EFFECT OF SELECTED MACROECONOMIC VARIABLES ON GOVERNMENT BOND YIELDS IN KENYA

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DECLARATION

I, the undersigned, declare that this my original work and has not been presented to any institution or university other than University of Nairobi for examination

Signed …… Date……

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This research project has been submitted for examination with my approval as the university supervisor

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DEDICATION

I dedicate this project to my family. I thank my wife Jackline and children: Charity; Griffin; Barrack and Wendy for the support they accorded me during the entire period of study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

ADF:	Augmented Dickey-Fuller
ARDL:	Autoregressive Distributed Lag
CBK:	Central Bank of Kenya
CPI:	Consumer Price Index
CUSUM:	Cumulative Sum Control Chart
EMH:	Efficient Market Hypothesis
GDP:	Gross Domestic Product
KNBS:	Kenya National Bureau of Statistics
LM:	Lagrangian Multiplier
MEFMI:	Macroeconomic and Financial Management Institute of Eastern and Southern Africa
NSE:	Nairobi Securities Exchange
OLS:	Ordinary Least Squares
UK:	United Kingdom
US:	United States

ABSTRACT

Developing countries in Africa and other parts of the world contends with challenges of rising budget deficits beside hikes in the rates of interest and inflation. Therefore, issuance of bonds remains a critical area in deficit financing in Kenya and developing countries around the world. Bond markets offer an important source of capital to African Governments. Government bonds provide a means to secure investment to the public and organizations because payment is guaranteed by the fact that repayment of government debts is prioritized in the budgeting process. The study sought to evaluate the effect of selected macroeconomic variables on government bond yields in Kenya. The selected macroeconomic variables were government debt, inflation, interest rates, economic growth rate and money supply. The study was anchored on a descriptive research design. The data for the period 1985-2018 was obtained from the Central Bank of Kenya, National Treasury and Kenya National Bureau of Statistics. The study used Autoregressive Distributed Lag models to analyse data. Diagnostic tests included Augmented Dickey Fuller test for stationarity and Johasen Cointergration Tests for the long run relationship between variables. Econometric analyses included Bound Testing (F-statistic), Breusch-Godfrey Serial Correlation (Lagrangian Multiplier) Test for serial correlation, Wald Test and the Cumulative Sum Control Chart for stability of the ARDL model. The study established that government bond yield in Kenya was not significantly influenced by macroeconomic variables such as government debt, rate of inflation, interest rate, economic growth and money supply. The study recommended that government bonds should be an area of priority in the formulation of monitory and fiscal policies in the country and that government should embark on an expansive awareness creation programme on government bonds and the benefits that they hold as a mean to increasing bond yields. The main limitation of the study was to narrow down the area of focus to selected macroeconomic variables and bonds. The study recommended further empirical studies on the effects of other macroeconomic variables such as the rate of unemployment and government spending on government bond yield.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Countries rely on both domestic sources of revenue and foreign debts. Many countries in Africa are unable to raise sufficient revenues through tax collection and they end up sourcing for foreign funds to finance fiscal budget (Ahwireng-Obeng, 2016). Capital flow in African countries has been adversely affected by the past global financial meltdowns. The foreign capital remains unreliable due to stringent condition attached to foreign debt. Foreign capital can also cease in the vent of global financial crisis and political instability hence. In this regard, developing countries seek alternative sources of capital like bonds in order to meet developmental needs.

Bond markets offers an important source of capital to African governments hence the need for continues research on the role it plays in development of African countries and various factors that affect bond yields. Nevertheless, Ahwireng-Obeng (2016) argued that literature on bond market in Africa is scanty and research on the development of the market is limited. In addition to the limited research in bond markets, the outcome on the variables influencing bond yields remain ambiguous and is receives little attention in African countries. The information on bond market in Africa is important in the development of appropriate strategies to guide the generation and utilization of bonds as well as in promoting accountability and streamlining access to information on capital markets in Africa (Ahwireng-Obeng, 2016).

The information on government bond yield is valuable to governments and individual or corporate investors in the bond market. The yield on bonds is important because it

constitutes the return on investment for investors in the bond markets. The information on the yields in the bond market also enables governments to come up with suitable prices for various types of bonds. Developing countries in Africa and other parts of the world contends with challenges of rising budget deficits beside hikes in the rates of interest and inflation. Therefore, issuance of bonds remains a critical area in deficit financing in Kenya and developing countries around the world.

1.1.1 Macroeconomic Variables

Macroeconomic variables are the major metrics on the economic status of a country. Macroeconomic variables enable determination of the economic performance of a country. Macroeconomic variables such as government debt, inflation, interest rates, economic growth rate, money supply and bond market liquidity influence the yields of government bonds. Inflation refers to the overall upsurge in prices in a year in reference to a base year (Balozi, 2017).

Government debts can be domestic or sovereign. Bond yields are positively related to government debt in the long run (Poghosyan, 2012). Local debt is raised through borrowing from banks and through treasury bonds. Money supply is an important indicator of cash flow in the country. The rates of inflation and interests' rates are important metrics in evaluation of economic performance in the country. The growth of the economy is measured using domestic growth rate and it is an important macroscopic variable used in gauging performance of the economy.

1.1.2 Government Bonds Yield

A bond can be termed as a fixed asset income and many governments use it to raise revenues to finance budget deficits (Karatheodoros, 2015). A government bond is a form of bond offered by the national government and earns interest at the end of

specified periods and its par value is repaid to the investor at the end of specific periods. Government bonds provide a means to secure investment because payment is guaranteed by the fact that repayment of government debts is prioritized in the budgeting process (Karatheodoros, 2015). The interest earned from investment in bonds is termed as bond yield (Mishkin & Eakins, 2012).

The government provides various types of bond including treasury bills and treasury bonds. The bonds differ in terms of the period in which they mature. A government bond with a maturity period of one year or less is termed as Treasury bill (Brusk, 2013). Treasury bill are considered as an investment with least risk in a country with a stable economy. The issuance of treasury bills is done at a discount of the face value and the interests earned are paid at the end of the maturity period. The liquidity in the secondary market is high for treasury bills and it act as a measure of interest rate in the short term market. The prices of treasury bills are stable because their level of credit risk is low (Brusk, 2013).

A government bond that matures within a period of one to 10 years is termed as a treasury bond (Brusk, 2013). The interest rates of treasury bonds are fixed and are paid periodically within the set maturity term. The payment of interest can be made semi-annually or annually. The level of liquidity in the secondary market for treasury bonds is high and the expected macroeconomic conditions can be predicted using the ten-year treasury bonds (Brusk, 2013).

1.1.3 Macroeconomic Variables and Government Bonds Yield

Studies have established the nexus between government bond yield and macroeconomic variables. According to Poghosyan (2014), government bond yield was associated with government debt debt-to- growth domestic product (GDP ratio and the rate

of economic growth in the long run. The rate of inflation and the real money market rates influenced bond yield in the short run. The rise in the level of government debt leads to decline in the prices of government securities (Gnabo & Bernal, 2010).

Costantini, Fragetta, Melina (2014) determined that liquidity risks and fiscal imbalances influenced government bond yields in the long run. According to Bhattacharyay (2013), the yields of government bonds are negatively associated with fluctuations in the rate of exchange, the growth domestic product and the rates of interest. The appreciation of local currency against US dollar positive affect government bond yields as a result of expected changes in inflation (Chee & Fah, 2013).

Essers, Blommestein, Cassimon and Flores (2014) established that growth of economy is a determinant of the yields on government bonds. The growth of the economy affects the yields on government bonds. Higher economic growth rates lead to reduction in the amount of government debt and decline in the issuance of bonds. Therefore, improvement in the state of economy results in reduction in the yields from government bonds (Gerlach, Schulz & Wolff, 2010). According to Jurkšas and Kropienė (2014), government bond yields increases with increase in money supply and reduces when money supply declines.

1.1.4 Bond Market in Kenya

According to the Central Bank of Kenya (2019), the treasury bonds in Kenya are issued on monthly basis at fixed rates of interest for periods that range from one to thirty years. The predictability of treasury bonds is therefore guaranteed and it is a long-term investment and source of income. The interest rates are paid semi-annually. Account holders in local commercial bank can directly buy treasury bonds through the central bank. Investment by corporate bodies and individuals can also be done through nomination by investment or commercial banks in Kenya. The government bonds in Kenya are fixed coupon treasury bonds implying the rate of interest does not vary across the period of maturity (CBK 2019).

The government of Kenya also offer infrastructure bonds that are exempted from tax (CBK 2019). The infrastructure bonds are issued when the government is undertaking particular infrastructural projects. The infrastructure bonds are exempted from tax and attract high rates of interest. The recent infrastructure bond in Kenya was the M-Akiba launched in 2017 which attracted high rates of interest (around 12 percent in 2018). M-Akiba was purchased through mobile phones and valued at 3,000 Kenya shillings. The return on investment was high and was free of risks (Suri, Karlan & Wayua, 2018).

Another type of bond offered by the government is the zero coupon bonds which are sold at a discount. The zero coupon bonds lack interest payments and issuance is done for short periods. Other types of government bonds in Kenya are amortized restructuring bonds, savings development bonds and Euro bonds (Balozi, 2019). The government bonds are denominated in Kenyan shillings (CBK, 2019).

1.2 Research Problem

Governments strive to finance budget deficit through borrowing and government bonds are an important source of revenue needed to finance shortages in the budgets. Besides acting as a source of income to government, bonds provide a secure investment opportunity to individuals and corporate entities. Return on investment is a consideration in any investment and the knowledge of variables that influence government bond yields critical for investors. However, studies on the variables that influence government bond yields have not been conclusive (Schrynmakers, 2016). The varied results on government bond yields has been attributed to variations in the length of time series, metrics used to estimate the variables, the partial sample of countries and econometric models used to analyse data (Pepino, 2012). The challenge is determination of yields from government bonds has also been linked to the static nature of metrics like solvency factors (Nordberg, 2011).

In the Kenyan context, there are limited studies on government bonds. For instance, Suri, Karlan and Wayua (2018) examined government bonds in a tool for savings through a random assessment of the uptake of M-Akiba bonds. The study was however halted due to difficulties encountered during the implementation of M-Akiba. Studies by Nyaga (2014) and Balozi (2017) focused on determinants of treasury bills in Kenya. However, the study by Nyaga (2014) and Balozi (2017) were limited by the use of regression analysis which could not establish long term and short-term effects of the variables under examination.

The lack of conclusion by empirical studies on the variables influencing government emphasizes the need for continued research on bond yield with focus on country specific data and through use of better econometric models to predict the outcome. In Kenya, the regression models used by Nyaga (2014) and Balozi (2017) were limited in predicting the factors that affect government bond yields. Therefore, this study sought to address the research gaps through an evaluation of the effects of macroeconomic variables on government bond yields in Kenya. The variables of interest in the study were government debt, inflation, interest rates, economic growth rate and money supply. The study sought to answer the research question: what was the effect of macroeconomic variables on government bond yields in Kenya?

