

**THE EFFECT OF PUBLIC DEBT ON INTEREST  
RATES IN KENYA**

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REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF  
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## DECLARATION

This proposal is my original work and has not been presented for the award of a degree in this University or any other Institution of higher learning for examination.

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## **DEDICATION**

This research project is dedicated to the late Hon. Prof. Paul Sumbi, my dad who set the foundation of education for me and who believed so much in education and offered it to many. I also express my dedication to my late mum, Wanza for making numerous sacrifices in nurturing me and for the inspiration to pursue an MBA.

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## **ABBREVIATIONS AND ACRONYMS**

<b>ANOVA</b>	Analysis of Variance
<b>CBK</b>	Central Bank of Kenya
<b>CBO</b>	Congressional Budget Office
<b>CBR</b>	Central Bank Rate
<b>DRI</b>	Data Resources, Inc.
<b>ECM</b>	Error Correction Modeling
<b>GDP</b>	Gross Domestic Product
<b>GDPPC</b>	Gross Domestic Product Per Capita.
<b>GMM</b>	Generalized Method of Moments
<b>KNBS</b>	Kenya National Bureau of Statistics
<b>KSH</b>	Kenya Shillings
<b>MOF</b>	Ministry of Finance
<b>NSE</b>	Nairobi Stock exchange
<b>OLS</b>	Ordinary Least Square
<b>ROK</b>	Republic Of Kenya
<b>TPF</b>	Total Factor Productivity

## **ABSTRACT**

Kenya, like many developing countries often borrows to finance her budget deficits. This borrowing may have an effect on the macroeconomic factors. To this end, this study sought to establish the effect of Public debt on interest rates in Kenya. The research was based on Barro-Ricardo Equivalence Theorem, the arbitrage pricing theory and the Crowding-out Effect. This study adopted the Descriptive research design to explain the effect of public debt on interest rates in Kenya. The study utilized data on public debt , interest rates inflation rates, economic growth rates and foreign exchange rates instrument, for an eleven year period from 2005 to 2015. The data used was Secondary data and was sourced from the CBK and KNBS. Analysis of the collected data was done by the descriptive measures of central tendency including means, standard deviation, skewness, kurtosis. For the inferential statistics data was analyzed by correlation and the multiple regression analysis. The findings revealed between public debt and the interest rates there existed a relationship in the study period as evidenced by the model summary. The study established that the interest rate had a strong positive co-relation with public debt and exchange rates. The study further established a weak correlation existed between the economic growth and the interest rate and between the in rate of inflation and the interest rate. Public debt was the most influential in determining the interest rate in the country evidenced by the high beta co-efficient. Inflation also influenced interest rate positively. The regression results further revealed that Economic Growth rate and the Foreign exchange rate had a negative influence on the interest rate. The study recommendations are that, the Kenyan government should encourage public debt that is sustainable as excessive Public debt can have inflation effects and may also lead crowding out of the private sector borrowing, to this end, it is pertinent for government borrowing to be monitored closely.

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the Study

Governments often have to borrow in order to finance their budget deficits. (Cecchetti, Mohanty & Zampolli, 2011) note that public debt enables the delivery of essential services to a country's citizens. Recently there have been debates on the effects of public debt on interest rates occasioned by resurgence in government budget deficits. The expanding debt may cause the reduction in the available investments which may cause the interest rate to increase. The increased public debt has an inverse effect through the wealth effect on the value of assets held by households and, it may dampen consumption. The degree to which public debt causes the interest rate to increase is what determines the magnitude and adversity of the effect. Despite the fact that analysis for the past twenty years has been ongoing, little consensus exists on the extent of how much public debt affects the interest rates. Some economists have argued that the effect of public debt on interest rate is significantly large while others have suggested the contrary that is existence of no effect.

Siew and Yan (2015), raised concern as to whether the recent use of public debt by developing countries to finance their respective budgets has had a positive effect in terms of boosting economic growth or it has been a great load for future generations to shoulder as they would be forced to settle these debts . They argue that these borrowing would cause a crowding out of investments by the private sector. Additionally they argue that for creditors to safeguard against increased risk, they would demand higher interest rates. Contrarily, there is the possibility of neutrality of debt which is explained by the

Ricardian equivalence theorem which considers government debt being equivalent to future taxes. Ricardian (1978) noted that with the assumption that consumers being both prospective and rational, the current deficit is equivalent to the discounted value of the future taxes. Hence there is no wealth effect created by the substitution of taxes by deficits and also consumption is not affected. If at present a rational consumer faces deficits then he decides to save for future taxes then the total savings would be unchanged. This is explained by private saving increase matched by a decrease in dissaving by the government doesn't change the level of total savings therefore doesn't affect the interest rates. To establish the effect of macroeconomic factors on the interest rate, we would employ the arbitrage pricing. According to (Mosley, Hundson & Horrell (1987) the anticipated return on an asset may be obtained by linearly calculating the relevant macroeconomic factors together with their market indices. It is expected that for most if not all relevant factors there will be some rate of change. MacKinnon (1991) Notes that the price arrived at using the arbitrage pricing theory model can be equated to the anticipate performance of assets.

Kenya, like many other developing countries often borrows to finance her budget deficits. This borrowing can be through various instruments which include, borrowing from commercial banks, bonds, treasury bills and overdraft from the Central Bank. The details of Kenya's debt burden as of July 2015 the public debt stood at Kshs. 3.2 trillion (GOK, 2015). From 1991 until 2016 Interest Rate in Kenya were at an average of 14.21 %, getting to a maximum rate of 84.67 % as of July 1993 and a minimum rate of 0.83% as of September 2003 (GOK, 2015). CBK reports the Interest Rate in Kenya. Against this

backdrop it is important to determine if government borrowing affects the interest rates in Kenya.

