



**INFLUENCE OF MACROECONOMIC VARIABLES ON GOVERNMENT BOND PERFORMANCE AT NAIROBI
SECURITIES EXCHANGE IN KENYA**

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Accepted: May 1, 2019

ABSTRACT

This study sought to evaluate influence of inflation, interest rate and foreign exchange on government bond market at the NSE. The study used bond index provided by FTSE to measure the performance of government bond. The study adopted quantitative research design, with the population under study consisting of all Kenya government bond issued and traded at the NSE between the periods of January 2012 and December 2018 a period characterized by financial markets growth and innovation. The study used Secondary data which was obtained from Central Bank of Kenya, Nairobi securities exchange, International Monetary Fund and Kenya national bureau of statistics for the purpose of analysis. These data was averaged quarterly and analyzed using E-views and the result presented by use of graphs and tables in a more comprehensive manner for easy interpretations. The study used Autoregressive Distributed Lag (ARDL) to test for cointegration while Error correction Model was used to run the regression equation. Augmented Dickey fuller (ADF) was used to test stationary of variables, while Jarque-Bera was used to check normality. Based on the findings, the study established that the macroeconomic variables were found to be satisfactory in determining bond market index, supported by R squared of 65%. However the ARDL test revealed long run relationship between bond and interest rate. The trend analysis and Error correction OLS regression (ECM) indicated that interest rate and inflation rate were negatively and significantly related to bond performance. While exchange rate was positively and insignificantly related to bond prices. The study therefore concluded that interest rate, inflation rate and exchange rate affected bond market performance. The study therefore recommended prudent monetary policy in respect to inflation, interest rates and stability of exchange rate to support Bond performance. The study further suggested investigating other variables the affect bond prices since R-squared was not 100%.

Key Words: *Inflation, Interest Rate, Foreign Exchange, Government Bond, Nairobi Stock Exchange*

CITATION: Kwamuma, P., & Weda, C. (2019). Influence of macroeconomic variables on government bond performance at Nairobi Securities Exchange in Kenya. *The Strategic Journal of Business & Change Management*, 6 (2), 1012 –1029.

INTRODUCTION

Bonds are useful and important tools for raising funds by government, companies and private institution, Becker and Irvishna (2011). The financial crisis that hit the financial market in 2007 increased the importance the bond market as a main source of financing to government. Most developed countries such United States of America (USA) has one of the most developed and the best bond market in the world, followed by Japan, United Kingdom and the rest of emerging markets (Adelegan, 2009). According to pearl (2014), the relation between macro-economic variable and financial market developments has been an area of interest to researcher and academicians.

Since the beginning of industrial revolution, Bond market has been one of the main contributors to economic growth and developments in the global financial markets. Bond market can also be described as debt market where investor trade on debt securities. This market is considered as a substitute for collecting resources by government and private sectors, Pearl (2014). Bond markets include bonds or securities issued by government and corporate debt securities. In developed markets bond market consist of corporate bonds, municipal bond; asset backed bond as well as government bonds, Platz (2014).

The Nairobi securities exchange market in Kenya is among the top in the emerging market in the African countries. The performance of the security market is highly dependent to macroeconomic factors. According to Olweny and Omondi (2011) security performance is important for economic growth because it enable a better utilization of fund to productive economic activities, thus acting as barometer of an economy. The importance of the bond market to the development of a country is linked to the effectiveness, governance, and the appropriate regulatory framework designed by both policy makers and politicians. The role of bond markets in economic development has continued to

attract the attention of many scholars and policy makers in the recent past. Bond yield is one of the most sensitive assets to economic condition.

Kimani and Olweny (2011) observed that the security market motivate investor who have excess money to channel the fund in other financial instruments that equals their liquidity preference and also appetite to risk. In that case, good mobilization of savings increase price of saving and eventually stimulate investments, these increase earning to the owners. Changes in equity prices are directly connected to some factors like firm's performance, government policy and key macro-economic variables.

Fluctuations in stock prices and indices predict stock trends, as well as that of the whole economy or a specific sector, in the foreseeable future Okioga (2013). There are other aspects that can act as a signal to investor and trader on whether to expect higher or lower returns on bond market performances as a result of various factors have become the focus and an indicator of economic performance. bond prices are so sensitive to economic environments of any country, and for this reason their value are so volatile and unpredictable leading to swings in the market thus causing bubbles, and these may eventually be detrimental to the entire economy Borys (2011). Further change in bond prices can have negative impacts in an economy, which gives fundamental relationship between economic changes as a result of macro-economic variables and returns at bond markets to be one of the most debated topics in financial markets in the last few years, Ozbay (2009).

Bond performance is measured in terms of yield to maturity also referred as YTM, Nominal Yield (NY) Yield to call (YC) and current yield (CY). Nyakeri (2009) defined YTM as the interest earn if a bond is held until maturity, in other words YTM is the same as market interest rates.

