AN ECONOMETRIC ANALYSIS OF THE IMPACT OF PUBLIC DEBT ON ECONOMIC GROWTH: THE CASE OF ZAMBIA

COINTEGRATION AND GRANGER NON-CAUSALITY APPROACH

By

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DECLARATION

I, Brenda Mumbi Chongo, declare that this dissertation:

1) Represents my own work;
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APPROVAL

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ABSTRACT

This study has analysed the impact of increasing public debt on Zambia's economic growth covering the period 1980 to 2008. For policy implication, the study also analysed the channels through which public debt is said to have an impact on economic growth namely through private investments, public investments and domestic savings. The Vector Error Correction Model (VECM) approach was employed to analyse the two scenarios above. Results from the analysis confirm a long-run negative relationship between public debt and economic growth. The result on the impact of public debt on private investments and domestic savings also gives indication to the presence of the crowding out and debt overhang effects which can be explained by a rising debt burden measured by both the stock of Public Debt to Gross Domestic Product (GDP) and Public Debt Service to Revenues. This outcome helps to explain the impact of huge dominance of government participation on the domestic market as it mobilises resources to finance the fiscal deficit. The study also found a positive relationship between public investment and public debt indicating a possibility of crowding in effect. However, the extent to which this affects economic growth depends on how the private sector responds given existing fiscal and monetary policies. This literature concludes with some policy recommendations. For instance, given the long run inverse relationship between public debt and economic growth, there is need for Government to put in place a public debt law to ratify any borrowings requirements. This will help in ensuring that all borrowings by Government are targeted towards financing of projects that have a high return which would result in crowding in of private investment s well as ensure fiscal sustainability. Expansion of the tax revenue base will help ease the budget deficit which compels huge borrowing by Governments both externally and internally.

On the other hand, the long run inverse relationship between real exchange rates with public debt and public debt service respectively, calls for Government to put in place a Medium-Term Debt Management Strategy to analyse the cost and risks inherent in the existing debt portfolio. This will help guide future borrowing strategies thus avoid exacerbating the existing debt burden to the detriment of economic growth.

Key words: Cointegration, Granger Causality, Public Debt, Economic Growth, Vector Error Correction Model

DEDICATION

To my Hubby, Daughter and Son; Misheck, Chikwanda and Mwanda.

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ABBREVIATIONS AND ACRONYMS

BOZ	Bank of Zambia
CPIA	Country Performance Indicator Assessment
DC	Developed Country
DSA	Debt Sustainability Analysis
GDP	Gross Domestic Product
GNP	Gross National Product
GRZ	Government of the Republic of Zambia
GMM	Generalised Method of Moments
HIPC	Highly Indebted Poor Countries
IMF	International Monetary Fund
LDC	Less Developed Countries
LICs	Low Income Countries
MDG's	Millennium Development Goals
MDRI	Multilateral Debt Relief Initiative
NDP	National Development Plan
NPV	Net Present Value
OLS	Ordinary Least Squares
PRGF	Poverty Reduction Growth Facility
SSA	Sub-Saharan African
UNCTAD	United Nations Conference on Trade and Development
US$	United States Dollar

CHAPTER ONE

1.0 INTRODUCTION

Public debt is an important means of bridging Government financing gap especially for low-income Countries like Zambia. Notwithstanding this fact, public debt can however be viewed as a doubled-edged sword. For instance, effective and efficient utilization of public debt can increase economic growth and help a Government to achieve its social and economic objectives. Theoretically, financing developmental related projects through debt can help a country to build its production capacity and facilitate economic growth (Cohen, 1993). A further argument is that borrowing from external sources enables a Country to finance capital formation not only by mobilizing domestic savings but also by tapping into foreign capital surplus. Based on this argument, an analysis carried out by Siddiqui (2002) found that foreign borrowing increased resource availability and contributed to economic growth in South Asia. On the other hand, excessive reliance on public debt and inappropriate public debt management and strategies can increase macroeconomic risks and hamper economic growth. Even with concessional flows of loans, high public debt calls for increased revenues to service debt and this certainly has social, economic and political implication in the absence of a broad tax revenue base. As a result, the Government is left with no other alternative but to cut allocations for other public spending that can have positive externalities on economic growth (Isa A, 2004).

Links between economic performance and public debt can be observed through the effect that a fiscal deficit has on investments. And this can be explained through the 'debt overhang' and 'crowding out' effects. According to theoretical arguments, huge fiscal deficit results in increased borrowing by the Government which then constrains capital resources and pushes up the cost of capital through high interest rates. And if there is some likelihood that in future, the debt will be larger than the Country's repayment ability, expected debt-service costs will discourage further domestic and foreign investment (Krugman, 1988). A high debt burden also encourages capital flight, through creating risks of devaluation in order to protect the 'real' value of financial assets. The outturn of this capital flight is a reduction in domestic savings and investment which ultimately results in reduced tax base, thereby affecting the Government's capacity to service debt (Alberto & Tabellini, 1989).

Another argument against public debt is the draw down of foreign reserves to service debt which results in limiting import capacity, competitiveness and investment, therefore growth of a Country (Wijeweera, 2005).

In the light of the above, this dissertation employed Country specific time-series observations to investigate the impact of public debt (a composition of both external and internal borrowing by Central Government) on economic growth in Zambia from 1980 to 2008. Imperatively, a situation analysis of Zambia's public debt covering the above indicated period was undertaken to guide statement of the problem for this particular study.