### **1.1.1 Public Debt**

Makau (2008) defines Public debt as a nation's total debt comprising of national and local government debt, which is a portion of public spending financed by borrowing in place of the collection of taxes. Akram (2010) classifies public debt into the summation of both domestic debt and foreign debt. According to Martin (2009) public debt is one of the ways in which governments finance their operations. Governments also avoid paying interest by monetizing their debts. The domestic debt is created through various ways such as overdrafts from the central bank, treasury bills, bonds multilateral loans, suppliers' credit and loans from foreign commercial banks.

Ariyo (1997) argues that the depending on external resources to complement those available for the economy domestically is a major factor that has led to high level of public debt. Klein (1994) states that debt source finance entails holding future resources as collateral to finance debt. .

### **1.1.2 Interest Rates**

Crowley (2007) defines Interest rate as the cost of borrowing. The policy environment and financial sector market microstructure define the spread of the interest rate. Crowley (2007) further states that interest spread is a key indicator for the financial performance and efficiency. He argues that if the spread is large, it would impede on the expansion and development of financial intermediation. Ngugi (2001) opines that interest rate is a

good information indicator as it forecasts future inflation as well as any anticipated change in money's purchasing power.

The interest rate is also affected by demand for loans or money by borrowers. Interest rates operate like other prices as market clearing mechanism, they ration the amount of credit available (Culbertson, 1977). Interest rates are determined in the credit markets, or the debt markets just the same way as stock prices are determined in the NSE (Kasemo, 2015).

### **1.1.3 Relationship between Public Debt and Interest Rate**

Those who support free market are of the opinion that the government borrowing from the economy should be as minimal as possible. Excess borrowing from the economy by the state would cause excess competition over the limited resources with the private sector resulting in driving up prices. This would ultimately lead the public sector activities crowding out the investments by the private sector. According Hall and Henry (1999), the main causes of the domestic borrowing problems are attributed to mismatching of project finance, inappropriate or unbalanced fiscal and monetary policy.

Siew and Yan (2015), question whether the recent use of public debt by developing countries to finance their respective budgets has had a positive effect in terms of boosting economic growth or it has been a great load for future generations to shoulder as they would be forced to settle these debts. They argue that these borrowing would cause a crowding out of investments by the private sector. Additionally they argue that for creditors to safeguard against increase risk, they would demand higher interest rates. Nations which finance by debt, pledge their future resources as security for the fixed

contractual obligations they enter into as they borrow. In-order for a country to meet the servicing requirement then the capacity to service debt should be higher than the exposure to financial risk. The perception of the investment environment of recipient country by the foreign investors would determine the frequency and magnitude in which a country would receive non- debt resources.

According to Patillo, Poirson and Ricci (2004), public debt can influence economic growth through total factor productivity (TFP). They argue that a country which borrows externally to fund its budget deficits would dedicate a large part of its future outputs to those foreign entities which would result in reduced motivation citing that most benefit would be enjoyed by the foreign investors. As a consequence, is reduction on the incentive for productivity. High level of debt would cause the level of risk to increase and investments to reduce. This impacts on the structure of investments is short term investments would favoured over long term investments .The high risk would negatively affect the capital accumulation ,which in turn would negatively affect the productivity in the economy.

#### **1.1.4 Public debt and Interest Rate in Kenya**

Kenya, like many developing countries has an increasing public debt .According to World Bank (2010) this raising debt has been used to make debt service payments and the remainder to finance development and recurrent expenditure. This raising debt can be attributed to reduced donor aid in the 1990's as well as the expenditure pressures and stagnating real revenue receipts. According to the ministry of finance Kenya website, public debt is both internal and externally owed .The internal debt which is domestic debt is borrowing by government from the residents in local currency, which is through

advances from commercial banks, overdrafts from central banks as well as government securities. In the 1980s Kenya received large amounts of foreign aid to finance her development needs. This development assistance drastically declined in the 1990s citing mismanagement of public resources as the major reason. This subsequently led to a debt crisis resulting in Kenya being highly indebted. The debt rose to an all high of 3.2 trillion Kenya shillings as at July 2015 (Government of Kenya, 2015). These high level of public debt has associated risk of the government defaulting on servicing that debt citing inadequacy of resources which could result in high levels of interest.

## **1.2 Research Problem**

The impact of Government borrowing on economic growth may be positive or negative. A tax cut would have an immediate impact of motivating consumers to spend. When the marginal propensity to save is less than the marginal propensity to consume, it results in government dissaving exceeding private sector saving, which in turn increases the real interest rate within an economy and encourages foreign capital. The higher interest rates would have a crowding out effect on private investments. Kenya finances some of her development projects through borrowings. This then suggests that it is now time if not too late for her to exercise caution in a bid to avert the short and/or long term effect that public debt can impact on her people. To tackle this emerging problem, interest rate as a key macroeconomic variable must be thoroughly considered.

Buchanan (1958) suggests that when domestic debt is incurred it would result in the differing the tax liability from the present to future generations which positively affect the interest rate. Barro (1978) study was to investigate the effect of domestic debt on economic growth. Locally Ng'eno (1991) focused on external debt problem in Kenya

and Mutiso (2001) investigated the determinants of external debt in Kenya. Koech (2012) investigated the determinants of Kenya's external debt sustainability. Matiti (2013) examined the effect of selected determinants on public debt in Kenya and established a direct relationship between foreign exchange rates depreciation and public debts. There exists limited evidence on the effect of public debt on interest rate. To fill the existing research gap this study seeks to conduct a study on the effects of public debt on interest rates in Kenya. By so doing it will also seek to answer the research question, what is the effect of public debt on interest rates in Kenya?

### **1.3 Research Objective**

To determine the effect of public debt on the interest rates in Kenya.