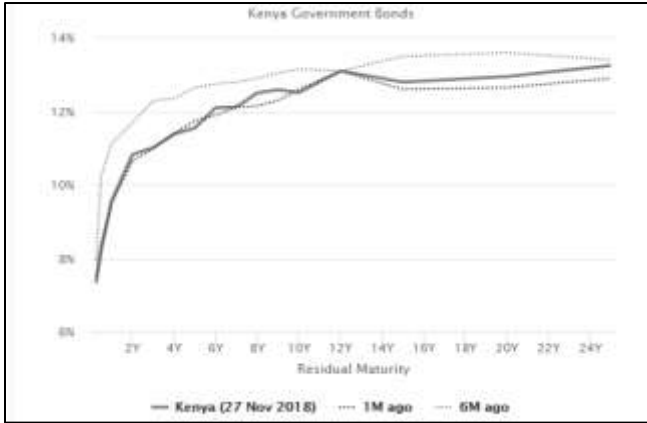


Figure 1: Kenya Yield Curve
Source NSE (2018)

Government bond yield curve which show the current interest rate of the bond against the duration of the bond, is what the investor have been tacking their performance in the market at the NSE. Bond price index and YTM is commonly used to measure bond performance since it also reflects the bond cash flow and coupon. The Nairobi security exchange together with the financial times stock exchange (FTSE) a British company provided the index for bonds through FTSE-NSE.

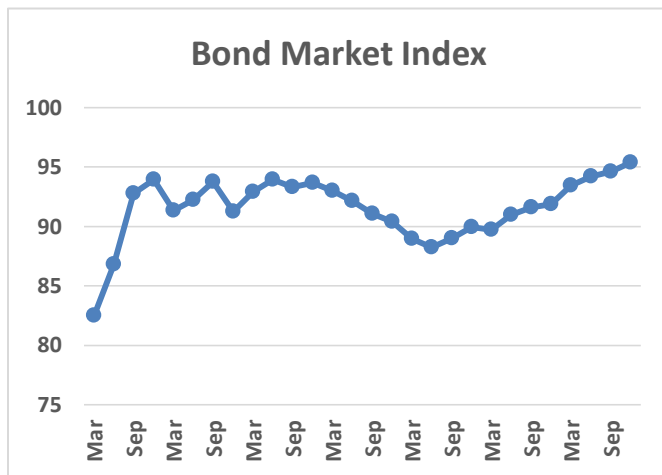


Figure 2: Bond Market Index
Source: NSE (2018).

According to Longei and Ali 2017 bond market index is a technique of calculating the value of a segment of bonds in the market. It is calculated from the value of

selected bonds in terms of weighted average. Indices in financial market aggregate large amount of price and other information that are important to the market thus help the investor to keep track of market developments. Bond price indices provide a way of measuring the performance of a specific segment of financial market. According to Clare and Thomas (2015) financial market indices are closely monitored by regulators and investors.

The Nairobi Securities Exchange (NSE) which was initially known as Nairobi Stock Exchange. It is a public market in which trading activities of various financial instruments take place, thus proving a platform for buying and selling of financial instruments of public companies which are listed.

The capital market authority, central bank of Kenya and government of Kenya has played a key role in strengthening the Nairobi securities exchange market. NSE is entrusted with the duty to administer listing or delisting and give directive of exchanging of money related instruments, for example, bond, shares and stocks, with the Kenya government bond taking 70 percent and the rest 30 per cent consist of the corporate bonds.

Statement of the Problem

Bond Market performance has been a main focus by many investors and policy maker since it acts like a barometer to measure economic growth of any country. The government of Kenya launched a bid to issue first Treasury bond in 1980 while first corporate bond was issued in 1996 Ngugi (2009). Bond markets are traded under separate market usually referred as fixed income securities. The Nairobi security exchanged automated trading on government bond in 2009. The trading is governed by rules and regulations outlined by Nairobi Stock Exchange and Capital Market Authority. These automations made a significant move for the regulators including the Central Bank of Kenya. Kenya bond market is highly dependent to macroeconomic variables such as inflation, exchange rate, interest rate and economic

growth Odhiambo (2012). These variables are considered the most important indicator of financial market behavior since they are used by investor to monitor market development thus guiding them on investment decision, thus considered significant in the study of bond market behavior Ngugi (2011).

Fen et al (2014) conducted a study to determinant of government bonds in Malaysia. The study established that influence of inflation on government bond yield was insignificant, however another study by Guber (2012) established that inflation had a positive impact on the government bond performance. Study conducted by Carlstom (2012) on macroeconomic variable on securities performance indicated that the relation between securities and economic variables is not clear. Other researcher like Verma (2015) and Harvey (2010) noted that securities market movement is caused by speculation and irrational conducts of traders and investors, and thus change in prices cannot be related to macroeconomic variables. In Kenya most studies have focused on relationship between macroeconomic factors and equity market at Nairobi securities exchange, studies on bond market performance at the NSE are scarce. Among the studies on bond market includes Koka (2009) who conducted a study on government bond and economic growth in Kenya. The study established government bond had a positive effect on economic growth. Thus economic growth was enhanced by government bonds uptake and effective bond market. Ngugi (2011) noted that growth in GDP always lead to increase in economic activities in a country thus giving investor confident about investment in financial instrument of the country. Balozzi (2017) in the study of determinant of Kenya government bond yields established that budget deficit, inflation, and interest rate influence bond performance.

As indicated in these studies, it notable that there is absence of harmony on the relationship of economic factors on performance of bond market at the NSE, the studies also concentrated mostly on equity

market as opposed to bond market. Few studies on the bond market focused on infrastructure bond and corporate bonds. The researcher therefore sought to bridge this literature gap, by finding out whether macroeconomic variables inflation, exchange rate and interest influence government bond market performance at Nairobi Securities Exchange in Kenya.