1.3 Research Objective

To evaluate the effect of selected macroeconomic variables on government bond yields in Kenya

1.4 Value of the Study

The Kenyan government issues bonds as mean to raise finance and reduce national budget deficit. Therefore, the findings of this study on macroeconomic variables on government

bond yields in Kenya will assist in formulation of fiscal policies in Kenya. The government will use the study findings on macroeconomic variables on government bond yields in Kenya as part of inputs into the review of strategies used by government to finance deficit under the MTEF budget cycles.

The findings of the study will be of great benefits to the investors in government bonds in Kenya. The information from this research will boost the decision-making processes by investors who will factor in macroeconomic variables that influence the return on the investments. Therefore, the investors will be informed of the factors in the economy that may vary the interest earned from their investment in government bond.

The study findings will contribute to the limited body of knowledge on government bond yields in Kenya. The findings of the study will also make great contributions to scholarly body of knowledge on government bond yield in developing economies like Kenya. Therefore, researchers and scholars will use the findings of the study as a source of reference in future studies on government bond yields.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews theoretical literature on the Keynesian framework, the efficient market hypothesis and crowding out theory. The chapter reviews literature on determinants of government bond yields and empirical literature on government bond yields. The chapter also present the conceptual framework and the summary of the literature review.

2.2 Theoretical Review

The study is premised on the Keynesian Framework, Efficient Market Hypothesis and Yield Curve Slope. The three theories will help the study in establishing the link between of macroeconomic variables on government bond yields in Kenya. This section discusses how each of the theories is relevant to the study.

2.2.1 The Keynesian Framework

According to Keynes (1930), the decisions and the initiatives by the central bank of a country influence the determination of the long-term rates of interest on government bonds. The government through the central bank formulate policies that regulate macroeconomic status of the country and on which short-term rates are anchored (Kregel, 2011). `Keynes (2007) argues that the central banks influence the yields on government bonds by using policy rates to regulate short term rates of interest. The government also apply monetary policy to influence yields on the bonds. In regard to the investors, Keynes (2007) argue that the long-terms investment prospects by investors depend on the existing their outlook on the near-term. The investors lack the

capacity to mathematically determine future uncertainties and depend on past and existing occurrences to form their perspective on the prospects of future investment outcomes. Consequently, the short-term and the long-term interest rates are influenced by the same variables.

The Keynesian view on government bond yield is a departure from the conventional view which posits that bond yields depend on budget deficit and government debt (Lam & Tokuoka, 2013; Poghosysan 2014). Keynesian framework attribute government bond yields to actions taken by the central bank and liquidity preferences which affect the rate of interest. Scholars in support of Keynesian framework (Akram & Das, 2015; Akram & Li, 2017) state that the rate of interest on government bond is influenced by inflation and short-term interest rates.

This study is based on Keynesian framework because it provides a theoretical basis upon which the study seeks to determine interest rates and inflation as macroeconomic variables that affect government bond yield in Kenya. Therefore, the study examines whether the same hypothesis in Keynesian Framework holds true for Kenya.

2.2.2 Efficient Market Hypothesis

Fama (1970) formulated Efficient Market Hypothesis (EMH) as a theory of information which argues that returns on investments is affected by information available to the investors. Investors can earn returns greater than the average returns in a market. Nevertheless, returns become normal after some time as information is availed. According to Ayentimi, Mensah and Naa-Idar (2013), EMH assumes that the information about stock is efficiently reflected in the security market. The fluctuations in the prices cannot be predicted and the market reflects information that is accessible to investors

(Zeren & Konuk, 2013). Moreover, access to information among investors is at the same level and on equal cost in an efficient market (Sarac, 2013).

EMH is categorized as weak, semi strong and strong (Fama, 2009). The weak EMH states bond prices are a reflection of past information availed to the public. All the investors are aware of the information and have access to it hence the returns are not abnormal (Fama, 2009). The semi strong EMH is anchored in the principles that prices are a reflection of new information that has been made available to the public and has been accessed by all investors. The new information cannot translate into excess gains. The strong EMH is premised on the principle that bond prices are a reflection of information in private and public knowledge and no investment can earn excess returns (Fama, 2004).

According to Zeren and Konuk (2013), information asymmetry exists in the bond market because investors may have access to different types of information. Therefore, EMH proved a theoretical foundation upon which the study seeks to examine the effect of microeconomic variables on the yields of bond in Kenya. Access to information is critical in the bond market where various players compete thus government bond yield reflect an efficient market. Kenyan government bonds are publicly traded in the Nairobi Security Exchange (NSE) that is open to all investors. The changes in prices are attributed to decisions made by investors in accordance with the information available. Through an examination of the effect of microeconomic variables on the yields of bond the study intends to reduce information asymmetry in the Kenyan bond market.

2.2.3 Yield Curve Slope

According to Avramov, Jostova and Philipov (2007), the yield curve is determined by the difference between the interest earned from long term bonds and interest earned from a short term bonds. The gradient of the yield curve depends on the amount of difference in the short term and long term bond yields. The curve slopes upwards when the return on

short term bond is less than return on long term bond. The yield curve avails information on future rates of interest rates and conditions of the economy.

Avramov *et al.,* (2007) hypothesized the nexus between the yield curve and the fluctuations in the yield spread. According to Avramov *et al.,* (2007), the yield curve is associated with future economic activity. The rise in economic growth is related to a steep upward sloping curve and denotes decline in the risk of defaults and subsequently lowers yield spreads. Avramov *et al.,* (2007) also argue that yield curve is associated with the future rates of interest. A steep upward sloping curve indicates an expected rise in the future rates of interest.

The study uses the hypothesised relationship between yield curve and economic activity and the rates of interest as a theoretical foundation for the examination of the effects of microeconomic variables on government bond yields. Interest rates and the rate of growth of the economy are macroeconomic variables of interest in the study.

2.3 Determinants of Government Bonds Yield

Government bond yield is influenced by a number of factors. This study reviews literature of the following determinants of government bond yield: government debt, inflation, interest rates, economic growth rate, money supply and bond market liquidity.

2.3.1 Government Debt

According to Poghosyan (2012), the effect of government debt on the yields of government bond yields takes place in two ways. The first one is when the steady-state capital reduces due to crowding out of investment by private entities as government expands its fiscal regime. The result is the rise in the rates of real interest. Secondly, as the risk of default rises due to higher government debt, the yield of sovereign bond

increases. Poghosyan (2012) argues that the two channels indicate that bond yields are positively related to government debt in the long run.

Gros (2011) argues that the influence of government debt on long-term interest rates relies on whether the source of fund is foreign or domestic. The long term rates of interest reduce when dependency on foreign debt reduces. The reduction in sovereign debt raises the confidence of the investors in the ability of government to prevent defaults. The shareholding by local investors increases when dependency sovereign debt reduces. A default by the government increases in the event of government default on sovereign debt. the losses of its citizens are larger in the case of government default. Since the local banks hold the largest share of government bonds, a government default on foreign debts destabilises financial system in the country (Gennaioli, Martin, and Rossi, 2011).

2.3.2 Inflation

According to Balozi (2017), inflation refers to the overall upsurge in prices in a year in reference to a base year. It implies the overall rise in the prices of commodities and services across a particular period of time. Nominal rates of interests are affected by inflation through the magnitude of the rate of inflation and through uncertainties surrounding inflation. The two channels affect the nominal rate of interest via risk premiums (Ichiue & Shimizu, 2012).

The prices of bonds that are not indexed to inflation are greatly influenced by increase in prices of commodities and services (Jurkšas & Kropienė, 2014). The effect takes place because increase of decrease in the rate of inflation causes a decrease or an increase pressure on the returns expected by investors who wish to maintain a constant real return on investment. Inflation acts as a metric the crises in the balance of payment

crises. Inflation is also a metric for the efficiency in management of the economy therefore having a direct effect on foreign default risk.

2.3.3 Interest Rate

According to Akram and Das (2017), a positive relationship exists between long-term short-term interest rate on treasury bills and the interest rate on government bonds. The relationship between rates of interest and bond yields takes place when the ratio of debt and inflation are controlled. Baker, Carreras, Kirby and Meaning (2016) 10-year sovereign bond yields in the Euro Area was influenced by the short-term nominal interest rate in the long-run.

Radier, Majoni, Njanike and Kwaramba (2016) established that the effect of the rate of interest on the yields of government bonds was positive or negative depending on the type of bond. According to Radier *et al.,* (2016), the rate of interest caused a positive effect on the yields of type AA, A, and B rated bonds in South Africa and caused a negative effect on type BBB rated bonds. Chadha, Turner and Zampolli (2013) argued that there is association between the rates of interest and the returns on bond when government debt is controlled in a study. Nevertheless, Chadha *et al.,* (2013) recommended that more research was needed to learn about the reactions of debt managers to interest rates.

2.3.4 Economic Growth Rate

According to Gerlach, Schulz and Wolff (2010), the growth in the economy affects the yield of government bonds. The returns on government bonds reduce with the increase in economic growth rate. The reduction in returns is attributed to the reduction of government debts when the economy performs well. The prices of securities decline as

government issues fewer bonds. In the event of poor economic performance, the bond yields increase as government source for more funds through issuance of more bonds.

Jurkšas and Kropienė (2014) also argued that economic growth influences bond yields. The government can strengthen monitory policy in the event of increased pressure on inflation as result of fast growth in the economy. This can reduce money supply coupled with rise in the rates of interest. The resultant effect of the economic growth and reduction in money supply is the decline in the prices of bonds as demand declines (Jurkšas & Kropienė, 2014).

2.3.5 Money Supply

Money supply has a significant and direct influence on the yield of government bonds (Jurkšas & Kropienė, 2014). The prices of securities are instantly affected by money supply. The immediate effect can be attributed to the fact that a portion of the increment in the money supply is used to purchase assets with high risk and debt securities. In the long run, continued increase in money supply lead to rise in inflation which in turn leads to rise in the rates of discounts and eventual fall in the prices of government securities. Therefore, the long term effect of the rise in money supply is reduction in bond yields as investors opt for investments with higher profit (Jurkšas. & Kropienė, 2014).

Consumer price movements can be predicted using rise in money supply which causes rise in inflation. Therefore, the effect of money supply on bond yield is similar to the effect of inflation on the yields. However, the effects of money supply on bond yield are not clear because a portion of money supply can be used to purchase debt securities (Jurkšas. & Kropienė, 2014).

2.4 Empirical Studies

Thotho (2014) examined major variables that influenced the advancement of bond markets in Tanzania, Mozambique, Kenya, Uganda and Zambia, using data obtained in the period between 2003 and 2012. The study used econometric analyses involving the use of Ordinary Least Squares (OLS). The study established that government bond market development (bond capitalization) was positively and significantly influenced by bank credit, capital account openness, exchange rate variability, monetary freedom, fiscal freedom, fiscal balance, size of the economy and economic development. Thotho (2014) recommended further research using the model in terms of fully testing its application as well as validating the findings using separate empirical work and taking into account the reform program that each country has been embracing.