### **1.4 Value of the Study**

To scholars and academicians, this study would increase the body of knowledge on public debt and its effects on interest rates in Kenya. It would also suggest areas for further research so that future scholars can pick up these areas and study further to enhance the body of knowledge which is very limited.

The Government, through the Ministry of Finance is responsible for formulation of policies on debt management strategies in the country. The study will therefore increase knowledge on the effect of the governments indebtedness on the rate of interest thereby assisting the policy formulators on the right guidelines on borrowing. The study will also be of assistance to Government in identify determinants of good debt management which will inform policy on setting the right levels of sustainable debt.

Lastly, it is of value to several areas of theory testing. It offers significant testing to the already existing theories like Barro-Ricardo Equivalence Theorem, Arbitrage Pricing Theory and Crowding-Out Effect. This would consequently offer specific guidelines for theory-builders to challenge these established theories and inspire new lines of development for the same. The research findings should contribute to deeper understanding on public debt and how it would affect interest rates and the associated theoretical arguments.

# **CHAPTER TWO**

## **LITERATURE REVIEW**

### **2.1 Introduction**

This chapter constitutes the review of literature by different scholars that focused on the Effect of public debt on interest rates. First, it briefly reviews the theoretical models that form the foundation of the study. The chapter then proceeds to present empirical studies guiding this study and chapter summary

### **2.2 Theoretical Framework**

This section examines various theories that will be used to inform the study on effects of public debt on interest rates. The theories include; Barro-Ricardo Equivalence Theorem, the arbitrage pricing theory and the Crowding-out Effect.

#### **2.2.1 Barro-Ricardo Equivalence Theorem**

The Ricardian equivalence theorem was first proposed by David Ricardo in the early nineteenth century which was further elaborated by Antonio De Viti De Marco in the 1890s. Barro (1974) in his essay “Are Government Bonds Net Wealth?” Gave the proposition a theoretical foundation. The Ricardian view proposes that the use of debt to substitute for current taxes. According to Barro (1989) the two are ‘equivalent’. As government has a reduction in taxation it incurs a budget deficit with a future tax implication. Seater (1993) notes that rational consumers recognise that the discounted value of taxes in the future are equal to incurred debt. According to Bernheim (1987) he notes that instead of raising the level of consumption they would save disposal income to pay for future taxes. This view is supported by Mankiw (2012) who notes that the

aggregate demand remains unchanged because the reduction of public savings is matched by a similar increase in the private sector saving. Summarily, government debt in the eyes of rational and forward looking households is not perceived as net wealth (Barro, 1974).

### **2.2.2 Crowding-Out Effect**

Crowding effect is brought about clearly by the presence of deficit in the fiscal policy by governments which results in a reduction in the investment spending, an increase on the interest rate and a weakening of the stimulus of the fiscal policy. McConnell and Brue (1990) state that the idea behind the crowding out effect is that, interest will be caused to increase by deficits in the fiscal policy with a reduction in investment spending, and weakening the stimulus of the fiscal policy. When the money market finances deficits in governments, the increase in demand for money raises the interest rates thus increasing the cost of borrowing money. Consequently, since investment spending varies with the interest rates thus some investment will be crowded out. Ahmed and Miller (2000) applied fixed and random effect methods in the case of some developed and developing countries. They established in developing countries, the expenditure by government on transport and communication lead to crowding in-effect while expenditure on welfare and social security lead to a decline in private investment.

### **2.2.3 Arbitrage Pricing Theory**

This theory was developed in 1976 by Stephen Ross. According to Mosley, Hundson and Horrell (1987) the anticipated return on any asset can be charted by linearly calculating all the relevant macroeconomic factors. MacKinnon (1991) notes that simulating scenarios using this model assists in arriving at prices which are equitable to the

anticipated performance of the asset. Hendry and Juselius (2000) notes that arbitrage pricing would be used to stabilize asset prices when they go beyond the parameters.

### **2.3 Determinants of Interest Rates**

The determinants of interest rates considered are: public debt, economic growth, exchange rate, reserve requirements and inflation rate.

#### **2.3.1 Public Debt**

Public debt which can also be referred to as government borrowing. According to Looney and Frederiken (1997) government borrowing may cause two main effects namely: the complementary effect and the crowding effect. They further argue that the net effect by the government borrowing would be the crowding out effect brought by competition for resources with the private sector on the one hand and the complementary effect on the other hand.

#### **2.3.2 Economic Growth**

This is represented by the Gross Domestic Product Per Capita. GDPPC is a measure that can be used to determine the ability to service loans and to determine the purchasing power. An increase in the GDPPC can either increase the demand for loans or may lower the demand for loans. An increased demand for loans would cause the interest rates spread. A lower demand for loans would signify that there is more saving which would cause the interest spread to be lowered

#### **2.3.3 Exchange Rate**

Mwanza (2007) findings from a study to investigate whether a relationship exists between the banks interest rates and exchange rate risk. The study findings established

between bank stock return, exchange rate and interest rates the existence of a positive relationship. The relationship between the level of derivate and long term interest rates was positive but a negative association between the exchange rate exposure and the interest rate.

