

**“SUSTAINABILITY OF PUBLIC DOMESTIC DEBT IN KENYA: AN EMPIRICAL
ANALYSIS (1980-2011) ”**

By

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**A Research Paper Submitted to the School of Economics, in Partial Fulfillment of the
Requirement for the Award of Master of Arts degree in Economics of the University of
Nairobi.**

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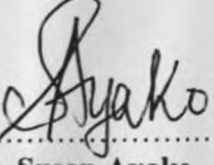
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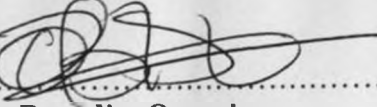
Declaration

This is my original work and has not been presented for any degree award in any other university.

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This research paper has been submitted with our approval as university supervisors

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Dedication

This work is dedicated to my parents, Mwai and Wangari for their great sacrifice, encouragement and support to lay a foundation in my life.

Acknowledgements

I would like to thank all those who contributed in any way to make this work a success. I commend my supervisors Ms. S. Ayako and Mr. B. Ongeru for their tireless effort in ensuring I achieved my objective. Their patience and support throughout the whole process is highly appreciated. I also extend my gratitude to the entire University of Nairobi, School of Economics for giving me an opportunity to expound my knowledge.

I salute my husband David for his loving support, encouragement, guidance and motivation which gave me the strength to soldier on. My dear sons Morris and Clovis whom I sacrificed time to be with them. Special thanks to all my family members for their moral support and prayers throughout the academic period.

Above all, I thank Almighty God for being a guiding star throughout my studies.

Abstract

This study is about the sustainability of public debt in Kenya. It seeks to analyze the sustainability of public domestic debt in Kenya using historical data of 1980-2011. Public debt sustainability is about good housekeeping. It ensures a government does not borrow to pay interest on existing debt.

This study adopts two approaches to test for public domestic debt in Kenya. First tests are performed on government debt and secondly on debt ratios. Results show that a one unit increase in previous period's debt leads to 1.45 increase in current public domestic debt. Unit root tests performed indicated that variables are non stationary and confirms that the No Ponzi Game condition which is a necessary condition for public debt sustainability is not satisfied meaning government is creating new debt to repay interest on existing debt.

To establish whether the necessary and sufficient condition is met, a cointegration test is carried out between government revenue and expenditure. Results reject a null hypothesis of no cointegration at 5% meaning government revenue and expenditure series are cointegrated. Similar test carried out between public debt and budget deficit shows there is a long run relationship between the two series. We conclude that inter- temporal budget constraint has not been violated and the Kenyan public domestic debt is weakly sustainable.

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List of Abbreviations

ADF	Augmented Dickey Fuller
AFRODAD	African Forum and Network on Debt and Development
AR	Auto Regression
CBK	Central Bank of Kenya
GDP	Gross Domestic Product
GNP	Gross National Product
IMF	International Monetary Fund
KIPPRA	Kenya Institute for Public Policy and Research Institute
KNBS	Kenya National Bureau of statistics
MEFMI	Macroeconomics and Finance Management Institute of Eastern and Southern Africa
NPG	No Ponzi Game
OLS	Ordinary Least Square
OMO	Open Market Operations
PV	Present Value
PVC	Present Value Constraint
SSA	Sub Saharan Africa
U.S.A	United States of America

CHAPTER ONE

INTRODUCTION

1.1 Background

The issue of a country's public debt, how to finance it and whether it is sustainable remains a critical area of study. When a country acquires finances through borrowing, public debt is created. Public debts created have to be repaid at a certain date in future. To ensure a country's fiscal policy remains sustainable a country need to generate enough future surpluses to cover for its primary deficits. This has not always been the case and countries have been accumulating public debt over the years. The problem of public debt sustainability has therefore been a source of concern in both developed and developing countries.

A country is said to have fiscal sustainability if its public debt do not keep on growing relative to its national income. This ensures that governments do not keep on constantly increase taxes and reduce spending on goods and services. In theory, fiscal sustainability is defined with respect to both a static and an inter-temporal budget constraint. A borrowing entity; in this case a government, is said to satisfy a static budget constraint if it is able to meet its current debt obligations as they fall due, without facing liquidity strain or the need to restructure its debt. A country satisfies an inter-temporal budget constraint if the present discounted value of its future budget surpluses is equal to the value of the outstanding stock of debt. It is expected that if a country satisfies both constraints then the contractual promises associated with the government's debt will be met in each period.

In the past, different countries worldwide have gone into public debt crises, meaning they have been unable to soundly service the public debt accumulated. Examples include Mexico and Latin

America in 1930s and 1982, Mexico in 1994, Asia and Russia in 1997, Pakistan in 2000 and Turkey in 2001. Clindy (2011) reported that in August 2011 the United States of America (U.S.A) House of Representative voted to raise the U.S.A public debt ceiling by USD 2.1 trillion to prevent the country from defaulting on its public debt. In 2009 the European zone experienced a financial crisis which intensified to a peak in 2010. By June 2012, countries such as Greece, Spain, Portugal, Ireland and Italy were still struggling to honor their public debt obligations, with Greece likely to go into insolvency¹ unless bailed out. This shows that countries have a responsibility to control their fiscal status and ensure that public debts are always within manageable levels.

Some African countries have also slipped into public debt crises. In the 1980s majority of African countries were struggling to cope with the burdens of excess external debt. Federici (2001) noted that in 1970s and 1980s public debt crisis was experienced by more than 25 African countries. This was caused by excessive external borrowing in form of concessional loans obtained from official bilateral and multilateral agencies. During those years these economies contracted minimal public domestic debt which was insignificant to raise an alarm. The situation has changed. As the burden of external debt persisted and majority of African countries defaulted on external interest payments, policies to reduce external debt were imposed by the World Bank and the International Monetary Fund (IMF).

Opportunities for expanding public debt through external debt has been dwindling given the current global crises which has reduced economic performance worldwide hence reducing availability of funds to lend. Public domestic debt has since been rising rapidly in many African

¹ Inability of a government to honor its debt payment when they fall due.

countries especially for the last ten years. This has raised the need to put in place policies to manage public domestic debt. The Kenya Debt Relief Network Report (2010) showed that in Africa, public domestic debt has been growing rapidly with Senegal public domestic debt reaching unsustainable levels in 2008.

A report by Macroeconomics and Finance Management Institute of Eastern and Southern Africa (MEFMI), (2001) outlined various reasons that have led to rapid growth of public domestic debt in the Sub Saharan Africa (SSA) countries. Some of the reasons include: liberalizing financial markets which affect domestic industries. External public debt crisis especially of 1970s and 80s, poor sovereign credit rating and liquidity problems which has reduced access to external funding. Another reason includes the shouldering in of losses incurred by public corporations due to corruption, mismanagement and embezzlement of fund. Political instability in these countries has also contributed through reduced economic performance calling for more borrowing. Internal and external shocks that affect countries leave the governments with a financial gap forcing them to borrow.

A study by Maana, Owino and Mutai (2008) outlines various reasons why a government contract domestic debt through the financial securities market. The most important reason is financing the budget deficit and bridging the financial gap necessitated by time lapse between approval and release of funds. The Kenyan government through the Central Bank of Kenya (CBK) uses government securities to raise funds from the public for its expenditure. The domestic debt market is also used as a monetary policy tool in regulating supply of money in the economy. This is done through Open Market Operations (OMO). The public domestic debt market also plays a major role in development of a country's financial market. This is through provision of wide

range of tradable instruments to investors, provision of benchmark interest rates to underpin issuance of private sector debt and fostering growth of basic financial infrastructure.

Even as developing countries emulate developed world in the use of public domestic borrowing, it is good for policy makers to set policy objectives that are relevant to their economies. This is because although developed countries have high levels of public domestic debt, their markets are highly developed and with strong macroeconomic backing. Japan, for instance, has a level of public domestic debt to GDP whose growth has accelerated over many years but the country has not had a public debt crisis since its citizens have embraced a strong savings culture.

Keynes advocated for countercyclical government spending. This means that government deficit incurred during recessions should be cleared when a country is in a boom. The challenge faced by many countries is the ability to use domestic borrowing counter cyclically. Countries tend to continually rely on domestic debt to finance the budget deficit leading to permanent public debt. As public debt keep on growing, it compromises sustainability of central government debt in these countries.

The Commonwealth secretariat (1999) highlighted some of the problems brought about by a government's over reliance on domestic borrowing. These include:

- a) More and more government revenue being shifted towards debt servicing, therefore leaving very little for other desirable expenditure such as health, education and infrastructure leading to poor economic performance.
- b) Excessive borrowing leads to rise in interest rate as the government tries to entice investors to invest in government securities. This increases the cost of borrowing and crowds out private investors. Reduction in private investment lead to reduced income,

low employment levels, reduced taxation which means reduced government revenue and in turn leads to government contracting more public debt.