Research Objectives

- To determine influence of inflation on government bond market performance
- To examine influence of interest rate on government bond market performance
- To investigate influence of foreign exchange rate on government bond market performance

LITERATURE REVIEW

Efficient Market Hypothesis Theory

Efficient market Hypothesis (EMH) theory is a theory in financial economics that state that asset price reflects the available information in the market. The theory was developed by Fama (1970) and defined by Anup Rao (2017) as the ability of the capital market to function efficiently such that prices of different financial instrument respond instantly to any new information in the market. Market efficiency is tied to its ability to communicate information relevant to market participant. In an efficient markets price reflects current knowledge and the investor. Such efficiency in the market will create prices that beneficial in terms of information that an investor will require in making investment decision. The efficient market hypothesis theory deals with news and information efficiency. The theory is mainly based on the idea that the bond prices are unpredictable and do not have any define pattern.

The efficient market hypothesis (EMH) deal with informational efficiency and strongly based on the idea that the asset prices or returns are unpredictable and do not follows any regular pattern. This makes it impossible to “beat the market”. According the EMH

theory securities prices reflects the information available and relevant to the investor. An aggressive investor gathers information very fast and immediately integrates the information into the bond prices. Mostly, new information which is unpredicted may cause changes in the in the prices, this makes bond market which depend on the news also unpredicted. News about improvement in GDP and economic growth will leads to increase in employment and as a result leads to inflation, this information send's signal to a rational investor and may cause price bubbles in the security market.

EMH theory states that neither previous technical study on equity prices or essential financial analysis such as industry, company and asset valuation can assist investor to determine an undervalued stock. In normal circumstance past prices cannot predict today's or future change in bond prices, in other words today's prices is totally independent of past prices.

The Liquidity Premium Theory

The liquidity premium theory was developed by an economist John M Keynes in 1930s. According to the theory investor prefers financial instrument that are more liquid and prepared to pay higher premium for these instrument or less than the market value for asset that are not liquid. Liquid premium is a term used to describe additional yield of an investment that cannot be readily sold at its fair market value. Bonds are considered as less risky due to its default-free aspect. However due to the uncertainty about inflation and future interest rates they are considered risky.

The theory assumes that long term bonds are hard to sell than those bonds that have shorter tenor. The bond holders are interested on purchasing power of the real return they will get from the bond rather than nominal value of the coupon payments Munasib (2013). Uncertainty about future inflation generates uncertainty about real return value for the investor

making investment in bond uncertain and risky. This theory assumes that bonds of different maturities as a substitute to each other but not a perfect substitute. Thus most investor would prefer instrument with shorter term time to maturity because they are free of interest rate risk and inflation. Bonds with longer maturity have higher price for a given change in the interest rate and future inflation thus leading to capital losses Adelegan&Radzewics (2009). Short term bonds are easily converted to cash as the need for cash arise. Converting bond to cash may be done but with possible loss of value to their unpredictability nature and inflation.

Arbitrage pricing theory

Arbitrage pricing theory (APT) was developed by an economist Ross Stephen (1976) theory of asset pricing which state that the expected gain from a financial asset has a linear relationship between various macroeconomic factors and asset expected returns that affects the asset risk. The theory is based on the assumptions that; investors are risk averse and prefer higher to lower returns, capital markets are perfectly competitive, all investors have the same view of all parameters and returns can be explained by linear combination of a set of variables.

APT give market analyst and investors multiple pricing factors for financial asset based on the relationship between risk of financial asset and expected gains.it assume that the share values are determined by multi-macroeconomic variables. The theory is also designed at pointing out the fair market price of securities that maybe mispriced.

Flow oriented models

Flow oriented models Dornbusch and Fisher (1980), assumes that rate at which one currency of country is exchange by another currency is determined mainly by a country current account or balance of payment performance. These model further state that exchange rate affects international attractiveness of a country trade balance position, these has an

influence on macroeconomic variable such as real income and output. The model assumes that exchange rate movements cause stock price movements, which also alter international competitiveness of a firm as well as the balance of trade balances.

This model is built on the macro view that as stock prices represent the discounted present value of a firm's expected future cash flows, then any phenomenon that effects a firm's cash flow will be reflected in that firm's stock price if the market is efficient as the Efficient Market Hypothesis suggests.

Flow oriented' models postulate that currency movements influence a firm's earnings and hence causes change in stock and equity prices. In the case of a multinational entity, changes in the value of the exchange rate alter the value of the multinational's foreign operations, showing up as a profit or loss on its books which would then affect its share price. It follows therefore that if exchange rate appreciates, exporters are likely to be affected negatively. In the same regard an appreciation of the currency is likely to cause goods and services to be dearer on the international market. This therefore, brings about a decline in exports and firm's earnings.

Empirical Review

Bond Market index

Financial market index represent a way of calculating a specific segment in the financial market. These markets are always characterized by thousands of individual bonds, stocks, derivatives currencies and other financial securities. A bond is a debt instrument and cheapest way of government and corporation to source money due to tax relieve on its interest. According to Clare and Thomas (2015) indices performance are regularly monitored by regulators such as central banks and investors.

Market indices are used as a barometer for a wider economy and related financial market. The

performance of stock market and government bond are most of the time used as proxies to explain economic condition of a country. The index provided by FTSE-NSE will important in tracking the performance of Kenya government bonds. Many studies that have been conducted established a significant relationship between performance of Securities market and economic variables like gross national product, inflation, exchange rate, money supply and interest rates.

