INFLUENCE OF PUBLIC DEBT ON ECONOMIC GROWTH IN KENYA: 
AN EMPIRICAL ANALYSIS

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C153/CTY/PT/38669/2017

A RESEARCH PROJECT SUBMITTED TO THE SCHOOL OF HUMANITIES AND 
SOCIAL SCIENCES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR 
THE AWARD OF THE DEGREE OF MASTER OF PUBLIC POLICY AND 
ADMINISTRATION OF KENYATTA UNIVERSITY

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DECLARATION

Student’s Declaration:
This research project is my original work and has not been presented to any other university or assessment body for any degree award.

Charles K. Kibigo
C153/CTY/PT/38669/2017

Sign: ___________________________ Date: ___________________________

Supervisor’s Declaration:
This research project has been submitted for examination with my approval as Kenyatta University Supervisor.

Sign: ___________________________ Date: ___________________________

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DEDICATION

This work is dedicated to my parents Mr. Samuel Kibigo and Mrs. Mary Wairimu Kibigo for their immense sacrifice and unreserved support throughout my education journey. Their prayers, material and financial support has made my scholarly journey worthwhile and allowed my dreams of achieving great strides in education come to fruition. This work serves to cordially appreciate them for always holding it together for me and my siblings.

I wish to comparatively dedicate this work to my wife, Cynthia Gathoni Mugambi for her unending assistance and persuasive proclamations which prodded me to attain a master’s degree. As I celebrate this academic milestone alongside her, a standard is set for our unborn children to scale the heights of education beyond the masters’ level, and this work will serve as a constant reminder to them, that I wish them well in their scholarly journey.

Lastly, I want to specially dedicate this work to my late grandmother, Esther Muthoni Joram, whose passionate pursuit of education during her time saw her reach up to Kenya African Preliminary Examinations (KAPE) level, and compassionately transferred to his children and grandchildren, the same passion for education with tenacity and resilience. I am but a product of her hard work.
ACKNOWLEDGEMENT

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECLARATION</td>
<td>i</td>
</tr>
<tr>
<td>DEDICATION</td>
<td>ii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td>iii</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>vii</td>
</tr>
<tr>
<td>ABBREVIATIONS/ACRONYMS</td>
<td>viii</td>
</tr>
<tr>
<td>OPERATIONAL DEFINITION OF TERMS</td>
<td>ix</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>xi</td>
</tr>
<tr>
<td>CHAPTER ONE: INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Study Background</td>
<td>1</td>
</tr>
<tr>
<td>1.1.1 Summary of Public Debt in Kenya</td>
<td>2</td>
</tr>
<tr>
<td>1.1.2 Overview of Economic Growth in Kenya</td>
<td>3</td>
</tr>
<tr>
<td>1.1.3 Public Debt and Economic Growth</td>
<td>5</td>
</tr>
<tr>
<td>1.2 Statement of the Problem</td>
<td>6</td>
</tr>
<tr>
<td>1.3 Research Questions</td>
<td>7</td>
</tr>
<tr>
<td>1.4 Objectives of the Study</td>
<td>7</td>
</tr>
<tr>
<td>1.5 Significance of the study</td>
<td>8</td>
</tr>
<tr>
<td>1.6 Scope and Limitations of the Study</td>
<td>8</td>
</tr>
<tr>
<td>CHAPTER TWO: LITERATURE REVIEW</td>
<td>9</td>
</tr>
<tr>
<td>2.1 Introduction</td>
<td>9</td>
</tr>
<tr>
<td>2.2 Theoretical Literature</td>
<td>9</td>
</tr>
<tr>
<td>2.2.1 Debt Overhang Theory</td>
<td>9</td>
</tr>
<tr>
<td>2.2.2 Solow Model of Economic Growth with Technological progress</td>
<td>10</td>
</tr>
<tr>
<td>2.3 Empirical Literature Review</td>
<td>12</td>
</tr>
<tr>
<td>2.3.1 Public Debt and Economic Growth</td>
<td>12</td>
</tr>
<tr>
<td>2.3.2 External debt and Economic Growth</td>
<td>15</td>
</tr>
<tr>
<td>2.3.3 Domestic debt and economic growth</td>
<td>17</td>
</tr>
<tr>
<td>2.4 Conceptual Framework</td>
<td>18</td>
</tr>
<tr>
<td>2.5 Summary of Literature Review and Knowledge Gaps</td>
<td>20</td>
</tr>
</tbody>
</table>
## CHAPTER THREE: RESEARCH METHODOLOGY ................................................. 22
3.1 Introduction .................................................................................................................. 22
3.2 Research Design .......................................................................................................... 22
3.3 Data description and source ....................................................................................... 22
3.4 Model Specification and Estimation Equation ........................................................... 23
3.5 Diagnostic Tests .......................................................................................................... 24
  3.5.1 Unit Root Test Analysis .......................................................................................... 24
3.6 Estimation Techniques ................................................................................................. 25
  3.6.1 The Cointegration Test .......................................................................................... 25
  3.6.2 Granger Causality ............................................................................................... 25
3.7 Data Analysis .............................................................................................................. 25

## CHAPTER FOUR: DATA ANALYSIS, RESEARCH FINDINGS AND DISCUSSIONS .. 26
4.1 Introduction .................................................................................................................. 26
4.2 Descriptive Statistics ................................................................................................... 26
4.3 Diagnostic Tests .......................................................................................................... 28
  4.3.1 Unit Root Test Analysis ........................................................................................ 28
4.4 Regression Estimation Results .................................................................................... 29
  4.4.1 Vector Autoregression Estimation (VAR) Results .................................................. 29
  4.4.2 The Cointegration Test .......................................................................................... 31
4.5 Granger Causality (Direction of Causality) ................................................................. 33

## CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS ........... 35
5.1 Introduction .................................................................................................................. 35
5.2 Summary of the research findings .............................................................................. 35
  5.2.1 Influence of the size of public debt on economic growth in Kenya. ....................... 35
  5.2.2 Influence of public debt service costs on nominal GDP ........................................ 35
  5.2.3 Influence of public debt service costs on GDP growth rates .................................. 35
5.3 Conclusion .................................................................................................................. 36
5.4 Policy Recommendations ........................................................................................... 37
5.5 Potential areas for further studies: ............................................................................. 37

REFERENCES .................................................................................................................. 38
LIST OF TABLES

Table 1.1: “Kenya’s Public and Publicly Guaranteed Debt (Kshs. Billion)” ........................................ 3

Table 4.1: Summary of variables descriptive statistics. .......................................................................... 26

Table 4.2: ADF Test Estimation Results. ............................................................................................... 28

Table 4.3: VAR optimal lag order estimation results ............................................................................. 29

Table 4.4: Vector autoregression estimation results. ............................................................................. 30

Table 4.5: Johansen test for cointegration estimation results. ............................................................... 32

Table 4.6: Granger causality Wald tests estimation results. ................................................................. 33
LIST OF FIGURES

Figure 2.1: Conceptual Framework ......................................................................... 18

Figure 4.1: Annual Trends Analysis of Key Variables (Kshs. Billions) .................. 27
ABBREVIATIONS/ACRONYMS

ACBF  African Capacity Building Foundation
ADF  Augmented Dickey Fuller
ARDL  Autoregressive Distributed Lag Model
CBK  Central Bank of Kenya
DD  Domestic Debt
DDS  Domestic Debt Service
EAC  East Africa Community
ECM  Error Correlation Method
ED  External Debt
PD  Public Debt
PDS  Public Debt Service
GDP  Gross Domestic Product
IMF  International Monetary Fund
KNBS  Kenya National Bureau of Statistics
Kshs.  Kenya Shillings
NI  National Income
NGDP  Nominal Gross Domestic Product
NGDPGR  Nominal Gross Domestic Product Growth Rate
OLS  Ordinary Least Squares
TFP  Total Factor Productivity
**OPERATIONAL DEFINITION OF TERMS**

**Public Debt:** Public debt is a measure of total monetary liabilities of a government that is owed by the state governments of a country and indicates the amount of borrowing that is used to finance a country’s public expenditure. It is composed of borrowing sourced from both domestic and external markets intended to finance the operational and developmental expenditure of a country. Thus, \( \text{PUBLIC DEBT} = \text{DOMESTIC DEBT} + \text{EXTERNAL DEBT} \).

For purposes of this study, public debt is the sum of both domestic and external debt sourced by Kenya for the period under consideration. Interest and principal payments on both debts will also constitute public debt for the purpose of this study.

**Economic growth:** This alludes to the process where the productive capacity of a country increases over a specific time period (usually one year) expressed in terms of both absolute and relative size of increase in GDP, GNP and NI per capita. It represents an increase in the market value of all goods and services produced within a country's borders over a specific time period.

For purposes of this study, the intermediary pointers of economic growth were nominal GDP and nominal GDP for the viable period.

**Domestic Debt:** Various definitions have been adopted in explaining that domestic debt is. Domestic debt alludes to the piece of all public debt that is owed to lenders within the boundaries of the country and includes marketable and non-marketable securities like Treasury Bills, Commercial papers, short-term infrastructure bonds and similar government obligations which does not include capital in public institutions, nor guarantees.

**External Debt:** External Debt alludes to that portion of all public debt that is borrowed for commercial and development and otherwise from overseas lenders through commercial, governments and global monetary institutions.

**Gross Domestic Product (GDP):** GDP is the absolute market worth of all goods and services delivered inside a nation's boundaries throughout a particular time span. Nominal GDP estimates a nation's GDP by utilizing current market costs, without adapting for inflation. For purposes of this study, Nominal GDP is used to proxy economic growth which is the independent variable of the study.
**Total Factor Productivity:** This is a proportion of efficiency in the economy that highlights the portion of output which cannot be attributed directly to the number of inputs used in the production process. It addresses the piece of development in genuine yield that is in abundance of the growth in primary factor inputs, coming about because of other factors like managerial, technological, strategic and financial innovations over time.

