCIENCE.

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**DECLARATION**

I the undersigned, declare that this research proposal is my own original work and does not include any material already submitted for a degree at the University of Nairobi, or any other degree at any other university.

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I46/81927/2015

This research proposal has been submitted for examination with my approval as the university appointed supervisor.

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## **DEDICATION**

*I dedicate this project to God Almighty my creator, my strong pillar, my source of inspiration, wisdom, knowledge and understanding. He has been the source of my strength throughout this program and on His wings only have I soared. I also dedicate. I also dedicate this work to my mum; Catherine Anyango who has encouraged me all the way and whose encouragement has made sure that I give it all it takes to finish that which I have started. To my aunts Stellan and Elizabeth who have been affected in every way possible by this quest. Thank you. My love for you can never be quantified. God bless you.*

## **ACKNOWLEDGMENT**

*Sincere gratitude to the most High for giving me life, brains and strength to undertake this project.*

*I would like to also thank my Aunt Stellah Adongo Onyango and mum Catherine Anyango Omollo for making it possible for me to pursue my academic dream.*

*I would extend my gratitude to my family and friends with particular mention of my cousin Crystal, Anthony, Fredrick, my friends and classmate Maureen, Dancun and Martha.*

*Finally, I cannot find enough words to express my gratitude towards those who assisted me with the technical know how with regard to this project Prof Richard Simwa and Mr. C Achola, I would like to take this space and time to say thank you for the keenness, interest and guidance accorded to me by you, in many aspects of this project.*

## **Abstract**

It is not possible to compare the relative value of bonds by looking at their prices as the different maturities, coupons etc will affect the price and so a lower priced is not necessarily better value. Therefore in order to calculate relative value investors will compare bond yields.

The main aim of this study is to analyze the yield curve of 2, 5, 10, 12, 15 year Kenyan treasury bonds issued between 2007 and 2014 by the Central Bank of Kenya. The yield curve of Bonds issued by the government usually demonstrates the tightness of the monetary policy; allow cross-country comparisons; assist in pricing of new issues; assess relative value between bonds; allow one to derive implied forward rates and help investors understand risk.

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## CHAPTER I

### INTRODUCTION

#### **Introduction**

Financing development is a challenge facing many emerging markets and constraining their ability to implement the set development objectives. Although Africa is experiencing financial sector development, the diversity of financing instruments is very narrow and among the long term financing options. While 1990s saw a wave of capital market reform, a lot of emphasis was on the stock market with very minimal effort put on the bonds market. This saw substantial development of stock markets with new stock exchanges being established, regulatory systems strengthened and trading system rejuvenated. However, in most cases this has not attracted a significant number of listings. There are very few fully fledged bonds markets. In most cases, bonds are traded in the stock exchange with a dominance of the government bonds. Corporate bonds are almost non-existence.

Bonds market is an alternative vehicle for mobilizing finance for both the government and the private sector in financing long-term projects such as housing and infrastructure development in addition to financing the government deficit. The development of bonds market is seen to play a crucial role in promoting partnerships in the development process between the government and the private sector. Successful development of bonds market though requires a developed money market, favorable macroeconomic policies, significant market participation, appropriate trading system and sound legal and regulatory framework. Experience also shows that development of government bonds market is crucial in paving way for development of the corporate bonds market.

In the development process of bonds market, it is expected that at the initial stage a lot of effort is given to strengthen and develop the short end of the market including transparency in securities operations and instrument design. After, focus moves to upgrading the trading facilities and the settlement process and the market regulations.

In the Kenyan context, various changes have been instituted including the establishment of a fixed income securities trading segment at the stock exchange, tax incentives and other factors that reduce the transaction costs, diversification of the maturities especially for the treasury bonds and the modernization of the trading system especially for the treasury bonds. It is also important to note the deliberate effort that the government



took in boosting development of the bonds market in 2001. The question is with all these developments, has the bonds market microstructure been strengthened? A market that is characterized by high liquidity, efficiency and with minimal transaction costs and volatility is desirable in the growth process. These are indicators that the market will play a significant role in financing development.

Institutional development is indicated as a major factor that determines development of the market microstructure. Policy makers and market administrators can influence investment strategies of the investors through their choice of institutional set up. Market microstructure determines the type of information available to market participants, the manner in which incoming orders to buy and/or sell are matched and surveillance of the market. As such, institutional set up defines the microstructure characteristics of the market including liquidity, efficiency, trading costs and volatility.