- c) Increased public debt through excessive borrowing today will mean higher debt servicing costs on future generations. This leaves the future generation with a burden of higher taxation.
- d) As a country public debt keeps rising, creditors face increased risk of default which leads to downgrading of a country's credit rating. For individuals to hold government securities of such a country they will demand to be highly compensated which will increase cost of borrowing in future.
- e) Finally if public domestic debt keeps building up, a level will be reached beyond which they become unsustainable. This can lead to an economic crisis or government insolvency.

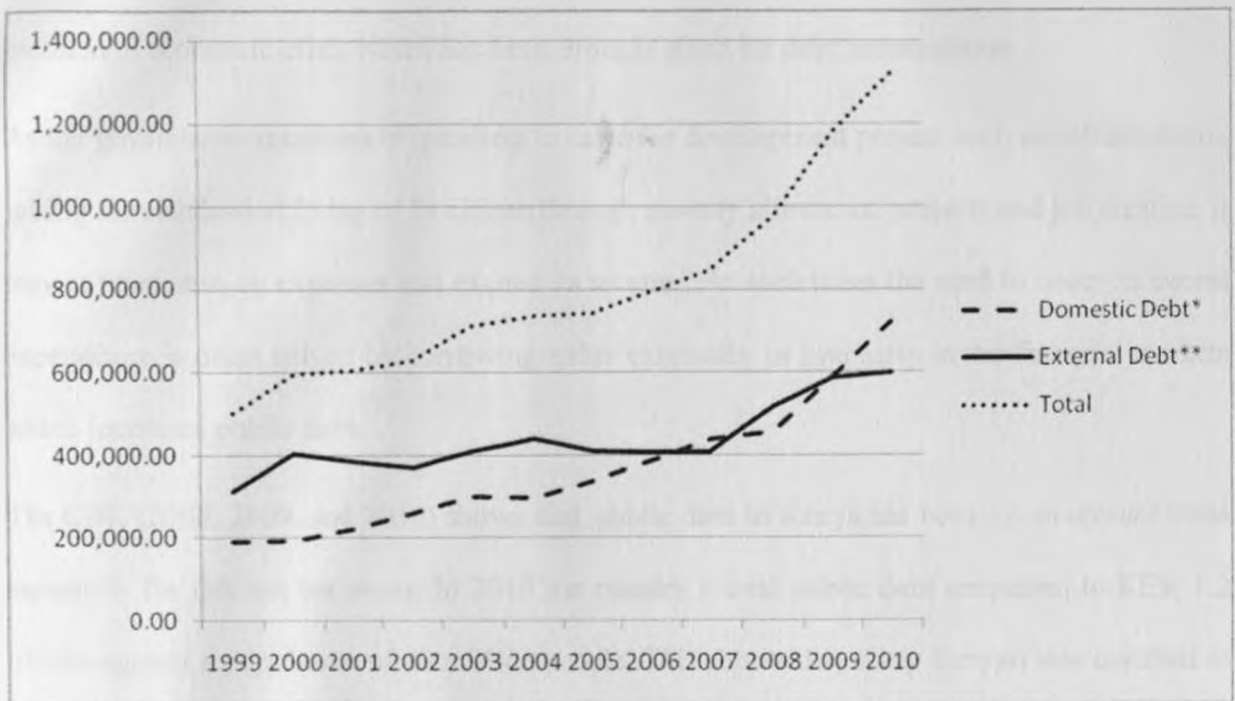
Kenya like majority of other developing countries has been experiencing growth of its total public debt. The CBK (2005) give statistics on public debt which stood at KES. 446,294 million in 1996 with external debt accounting for 50.3 percent of Gross Domestic Product (GDP) while public domestic debt represented only 17.5 percent of GDP. As sources of external public debt became scarcer there was a need by the government to strengthen the domestic debt market to tap local savings to finance its increasing budget deficit. In 2001 the government initiated steps to restructure public domestic debt and develop the domestic debt markets. This was to enable the government to use this market more efficiently through mitigation of roll over risk associated with short term securities (in 2010 the ratio of Treasury bond to Treasury bill stood at 70:30) and also to encourage local investors to turn savings into investments.

In 2003 the government saw the need to have debt management policies put in place. This is because in the past Kenya public debt management was characterized by weak public debt policy framework and ad hoc debt management strategies. Through technical assistance from the World Bank and the IMF an assessment report of central government public debt management and domestic debt market development program was established. The report recommended setting up of debt management office to oversee public debt management in Kenya. All these strategies have led to significant change in the composition of public domestic debt.

The CBK (2011) showed that for the period June 2009 to June 2010 total public debt had gone up to KES. 1.2 trillion, representing a percentage change of 5.1 of GDP from 45.9% to 51.0%. Public domestic debt rose significantly by 4.9% from 22.5% to 27.4% while external debt rose by only 0.2% from 23.4% to 23.6 % over the same period. This has helped the government meet their budget deficit needs, but on the other hand this has led to an increase in public debt.

Chart 1 shows the total public debt (internal and external) in Kenya. From 1999, there has been an upward trend of total public debt from KES. 502, 253 million in 1999 to 1,320,138 million in 2010 representing an increase of 162.84 percent. Out of this, public domestic debt have accounted for the highest increase of 278% compared to 92.31% rise in external debt during the same period of time. Panniza (2007) argues that, the advantage of external borrowing over domestic borrowing is that while the first increases a country's access to resources, the later only transfer resources within the country.

Figure 1: Composition of Public Debt in Kenya



Sources: Monthly Economic Review- Central Bank of Kenya.

**Includes public and publicly guaranteed foreign currency loans

*Domestic debt is reported on gross basis.

As the budget deficit requirements of Kenya continue to rise there is a need by the debt management team and policy makers to keep reassessing whether the rise in public debt is matched with respective economic growth. This is because if public debt is not well utilized, debt will accumulate at a higher rate than economic growth leading to permanent public debt accumulation a situation which leads to debt crisis.

1.2 Statement of Problem

Public domestic debt has been on the rise in majority of the SSA countries. Accumulation of public debt adversely affects the economy through high cost of debt servicing and rising interest rate which crowd out private investors. Financial crisis and economic insolvency is a result of

chronic accumulation of public debt. Currently countries in Euro zone are dealing with a problem of economic crisis which has been brought about by debt accumulation.

As the government increases its spending to cater for development projects such as infrastructure, raising the standard of living of its citizens through poverty alleviation projects and job creation, it may at times, run up expenses that exceed its revenue. At such times the need to cover its excess expenditure is often solved by borrowing either externally or internally in the financial markets which increases public debt.

The CBK (2008, 2009, and 2010) shows that, public debt in Kenya has been on an upward trend especially for the last ten years. In 2010 the country's total public debt amounted to KES. 1.2 trillion against a population of 40 million people. This shows that every Kenyan was indebted to the level of KES. 30,000.00. The shift has been towards domestic borrowing where in 2010 public domestic debt was estimated at 27.4% of GDP. Studies such as Panniza (2007) and Christensen (2005) have shown that public domestic debt is more expensive than external debt. This is because as the public domestic debt keeps on rising, government resorts to raise interest rate to continue attracting investors which increases cost of public debt servicing.

There is evidence that the amount of public debt in Kenya is rising. But how far can it rise without impacting negatively on macro economic factors? And does the government of Kenya have proper fiscal and management policies in place to ensure that public debt remain within manageable levels? Or is the Kenyan economy headed to public debt crisis in future.

Using criteria deployed by Qin D. et al (2005) in the context of the Philippines, this study seeks to analyze whether sustainability of public domestic debt is a matter of critical concern in Kenya. From the analysis, the study seeks to inform policy makers on possible policy direction that the

country needs to follow in order to avoid a debt crisis in future and ensure sustained economic growth is achieved.

1.3 The Research Questions

The study seeks to answer the following questions:

- a) What is the level and trend of public debt in Kenya?
- b) Is Kenya's public debt within sustainable levels?
- c) What are the policy issues to be addressed to ensure sustainability of public domestic debt is maintained?

1.4 Objectives of the Study.

The overall objective of this study is to analyze sustainability of public domestic debt in Kenya over the period 1980 to 2011. Specifically the study seeks to:

- a) Empirically perform sustainability test on public domestic debt.
- b) Perform sustainability test using debt ratios.
- c) Give policy recommendations based on the study's findings.

1.5 Justification of the Study

Public domestic debt has been on the rise in Kenya since late 1990s when the government resorted to increase domestic borrowing due to reduced availability of external funding. This borrowing if not properly managed can result to chronic deficit-financing which has the potential to trigger accelerated increases in inflation and interest rate. This would be accompanied by crowding out of private investors and may culminate into insolvency of an economy and austerity in government spending.