**Public debt management:** This is the process of ensuring that the government’s budgetary and financing needs, and its expenditure and payments obligations are met at the least possible related costs, consistent with a well-advised degree of risk over the medium term to long run time periods.
Many countries across the world find themselves in positions of fiscal deficits that compel them to borrow either internally or externally from various sources to bolster improvement and advancements in their economies. However, the choice of employing such deficit financing, and to what extent, demands to be at levels deemed sustainable and in close tandem with the government’s budgetary needs, fiscal policies and public debt management guidelines. In this regard, policymakers in national governments and monetary authorities, as well as technocrats, international policy organizations and other non-state actors need to understand the influence that public debt obligations cast on the growth and performance of the economy so as to calibrate the effective debt policies that balances the suitability of using deficit financing to bolster economic growth and development. The pace at which Kenya accumulated public debt in the last almost a decade, justified on grounds of expanding its economy, has seen its share of public debt since independence more than double. This has raised concerns as to the influence that the accumulated debt has had on the Kenyan economy. The purpose of this study was to establish the influence that public debt obligation casts on the upheld growth of the Kenyan economy. In establishing this, the study looked to accomplish three objectives; to ascertain the influence of the size of public debt on nominal GDP in Kenya; to establish the influence of public debt services on nominal GDP in Kenya; and to examine the influence of public debt services on nominal GDP growth rates in Kenya. Debt Overhang Theory by Myers (1977) and Solow neoclassical growth model (1965) formed the two theoretical foundations whose contributions to existing literature motivated the discussions behind the empirical findings of this inquiry. A non-experimental, correlational research design approach was adopted in the assessment. Secondary time series data ranging from 1999 to 2019 was used to empirically analyze study variables. Vector Autoregression (VAR) estimation technique for a linear time series regression model and the Johansen’s multivariate cointegration test were performed to assess the short run and the long-run influence of public debt on economic growth. The results of vector autoregression (short-run) estimation between public debt and economic growth showed that the second lag of deficit financing has a causal influence on economic growth in the short-run at 90% confidence level. However, the presence of cointegration in the model variables concluded a long-run association between public debt and economic growth in the time series, implying that the variables are connected and can be consolidated in a direct design in the context of Kenya. The key findings of the study concluded that public debt in Kenya positively influences the country’s economic growth both in the short-run and in the long-run. This established influence birthed three policy recommendations: foremost, that the increased utilization of public debt ought to be considered only if it will result in expanded economic and production activities of the country, since economic growth in the country appears to increase with the size of public debt; Additionally, external commercial loans were found to raise the debt servicing costs, which may be detrimental to the long-run growth and the growth rate of nominal GDP in Kenya. Hence, greater amount of bilateral and multilateral advances and less of commercial loans should be preferred to forestall the increased debt servicing costs from watering down the gains of economic growth in Kenya; and finally; external debt servicing costs were found to adversely influence the long-run growth rates of nominal GDP in Kenya, and thus need to be controlled for in the public debt management guidelines so as to prevent their deleterious effects on the Kenyan economy.
CHAPTER ONE: INTRODUCTION

1.1 Study Background
The influence that public debt casts on countries’ economic growth continues to spur a lot of policy debate following the global financial crisis that left many governments in huge debt positions (Chudik, Mohaddes, Pesaran & Raissi, 2018), and continues to pose serious risks of a future debt crisis. Public debt comprises a significant source of income for many governments in the financing of development projects meant to impact their economy. Isibor, Babajide, Akinjare, Oladeji and Osuma (2018) assert that governments borrow from both domestic economy and external financial markets in order to smoothen development expenditures and supplement huge budget deficits from shortfalls in domestic tax revenues. Yusuf and Said (2018) argue that a lot of countries in Africa result to borrowing either domestically or internationally in order to finance their economic development with debt playing a critical role as a supplementary medium of funding in fostering economic growth and development. This view is shared by Esteve and Tamarit (2018) who claim that resorting to public debt as tool of fiscal policy allows individual country’s authorities to stimulate the level of aggregate demand and stabilize growth in their economies.

Over the years, excessive borrowing has left many governments with huge outstanding debts and weak economies, raising serious policy concerns about the economic implications of public debt utilization on the productivity of countries’ economies. Some empirical analysis conducted by León, Murillo and Hernández (2019), revealed that a ratio of 75% between Public Debt and GDP led to a decline in economic growth in Latin America while that of 35% increased volatility in economic growth. A different study carried out by Ogawa, Sterken and Tokutsu (2016) established some causal relationship in the ratio between the pace of GDP development and public debt to GDP, with findings showing that, an ascent in the real cost of borrowing in the long-term coupled with a decrease in interest sensitive demand leads to a sizeable ratio between debt-to-GDP which has an adverse effect on economic growth in highly indebted countries. However, empirical findings of the same study find no connection between public debt-GDP ratio and GDP growth rate, given any levels of public debt. Yet, available evidence from another study (Yusuf & Said, 2018) shows that external debt (a component of public debt) may benefit a country if it is prudently used for development expenditure since such kind of expenditure, when channeled to infrastructure development, may end up enhancing a country’s economic growth.
The standard view held is that public debt has the effect of stimulating the level of short-run aggregate demand and economic output, but in the long haul decreases output and crowds out investible capital (Coulibaly, Brahma & Gandhi, 2019). However, the accumulation of public debt by various governments in itself is not evidence of an ill-advised policy. Fiscal policy instruments like public debt contributes significantly to the performance of an economy both in the interim and in steady time periods. While a country’s economic growth is dependent on many factors such as improvements in the total factor productivity (TFP)/technological progress, capital accumulation, human resource (labour) formation, global market integration and enhancement of competition among others, public debt has proven to be a reliable tool of fiscal policy in stimulating of aggregate demand in developing countries.

1.1.1 Summary of Public Debt in Kenya
According to Kenya’s monetary authority, the economic review publication for the second quarter period between April and June 2019 reported the country’s public and publicly guaranteed debts as standing at about 5.8 Trillion in Kenya shillings. This figure had registered an increase over time due to increased access to the international financial markets and driven in part by proceeds from Eurobonds issued (African & Bank, 2020). Analysis by the Institute of Economic Affairs (IEA Kenya) depicted Kenya’s public debt trend as being on an upward trajectory since 2013, with the country’s debt appetite on the rise to meet budget deficits (Affairs-kenya, 2019), indicating a rise in the nominal ratio between Debt and GDP at 58.1% as at June 2018. As a result of this rise, the cost of servicing debt also spiked and could have significant long run adverse effects on different sectors of the country’s economy (Brenda, 2018).

Kenya as a developing country depends heavily on debt financing, especially from the external financial markets to finance its development projects. As at June 2019, the country’s mix of public debt stood at 51%:49% in composition for external and internal debt respectively (African & Bank, 2020).
Table 1.1 below shows a snippet of Kenya’s Public Debt as at June 2019.

**Table 1.1: “Kenya’s Public and Publicly Guaranteed Debt (Kshs. Billion)”**

<table>
<thead>
<tr>
<th></th>
<th>2017/18 Q3</th>
<th>2017/18 Q4</th>
<th>2018/19 Q1</th>
<th>2018/19 Q2</th>
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<th>19-May</th>
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<td>Bilateral</td>
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<td>815.4</td>
<td>812.5</td>
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<td>976.7</td>
<td>974.2</td>
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<td>892.3</td>
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<td>898.3</td>
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<td>956.7</td>
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<td>16.7</td>
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<td>16.7</td>
<td>16.8</td>
<td>16.8</td>
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<td><strong>Sub-Total</strong></td>
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<td>2568.4</td>
<td>2605.3</td>
<td>2723.7</td>
<td>2721.6</td>
<td>2842.5</td>
<td>2834.8</td>
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<td>30</td>
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<td>266.5</td>
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<td>Non-residents</td>
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<td>25.4</td>
<td>26.2</td>
<td>25.4</td>
<td>25.5</td>
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<td><strong>Sub-Total</strong></td>
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<td>2478.8</td>
<td>2540.7</td>
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<tr>
<td>(As a % of GDP)</td>
<td>28.5</td>
<td>30.4</td>
<td>29.2</td>
<td>28.6</td>
<td>29.5</td>
<td>28.8</td>
<td>29.2</td>
<td>29.3</td>
</tr>
<tr>
<td>(As a % of total debt)</td>
<td>48.6</td>
<td>49.1</td>
<td>49.4</td>
<td>48.3</td>
<td>49.8</td>
<td>49.1</td>
<td>49.4</td>
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<td><strong>GRAND TOTAL</strong></td>
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<td>5146</td>
<td>5272.5</td>
<td>5420.1</td>
<td>5584.2</td>
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<td>(As a % of GDP)</td>
<td>58.6</td>
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<td>59.2</td>
<td>58.7</td>
<td>59</td>
<td>61.1</td>
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**1.1.2 Overview of Economic Growth in Kenya**

The sustainable development goal (SDG) number 8 tries to among other things, advance a supported, comprehensive and manageable economic growth for all countries, with full and high-yielding employment and satisfactory work for all (Johnston, 2016). Real growth in the economy has many drivers. Globalization has been found to integrate the world’s economies through faster communication and sharing of ideas and skills that have bridged the knowledge gap between the developed and less developed countries thereby driving economic growth (Kandil, Shahbaz, Mahalik, & Nguyen, 2017). Capital markets have also been linked due to globalization in support of investment borrowing for faster economic growth in developing economies.

Statistics have shown that many African countries recorded economic growths of about 5% over the last one decade (ACBF, 2017). The growth is attributed to implementation of solid macroeconomic policies, improvement in the governance structure and enhancement of regional factors.
business conditions which has seen the global demand for goods and services go up with commodity booms and progress as a result of regional integration.

Kenya’s economic growth in particular was largely driven by different sectoral performance over the years, focused majorly on sector-driven occurrences of enhancing economic growth in order to establish job creating opportunities in different sectors of the economy in the long haul (KNBS, 2019). As the growth of East Africa Countries’ (EAC) economy was expected to record normal pace of 6.1% in the year 2020 - the fastest growing region in Africa – the drivers of growth in the Kenyan economy were slowly balancing out in the contemporary years (Zerihun and Sennoga, 2018).