This study attempts to analyze the microstructure characteristics of the bonds market in Kenya, to see the implications of the various efforts being put on development of the market.

From a macroeconomic perspective, the short- term interest rate is a policy instrument under the direct control of the central bank, which adjusts the rate to achieve its economic stabilization goals. From a finance perspective, the short rate is a fundamental building block for yields of other maturities, which are just risk-adjusted averages of expected future short rates. Thus, as illustrated by much recent research, a joint macro-finance modeling strategy will provide the most comprehensive understanding of the term structure of interest rates. In this paper, we discuss some salient questions that arise in this research, and we also present a new examination of the relationship between two prominent dynamic, latent factor models in this literature: the Nelson-Siegel and affine no-arbitrage term-structure models

## **1.1 Treasury bonds**

Treasury bonds are a secure, medium- to long-term investment that typically offers you interest payments every six months throughout the bond's maturity. The Central Bank auctions Treasury bonds on a monthly basis, but offers a variety of bonds throughout the year, so prospective investors should regularly check for upcoming auctions.

Most Treasury bonds in Kenya are fixed rate, meaning that the interest rate determined at auction is locked in for the entire life of the bond. This makes Treasury bonds a predictable, long-term source of income. The National Treasury also occasionally issues tax-exempt infrastructure bonds, a very attractive investment.

Individuals and corporate bodies can invest in Treasury bonds as a nominee of a commercial bank or investment bank in Kenya, but if you hold a bank account with a local commercial bank you can also invest directly through the Central Bank and avoid additional fees.

## **1.2 The Central Bank of Kenya**

The **Central Bank of Kenya** has over time been endowed with the duty to compile indicative foreign exchange rates daily for use by the general public. These rates do reflect the average rates buying and selling of the major participants in the foreign exchange market at the open of trade every day, thus providing a good indicator for any interested party on the value of the shilling on any particular day.

It is noteworthy that the rates provided by the central bank are only indicative and the forex dealers, i.e. commercial banks and forex bureaus, may apply varying rates on their forex transactions. It is expected that competition among the dealers will lead to reasonable/competitive margins being applied to forex transactions with customers.

Forex bureaus are licensed to cater specifically for the retail end of the forex market, i.e. buyers and sellers of small amounts of forex, mainly cash. Bureaus therefore often have favorable rates for this market segment when compared to commercial banks' cash rates.

The commercial banks are more competitive when dealing with larger amounts of forex that are settled via telegraphic transfers using correspondent accounts abroad and therefore tend provide finer rates for this market segment. Nevertheless, all forex deals are transacted on a willing buyer willing seller basis and are subject to negotiation between the forex dealers and their customers

## CHAPTER II: LITERATU RE REVIEW

### 2.1 Theoretical Background

#### 2.1.1 Bond

A bond is a debt instrument requiring the issuer (also called the debtor or borrower) to repay to the lender/ investor the amount borrowed plus the interest over a specified period of time (Horne, 2002). A bond is normally an interest rate-only loan, meaning that the borrower will pay the interest every period, but none of the principal will be repaid until the end of the loan (Ross, Westerfield, & Jordan, 2003).

(Fabozzi, 2000) A fundamental property of bond is that its price changes in the opposite direction from the change in the required yield. The reason is that the price of the bond is the present value of the cash flows. As the required yield increases, the present value of the cash flow decreases; hence the price decreases. The opposite is true when the required yield decreases: the present value of the cash flows increases, and therefore the price of bond increases. The expected cash flows are determined from bond characteristics or bond contract (Brealey, 2006).

Bonds are loans lasting from 12 months to over 30 years that normally pay interest at regular intervals and with repayment of their principal on the maturity date. Bonds are also known as debt, credit and fixed-income market (Mobius, 2012). Bond as a debt instruments requires from the issuer (debtor or borrower) to repay to the lender investor the amount borrowed (principal) plus interest over a specified period of time. A key feature of a bond is the nature of the issuer, which is usually divided in three groups: government, municipalities and corporations (domestic and foreign) (Ivanovskia, Stojanovskib, & Ivanovskac, 2013).

There are four main types of bond (Romzi, 2013):

#### *Treasury bonds*

These bonds are issued by the government. Some kinds of treasury bonds issued in Indonesia are Surat Utang Negara (SUN), State Sharia securities (Sukuk), Fixed-rate bond, the State variable bonds. This bond is risk-free rate means no default risk.