#### **2.3.4 Reserve Requirement**

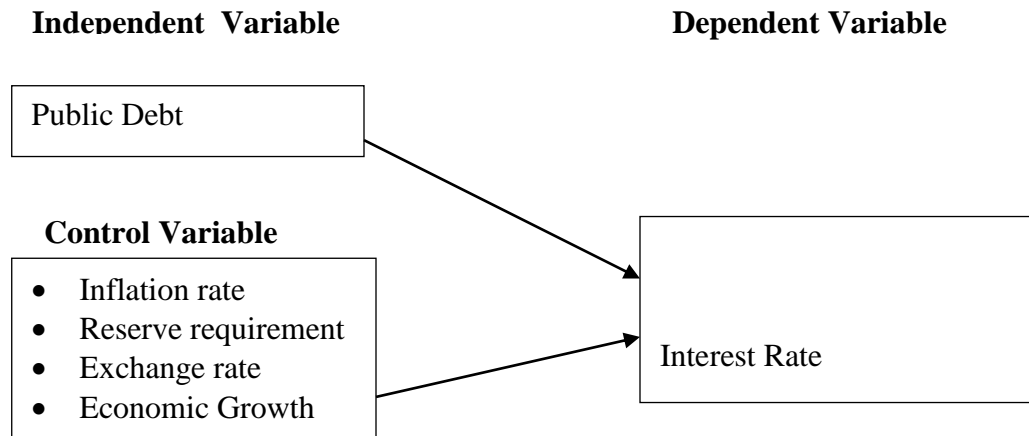
Gelos (2006) noted that the key factors driving the interest spread in Latin America where reserve requirements, the overhead costs and also the extent of competition in banking which was determined by the degree of market concentration. Gelos (2006) findings where in comparison to other banks in other regions, the Latin America banks had high spreads due to less efficiency high, lending rates and larger reserve requirements. Locally Ngugi and Kabubo (1998) carried out a study to determine the response of the financial sector to the reform process. As indicators to the response they examined determining factors, interest rate level and interest spreads. They sampled 20 banks in the study and collected their data from various relevant institutions including the central bank of Kenya. Their study findings were in as much as a lot was accomplished, the financial system was still characterised by repression. Kwakye (2010) and Sarpong et al. (2011) and also confirmed that commercial banks in Ghana increase the margin between lending and deposit rates response to any increase in the reserve requirements .They further established among the responsive factors to policy activities which included underdeveloped financial markets, negative real interest rates and financial intermediation inefficiency ,that interest rates were most responsive.

#### **2.3.5 Inflation Rate**

To establish the profitability of commercial banks in turkey Alper and Anbar (2011) investigated the macroeconomic determinants as well as bank specific determinants.

The study was over the period of 2002 -2010. The conclusion drawn was that an increase in inflation influenced the real interest rate to increase, which in turn lead to increased profitability in the commercial banks in Turkey.

## 2.4 Conceptual Framework Model



**Source: Author, 2016**

## 2.5 Empirical Review

Elmendorf (1993) carried out a study to determine whether treasury yields were affected by expected federal government deficits. The data was collected from data resources Inc. (DRI) which were private sector forecasts on the federal government's deficit made by the congressional budget office (CBO). Elmendorf (1993) argues that the (DRI) deficit forecasts were more accurate than the CBO projections. Following the regression analysis the analysis the results established DRI forecasts on federal government deficits had a positive effect on medium term treasury yields. The analysis further revealed that a percentage increase in the expected deficit of the GDP lead to a more than 40 basis point increase in the medium term treasury rates. However the same increment on a long term treasury rate of the expected deficit lead to a smaller insignificant effect. Elmendorf

(1993) concluded that if federal government borrowing had a crowding effect then the expected impact would be more significant on interest rates.

Schclarek (2004) sought to analyse the debt growth in industrial countries and developing countries. The author study was an improvement on Patillos research as he analysed both private external debt and public external debt. The data was collected from both developing and developed countries. In-order to identify the determinants of growth Schclarek (2004) tested the model with four independent variables which were GDP per capita growth rate, total factor productivity private saving rate and capital accumulation growth rate. The author concluded that in developing countries. The findings further revealed that throughout the capital accumulation growth, the debt is affected while the evidence of the effect on debt by the total factor productivity is limited .In contrast analysis of the industrial countries revealed a non-statistically significant relationship between to variables.

Norris and Floerkemeir (2007) studied the factors explaining interest rate spread and margins .The author used bank level data set. The period of study was from 2002 to 2006. The variables for the study were macroeconomic variables as well as bank specific variables which included real GDP, inflation, money market rate, foreign bank participation, return on assets, overhead costs, non-interest income, bank size liquidity capital adequacy and nominal exchange rate change. The study employed pooled OLS together with fixed effect regression. From the study conclusions drawn where liquidity, market concentration, size and market power explained a large proportion of banking spreads.

Kitchen (2002) study was to determine the effect of the CBO's current federal government deficit measure on the spread between short term treasury yield and long term treasury rates. The study current deficit CBO was standardized in that it made adjustments on the actual deficits for business cycle effects. His findings estimate that by increasing the standardized federal government deficit by one percent would result in a 42 basis point increase on the spread between long and short term treasury rate. The study employed regression of the interest rate on the federal deficit. An observable gap in his study is the non- incorporation of macro- economic factors affecting the interest rates.

Safdari and Mehrizi (2009) study investigated the impact of external borrowing on economic growth. They carried out the study in 24 developing countries for the study period between 1976 to 2003. The findings revealed debt servicing to gross domestic product had a negative effect on the economic growth. They further revealed that in these countries debt servicing left less funds available to finance private investments hence resulting to a crowding out effect. .

Locally Gikandu (2008) carried out a study to determine the relationship between debt and economic growth in Kenya. The study collected secondary data on real GDP and real GDP growth, data on the volume of domestic debt and on domestic debt by instrument. The study period was 12 years from 1999/2000 to 2010/2011 financial year .Spearman's rank correlation was carried out to establish the existence of a relationship between domestic debt and economic growth in Kenya. The analysis revealed a non-significant relationship between domestic debt and economic growth. The study further recommended though a positive relationship existed the use of domestic debt to finance

government needs should be closely monitored so that the associated interest does not negatively impact the economic growth.