1.1 OVERVIEW OF PUBLIC DEBT IN ZAMBIA

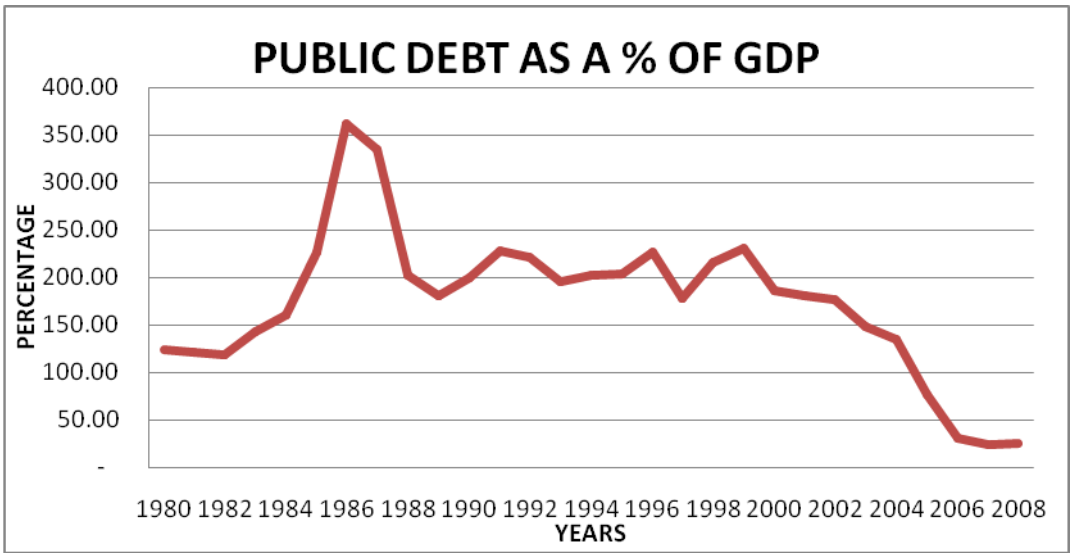
1.1.1 The Development of Public Debt in Zambia

Borrowing by the Government of the Republic of Zambia (GRZ) both internally and externally has continued to be an integral part of resource mobilisation to fill the financing gap in the budget. In the past three years, borrowing by Government has been restricted to 2% of GDP save for the 2011 budget where borrowing both externally and locally was set at 3% of GDP (GRZ, 2010). Government secures financing externally to finance programmes within the budget (i.e. Direct Budget Support-DBS and through Sector Budget Support-SBS) and capital projects in the Country. Domestic borrowing by the Government is mainly used to finance fiscal operations.

A review of Zambia's economic performance show that at Independence, Zambia was a relatively rich Country. Due to the fast economic growth averaging 6% between 1964 and 1974, the World Bank classified Zambia as a middle income Country (Anderson, Arne, & Persson, 2000). However, the World economic recession of the 1970's which was characterised by rising oil prices and deteriorating terms of trade derailed this positive outlook, causing severe Balance of Payment (BOP) problems and increased the budget deficit. The poor performance of the economy continued into the 1980's compelling Government to seek external assistance, initially from the IMF and later from other Multilateral and Bilateral Institutions. In 1980, the stock of public debt was recorded to be

K3.7 billion indicating 123.3% of GDP. Of this amount, 85% accounted for external debt. Figure 1 below helps to see the trends in public debt expressed as a ratio of GDP.

Figure 1: Trends in Zambia's Public Debt from 1980 to 2008



Authors' own computation using data from MOF & BOZ

Analysis of public debt in the above graph shows that between the periods 1980 to 2004, the stock of public debt was more than the GDP figure. Between 1984 and 1988, the ratio of public debt to GDP reached a maximum high indicating an increase of 250 % over GDP. The increase in the stock of public debt was mainly attributed by the accumulation of arrears of approximately US$3.0 billion following Governments disbarnment of the International Monetary Fund (IMF) economic supported programme (GRZ, 2005). Another contributing factor to the rise in the ratio of public debt to GDP was the extensive borrowing by GRZ from the domestic market through issuance of bridge loans to finance the budget deficit and servicing of public external debt (CYMA, 2006). The high inflation rates of over 100% recorded around this period also had a compounding effect on the stock of public debt (WB, 2010). As the share of public external debt stock was increasing, the stock of public domestic debt was also on the rise mainly because Government could not access external resources due to a high debt distress.

The first debt relief of approximately US$3.5 billion extended to Zambia under the Paris Club between the period 1984 and 1986 greatly reduced the stock of public debt to about K5.9 trillion or 143% of GDP. In 2003, Zambia's public debt stock was further reduced by US$3.8 billion through the debt relief extended under the first HIPC Framework (Chikuba,

2003). This brought the stock of total public debt to K30.5 trillion or approximately 147.6% of GDP. The component of public external debt stock reduced drastically from US$7.2 billion to US$1.1 billion in 2006 after Zambia received an irrevocable debt relief from its Multilateral and Bilateral creditors under the MDRI and Enhanced HIPC Framework Initiative. Consequently the stock of total public debt reduced to K11.6 trillion or below 40% GDP as indicated in Figure 1 above.