Majority of the research work done on public debt sustainability in developing economies has been in the context of external debt which affected many economies in 1980s. Even with the rise in domestic borrowing very little research has been done on ascertaining sustainability of public domestic debt. This study seeks to establish whether the upward trend of domestic borrowing by the government of Kenya is sustainable. The study applies public domestic debt sustainability test and give policy recommendations on the way forward for management of Kenyan public debt.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical Literature

The history of public debt can be traced as early as 1923 when Keynes argued that a government can incur budget deficit during recessions. Reinhard and Sturm (2008) noted that as predicted by the Keynesian tradition, markets sometimes may not fully utilize available productive resources. At such times the government has to ensure an adequate level of aggregate demand is created in the economy to stimulate economic growth, through creation of public debt to finance deficit spending. Public debt created should be offset by the budget surpluses acquired in times of boom. Permanent public debt must be avoided.

Domar (1944) expanded the Keynesian argument that debt financing of the government is necessary to restore the equilibrium aggregate demand. This is especially if private investors are unable to absorb saving over a long period of time. Once equilibrium between saving and investment is attained, additional government borrowing would lead to rise in public debt. Servicing of public debt requires future increases in taxation which raise the possibility of a future economic crisis. Domar (1944) states that for fiscal sustainability to be maintained the nominal GDP growth rate should be higher than the nominal rate of interest. A constant overall budget deficit to GDP ratio ensures convergence of both the public debt to GDP ratio and the interest to GDP ratio towards infinite.

Bohn (1991) criticized earlier theories used for testing sustainability since they were based on theoretical models that assumed an interest rate on government bonds above the average rate of economy. This theory argued that because of risk aversion, the equilibrium interest rate can be

below the average economic growth with public debt remaining sustainable. Bohn (1991 pg. 4) states that *“a sufficient condition for the sustainability of government policy in stochastic, dynamically efficient economies with complete market is that the level of the primary deficit responds positively to marginal changes in the debt-Gross National Product (GNP) ratio”*.

Chalk N. and Hemming R. (2000) discussed the theory of the Present Value Constraint (PVC) using inter- temporal government budget constraint. This approach states that for sustainability condition to be fulfilled in an economy, the Present Value (PV) of the future primary budget surpluses must be large enough to cover the difference between the initial primary deficits and the PV of the terminal public debt stock. If the PV is positive as the period approaches infinity, then the government fiscal policy is sustainable.

For public debt to be sustainable a transversality condition must hold, such that today's government debt is matched by an excess of future primary surpluses over primary deficits in PV terms. This constrains public debt from growing at a faster rate than the rate of interest. Sustainability of public debt becomes a matter of concern when total public debt exceeds the overall size of the economy.

2.2 Empirical Literature

Abbas and Christensen (2007) analyzed the optimal domestic debt levels in low income countries and emerging markets for the period 1975-2004. Using the Granger Causality regression model their study found that, first: moderate levels of marketable domestic debt as a percentage of GDP have significant positive effect on economic growth. Secondly, the study found that since commercial banks in low income and developing economies hold a major share

of government securities, public debt levels exceeding 35 percent of total bank deposits have negative impact on the economy.

Christensen (2005) analyzed the role of domestic debt markets in 27 SSA countries from 1980 - 2000. The study also sought to determine the impact of public domestic debt to private sector borrowing. The study found that domestic markets in these countries were undeveloped; debt securities have a short maturity profile and the countries had a narrow investor's base. The study also found that since majority of government securities were held by commercial banks (more than half of the outstanding public domestic debt) expansion of domestic debt market had a significant crowding out effects on private lending. Domestic debt financing was found to be much more expensive than foreign borrowing due to relatively higher domestic interest rates. Despite public domestic debt being less than external debt, domestic interest payment presented a significant burden to the budget.

Maana, Owino and Mutai (2008) sought to analyze the impact of development of public domestic debt markets in Kenya for the period 1996 to 2007, and provide policy recommendations on how to improve domestic debt management in Kenya. The study adopted the Barro growth regression model used by King and Levine's (1993). The composition of public debt in Kenya was found to have shifted towards public domestic debt. The study concurred with Christen (2005) that significant rise in public domestic debt implies higher domestic interest payments. Regression analysis indicated that public domestic debt expansion had a positive but insignificant effect on economic growth during the period. No evidence in support for crowding out private investors was established.

Adoufu and Abula (2010) analyzed causes and effects of rising public domestic debt on the Nigerian economy. The study applied Ordinary Least Square (OLS) technique using time series

data for 1986-2005. They established that domestic debt in Nigeria serve three main purposes which included: budget deficit financing, monetary policy tool and development of financial sector. Regression results showed that public domestic debt had negatively affected growth of the Nigerian economy. They recommend that ways should be established to reduce the outstanding domestic debt. The findings of the study showed that several factors such as high budget deficit, low output level, increased government expenditures, high inflation rate and narrow revenue base have contributed to rising public domestic debt in Nigeria.

Qin D. et al (2005) sought to develop empirical methods for ascertaining sustainability and feasibility of public debt in Philippines. The assessment was based on No Ponzi Game²(NPG) criterion using quarterly data for 1990 to 2004. The study applied auto regression to carry out sustainability tests on both public debt and public debt ratios using one lag series of data. Unit-root test results on both debt and debt ratios series exhibited strong non- stationarity properties meaning Philippines public debt was not sustainable. To test whether the necessary and sufficient condition for the NPG criterion was satisfied, the study examined effects of different interest rates. They concluded that the Philippines government was playing a weakly feasible ponzi game hence the country's debt situation was found to be vulnerable. A simulation model to examine how much an adverse shock would worsen the government public debt situation was carried out. It established that a simple fiscal policy of medium -term budget deficit control alone was inadequate to reverse the unsustainable debt situation in Philippines.

MEFMI (2001) sought to establish the level of debt sustainability in nine MEFMI countries using data for the period 1980-1997. The study was based on cointegration test. The condition to be tested was whether the cointegration coefficient b between government revenue and

² No ponzi game is a condition that ensures that government does not finance interest payments on outstanding public domestic debt by issuance of new bonds thereby increasing the initial stock of debt.

expenditure lies in the range $0 < b \leq 1$ using the Phillips and Hansen (1990) regression model. If the coefficient $b=1$ and government revenue and expenditure are cointegrated, it is an indication of strong form of debt sustainability. The study concluded that the changes in domestic debt to GDP ratio need not be zero for a country to have fiscal sustainability, but there is a critical threshold beyond which domestic debt and thus fiscal position is not sustainable. Results from regression showed that Botswana and Namibia had a strong form of sustainability. Uganda, Tanzania, Lesotho and Swaziland had a weak form of sustainability. Malawi, Zimbabwe and Zambia fiscal policies were unsustainable.

Bernie, Ndove and Tjipe (2004) sought to establish whether the fiscal policy in Namibia was sustainable using data for the period 1990-2002. The study applied the model used by Ley (2003) supported by the MEFMI (2001) approach. They tested Namibia debt sustainability using three scenarios which included historical data, projections and worst case scenario. Using Ley (2003) model, results on debt-GDP ratio indicated that public debt was sustainable in the first two scenarios. In a worst case scenario, results showed that Namibia's central government debt may become unsustainable if the macroeconomic environment changes. Using the MEFMI (2001) approach results showed cointegration of order one between government revenue and expenditure. This indicated that Namibia's public debt will be sustainable in the medium term.

El-Mahdy and Torayeh (2009), sought to assess and analyze whether the growth of the public domestic debt is consistent with sustainability path using data for the period 1985-2006. The study adopted the model used by Pallitto, Poirson and Ricci (2002) to investigate the non linear growth effects of public domestic debt in Egypt using domestic debt to GDP ratio and various control variables. The estimated coefficient of the error correction term was statistically significant at 5% with a negative sign. They concluded that persistent uptrend of domestic debt

exerted negative short run and long run impacts on economic growth in Egypt. High public domestic debt will eventually push interest rates up which could lead to crowding out effects. The study argued that the rapid growth of public domestic debt in Egypt was a challenge to future public debt sustainability if proper fiscal management policies were not put in place to reverse the situation.

Florencia M. et al (2006) analyzed the fiscal sustainability of Argentina for the period 1865 to 2002. The study adopted the model used by Hamilton and Flavian (1984) which uses inter-temporal government budget constraint to test whether government revenues and expenditure were cointegrated. Tests done on various sub samples showed that Argentina's fiscal performance had either been weakly unsustainable or not sustainable.

2.3 Overview of the Literature

It is evident from literature review that every government is faced with a challenge of balancing between the need to finance its budget deficit through domestic borrowing and the danger of creating chronic debts. A moderate level of public domestic debt in an economy has proved to have positive effects on economic growth. Public domestic debts in developing countries have been growing rapidly over the years since they act as a substitute to scarce foreign debt. This growth in domestic debt has not had a direct impact in GDP growth in many countries. This situation a situation has led to public domestic debt accumulation and which affect macroeconomic variables.

Failures to implement good policies to curb ever increasing debt have seen countries suffer from unsustainable public debt. To address this problem, policy makers have seen the need to carry

out debt sustainability test to analyze the status of their fiscal policies. These tests have established that some countries such as Philippines (2005) were playing a ponzi game and their public debts had reached unsustainable levels. Study by Maana et al (2008) found that composition of public debt in Kenya has shifted towards domestic debt although the results did not show any support of crowding out private sectors. There is therefore a need to perform sustainability test on the Kenyan public domestic debt and establish whether the current fiscal policies will remain sustainable in the medium term.