## *Corporate bonds*

Corporate bonds are bond which is issued by corporate. These bonds have higher risk rather than Treasury bond. The higher risk of corporate bonds caused these bonds have higher coupon payment compared to treasury bonds.

Corporate bonds are debt obligating of a corporation to pay periodic interest with full repayment at maturity. Corporate bonds are classified by the type of issuer. The four general classifications are (1) Public utilities, (2) transportation, (3) banks/finance, and (4) industrial. The essential features of a corporate bond are relatively simple. The corporate issuer promises to pay a specified percentage of par values on designated dates (the coupon payments) and to repay par or principal value of the bond at maturity. In order to estimate the ability of the issuer to live up to its future contractual obligations, professional money managers use various techniques to analyze information on companies and bond issues one of them is by using three rating systems. The commercial rating companies are (1) Moody's investors Service, (2) Standard and Poor's Corporation, and (3) FitchRatings. In Indonesia, the most outstanding commercial rating company is Pefindo.

## **Municipal bonds**

These bonds are issued by local government (province). Municipal bonds have default risk as corporate bonds. Usually if the bondholders are local resident, it is free of tax for the coupon rates.

## **Foreign bonds**

Foreign bonds are issued by foreign governments or foreign corporations. Additional risk exists if the bonds are denominated in foreign currency.

According to Brigham and Ehrhardt (2005) bonds have some characteristics:

### *Par value*

It is the stated face value of the bond that represents the amount of money the firm borrows and promises to repay on the maturity date.

### *Coupon rate*

It is the fixed payment of bond issuers to the bond holders in terms of certain amount of coupon (quarterly, semi-annually or annually).

### *Maturity date*

It is a specified date on which the par value must be repaid by the bond issuers.

### *Provisions to call or redeem bonds*

It is a right which gives the issuers to call the bonds for redemption.

### *Sinking funds*

It facilitates the orderly retirement of the bond issue.

### *Other features*

Some bonds have certain features, such as convertible bonds which can be converted into common stock, warrants, income bonds, etc.

### **Bond Yield**

Return on bond investment is source of income for the investors who allocate their money to buy a retail bond/corporate bond/government bond. One of the important thing that is to be considered before they decide to invest in bond is the amount of bond yield as a measurement tool to know the annually rate of return. There are two terminologies in calculating yield, *current yield* and *yield to maturity*. (Fabozzi, 2000)

*2.1.2.1 Current yield relates the annual coupon interest to the market price. The formula for the current yield is:*

Current yield =

2.1.2.2 Yield to maturity (YTM) is computed in the same way as the yield (internal rate of return); the cash flows are those that the investor would realize by holding the bond to maturity

$$p = \sum_{t=1}^n \frac{C}{(1+y)^t} + \frac{M}{(1+y)^n}$$

Explanation:

C = coupon

n = period of time to maturity (in year) R = redemption value

P = purchasing value

2.1.3 Yield Spreads

Yield is return on bond investment in form of percentage. Yield to maturity is compounded rate of return investor get when they buy the bond in current price and hold it until maturity date. Yield to maturity is measure of yield reflects return and compounded rate of return which is expected by investor, if two assumptions are signalized can be fulfilled, then yield to maturity is expected same as realized yield. First assumption is investor will hold their bond until maturity date. Value that investor get if the first assumption is fulfilled called Yield to Maturity. Second assumption is investor re-invest their income generated from Yield to Maturity (Tendelilin, 2007)

Yield to maturity of bond is rate of return that investor achieved from investing in bond. The yield to maturity considers three sources of dollar return in investing in a bond – coupon interest, reinvestment income, and capital gain (or loss), but is deficient in assuming that all coupon interest can be reinvested at a rate less than the yield to maturity (Fabozzi, 2000).

Higher yield to maturity will cause higher return for investing. When the yield to maturity increase, the discount rate to the bond's remaining cash flows will increase, and then reducing the present value and the bond's price. Investor demands a lower yield to maturity. Lower yield to maturity will reducing the discount rate applied to the bond's cash flows and raising the price (Berk, DeMarzo, & Harford, 2012).

Yield to maturity is referred to as simply yield. The difference between the yields of any two bonds is called a yield spread. Usually the spreads describe in term of “basis point (bps). 1 percentage point is equal to 100 bps. Investor will be able to identify their opportunities by looking at the yield spreads. Higher the yield spread, the greater the difference between two securities or instrument.