Langat, Chepkulei and Rop (2013) looked at the effect of interest rates spread on the performance of banking industry in Kenya. The study sampled 15 commercial banks in Nairobi and used both primary and secondary data. The findings revealed CBK regulations, credit risk and macro-economic environment influence the extent of the interest rates spread which are a contributing factor to the performance of the banking industry. The findings further revealed that interest rate spread provided sufficient margins for the continuation of banks operations in the market. The study drew the conclusion that commercial banks performance in Kenya is largely affected by interest rates.

Harmon (2012) studied the impact of public debt on GDP growth ,inflation and the interest rates in Kenya .The study period was from 1996-2011, secondary data was collected for the study. Using 3 linear regression models the study established between public debt and the inflation existence of a weak positive relationship. For the public debt and interest rate the study established a strong negative association. The study concluded that there were various relationships evidenced by some variables showing a strong relationship like public debt and interest rates, while others showed a weak connection in the case of public debt and GDP and inflation.

Makau (2008) analysed the external public debt servicing and economic growth in Kenya. The period of study was from 1970-2003. The study employed OLS to estimate a single growth model equation. The study findings revealed that the external debt is

mainly official with the bulk of it being from multilateral sources the study further revealed that from the early 1990's the external debt rose steadily. A "specification associated with error correction modelling (ECM) was applied. By using co-integration and an error correction model, the study established both the short run and long run equilibrium. The estimated model was a single regression equation. The dependent variable being the growth rate of Gross Domestic Product and explanatory variables were savings as-a ratio of GDP, stock of external debt as a ratio of GDP, debt service as a ratio of GDP, interest payment as a ratio of GDP and the annual growth rate of labour force. The empirical results in the short run estimated model indicated that the coefficients of external debt to GDP, savings to GDP and debt service to GDP had the correct sign and significant while the coefficients of interest to GDP and growth in labour force were insignificant. In the long run estimated model, the coefficients of debt to GDP, debt service to GDP and savings to GDP were significant while the coefficient for growth in labour force and interest to GDP were insignificant.

Matiti (2013) examined the effect of selected determinants on public debt in Kenya. This study made use of descriptive study design and used secondary data. Annual data was used in the computations. The study covered ten years starting 2003 to the year 2012. The findings established that there was a direct relationship between public debt and exchange rates, while between public debt and total grants there was an inverse relationship. The study findings further established that debts and exchange rates had been increasing; grants had been decreasing over years, while budget deficits remained high in the country.

## **2.6 Summary of Literature Review**

Over the past two decades several different surveys have evaluated the empirical literature on the effect of public debt on macroeconomic variables such as interest rates inflation and GDP. These have included studies by kitchen (2002) Makau (2008), Schclarek (2004), Elmendorf (1993). From careful review of their findings it is apparent that there exists no clear consensus on the economic and statistical significance of the relationship between public debt and interest rate, evidenced by varying conclusions drawn on the nature of the relationship. Due to mixed available evidence on the effect of public debt on interest rate one cannot confidently state that public debt has an effect on the interest rates. This study sought to fill the research gap by conducting the study to establish the effect of public debt on interest rates in Kenya.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter describes the procedure followed in conducting the study. The research methodology presents the research design, sample design, data collection and the data analysis.

#### **3.2 Research Design**

Dooley (2007) defines a research design as a plan, scheme or outline that is used on research problems to generate answers. The descriptive design was employed in this research. Descriptive research is used to determine the status of the population under study and report on the same (Mugenda & Mugenda, 2003).

#### **3.3 Data Collection**

This study used secondary data collected from the Ministry of Finance, Central Bank of Kenya (CBK) World Bank and KNBS. The data was collected quarterly for 10 years starting year 2005 to 2015. The GDP growth rates, interest rates, public debt and inflation rates from these years constituted the target population for this study.

#### **3.4 Data Analysis Techniques**

Descriptive statistics such as mean, standard deviation, frequency distribution and percentages were used to analyze the data. The study conducted correlation analysis to establish the relationships. To determine the relationship between the variables multiple regression analysis was used. The study therefore proceeded by modifying (Adofu &

Abula, 2010) adaptation of the Classical Linear Normal Regression Model (CLRM). The modification took the form:

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

Where; Y= Interest Rate

$\alpha$  = Constant term/intercept,

$\beta$  = Beta coefficient,

X1=Public debt (natural logs of public debt),

, X2 = economic growth (GDP per capita),

X3 = exchange rate,

X4= inflation rate

e = Error term.

The regression coefficients tested the magnitude of the relationship between the public debt and the interest rate. Analysis of variance (ANOVA) and t-test to tested the significance of the relationship.

## **CHAPTER FOUR**

### **DATA ANALYSIS, RESULTS AND DISCUSSION**

#### **4.1 Introduction**

This chapter contains analysis and presentation of data collected for the project. The study sought to determine the effect of public debt on interest rates in Kenya. The Data was collected on the independent variable, (public debt), dependent variables (interest rates) and the control variables (Inflation rate, economic growth, and the foreign exchange rate). The data on the variables was secondary data collected from the KNBS and the CBK.

#### **4.2 Descriptive Statistics**

The study undertook to perform a descriptive statistic test to determine the general properties of the collected data at a glance. The output is explained in the subsequent sections clearly showing the minimum, maximum, means and standard deviations. The findings were represented in Table 4.1 below.