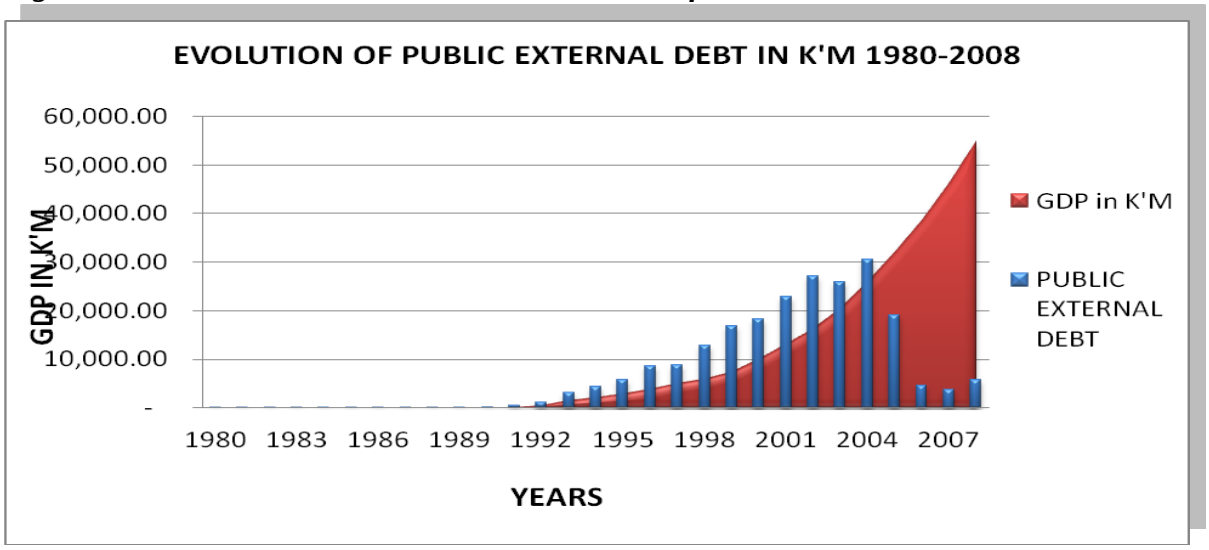
Despite the recorded increase in the GDP growth rate averaging 6.3% between the periods 2002 to 2010, the Government is still faced with the challenge of low revenues to achieve the Vision 2030 and meet the Millennium Development Goals (MDG's). In this aspect, Government has continued to borrow externally and from the domestic market. According to the 2010 Economic Report for Zambia, the stock of public debt as at end 2010 was approximately K17.9 trillion or US$4.2 billion (representing 23% of GDP). Comparing to the 2005 public debt stock figure of K11.5 trillion, this indicates an increase of 56% in the stock.

Public debt is composed of external and domestic debt. In order to appreciate how each component of debt has contributed to the accumulation of public debt stock, this study analysed the trends of each component. The two component of public debt are thus discussed below.

1.1.2 Development of Public External Debt in Zambia

The trends in public debt review that external debt highly contributed to the accumulation of public debt in Zambia. Figure 2 below shows how external public debt evolved over the period under review;

Figure 2: Trends in Zambia's Public External Debt from 1980 -2008



Authors own computation using data from MOF & BOZ

The stock of public external debt depicted a rising trend from the base year of analysis to 2005. The rise in the stock of debt was mainly triggered by the economic recession of the 1970's referred to in the foregoing paragraphs, which affected the performance of Zambia's economy in particular, the export sector.

In 1980, the ratio of public external debt to GDP was recorded to be 85.1% indicating a stock of US $3.4 billion. The performance of the economy further deteriorated with Zambia's external debt more than doubling to US$6.9 billion by end 1990. Consequently, the debt service payments as a percentage of exports rose from 11% in 1975 to 24 per cent in 1980 (Anderson, Arne, & Persson, 2000). By 1982, substantial arrears had accumulated and Government for the first time failed to meet it's debt service obligations and sought debt rescheduling. The BOP support became an increasingly important proportion of Zambia's debt portfolio. In 1998, the total debt was almost double the GDP figure as indicated in Figure 1.

At its peak, Zambia's public external debt was recorded to be US$7.2 billion (in 2004) making Zambia one of the most highly indebted Countries in Sub-Saharan Africa. This situation set the stage for Zambia's re-entry into the IMF and World Bank's HIPC initiative programme aimed at bringing poor Countries' debt down to 'sustainable' levels. Upon

reaching the HIPC Completion Point in 2005, Zambia's Bilateral and Multilateral creditors provided significant debt relief by writing-off Zambia's debt. The outcome of this irrevocable debt relief was a decrease in Zambia's public external debt stock from approximately US$7.2 million in 2004 (before the HIPC Completion Point) to US $1.1 million in 2007.

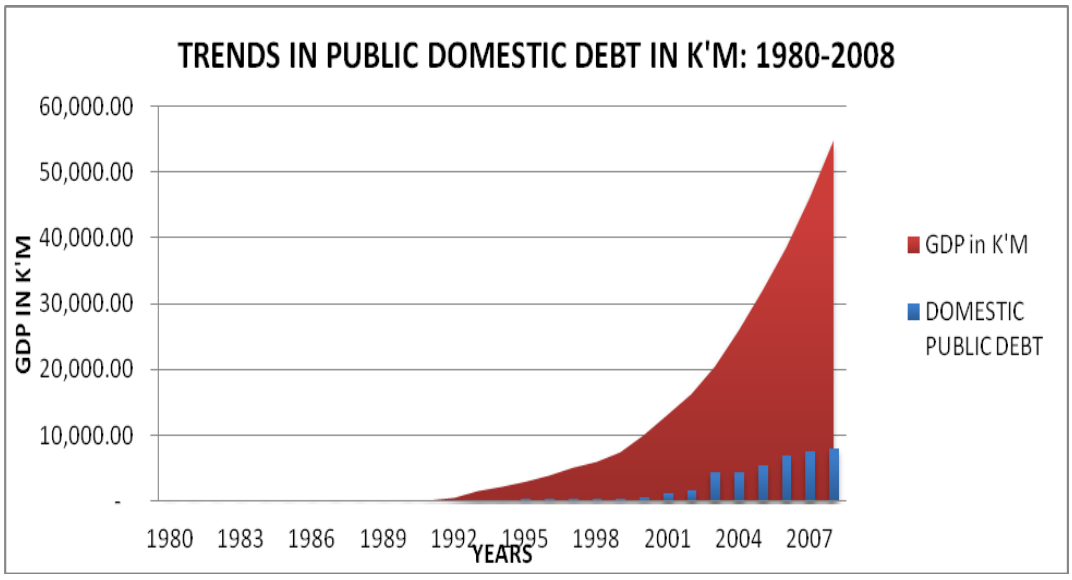
Figure 2 above, depicts the ratio of public debt to GDP from the period 1989 to 2004 to be above GDP. This trend gives compelling reason to argue that the huge public debt accumulation by GRZ resulted in debt overhang. This fact was also acknowledged by Government in the budget speech for 2004.