According to the 2018 annual published report by the Central Bank of Kenya (CBK), “growth in the manufacturing sector in 2017 decreased to 0.2% down from 2.7% registered in 2016. The weak presentation was majorly credited to reduced agro-processing due to constrained supply of agricultural raw materials, uncertainties related to elections, high cost of inputs, and stiff competition from imported goods (Ya & Report, 2018, p7).” This had a negative multiplier effect on the production of assorted items like cement, sugar and assembled motor vehicles which consequently reduced in 2017. “The electricity and water supply sector grew by 8.6 percent in 2017 compared to 9.8 percent in 2016, despite the drought conditions which affected hydroelectricity generation and water supply. Total electricity generation increased by 2.0 percent in 2017, driven by increased generation of geothermal, thermal and wind electricity, as hydroelectricity generation declined (Ya & Report, 2018, p8).”

“Growth in the Agriculture sector slowed to 1.6 percent in 2017 from 4.7 percent in 2016. The poor performance was attributed to low production of most agricultural commodities, particularly tea, maize, wheat and rice, due to drought experienced in the first half of 2017. (Ya & Report, 2018, p5).” Further, “Consumption’s contribution to real GDP growth declined from 55 percent in 2015 to 48 per- cent in 2018, while investment’s contribution increased from 14 percent to 48 percent. Net exports, historically a drag on economic growth, have had a positive contribution since 2014 (Zerihun and Sennoga, 2018).” Each of the many specific economic sector growth thus, have a essential task to complete in the contributions towards real GDP growth rates in Kenya.
The concept of economic growth for a country is important not only for reasons of the economic well-being since people naturally prefer more welfare and upgraded living standards, but also because it is simple to appropriate wealth, improve the welfare of an economic man and advance new technologies with a growing economy (Zuvekas & Zuvekas, 2006). Not only government policy makers but also economists, are interested in economic improvements from the productive capacity front because in the end, they are concerned with raising a country’s standard of living in the long run.

1.1.3 Public Debt and Economic Growth
The general perspective that deficit financing impacts adversely on the growth of the economy over the long run while having positive influence in the short run (GGmez-Puig & Sosvilla Rivero, 2017) is one that continues to spark global policy debates to date. From a study done by (Yusuf & Said, 2018), public debt is inversely correlated with economic growth as a result of high interest burden of debt that is channeled towards the repayment of principals (debt servicing costs) which affects a country’s ability to channel resources to otherwise useful economic sectors in efforts to spur growth in the economy. This view is underpinned by the findings of (Mousa & LShawareh, 2017) which indicate that total deficit financing causes adverse effect on the growth levels of an economy, with foreign debt having more adverse effects on growth both on the interim and in the long haul.

However, contrary to the general view held by previous scholars on the relationship between public debt and economic growth (Owusu-Nantwi & Erickson, 2016), another study revealed a positive relationship between deficit financing and economic growth with the association being statistically significant in the long run, especially when the debt is channeled in well appraised, high need undertakings and projects that are supported by prudent macroeconomic policies.

As the debate continues to attract more contributions from various scholars around the world, policy analyst and economists agree that the debt-growth relationship is country-specific and based on a number of considerations such as individual country’s business cycles, type of economies and country’s demographic changes among others. This inquiry sought to ascertain the influence of Kenya’s public obligation on its economic advancement from a policy perspective, with empirical evidence of the analysis used to inform debt policies in the country.
1.2 Statement of the Problem
The stock of public debt in Kenya had been increasing in nominal terms since 2013, incurred majorly to finance development projects meant to spur economic growth in the country, and partly to cover the widening fiscal deficit arising from revenue shortfalls (National Treasury and Planning, 2018). Its sources include external borrowing from multilateral, bilateral and commercial lenders and domestic loans from issuance of debt securities in the domestic market. However, the country’s nominal GDP growth rate appeared to have stagnated, hovering at about 5.6% on average over the same period of time. This has raised serious policy concerns as to the influence that public debt has on the economic growth of Kenya. Developing countries’ utilization of deficit financing to boost economic growth as an effective tool of fiscal policy proved to be an interesting policy subject from the existing body of literature, one that this study sought to contribute to through its findings.

The influence of public debt on economic growth forms an integral part of the macroeconomic environment and its management from the policy front directly affects the macroeconomic stability of a country. Different perspectives in policy have been advanced by various scholars on the desirability of using public debt to augment economic growth and otherwise. Some studies have shown that a rise in the use of debt financing due to fiscal expansion in the short run helps the economy to grow by stimulating the level of aggregate demand in a country (Chudik et al., 2018). Other studies have identified the presence of a strong inverse connection between debt financing and economic growth over time (Swamy, 2015). Conversely, further evidence casts doubt on the presence of any protracted connection between the two variables with regard to moderate levels of public debt (Saungweme & Odhiambo, 2019). In conclusion, recent studies have discounted any drawn out association between debt financing and economic growth in general (Fackry, 2016). Thus, a clear comprehension of the influence, and the lasting policy implications that the use of debt financing poses on economic growth was of significant interest for this study.

Given the fact that many countries all over the world have continued to utilize large amounts of public debt to boost growth in their economies, this study found it crucial to ascertain how Kenya’s excessive use of public debt is connected to the achievement of a sustained long run path to economic growth through deficit financing. From a policy perspective, there was little systematic empirical analysis that had been done on the influence of public debt on the economic growth in the context of developing economies like Kenya, a gap that the study found apt in filling.
1.3 Research Questions
The study was guided by the accompanying explicit questions.

1. How does the size of public debt influence the growth of nominal GDP in Kenya?
2. What is the influence of public debt service costs on nominal GDP in Kenya?
3. Does public debt services influence the growth rates of nominal GDP in Kenya?

1.4 Objectives of the Study
In an attempt to answer the above research questions, the study sought to establish the influence of public debt on the economic growth of Kenya from a policy point of view. In particular, the study endeavored;

1. To ascertain the influence of the size of public debt on nominal GDP in Kenya.
2. To assess the influence of public debt service costs on nominal GDP in Kenya.
3. To examine the influence of public debt service costs on GDP growth rates in Kenya.
1.5 Significance of the study
Due to the significant economic and policy implications that the use of debt financing has on economic growth as opined by different schools of thought, the study sought to ascertain the influence that public debt presents on the growth and performance of the Kenyan economy. The empirical study attempted to assess the suitability of using debt financing to spur economic growth in order to determine the short run and long-run policy implications of public debt sustainability in the country. The study not only sought to provide the analytical proof of the increased utilization of public debt and its influence on the improvement of the country’s economy, but also endeavored to outline the policy implications of its excessive use on the long run performance of the country’s economy, so as to inform sound public debt policies for the long-run use and sustainability of debt financing in the country.

The study also aimed to provide valuable policy insights to stakeholders within the government in calibrating sound institutional policies and structures for prudent fiscal management, in light of clear responsibilities for authorized government agencies tasked with the management of public debt so as to avoid excessive reliance on deficit financing which can have deleterious influence on the drawn-out development of the country’s economy.

1.6 Scope and Limitations of the Study
The inquiry tried to establish the influence of debt financing on Kenya’s economic growth. It was delimited to Kenya as one of the countries within the larger Eastern Africa and a member of the East African Community (EAC) with a robust economy, setting the pace in the region in terms of economic growth despite its huge population base and complex economic structure. Just like in other East African countries, the administration of public obligation in Kenya is a function of the national treasury in liaison with the Central Bank of Kenya (CBK), which is mandated to enact effective laws and regulations that guarantee the least possible cost for meeting the fiscal needs and payment obligations by the government, consistent with a well-advised degree of risk.
CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction
This section inspected the existing conceptual, empirical and theoretical foundations of public debt-economic growth relationships in both advanced and developing nations in order to provide illustrations of the association that exists between these two variables. The scope of review was limited to empirical studies involving the relationships between individual components of public debt on one hand and economic growth with its related concepts on the other so as to make generalized conclusions of the existing relationship between them. Accordingly, the relationship between these variables was depicted diagrammatically in a conceptual framework presented at the end of the chapter. The conclusion of the chapter exposed some of the knowledge gaps realized from the literature reviewed in order to motivate further empirical studies.

2.2 Theoretical Literature
The review of literature on the influence of public debt on economic growth was guided by two theories; Debt Overhang Theory and Solow’s neoclassical growth model. Solow’s neoclassical growth model is remarkable for its simplicity in explaining both fundamental and proximate causes of economic growth. This theoretical foundation helped in integrating the assumptions behind the supply side drivers of economic growth by illustrating the supply constraints of two factor inputs namely capital (K) and labour (L).

2.2.1 Debt Overhang Theory
Debt overhang theory as theorized by Myers in 1977 points out to a situation where an entity’s outstanding debt is so high that it reduces its ability to undertake profitable investments due to its distorted investment incentives downwards, even when the decision to maximize the company’s equity value is most viable. (Diamond & He, 2014). This situation is in part brought about by long-term debts whose maturity period extend for long periods of time, making a firm unable to make investment decisions because of their debt servicing obligations presented by the long term debts. According to Kobayashi (2015), fiscal deterioration as a result of high debt brings about low growth, ultimately leading to “crowding-out effects where domestic interest rate rises so high that it hinders investments and causes economic deterioration. This theory becomes relevant when considering the impact the excessive use of public debt present on the economic growth and prosperity of countries as informed by the reviewed literature.
Abdullahi, Bt Abu Bakar, and Hassan, (2016) opine that the ramifications of excessive use of public debt are economic slowdowns and distortions in the short run. This in turn causes domestic interest rates to shoot up in order to attract more investments, in the process choking off domestic investments, leading to a crowding-out effect in the economy. As a result of domestic investments crowding out, economic activities of the country slow down, leading to unemployment and low revenues for the government. Shortages in fiscal revenues cause the government to distort taxes upwards or lower its investment, further distressing the domestic economy. The situation is further worsened when high public debt breeds uncertainty in investors’ about the risk of default. Such vulnerability raises borrowing costs (building the issue of contorting charges) and further debilitate speculation action. Profoundly obligated buyers will scale back consumptions, possibly affecting development through more fragile aggregate demand. This ultimately ends up hurting the domestic economy by limiting the country’s ability to borrow in the foreseeable future.