There are 2 theories that try to explain the movement of securities prices in the security market. The first is the efficient market hypothesis and the other is the behavioral finance which explains the behavior of finance specialist which affects the markets. According to Geethaet al. (2011), financial theorists suggest that there are direct and indirect aftermaths of inflation in every sector of the economy ranging from exchange rates, investment, unemployment, interest rates, and financial instrument markets among others.

Inflation

The relationship between bond market and inflation has received a significant consideration in the available studies. Inflation is described as decrease in purchasing power of a currency by individual or companies Thobarry (2009). It is also described as persistent increase in general price levels of goods and services. It occurs when we need more money to purchase same quantity of goods and services. The theory of Friedman (1987) state that inflation is always and everywhere monetary phenomenon.

When inflation rate increase in an economy, the real value of money reduces which tend to lower the real value of investments. High unexpected inflation often leads to lower the discount rate of present cash flows, this affect prices of asset as well as equity prices. Thus the connection between equities and velocity of money can be based upon the fisher (1930), monetarist and money illusion theory which

state that equities which is a claim of ownership may be used to hedge against inflation. The instability that invaded American stock market after the economic crash of 2008 has seen seesaw effects on the global financial market. Changes in money supply can be inflationary causing alteration in prices, rising uncertainty in the economy which discourages investment decision in the long run.

Interest rates

The relationship between interest rates and bond prices has received considerable attention in the empirical literature. Interest rate is described as a cost of borrowing or payment for services of capital and therefore resents return on capital Crowley (2007). Short term instrument are considered as part of money market in financial market that trade in instruments that have short maturities of up to one year and thus making them very liquid. Increase interest rate leads to reduction in corporate profit and increase in discount rate to corporate investor, which in turn have an implication on bond prices.

In Kenya increase or decrease of interest rate is wholly determined by economic condition. Change in central bank rates also plays a significant role in determining the market value of securities Ali and Longei (2017). Financial instruments which have short term tenor Short term instruments such as treasury bills, repo rates, and interbank overnight are considered as a substitute of equity market instruments as wave of speculation activities as interest rate change In theory, there are two index models that illustrate how the return of an underlying security reacts to interest rate changes and stock market index (Khan and Mahmood, 2013).

Exchange rates

According to Miskin and Eakins (2009) exchange rate can be described as the price of one currency from a country expressed in another currency of a different country. In other words it is the rate at which a currency can be converted into another currency. Movements of exchange rate affect equity market

return owing to information available to a rational investor. When there are high fluctuations in the exchange rates, the exchange rates movement, there would be high movements of market return volatility. A substantial appreciation of domestic currency exchange rate would make exports expensive relatively to other foreign goods which will result to a demand curve shifting away from home goods to foreign goods, thus reducing sales and subsequently earnings for the company. This will affect the performance of the company at the stock market. Some studies have concluded that there is a strong relationship between exchange rate movement and stock market returns volatility, while others have not. From macroeconomic point of view, exchange rate affects country economic while from the microeconomic point of view exchanges rate affects firms Obura and Anyago (2016). This means then exchange rate instability has implication on a country's financial and economic sector and to be specifically the equity market.

METHODOLOGY

This study employed quantitative research design. According to Thornhill and Lewis (2009), quantitative research fall in to two categories; studies that describes events and those that are interested in establishing inference or causal relationships. The study sought to examine influence of macroeconomic variables on bond market performance, this mean analyzing data that had already been investigated previously, and as such descriptive research was the most appropriate for this study. The research population of this study consisted of all Kenya government bonds issued and traded during the periods January 2012 and December 2018 at the NSE. New issue and redemption of government bond are done on monthly basis. This study considered government bond because they are the most active and actively traded at the NSE (My Stock 2017). The sample frame consisted of all Kenya government bonds issued and traded during the periods January

2012 and June 2018 at the NSE. This study used secondary data which was obtained from the Nairobi Securities Exchange for bond market index, Kenya National bureau of Standard and International Monetary Fund (IMF) for inflation and Central Bank of Kenya for foreign exchange rate and interest rates. This study used quantitative data analysis. According to Sekaran and Bougie (2016) quantitative data analysis is based on statistical and measurements, mathematical or numerical analysis of collected data. Error Correction Regression model was used to establish the effect or relation between inflation, interest rate, and foreign exchange rate and bond market performance.

Table 1: Summary of Descriptive Statistical Results

	BOND	EXCH	INFL	INTER
Mean	91.53726	94.84265	6.835758	9.393393
Median	92.00500	98.83831	6.440906	8.691500
Maximum	95.37667	103.8946	16.87097	18.92400
Minimum	82.51000	83.42731	3.529577	7.434000
Std. Dev.	2.727994	7.945656	2.713262	2.537884
Skewness	-1.388380	-0.181987	2.020575	2.781396
Kurtosis	5.450757	1.214381	8.043733	10.11943
Jarque-Bera	16.00271	3.874399	48.73182	95.23610
Probability	0.000335	0.144107	0.000000	0.000000
Sum	2563.043	2655.594	191.4012	263.0150
Sum Sq. Dev.	200.9328	1704.603	198.7684	173.9031
Observations	28	28	28	28

Standard Deviation and Variance measure dispersion or spread of the series. Standard Deviation and Variance showed how close the samples are centered around the mean. The closer the standard deviation was to the mean, the better. From the results above all the standard deviations were above one and thus the results of all variables were all spread from the mean, which is they varied from the mean.