A review of the Economic Report for 2008 indicates that the stock of public external debt has since increased to US$1.2 billion. As at end 2010, the stock of public external debt reached US$1.76 billion indicating a sharp increase of 60% from end 2005. This gives the composition of external debt to be 46% of the total public debt stock. Even though most of the debt contracted externally is concessional, a build-up on the stock of public debt increases the Country's debt burden particularly when it comes to debt service. And if the debt acquired is not commensurate to the rate of economic growth the Country's debt distress can exacerbate.

1.1.3 Development of Public Domestic Debt in Zambia

Currently Zambia's domestic debt remains higher than the external debt accounting for approximately 53% of the total public debt. A review of public domestic debt composition over the period of analysis shows that it was lower than external debt albeit rising significantly in 2001 and thereafter. The graph showing the trends in public domestic debt is presented in Figure 3 below;

Figure 3: Trends in Zambia's Public Domestic Debt from 1980-2008



Authors own computation using data from MOF & BOZ

According to CYMA (2006), the increase in the stock of public domestic debt was mainly attributed by the policy of rolling-over which necessitated the capitalisation of principal and interest and also increased borrowings to finance external debt service obligations and programmes in the budget. Capitalisation of principle and interest has since been discontinued as interest payments are now budgeted for while the principle amount is rolled over.

In 2002, the stock of public domestic debt increased from K4.1 trillion to K4.9 trillion. Figure 3 above shows that by end 2003, the stock of public domestic debt increased to K6.2 trillion representing an increase of 28.6% from 2002. As Government was faced with the external debt trap during the period 1990 to 2004, the only alternative measure to access resources was through domestic borrowing. Thus the compounding effect of huge accumulation of public external debt was an increase in domestic borrowing to finance the fiscal deficit. After the debt relief in 2005, the share of public domestic debt to total public debt remained high at 70% representing 27% of GDP.

In 2008, the stock of public domestic debt rose to K8.0 trillion, or 15.0% of GDP. This represents an increase of 15.13% from the recorded stock of K6.9 trillion at end of 2006 (GRZ, 2008). By end 2010, the stock of public domestic debt was recorded to be K9.9

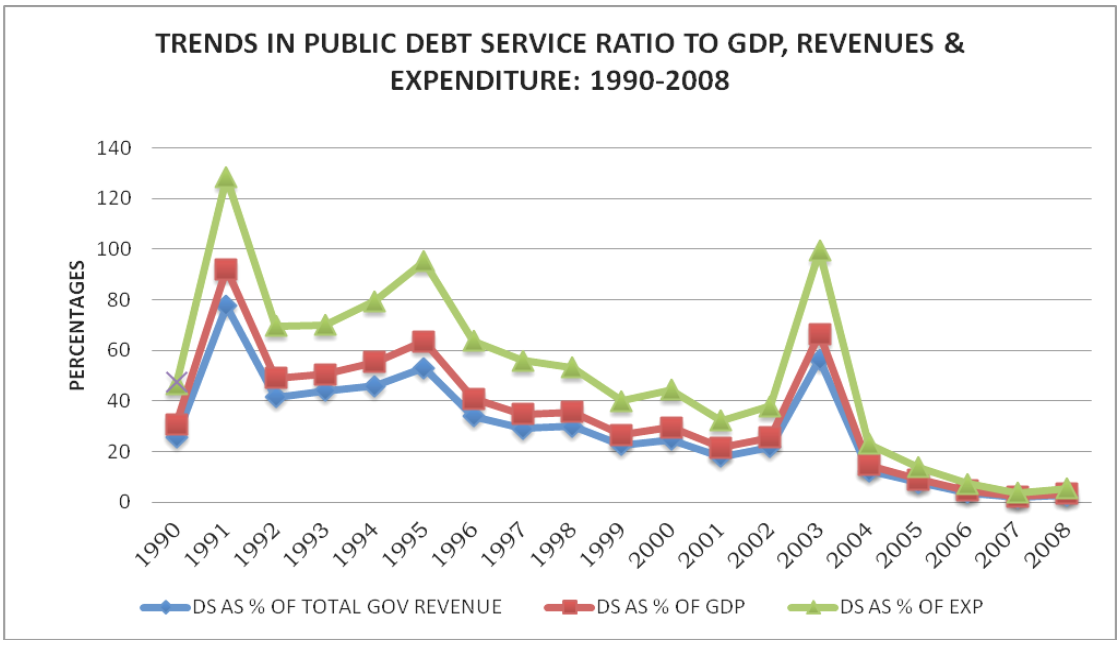
trilllion and accounted for 57.6% of the total public debt or 12.8% of GDP. This indicated an increase of 23.9% from 2008 (GRZ, 2010).

The increase in the stock of public domestic debt has had serious implication on the performance of credit creation in the Country. In particular, the dominance of Government participation on the domestic financial market pushed the yield rates up and in some cases the Treasury Bill yield rates reached as high as 43% (1995), 55% (2001), 15% (2008) and 9% (2010). This has a serious binding constraint on savings accumulation resulting in crowding-out of investments and thus weighs down economic growth. (Anderson, Arne, & Persson, 2000; IMF, 2007; IMF; 2010).

1.1.4 Public Debt Service in Zambia

A key concern to accumulation of public debt stock is the debt service obligations comprising of interest and principle repayments. An analysis of figures indicates that before the HIPC and MDRI initiatives, public debt service averaged around 50 and 30 percent as a ratio of exports and revenues respectively. The trend in public debt service over the years is shown in Figure 4 below;

Figure 4: Trends in Public Debt Service from 1990-2008



Authors own computation using data from MOF & BOZ

The trigger effect of huge borrowing by Government in the 1980's was a rise in public debt service obligations. Between the period 1990 and 1995, Government's dominance on the domestic market to mobilise resources to finance external debt service and other fiscal programmes resulted in high yield rates aimed at attracting supply of credit by the private sector. For instance, in 1993, the Treasury bill market became extremely attractive for investors when the Treasury Bills yield rates hit real interest rates of above 200%, a situation which was compounded by high rates of inflation. By mid-1993, the rate increased to above 208% though it reduced and stabilised around 45% in 1995. The outcome of huge borrowing during that period was an increase in debt service which averaged K0.18 trillion per annum. Further, the implication of excessive dependence of Government on the Banking System was the crowding out of private business to invest in the economy. Figure 4 above exactly depicts a rise in the ratio of debt service to revenue, exports and GDP.