The theory is relevant to this study in that it highlights the adverse ramifications Kenya stands to experience in the long-run as result of excessive borrowing which may end up slowing the economy if prudent public debt management policies are not instituted to forestall them.

2.2.2 Solow Model of Economic Growth with Technological progress

The “Solow growth model” is a simple and dynamic general equilibrium model that explains how and why output (Y), capital (K), consumption (C) and population (L) change over time (Acemoglu, 2008). Technological progress (A) in the model is assumed to be *exogenous* and *disembodied* in the sense that the technology of production available for the firms in the economy is independent of their actions and raises the productivity of both old and new factor inputs respectively. The model employs Cobb-Douglas production functions with three types of technological progress.

i. Purely Labour-Augmenting technological progress to enhance labour productivity.

\[ Y = f(\text{AL}, K) \] \hspace{1cm} (1)

ii. Purely Capital-Augmenting technological progress to enhance capital accumulation.

\[ Y = f(L, AK) \] \hspace{1cm} (2)

iii. Equally Capital and Labour Augmenting (Hicks-neutral) technological progress to enhance both labour and capital productivity.

\[ Y = Af(L, K) \] \hspace{1cm} (3)
Assuming the Hicks-neutral technological progress, the Cobb-Douglas version of the neoclassical production function used for purposes of this study assumes the functional nature of the form:

\[ Y = A \cdot K^\alpha L^{1-\alpha} \]  

(4)

Where:  
\( \alpha = \) Share of capital stock in the National Income (Y)  
\( 1-\alpha = \) Share of Labour in the National Income (Y)

Since the production function exhibits constant returns to scale, the scale of output has no effect on output per worker. Constant returns to scale also imply that for a given state of technology \((A_0)\), there exists a favorable association between individual worker’s output and capital per worker.

From the model, it can be shown that at the steady-state (Long-run equilibrium position), the capital-output ratio \((Y/K)\) is constant. This means that the steady-state output \((y)\) and the steady-state capital stock \((k)\) develop at the same pace in the long-run. It also means that the output level \((Y)\), amount of capital \((K)\) and amount of effective labour force \((AL)\) grow at the same rate leading to a balanced-growth path.

The theory is relevant to this study in the sense that the increased utilization of public debt in Kenya has justified on the grounds of financing development expenditure meant to spur the long-run economic growth in the country. The government has embarked on the improvement of infrastructure like the Standard Gauge Railway (SGR Project) and super highways, purchase of expensive medical equipment like Dialysis Machines and Cancer treatment machines among others in order to provide the necessary public infrastructure needed to the country’s business and investment prosperity. Through these projects, the ease of doing business in Kenya has improved since suppliers are now able to get their goods to the market in good time for business. The country has also reduced considerably, the active population of patients leaving the country for specialized treatment as more machines have increased the capacity of hospitals in Kenya to handle such cases and provide quality healthcare to its population which is key to economic growth.
2.3 Empirical Literature Review
The survey of the existing empirical literature attempted to address the study research questions by examining past empirical studies to derive actual knowledge from observed and measured phenomena in those studies.

2.3.1 Public Debt and Economic Growth
The influence that public debt sets on the growth of a country’s economy is one that is viewed from different policy perspectives by different literatures. While some studies revealed an unfavorable statistically significant association between public debt and economic growth, other studies revealed a favorable association between those two study variables with some maintaining a neutral relationship between them. Economic growth of countries is adversely influenced by use of deficit financing.

A cross-country empirical analysis from a baseline panel regression by (Woo & Kumar, 2015) established an inverse and considerable interconnection between deficit financing and economic improvement for both advanced and advancing economies. Regression results from a cross-country Ordinary Least Squares (OLS) estimation showed that, a rise in the primary ratio between Debt and GDP by 10 percent on average is connected to a decrease in real per capita GDP growth per year by 0.2 percent with somewhat a smaller effect in the developed economies.

An almost similar range of study results by (Chudik et al., 2018) revealed that on average, a consistent 3% annual accumulation in debt-to-GDP ratio is connected with 0.2 to 0.3 percentage points decline in annual GDP growth outcomes. The transmission mechanisms through which debt financing adversely influences economic growth flowed through one or more of the channels identified by some empirical studies. One channel is justified by the findings that public debt increases the domestic interest rates by crowding out private investment (Lau, Tan, & Liew, 2019). “Crowding out effect” arises when the rate of domestic interest rates increases to reduce the spending habit on private investments, thereby reducing the initial increase in total investment spending in the domestic economy (Yule, 2013). The main findings of an empirical study conducted by (Lau et al., 2019) on “The Asymmetric Link between Public Debt and Private Investment in Malaysia” revealed a substantial adverse effect of state borrowing over private credit with a crowding out effect of more than one to one.
These findings go along with other findings by (Mahmoudzadeh, Sadeghi, & Sadeghi, 2013) which compared “fiscal spending and crowding out effect between developed and developing countries”. The outcomes demonstrated a significant negative connection between government consumption and private expenditure with a larger crowding out effect in developed countries than in developing countries attributed to private sector over taxation in efforts to finance the public sector.

In principle therefore, the economic growth of a country is affected by government borrowing through the lending rate on private investment component of real economic output (GDP) (Anyanwu, Gan, & Hu, 2018).

Another channel is explained by the fact that public debt increases the use of fiscal and financial resources through debt servicing costs that would otherwise be reserved for private investment to boost economic growth (Ang, 2009a). The Kenya Economic Survey 2019 indicated that net servicing charges for public debt increased by 48.2 percent in the fiscal year 2017/2018 to reach 664.2 billion in nominal terms (KNBS, 2019). The opportunity cost for these charges is the value of improved transport infrastructure in the country, or enhanced healthcare system that is in deplorable state. “A critical review of the dynamics of government debt servicing in Zimbabwe” undertaken by (Saungweme & Odhiambo, 2018) found out that the service payments of public debt doubled the earnings of improvements in export and GDP between 1980 to 2015, constraining economic performance due to liquidity shortages that further intensified the distress of servicing public debt. These findings highlighted the critical need for policy reforms in the management of public debt servicing costs, geared towards reducing the challenges of increasing debt finance not only in Zimbabwe but also across other countries in Africa.

Yet, another channel through which public debt adversely influence the economic growth of a country is evidenced by the fact that public debt induces uncertainty over the expectation of higher future taxes in future thereby hampering economic growth (IMF, 2015). An inquiry conducted by (Alawneh, 2017) on “The Impact of Public Expenditure and Public Debt on Taxes in Jordan” established a substantial positive correlation between internal and external public debt and taxes at the level of (α 0.05) consistent with economic literature. The study findings showed that an increase of internal debt by (100%), resulted in a rise in the amount of the government taxes by (0.462794) as the Government worked to increase the tax revenue in order to repay and service its internal debt.
Similar empirical studies by (Casalin, Dia, & Hughes Hallett, 2019) revealed that the level of debt an economy holds determines to a very large extent that ability of of a country to raise taxes or institute new ones in order to achieve financial stability which is ensured by an anticipated stream of tax revenues. This is especially critical for developing countries with heavy reliance on debt because their ostensible yield is extremely unpredictable to tax changes due to exchange rates and crude material price instability (Casalin et al., 2019).

Some empirical analysis however, showed a favorable short-run connection between debt financing and economic growth.

An empirical inquiry by Afonso and Ibraimo (2020) on “The macroeconomic effects of public debt in Mozambique”, applied the use of Vector Auto Regression Models to assess the influence that public obligation has on economic improvement and concluded that external debt financing had a positive influence on real output during the period under review, with ambiguous result on price levels, but no substantial effect on the rate of interest variables in the short run. Over the long haul nonetheless, public debt acquired for highly ranked development projects together with well valued and independent programs contribute favourably to the growth of the economy. This was according to long-run Granger Causality results of an empirical study by Esteve & Tamarit (2018) on “Public Debt and Economic Growth in Ghana” which showed a statistically consequential and favorable influence of debt financing on rates of growth of real GDP, suggesting a significant contribution of deficit financing to the growth of Ghananian economy.

The sustainability of long-run economic growth remains a major concern for many governments as public debt levels continue to rise across countries following the economic recession of 2008 (Kim, Ha, & Kim, 2017). Given the fact that many countries need to bolster their long run economic improvement and advancement, the management of public obligation as a fiscal policy in achieving steady long-term economic growth according to Da Silva, de Castro Pires, and Bittes Terra (2014) requires prudent fiscal management geared towards mitigating the adverse effects of debt financing while ensuring its sustainability.
2.3.2 External debt and Economic Growth

Many developing economies depend on external financial resources to fund their annual budget deficits and promote growth and development in their economies by supplementing their low levels of domestic savings (Mohamed, 2018). However, from different inquiries done on the interconnection between foreign debt and economic growth, different analyses revealed variant findings about this interconnection based on time period, and in different countries under different contexts. Challenges also existed on the underlying relationship between the study variables (Musibau, Mahmood, Ismail, Shamsuddin, & Rashid, 2018), thus a clear link sufficed in clarifying the interconnection between external debt financing and improvements in economies.

A study by (Oliver, 2018) on “The relationship between government external borrowing and economic growth in Oman between 1969 and 2015” established a positive external debt to export ratio which casted positive contributions to the economy in the interim. The empirical analysis of the study which applied the Autoregressive Distributed Lag cointegration approach in the estimating the interconnection between external debt financing and long-run improvement in the economy discovered an adverse and consequential external debt influence on economic growth in Oman which is explained by the probability of a debt overhang scenario together with the problem of crowding-out in the model. These findings were consistent with another empirical analysis carried out by Abdelaziz and Boussaada Rim (2019) whose results indicated an adverse and consequential correlation between external debt financing and experienced improvement levels in the economy, including investment for total samples studied.