Skewness is a measure of symmetry. If skewness is less than -1 or greater than 1, the distribution is highly skewed. If skewness is between -1 and -0.5 or between 0.5 and 1, the distribution is moderately skewed. If skewness is between -0.5 and 0.5, the distribution is approximately symmetric. From the results above, bond price was negatively

FINDINGS

Descriptive Statistics

Descriptive results were presented in Table 1 for the selected macroeconomic dependent and independent variables under the study. The number of observations under study was 28 which had been chosen according to availability of data. From the table, the mean which describes the average value in the series and the median which is the middle value are close, which implies that there are no outliers in each of the variables under study.

and highly skewed -1.388, exchange rate was negatively and moderately skewed -0.181, inflation rate was positively and highly skewed at 2.02, while interest rates was positively and highly skewed.

Kurtosis of normal distribution is 3; however Kurtosis of more than 3 indicates that the data is leptokurtic, with peakedness which is higher than that of normally distributed data. Kurtosis of less than 3 indicates that the data is platykurtic, with peakedness that is lower than that of a normal distribution. From the results above the kurtosis of bond price 5.45, inflation rate 8.043 and interest rate 10.11 were more than 3 implying that the data was leptokurtic. The kurtosis of exchange rate 1.21 was less than 3 and thus the data was platykurtic.

The null hypothesis for testing Normality was that, variables were normally distributed against the alternative hypothesis. Using P-values, null hypothesis was rejected if p-value was less than 0.05 for 5% significance level and the alternative hypothesis accepted. For this case then, we reject the null hypothesis since p-value of inflation rate, bond price and interest rates were less than the significant value of 0.005 and conclude that the variables were normally distributed at 5% significance level.

Trend Analysis

The study performed annualized trend analysis on the variables for the period of study. The results were plotted in the figure 3 below;

Inflation Rate

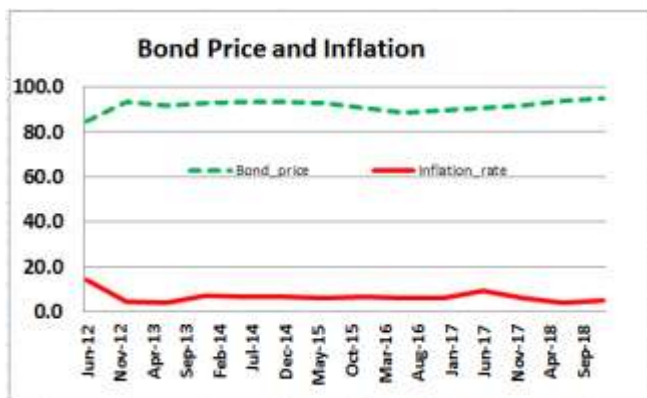


Figure 3: Trend Analysis for bond price and Inflation rate

The study sought to establish the influence of inflation on the bond market performance for a period of 7 years ranging from 2012 to 2018. A trend analysis for the two variables was plotted and result present in figure 3. The results indicated those bond prices were inversely related to inflation. As the inflation decrease the bond prices increased. This was in line with Longei and Ali (2017) who established bond price and inflation are inversely related.

Interest Rate

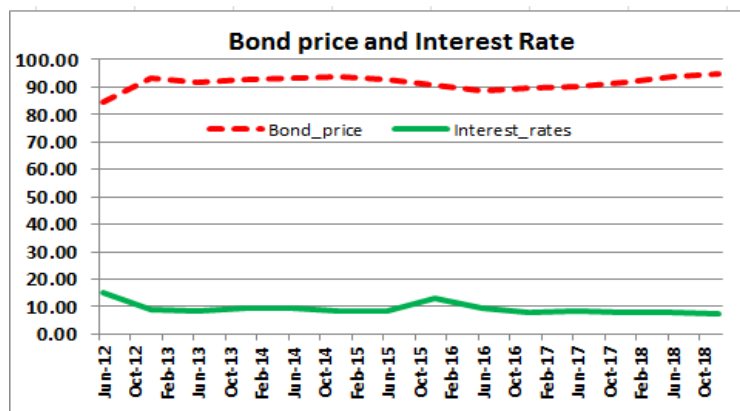


Figure 4: Trend Analysis for Interest rate

Figure 4 postulated the general trend between bond prices and 91 days interest rate for the period 2012 to 2016. The trend analysis for the two variables was plotted and the result showed the interest rate was varying across the years under study. Further, as interest decreased the bond prices increased. This mean the bond price was inversely related to the 91 days interest rates. This finding concurred with those finding of Balozi (2017) who established an inversely relationship between bond price and interest rates.

Foreign Exchange Rate



Figure 5: Trend Analysis for Foreign Exchange rate

Further, this study related the relationship between bond prices and exchange rate for years 2012 to 2018. A trend analysis between foreign exchange measured by Usd to Kes was plotted. The results revealed that there was little change in the bond index as the exchange rate change during the period under study. This was in line with Songole (2012)

who established insignificant negative relationship between performance of financial instrument at NSE and exchange rate.