A compounding effect on public debt service was the capitalisation of interest and principle which made the existing stock of public domestic debt to be financed at very high cost and therefore requiring huge budget outlay (IMF, 2004). As Zambia could not access external resources due to the debt trap, the only alternative measure for resource mobilisation was domestic borrowing. The period from 2001 to 2004 was therefore characterised with increased domestic borrowing by the Government. For instance in 2000, the sale of Treasury

Bills and Bonds to GRZ accounted for about 65% of the total domestic credit supplied by the Commercial Banks while yield rates ranged between 43% to 55% during this period (GRZ, 2000). By implication, this increased debt service obligation and consequently the budget deficit. This phenomenon helps to explain the spike between the period 2001 and 2004 indicated in Figure 4 above.

The period from 2005 and thereafter has continued to depict a declining trend in public debt service. The reduction in debt service was mainly attributed by a tremendous decline in public external debt service from US$325.0 million to US$65.2 million in 2006. And as Government continued to conclude the remaining Debt Relief Agreements, public debt service maintained a declining trend.

Given the above overview of public debt, the rising public debt stock is yet to impose a serious problem of debt overhang especially if the situation is not curbed. The increase in public debt service which is exacerbated by huge accumulation of the stock of debt will ultimately result in increased budget deficit. To finance the deficit, Governmnet has to borrow from external and domestic sources.

On the domestic front, Governmnet will have to compete with the private sector for funds to finance the budget deficit. As argued by Krugman (1988), this phenomenon reduces the credit available for the private sector (crowding out effect) and at the same time drives up interest rates and the overall cost of doing business which then constrain economic development.

1.1.5 Government's Debt Carrying Capacity

The study also reviewed the debt carrying capacity for Zambia especially after the HIPC era. Under the Low Income Country Debt Sustainability Framework (LIC DSF), the debt sustainability thresholds are linked to a Country's quality policy and implementation as measured by the Country Policy and Institutional Assessment (CPIA) calculated by the World Bank. Zambia has been classified as a medium performer by the World Bank. The indicative thresholds for analysing a Country's debt sustainability falling within this category are given in Table 1 below;

Table 1: Solvency and Liquidity Indicators

DEBT SUSTANABILITY THRESHOLDS-MEDIUM INCOME COUNTRY	
RATIOS	**THRESHOLDS (%)**
SOLVENCY INDICATORS:	
NPV of Debt to GDP	40
NPV of Debt to Exports	150
NPV of Debt to Revenue	250
LIQUIDITY INDICATORS:	
NPV of Debt Service to Exports	30
NPV of Debt Service to Revenue	20

Source Data: Joint IMF/WB LICS DSA for Zambia-2007

The recent DSA for LICs applied to Zambia using macro-economic and fiscal data for 2009 indicated that Zambia's external debt distress remains low while all debt indicators stay well below the risk thresholds throughout the projection period (2009-2029). The external debt-to-GDP remains stable in the 10-11 percent range through 2019 and decline thereafter. Even under the alternative scenarios and the bound stress tests, indicators remain well below the thresholds. For instance, assuming new borrowing by Government on commercial terms in the order of US$1 billion over five years, the alternative scenarios and bound tests still returns stable ratios well below the thresholds. The Present Value (PV) of public external debt-to-GDP ratio and the PV of public external debt-to-exports ratio would however peak in 2013 at 15.5% and 42.4% respectively. Consequently, Zambia's public debt would increases marginally from 26% of GDP in 2008 to 28% by 2011 and decline thereafter to 18% by 2019. Therefore, both ratios will converge to the baseline scenario by 2019, hence would not pose any threat to debt sustainability (IMF, 2009). However, the overall DSA result that Zambia's public debt was manageable over the projected period is on the assumption that Government implements a cautious public debt policy and strategy and that economic growth follows the projected path.

Recently, a study was also undertaken by Masengo (2011) on Zambia's public domestic debt sustainability covering the period 1980 to 2010. To analyse this phenomenon, two approaches were used. Using the Commonwealth Secretariat rule of thumb which requires that public domestic debt remain consistently below 200% of domestically generated Government revenues, the study indicates that Zambia's public domestic debt has been

sustainable for the period under review. On the contrary, when the Debt Relief International (DRI) threshold of between 92% and 167% are applied, domestic debt is considered to be unsustainable, in particular for the period between 1990 and 2002. The second approach employs an econometric analysis of the Present Value Budget Constraint (PVBC) which uses cointegration method (test for cointegration between revenue and expenditure).

The overall outcome of the study from both debt sustainability threshold ratios and the PVBC approach show that Zambia's domestic debt is still sustainable. According to Masengo (2010), the positive outcome has mainly been attributed by the irrevocable debt relief extended to Zambia in 2005 which freed resources from external debt service towards domestic deficit and project financing. A further reason advanced in the study is Government's implementation of various recommendations from previous studies on debt sustainability undertaken by CYMA (2006) and MEFMI (2007) as well as pursuing prudent fiscal policy which has resulted in macroeconomic stability.

1.2 PROBLEM STATEMENT

A number of empirical studies undertaken in this area show that in the long run and beyond a certain threshold, public debt would exert negatively on economic growth and such conclusion are consistent with the debt overhang theories advanced by the neoclassical economists. In the case of Zambia, public debt over the period of analysis depicts a rising trend and in some periods has been recorded to be above GDP. The rise has been attributed by continuous borrowing by Government, both external and internal to finance its budget deficit as it aspires to achieve its development agenda defined in the National Development Plans (NDP). Therefore, the Country is not precluded from the implication of a risisng public debt stock and this has necessitated the need for an empirical analysis of the above phenomenon in Zambia.