CHAPTER THREE

METHODOLOGY

3.1 Model Specification

The literature on public domestic debt is primarily concerned with whether or not government inter temporal solvency constraint is violated. Empirical examinations of this issue have fallen into two categories. The first group of studies such as Hamilton and Flavian (1986), Wilcox (1989) and Qin et al (2005) examined the possibility of stationarity in public debt by conducting tests of unit roots. Evidence against the existence of unit roots has been considered as support for strong form of public debt sustainability.

The second group of studies such as MEMFI (2001), Quintos (1995), Hakkio and Rush (1991) and Trehan and Walsh (1989) has addressed the issue of public debt sustainability by examining the long run relationship between non stationary using cointegration. The existence of cointegration has been considered as evidence consistent with the inter-temporal budget constraint and can be regarded as the weak form of public debt sustainability. This study will use the two tests to establish whether the Kenyan government debt is stationary and if not whether the series are cointegrated of order I (1) meaning its weakly sustainable.

This research study adopts the empirical method developed by Duo Qin et al (2005) to assess sustainability of public debt using the No ponzi Game criterion and uses Kenya as a test case. The research study has applied two approaches to test public domestic debt sustainability. First tests are carried out using nominal values of public domestic debt. The second approach carries out tests in relative terms using public debt to GDP ratios.

To develop the model we start from the accounting identity where government debt in period 1 is given by the primary deficit (government revenue less expenditure), the value of debt in period 0 and interest rate at period 0. Government inter temporal budget constraint in nominal terms can be expressed as;

$$B_{t+1} = (1+r_t)B_t + G_{t+1} - T_{t+1} \dots\dots\dots (1)$$

Where B_t is the nominal value of government debt at time t

r_t is the one period rate of interest payable on the government debt

T_t is the government revenue in time t

And G_t is government expenditure in time t

This equation implies that new debt is issued to finance budget deficit when there is a shortage. Hence through iterations, the following condition must hold in all periods such that in period 2 we have;

$$B_{t+2} = (1+r_{t+1})B_{t+1} + G_{t+2} - T_{t+2} \dots\dots\dots (2)$$

Substituting B_{t+1} from equation 1 to equation 2 give us,

$$B_{t+2} = (1+r_{t+1})[(1+r_t)B_t + G_{t+1} - T_{t+1}] + G_{t+2} - T_{t+2} \dots\dots\dots (3)$$

We can get B_t by rearranging equation 3 which is expressed as,

$$B_t = \frac{B_{t+2}}{(1+r_{t+1})(1+r_t)} + \frac{T_{t+2} - G_{t+2}}{(1+r_{t+1})(1+r_t)} + \frac{T_{t+1} - G_{t+1}}{(1+r_t)} \dots\dots\dots (4)$$

Rewriting equation 4 for the subsequent periods can be summarized as,

$$B_t = \sum_{j=1}^{\infty} \frac{-D_{t+j}}{\prod_{i=1}^j q_{t+i}} + \lim_{\tau \rightarrow \infty} \frac{B_{t+\tau}}{\prod_{j=1}^{\tau} q_{t+j}} \dots\dots\dots(5)$$

Where $q_t = (1+r_{t+j})$ is the one period interest factor

And $T_{t+j} - G_{t+j} = D_{t+j}$ is the primary deficit

For an economy, the following condition must hold to have sustainable fiscal policy as it imposes a government inter temporal budget constraint and results to a NPG condition.

$$\lim_{\tau \rightarrow \infty} \frac{B_{t+\tau}}{\prod_{j=1}^{\tau} q_{t+j}} = 0 \dots\dots\dots(6)$$

Condition (6) is a necessary condition for the long-run debt sustainability. It means that:

- (i) The value of current government debt equals the sum of future primary budget surpluses.
Thus governments would only run future surpluses equal to current market value of debt in expected value terms.
- (ii) The present value of government debt must approach zero in infinity. This implies that the government debt will grow at a lower rate than the average interest rate over time.

The second approach is based on relative rather than nominal terms. The public debt to income ratio is used to carry out the debt sustainability test. The debt ratio $b_t = B_t/Y_t$ and the primary deficit ratio $d_t = D_t/Y_t$, given by revenue ratio (T_t/Y_t) minus government expenditure ratio (G_t/Y_t) are used to restate equation 5.

Equation (5) expressed in debt ratio terms becomes:

$$b_t = \sum_{j=1}^{\infty} \left[\prod_{i=1}^j \frac{g_{t+i}}{q_{t+i}} \right] (-d_{t+j}) + \lim_{\tau \rightarrow 0} \prod_{j=1}^{\tau} \frac{g_{t+j}}{q_{t+j}} b_{t+\tau} \dots\dots\dots (7)$$

Where g_t is the growth factor and $Y_{t+1} = g_{t+1} Y_t$

In this case if a country's debt is sustainable it must satisfy condition (8)

$$\lim_{\tau \rightarrow 0} \prod_{j=1}^{\tau} \frac{g_{t+j}}{q_{t+j}} b_{t+\tau} = 0 \dots\dots\dots (8)$$

Qin et al (2005) argues that the empirical tests of the public debt sustainability tries to establish whether the conditions of No Ponzi game are satisfied. One way of evaluating public debt sustainability is to investigate past fiscal data to see if the government debt follows a stationary process by testing whether the public debt series has unit root. In order to carry out unit root tests, Augmented Dickey Fuller (ADF) test are performed. Since the explanatory variable is a lagged value of dependent variable, autoregressive (AR) process is used to perform public debt sustainability test using equations 10 and 12.

Order one is stated as;

$$a) B_t = \alpha_0 + \alpha_1 B_{t-1} + \varepsilon_t \dots\dots\dots (9)$$

This can be expressed as follows for order k.

$$B_t = \sum_{k=0}^{t-1} \alpha_0 \alpha_1^k + \alpha_1^t B_0 + \sum_{k=0}^{t-1} \alpha_1^k \varepsilon_{t-k} \dots\dots\dots (10)$$

Where ε_t is a zero mean stationary process.

When $\alpha_1 < 1$, the NPG condition in (6) is satisfied and the fiscal policies are sustainable.

If $\alpha_1 > 1$ the debt series is non stationary.

Similarly for the scaled variables,

$$b_t = \beta_0 + \beta_1 b_{t-1} + v_t \dots \dots \dots (11)$$

This can be expressed as follows for order k,

$$b_t = \sum_{k=0}^{t-1} \beta_0 \beta_1^k + \beta_1^t b_0 + \sum_{k=0}^{t-1} \beta_1^k v_{t-k} \dots \dots \dots (12)$$

Where v_t is a zero mean stationary process.

When $\beta_1 < 1$, the NPG condition in (8) is satisfied and the fiscal policies are sustainable.

If $\beta_1 > 1$ the debt series is non stationary.

After testing for the necessary condition (6 and 8), if the condition is not satisfied we extend our analysis to establish whether the sufficient condition for public debt sustainability is satisfied.

According to Chalk and Hemming (2000) stationary of public debt series is a necessary but not a sufficient condition for public debt sustainability. This means that public debt could be sustainable even if debt and debt ratios are non stationary. If there exist unit root, meaning the series are non stationary a necessary and sufficient condition for public debt sustainability is to test whether the series are cointegrated of order I (1). Accepting the null hypothesis of no cointegration will mean that Kenyan Public domestic debt is not sustainable.

Quintos (1995) defines cointegration relationship between government revenue and expenditure with a cointegration coefficient close to one, given that both series are non stationary and of the

same order of integration as the necessary and sufficient condition for inter-temporal budget constraint given as;

$$R_t = a + B_1 G_t + u_t \dots\dots\dots(13)$$

u_t is the error term.

Where $B_1 < 1$ check whether R_t and G_t series form a cointegration relationship. The public debt is sustainable in the strong form if and only if the R_t and G_t series are integrated I (1).

Trehan and Walsh (1988) give an alternative method to examine whether the data are consistent with the inter-temporal budget constraint. This includes studying the cointegration relationship between the public debt and the primary deficit given that both series exhibit non stationary properties. A necessary and sufficient condition for public debt sustainability is that debt and primary balances are cointegrated I (1) such that

$$B_{t+1} - B_t = rB_t + D_t \dots\dots\dots(14)$$

If B_t is integrated of order 1 then $B_{t+1} - B_t$ is stationary by definition.

3.2 Time series properties

An empirical test of the public debt sustainability entails knowledge of time series properties of the variables in the equation. This is because in theory one way of establishing whether a country's public debt is sustainable or not is performing unit root tests. If a trend is stationary it gives an indication that the public debt is sustainable. The presence of unit root shows that the trend is non stationary and the country's public debt is unsustainable.