Correlation Analysis

Relationship between variables was established through correlation analysis. The researcher conducted correlation analysis in order to establish the nature of relationship, if any, between bond performance, interest rate, exchange rate and

inflation rate. According to Mugenda (2008) correlation revealed the magnitude of the association between variables under study. Negative coefficient indicated there was a negative relationship, while a positive coefficient was an indication of positive relationship between variables.

Correlation analysis results were presented in Table 2 below.

Table 2: Correlation Results

	Bond price	Exchange rate	Inflation rate	Interest rates
Bond Price	1.000			
Exchange rate	0.042	1.000		
	0.707			
Inflation rate	-0.704	-0.197	1.000	
	0.000	0.073		
Interest rates	-0.622	-0.247	0.649	1.000
	0.000	0.024	0.000	

The results revealed that exchange rates were positively and insignificantly correlated with government bond market performance ($r=0.042$, $p=0.707$). This findings agreed with that of Songole (2012) established that exchange rates was not statistically significant affecting the performance of security market. In addition, inflation rates were negatively and significantly correlated with government bond market performance ($r=-0.704$, $p=0.000$). These findings agreed with that of Shaoping (2008) who established a strong relationship between inflation and bond market performance. The results further indicated that interest rates were negatively and significantly correlated with government bond market performance ($r=-0.622$, $p=0.000$). These findings agreed with that of Smales (2012) who established that interest rate significantly affected

the performance of a bond. A slight change in interest rate may influence the performance of government bond at the Nairobi Security Exchange.

Model Tests

Model tests which included unit root tests, multicollinearity tests, normality tests and autocorrelation tests were conducted.

Unit Root Tests

Most economic variables are usually non-stationary in nature and prior to running a regression analysis. Unit root tests were thus conducted using the Augmented Dickey-Fuller (ADF) test to establish whether the variables were stationary or non-stationary. The purpose of this is to avoid spurious regression results being obtained by using non-stationary series.

Table 3: Unit Root Tests at Level

	ADF Test	1% level	5% level	10% level	P value	Comment
Bond Price	-2.93812	-3.51126	-2.89678	-2.58563	0.05	Non stationary
Exchange rate	-0.94738	-3.51126	-2.89678	-2.58563	0.77	Non stationary
Inflation rate	-4.31994	-3.51229	-2.89722	-2.58586	0.00	stationary
Interest rate	-4.95765	-3.51126	-2.89678	-2.58563	0.00	stationary

Results indicated that bond price and exchange rates were non-stationary (i.e. presence of unit roots) at 1%, 5% and 10% levels of significance. This means these variables followed a random walk with a drift

and therefore calls for first differencing of the non-stationary variables before running a regression model. However, inflation rates and interest rates were stationary at level.

Table 4: Unit Root Tests at first differencing

	ADF Test	1% level	5% level	10% level	P value	Comment
Bond Price	-7.7041	-3.5123	-2.8972	-2.5859	0.00	stationary
Exchange rate	-8.5931	-3.5123	-2.8972	-2.5859	0.00	stationary

From table 4 we can see the p-value (0%) less than the critical level (5%) displaying unit root tests after first differencing. It was clear from the results in table below that showed that bond price and exchange rate become stationary (unit root disappears) on first differencing.

unpredictably with a slight change in the data. In the study multicollinearity was assessed using the variance inflation factors (VIF). As argued by Field (2009), variance inflation factor (VIF) of greater than 4 or 4 suggests multicollinearity, VIF of greater than 10 is strong evidence that collinearity is affecting the regression coefficients.

Multicollinearity Test

Multicollinearity occurs when two or more variables are highly correlated and the coefficient may change

Table 5: Multicollinearity Tests

Variable	Coefficient Variance	Centered VIF	1/VIF
C	8.52646	NA	NA
EXCHANGE_RATE	0.00077	1.0674	0.9368
INFLATION_RATE	0.01021	1.73085	0.5777
INTEREST_RATES	0.01045	1.77154	0.56449

The results above implied that all values were less than 10 thus implying absence of multicollinearity. This implied that there was no relationship between the independent variable and thus regression can be conducted.

Test for normality

The Jarque-Bera test was used to test the normality of the residuals since it is more conclusive than skewness and kurtosis tests.