1.3 GENERAL OBJECTIVE

The aim of this study is to investigate the impact of Zambia's increasing public debt stock on economic growth. For policy implication, the proposed study will also analyse the impact

of public debt on the determinants of economic growth rate namely, public & private investments and domestic savings.

1.3.1 Specific Objectives

The specific objectives of this study are defined as follows;

1. To determine the relationship between public debt and real economic growth.
2. To determine the impact of public debt on:
    a) Private investments;
    b) Public investments;
    c) Domestic savings; and
    d) Public Debt Service.

1.4 SIGNIFICANCE OF THE STUDY

Government continues to rely on both external and domestic resources to meet its financing needs as articulated in the Sixth National Development Plan (SNDP) and the policy document pronounced annually (i.e. the Budget speeches). Since 2005, there has been a recorded increase in the stock of public debt and the current rating of B^+ and re-classification of the Country as a lower mid-income performer allowing the Country to access funds in the International Capital Market has serious implication on the economy if a conservative borrowing policy by Government is not pursued. In this regard, an in depth empirical analysis of the impact of Zambia's public debt stock on the economic growth will provide basic foundation for policy formation geared towards a successful debt management strategy that contributes to a sustainable economic growth in the Country. The literature review shows that very few studies have been undertaken in this area and mostly focused on public external debt. Therefore, this study is also aimed at filling the information gap.

1.5 HYPOTHESIS TESTING AND EXPECTED OUTCOME

In this study, statement of hypotheses and the expected outcomes have been guided by the theoretical arguments advanced on growth effects of public debt. The following are the expected hypotheses from the study;

a) Public Debt has a long-run negative relationship with economic growth;

b) Public Debt has a negative impact on determinants of growth (public investments, private investment and domestic savings).

c) Public Debt has a positive impact on debt service.

1.6 DEFINITION OF PUBLIC DEBT

The term public debt includes external and domestic debt owned by the Government. For the purpose of this study, public debt will refer to debt contracted pursuant to the Loans and Guarantee Authorisation Act, Chapter 366 of the Laws of Zambia. In this regard, the paper defines public external debt according to IMF (2003) as the gross external debt currently outstanding and not contingent liabilities that require payment of principal and/or interest by the debtor at some point in the future which is owed to non-residents by residents of an economy. This definitition captures only the net flows of external debt, that is disbursements minus debt service. The operational definition of public domestic debt will therefore be defined as total debt that Government owes to domestic entities and this includes all outstanding payments for Government Securities and Treasury Bills.

1.7 OUTLINE OF DISSERTATION

The structural framework of this dissertation is thus defined as follows:

Chapter one gives an overview of public debt management in Zambia and the evolution of both public external and domestic debt. Imperatively, the research topic, objectives and significance of the study is highlighted in this section.

Chapter two examines theoretical aspects to public debt and economic growth. It also examines empirical studies undertaken in Zambia and elsewhere in the World. The impetus of empirical literature review is to gain insight on how various variables used in similar studies have been measured and the methodology employed.

On the basis of the literature review, Chapter three explains the methodology to be employed in the course of the study. Reasons for the choice of the methodology to be employed have also been advanced.

Chapter four confers econometric analysis and interpretation of empirical results. Cointegration analysis is carried out on stationery data and consequently the short-run and long-run dynamics of variables in the model are analysed by a Vector Error Correction technique. The chapter also discusses the causal relationship of variables employed in the analysis using the VEC based Granger non-causality test.

Inferring to the estimation results, Chapter five draws conclusion and policy recommendation with respect to public debt phenomenon in Zambia. Challenges encountered during the whole research as well as arguments for future research to fill the literature gap in this area are also advanced.

CHAPTER TWO

2.0 LITERATURE REVIEW

Literature review is important to guide statement of hypotheses, determine an appropriate methodology and to understand the measurement of variables in the analysis of this nature. In this regard, this chapter analyses the theoretical framework underlying growth effects of public debt as well as empirical works. An analysis of the different methodologies applied in the econometric analysis of public debt and economic growth was also given consideration under this chapter.

2.1 THEORETICAL LITERATURE

Conventional view of public debt based on the neoclassical setting informed theoretical literature analysis in this study. According to the neoclassical theories, the growth models are augmented with variables depicting issuance of debt to finance government expenditure which include both consumption and capital goods (Adam & Bevan, 2005; Cohen, 1993; Elmendorf and Mankiw, 1999; Diamond, 1965; Solow, 1956). Analysis of such models tends to depict a negative relationship between public debt and economic growth. The argument for this conclusion is well explained using the crowding in/out and debt overhang hypotheses as some empirical studies have done (Fosu, 1996; Green, 1991; Savvides, 1992; Cordella et al, 2005). The theoretical arguments of crowding in/out and debt overhang effects of public debts are thus discussed as follows.

2.2 CROWDING IN OR OUT HYPOTHESIS

Mostly, Government mobilises debt resources to undertake huge capital investment projects. To the extent that debt is being used to finance these projects, the net effect of this budget deficit will depend on whether it's crowding in or crowding out private investment.

2.2.1 Crowding In Hypothesis

Crowding in effect can be viewed as an attempt by Government to increase private sector investment through undertaking of capital projects such as roads infrastructure, hydro-power, education or health care facilities which ultimately reduce the marginal cost of producing one unit of output for the private sector (Piana, 2001). This entails that huge Government spending directed towards production of capital goods can potentially increase the stock of public capital investment and thus crowd in private sector participation. Undertaking such projects would require Governmnet to issue debt instrument (domestic or/and foreign) or raise taxes.

2.2.2 Crowding Out Hypothesis

According to Elmendorf and Mankiw (1999), public debt contracted to finance the budget deficit is a primary source of crowding out private investments. The implication of huge borrowings by the Government is an increase in interest rates. The increase in interest rates may reduce or crowd out private-sector investments in plants and equipment. This decline in investment means that the overall economy has a smaller capital stock with which to work, which then decreases future growth rates.