**Table 4.1: Descriptive Statistics**

Statistics	Interest rate	Public Debt	Economic Growth Rate	Foreign Exchange Rate	Inflation Rate
Mean	15.23924242	4174452.6	5.438636364	80.5729697	8.470757576
Standard Error	0.310052449	291907.666	0.485402297	1.440340455	0.720553775
Median	14.62	3574949.54	5.35	80.081	7.015
Mode	13.89333333	#N/A	5.9	#N/A	#N/A
Standard Deviation	2.056655279	1936296.4	3.219794585	9.554137716	4.779613029
Sample Variance	4.229830937	3.7492E+12	10.36707717	91.2815475	22.8447007
Kurtosis	0.079088435	-0.30361562	16.06994276	-0.229284862	-0.226448189
Skewness	0.909023639	0.86719809	3.03165742	0.308412432	0.994129066
Range	8.093333333	6626767.5	21.7	40.32133333	16.56
Minimum	12.12	2190465.52	0.3	62.646	2.626666667
Maximum	20.21333333	8817233.02	22	102.9673333	19.18666667
Sum	670.5266667	183675914	239.3	3545.210667	372.7133333
Count	44	44	44	44	44

Source: Research Findings

The findings indicate values of interest rate with variations over the 11 year quarterly period with 15.23924242 and 2.056655279 as the mean and standard deviation. The skewness of 0.909023639014 which showed that the interest rates in Kenya had been fluctuating around mean with most values concentrated on left of the mean 15.23924242. The range of the interest rates was 8.093333333 with the maximum rate as 20.21333333 and minimum as 12.12.

Public debt was on a steady increase from the year 2005 to 2015 the minimum value was 2190465.52 million shillings while the maximum value was 8817233.02. Public debt had a positive skewness of 0.86719809 which showed that the public debt in Kenya had been fluctuating around mean with most concentration of values on left of the mean 4174452.6 while extreme values are to the right over the period. The distribution was however approaching that of a normal distribution since the curve was almost symmetric about the mean. This is due to the fact that the skewness statistic was greater than 0.

Economic growth rate fluctuated over the study with the mean of 5.438636364 and a standard deviation of 3.219794585. The Economic growth data was positively skewed with a co-efficient of 3.031657421.394 findings indicate rising and falling foreign exchange rate values with huge variations over the 11 year period with the mean of 80.5729697 and standard deviation of 1.440340455, the maximum exchange rate recorded was 102.9673333 while the minimum foreign exchange rate was 62.646.

The foreign exchange rate had a positive skewness of 0.308412432. The mean for the inflation rate for 44 quarters covering 11 years was 8.470757576 with a standard deviation of 4.779613029. The minimum inflation rate value was 2.626666667 and the maximum value was 19.18666667.

The inflation rate had a positive skewness of 0.994129066. This implied that the growth distribution of the inflation rate was therefore approaching a normal distribution since the curve was almost symmetric about the mean. The inflation rate was therefore increasing above the mean. The sample size was 44 since the researcher adopted quarterly data for a period of 11 years from 2005 to 2015.

#### **4.3 Inferential Statistics**

The regression analysis was done using Ordinary Least Squares (OLS) method. However, before running the regressions, descriptive statistics and correlation analysis were considered. The relationships between the different variables in the study was shown by the regression analysis. The correlation matrix presented simple bivariate correlations.

### 4.3.1 Co-relation Analysis

The co-relation analysis was also conducted to establish the various relationships. Those of the independent, dependent and control variables

. The results are represented in Table 4.2.

**Table 4.2: Co-Relations**

	Interest rate	Public Debt	Economic Growth rate	Foreign Exchange rate	Inflation rate
Interest rate	1				
Public Debt	0.705069872	1			
Economic Growth rate	0.018524237	0.092964275	1		
Exchange rate	0.61377662	0.885893932	-0.001783181	1	
Inflation rate	0.055987209	0.082502343	-0.311188016	0.055004453	1

**Source: Research Findings**

A multiple co-relation analysis was conducted so as to establish the multi co-linearity between the study variables. The interest rate had a strong positive co-relation with public debt shown by a co-efficient of 0.705069872. The interest rate and foreign exchange rate had a moderately strong correlation with a co-efficient of 0.61377662. A positive strong co-relation exists between Public debt and exchange rate with a co-efficient of 0.885893932. The public debt had a weak positive co-relation with economic growth rate with a co-efficient of 0.092964275. Similarly public debt had a weak positive co-relation with inflation rate with a co-efficient 0.082502343. Lastly, the co-relation between economic growth and the foreign exchange rate was a weak one with a negative co-efficient of -0.001783181. The research findings therefore revealed that the public debt and the foreign exchange rates had a positive co-relation with interest rates.

### 4.3.2 Regression Analysis

To measure the relationship between individual independent (Public debt, economic growth rate, foreign exchange rate, inflation rate) and dependent variable (Interest rate)

Regression analysis was conducted. The regression analysis was of the form:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + e$$

Whereby Y is interest rate, X1 is the Public debt, X2 is the economic growth rate, X3 is foreign exchange rate, X4 is the inflation rate, X5  $\beta_0$  represents the regression constant, while  $\beta_1$  to  $\beta_4$  represent the regression coefficients and  $\epsilon$  represent the model's error term. The relationship's strength between the dependent variable (Interest rates) and independent variables is illustrated by table 4.3.

**Table 4.3: Model Summary**

SUMMARY OUTPUT	
<i>Regression Statistics</i>	
Multiple R	0.730139716
R Square	0.533104005
Adjusted R Square	0.485217236
Standard Error	1.475616502
Observations	44

Source: Research findings

The coefficient of co-relation was 0.730139716 whereas the value of R-square was 0.533104005. This implied the independent variables from the study account for 53.3104005% of the interest rates in Kenya. This therefore implied that the other factors not included in the study contributed the remaining 46.6895995% of the changes in the dependent variable. The standard error would estimate the variation of the observed interest rate about the regression line.

### Analysis of variance

Analysis of Variance (ANOVA) tested the significance of the relationship between variables. The ANOVA results presented in Table 4.4 shows SS Regression of 93.46874376 which is the variation explained by the regression line; SS Residual of 88.41398654. From the findings the model is statistically significant since  $8.58E-06 < 0.05$ .