Nyaga (2014) studied factors facilitating the uptake of Treasury Bonds in Kenya. Nyaga (2014) designed his study as a descriptive survey that collected data on Treasury bonds issued between 2001 and 2014 whereby the study selected fixed coupon, floating interest, the zero coupon and infrastructure bonds available at both CBK and the Nairobi Securities Exchange (NSE). Multiple linear regression was used to examine the association between the variables. The study established that the determinants of treasury bonds uptake were liquidity, credit rating, the rate of interest, floating rate bonds and years to maturity. The study recommended additional studies on the link between the rates of inflations and exchange on the Treasury bond uptake/investment. The study by Nyaga (2014) was limited in the data analysis methods in which regression and correlation analyses could not determine the long or short term association among the variables.

Afonso, Arghyrou and Kontonikas (2015) assessed the variables that influenced the return on government bond yields in the euro area. Afonso *et al.,* (2015) looked at the changes in the composition of the yields across particular periods of time. The study

employed a monthly panel data (1999-2010) from ten countries in the Euro area. Afonso *et al.,* (2015) assessed variables such as credit ratings of the ten courtiers, international risk and levels of liquidity. The study established that government bond yields were determined by international risk, economic growth rate, real exchange rate appreciation, bond market liquidity and the credit ratings of each country. Afonso *et al.,* (2015) noted that the results should be interpreted with caution because there were few observations related to the years when there was economic meltdown.

A study by Baker, Carreras, Kirby and Meaning (2016) explored the nexus between the yields of sovereign bond and monitory policy in the Euro Area. Baker *et al.,* (2016) used an error correction models that included other variables like rates of interest and public debt. Baker *et al.,* (2016) concluded that the returns on bonds were affected by monetary policy and rates of interest in the long run. The returns realized from investment in bonds depended on prospects on existing and expected changes in the monetary policy as well as the risks of default (Baker *et al.,* 2016).

Akram and Das (2017) investigated the variables associated with the long run yields of government bonds in India. The main variable in the study was the rates of interest alongside the growth of economy and inflation. Akram and Das (2017) found out that the long term bond yields were associated with the rates of interest and inflation. Nevertheless, the growth the economy in terms of nominal income was not associated with yields of government bonds in the long run.

Balozi (2017) assesses the variables that influenced the yields of government bonds in Kenya. Balozi (2017) sought to determine the effects of national budget deficit, inflation and the rates of interest on the returns on bonds. The return on Kenyan government bonds was estimated sing the rate of interest that a bond attracts. The study used regression analysis to analyse data for the period 1985-2015. Balozi (2017)

established that deficit in the budget, changes in the rates of interest and inflation affected the returns on the government bond yields of the ten, three and one-year government bond at 76.6%, 65.3 % and 66.1 %. The main limitation of the study was the use of regression model that could not determine when the associations were in the long or short run. Another limitation was the restriction of the study to only three variables and Balozi (2017) took note of this limitation by suggesting further studies on determinants of Kenyan bonds with specific emphasis on foreign exchange fluctuations, bond denominations and bond coupon rates.

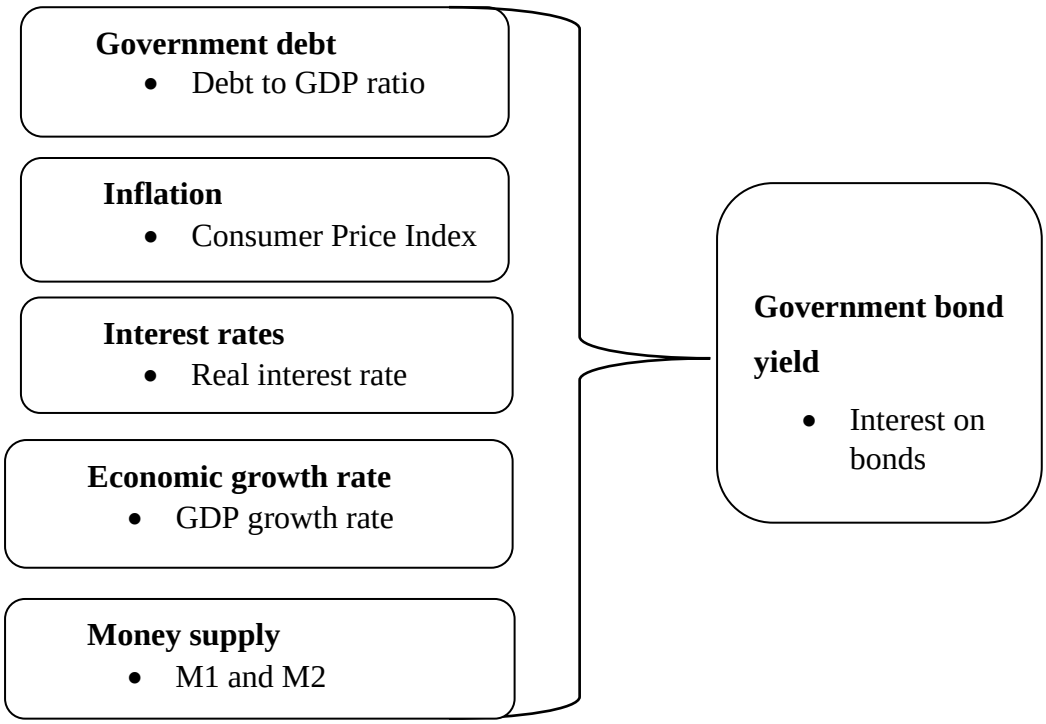
Suri, Karlan and Wayua (2018) examined government bonds in a tool for savings through a random assessment of the uptake of infrastructure bonds called M-Akiba. The study was to randomly assess entrepreneurs carrying out business in the informal sector. However, Suri *et al.,* (2018) did not proceed with the evaluation on the grounds of setbacks encountered in the initial phases of implementation of the bond. There were low levels of public purchase of the bond attributed to low levels of public awareness. The study could not therefore attain the target sample of 2000 subscribers. The M-Akiba bond was to be transacted through mobile phones which was marred with logistical challenges that hampered take off of the initiative.

Yie and Chen (2019) carried out an assessment of the variables that affected the yield of government bonds in Malaysia between the years 2006 and 2016. The variables of interest were growth in the economy (GDP growth rate), the rates of interests, the changes in the rate of exchange and the ratio of current account to gross domestic product as determinants of government bond yield. Yie and Chen (2019) used ARDL Model in their evaluation and the results revealed that returns on bonds were positively influenced by account balance to gross domestic product ratio. In order to enhance the statistical outcomes of research, Yie and Chen (2019) acknowledged the limited size of

the sample considered in the study and urged researcher to carry out similar evaluation using larger size of the sample.

2.5 Conceptual Framework

Figure 2.1 is an illustration of the associations among variables of interest in the study. The study expects that there will be short run effect of independent variables (government debt, inflation, interest rates, economic growth rate and money supply) on the dependent variable (government bond yields in Kenya). The study also expects that there will be long run effect of government debt, inflation, interest rates, economic growth rate and money supply on government bond yields in Kenya.



Independent Variables **Dependent Variable**

Figure 2.1: Conceptual Model

Government bond yield will be measured in terms of the interest earned by the investors. The ratio of debt to gross domestic product will measure the level of

government debt. Consumer Price Index (CPI) will be the metric for inflation. Interest rates will be evaluated in terms of the interest rates declared by the Central Bank of Kenya for government bonds. Economic growth will be measured in terms of GDP growth rates. M1 and M2 money supply will be used to measure money supply.

2.6 Summary of Literature Review

The literature discussed the Keynesian Framework and the Efficient Market Hypothesis. The Keynesian Framework underpins the study by providing a basis on which interest rates and inflation influences bond market yield (Akram & Das, 2015 and Akram & Li, 2017). The two variables, interest rates and inflation, are of interest in the study which seeks to examine their association with the returns on bonds. The EMH forms the basis on which the study seeks to provide information on determinants of bond yields in Kenya become. Information accessible to investors is reflected by bond market price fluctuations (Zeren and Konuk, 2013).

The empirical literature has identified various limitations in the previous studies on bond market yield globally and in Kenya. From a global perspective, the study by Afonso *et al.*, (2015) noted that the results should be interpreted with caution because there were few observations related to the years when there was economic meltdown. Thotho (2014) recommended further research using the model in terms of wholesome assessment of its applicability as well as validating the findings using separate empirical work and taking into account the reform program that each country has been embracing to further promote the growth in the local bond market.

The cardinal limitation of Kenyan studies was the use of regression model that could not determine the associations between the variables in the long or short run. Another limitation was the restriction of the study to only three variables and Balozi (2017) took note of this

limitation by suggesting further studies on determinants of Kenyan bonds with specific emphasis on foreign exchange fluctuations, bond denominations and bond coupon rates. The limitation of the study by Nyaga (2014) was also in the methods of data analysing in which regression and correlation analyses could not determine the interactions between the variables in the long or short run. In a departure from the study by Balozi (2017) and Nyaga (2014), this study will assess the associations between the macroeconomic variables and the returns on bonds in the long or short run.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter looks at the form of design upon which the study was anchored as well as the sources of data for various variables and the models employed in the analysis.

3.2 Research Design

The evaluation was guided by the descriptive research design. Descriptive research design identifies and describes the phenomenon under study by answering the questions who, what, where, when, and to what extent (Loeb, Dynarski, McFarland, Morris, Reardon & Reber, 2017). The advantage of descriptive research design is that it identifies information that had not been identified in previous studies. It also provides more information on causal relationships.

The descriptive research design enabled the study to define the nature of association between macroeconomic variables and the yields on government bond. The study was also purely quantitative in nature and intended to statistically determine associations among the variables. The study used time series data to establish the effects of government debt, inflation, interest rates, economic growth rate and money supply on government bond yields in Kenya for the period 1985 to 2018.

3.3 Data Collection

The study used secondary data on the variables for a period of 30 years from the fiscal year 1988/89 to 2018/19. The data on government bond yields and government debt

was sourced from the National Treasury. The data on money supply was sourced from the Central Bank of Kenya.

The data on the rates of inflation, interest rates and economic growth rate was sourced from the Kenya National Bureau of Statistics (KNBS). Appendix I shows the data used in the study. The study focused on 10-year treasury bonds issued by Central Bank of Kenya (2019).

3.4 Diagnostic Tests

The study conducted diagnostic tests prior to econometric analysis in order to determine suitability of the data to runs econometric analysis. The stationarity of the data was tested prior to estimation of the model. The study used Augmented Dickey Fuller (ADF) test to evaluate stationarity of the data. The study employed Johasen Cointergration tests to evaluate the existence of long-run association between variables.

3.5 Data Analysis

Autoregressive Distributed Lag (ARDL) models was employed the analysis of data. The study used the ARDL model below:

$$ǰ = \alpha_0 + \delta_1 ǰ_{t-1} + \beta_{i1} D_{t-1} + \beta_{i2} C_{t-1} + \beta_{i3} I_{t-1} + \beta_{i4} G_{t-1} + \beta_{i5} M_{t-1} + \beta_{i7} D_{t-2} + \beta_{i8} C_{t-2} + \beta_{i9} I_{t-2} + \beta_{i10} G_{t-2} + \beta_{i11} M_{t-2} + \varepsilon$$

Where:
ǰ = Interest earned (government bond yield)
α_0 = Constant Term
β_1 to β_{i12}= Beta Coefficients
D = Debt-GDP Ratio (government debt)
C = Consumer Price Index (inflation)
I = Interest Rate
G = GDP Growth Rate (economic growth)
M = Money Supply (M1 and M2)
ε = Error Term

The serial correlation and the stability test for the model was performed using use Breusch-Godfrey Serial Correlation (Lagrangian Multiplier (LM) test and Cumulative Sum Control Chart (CUSUM) test respectively. The long or the short run association among the variables was examined using Wald Test (bound testing and the error correction term).