The SUR model applied in the analysis of the study concluded that a one rate point ascend in the level of external debt financing has the effect of decreasing the total investment by about 0.088 rate with a corresponding decrease in economic growth by about 0.182 percentage point. The negative association between the study variables was supported by a hypothesis about debt overhang, a situation where a rise in the external debt levels of up to a given threshold adversely affects the economy since the associated increase in debt service costs slows down economic growth by crowding out private investments (Ismaila Jarju, Edward Nyarko, Kormay Adams, 2016). Negative signals are then sent out to investors to discourage further investments due to instability in the macroeconomic environment once the economy slows down (Guei, 2019).
Contrary to the conventional findings of studies that examined the association between external debt financing and its influence on growth in the economy, an analysis by GÖVDELİ (2019) on the influence of external debt financing on the growth of Turkish economy exhibited a positive coefficient in the research variables. The positive coefficient from the analysis both on the interim and in the long haul was attributed to efficient use of the sourced external debt both, directed into areas where domestic investment could not be hampered as well as into investments with high added value. The study concluded that it is possible for developing economies to avoid scenarios of debt overhang and crowding out phenomena if external debt was channeled into productive, high added value investments and own resources efficiently used through funding with minimal use of external borrowing in the long run (GÖVDELİ, 2019).

Building further on the positive influence that external debt financing posed on the measured growth levels in the economy were the conclusions of a study by Ijirshar, Joseph and Godoo (2016) on “The relationship between external debt and economic growth in Nigeria from 1981 to 2014” using regression and analytical tools of Augmented Dickey Fuller Test (ADF) and Ng and Perron (2001). The unit root analysis from the tests revealed a favorable influence of external debt financing on the long-run improvement level of the Nigerian economy, attributed to the growth in capital expenditure and exports growth rates from external debt financing. However, the external debt servicing costs had a significant adverse effect on the interim and long-run growth of Nigerian economy, an inverse relationship that also held true for interest rates with regards to the growth of the economy.
2.3.3 Domestic debt and economic growth
Most African governments resort to domestic borrowing due to shortfalls in their domestic revenues in order to finance their budget deficit (Haffner, Aruna, & Adams, 2017) and meet their immediate and intermediate fiscal goals. This has seen the countries’ aggregate domestic debt increase over the years to unsustainable levels, reflecting some possibilities of financial crises which has had some deleterious effects in the economies of some countries (Hanson, 2007).

An empirical study carried out by Lotto and Mmari (2018), sought to ascertain the influence that domestic debt financing had on the growth of the economy in Tanzania using Ordinary Least Square (OLS) regression method between 1990 and 2015 time period. The analytical findings of the study concluded a negative but inconsequential association between domestic debt financing and the measured growth levels in the economy of Tanzania, caused by factors like increased domestic borrowing trends and improper use of domestically borrowed funds among others measured in light of GDP annual growth. A similar study conducted by Haffner et al. (2017) on the influence of domestic debt financing on the growth of Sierra Leone’s economy, employed the use of the ARDL model in analyzing secondary data of time series nature from 1970 to 2015 on selected variables. The analytical results of the model revealed a negative short-run association of variables where domestic debt exerted an adverse impact on the improvement of the economy which was also observable in the long run. The empirical analysis concluded that private sector credit and investment are crowded out above 20 percent of domestic debt to GDP the ratio, reinforcing a “debt overhang” situation.

Matthew and Mordecai (2016) in their inquiry utilized secondary time series data on an annual basis for the period between 1985 and 2014 to investigate “The impact of domestic debt on agricultural output in Nigeria”. Their analysis, which utilized the various tests of Augmented Dickey-Fuller, ECM test, Granger causality and Johansen Co-integration concluded the existence of a long-run relationship between public agricultural expenditure, agricultural output, domestic debt and interest rate. Unlike previous conclusions by (Lotto & Mmari, 2018) and (Haffner et al., 2017), the parsimonious ECM model findings indicated a substantially favorable effect of domestic debt financing on agricultural output, with an insignificant positive effect on agricultural outputs of public agricultural expenditures.
These findings concluded that domestic debt had a significant contribution to the growth of agricultural output and formed one among many means through which governments funded primary areas of the economy to boost output improvements (Matthew & Mordecai, 2016).

2.4 Conceptual Framework:
The conceptual framework provided a diagrammatic representation of the particular study variables and how they interconnected with each other, acting as the researcher’s “map” in carrying out the investigation (Bhattacharya et al., 2006).

![Conceptual Framework Diagram](image)

In the diagram above, Public Debt was an aggregate of both external debt financing and domestic debt financing and formed the independent variable while economic growth was the dependent variable. The size of public debt was assessed to establish its influence on the growth of nominal GDP in Kenya. Debt servicing costs in terms of interest and principal payments of both domestic and external debt were also analyzed as public debt service costs and their influence on the growth rates of nominal GDP in Kenya assessed.
### 2.5 Summary of Literature Review and Knowledge Gaps

This section summarizes the key findings of the empirical review and identifies the knowledge gaps in the study related literature.

<table>
<thead>
<tr>
<th>Author of study</th>
<th>Focus of Study</th>
<th>Methodology Used</th>
<th>Findings</th>
<th>Knowledge Gaps</th>
<th>Focus of current study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woo and Kumar (2015)</td>
<td>“Impact of high public debt on long-run economic growth in a large panel of countries over four decades.”</td>
<td>Cross-country empirical analysis from a baseline panel regression for OLS. Uses pane data for analysis</td>
<td>“Negative and significant relationship between public debt and economic growth for both advanced and emerging economies.”</td>
<td>Time series data can be used for analysis in a large group of countries to establish the “influence of debt financing on economic growth.”</td>
<td>This investigation looked for “the influence of public debt and economic growth in Kenya” alone. Annual secondary data of time series nature was used for analysis.</td>
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<tr>
<td>Afonso and Ibraimo (2020)</td>
<td>“The macroeconomic effects of public debt: an empirical analysis of Mozambique.”</td>
<td>Unrestricted VAR model was adopted. Study employed use of Quarterly data of time series nature ranging from Q1 of 2000 to Q4 of 2016 in its estimation.</td>
<td>Findings show “that public external debt has a positive effect on real output in the short run but not in the long-run.”</td>
<td>A gap exists to study “the macroeconomic effects of public debt and debt service on real output, general price level exchange rate, treasury bills rate and lending rate.”</td>
<td>This examination sought to “test for causality between public debt and economic growth.” VAR regression technique was used in the inquiry.</td>
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<tr>
<td>Oliver (2018)</td>
<td>“External Debt and Economic Growth: The Case of Oman as an emerging economy.”</td>
<td>“Autoregressive Distributed Lag cointegration approach” was employed in the empirical analysis.</td>
<td>There was “a negative and significant influence of external debt on economic growth in Oman” in the outcomes of the study.</td>
<td>An existing gap to study the “relationship between external debt and economic growth” in an advancing economy in Africa.</td>
<td>This inquiry focused on “the influence of external debt on economic growth in Kenya.”</td>
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<td>Author(s)</td>
<td>Title of Study</td>
<td>Methodology</td>
<td>Findings</td>
<td>Additional Notes</td>
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<tr>
<td>GÖVDELI (2019)</td>
<td>“Impact of external debt on economic growth in Turkey”</td>
<td>“Analysis employed the use of time series data obtained from the World Bank for the period from 1970 to 2016.” “ARDL regression model was used to estimate the relationship between the study variables.”</td>
<td>Findings show a positive short-run and long-haul coefficient between the two study variables.</td>
<td>An existing gap to study “the relationship between external debt and economic growth in Kenya.” “VAR regression model” was be adopted to estimate “the influence of external debt economic growth in Kenya.”</td>
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<tr>
<td>Lotto &amp; Mmari (2018)</td>
<td>“Impact of domestic debt on economic growth in Tanzania for the period between 1990 and 2015.”</td>
<td>“The study used Ordinary Least Square (OLS) regression method to analyze the relationship of the study variables for the period 1990 to 2015.”</td>
<td>Analytical results of the study concluded -an opposite and inconsequential relationship between- “domestic debt and the economic growth of Tanzania.”</td>
<td>An existing gap to study “the Impact of domestic debt on economic growth in Kenya for the period between 1990 and 2015.” This study looked for “the influence of domestic debt on economic growth in Kenya for the period between 2000 and 2019.” Ordinary Least Squares and Augmented Dickey Fuller tests regressions method was used to analyze the study variables.</td>
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CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction
This section laid out the technique that was employed in ascertaining the influence of public debt on economic growth in Kenya. Every component involved in carrying out the empirical inquiry from the research design adopted, the type of data used and its sources, the model specifications to the study estimation techniques is highlighted. In summary, the selected mode of empirical analysis used in estimating the study variables was provided in details in this chapter.

3.2 Research Design
The study embraced the utilization of non-experimental, correlational research design in estimating public debt-economic growth relationship so as to appropriately ascertain the influence that public debt had on the growth of Kenyan economy following the Solow-growth model of general equilibrium developed in chapter two.

3.3 Data description and source
Annual secondary data of time series nature for the period between 1999 and 2019 was empirically analyzed to ascertain the influence of public debt on Kenya’s economic growth. The data frequency (annual) and the time period was selected based the availability of data in authorized sources and after careful considerations of the existing circumstances, public-debt debates intensification, in addition to the paltry analytical research carried out on the impact of debt financing on the growth of Kenyan economy within the study period.

The main variables of analysis for Public Debt were: Domestic Debt Outstanding (DD) – Amount of Debt sourced internally as per the published records of CBK, External Debt Outstanding (ED) – Amount of debt sourced externally as per the published records of CBK, Domestic Debt Principal and Interest Payments (DDS) – Amount of interest and loan principle paid to domestic investors, External Debt Principal and Interest Payments (EDS) – Amount of debt interest and loan principle paid to external investors. The two proxy indicator for Economic Growth in the study included Nominal GDP (NGDP) – Amount of GDP in current prices as published by the CBK, and Nominal GDP Growth Rates (NGDPGR) – rate of nominal GDP growth recorded by the CBK.