**Table 4.4: Analysis of Variance**

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	96.96241194	24.2406	11.1326	4.04E-06
Residual	39	84.92031836	2.17744		
Total	43	181.8827303			

Source: Research Findings

Table 4.5 illustrates regression coefficients for independent variables. This lead to establish the following model:

Interest Rate =  $-49.9730996 + 10.64837768 * \text{Public Debt} - 0.137 - 0.05140445 * \text{Economic}$

Growth Rate  $-0.06456456 * \text{Foreign Exchange Rate} + 0.076529738 * \text{Inflation Rate}$

**Table 4.5: Model Coefficients**

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	-49.9730996	14.76997431	-3.3834	0.00164	-79.8482	-20.098	-79.84819	-20.09801
Public Debt	10.64837768	2.85666489	3.72756	0.00061	4.870228	16.42653	4.870228	16.426528
Economic Growth	-0.05140445	0.073677271	-0.6977	0.48951	-0.20043	0.097622	-0.200431	0.0976219
Exchange Rate	-0.06456456	0.057753466	-1.1179	0.27043	-0.18138	0.052253	-0.181382	0.0522528
Inflation	0.076529738	0.050081963	1.52809	0.13456	-0.02477	0.17783	-0.024771	0.1778301

Source: Research Findings

According to the model, taking all the factors (public debt, Economic growth, Foreign Exchange Rate, Inflation Rate) constant at zero, Interest Rate was -49.9730996. The data findings also showed one unit increase in Economic Growth lead to 0.05140445 Interest Rate decrease; one unit foreign exchange rate increase lead to 0.06456456 interest rates decrease; increasing inflation rate by a unit led to 0.076529738 Interest rate increase. One unit public debt would lead to a 10.64837768 interest rate increase. This meant that the most significant factor in influencing interest rate was public debt followed by inflation rate. The study therefore established between the dependent variable and two independent variables the existence of a positive relationship.

#### **4.4 Summary and Interpretation of Findings**

From the findings, there is evidence that suggests that public debt Economic growth rate, foreign Exchange Rate, Inflation Rate are important determinants of interest rates.. This study only considers four Interest rate variables owing to data availability. The study established the following equation:

$$\text{Interest Rate} = -49.9730996 + 10.64837768 * \text{Public Debt} - 0.05140445 * \text{Economic Growth Rate} - 0.06456456 * \text{foreign Exchange Rate} + 0.076529738 * \text{Inflation Rate}$$

The study established significant, negative and good linear relationships between Interest rate and economic growth rate and foreign exchange rate. The findings established a significant, positive and good linear relationships between interest rates and public debt and inflation rate. These findings however disagree with Harmon (2012) whose study showed that public debt and interest rates had a strong negative relationship .These research findings also differ with Seater (1993) whose findings were consistent with the Ricardian equivalence hypothesis. However the findings concur with Bernheim (1989),

who argues on the rejection of Ricardian equivalence hypothesis, implying the existence of a positive relationship between public debt and interest rates were more apparent. Also consistent with the research findings of Engen and Hubbard (2004) who deduced that real interest rate would increase by 3-5 basis points with one percent increase in debt. Similarly in Europe, Faini (2004) findings were one percent increase in public debt increased real interest by 5-7 basis point.

## CHAPTER FIVE

### SUMMARY, CONCLUSION AND RECOMMENDATIONS

#### 5.1 Introduction

This chapter presents summary of the study findings, conclusion and recommendations. The study's objective was to establish the effects of public debt on Interest rates in Kenya.

#### 5.2 Summary of the Findings

The study established interest rate having a strong positive co-relation with public debt and the foreign exchange rate shown by a co-efficient of 0.705069872 and 0.61377662 respectively. The findings revealed interest the rate and economic growth rate had a weak correlation and the inflation rate and interest rate with a co-efficient of 0.01824 and 0.05598 respectively. The coefficient of determination was 0.533104005. This implied the independent variables from the study accounts for 53.3104005% of the interest rates in Kenya.

Public debt was the most influential in determining the interest rate in the country. The study revealed that holding economic growth, foreign exchange rate, inflation rate to a constant zero, interest rate in Kenya would be at -49.9730996, unit increase in public debt led to 10.648376% rise in interest rate. This compared to the other variables had the most significant effect.

Inflation rate was also a variable that positively influenced the interest rate in Kenya, the data findings showed that increasing the inflation rate by a unit led to 0.076529738 increase in interest rate whereas foreign exchange rate and economic growth rate

negatively influenced interest rate. The findings revealed that increasing foreign exchange rate by a unit lead to 0.06456456 decrease in the interest rates and unit increase of Economic Growth lead to 0.05140445 decrease of Interest Rate. The empirical results obtained fulfilled the objective of this research and indicated that public debt has a strong positive contribution to the interest rates in Kenya.

### **5.3 Conclusion**

The study's research objective was to determine the effect of public debt on the interest rates in Kenya, it covered 11 years from 2005 to 2015 and revealed that ,expanding the Public debt positively influenced interest rates and positive strong co-relation exists between Public debt and exchange rate with a co-efficient of 0.885893932, this is consistent with the with Bernheim (1989), who argues on the rejection of the Ricardian equivalence hypothesis. Thus the study concludes that Public debt has a significant positive influence on the interest rates.

Interest rates is dependent on other factors other than public debt. These include Inflation rate, economic growth rate and foreign exchange rate. From regression analysis the study concluded that Inflation rate was also a variable that positively influenced the interest rate in Kenya. Contrarily, economic Growth rate and the Foreign exchange rate are the factors that had a negative influence on the interest rate.