Table 3.1: Operationalization of the Study Variables

Variable	**Indicator**	**Tests of Significance**
Government bond yield	Intereset on bonds	F-statistic Chi Square Statistic
Government debt	Debt-GDP Ratio	F-statistic Chi Square Statistic
Inflation	Consumer Price Index	F-statistic Chi Square Statistic
Interest Rate	Real Interest Rate	F-statistic Chi Square Statistic
Economic growth	GDP Growth Rate	F-statistic Chi Square Statistic
Money Supply	M1 and M2	F-statistic Chi Square Statistic

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the empirical findings and discussion of the study findings. The main objective of the study was to assess the effect of macroeconomic variables on government bond yields in Kenya. The selected macroeconomic variables were government debt, rate of inflation, interest rate, economic growth and money supply. The data used covered the period 1985-2018 (Appendix i). This chapter presents the descriptive statistics, diagnostic tests and the ARDL model.

4.2 Descriptive Statistics

The study generated the test statistics as shown in Table 4.1

Table 4.1: Descriptive Statistics

	Government 10-year Bond Yield (%)	**Debt-GDP Ratio (%)**	**Inflation (Consumer Price Indices)**	**Real Interest Rate (%)**	**GDP Growth Rate (%)**	**Money supply (M1) in Kshs. 10Billions**	**Money supply (M2) in Kshs. 10Billions**
Mean	12.44588	48.92341	10.48038	8.411176	4.105127	35.91231	72.16867
Median	12.49000	45.55598	7.911500	7.900000	4.484713	14.00540	32.34895
Maximum	17.07000	99.65365	45.97900	21.10000	8.405699	147.7526	275.5973
Minimum	8.120000	36.02794	1.554000	-8.000000	-0.799494	1.574060	3.001600
Std. Dev.	1.939574	12.30316	8.679433	6.597177	2.337331	42.95900	81.73570
Skewness	0.355524	2.317648	2.519132	-0.291745	-0.466867	1.364626	1.259410
Kurtosis	3.600685	9.785636	9.943555	3.093451	2.287325	3.683185	3.266050
Jarque-Bera	1.227418	95.66867	104.2625	0.494691	1.954665	11.21371	9.088258
Probability	0.541339	0.000000	0.000000	0.780871	0.376314	0.003673	0.010629
Sum	423.1600	1663.396	356.3330	285.9800	139.5743	1221.019	2453.735
Sum Sq. Dev.	124.1442	4995.136	2485.974	1436.250	180.2829	60900.70	220463.9

Observa-tions	34	34	34	34	34	34	34

The study findings in Table 4.1 indicate that the 10-year bond yield ranged from 8.12% to 17.07% and an average of 12.44588 % for the period 1985-2018. The average values of the independent variables were 48.92341% for debt-GDP Ratio, 10.48038 for inflation, 8.411176% for real interest rate, 4.105127% for GDP growth rate, KShs. 3591.231 Billion for money supply (M1) and KShs. 721.6867 Billion for money supply (M2).

The study finding in Table 4.1 indicate positive skewness for government bond yield (0.355524), debt-GDP Ratio (2.317648), the rate of inflation (2.519132), M1 (1.364626) and M2 (1.259410). Therefore, many values in the data for government bond yield, debt-GDP Ratio, rate of inflation, M1 and M2 were higher than the sample means for the variables. Conversely, the study findings show negative skewness for real interest rate (-0.291745) and GDP growth rate (-0.466867). Therefore, many values in the data for real interest rate and GDP growth were lower than the sample means for the variables.

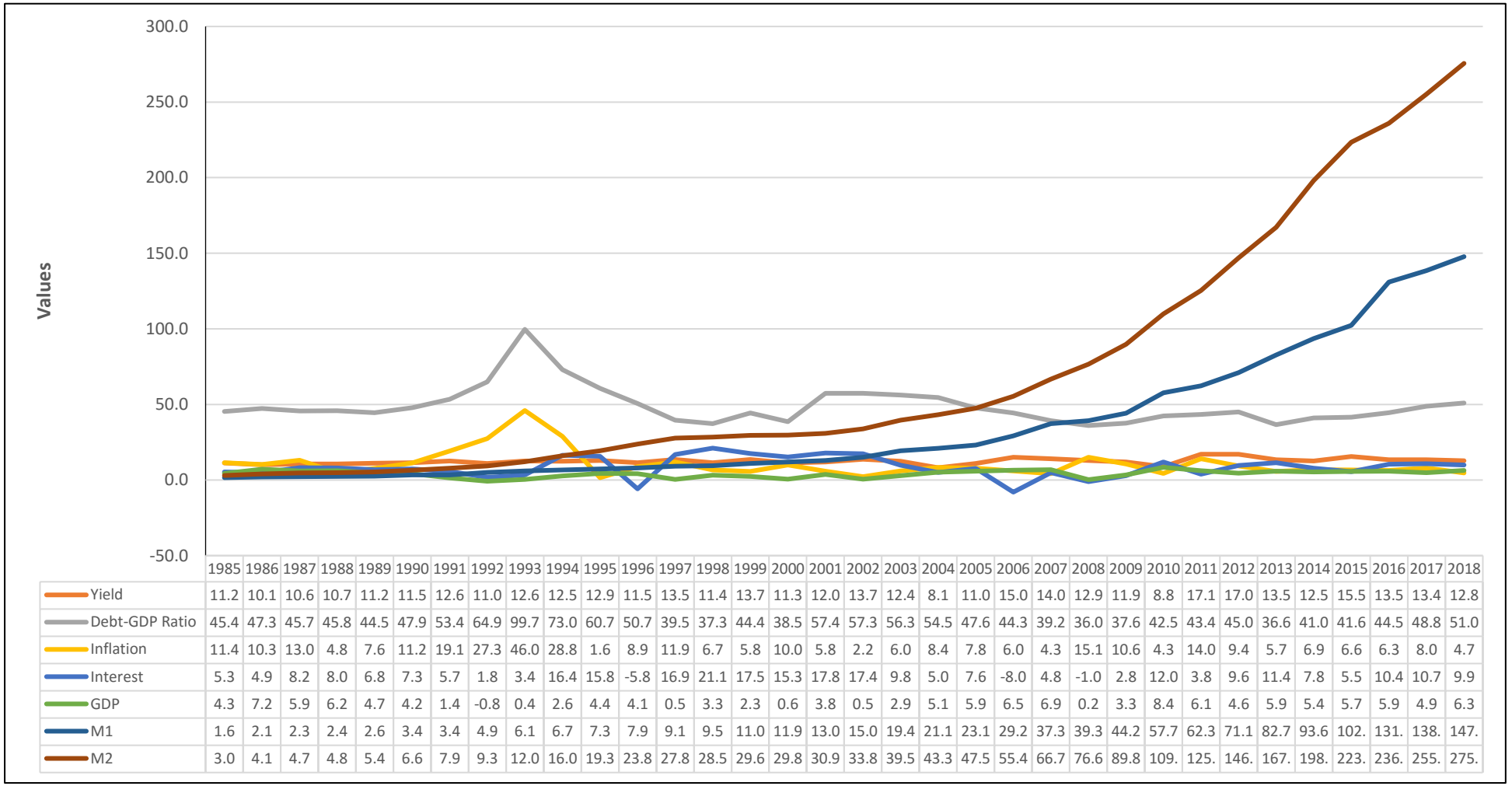
The study findings show that the GDP growth rate was platykurtic variable (variable with negative kurtosis or flattened curves) with Kurtosis of 2.287325 which was less than 3. The leptokurtic variables (had positive kurtosis or peaked curve) indicated by Kurtosis greater than 3 were: bond yields (3.600685), Debt-GDP Ratio (9.785636), the rate of inflation (9.943555), real interest rate (3.093451), M1 (3.683185) and M2 (3.266050).

In regards to normality of the data, the Jarque-Bera statistics show that the data for bond yield (p=0.541339), real interest rate (p=0.780871) and GDP growth rate (p=0.376314)

were normally distributed. The data for Debt-GDP Ratio (p=0.000000), rate of inflation (p=0.000000), M1 (p=0.003673) and M2 (p=0.010629) were not normally distributed. The data for Debt-GDP Ratio, rate of inflation, M1 and M2 were transformed to normal through conversion to natural logarithm.

Figure 4.1 shows the trends in study variables. The government bond yield remained relatively stable across the study period. The highest value of bond yield was 17.07% recorded in the year 2011 and the lowest bond yield was 8.12% in 2004. The debt to GDP ratio also remained relatively stable across the study period. The highest debt to GDP ratio was 99.65365% in 1993 and the lowest was 36.02794% in 2008. The highest and the lowest rates of inflation were 45.979% in 1993 and 1.554% in 1995 respectively. The real interest rate was - 8% in 2006 and the highest was 21.1% in 1998.

GDP growth rate remained relatively low until the year 2004 when GDP growth rate rose to 5.1% in the year 2004. However, the GDP growth rate fell to 0.2% in the year 2008 following post-election violence after 2007 general elections in Kenya. Thereafter, the GDP growth rate rose to 8.4% in 2010, a period when Kenya 2010 Constitution was promulgated. Money supply gradually rose across the study period from lows of KShs 15.7406 Billion (M1) and KShs 30.016 Billion (M2) in 1985 to high values of KShs 1477.526 (M1) Billion and KShs 2755.973 Billion (M2) in 2018.



	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Yield	11.2	10.1	10.6	10.7	11.2	11.5	12.6	11.0	12.6	12.5	12.9	11.5	13.5	11.4	13.7	11.3	12.0	13.7	12.4	8.1	11.0	15.0	14.0	12.9	11.9	8.8	17.1	17.0	13.5	12.5	15.5	13.5	13.4	12.8
Debt-GDP Ratio	45.4	47.3	45.7	45.8	44.5	47.9	53.4	64.9	99.7	73.0	60.7	50.7	39.5	37.3	44.4	38.5	57.4	57.3	56.3	54.5	47.6	44.3	39.2	36.0	37.6	42.5	43.4	45.0	36.6	41.0	41.6	44.5	48.8	51.0
Inflation	11.4	10.3	13.0	4.8	7.6	11.2	19.1	27.3	46.0	28.8	1.6	8.9	11.9	6.7	5.8	10.0	5.8	2.2	6.0	8.4	7.8	6.0	4.3	15.1	10.6	4.3	14.0	9.4	5.7	6.9	6.6	6.3	8.0	4.7
Interest	5.3	4.9	8.2	8.0	6.8	7.3	5.7	1.8	3.4	16.4	15.8	-5.8	16.9	21.1	17.5	15.3	17.8	17.4	9.8	5.0	7.6	-8.0	4.8	-1.0	2.8	12.0	3.8	9.6	11.4	7.8	5.5	10.4	10.7	9.9
GDP	4.3	7.2	5.9	6.2	4.7	4.2	1.4	-0.8	0.4	2.6	4.4	4.1	0.5	3.3	2.3	0.6	3.8	0.5	2.9	5.1	5.9	6.5	6.9	0.2	3.3	8.4	6.1	4.6	5.9	5.4	5.7	5.9	4.9	6.3
M1	1.6	2.1	2.3	2.4	2.6	3.4	3.4	4.9	6.1	6.7	7.3	7.9	9.1	9.5	11.0	11.9	13.0	15.0	19.4	21.1	23.1	29.2	37.3	39.3	44.2	57.7	62.3	71.1	82.7	93.6	102.	131.	138.	147.
M2	3.0	4.1	4.7	4.8	5.4	6.6	7.9	9.3	12.0	16.0	19.3	23.8	27.8	28.5	29.6	29.8	30.9	33.8	39.5	43.3	47.5	55.4	66.7	76.6	89.8	109.	125.	146.	167.	198.	223.	236.	255.	275.