A further argument advanced by Elmendorf and Mankiw (1999) is the effect of a budget deficit on savings accumulation. An increased flow of Government borrowing can result in distortionary tax measures which can incite dissaving behaviour among consumers and consequently raise interest rates. By implication, this reduces investible funds and raises the cost of capital through high interest rates. The result is a decline in private sector investments. Aschauer (1989) provides empirical evidence pointing out to budget deficit as the primary source for crowding-out private investments as advanced above by the two scholars.

2.3 DEBT OVERHANG HYPOTHESIS

The adverse effect of public debt stock on economic growth has largely been explained by debt overhang hypothesis**.** Krugman (1988) thus defines debt overhang as a situation in which investments are reduced or postponed since the private sector anticipates that the returns from their investment will serve to pay back creditors. Implying that, the expected future public debt service of a country is likely to be an increasing function of the Country's output level. Therefore, huge accumulation of public debt stock creates uncertainty behaviour among investors on the actions and policies that the Government will adopt to meet its debt service obligations. In this regard, Krugman (1988) contends that most potential investors will assume that Government will finance its debt service obligations through distortionary tax measures, thus they will adopt a wait and see attitude which will affect private investments and therefore economic growth.

Empirical evidence to support the above theoretical arguments advanced by Krugman (1988) can be found in studies undertaken by various scholar namely; Greene and Villanueva (1991); Levy and Chaudhary (1993); Elbadawi, Ndulu, and Ndungu (1997); Deshpande (1990); Fosu (1996); Chowdhury (2001); Syed et al (2010) and Isu (2010.

Theoretically, it is also argued that a high level of public debt can have adverse consequences on the macroeconomic stability, discouraging capital inflows while favouring capital flight (Alberto & Tabellini, 1989; Cerra, Meenakshi, & Saxena, 2008).

Focusing on the interaction effects of deficits and debt stocks, Adam & Bevan (2005) argue that a high debt stock exacerbates the adverse consequences of high deficits. Using a simple theoretical model integrating the Government budget constraint and debt financing, the study found that an increase in productive Government expenditure, financed out of a rise in the tax rate, will be growth-enhancing only if the level of public debt is sufficiently low.

2.4 METHODOLOGY APPROACH TO ANALYSIS OF GROWTH EFFECTS OF PUBLIC DEBT

Choice and application of methodology in econometric analysis relating to time series data and the objective of the study is of particular importance. Notable estimation techniques

employed in the analysis of growth effects of debt include, the Ordinary Least Squares (OLS), Instrumental Variables & Generalised Methods of Moments and the Vector Auto-Regressive (VAR) framework. The methodologies cited here have their own weaknesses and strength when it comes to choosing the appropriate model especially for studies like this one. An in-depth understanding of the estimation technique to guide this research was therefore important. The discussion of the above cited estimation techniques are presented below.

2.4.1 **Generalised Methods of Moments**

The Generalised Method of Moment (GMM) estimation technique for public debt has increasingly gained leverage over other techniques especially in recent studies undertaken to model public debt and economic growth. As argued by Arellano and Bond (1991), the advantage of GMM lies in its robustness to standard errors. The use of instrumental variables also helps to reduce the endogeneity effects of regressors, particularly the debt and growth variables. GMM is also able to capture biases associated with observed Country specific effects in the case of panel or cross section data, hence the relaxation of the heteroskedasticity assumption (Pattillo, 2002). However, a limitation of GMM as advanced by Reinhart and Rogoff (2010) lies in the failure of the methodology to identify the direction of causality given the existence of feedback effects between the debt variable with other macroeconomic variables. This methodology is however more advantageous to studies relating to panel or cross section data.

2.4.2 Ordinary Least Squares Estimation Techniques

Macroeconomic data relate itself to time series which is either deterministic or stochastic leading to errors being correlated overtime and feedback effects or trending of data, all which can result in biased estimates of standard errors and coefficients, which Engle and Granger (1987) referred to as “spurious regression results”. Therefore, the dynamic structure of time series models makes the Ordinary Least Squares (OLS) estimator upwards biased and inconsistent. This is because the lagged level of depended variable is correlated with the error term. Nickel (1981) argues that the within transformation of the model under OLS does not solve the problem unless you include instrumental variables. A further limitation of traditional OLS according Sachs (1989), EL-Mahdy (2009) and Omotoye et al. (2006), lies in the failure of the technique to capture both short-run and long-run dynamics of the macroeconomic variables in a specified model.

2.4.3 Vector Autoregressive Regression (VAR) Framework

Time series properties are dynamic by their nature as alluded to by Enders (1995). In this respect, analysis of time series data require application of the methodology that take into account the inherent setback (i.e. trending of data, the feedback effects between past and present values, and the stochastic behaviour of data). According to Johansen (1988), the VAR framework has an advantage over other alternative estimators when modelling time series data especially macroeconomic variables. In this respect, El-Mahdy (2009) advanced that the appropriate approach to explaining the growth effects of public debt is by employing a VAR framework. This is because the framework is able to capture both the short-run and long-run effects of public debt on economic growth. And on the basis of the short-run and long-run trajectory, informed policy decision can be infered.

2.5 ANALYSIS OF EMPIRICAL STUDIES

There are a lot of empirical studies on growth effects of public debt. Though, most of the studies in this area generally deal exclusively with either public external debt or public domestic debt. Inferring to empirical literature, most of the studies on public external debt have been a reaction to the two waves of (external) debt crisis, the first affecting several Latin-American Countries in the 1980s (Green and Villanueva, 1991; Savvides, 1992), and the second concerning the debt relief policies which targeted a number of heavily indebted and poor Countries (HIPC) including Zambia. These studies include among others "Debt Relief Initiatives, Policy Design and Outcomes" by Arnone and Presbitero (2010) and "Debt Overhang or Debt Irrelevance" by Cordella, Ricci and Ruiz-Arranz (2005). Studies focusing on either domestic debt or total public debt investigating the effects of public debt on economic growth have also been undertaken.