3.3. Cointegration Analysis

Cointegration is a long-run concept that shows that group of variables move together because they are tied together by some theory. The idea behind cointegration is that although macro economic variables may trend up and down over time, groups of variables may drift together. Variables are said to be cointegrated if a linear combination of these variables assumes a lower order of integration. If the variables of interest are cointegrated of order I (1) then Kenyan public domestic debt is sustainable even though the series are non stationary.

3.4 Hypothesis tested

The research intends to test the following hypotheses to check whether the Kenyan domestic debt is sustainable or not.

- a) $H_0: \alpha_1 > 1$ Kenyan public debt is unsustainable
 $H_a: \alpha_1 < 1$ Kenyan public debt is sustainable
- b) $H_0: \beta_1 > 1$ the debt series is non stationary
 $H_a: \beta_1 < 1$ NPG condition is satisfied
- c) $H_0: p < \text{than } 5\%$, Revenue and expenditure not cointegrated
 $H_a: p > \text{than } 5\%$, Revenue and expenditure are cointegrated
- d) $H_0: p < \text{than } 5\%$, Debt and Deficit are not cointegrated
 $H_a: p < \text{than } 5\%$, Debt and deficit are cointegrated

3.5 Diagnostic tests

Diagnostic test establishes whether the model is consistent or not. The following tests were carried out to test for consistence of the model used. Test for normality Jarque-Bera statistics to determine whether the residual variances are normally distributed. Serial correlation test are done to establish whether the residual variance is correlated. Another test performed is the test for heteroskedasticity. This determines whether the error terms have equal variances or not. If the variances are not constant, heteroskedasticity is present.

3.6 Definition of Variables

This section defines the variables which are used to carry out sustainability test of the Kenyan public domestic debt. These variables include:

- I. **Government debt (DDEBT)** this is the amount of public domestic debt incurred by the government every year in nominal values. It was measured in million Kenyan shillings. In our analysis it is taken as the dependent variable.
- II. **Government expenditure (EXP_G)** this is total government expenditure both recurrent and development. It was measured in million Kenyan shillings and expressed in nominal values since there in no common deflator of all sources of revenue.
- III. **Government Revenue (REV)** this is the amount of revenue collected from all revenue generating sources in the country at a period of time. It was measured in million Kenyan shillings and expressed in nominal values since there in no common deflator of all sources of revenue.

- IV. **Interest rate (Tbill)** The 91-days Treasury bill rate was used as a proxy for the cost of debt. This is the one period rate of interest payable to the holders of the government securities. It was expressed in percentage.
- V. **Debt ratio (DEBRAT)** this is the ratio of government domestic debt to GDP. It is expressed in percentage and explains the rate at which a countries national income is supported by borrowing.
- VI. **GDP (GDP_Nom)** this is the national income of the Kenyan economy in nominal values. It was measured in million Kenyan shillings.
- VII. **GDP deflator (GDP_DEFL)** it is computed as a ratio of nominal GDP divided by Real GDP multiplied by 100. It is done for accuracy of results.
- VIII. **Government balance (GVbal)** this is the government budget deficit. It is the difference between government revenue and expenditure. When revenue is greater than expenditure it is a surplus and the vice versa is a deficit.

3.7 Data sources and Types

This study has used annual time series secondary data for the period 1980-2011. The main sources of data include Central Bank of Kenya, Annual Statistical Abstracts and Economic Surveys from Kenya National Bureau of statistic (KNBS), and Kenya Institute for Public Policy and Research Analysis (KIPPRA) data compendium.

CHAPTER FOUR

EMPIRICAL RESULTS AND DISCUSSIONS

4.1 Introduction

In this chapter the empirical tests on Kenya's public domestic debt is performed to establish whether it meets sustainability conditions. As pointed in section 3.0 to evaluate the fiscal policy sustainability, one investigates past fiscal data with a view to determine whether government debt follows a stationary process and if not stationary whether the series are cointegrated I (1). The estimations use annual sample data from 1980- 2011.

4.2 Descriptive Statistics

This study examined whether the variables used in the analysis are normally distributed. Most economic data is skewed (non-normal), possibly due to the presence of outliers. The Jarque-bera statistics test is used to test normality of the series. It utilizes the mean based coefficients of skewness and kurtosis to check normality of variables used.

Normality test uses the null hypothesis of normality against the alternative hypothesis of non-normality. If the probability value is less than Jarque-Bera chi-square at the 5 percent level of significance, the null hypothesis is not rejected

Appendix table A3 provides the summary statistics of the variables used for analysis. The Jarque-Bera tests reveals that the debt and debt ratios follows a normal distribution. The average public domestic debt over the sample period is KES. 214,240 million with the average debt to

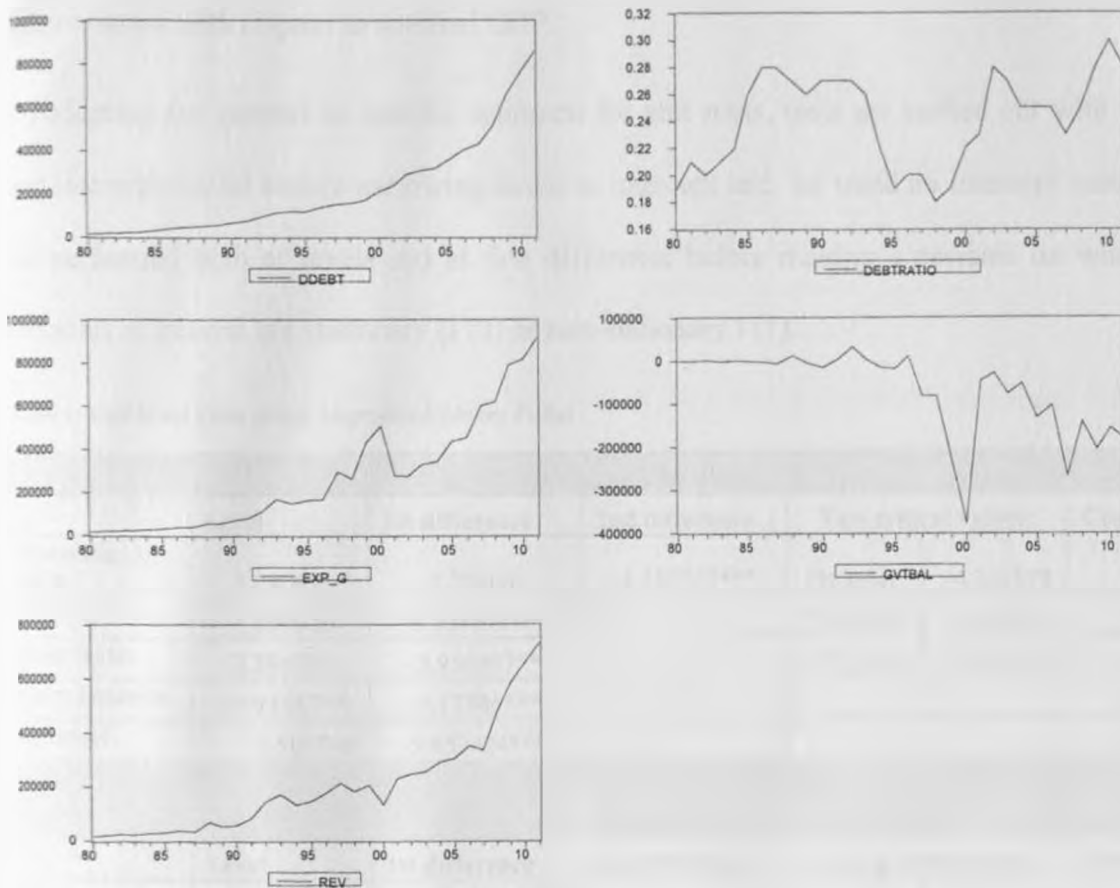
GDP ratio standing at 24%. This means every year, the Kenya incurs a public domestic debt equal to KES. 214, 240 million which account for 24% of the GDP.

4.3 Unit Roots Tests

This study undertook unit root tests to establish whether the Kenyan public debt is stationary. Presence of unit root indicates a violation of NPG condition which is a necessary condition for public debt sustainability.

The appropriate public debt sustainability test is then to see if the historical process that generates fiscal data is likely to result in the PVBC eventually being violated. Hamilton and Flavian (1986) argue that a sufficient condition for PVBC to hold is for the primary balances to be stationary. Stationarity test are performed by establishing whether a series has unit root or not. Presence of unit root raises doubt about a county's public debt sustainability.

Figure 2: Graphical Tests for Unit roots



From the graphical presentation (figure 2), domestic debt in levels appears to follow an upward trend with a slight reduction between 1995 and 2000. The period between 2005 and 2010 saw a rapid increase public domestic debt after the change of governing regime. The ratio of debt to GDP has been fluctuating with some years experiencing a ratio of as high as 30%. Government revenue and expenditure have been on an upward trend. To establish whether these trends follow a stationary process which confirm with a necessary condition for sustainability, we will perform unit root tests.