Figure 4.1: Trends in the Study Variables

4.3 Stationarity Test

The Study used Augmented Dickey Fuller (ADF) test to examine stationarity of the time series data for the variables government bond yield, government debt, rate of inflation, interest rate, economic growth and money supply in Kenya.

Table 4.2: ADF Test-Bond Yield

Level						
Bond Yield	Intercept only		Linear Trend and Intercept		No trend and No intercept	
	t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.
Augmented Dickey-Fuller test statistic	-4.327552	0.0017	-5.559193	0.0004	1.138864	0.9300
5% level	-2.954021		-3.557759		-1.953381	
Augmented Dickey-Fuller Test Equation		Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept only		Y(-1)	-0.747410	0.172710	-4.327552	0.0001
Linear Trend and Intercept		Y(-1)	-1.344591	0.241868	-5.559193	0.0000
No trend and No intercept		Y(-1)	0.034553	0.030340	1.138864	0.2670
First Difference						
Bond Yield	Intercept only		Linear Trend and Intercept		No trend and No intercept	
	t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.
Augmented Dickey-Fuller test statistic	-5.293106	0.0002	-5.229086	0.0012	-6.510678	0.0000
5% level	-2.971853		-3.580623		-1.952473	
Augmented Dickey-Fuller Test Equation		Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept only		D(Y(-1))	-4.871976	0.920438	-5.293106	0.0000
Linear Trend and Intercept		D(Y(-1))	-4.908826	0.938754	-5.229086	0.0000
No trend and No intercept		D(Y(-1))	-2.663995	0.409173	-6.510678	0.0000

The ADF results in Table 4.2 show that the level data for bond yield not stationary (had a unit root) as indicated by the ADF test equation with intercept only (p=0.0017), trend and intercept (p=0.0004), neither time trend nor intercept (p=0.9300). The probability vales were greater than 0.05 and the calculated t-statistics were less than critical values

at 5% level. However, the data for bond yield became stationary (had no unit root) after first differencing as indicated by the ADF test equation with intercept only (p=0.0002), trend and intercept (p=0.0012), neither time trend nor intercept (p=0.0000). The probability vales were less than 0.05 and the absolute calculated t-statistics were greater than critical values at 5% level. All the ADF test equations were fit for the analysis because all the variable coefficients were negative.

Table 4.3: Debt-GDP Ratio

Level						
Debt-GDP Ratio	Intercept only		Linear Trend and Intercept		No trend and No intercept	
	t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.
Augmented Dickey-Fuller test statistic	-1.124299	0.6904	-4.220300	0.0135	-0.524333	0.4798
5% level	-2.981038		-3.595026		-1.954414	
Augmented Dickey-Fuller Test Equation		Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept only		DT(-1)	-0.364764	0.324437	-1.124299	0.2765
Linear Trend and Intercept		DT(-1)	-2.768606	0.656021	-4.220300	0.0007
No trend and No intercept		DT(-1)	-0.022229	0.042394	-0.524333	0.6064
Second Difference						
Debt-GDP Ratio	Intercept only		Linear Trend and Intercept		No trend and No intercept	
	t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.
Augmented Dickey-Fuller test statistic	-4.724890	0.0010	-4.337753	0.0113	-4.995311	0.0000
5% level	-2.991878		-3.612199		-1.955681	
Augmented Dickey-Fuller Test Equation		Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept only		D(DT(-1),2)	-3.693300	0.781669	-4.724890	0.0003
Linear Trend and Intercept		D(DT(-1),2)	-3.994266	0.920814	-4.337753	0.0007
No trend and No intercept		D(DT(-1),2)	-3.738633	0.748429	-4.995311	0.0001

The ADF results in Table 4.3 show that the level data for Debt-GDP Ratio not stationary as indicated by the ADF test equation with intercept only (p= 0.6904), trend and intercept (p=0.0135), neither time trend nor intercept (p=0.4798). However, the data for Debt-GDP Ratio became stationary after first differencing as indicated by the ADF test equation with intercept only (p=0.0010), trend and intercept (p=0.0113), neither time trend nor intercept (p=0.0000). All the ADF test equations were fit for the analysis because all the variable coefficients were negative.

Table 4.4: Inflation

Level						
Inflation	Intercept only		Linear Trend and Intercept		No trend and No intercept	
	t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.
Augmented Dickey-Fuller test statistic	-2.517382	0.1215	-3.419461	0.0677	-1.294300	0.1763
5% level	-2.963972		-3.568379		-1.952066	
Augmented Dickey-Fuller Test Equation		Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept only		INF(-1)	-0.528310	0.209865	-2.517382	0.0186
Linear Trend and Intercept		INF(-1)	-0.760225	0.222323	-3.419461	0.0022
No trend and No intercept		INF(-1)	-0.138690	0.107154	-1.294300	0.2061
First Difference						
Inflation	Intercept only		Linear Trend and Intercept		No trend and No intercept	
	t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.
Augmented Dickey-Fuller test statistic	-3.652977	0.0107	-3.610233	0.0464	-3.721473	0.0006
5% level	-2.967767		-3.574244		-1.952910	
Augmented Dickey-Fuller Test Equation		Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept only		D(INF(-1))	-1.609382	0.440567	-3.652977	0.0013
Linear Trend and Intercept		D(INF(-1))	-1.625736	0.450313	-3.610233	0.0015
No trend and No intercept		D(INF(-1))	-1.606877	0.431785	-3.721473	0.0010

The ADF results in Table 4.4 show that the level data for inflation not stationary as indicated by the ADF test equation with intercept only (p= 0.1215), trend and intercept (p= 0.0677), neither time trend nor intercept (p=0.1763). However, the data for inflation became stationary after first differencing as indicated by the ADF test equation with intercept only (p=0.0107), trend and intercept (p=0.0464), neither time trend nor intercept (p=0.0006). All the ADF test equations were fit for the analysis because all the variable coefficients were negative.

Table 4.5: Interest Rate

Level						
Interest Rate	Intercept only		Linear Trend and Intercept		No trend and No intercept	
	t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.
Augmented Dickey-Fuller test statistic	-4.098088	0.0032	-4.033228	0.0172	-0.764129	0.3770
5% level	-2.954021		-3.552973		-1.952066	
Augmented Dickey-Fuller Test Equation		Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept only		INT(-1)	-0.700127	0.170842	-4.098088	0.0003
Linear Trend and Intercept		INT(-1)	-0.700318	0.173637	-4.033228	0.0003
No trend and No intercept		INT(-1)	-0.098604	0.129041	-0.764129	0.4512
First Difference						
Interest Rate	Intercept only		Linear Trend and Intercept		No trend and No intercept	
	t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.
Augmented Dickey-Fuller test statistic	-7.020457	0.0000	-6.893401	0.0000	-7.138555	0.0000
5% level	-2.960411		-3.562882		-1.952066	
Augmented Dickey-Fuller Test Equation		Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept only		D(INT(-1))	-1.990584	0.283540	-7.020457	0.0000
Linear Trend and Intercept		D(INT(-1))	-1.990621	0.288772	-6.893401	0.0000
No trend and No intercept		D(INT(-1))	-1.988502	0.278558	-7.138555	0.0000

The ADF results in Table 4.5 show that the level data for interest rate not stationary as indicated by the ADF test equation with intercept only (p=0.0032), trend and intercept (p=0.0172), neither time trend nor intercept (p=0.3770). However, the data for interest rate became stationary after first differencing as indicated by the ADF test equation with intercept only (p=0.0000), trend and intercept (p=0.0000), neither time trend nor intercept (p=0.0000). All the ADF test equations were fit for the analysis because all the variable coefficients were negative.

Table 4.6: GDP Growth Rate

Level						
GDP Growth Rate	Intercept only		Linear Trend and Intercept		No trend and No intercept	
	t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.
Augmented Dickey-Fuller test statistic	-3.203698	0.0287	-3.522097	0.0539	-0.417167	0.5240
5% level	-2.954021		-3.557759		-1.952910	
Augmented Dickey-Fuller Test Equation		Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept only		GDP(-1)	-0.511385	0.159624	-3.203698	0.0031
Linear Trend and Intercept		GDP(-1)	-0.656679	0.186446	-3.522097	0.0015
No trend and No intercept		GDP(-1)	-0.043351	0.103918	-0.417167	0.6803
First Difference						
GDP Growth Rate	Intercept only		Linear Trend and Intercept		No trend and No intercept	
	t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.
Augmented Dickey-Fuller test statistic	-4.160681	0.0031	-4.326310	0.0096	-6.109348	0.0000
5% level	-2.967767		-3.574244		-1.952066	
Augmented Dickey-Fuller Test Equation		Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept only		D(GDP (-1))	-2.196485	0.527915	-4.160681	0.0004
Linear Trend and Intercept		D(GDP (-1))	-2.368809	0.547536	-4.326310	0.0002
No trend and No intercept		D(GDP (-1))	-1.632979	0.267292	-6.109348	0.0000

The ADF results in Table 4.6 show that the level data for GDP growth rate not stationary as indicated by the ADF test equation with intercept only (p=0.0287), trend and intercept (p= 0.0539), neither time trend nor intercept (p= 0.5240). However, the data for GDP growth rate became stationary after first differencing as indicated by the ADF test equation with intercept only (p=0.0031), trend and intercept (p= 0.0096), neither time trend nor intercept (p=0.0000). All the ADF test equations were fit for the analysis because all the variable coefficients were negative.