Based on Rose and Marquis (2009) interest rate has four functions for the economy of a country:

- 1) Interest rate facilitates the flow of current savings into investments that promote economic growth.
- 2) Interest rate allocates the available supply of credit to those investment projects with the highest return.
- 3) Adjustment in interest rate can bring the supply of money into balance with demand.
- 4) Interest rate is important tool for government policy through their influence on the volume of saving and investment.

### **Time to Maturity**

According to Fabozzi (2000), the price of bond will fluctuate over its life as yields in the market change. The time remaining on a bond's life is referred to its term to maturity. The longer the term to maturity of a bond, the greater the price volatility resulting from a change in the market yields. Generally bonds are classified into three maturity sectors:

- (1) Short term : 1- 5 years
- (2) Intermediate term : 5- 12 years
- (3) Long term : > 12 years

A key bond-interest rate relationship is that bond prices are inversely proportional to changes in market interest rates. This means that all else equal, long-term bonds are more sensitive to interest rate changes than short - term bonds (Ivanovskia, Stojanovskib, & Ivanovskac, 2013). Bond with longer term to maturity has greater risk rate and caused the yield achieved by the investor will be different compared to the corporate bond with shorter time to maturity. Generally, the change of bond price is caused by the period of time to maturity. Basically,

when the interest rate changes, bond price with longer term to maturity will be more affected rather than bond with shorter-term to maturity. According to Ziebart & Reiter (1992), they found that years to maturity are negatively affect the bond yields.

## **Coupon rate**

The coupon rate, also called nominal rate, is the interest rate that the issuer agrees to pay each year. All bonds make periodic coupon payments. Zero-coupon bonds, the holder of a zero-coupon bond realizes interest by buying the bond substantially below its principal value. Interest then paid at the maturity date, with the exact amount being difference between the principal value and the price paid for the bond. Floating-rate bonds also exist, for these bonds coupon rates are reset periodically according to a predetermined benchmark (Fabozzi, 2000).

### **Coupon rate of bond has two characteristics:**

#### **(1) Fixed Rate Bond**

A bond pays the same amount of interest for its entire term. The benefits of owning a fixed-rate bond is that investors know with certainty how much interest earned and the duration. An investor who wants to earn a guarantees interest rate for a specified term could purchase a fixed-rate treasury bond, corporate bond or municipal bond. A key risk of owning fixed-rate bonds is interest rate risk, or the chance that bond interest rates will rise, making an investor's existing bonds less valuable (Investopedia).

#### **(2) Floating Rate Bond (variable rate bonds)**

Bond Interest rate is adjusted periodically based on the Treasury Bills interest rate or the average time deposits of certain banks. Bond variable interest rate issued by the government in order to recap the interest rate determined every three months based on 3-month SBI interest rate (IDX, 2012).

(Romzi, 2013) Coupon rates are typically calculated on annual basis, known as the annual percentage rate, since coupon rate is a cost, firms tend to minimize it in order to be efficient in their financing decisions. Therefore,



managers tend to time the issuance of bond based on the level of bonds coupon rate in the market.

If the coupon rate gets higher, at least there are two implications for the firms; (1) firms coupon expense will increase, especially for the firms which have higher bond, thus exposing the firms to bankruptcy, and (2) it is possible that common goods that are used in firms production increase too, this will increase the firms operational expenses. These two implications lead to the potential of decreasing in firm's net income.

Graham and Harvey (2001) find coupon rate is the most important factor considered in borrowings. Their survey provides evidence CFOs attempt to time the coupon rates by issuing bond when they think that the market bond's coupon rates are occasionally low.

## Previous Research

There are many empirical research focused on this study, Duffee (1998), Jacoby, Liao, and Batten (2009), and Morris, Neal, and Rolph (2000) investigated yield spread dynamics by estimating the effect of government rates on yield spreads not only over the long-run, but also over the short-run. Most researchers in this area apply standard regression analysis on changes over time in yield spreads as a function of changes in government rates (Duffee, 1998 and Jacoby et al, 2009). However, some argue that this approach lacks empirical power since they find evidence that the time series of yields on corporate and government bonds are non-stationary. To avoid problems associated with non-stationary, Duffee (1998) and Jacoby et al (2009) apply statistical analysis on changes in bonds' interest rates rather than their levels.

Duffee (1998) finds that the relation of both callable and noncallable bond yield spreads and treasury yields is negative. However, this negative relation is much stronger for callable bond issues. The relation is also found to be more negative for high-priced callable bonds than for low-priced callable bonds. This is because the call option for high-priced callable bonds is deeper in the money. Lower coupon rates of treasury bonds as compared with corporate bonds reflect the higher duration of treasury bonds.