ADF tests are performed to test presence of unit root tests. Since the explanatory variable is a lagged value of dependent variable, AR process is used to test for public debt sustainability using

equations 10 and 12. This is done at both as nominal values using government debt and in relative terms with respect to nominal GDP.

By adopting the general to specific approach for unit roots, tests are carried out with the trend and intercept model before narrowing down to intercept and no trend no intercept model. Tests are performed both at levels and at first difference before making a decision on whether our variables of interest are stationary I (0) or non-stationary I (1).

Table 1: Unit Root Tests using Augmented Dickey Fuller

ADF-Trend and Intercept						
	Level	1st difference	2nd difference	Test critical values:		Conclusion
Domestic DEBT	3.39001	-2.704663	-5.556767***	1% level	-4.323979	I(2)
EXP_G	-1.267926	-6.504944***		5% level	-3.580623	I(1)
Debt Ratio	-2.396391	-3.956567**		10% level	-3.225334	I(1)
Govt Balance	-3.991062**	-7.17886***				I(0)
Revenue	0.502748	-5.853424***				I(1)
ADF- Intercept						
	Level	1st difference	2nd difference	Test critical values:		Conclusion
Domestic DEBT	8.747196	1.362336	-6.211135***	1% level	-3.67017	I(2)
EXP_G	1.095484	-5.873932***		5% level	-2.963972	I(1)
Debt Ratio	-2.387563	-4.030135***		10% level	-2.621007	I(1)
Govt Balance	-2.562674	-7.302763***				I(1)
Revenue	2.770075	-4.660388***				I(1)
ADF- None						
	Level	1st difference	2nd difference	Test critical values:		Conclusion
Domestic DEBT	12.10172	2.173998	-5.79954***	1% level	-2.644302	I(2)
EXP_G	2.385116	-5.081593***		5% level	-1.952473	I(1)
Debt Ratio	0.535619	-4.090326***		10% level	-1.610211	I(1)
Govt Balance	-1.841359	-7.383449***				I(1)
Revenue	4.344389	-1.707112*				I(1)

*(**)[***] significant at 10(5)[1] % level

The ADF test for Unit root involves setting the null hypothesis of unit root. The null is rejected if the ADF statistics is small (more negative) than the test critical value as shown in table 1.

It can be seen from the conclusions column that domestic debt is integrated of order two. This implies that it must be differenced twice to become stationary. Since it is found to be non-stationary, it raises doubt about sustainability of public domestic debt in Kenya. Government expenditure, debt ratio, government balance and revenue are integrated of order one. To become stationary, they must be differenced once. Results show that both debt and debt series exhibit strong non stationary properties.

To confirm the test results, a regression analysis is performed on both debt and debt ratios. Since the explanatory variable is a lagged value of the dependent variable AR process is used. To make a decision on the lag length of our AR model correlogram is used. The lag must be long enough to make our residual white noise (stationary).

Table 2: 1st difference Correlogram: Domestic Debt and Debt Ratio

Domestic Debt						
Sample: 1980 – 2011						
Included observations: 31						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob.	
. *****	. *****	1	0.733	0.733	18.340	0.000
. ****	. *	2	0.499	-0.084	27.125	0.000
. **	. .	3	0.339	0.009	31.329	0.000
. *	. *	4	0.199	-0.071	32.822	0.000
. .	. .	5	0.120	0.031	33.385	0.000
Debt Ratio						
Sample: 1980 – 2011						
Included observations: 31						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob.	
. **	. **	1	0.244	0.244	2.0238	0.155
. *	. *	2	-0.084	-0.153	2.2748	0.321
. .	. .	3	-0.068	-0.007	2.4419	0.486
. .	. .	4	-0.061	-0.058	2.5844	0.630
. .	. .	5	-0.162	-0.154	3.6150	0.606

From table 2 above, the lag length of 4 is adequate to make our residuals white noise. This implies therefore, we needed to perform and AR of order 4 for both domestic debt and debt ratio as a percent of GDP.

4.4 Estimation: Autoregressive Process (AR lag 4)

Table 3: Autoregressive Models (AR 4)

		1983 2011					
		Obs	29				
		AR(1)	AR(2)	AR(3)	AR(4)	C	Adj. R ²
Ddebt	Coefficient	1.452706	0.82529	0.833064	-0.30637	27185.1	0.99
	t stats	(7.4)***	(-2.2)**	(2.2)**	(-0.9)	(0.8)	
Debtrat	Coefficient	1.152183	0.50869	0.175471	-0.16438	0.245439	0.67
	t stats	(5.5)***	(-1.6)	(0.6)	(-0.8)	(22)	

(**)[***] significant at 10(5)[1]% level

AR results as shown in table 3 for domestic debt shows an adjusted R-squared of 99% which implies the model produces the best fit for our data. Lag terms one to three are statically significant at 1 per cent, 5 per cent, respectively. Debt ratio shows an adjusted R-square of 67%, which is defensible as providing a good fit for the data. However, only the order one of the lag term is found to be statistically significant at 1 percent level. The intercept is also statistically significant at 1 percent level. This confirms that both debt and debt ratios are integrated of order 1.

4.5 Estimation: Johansen Cointegration Test

As Chalk and Hemming (2000) indicated stationary of public debt series is a necessary but not a sufficient condition for public debt sustainability. This means that public debt could be sustainable even if debt and debt ratios are non stationary. As Quintos (1995) put it, a necessary and sufficient condition for inter-temporal budget constraint is that government revenue and expenditure should be integrated I (1). This will form a weak form of sustainability. Another alternative is to examine the cointegration relationship between the public debt and the primary deficit given that both series exhibit non stationary properties. A necessary and sufficient condition for public debt sustainability is that debt and primary balances are cointegrated I (1)

Johansen (1988) suggests two approaches to find out the existence of cointegration vectors in non stationary time series.

a) Likelihood ratio trace statistics

b) Maximum Eigen value statistics

Table 4: Johansen Cointegration Test

Debt, Deficit Series

a) Likelihood ratio trace statistics

Hypothesized No. of CE(s)	Eigen Value	Trace Statistics	0.05 Critical Value	Prob.
None	0.409216	25.11478	15.49471	0.0013
At most 1	0.247121	8.799354	3.841466	0.0030

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

b) Maximum Eigen value statistics

Hypothesized No. of CE(s)	Eigen Value	Trace Statistics	0.05 Critical Value	Prob.
None	0.409216	16.31543	14.26460	0.0234
At most 1	0.247121	8.799354	3.841466	0.0030

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Revenue, Expenditure Series

a) Likelihood ratio trace statistics

Hypothesized No. of CE(s)	Eigen Value	Trace Statistics	0.05 Critical Value	Prob.
None	0.311170	20.99155	15.49471	0.0067
At most 1	0.262424	9.435977	3.841466	0.0021

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

b) Maximum eigen value statistics

Hypothesized No. of CE(s)	Eigen Value	Trace Statistics	0.05 Critical Value	Prob.
None	0.311170	11.55558	14.26460	0.1285
At most 1	0.262424	9.435977	3.841466	0.0021

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

The results of the table 4 shows there is cointegration relationship between each two variables. (i.e Debt and Deficit, Revenue and Expenditure). The p-value shows the null hypothesis of no cointegration is rejected in favour of cointegration at 5% level of significance.

4.6 Diagnostic tests

Diagnostic test shows whether the model is consistent or not. Such tests include test for normality, serial correlation and heteroskedasticity tests. The Jarque-Bera statistics test is used to test normality of the series. Normality test uses the null hypothesis of normality against the alternative hypothesis of non-normality. If the probability value is less than Jarque-Bera chi-square at the 5 percent level of significance, the null hypothesis is not rejected. Figure 3 in appendix gives the summary of the normality test. From the p value of 0.7852, we do not reject the null hypothesis. And conclude that the residuals are normally distributed.

Serial correlation test tries to establish whether the lag correlation between two different series is the same. In a regression model containing lagged values of the regressand or higher-order autoregressive, Breusch-Godfrey serial correlation (LM) test is more appropriate in establishing whether the problem of serial correlation is present. The null hypothesis of no serial correlation is rejected if the p value exceeds the critical chi-square value of the chosen level of significance. From the p value of 0.1362 in Appendix table A7, we do not reject the null hypothesis. And conclude that the residuals are not serially correlated.

Heteroscedasticity test the presence of unequal spread between variances. When the variance is not constant it means the variance varies depending with the value of explanatory variable taken giving biased results. Appendix table A8 shows White test result which shows the residuals are homoskedastic.

4.7 Discussion of Results

We begin with the full sample model in which the coefficient on AR (1) is equal to 1.45 units and is statistically significant at 1 percent level. A one unit increase in previous period's domestic debt leads to 1.45 increase in debt of the current domestic debt, holding all other factors constant. This implies that domestic debt will keep on increasing providing evidence of Ponzi Game Scheme on the part of the authorities. It also means that the fiscal policy is unsustainable for Kenya. This result is supported by the unit root process ascertained earlier on.