Table 4.7: Money Supply (M2)

Level						
Money Supply (M2)	Intercept only		Linear Trend and Intercept		No trend and No intercept	
	t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.
Augmented Dickey-Fuller test statistic	1.635704	0.9993	0.330956	0.9980	1.816208	0.9810
5% level	-2.957110		-3.557759		-1.951687	
Augmented Dickey-Fuller Test Equation		Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept only		M2(-1)	0.033398	0.020418	1.635704	0.1127
Linear Trend and Intercept		M2(-1)	0.007864	0.023762	0.330956	0.7431
No trend and No intercept		M2(-1)	0.036841	0.020285	1.816208	0.0793
Second Difference						
Money Supply (M2)	Intercept only		Linear Trend and Intercept		No trend and No intercept	
	t-Statistic	Prob.	t-Statistic	Prob.	t-Statistic	Prob.
Augmented Dickey-Fuller test statistic	-6.964960	0.0000	-6.875511	0.0000	-6.874450	0.0000
5% level	-2.960411		-3.562882		-1.952066	
Augmented Dickey-Fuller Test Equation		Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept only		D(M2(-1),2)	-1.251186	0.179640	-6.964960	0.0000
Linear Trend and Intercept		D(M2(-1),2)	-1.255786	0.182646	-6.875511	0.0000
No trend and No intercept		D(M2(-1),2)	-1.224719	0.178155	-6.874450	0.0000

The ADF results in Table 4.7 show that the level data for Money Supply (M2) not stationary as indicated by the ADF test equation with intercept only (p=0.9993), trend and intercept (p= 0.9980), neither time trend nor intercept (p=0.9810). However, the data for Money Supply (M2) became stationary after second differencing as indicated by the ADF test equation with intercept only (p=0.0000), trend and intercept (p=0.0000), neither time trend nor intercept (p=0.0000). All the ADF test equations were fit for the analysis because all the variable coefficients were negative.

The data for government bond yield, rate of inflation, interest rate, economic growth and GDP growth rate became stationary on first difference as indicated. The government debt and money supply became stationary upon second difference. The variables were therefore fit for econometric analysis upon differencing.

4.4 Cointegration Test

Johansen Cointegration Test was used to examine whether the variables had a long run association. Variables have a long run association when they are integrated in the same order and move together. Table 4.8 shows the results.

Table 4.8: Johansen Cointegration Test

Sample (adjusted): 1987 2018
Included observations: 32 after adjustments
Trend assumption: Linear deterministic trend
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.751320	117.8730	95.75366	0.0007
At most 1 *	0.632667	73.34227	69.81889	0.0255
At most 2	0.502009	41.29471	47.85613	0.1795
At most 3	0.314249	18.98515	29.79707	0.4940
At most 4	0.160137	6.913456	15.49471	0.5877
At most 5	0.040679	1.328930	3.841466	0.2490

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.751320	44.53078	40.07757	0.0148
At most 1	0.632667	32.04756	33.87687	0.0813
At most 2	0.502009	22.30956	27.58434	0.2049
At most 3	0.314249	12.07170	21.13162	0.5406
At most 4	0.160137	5.584526	14.26460	0.6669
At most 5	0.040679	1.328930	3.841466	0.2490

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

The study findings in Table 4.8 show that the trace statistic was 117.873, a 5 percent critical value of 95.75366 and p=0.0007 for the null hypothesis (H_0) that there was zero number of cointegrations. The trace statistic was therefore greater than 5 percent critical value (117.873> 95.75366) leading to the rejection of null hypothesis (H_0)

that there was no cointegration among the study variables. On the contrary, the Trace test indicates 2 cointegrating equations at the 0.05 level.

Similarly, the Max-Eigen statistics (44.53078) was greater than the 5 percent critical value (40.07757) and the probability value of p=0.0148 leading to the null hypothesis (H_0) that there was no cointegration among the study variables. On the contrary, Max-eigenvalue test indicated 1 cointegrating equation at the 0.05 level. The Eigenvalue values are strictly bounded by 1, i.e. $\lambda_i < 1$ (all the Eigenvalues are less than 1) thus stationarity of the time series data used in the study is guaranteed.

The study therefore concluded that there was cointegration among the study variables. The study variables (government bond yield, government debt, rate of inflation, interest rate, economic growth and money supply) had either shot-term or long-run association. The study therefore run ARDL model to determine the existence of short-term or long-run association among the variables.

4.5 Long Run Autoregressive Distributed Lag Model

The objective of the study was to determine the effect of macroeconomic variables on government bond yields in Kenya. The Johansen Cointegration tests in section 4.4 revealed a cointegration among the study variables. The variables were auto-correlated thus exhibited dependencies on their lags. Autoregressive Distributed Lag model was used to establish the long run and short run causality among the variables.

4.5.1 Lag Selection

The study developed a Standard ARDL models having three lags, two lags and one lag to determine the most suitable model using Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC). Table 4.9 shows the results

Table 4.9: Lag Selection Criteria

Criteria	3 Lags	2Lags	1Lag
Akaike info criterion	3.158764	4.350969	4.376435
Schwarz criterion	4.326428	5.229865	4.971891

The results show that the standard ARDL model having three lags had the lowest values of AIC (3.158764) and SIC (4.326428). Therefore, the study chose the ARDL model having three lags as shown in Table 4.10.

Table 4.10: Standard ARDL Model with One Lag

Dependent Variable: D(Y)
Method: Least Squares
Sample (adjusted): 1989 2018
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	28.84329	15.23359	1.893401	0.1168
D(Y(-1))	0.888156	0.971938	0.913799	0.4027
D(Y(-2))	0.539579	0.635736	0.848746	0.4348
D(Y(-3))	0.305477	0.423951	0.720548	0.5035
D(DT(-1))	0.172951	0.066768	2.590346	0.0488
D(DT(-2))	0.066562	0.058333	1.141064	0.3055
D(DT(-3))	-0.042660	0.047949	-0.889711	0.4144
D(INF(-1))	-0.265409	0.115388	-2.300136	0.0698
D(INF(-2))	-0.144432	0.079984	-1.805755	0.1308
D(INF(-3))	-0.039535	0.067289	-0.587534	0.5824
D(INT(-1))	-0.213366	0.117043	-1.822965	0.1279
D(INT(-2))	-0.181995	0.098162	-1.854027	0.1229
D(INT(-3))	-0.223458	0.069246	-3.226995	0.0233
D(GDP(-1))	0.435522	0.339257	1.283754	0.2555
D(GDP(-2))	0.660825	0.250949	2.633306	0.0463
D(GDP(-3))	0.211581	0.234613	0.901830	0.4085
D(M2(-1))	0.245407	0.124203	1.975845	0.1051
D(M2(-2))	-0.077606	0.097996	-0.791925	0.4643
D(M2(-3))	0.287782	0.197234	1.459084	0.2044
Y(-1)	-1.913135	1.180160	-1.621081	0.1659
DT(-1)	-0.208038	0.081595	-2.549627	0.0513
INF(-1)	0.328934	0.118407	2.778003	0.0390
INT(-1)	0.173840	0.111442	1.559914	0.1795
GDP(-1)	-0.281297	0.549105	-0.512283	0.6303
M2(-1)	-0.028374	0.024403	-1.162715	0.2974

R-squared	0.957203	Mean dependent var	0.069333
Adjusted R-squared	0.751779	S.D. dependent var	2.508558
S.E. of regression	1.249808	Akaike info criterion	3.158764
Sum squared resid	7.810097	Schwarz criterion	4.326428
Log likelihood	-22.38146	Hannan-Quinn criter.	3.532310
F-statistic	4.659643	Durbin-Watson stat	2.907923
Prob(F-statistic)	0.047109		

The study chooses the standard ARDL model having three lags in Table 4.10 was used to run long run association among the study variables.

4.5.2 Breusch-Godfrey Serial Correlation LM Test

The study used Breusch-Godfrey Serial Correlation LM Test to examine whether the long run standard ARDL model had serial correlation or not. Table 4.11 shows the findings of the study.

Table 4.11: Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.362900	Prob. F(3,4)	0.7844
Obs*R-squared	6.418333	Prob. Chi-Square(3)	0.0929

Sample: 1989 2018
Included observations: 30
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.058846	21.52199	0.142127	0.8939
D(Y(-1))	0.212259	1.466021	0.144785	0.8919
D(Y(-2))	0.139179	1.012045	0.137522	0.8973
D(Y(-3))	0.106815	0.588106	0.181625	0.8647
D(DT(-1))	0.031426	0.101572	0.309395	0.7725
D(DT(-2))	0.030382	0.109319	0.277918	0.7948
D(DT(-3))	-0.035617	0.083347	-0.427334	0.6911
D(INF(-1))	-0.112088	0.243084	-0.461110	0.6687
D(INF(-2))	-0.004085	0.116151	-0.035167	0.9736
D(INF(-3))	0.035933	0.109380	0.328515	0.7590
D(INT(-1))	-0.143900	0.268061	-0.536818	0.6199
D(INT(-2))	-0.116187	0.207922	-0.558801	0.6061
D(INT(-3))	-0.053162	0.123263	-0.431291	0.6885
D(GDP(-3))	0.117406	0.321066	0.365675	0.7331
D(M2(-1))	-0.047982	0.183754	-0.261121	0.8069
D(M2(-2))	-0.018572	0.160791	-0.115501	0.9136
D(M2(-3))	0.134031	0.321956	0.416304	0.6986
Y(-1)	-0.086413	1.883681	-0.045874	0.9656
DT(-1)	-0.060361	0.152164	-0.396686	0.7119
INF(-1)	0.115420	0.247260	0.466794	0.6649
INT(-1)	0.041135	0.183990	0.223574	0.8340
GDP(-1)	-0.187870	0.525361	-0.357602	0.7387
M2(-1)	-0.004928	0.039622	-0.124362	0.9070
RESID(-1)	-0.678177	0.750705	-0.903387	0.4174
RESID(-2)	0.263080	0.764292	0.344213	0.7480
RESID(-3)	1.215270	1.582321	0.768030	0.4853

R-squared	0.213944	Mean dependent var	-1.43E-15
Adjusted R-squared	-4.698903	S.D. dependent var	0.809425
S.E. of regression	1.932289	Akaike info criterion	3.873718
Sum squared resid	14.93496	Schwarz criterion	5.088089
Log likelihood	-32.10576	Hannan-Quinn criter.	4.262205
F-statistic	0.043548	Durbin-Watson stat	1.834287
Prob(F-statistic)	1.000000		

From the study findings in Table 4.11, the probability values of probability of F-statistic Prob. F (3,4) = 0.7844 and Prob. Chi-Square (2) = 0.0929 were greater than 0.05 at 95 percent level of confidence. Therefore, the study accepted the null hypothesis that the long run ARDL model had no serial correlation. The model was desirable.

4.5.3 CUSUM Test for Stability of the long run ARDL Model

The study used CUSUM Test to examine whether the standard ARDL model was stable or not. Figure 4.2 shows the findings of the study.