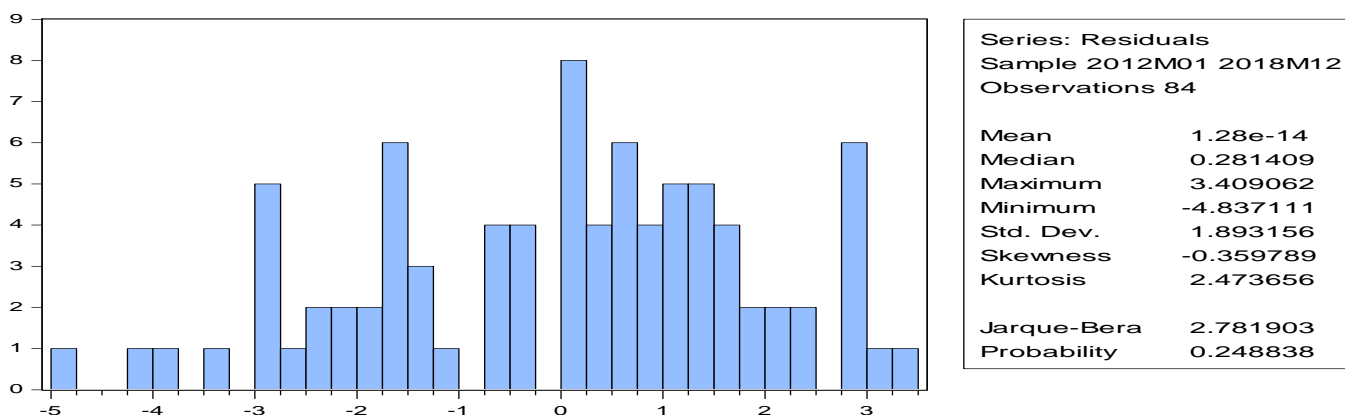


Figure 6: Test for Normality

If the p-value of Jarque-Bera statistics is less than 5 percent (0.05), it means that the residuals (u) are not normally distributed. From the figure 6 the residuals originating from the model p value is more than 0.05 which mean that the residual of our model follows normal distribution. This was supported by a Jarque-Bera statistic of 2.781903 and a p value of 0.248838 which is more than 0.05.

Auto Correlation

Serial correlation tests were run in order to check for correlation of error terms across time periods. Serial/auto correlation was tested using the Durbin-watson statistic, which assumes that the relationship is between an error and the previous one. When the p value of Durbin-watson is less than 1.00 or more than 3.00, the data may suggest presence of serial correlation, thus the test result was better when it's around to 2.00.

Table 6: Autocorrelation

R-squared	0.651245	Mean dependent var	91.87160
Adjusted R-squared	0.632889	S.D. dependent var	2.296082
S.E. of regression	1.391188	Akaike info criterion	3.557935
Sum squared resid	147.0908	Schwarz criterion	3.705740
Log likelihood	-139.0964	Hannan-Quinn criter.	3.617236
F-statistic	35.47946	Durbin-Watson stat	1.253128
Prob(F-statistic)	0.000000		

The probability value had p value of 1.2531 which was within the acceptable limits as stated by Gujarat (2009). This therefore, indicated that we did not reject the null hypothesis of no serial correlation and conclude that serial correlation does not exist. This

Table 7: ARDL Bound Test critical values

Dependent variable	Critical Value		
	F-stastict	5%	
BOND	7.129	3.77	Cointegration
INFL	2.9582	3.67	No cointegration
INTR	8.1514	3.23	Cointegration
EXCH	2.2976	3.23	No cointegration

$H_0 : b_{1i}=b_{2i}=b_{3i}=b_{4i}=0$ (There was no long run relationship among the variables)

$H_1 : b_{1i} \neq b_{2i} \neq b_{3i} \neq b_{4i} \neq 0$ (There was long run relationship among the variables)

If the computed F-statistic is greater than the critical value, then the null hypothesis is rejected (variables are cointegrated) and if it is below the critical value

implied that there was no correlation of error terms and thus regression could be conducted.

Cointegration Test

This study found it necessary to perform cointegration test since some variable were stationery at level while other were stationery after first differencing. In applied econometrics, the Granger (1981) and, Engle and Granger (1987), Autoregressive Distributed Lag (ARDL) cointegration technique or bound test of cointegration (Pesaran and Shin 1999 and Pesaran et al. 2001) and, Johansen and Juselius(1990) cointegration techniques have become the solution to determining the long run relationship between series that are non-stationary and stationery at level. When one cointegrating vector exists, Johansen and Juselius(1990) cointegration procedure cannot be applied. Hence, it become imperative to explore Pesaran and Shin (1995) and Pesaran et al (1996b) proposed Autoregressive Distributed Lag (ARDL) approach to cointegration or bound procedure for a long run relationship, irrespective of whether the underlying variables are I(0), I(1) or a combination of both.

The ARDL (p,q) model specification is given as follows:

$$\Delta Y_t = \alpha_0 + \phi_2 X_{t-1} + \phi_3 X_{t-2} + \phi_4 X_{t-3} + \sum_{i=1}^p \beta_i \Delta Y_{t-i} + \sum_{i=1}^q \beta_1 \Delta X_{t-i} + \sum_{i=1}^q \beta_2 \Delta X_{t-i} + \sum_{i=1}^q \beta_3 \Delta X_{t-i} + \epsilon_{1t} \dots \dots \dots \text{Equation (1)}$$

then null hypothesis cannot be rejected (there is no cointegration among the variables). From the table, bond and interest rate calculated F-statistics 7.129

and 8.1514 were higher than the critical of 3.77 and 3.23 respectively at the 5% level, thus we rejected the null hypothesis at 5% and concluded that there exist long run relationships between the vector and the regressor, while inflation and exchange rate F-statistic 2.95 and 2.297 were less than critical value of 3.67 and 3.23 respectively, thus we failed to reject null hypothesis and concluded that there was no long run relationship.

Regression

The Error correction model OLS approach was found to be most suitable in obtaining the regression line due to the presence of long run relationship between variables. Before error correction model test was performed, the optimal lag length for analysis was identified.