Debt ratio as a percent of GDP shows the coefficient on AR (1) equivalent to 1.15 percent and is statistically significant at 1 percent. A one percent increase in previous period's debt to GDP ratio, leads to an increase in the current debt to GDP ratio by 1.15 percent, holding all other factors constant. Based on the above findings, the NPG condition is violated in the Kenyan case meaning the Kenyan public domestic debt do not satisfy the condition for strong sustainability

However cointegration tests performed on series of revenue and expenditure and debt and deficit shows that the two series are cointegrated. This means there is a long run relationship between the variables. Since cointegration is a necessary and sufficient condition for sustainability we conclude that Kenyan public domestic debt is weakly sustainable.

CHAPTER FIVE

CONCLUSION AND POLICY RECOMMENDATION

5.1 Summary

Prudent debt management and testing of government fiscal policies is critical for every country. Failures to implement good policies to curb ever increasing debt have seen countries suffer from unsustainable public debt. Although a lot of research has been done on public domestic debt sustainability test in developed economies, less has focused on developing countries, including Kenya. This study sought to contribute to understanding the dynamics of Kenya's public domestic debt and draw lessons regarding the sustainability of public domestic debt and recommend policy actions needed.

Thus the overall objective of this study was to analyze sustainability of domestic debt in Kenya over the period 1980 to 2011. Specifically the study sought to perform sustainability test on public domestic debt both at levels and in relative terms as domestic debt as a per cent of GDP.

Historical data is investigated with a view to determine whether the data generating process entails a stationary or non stationary process. This was done by conducting unit root tests using the ADF method. Since the explanatory variable is a lagged value of dependent variable, AR model was estimated to establish whether the NPG condition is satisfied for the Kenyan case.

The unit roots tests performed show that Kenya's domestic debt management falls short of meeting the NPG condition and the government is borrowing to repay interest on existing debt. This means that the public domestic debt will grow at a higher rate than national income since the country is not producing enough surpluses to ensure the PV of government debt converges to

zero in future. These findings are also supported by results of the AR model in which shows the coefficient on AR (1) of domestic debt at 1.45 units which is a violation of the NPG condition in which the coefficient should be less than 1.

The study utilized the Johansen cointegration technique to unveil the existence of a long-run relationship debt and budget deficit and also between revenue and expenditure. Since the null hypothesis of no cointegration is rejected, the study concludes that Kenyan public domestic debt is weakly sustainable and the government is practicing ponzi games

5.2 Policy Recommendations

In terms of recommendations, several policy implications can be drawn. Public debt has an impact on other macroeconomic variables e.g interest rates and overall economic growth which are also factors that determine public debt sustainability. There should be collective action to control public domestic debt in the country to ensure it remains within the sustainable level. One such policy is to avoid the ponzi scheme practice by utilize revenue or income from sale of assets to retire some of the domestic debt. The Government should also consider financing its development expenditures from tax revenues and not through domestic borrowing.

One way the Kenyan government has been able to utilize the domestic market is through strategies which has made it very vibrant especially the ability to trade government securities in the secondary market. Since these markets remain inefficient, proper policies should be put in place to ensure rapid growth of the financial markets. When a country has a well established financial market with diversified investors and tradable instruments, it can borrow without affecting private investors.

There is also a need by the government authority to ensure there is a balance between external and domestic debt. As Panniza (2007) argued, external borrowing is preferable to internal borrowing since while the first increases a country's access to financial resources, the later only transfer financial resources within the country causing competition among users. Government should also engage with international lending institutions as a first priority before they turn to local market. They should also float Euro bonds³ to capture the international market.

Faster expansion in output is essential for the economy to mobilize enough revenue resources and also lower the domestic debt to GDP ratio and gravitate towards the NPG convergence condition. Kenya relies significantly on imported goods even for the commodities that can be produced or manufactured domestically. This has killed all our local industries and denied the government on tax revenue. The government should give good incentives to local investors to revive the industries. Proper policies should be put in place to ensure that the country's production increases as a way of increasing the national income so as to produce government spending surpluses.

As the county shift from a central way of governing to county governments, proper policies should be put in place to ensure contingent liabilities of county government is well budgeted for. Since the central government will be a guarantor of loans taken by these governments it should ensure that funds allocated to counties are not misappropriated leading to more debts.

Public debt creditors should also ensure that their lending policies address achievement of public debt sustainability by funding projects based on incentive by the government to achieve sustainability.

³A Eurobond is a bond issued in a currency other than the currency of the country or market in which it is used.

5.3 Areas for Further Research

This study is limited to domestic debt. A more holistic approach to assess the sustainability of Kenya's public debt and consolidated debt for the entire economy may be pursued. The dynamic analysis may be enhanced by looking at the projected trends in domestic debt for Kenya. To establish the level at which the government is playing ponzi game there is a need to test for public debt feasibility in Kenya.

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Appendices

Table A1: Raw Data

YEAR	Ddebt	GDP cons	GDP Nom	GDP Defl	Debratio	Rev	Exp	Gvtbal	91tbill
1980	12,250.54	548,000	65,671	14.51	0.19	17,004.40	17,214.92	(210.52)	6.03
1981	16,045.10	569,000	75,197	14.61	0.21	20,376.58	20,614.04	(237.46)	10.12
1982	17,570.39	574,617	86,181	15.00	0.20	22,860.96	21,519.76	1,341.20	13.48
1983	20,342.98	592,508	96,043	16.21	0.21	21,359.42	22,617.76	(1,258.34)	15.12
1984	24,401.30	601,135	109,942	18.29	0.22	27,431.52	26,714.84	716.68	12.50
1985	31,930.50	627,201	123,915	19.76	0.26	30,209.12	30,911.06	(701.94)	14.14
1986	41,210.00	665,743	146,324	21.99	0.28	35,552.52	37,484.66	(1,932.14)	11.15
1987	45,449.00	697,480	163,190	23.40	0.28	33,082.80	38,388.24	(5,305.44)	13.00
1988	50,357.00	733,960	187,863	25.60	0.27	69,632.26	56,654.06	12,978.20	15.00
1989	54,879.70	769,695	215,051	27.95	0.26	52,744.50	57,219.20	(4,474.70)	14.00
1990	65,705.60	804,825	240,602	29.90	0.27	56,235.50	70,761.70	(14,526.20)	15.93
1991	72,527.40	816,504	272,638	33.40	0.27	83,171.70	79,435.98	3,735.72	16.77
1992	90,521.00	814,402	331,102	40.67	0.27	145,264.66	111,923.70	33,340.96	16.96
1993	110,339.70	820,675	426,941	52.04	0.26	170,956.14	167,894.20	3,061.94	39.34
1994	118,270.50	857,532	536,517	62.58	0.22	132,963.30	148,040.62	(15,077.32)	17.90
1995	116,180.00	887,797	600,837	67.70	0.19	146,086.56	164,484.30	(18,397.74)	20.90
1996	137,556.70	918,378	683,839	74.48	0.20	177,570.12	166,432.12	11,138.00	21.61
1997	151,170.00	920,848	765,528	83.16	0.20	214,392.98	295,783.66	(81,390.68)	26.36
1998	156,132.10	951,739	846,125	88.93	0.18	183,352.88	264,587.35	(81,234.47)	12.56
1999	169,038.50	971,761	900,091	92.65	0.19	206,213.39	432,346.34	(226,132.95)	20.47
2000	211,812.60	976,485	960,124	98.34	0.22	133,645.05	509,990.85	(376,345.80)	13.47
2001	235,991.00	1,020,004	1,020,007	100.00	0.23	229,644.28	276,154.27	(46,509.99)	10.81
2002	289,376.97	1,025,684	1,035,374	100.95	0.28	246,205.29	274,224.23	(28,018.94)	8.38
2003	306,234.66	1,055,891	1,138,061	107.81	0.27	254,686.32	330,615.60	(75,929.28)	1.41
2004	315,572.50	1,109,771	1,286,462	115.97	0.25	291,178.08	342,586.53	(51,408.45)	8.29
2005	357,838.95	1,175,248	1,445,477	123.25	0.25	305,218.00	436,773.21	(131,555.21)	8.14
2006	404,706.35	1,249,470	1,642,405	131.98	0.25	352,013.17	454,501.72	(102,488.55)	5.83
2007	430,611.73	1,336,846	1,833,511	137.15	0.23	336,237.35	604,235.64	(267,998.29)	6.87
2008	518,346.15	1,357,263	2,107,589	155.28	0.25	479,630.27	621,387.70	(141,757.43)	8.59

2009	660,267.68	1,394,387	2,366,984	169.75	0.28	586,377.00	791,835.00	(205,458.00)	6.82
2010	764,222.80	1,474,763	2,549,825	172.90	0.30	660,764.00	817,089.00	(156,325.00)	4.00
2011	858,829.55	1,539,306	3,024,782	196.50	0.28	734,430.00	915,890.00	(181,460.00)	9.00

Table A.2: Kenya Public Debt Composition

	PUBLIC DEBT(million shillings)		
	Domestic Debt*	External Debt**	Total
1999	190,300.00	311,953.00	502,253.00
2000	192,665.30	405,355.31	598,020.61
2001	221,984.00	384,302.58	606,286.58
2002	259,828.23	369,729.83	629,558.06
2003	301,190.58	410,149.00	711,339.58
2004	295,374.44	439,992.95	735,367.39
2005	335,001.89	408,601.92	743,603.81
2006	385,121.22	407,742.55	792,863.77
2007	438,059.11	406,923.00	844,981.50
2008	456,227.91	516,671.33	972,899.25
2009	588,930.27	588,970.31	1,177,940.63
2010	720,207.97	599,930.46	1,320,138.43

*Domestic debt is reported on gross basis.