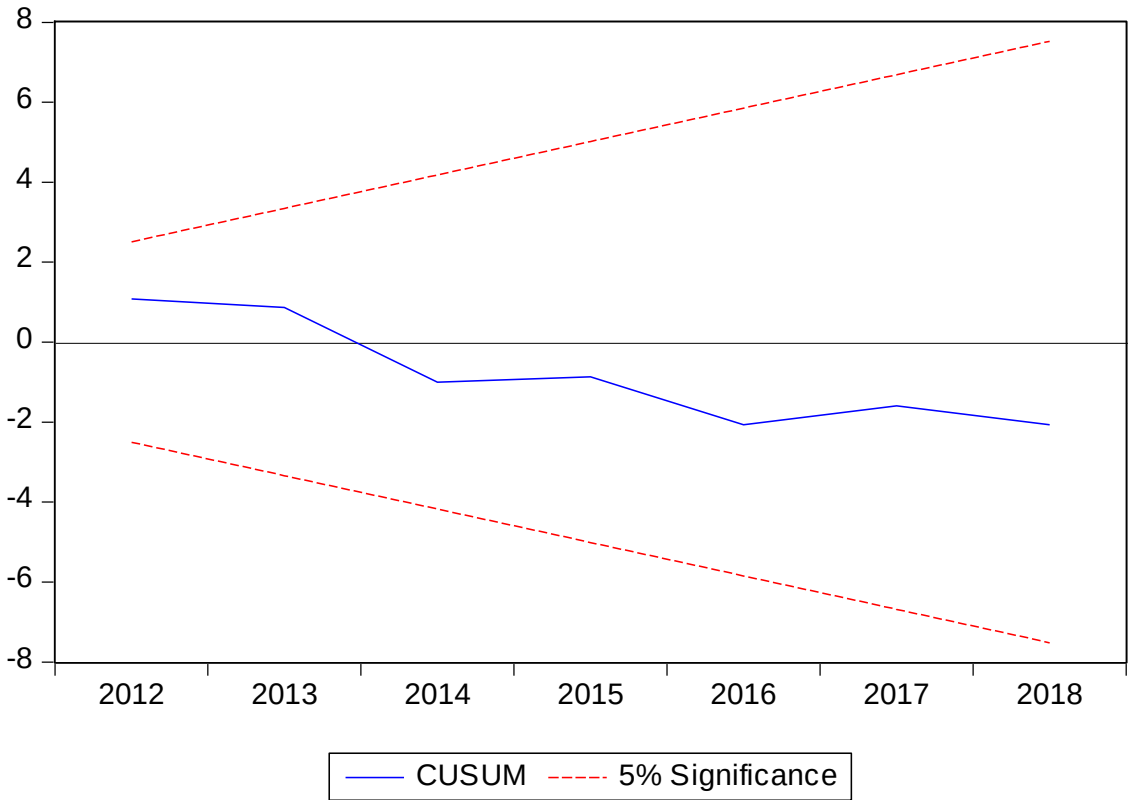


Figure 4.2: CUSUM Test for Stability of the long run ARDL Model

The CUSUM test in Figure 4.2 show that the line graph lies between the two red lines. Therefore, the long run ARDL model was stable. From the study findings above, the long run ARDL model had no serial correlation and was stable and is fit for analysis of the long run causality. The study therefore proceeded to bound testing to establish

whether the six variables (government bond yield, government debt, rate of inflation, interest rate, economic growth and money supply) have long term association or not.

4.5.4 Bound Testing for Long Run Causality

The study carried out bound testing to establish whether the variables had long term association or not in the standard ARDL model. The study applied Wald Statistics to examine the long term association among the variables as shown in Table 4.12.

Table 4.12: Wald Test

Test Statistic	Value	df	Probability
F-statistic	2.946795	(6, 7)	0.0917
Chi-square	17.68077	6	0.0071

Null Hypothesis: C(18)=C(19)=C(20)=C(21)=C(22)=C(23)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(18)	-1.935253	1.322449
C(19)	-0.156090	0.099977
C(20)	0.322029	0.154903
C(21)	0.283397	0.135581
C(22)	0.206970	0.389528
C(23)	-0.033350	0.031209

Restrictions are linear in coefficients.

The value of F statistics in Wald Test (Table 4.11) was 2.946795 and was compared to Pesaran Critical value at 5 percent level. From the Pesaran table, the Lower bound value is 1.8557 and Upper bound is 4.56 for 5 regressors. In this study, F statistics 2.946795 was less than the upper bound value 4.56. Therefore, the study concluded that the six variables (government bond yield, government debt, rate of inflation, interest rate, economic growth and money supply) no long run association.

4.6 Short Run Autoregressive Distributed Lag Model

The study further developed the long run models by deriving its residuals. The residual was used to generate the variable termed Error Correction Term (ECT). The short run standard ARDL model with one lag and Error Correction Term is shown in Table 4.13.

Table 4.13: Short Run Standard ARDL Model

Dependent Variable: D(Y)
Method: Least Squares
Sample (adjusted): 1989 2018
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.164563	0.478685	0.343781	0.7370
D(Y(-1))	0.252210	0.311657	0.809253	0.4341
D(Y(-2))	-0.182614	0.220199	-0.829312	0.4231
D(Y(-3))	-0.157409	0.232593	-0.676757	0.5114
D(DT(-1))	0.019400	0.058003	0.334469	0.7438
D(DT(-2))	0.005718	0.051405	0.111231	0.9133
D(DT(-3))	-0.040349	0.048628	-0.829758	0.4229
D(INF(-1))	0.023741	0.090515	0.262282	0.7976
D(INF(-2))	-0.105604	0.067884	-1.555657	0.1458
D(INF(-3))	0.017202	0.084892	0.202637	0.8428
D(INT(-1))	0.061430	0.076799	0.799890	0.4393
D(INT(-2))	-0.003830	0.073030	-0.052447	0.9590
D(INT(-3))	-0.121116	0.061645	-1.964743	0.0730
D(GDP(-3))	-0.225293	0.262281	-0.858975	0.4072
D(M2(-1))	0.161557	0.092248	1.751330	0.1054
D(M2(-2))	-0.201599	0.119242	-1.690681	0.1167
D(M2(-3))	0.032819	0.097363	0.337078	0.7419
ECT(-1)	-1.201744	0.425435	-2.824742	0.0153

R-squared	0.779520	Mean dependent var	0.069333
Adjusted R-squared	0.467174	S.D. dependent var	2.508558
S.E. of regression	1.831121	Akaike info criterion	4.331443
Sum squared resid	40.23604	Schwarz criterion	5.172161
Log likelihood	-46.97164	Hannan-Quinn criter.	4.600396
F-statistic	2.495690	Durbin-Watson stat	1.878180
Prob(F-statistic)	0.056202		

The Error Correction Term (ECT=-1.201744) is the speed of adjustment towards long run equilibrium. The ECT is negative -1.201744) and significant (p=0.0153) indicating the whole system (ARDL model) adjusts towards long run equilibrium at a speed of 120.1744 percent.

4.6.1 Breusch-Godfrey Serial Correlation LM Test

The study then examined existence of serial correlation and stability in the short run ARDL model. Table 4.14 shows the result of Breusch-Godfrey Serial Correlation.

Table 4.14: Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.989622	Prob. F(3,9)	0.4404
Obs*R-squared	7.441471	Prob. Chi-Square(3)	0.0591

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 10/28/19 Time: 21:16
Sample: 1989 2018
Included observations: 30
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.114349	0.495622	-0.230717	0.8227
D(Y(-1))	-0.151581	0.421048	-0.360009	0.7271
D(Y(-2))	-0.109516	0.230980	-0.474137	0.6467
D(Y(-3))	0.015341	0.236125	0.064970	0.9496
D(DT(-1))	0.018017	0.063129	0.285401	0.7818
D(DT(-2))	-0.032842	0.059359	-0.553280	0.5935
D(DT(-3))	0.045159	0.056738	0.795927	0.4466
D(INF(-1))	-0.011087	0.114509	-0.096824	0.9250
D(INF(-2))	-0.033495	0.074052	-0.452317	0.6617
D(INF(-3))	-0.095560	0.104118	-0.917805	0.3827
D(INT(-1))	0.021127	0.077989	0.270902	0.7926
D(INT(-2))	0.033607	0.077304	0.434745	0.6740
D(INT(-3))	0.022023	0.064876	0.339465	0.7420
D(GDP(-3))	-0.244062	0.317465	-0.768785	0.4617
D(M2(-1))	-0.001813	0.095262	-0.019033	0.9852
D(M2(-2))	0.071887	0.142155	0.505696	0.6252
D(M2(-3))	-0.046937	0.122264	-0.383896	0.7100
ECT(-1)	0.014682	0.597324	0.024580	0.9809
RESID(-1)	0.254008	0.477630	0.531809	0.6077
RESID(-2)	0.159379	0.561065	0.284065	0.7828
RESID(-3)	-1.062748	0.637929	-1.665936	0.1301

R-squared	0.248049	Mean dependent var	-2.59E-16
Adjusted R-squared	-1.422953	S.D. dependent var	1.177900
S.E. of regression	1.833501	Akaike info criterion	4.246359
Sum squared resid	30.25553	Schwarz criterion	5.227197
Log likelihood	-42.69538	Hannan-Quinn criter.	4.560137
F-statistic	0.148443	Durbin-Watson stat	1.894710
Prob(F-statistic)	0.999802		

LM Test for Short Run ARDL Model. Breusch-Godfrey Serial Correlation LM Test shows that probability of the F-statistics F(3,9)=0.4404 leading to acceptance of the null hypothesis that the short run ARDL model has no serial correlation thus the model is desirable.

4.6.2 CUSUM Test for Stability of the Short run ARDL Model

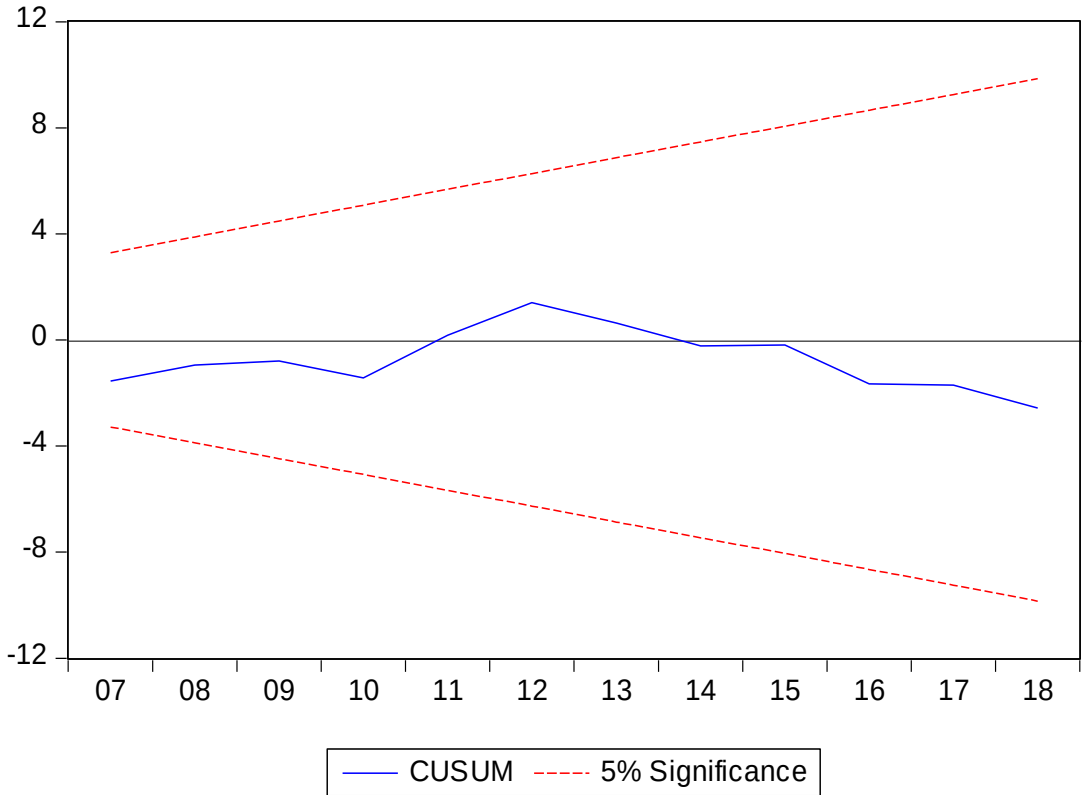


Figure 4.3: CUSUM Test for Stability of the long run ARDL Model

The CUSUM test in Figure 4.3 show that the line graph lies between the two red lines. Therefore, the short run ARDL is stable. From the study findings above, the short run ARDL model has no serial correlation and is stable and is fit for the analysis of short run causality.