The secondary data used for empirical analysis was sourced from World Bank reports, the Central Bank of Kenya (CBK) publications, KNBS statistical bulletins and The National Treasury reports. The data was on a financial year basis.
3.4 Model Specification and Estimation Equation
The study adopted the Vector Autoregressive Model (VAR) in assessing the impact that public debt projects on economic growth in Kenya. VAR model framework was used because of its ability to cater for data trends, provide the feedback effects between values both in past and present, as well as in light of the stochastic behavior of data. The model leveraged on the past observed outcomes of economic growth proxies to predict their future expected values in light of the explanatory variables of public debt proxies, a quality that made it most suitable for supporting the empirical findings of the study in formulating policy recommendations. In testing for causal relationships between the study’s variables, the model was determined as follows:

\[ \text{NGDP} = f (\text{PUBD}) \]  \hspace{1cm} (1)

Where;
- \( \text{NGDP} \) = Nominal Gross Domestic Product.
- \( \text{PUBD} \) = Public Debt.

Public Debt (PUBD) was further specified as follows:

\[ \text{PUBD} = f (\text{ED, DD, EDS, DDS}) \]  \hspace{1cm} (2)

Where;
- \( \text{ED} \) = External Debt Outstanding.
- \( \text{DD} \) = Domestic Debt Outstanding.

Equation (1) for public debt-economic growth relationship was represented in the VAR model in equation three (3) below in order to capture the study objectives as stated:

\[ \text{NGDP}_t = a_{10} + \sum_{j=0}^{k} a_{ij} \text{NGDP}_{t-j} + \sum_{j=1}^{k} b_{1j} \text{PUBD}_{t-j} + U_t \]  \hspace{1cm} (3)

\[ \text{PUBD}_t = a_{20} + \sum_{j=1}^{k} a_{2j} \text{PUBD}_{t-j} + \sum_{j=1}^{k} b_{2j} \text{NGDP}_{t-j} + U_t \]  \hspace{1cm} (4)

Where;
- \( \text{NGDP}_t \) = Intermediary for economic growth
- \( \text{PUBD}_t \) = Intermediary for public debt
- \( U_t \) = A white noise error term
Public debt was aggregated from individual components of external debt and domestic debt so as to assess its aggregated influence on economic growth. Empirical findings of the analyses were then used to inform relevant discussions and economic policies on the suitability of utilizing public debt to effect economic growth.

3.5 Diagnostic Tests
3.5.1 Unit Root Test Analysis
The presence of unit roots in each study variable in the time series model was tested using “Augmented Dickey-Fuller (ADF)” test in order to establish the existence of non-stationarity in the times series data. ADF test was carried out due to its famous application in estimating model variables for stationarity using time series data. Time series is considered fixed or stationary on the off chance that it doesn't change overtime, implying constant variability in its values. Stationarity tests allow empirical analyses to avert any complications of “spurious regressions” that are related with non-fixed time series models. In the presence of unit roots in the regression model, ADF test allows for differencing of non-stationarity variables at different levels to make them stationary and avert any risks of spurious regression. Equation (6) below models the general ADF equation.

\[ \Delta X_t = \mu + \gamma T + \delta X_{t-1} + \sum_{i=1}^{k} \lambda_i \Delta X_{t-i} - 1 + \varepsilon \]  

Where;  
Xt represents the variable in question,  
T is the trend,  
k is the lag length and \( \varepsilon \) is a random variable assumed to be white noise.

The Null Hypothesis (Ho :) in ADF test assumes the time series data to be non-stationary in nature and is set as below;

**Ho:** Time Series Data is NOT Stationary.

**H_A:** Time Series data is Stationary.

The study sought to test for the presence of unit roots in the model using ADF test in order to ‘REJECT’ or ‘NEGLECT TO REJECT’ the Null Hypothesis.
3.6 Estimation Techniques

3.6.1 The Cointegration Test
Johansen’s multivariate cointegration test was performed in examining the long run association between the model factors through the assessment of the number of cointegration vectors. The procedure is usually performed to reveal any likelihood of at least one cointegrating vector between factors in the VAR models. However, the test is only performed once the regression model factors are found to have no unit root or be fixed at the primary contrast after the unit root test.

3.6.2 Granger Causality
Finally, Granger causality estimation technique was executed to affirm the course of causality between public debt and economic growth in the economy. The technique was important for revealing the proximate and fundamental influence of public debt proxy variables on economic growth in model. This enabled the analytical findings of the model to evaluate whether it was external debt or domestic debt or both that enhanced growth in Kenya, and helped in informing the necessary public debt policies required for a sustained economic growth in the long run.

3.7 Data Analysis
Data was analyzed using STATA software because of its precision and its ability to run multivariate analysis, analyze, manage, and produce graphical visualizations of the study empirical data.
CHAPTER FOUR: DATA ANALYSIS, RESEARCH FINDINGS AND DISCUSSIONS

4.1 Introduction
This section comprises the findings, presentations and interpretation of the study investigation. The investigation utilized a four-stage econometric methodology in its exact examination.

4.2 Descriptive Statistics
The initial step of the empirical analysis involved the summarization of the study variables into their descriptive statistics in order to uncover the fundamental qualities of the information utilized. Table 4.1 below shows the results of the model descriptive statistics.

Table 4.1: Summary of variables descriptive statistics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY</td>
<td>21</td>
<td>2009</td>
<td>6.204837</td>
<td>1999</td>
<td>2019</td>
</tr>
<tr>
<td>DD</td>
<td>21</td>
<td>940.2207</td>
<td>804.949</td>
<td>377.7</td>
<td>3023.139</td>
</tr>
<tr>
<td>ED</td>
<td>21</td>
<td>174.305</td>
<td>2785.483</td>
<td>798.9213</td>
<td>3023.139</td>
</tr>
<tr>
<td>Int_ED</td>
<td>21</td>
<td>20.591</td>
<td>28.03601</td>
<td>3.645</td>
<td>103.372</td>
</tr>
<tr>
<td>Int_DD</td>
<td>21</td>
<td>86.11152</td>
<td>78.29596</td>
<td>22.068</td>
<td>272.351</td>
</tr>
<tr>
<td>Pr_ED</td>
<td>21</td>
<td>40.96838</td>
<td>59.0199</td>
<td>9.23</td>
<td>265.106</td>
</tr>
<tr>
<td>Pr_DD</td>
<td>21</td>
<td>38.9229</td>
<td>72.58579</td>
<td>0</td>
<td>209.242</td>
</tr>
<tr>
<td>NGDP</td>
<td>21</td>
<td>3693.751</td>
<td>2864.355</td>
<td>886.47</td>
<td>9740.36</td>
</tr>
<tr>
<td>NGDPGR</td>
<td>21</td>
<td>4.619048</td>
<td>2.129464</td>
<td>.5</td>
<td>8.4</td>
</tr>
</tbody>
</table>

Source: STATA Computations.

From the table above, the study employed the use of nine (9) different variables in its analysis to analyze the influence of public debt on economic growth in Kenya. Each variable was studied for a period of twenty one years on an annual basis and therefore recorded twenty one observations (obs) as indicated in the table. The values of DD, ED, Int_ED, Int_DD, Pr_ED, Pr_DD and NGDP were in Billions of Kenya shillings, with their respective minimum values being 174.3, 377.7, 3.645, 22.0, 9.2, 0 and 886.5 respectively for the variables. DD recorded the highest value of 2785.483 with that of ED being 3023.139. The highest NGDP value in the data was 9740.36. NGDPGR was analysed as a percentage over the years, with its highest value being 8.4% and the least value in the data being 0.5%. The average figures for DD, ED, Int_ED, Int_DD, Pr_ED, Pr_DD and NGDP were 889.6, 940.2, 20.6, 86.1, 40.9, 38.9 and 3693.8 respectively. It is worth noting that Kenya pays more interest on domestic debt than external debt as indicated in the table.
This can be attributed to the fact that much of the debt borrowed domestically (Treasury Bonds) is long-term in nature extending up to 20 years, and therefore the interest payment on it is higher compared to debt borrowed externally. However, due to the commercial nature of external debt, the principle payment on external borrowing is much more than that settled on domestic debt, making the external loan a little more expensive that compared to domestic debt. Taking into consideration the volatility of exchange rates, external debt principle settlement appears to be much higher than that of domestic debt.

Annual trends of key variables of public debt (PD), nominal GDP (NGDP), public debt service (PDS) and nominal GDP growth rate (NGDPR) were analyzed over the years under study and represented graphically in the figure below.

**Figure 4.1: Annual Trends Analysis of Key Variables (Kshs. Billions)**

Source: STATA Visualization.
The figure above shows the annual trends of key variables within the period under study. It is evident that deficit financing and economic improvement were on a steady upward trend over the years with the corresponding public debt service and economic growth rate registering the same upward trend. However, the pace of economic growth rate was unsteady over the years as evidenced by the zigzag trend line.

4.3 Diagnostic Tests
4.3.1 Unit Root Test Analysis
The second step of the empirical analysis involved running some diagnostic tests on the variables to check for the existence of unit roots using “Augmented Dickey-Fuller (ADF)” test of stationarity. The running of this diagnostic test was important due the nature of data (time series) the study was using. The decision criteria for the existence of unit roots in the model variables is such that if the T-statistic is greater (> ) than the 5% critical value, then the null hypothesis of “presence of unit roots” is REJECTED at 95% confidence level. ADF unit root test was applied on all the factors without any lags or constants. All the factors were found to be stationary and integrated of order zero (0). Thus there was no need to run any differencing on them to make any variable stationary. The estimation outcomes of the unit root tests are tabulated below.