Ibrahim (2008) used multiple linear regression in testing the effect of interest rate, bond rating, firm size, and debt to equity ratio of 22 corporate bond yields period 2004-2006. He found that interest rate and DER positively related to the corporate yields, bond rating and firm size negatively related to corporate bond yield.

Longstaff and Schwartz (1995) find that yield spreads are negatively related to interest rates. They account for this result by presuming that the correlation between the value of the firm's assets and the risk free rate is negative, their regression analysis yields a negative yield spread-treasury rate relation, decreasing in magnitude as credit rating of the bond issue increases.

MNR (2000) use co-integration approach to model the relation between corporate and treasury yields. They use monthly averages of daily yields for 10-year constant maturity treasury bonds and Moody's Aaa and Baa seasoned bond indices obtained from the Board of Governors of the Federal Reserve System. The sample size of each data series sums to a total of 456 observations. They show that corporate rates are co-integrated with treasury rates. Theoretically, this result suggests that the dynamics of this relationship is time-varying-the relation between corporate and treasury rates is positive in the long-run and negative in the short-run. Intuitively, this pattern implies the same time-dependent relation for the relation between yield spreads and

treasury yields. To confirm this, they compute the separate impulse response functions for corporate and treasury yields as a result of a shock in the treasury yield. Then they find the implied change in yield spreads by taking the difference between the two functions.

Shiller (2012) applied two commonly used cointegration techniques to study the relation between corporate yields and government yields and derive implications for the relation between yield spreads and government yields. The hypothesis of non-stationarity for corporate and government yields is not supported. They found preliminary evidence of the existence of cointegrating relation between corporate and government yields based on the Engle-Granger method. The effect of a shock to the 10-year government yield appears to have a consistently negative impact on A and BBB yields spreads, both over the short-run and long-run.

### **Hypothesis Development**

The hypotheses developed in this research are:

$H_{a1}$  : There is cointegration between SBI rate corporate and yield spreads both in short-run and long-run relationship.

$H_{a2}$  : There is cointegration between time to maturity and yield spreads both in short-run and long-run relationship.

$H_{a3}$  : There is cointegration between coupon rate affects yield spreads both in short-run and long-run relationship.

## CHAPTER III: METHODOLOGY

### 4.1 Empirical framework

The purpose of this study was to analyze the microstructure characteristics of the bonds market. The main elements considered include: liquidity, efficiency and volatility. Although literature provides more sophisticated models of carrying out the analysis, because of data constraints the study carried out a simple but informative analysis about the state of the market microstructure in the bonds market in Kenya.

#### a) Liquidity

To capture liquidity, the study used the traded value (which is what was available) and number of deals. If all the statistics of the outstanding value of bonds were available, the study would have used the turnover ratio. Similarly, it would have been more preferable to use the traded volumes rather than values because of the impact of price changes. The number of deals shows participation in the market while the traded volume/values show the size of transactions. Thus, we expect that the higher the number of deals, the higher the level of participation and the higher the value traded the larger the size of transactions. It is possible however; that small deals could be associated with higher traded values so that large transactions fail to capture the participation rate. In this regard the study used the average traded value per deal to analyze the average size of each transaction.

#### b) Efficiency

The study looked at various aspects that have implications on the efficiency of the market. The first aspect considered was thinness of the market measured by the number of days of traded out of the ideal situation (this excludes weekends and holidays and includes all the days that the market is open for trading in the week). A thin market is said to be inefficient because of the information asymmetry. Second, it is hypothesized that when information assimilation is not an issue for the market, then the difference between the closing prices and the highest prices quoted during the day should not be significantly different. In this study we compare the closing prices with the highest quoted prices. Inefficiency is inferred when the dispersion between the two is high. An assumption is also made that the closing price that captures the information in the course of trading should be between the high and low quotations of the day. It would have been interesting to capture efficiency by looking at how the market adheres to administrative directives. For example, there are defined limits within which the current price should not exceed. With daily data it would be possible to trace the magnitude of the daily prices and calculate their dispersions. However, the study did not get access to this type of data.