4.6.3 Wald Test

The study therefore proceeded to bound testing to establish whether the predictor variables (government bond yield, government debt, rate of inflation, interest rate, economic growth and money supply) had short run association with bond yield or not. Table 4.15 shows Wald Test results for short run causality running from independent variables to NPL ratio.

Table 4.15: Wald Test results

	Test Statistic	Value	df	Probability
Debt to GDP	F-statistic	0.235440	(3, 12)	0.8699
H_0: C(Debt : GDP)=0	Chi-square	0.706321	3	0.8717
Inflation	F-statistic	0.863096	(3, 12)	0.4867
H_0: C (Inf)=0	Chi-square	2.589287	3	0.4594
Interest Rate	F-statistic	2.407173	(3, 12)	0.1180
H_0: CInt)=0	Chi-square	7.221519	3	0.0652
GDP	F-statistic	0.737838	(1, 12)	0.4072
H_0: C(GDP)=0	Chi-square	0.737838	1	0.3904
M2	F-statistic	1.262319	(3, 12)	0.3312
H_0: (M2)=0	Chi-square	3.786957	3	0.2854

Predictor: Bond Yield (Y)

The Chi Square statistics in the Wald Test indicated that there was no short run causality running from Debt to GDP ratio to government bond yield as indicated by p = 0.8717 which was greater than 0.05. The Chi Square statistics also indicate lack of short run causality running from inflation rate (p= 0.4594), interest rate (p= 0.1180), GDP (p= 0.3904) and money supply (p= 0.2854) to government bond yield.

The study established that the macroeconomic variables did not cause the changes in the bond yield in the short run and in the long run. The results can be attributed to the fact that the treasury bonds in Kenya are issued on monthly basis at fixed rates of interest for periods that range from one to thirty years. The interest rates of treasury

bonds are fixed and are paid periodically within the set maturity term. The predictability of treasury bonds is therefore guaranteed and the bong yield is not subject to changes in the macroeconomic variables. The study findings are in tandem with Karatheodoros (2015 who argued that Government bonds provide a means to secure investment because payment is guaranteed by the fact that repayment of government debts is prioritized in the budgeting process

The study findings are supported by Keynesian framework which theorizes that the yields of government bonds are not subject to the debt held by government and deficits in the budget. Instead, the returns on the bonds issued by the government depend on decisions taken by the central bank (Keynes, 2007). In the Kenyan context, the study findings imply that the returns on government bonds were not subjects to macroeconomic variables such as government debt, rate of inflation, interest rate, economic growth and money supply. Instead, the yields on the bonds issued by the National Treasury in Kenya were dependent on policies and actions by the Central Bank of Kenya.

Money supply influences the prices of securities with high risk. Changes in the levels of money supply affect the purchases of securities in the money market. Nevertheless, the study established that money supply had no significant influence on the returns of government bonds. This was attributes to the fact that treasury bonds in Kenya have fixed rates of return and investments in government bonds have secure return over the maturity period. The study findings also concur with a similar study by Jurkšas and Kropienė (2014) who reached a conclusion that the effects of money supply on bond yield was not clear because a portion of money supply could be used to purchase debt securities.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This section highlights the key findings of the study in regard to the effect of macroeconomic variables on government bond yields in Kenya. The chapter also present the conclusions drawn from the study findings and recommendations made in regards to policy development and further research.

5.2 Summary

The descriptive statistics showed that the government bond yield, debt-GDP Ratio, rate of inflation, M1 and M2 were positively skewed while the real interest rate and GDP growth were negatively skewed. The GDP growth rate was platykurtic (had negative kurtosis or flattened curves) while bond yields, Debt-GDP Ratio, the rate of inflation, real interest rate, M1 and M2 were leptokurtic (had positive kurtosis or peaked curve). The data the data for bond yield (p=0.541339), real interest rate (p=0.780871) and GDP growth rate (p=0.376314) were normally distributed. The data for Debt-GDP Ratio (p=0.000000), rate of inflation (p=0.000000), M1 (p=0.003673) and M2 (p=0.010629) were not normally distributed and natural logs were used to make the data normal.

The stationarity test indicated that all the variables were not stationary at level as all the variables had probability values greater than 0.05 at level. Nevertheless, the data for government bond yield, rate of inflation, interest rate, the economic growth rate and GDP growth rate became stationary on first difference as indicated. The government debt and money supply became stationary upon second difference. The variables were therefore fit for econometric analysis upon differencing.

The trace statistics in Johansen Cointegration Test indicated that there were 2 cointegrating equations at 0.05 level and Max-eigenvalue test indicated 1 cointegrating equation at the 0.05 level. Therefore, the study variables (government bond yield, government debt, rate of inflation, interest rate, economic growth and money supply) had shot-term or long-run association and the study proceeded to run ARDL model to determine the nature of association among the variables.

The study used a standard RDL model having one lag to establish the long run and short run causality among the variables. The long run standard RDL model had no serial correlation as indicated by the probability of F-statistic p=0.7844 in the Breusch-Godfrey Serial Correlation LM Test. The CUSUM test indicated that the model was stable and fit for analysis of the long run causality. The F statistics in Wald Test F=2.946795 was less than the upper bound value (4.56) from Pesaran table indicating that the six variables (government bond yield, government debt, rate of inflation, interest rate, economic growth and money supply) had no long run association.

The study established that the ARDL model adjusted towards long run equilibrium at a speed of 120.17 percent. The study established that there was no short run association causality among the study variables as indicated by the following probability of Chi Square values in the Wald test: Debt to GDP (p=0.8717), inflation rate (p=0.4594), interest rate (p=0.1180), GDP (p=0.3904) and money supply (p=0.2854).

5.3 Conclusion

The study concludes that government bond yield is Kenya is not significantly influenced by macroeconomic variables such as government debt, rate of inflation, interest rate, economic growth and money supply. The fact that interests on bonds are fixed render bond yields unsusceptible to macroeconomic changes in the country. Government bonds are therefore secure form of investment that is not dependent on external factors.

The rates of returns on the bonds issued by the national treasury are determined by actions taken the government in regard to money that need to be raised in form of bonds. Once the rates of interests have been set, the return on investment per individual investor and yields declared by the government depends on the quantities of bonds purchased and the set dates of maturity. Therefore, the macroeconomic variables do vary the yields of government bonds in Kenya.

5.4 Recommendations

The study recommends that government bonds should be an area of priority in the formulation of monitory and fiscal policies in the country. The rates of interest on bonds issued by the government should attract good yields that encourage more citizens to invest in bonds without adverse effects on investments in other securities at the capital market.

The study recommends that government should embark on an expansive awareness creation programme on government bonds and the benefits that they hold as a mean to increasing government bond yields. Educating the public on treasury bonds and bills should be an integral part of government strategy address deficits in the budget, minimise foreign debt and entrench a culture of long-term investments among the citizens.

5.5 Limitations of the Study

The main limitation of the study was to narrow down the area of focus to selected macroeconomic variables and bonds. The study focused on government debt, rate of inflation, interest rate, economic growth and money supply as the selected macroeconomic variables and 10-year government bond yield whose data could be accessed for the study period 1985-2018. Therefore, the study findings may not be generalized to other macroeconomic variables and types of bonds.

5.6 Suggestions for Further Research

Further empirical studies should focus on the effects of other macroeconomic variables such as the rate of unemployment and government spending on government bond yield. Further study should also be carried out on what determines the yields of sovereign bond in Kenya.

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Appendix I: Data 1985-2018

Year	Y	Debt to GDP ratio	Rate of Inflation	Rate of Interest	GDP growth rate	Money Supply (M2)
1985	11.23	45.42412	11.398	5.3	4.300562	3.0016
1986	10.13	47.27538	10.284	4.9	7.177555	4.0535

1987	10.6	45.68785	13.007	8.2	5.937107	4.7299
1988	10.67	45.834	4.804	8	6.203184	4.7949
1989	11.15	44.53487	7.617	6.8	4.690349	5.3657
1990	11.45	47.87343	11.2	7.3	4.192051	6.5552
1991	12.56	53.44592	19.104	5.7	1.438347	7.8541
1992	11	64.93361	27.332	1.8	-0.79949	9.3275
1993	12.59	99.65365	45.979	3.4	0.353197	12.0428
1994	12.45	72.95407	28.814	16.4	2.632785	16.0107
1995	12.9	60.71999	1.554	15.8	4.406217	19.2584
1996	11.5	50.65944	8.862	-5.8	4.146839	23.8366
1997	13.5	39.5414	11.924	16.9	0.474902	27.7811
1998	11.4	37.32511	6.716	21.1	3.290214	28.451
1999	13.65	44.42522	5.753	17.5	2.305389	29.5513
2000	11.34	38.53084	9.955	15.3	0.599695	29.7872
2001	12	57.44088	5.824	17.8	3.779906	30.8735
2002	13.7	57.3122	2.156	17.4	0.54686	33.8244
2003	12.4	56.28419	5.983	9.8	2.932476	39.5116
2004	8.12	54.49199	8.381	5	5.1043	43.2567
2005	11	47.59356	7.823	7.6	5.906666	47.4883
2006	15	44.2817	6.041	-8	6.472494	55.3907
2007	14	39.18711	4.265	4.8	6.85073	66.6875
2008	12.9	36.02794	15.101	-1	0.232283	76.6078
2009	11.89	37.62258	10.552	2.8	3.30694	89.8099
2010	8.82	42.45986	4.309	12	8.405699	109.9234
2011	17.07	43.37999	14.022	3.8	6.108264	125.3958
2012	17.02	45.02793	9.378	9.6	4.563209	146.94
2013	13.48	36.62685	5.717	11.4	5.878681	167.1595
2014	12.53	41.04302	6.878	7.8	5.357126	198.186
2015	15.51	41.55213	6.6	5.51	5.718507	223.4797
2016	13.49	44.52647	6.3	10.43	5.878949	236.0202
2017	13.36	48.76236	8	10.7	4.862538	255.1811
2018	12.75	50.95619	4.7	9.94	6.319781	275.5973

Sources: National Treasury (2019), CBK (2019) and KNBS (2019).