<table>
<thead>
<tr>
<th>Variable</th>
<th>T-Statistic</th>
<th>5% Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGDP</td>
<td>7.173</td>
<td>-3.000</td>
</tr>
<tr>
<td>NGDPR</td>
<td>-3.046</td>
<td>-3.000</td>
</tr>
<tr>
<td>PD</td>
<td>10.009</td>
<td>-3.000</td>
</tr>
<tr>
<td>PDS</td>
<td>4.004</td>
<td>-3.000</td>
</tr>
</tbody>
</table>

Source: Author’s Computations

From the table above, the results of the ADF unit root tests for every one of the factors utilized in the model show that the null hypothesis for the presence of unit roots is dismissed at 5% significance level. Therefore, every one of the factors were discovered to be fixed, and the outcomes got from the regression of the factors predictable. This implies that the correlation between public debt and economic growth in the model estimation will not be misleading or spurious.
4.4 Regression Estimation Results

4.4.1 Vector Autoregression Estimation (VAR) Results

The third step of the econometric model analysis involved the estimation of Vector Autoregression and Johansen test for cointegration to determine the short run and the long run relationship of the study variables respectively. Vector Autoregression (VAR) technique is used to capture the relationship between multiple variables as they change over time (short-run). It is famous in statistics because of its usefulness in portraying the powerful conduct of economic time series and for prediction. Thus, the study employed the use of VAR technique in the estimation of model variables because of its quality in giving better conjectures than those from univariate time arrangement models and elaborate hypothesis based concurrent conditions models.

In estimating VAR, all the model variables are endogenous. Before estimating the connection between public obligation and economic growth using the VAR model, the optimal lag length (k) for the model variables was determined with a maximum of 2 lags in order to ensure accuracy of their existing relationship. The model determined the second lag (2\textsuperscript{nd}) as the optimal lag order to use given the indicated information criteria as shown by the many asterisks (*) in table 4.3 below.

<table>
<thead>
<tr>
<th>Table 4.3: VAR optimal lag order estimation results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Selection-order criteria</strong></td>
</tr>
<tr>
<td><strong>Sample:</strong> 2001 - 2019</td>
</tr>
<tr>
<td><strong>Number of obs</strong> = 19</td>
</tr>
<tr>
<td><strong>lag</strong></td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

Source: STATA Computation.

AIC information criteria was used because it had the lowest asterisked value of the sixth lag as indicated by the table above. The VAR model dictates that the lower the value, the better the model in determining the existing relationship of the study variables. Thus, AIC information criteria was the most ideal for the model. Table 4.4 below summarizes the results of the VAR technique applied in the estimation of short-run relationship between debt financing and its related debt service costs and economic growth and its related growth rates.
Table 4.4: Vector autoregression estimation results.

```
. var NGDP NGDPRG PD PDS, lags(1/2) small dfk

Vector autoregression

Sample: 2001 - 2019  Number of obs  =  19
Log likelihood  =  -326.0679  AIC          =  38.32293
FPE          =  -7.18e+11  HQIC         =  38.62576
Det(Sigma_ml) =  -1.17e+10  SBIC         =  40.1124

Equation          Parm   SE     Durbin-Matthews   R-sq  F   P > F
                  t        Error

NGDP
9  139.311       946.629  0.0000
NGDPRG
9  1.94108     0.43890  0.5050
PD
9   9.498     0.99994  0.0000
PDS
9  36.1893       91.68212  0.0000

|                      |        Coef. | Std. Err. | t | D>|t| | [95% Conf. Interval] |
|----------------------|-------------|-----------|---|-----|----------------------|
| NGDP                 |             |           |   |     |                      |
| L1.                  | 0.7249069   | 0.2643197 | 2.74 | 0.021 | 0.1359659 | 1.313848 |
| L2.                  | 0.6290354   | 0.2901869 | 2.17 | 0.055 | -0.0175413 | 1.275612 |
| NGDPRG               |             |           |   |     |                      |
| L1.                  | -10.47079   | 10.4225   | -0.57 | 0.502 | -51.52680 | 30.56911 |
| L2.                  | 33.02211    | 17.73872  | 1.86 | 0.092 | -6.502211 | 72.54644 |
| PD                   |             |           |   |     |                      |
| L1.                  | 0.372006    | 0.7268604 | 0.51 | 0.620 | -1.24754  | 1.991552 |
| L2.                  | -1.08537    | 0.5297857 | -1.99 | 0.074 | -2.238006 | 0.120664 |
| PDS                  |             |           |   |     |                      |
| L1.                  | 0.4985942   | 1.001398  | 0.50 | 0.629 | -1.732661 | 2.729649 |
| L2.                  | 0.7803793   | 1.665461  | 0.47 | 0.649 | -2.9305   | 4.491258 |
| _cons                | 104.9631    | 103.4189  | 1.01 | 0.334 | -125.4686 | 335.3948 |

| NGDPRG               |             |           |   |     |                      |
| L1.                  | 0.0053813   | 0.0036829 | 1.46 | 0.175 | -0.0028247 | 0.0135873 |
| L2.                  | -0.0065926  | 0.0040433 | -1.63 | 0.134 | -0.0156016 | 0.0024164 |
| NGDPRGR              |             |           |   |     |                      |
| L1.                  | 0.225195    | 0.2566884 | 0.88 | 0.401 | -0.3467424 | 0.7971324 |
| L2.                  | -0.2440741  | 0.2471609 | -0.99 | 0.347 | -0.7947829 | 0.3066347 |
| PD                   |             |           |   |     |                      |
| L1.                  | 0.0031877   | 0.0101276 | 0.31 | 0.759 | -0.0193781 | 0.0257535 |
| L2.                  | 0.0006161   | 0.0073817 | 0.08 | 0.935 | -0.0158314 | 0.0170636 |
| PDS                  |             |           |   |     |                      |
| L1.                  | -0.009568   | 0.0139529 | -0.69 | 0.509 | -0.040657  | 0.021521 |
| L2.                  | -0.0121582  | 0.0232056 | -0.52 | 0.612 | -0.0638634 | 0.039547 |
| _cons                | 3.30634     | 1.440979  | 2.29 | 0.045 | 0.0956393  | 6.51704 |
```

Source: STATA Computation
The results of vector autoregression (short-run) estimation between public debt variables (PD and PDS) and economic growth variables (NGDP and NGDPGR) show that the first lag of public debt on economic growth (PD, L1 = 0.620) is not as significant as compared to its second lag at 10% significance level (PD, L2 = 0.074). We therefore conclude with 90% confidence level that only the second lag of public debt has a causal influence on economic growth in the short-run. However, both lags of public debt service (PDS, L1 = 0.629, L2 = 0.649) are not significant to economic growth, inferring no causal impact on economic growth (NGDP) on the interim. This implies that the effects of using debt financing to finance capital project may not felt immediately due to the long period of time capital projects like super highways and SGR projects take before being completed. These results confirm that public debt influences economic growth in Kenya, but not in the short-run.

When it comes to economic growth rate (NGDPGR), both lags of public debt (PD, L1=0.759, L2=0.935) and public debt service (PDS, L1=0.508, L=0.612) no significant causal effect on economic growth rate at 10% significance level. Therefore, we can conclude that in the short-run, deficit financing and its related service costs have no causal effect on the economic growth rates in Kenya. This can be justified by the fact that it takes time for capital projects to be completed, and also once they are completed, the economy has to pick up the momentum of utilizing them to generate revenue off the projects.

4.4.2 The Cointegration Test
One of the motivations of conducting the empirical analysis of this study was to ascertain whether there existed any connection between public obligation and economic improvements over the long haul in order to inform sound economic policies on the suitability and sustainability of using deficit financing to effect economic growth. Johansen’s test for co-integration was performed in examining the long run connection between debt financing and its related service cost variables and economic improvement through the estimation of the number of cointegration vectors. The procedure is usually performed to reveal any likelihood of at least one cointegrating vector between factors in the VAR models. The decision criteria for the presence of cointegrating vectors in the model variables is such that if the test trace statistic and the max statistic are greater (> ) than the 5% critical value, then the null hypothesis of “No Cointegration” is REJECTED at 95% confidence level. The estimation outcomes of the Johansen tests are tabulated below.
Table 4.5: Johansen test for cointegration estimation results.

<table>
<thead>
<tr>
<th>maximum</th>
<th>5%</th>
<th></th>
<th>trace</th>
<th>critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>rank</td>
<td>parms</td>
<td>LL</td>
<td>eigenvalue</td>
<td>statistic</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>-368.89326</td>
<td>.</td>
<td>81.6508</td>
</tr>
<tr>
<td>1</td>
<td>27</td>
<td>-349.45763</td>
<td>0.87073</td>
<td>42.7795</td>
</tr>
<tr>
<td>2</td>
<td>32</td>
<td>-338.32647</td>
<td>0.69016</td>
<td>20.5172</td>
</tr>
<tr>
<td>3</td>
<td>35</td>
<td>-329.69459</td>
<td>0.59692</td>
<td>3.2535</td>
</tr>
<tr>
<td>4</td>
<td>36</td>
<td>-328.06787</td>
<td>0.15738</td>
<td></td>
</tr>
</tbody>
</table>

Source: STATA Computations.

The table results above show that the NULL hypothesis of “No cointegration” is dismissed at 95% confidence level for all the ranks between 0 and 2, since both the t statistic and the max statistic are greater than the 5% critical value, hence there exists cointegration in the regression model. The implication of cointegration on the maximum rank is that, of all the model variables of NGDP, NGDPGR, PD and PDS, there exists at least two cointegrating vectors among them and a maximum of three cointegrating variables in the short run.