### c) Volatility

The study used the standard deviation and variance of bonds return to capture the volatility in the market. The standard deviation captures the direction of fluctuations while the variance captures the magnitude. The volatility is defined as:

Where,  $\sigma$  is the standard deviation,  $\log$  is the natural logarithm,  $Q$  represents price, current yield or any other variable whose volatility is being measured.  $X_t$  is the monthly observation and  $\bar{X}$  is the mean value of 12 months. Subscript  $t-1$  indicates that the standard deviation is conditional on information available at time  $t-1$ . The variance is defined as the square of the standard deviation. Bonds return is a sum of the current yield and capital gain or loss. Thus, the study divided the bonds returns into the two components and analyzed them separately. The idea was to capture the size of the two components in the total volatility. Further, the study captured the dispersion between the lowest and highest prices to give an indication of the price dispersions.

#### 4.2 Variable definition

Bond return = current yield + capital gain/loss; Current yield = coupon/bond prices; Capital gain/loss =  $\log(\text{bond price})_t - \log(\text{bond price})_{t-1}$ ; Value = traded value of bonds; Deal = number of deals struck in the period; APD = ratio of Value to Deal; Day = the number of days traded; Day\* = the ratio of number of days traded to total ideal number of days; Closing = closing price in the day of trading; High = the highest price quoted in the day of trading; Low = the lowest price traded in the day of trading

### **4.3 Data and Sample**

The study covers the period 2000-2004. This is the period when comprehensive monthly data is available as observed from the NSE's monthly bulletins. In total the study uses 1,279 treasury bonds traded value observations, 45 corporate bonds traded value observations, 60 bonds deals, 1,266 bond price and 1,093 current yield observations for treasury bonds, and 45 bond price and current yield observations for the corporate bonds. The variation in sample sizes is as a result of the way bonds data is entered at NSE; it keeps changing the style over time and there are variations in frequency of trading.

## CHAPTER IV: DATA ANALYSIS

### 4.1 Data and Sample

The study covers the period 2007-2014. This is the period when comprehensive monthly data is available as observed from the NSE's monthly bulletins. In total the study uses 109 treasury bonds traded value observations.

The variation in sample sizes is as a result of the way bonds data is entered at NSE and CBK sites; it keeps changing the style over time and there are variations in frequency of trading.

The value (in Kshs. billions) of the Kenyan bond market (1996-2003)

### 4.2 Data Description

Tenor	Face Value (Kshs Millions)	Coupon Rate	Redemption Yield	Issue Date
2	Mean	5317.623333	10.673400	12.332200
	N	15	15	15
	Std. Deviation	8993.005697	5.7732162	5.7059297
	Variance	5	33.330	32.558
	Kurtosis	80874151.47	1.061	.062
	Skewness	6	1.199	.364
	Mean	500002573.9	9.262000	10.583000
5	N	47500	20	20
	Std. Deviation	2236067371.	1.8157970	1.9679000
		6644670		

		4999997290			
	Variance	622437400.00	3.297	3.873	
	Kurtosis	20.000	-.440	-.075	
	Skewness	4.472	.198	-.600	
	Mean	1420.417647	10.872176	11.450000	
10	N	17	17	17	17
	Std. Deviation	3838.6935597	1.8125147	1.9468649	
	Variance	14735568.245	3.285	3.790	
	Kurtosis	5.490	-.898	-.185	
	Skewness	2.607	.491	-.490	
	Mean	3001029221.795834	12.125000	14.565417	
12	N	12	12	12	12
	Std. Deviation	7060268059.8198140	.8012774	2.3471641	
	Variance	49847385076511834000.000	.642	5.509	
	Kurtosis	3.131	2.148	-1.598	
	Skewness	2.122	.944	-.463	
	Mean	2674626782.996429	12.000000	13.121214	
15	N	14	14	14	14
	Std. Deviation	8727361221.5850890	1.6955825	1.3261401	
	Variance	76166833892027170000.000	2.875	1.759	
	Kurtosis	13.256	-.064	1.748	
	Skewness	3.615	-.454	-1.159	



Total	Mean	1069965141. 203847	10.816256	12.176603	
	N	78	78	78	78
	Std. Deviation	4777407069. 4456410	3.0474839	3.2525589	
	Variance	2282361830 7189187000. 000	9.287	10.579	
	Kurtosis	28.749	4.955	2.331	
	Skewness	5.178	1.174	.357	

The redemption yield in all the tenors is normally distributed as the skewness values are close to zero.