### **5.4 Policy Recommendation**

The fact that the study finds positive relationship between public debt and interest rates, It recommends encouragement of sustainable public debt by the Kenyan government and also proper utilization of these funds in productive economic avenues maintaining debt

at sustainable levels. Excessive Public debt can lead to an inflation effect as well crowding out private sector borrowing. To this end, it is pertinent for government borrowing to be monitored closely. The study also reveals existence of a positive relationship between interest rate and the inflation rate. It is imperative for the policy formulators to formulate various economic policies that will help in maintaining inflation at a low rate (single digit) for a healthy macroeconomic environment.

### **5.5 Limitations of the Study**

The study was limited to establish the effect of Public debt on interest rates in Kenya, where the inflation rate, economic growth and the foreign exchange rate were used as the control variable, other determinants that influence interest rate were not considered in this study. Secondly in testing the relationship, multiple regression analysis was employed, however the study did not conduct a multicollinearity between the study. This study limited the data to an 11year period between 2005-2015 with data being collected quarterly. The data used was based on Public debt available on KNBS as well as CBK, any data not captured by these two bodies was not considered for the purpose of this study.

### **5.6 Suggestion for Further Research**

The study was on determining the effect of Public debt on interest rate in Kenya for further research a comprehensive study on impact of public debt on inflation should be carried out. The study`s independent variables only contributed a portion of the changes in the interest rates. This is evidenced by the fact that interest rates is still affected by other macro-economic factors not included in the study. The study recommends a further in depth study to address this issue by introducing a wider pool of independent variables

in similar studies so as to identify the variables causing the 46.6895995% changes in interest rates. Finally the study recommends for comparisons to be made on the study by research being replicated in other neighboring countries.

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## APPENDICES

### Appendix I: Data on Interest Rate, Public Debt, Economic Growth Rate, Foreign Exchange Rate and Inflation Rate

YE R	QUART ER	INTEREST RATE as %	Public Debt	Economic Growth rate	foreign Exchange rate	Inflation rate
2005	Q1	12.12	6.348309638	0.301029996	1.883984907	1.155943018
	Q2	13.10666667	6.340536421	0.86332286	1.883138832	1.153509989
	Q3	12.98333333	6.349748985	0.924279286	1.877267656	0.882714228
	Q4	13.02	6.353922898	0.770852012	1.868358341	0.63076677
2006	Q1	13.26666667	6.349568642	0.77815125	1.857933257	0.948249912
	Q2	13.75	6.352870195	0.792391689	1.858282481	0.674861141
	Q3	13.63333333	6.36932033	0.913813852	1.864101512	0.699259438
	Q4	13.89333333	6.378985611	0.69019608	1.851346014	0.848599603
2007	Q1	13.66	6.379201606	0.851258349	1.84259676	0.515873844
	Q2	13.28333333	6.381735099	0.919078092	1.82896693	0.419404963
	Q3	13.06666667	6.386059087	0.799340549	1.8261569	0.735332706
	Q4	13.31666667	6.397715905	0.806179974	1.81433196	0.757396029
2008	Q1	13.89333333	6.406825646	0.041392685	1.831718374	1.026397058
	Q2	13.99333333	6.414017609	1.342422681	1.796893346	1.243864489
	Q3	13.74	6.415618499	0.414973348	1.836307233	1.256717746
	Q4	14.44	6.421377098	-0.522878745	1.889997883	1.271919014
2009	Q1	14.77333333	6.453514309	0.806179974	1.900811211	1.15136985
	Q2	14.88333333	6.475865246	0.322219295	1.894570804	1.009025742
	Q3	14.76333333	6.494599631	0.278753601	1.882198078	0.875832657
	Q4	14.79666667	6.511064638	-0.096910013	1.875859631	0.751792151
2010	Q1	14.92	6.527420321	0.681241237	1.883591413	0.701855693
	Q2	14.47666667	6.544216344	0.681241237	1.897284285	0.565454258
	Q3	14.15	6.562138599	0.77815125	1.908088075	0.522878745
	Q4	13.89	6.586289397	0.86332286	1.906230856	0.584708053
2011	Q1	13.95666667	6.599516454	0.707570176	1.915061978	0.848189117
	Q2	13.90333333	6.619312732	0.544068044	1.935124192	1.119255889
	Q3	14.41666667	6.646969273	0.602059991	1.968546765	1.217659381
	Q4	17.92	6.673394114	0.681241237	1.972525276	1.282999531
2012	Q1	20.05333333	6.654563879	0.672097858	1.924995626	1.227115083
	Q2	20.21333333	6.672234671	0.633468456	1.924900985	1.071022383
	Q3	20.00333333	6.688689115	0.653212514	1.925703914	0.805047524
	Q4	18.32333333	6.710961197	0.672097858	1.932363824	0.547774705
2013	Q1	17.9	6.731444145	0.763427994	1.938125946	0.610305202
	Q2	17.43	6.736160159	0.875061263	1.927409718	0.640150041

	Q3	16.94666667	6.760049906	0.799340549	1.940790323	0.844891184
	Q4	16.96	6.787066284	0.491361694	1.934030238	0.870598962
2014	Q1	17	6.800389986	0.672097858	1.936146649	0.831229694
	Q2	16.67666667	6.813318806	0.770852012	1.940748843	0.847161201
	Q3	16.40333333	6.841752979	0.716003344	1.945657296	0.877563299
	Q4	15.97666667	6.849083014	0.740362689	1.9536534	0.790988475
2015	Q1	15.62	6.867394025	0.698970004	1.961538156	0.764674177
	Q2	15.57333333	6.906741742	0.770852012	1.98156493	0.844684229
	Q3	16.08333333	6.929916193	0.77815125	2.012699465	0.78840408
	Q4	17.34666667	6.945332318	0.755874856	2.010217953	0.866287339

**Source: Kenya National Bureau of Statistics and Central Bank of Kenya**