The presence of cointegration in the model variables conclude that the time series exhibit a long-haul association between public debt and economic growth, implying that the variables are connected and can be consolidated in a direct design. It also implies that, in the event of a shock, the movement of individual variables may be affected in the short-run and show no causal impact between public obligation and economic improvement, but ultimately, there will be a long run convergence in these variables. These results are consistent with results from a study done by Afonso and Ibraimo (2020) on “The macroeconomic effects of public debt in Mozambique”. The study concluded that public debt had a positive influence on long run real output during in Mozambique. Thus the use of public debt positively influences the long run economic growth in Kenya.
4.5 Granger Causality (Direction of Causality)

The final step of the empirical analysis involved the estimation of model granger causality to determine which variable between public debt and economic growth causes a movement in the other. The decision criteria of the test’s null hypothesis are such that Ho: is REJECTED at 5% confidence level for “no causality of public debt on economic growth” if the P-value (Prob > F) is lower or equal (<=) to 0.05. Thus, if the P-value is higher than 0.05, we CAN NOT REJECT the null hypothesis of no granger causality in the model. The results of the estimated model granger causality are tabulated below:

**Table 4.6: Granger causality Wald tests estimation results.**

<table>
<thead>
<tr>
<th>Equation</th>
<th>Excluded</th>
<th>F</th>
<th>df</th>
<th>df_r</th>
<th>Prob &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGDP</td>
<td>NGDPGR</td>
<td>1.0031</td>
<td>2</td>
<td>10</td>
<td>0.2144</td>
</tr>
<tr>
<td>NGDP</td>
<td>PD</td>
<td>4.955</td>
<td>2</td>
<td>10</td>
<td>0.0320</td>
</tr>
<tr>
<td>NGDP</td>
<td>PDS</td>
<td>0.19624</td>
<td>2</td>
<td>10</td>
<td>0.8249</td>
</tr>
<tr>
<td>NGDP</td>
<td>ALL</td>
<td>2.9543</td>
<td>6</td>
<td>10</td>
<td>0.0630</td>
</tr>
<tr>
<td>NGDPGR</td>
<td>NGDP</td>
<td>1.3294</td>
<td>2</td>
<td>10</td>
<td>0.3076</td>
</tr>
<tr>
<td>NGDPGR</td>
<td>PD</td>
<td>0.305</td>
<td>2</td>
<td>10</td>
<td>0.7437</td>
</tr>
<tr>
<td>NGDPGR</td>
<td>PDS</td>
<td>0.31511</td>
<td>2</td>
<td>10</td>
<td>0.7367</td>
</tr>
<tr>
<td>NGDPGR</td>
<td>ALL</td>
<td>1.0391</td>
<td>6</td>
<td>10</td>
<td>0.4551</td>
</tr>
<tr>
<td>PD</td>
<td>NGDP</td>
<td>11.015</td>
<td>2</td>
<td>10</td>
<td>0.0030</td>
</tr>
<tr>
<td>PD</td>
<td>NGDPGR</td>
<td>1.0219</td>
<td>2</td>
<td>10</td>
<td>0.3947</td>
</tr>
<tr>
<td>PD</td>
<td>PDS</td>
<td>13.716</td>
<td>2</td>
<td>10</td>
<td>0.0014</td>
</tr>
<tr>
<td>PD</td>
<td>ALL</td>
<td>10.361</td>
<td>6</td>
<td>10</td>
<td>0.0008</td>
</tr>
<tr>
<td>PDS</td>
<td>NGDP</td>
<td>4.453</td>
<td>2</td>
<td>10</td>
<td>0.0414</td>
</tr>
<tr>
<td>PDS</td>
<td>NGDPGR</td>
<td>0.84987</td>
<td>2</td>
<td>10</td>
<td>0.4562</td>
</tr>
<tr>
<td>PDS</td>
<td>PD</td>
<td>10.439</td>
<td>2</td>
<td>10</td>
<td>0.0036</td>
</tr>
<tr>
<td>PDS</td>
<td>ALL</td>
<td>5.3526</td>
<td>6</td>
<td>10</td>
<td>0.0102</td>
</tr>
</tbody>
</table>

*Source: STATA Results.*

Looking at the results of the table above, the P-value of the null hypothesis that “public debt does not granger cause economic growth” is given by (Prob > F = 0.0320 < 0.05). We therefore reject Ho: at 10% significance level and conclude that public debt indeed granger causes economic growth. This implies that policy makers can utilize public debt to influence economic growth in Kenya. High economic growth can be achieved through more utilization of public debt in Kenya.
However, the P-value of the null hypothesis that “public debt service does not granger cause economic growth is given by ((\text{Prob} > F = 0.8249 > 0.05). We therefore, FAIL to reject Ho: and infer that indeed public debt service does not granger cause economic growth. Taking everything into account, we can conclude that the cointegration of NGDPGR, PD and PDS does not granger cause economic growth at (\text{Prob} > F = 0.0630 > 0.05). These findings imply that that public debt service costs are incidental to the utilization of public debt to effect economic growth in Kenya, and as such, need to be controlled for in the event that their increases divert fiscal resources to loan repayments as opposed to development project in the country.

Looking at the null hypothesis that “economic growth does not granger cause public debt”, we reject Ho: at 95% confidence level and conclude that indeed economic growth granger causes public debt (\text{Prob} > F = 0.0030 < 0.05). This means that the cointegrating causal effect of NGDP and PDS is so significant on public debt that their movements in the long-run have a huge impact on public debt. In general, we can conclude with 99% level of confidence that combination of NGDP and PDS granger cause public debt or public with a P-value of (\text{Prob} > F = 0.0008). The more public debt is being utilized to influence economic growth, the more public debt service costs the country incurs which may prove deleterious in the long run if not kept in check.

In general, the cointegrating causal effect of NGDP, PD and PDS have no effect on public debt in both the short run and the long run. However, the cointegrating effect of NGDP, NGDPGR and PD have a sizeable causal effect on PDS over the long haul.
CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction
This chapter summarizes the findings of the study in relation to the research objectives, provides the study conclusion, recommends some policy considerations and identifies gaps identified for further research studies.

5.2 Summary of the research findings
5.2.1 Influence of the size of public debt on economic growth in Kenya.
The study revealed that the second lag of public debt (PD, L2 = 0.074) indeed influences economic growth in Kenya, and that this influence is positive in the long run with 90% confidence level. In the short-run, there exists no significant causal relationship between public debt and economic growth. The presence of cointegration in the model variables conclude that the time series exhibit a long-haul association between public obligation and economic improvement, implying that the variables are connected and can be consolidated in a direct design. The granger causality results (Prob > F = 0.0320 < 0.05) concluded that it is public debt that indeed granger causes economic growth in Kenya. This finding provide solid evidence to policy makers on the influence that public debt has on economic growth in Kenya, both in the short-run and in the long run.

5.2.2 Influence of public debt service costs on nominal GDP
From the study findings, both lags of public debt service costs (PDS) do not have any significant influence on nominal GDP (PDS, L1=0.629, L2=0.649). This implies that public debt servicing costs do not have significant influence on economic growth of the country, at least in the short run. However, in the long-run, increased debt service costs may have adverse influence on either economic growth or economic growth rate going by the result of Johansen test for cointegration estimation results. There is need to keep the level of public debt within sustainable levels in order to forestall any adverse influence that debt servicing cost may have on the long run economic growth and/or economic growth rate.

5.2.3 Influence of public debt service costs on GDP growth rates
The study results revealed that public debt servicing costs (PDS) does not have any significant influence of on the economic growth rate of Kenya, both in the short-run and in the long-run as there was no direct relationship that was evident from the model estimation. However, because increased public debt service costs come about as a result of increased utilization of public debt, they should be kept in check by maintaining sustainable levels of public debt usage in the Kenya.
5.3 Conclusion
The purpose of the study was to ascertain the influence of public debt on economic growth in Kenya so as to provide informed policy recommendations on the suitability and sustainability of using debt financing to affect economic growth. The findings of this investigation demonstrate that in reality, deficit financing influences economic growth in Kenya.

The findings of VAR and Johansen test for cointegration in table 4.4 and table 4.5 respectively reveal that the impact of public obligation on economic improvement is significant both in the interim and over the long haul. The causal effect of public debt on economic growth was also found to be unidirectional, revealing that it is public debt that has an important influence on economic growth and not the other way around. This suggests that the administration of public debt both in the interim and over the long haul is essential in ensuring that sustainable levels of economic growth are maintained for continuous improvement of economic welfare and development in the country.

The study also uncovered that there exists a positive and significant association between public debt and economic growth in Kenya. As more debt is being utilized, the economy continues to grow and flourish lagging behind with its significant growth rates in different sectors of the economy. This implies that for the Kenyan economy to encounter high development rates, public debt may be used to reinforce significant growth in nominal GDP in various sectors of the economy in the long run. However, this may require a well-informed strategy affecting the country’s economic growth rates as also revealed in the fact that increased utilization of public debt to grow the different sectors of the economy conspires a significant increase in public debt service costs which has an indirect but significant influence on the country’s economic growth rates. This may ultimately lead to observed reduced growth rates over the long haul.

The study failed to reveal directly the causal influence of public debt and its related service costs on economic growth rates. There was no evidence of any potential “debt overhang” phenomenon ever occurring in Kenya because of inordinate usage of public debt as the economy unilaterally grew with the ramping up of public debt.
5.4 Policy Recommendations
In light of the study findings, policy maker in the national government and monetary authority in Kenya s ought to consider embracing the accompanying recommendations as a matter of policy in the utilization of debt financing: Foremost, public debt was found to positively influence economic growth in Kenya in the long run. As more debt is being utilized, the economy continues to grow and flourish lagging behind with its significant growth rates in different sectors of the economy. Thus, the utilization of debt financing ought to be preferred in the financing of long term development projects in order to positively influence economic growth in the country.

Additionally, public debt servicing costs were found not to have direct significant influence on nominal GDP in the short-run. However, in the long run, increased debt servicing costs may adversely injure the economy by diverting scarce fiscal resources to huge loan repayments as opposed to financing productive sectors of the economy. As such, the country’s Public Debt Management Department ought to keep the level of public debt within the sustainable debt ceiling prescribed by the Public Finance Management Act of 2012. This will help curtail excessive fiscal outflows in form of debt service costs that would otherwise be channeled to more productive sectors of the economy, increase sectoral productive capacity and ultimately generate more domestic revenue as a result of gradual economic growth in the long run.

Lastly; While the study failed to reveal any direct causal influence of public debt and its related service costs on economic growth rates in Kenya, the ability of an economy to record gradual, but consistent positive growth rates is one of the fundamental macroeconomic objective of many governments. Policy makers in the National Treasury, together with other technocrats working in the Public Debt Management Departments within the government, ought to consider focusing on the allocation of public debt to sectors most profitable and rewarding in the economy so as to foster speedy and adequate economic returns in term of higher economic growth rates enough to cover the accompanying public debt service obligations.

5.5 Potential areas for further studies:
There is need to investigate the influence of Foreign Direct Investments (FDIs) on economic growth in Kenya since FDIs act as an alternative source of financing for sectoral economic growth in Kenya.
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