#### 4.3 Test for correlation

Correlation

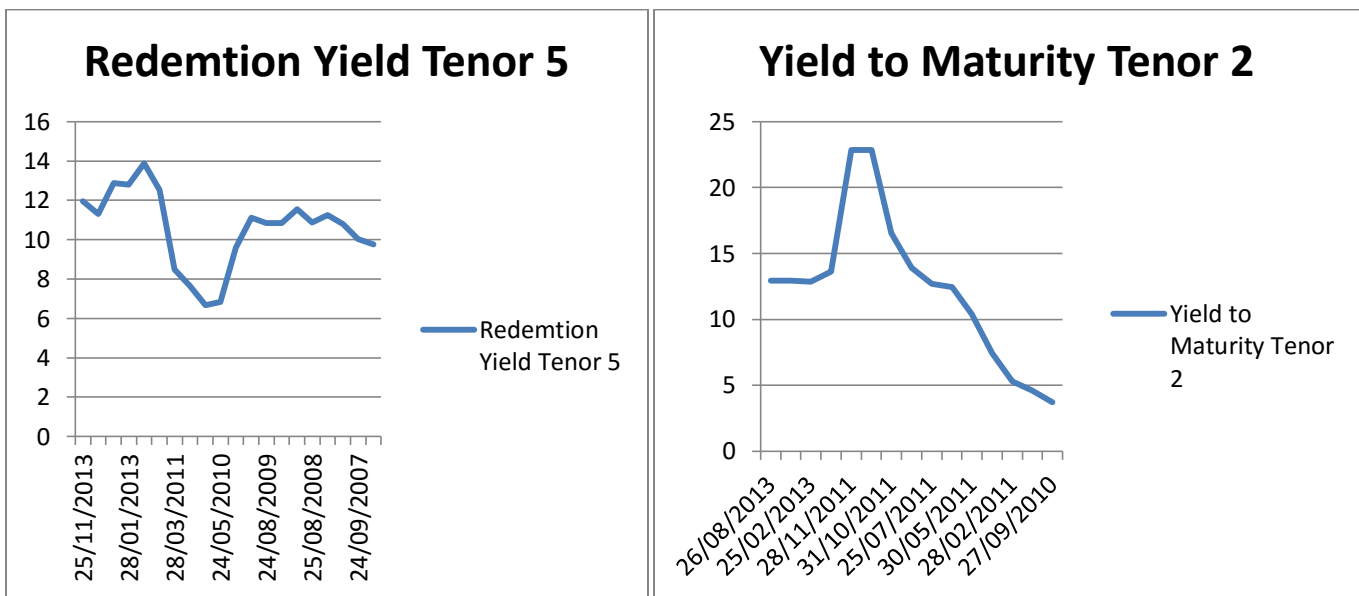
#### Correlations

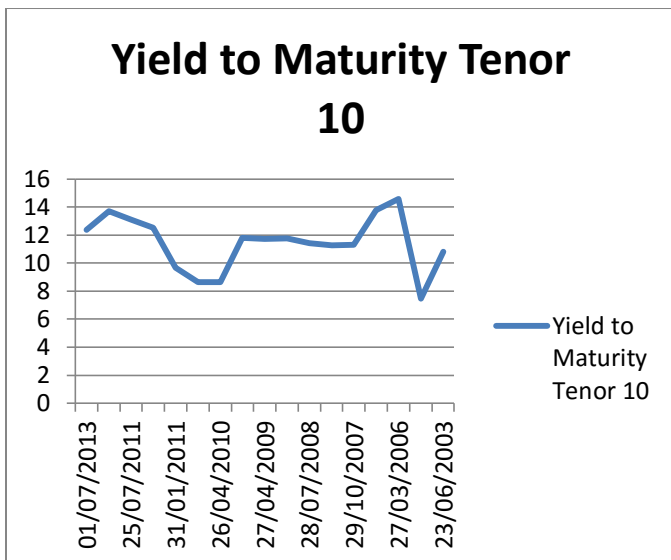
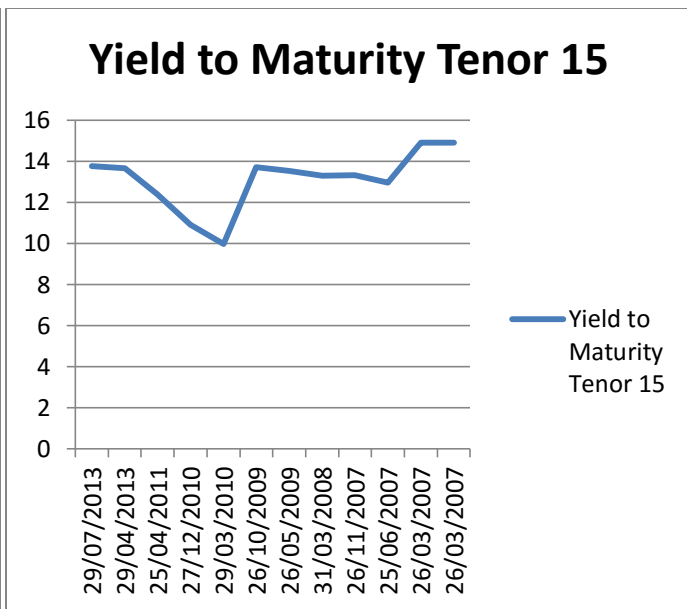
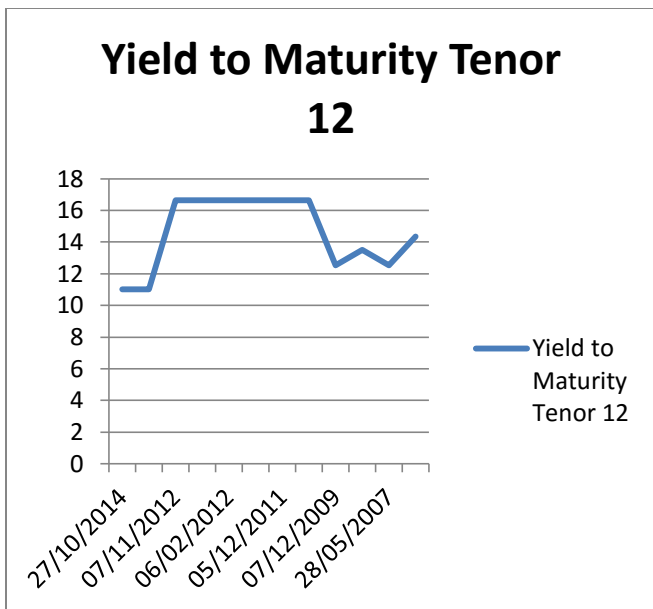
Control Variables		Face Value (Kshs Millions)	Coupon Rate	Redemption Yield
Tenor	Correlation	1.000	.003	-.054
	Face Value (Kshs Millions)		.983	.638
	Significance (2- tailed)			
	df	0	75	75
Coupon Rate	Correlation	.003	1.000	.808
	Significance (2- tailed)	.983		.000

	df	75	0	75
	Correlation	-.054	.808	1.000
Redemption Yield	Significance (2-tailed)	.638	.000	.
	df	75	75	0

From the correlation table above, we can see there is a strong relationship between Redemption Yield and Coupon rate because of the Pearson Correlation value of 0.808 and significance value of  $0.00 < p\text{-value} = 0.05$ . There is no correlation or exist weak relation between face value and coupon rate as the correlation value is 0.003 and significance value of  $0.983 > 0.05$ . Also, there exist negative and weak relationship between face value and Redemption Yield as shown on the table above with correlation value of -0.054 and significance value of  $0.638 > p\text{-value} = 0.05$

#### 4.4 Yield Curves





The 5-year bond as from the graph above, from the year 2013, the curve seems to be normal or up-sloped yield curve implying that yields on longer-term bonds may continue to rise, responding to periods of economic expansion.

The 2, 12, and 15 year bond from the year 2013 there seemed to be an overall flat yield curve which arose from normal or inverted yield curve, depending on changing economic conditions.

The 10 year bond showed an inverted or down-sloped yield curve from the year 2011 to the year 2013 suggesting yields on 10 year bonds may continue to fall, corresponding to periods of economic recession.

## **CHAPTER V: DISCUSSION, CONCLUSION AND RECOMMENDATION**

Bond market microstructure is an important area of research, going by the attention that this area of financial economics has received hitherto. Our study analyzed the various bond in Kenya with the objective of seeking to understand how these coupon rates, tenor type and dates issued influence bond price and ultimately, the performance of the bond market in Kenya.

On the basis of the analysis of the different bonds, the study found out that they differ across bond categories. Liquidity was found to be higher in the 5 year Treasury bonds market than in the 2, 10, 12, and 15bonds market. Efficiency was also found to be higher in the 5 year Treasury bonds market as compared to the other bonds market. However, as concerns volatility, the reverse was the case. It was found to be higher in 5 year Treasury bonds than in the other bonds market.

Overall, the performance in the 5 year Treasury bonds market is better than in the year bonds market in terms of the analyzed redemption yield. Concerted efforts should therefore be made, to improve operations in the 2,10, 12 and 15 year bonds market so that they can operate optimally even as the overall government bond market gets more vibrant.

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