Table 8: Regression Analysis

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-163.0929	NA	3.817247	4.177323	4.296424	4.225074
1	-115.8648	88.55277	1.201902	3.021619	3.170496	3.081308
2	-113.6964	4.011550*	1.167441*	2.992409*	3.171061*	3.064036*
3	-113.6925	0.007016	1.197079	3.017313	3.225740	3.100878
4	-113.6734	0.034368	1.227070	3.041836	3.280038	3.137338

Tables 9: Error correction Model Table

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000951	0.001338	0.710379	0.4797
D(LNINFL(-2))	-0.255109	0.123959	2.058016	0.0431
D(LNEXCH(-2))	0.006519	0.007941	0.820863	0.4144
D(LNINTR(-2))	-0.232598	0.109988	2.114759	0.0378
ECM(-1)	-0.330370	0.099575	3.317788	0.0014

$$\Delta \ln \text{Bond} = \alpha + \sum_{i=1}^q \alpha_{1i} \Delta \ln \text{Inf}_{t-2} + \sum_{i=1}^q \alpha_{2i} \Delta \ln \text{Int}_{t-2} + \sum_{i=1}^q \alpha_{3i} \Delta \ln \text{Exch}_{t-2} + \text{ECM}_{t-1} + \varepsilon_t \dots \dots \text{Equation 2}$$

From error correction model regression table results indicated that exchange rate and its lags jointly helped correcting the disequilibrium of bond performance in the short run with the coefficient of

Inexch showing positive 0.0065 and a p-value of 0.4144 which greater than 0.05, thus indicating the level of control of exchange to the bond performance been insignificant. These findings deduced that change in bond performance has little association with exchange rates. Further the result showed one percent change in Inflation negatively influenced the performance of bond in the long run with a coefficient of 0.25 and a p value of 0.0431 while interest rate and its lag also negatively affected bond market performance with a long run coefficient of 0.23 and a p-value of less than 0.05 indicating the magnitude of the significance.

DISCUSSIONS

From the overall findings, it was established not all variable significantly affected bond performance at the Nairobi Securities Exchange. Inflation rate had a negative and significant effect with government bond market performance this is clearly show by β coefficient of -0.2551 meaning that a unit increase in inflation rate led to 26 percent increase in bond prices. $P=0.043$ which was less than 0.05 level of significance indicated that inflation rate significantly influenced bond performance at the NSE. The finding means that inflation played a big role in determining the bond prices. These findings agreed with that of Shaoping (2008) who established a strong relationship between inflation and bond market performance.

Further revealed that interest rate had a negative and significant effect on government bond market performance this was shown by a negative β coefficient -0.232 accounting for 23 percent changes in bond performance. The p value of 0.03 was also less than the required significant level 0.05, an indication that interest rate influence the performance of bond in the NSE market. These findings were in line with that of Smales (2012) who established that interest rate significantly affect the performance of a bond.

The results further, established that, holding other factors constant at time t , a unit increase exchange rate will lead to increase in bond prices by 0.6 percent. This was further determine of p value of 0.100 which was higher than 0.05, thus indication that the influence of exchange rate on bond performance is insignificant. This findings agreed with that of Songole (2012) established that exchange rates was not statistically significant affecting the performance of stock market.

Regression results further indicated that the R squared was 0.6512. This means exchange rate, inflation rate and interest rate explain 65.1% of the variations in the dependent variable which is bond performance. Finding of this study are compared to the finding of other research in Kenya Amataet *al* (2017) who studied the impact of macroeconomic variable on financial instruments using the vector Autoregressive Model. These studies established that inflation, interest rate were inversely related with financial asset.

CONCLUSION

The general objective of the study was to establish influence of macroeconomic factors on government bond market performance at Nairobi securities exchange in Kenya. Based on the findings, the study concluded that macroeconomic factors had a significant influence on government bond market performance at Nairobi securities exchange in Kenya.

Based on findings from objective one, the study concluded that inflation rates have a negative and significant effect on government bond market performance at Nairobi securities exchange in Kenya. A decrease in inflation rates leads to an increase in government bond market performance.

Based on findings from objective two, the study concluded that interest rates have a negative and significant effect on government bond market performance at Nairobi securities exchange in Kenya.

A decrease in interest rates leads to an increase in government bond market performance.

Based on findings from objective three, the study concluded that exchange rates have a positive and insignificant effect on government bond market performance at Nairobi securities exchange in Kenya. This means that a change in exchange rate does no directly affect government bond market performance.

RECOMMENDATIONS

The study offered a number of recommendations for policy in light of the findings made. Inflation is found to be a key contributing factor to government bond market performance in Kenya since an decrease in inflation leads to a significant increase in government bond market performance. This informs government monetary policy that government bond market performance can be significantly increased if the rate of inflation in the country is controlled. In light of this finding, the study recommended a strict monetary policy and control of factors contributing to change in inflation rate in order to increase government bond market performance.

The study found that interest rates contribute significantly to government bond market performance. In particular, a decrease in the interest rates leads to an increase in the government bond market performance. This study recommended that policies on interest rate controls be observed closely to be able to increase government bond market performance.

In addition, the stability of the Kenyan shilling against currencies of key trading partner countries is critical in increasing government bond market performance. Policy interventions should be put in place to ensure a stable Kenyan shilling.

Suggestion for Future Research

The study determined the effect of macroeconomic factors on government bond market performance at

Nairobi securities exchange in Kenya. The study was conducted in Kenya only. Further study should focus on other countries in East Africa for example Uganda and Tanzania.

The current study concentrated on only 7 years. Further areas of study should focus on a longer time span, probably 20 to 30 years. This would disclose

whether the observed relationship changes over the years.

Since the R squared was not 100% it seems there are other macro-economic factors that were not addressed by the study. Other studies should therefore focus on other macroeconomic factors on government bond market performance at Nairobi securities exchange in Kenya.

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