**Includes public and publicly guaranteed foreign currency loans.

Source: Treasury and Central Bank of Kenya

Table A3: Descriptive Statistics

	DDEBT	DEBRATIO	EXP G	GVTBAL	REV
Mean	214240.3	0.24125	268947.3	-67181.94	201765.3
Median	127913.6	0.25	167163.2	-16737.53	158521.4
Maximum	858829.6	0.3	915890	33340.96	734430
Minimum	12250.54	0.18	17214.92	-376345.8	17004.4
Std. Dev.	225519.7	0.034431	259744.6	97466.4	190464.5
Skewness	1.426085	-0.24239	0.998281	-1.46805	1.323722
Kurtosis	4.24151	1.729763	2.99938	4.602617	4.123467
Jarque-Bera	12.90162	2.464688	5.315015	14.91875	11.02819
Probability	0.001579	0.291608	0.070123	0.000576	0.00403
Observations	32	32	32	32	32

Table A4: Regression Analysis Results

Dependent Variable: DDEBT					
Method: Least Squares					
Date: 10/06/12 Time: 13:22					
Sample (adjusted): 1984 2011					
Included observations: 28 after adjustments					
Convergence achieved after 14 iterations					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	27185.10	32142.16	0.845777	0.4064	
AR(1)	1.452706	0.204767	7.094426	0.0000	
AR(2)	-0.825294	0.346286	-2.383276	0.0258	
AR(3)	0.833064	0.423589	1.966678	0.0614	
AR(4)	-0.306365	0.326911	-0.937154	0.3584	
R-squared	0.994381	Mean dependent var	242481.4		
Adjusted R-squared	0.993403	S.D. dependent var	227542.9		
S.E. of regression	18481.02	Akaike info criterion	22.64731		
Sum squared resid	7.86E+09	Schwarz criterion	22.88520		
Log likelihood	-312.0623	Hannan-Quinn criter.	22.72003		
F-statistic	1017.492	Durbin-Watson stat	1.945594		
Prob(F-statistic)	0.000000				
Inverted AR Roots	1.16	.46	-.09+.75i	-.09-.75i	
Estimated AR process is nonstationary					

Table A5: Results of Johansen Cointegration Test- Deficit, Debt

Results of Johansen Cointegration Test- Deficit, Debt.

Date: 11/02/12 Time: 21:52

Sample (adjusted): 1981 2011

Included observations: 31 after adjustments

Trend assumption: Linear deterministic trend

Series: DEBT DEFICIT

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.409216	25.11478	15.49471	0.0013
At most 1 *	0.247121	8.799354	3.841466	0.0030

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.409216	16.31543	14.26460	0.0234
At most 1 *	0.247121	8.799354	3.841466	0.0030

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'S11*b=I):

DEBT	DEFICIT
-3.63E-06	1.24E-05
1.18E-05	1.12E-05

Unrestricted Adjustment Coefficients (alpha):

D(DEBT)	D(DEFICIT)
-12233.74	-19283.20
3831.318	-37152.14

1 Cointegrating Equation(s): Log likelihood -737.9787

Normalized cointegrating coefficients (standard error in parentheses)

DEBT	DEFICIT
1.000000	-3.429713
	(0.96786)

Adjustment coefficients (standard error in parentheses)

D(DEBT)	0.044392
	(0.01159)
D(DEFICIT)	0.069973
	(0.05464)

Table A6: Results of Johansen Cointegration Test-Revenue and expenditure

Results of Johansen Cointegration Test-Revenue and expenditure

Date: 11/02/12 Time: 22:03
 Sample (adjusted): 1981 2011
 included observations: 31 after adjustments
 Trend assumption: Linear deterministic trend
 Series: EXPENDITURE REVENUE
 Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.311170	20.99155	15.49471	0.0067
At most 1 *	0.262424	9.435977	3.841466	0.0021

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.311170	11.55558	14.26460	0.1285
At most 1 *	0.262424	9.435977	3.841466	0.0021

Max-eigenvalue test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

EXPENDITURE	REVENUE
-3.33E-06	-3.67E-06
1.62E-05	-2.54E-05

Unrestricted Adjustment Coefficients (alpha):

D(EXPENDITURE)	-6647.911	-31355.68
D(REVENUE)	-22714.67	6098.072

Cointegrating Equation(s): Log likelihood -754.6447

Normalized cointegrating coefficients (standard error in parentheses)

EXPENDITURE	REVENUE
1.000000	1.101589
	(0.74900)

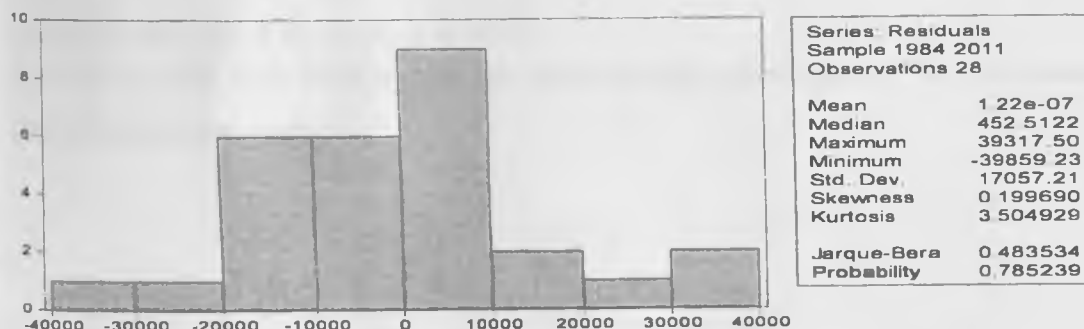
Adjustment coefficients (standard error in parentheses)

D(EXPENDITURE)	
RE)	0.022147
	(0.03975)
D(REVENUE)	0.075671
	(0.02297)

Diagnostic tests

Diagnostic test shows whether the model is consistent or not. The following tests were carried out.

Figure 3: Normality tests: JB normality tests



This test determines whether the variables used in the analysis are normally distributed. The study used Jarque- Bera statistics

Ho: residuals are normally distributed

Ha: they are not.

Decision: reject Ho if the pvalue is <0.05

From the p value of 0.7852, we do not reject the null hypothesis. And conclude that the residuals are normally distributed.

TableA7: Serial Correlation: LM test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.743428	Prob. F(2,21)	0.1993
Obs*R-squared	3.987118	Prob. Chi-Square(2)	0.1362

Ho: residuals are not serially correlated

Ha: they are serially correlated

Decision: reject Ho if the pvalue is <0.05

From the p value of 0.1362, we do not reject the null hypothesis. And conclude that the residuals are not serially correlated.

TableA8: Heteroskedasticity: White test

Heteroskedasticity Test: White			
F-statistic	9.927271	Prob. F(14,13)	0.0001
Obs*R-squared	25.60498	Prob. Chi-Square(14)	0.0290
Scaled explained SS	21.63861	Prob. Chi-Square(14)	0.0864

Ho: Residuals are homoskedastic

Ha: They are heteroskedastic

Decision: reject Ho if the p value is <0.05

From the p value of 0.0864, we do not reject the null hypothesis at 5%. And conclude that the residuals are homoskedastic.

TableA9: Debt Ratio

Dependent Variable: DEBRATIO				
Method: Least Squares				
Date: 10/06/12 Time: 13:35				
Sample (adjusted): 1984 2011				
Included observations: 28 after adjustments				
Convergence achieved after 3 iterations				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.245439	0.010843	22.63486	0.0000
AR(1)	1.152183	0.208164	5.534964	0.0000
AR(2)	-0.508688	0.318280	-1.598240	0.1236
AR(3)	0.175471	0.312575	0.561374	0.5800
AR(4)	-0.164377	0.203153	-0.809130	0.4267
R-squared	0.719281	Mean dependent var		0.246786
Adjusted R-squared	0.670461	S.D. dependent var		0.033116
S.E. of regression	0.019011	Akaike info criterion		-4.927206
Sum squared resid	0.008312	Schwarz criterion		-4.689312
Log likelihood	73.98089	Hannan-Quinn criter.		-4.854480
F-statistic	14.73315	Durbin-Watson stat		2.000528
Prob(F-statistic)	0.000004			
Inverted AR Roots	.72-.38i	.72+.38i	-.14+.48i	-.14-.48i