Studies investigating growth effects of debt would focus either on cross section analysis or Country specific. In this study, empirical review is done to help in the selection of an appropriate methodology to be employed and also appreciate how variables of interest have been measured. A further reason justifying empirical review is to see how estimated results support theoretical arguments about debt and growth. Empirical literature was therefore analysed according to specific grouping.

2.5.1 Cross Section or Panel Studies

Most studies undertaken at cross Country level have mainly applied the GMM technique utilising panel data. As discussed earlier, most argument for using this methodology lies in its robustness to standard errors and ability to capture Country specific effects. Most results under GMM techniques analysing the impact of public debt (domestic or external debt) on economic growth have been consistent with theory.

For instance, Pottillo et al (2002) analyzed the consequences of debt on economic growth. The analysis covers 93 Countries covering the time period 1968 to 1998. Armone and Presbitero (2007) using a data set covering 121 countries over a period 1980-2004 also investigated the relationship between external indebtedness and economic growth, with particular attention to LICs, for which the theoretical arguments of debt overhang and liquidity constraint were considered.

In the two studies analysed above, it was noted that in the short-run, external debt has a positive impact on economic growth while in the long-run and above a certain threshold, debt exerts negatively on economic growth. Particularly, Pattillo et al (2002) concludes that lofty burden of debt hampers economic growth, mainly due to decline in the efficiency of investment and not because of the volume of debt. The negative and linear relationship between past values of the NPV of public external debt and current economic growth was supported by a study done by Armone and Presbitero (2007). He argued that the outcome of the study was due to the "extended debt overhang", where it was argued that a large indebtedness leads to misallocation of capital and discourage long-term investment and structural reforms.

Abbas and Christensen (2010) also complement the vast literature in this area but focusing on public domestic debt growth effects using a panel of low-income Countries and emerging markets. Applying GMM technique, the study shows that moderate levels of domestic debt have a positive contribution to GDP growth. He argued that the presence of developed financial markets, increased private savings, better institutions & political accountability and improved monetary policy mainly accounted for this outturn. He however concluded that in the long-run and when the stock of domestic debt becomes too large (above the 35 percent

of bank deposits), its contribution to economic growth would be negative, because of inflationary pressures and crowding out of the private sector.

The application of Instrumental Variables (IV) in this methodology was able to minimise the endogeneity effect between public debt and economic growth. Engle and Granger (1987) asserts that most endogenous variables have feedback effects implying causality. However, the above studies and many that have applied GMM like Chrietensen, 2005; Schclarek, 2004; Maana et al, 2008; Checherita & Rother, 2010 did not detect the direction of causality which according to EL-Mahdy (2009) is important for policy guidance.

A cross Country study was also undertaken by Fosu (1996) to investigate the effects of public external debt on Sub-Saharan Africa using OLS estimation method. The study covered a time period 1970 to 1986. His findings were consistent with theory as the study reviewed that 33% reduction in growth was due to the debt burden effects.

Applying OLS estimation technique, a study was also done by Deshpande (1990) on 13 severely indebted Countries including Zambia, Venezuela, Sierra Leone, Philippines, Peru, Morocco, Mexico, Kenya, Honduras, Egypt, Ivory Cost, Argentina and Algeria. Data used covered a period 1971 to 1991. He concluded that in the short-run, investment showed a rising trend in all Countries but as debt accumulates a declining trend sets in.

Notwithstanding the above, the application of OLS to analyse time series data and in particular public debt and economic growth variables which are highly endogenous could render the result bias even though consistent to theory. (Engle and Granger,1987).

2.5.2 Country Specific Studies

At Country level, some of the studies reviewed in this area also showed consistent results to theory despite applying different methodology techniques. For instance, Syed et al (2010) employed OLS to analyse public debt and economic growth in Pakistan for a period 1972 to 2010. The study did allude to poor social economic conditions arising mainly due to huge public debt which stands to be over the GDP figure in Pakistan. The results in this study were in support of the neoclassical theoretical arguments on debt accumulation.

Isa (2004) also applied the OLS technique using time series data to examine the impact of external debt on economic growth and public investment in Nigeria from 1970-2002. The debt service burden was said to impede the Country's rapid economic development and worsened the social problems. Service delivery by key institutions designed to mitigate the living condition of vulnerable groups were hampered by decaying infrastructure due to inadequate funding. By cutting down expenditure on social and economic infrastructure, the Government appears to have also constrained private sector investment and growth. He concluded that debt overhang was the major factor that contributed largely to the poor performance of Nigeria's economy during the period under review.

Cholifihani (2008) applied a production function model using a VEC to analyze the relationship between public debt and economic growth in Indonesia for the time period of 1980 to 2005. The study concluded that in the short run, the change in capital stock boost up economic growth but in the long run the debt service slowed down economic growth.

A vector error correction model was also employed by Isu et al (2010) to analyse the impact of public external debt on economic growth in Nigeria. Using the national identity framework, a negative long run relationship between external debt and growth was observed. The results were both significant and consistent with theory. The VEC based granger causality was also applied to detect the direction of causality. Uni-directional causality was found to run from external debt to public debt service while a bi-directional causality was found to be present between external debt and economic growth.

In the case of Zambia the study undertaken by Chikuba (2003) focused only on public external debt effects on growth from 1970 to 1999. The study concluded that there was crowding out of investment in Zambia due to the presence of debt overhang. The study applied the two-stage-least squares regression approach and OLS to estimate the growth and investment model respectively. The two-stage-least squares technique was applied to cater for endogeneity problem between the debt and growth variables. Like other studies so far analysed in this section, his results were valid and consistent with theoretical arguments, however the methodology did not state the direction of causation effect.

Not too many studies focusing on either public external or domestic debt have been undertaken in Zambia thus creating a gap in information especially for policy guidance.

Further, the study undertaken by Chikuba (2003) did not take into account the effects of public domestic debt on growth, despite being on the increase. This study has filled in this information gap by analyzing the short and long run economic growth effects of a rising public debt stock (both domestic and external public debt) in Zambia covering both the pre and post HIPC periods from 1980 to 2008. A further contribution by this study is the analysis of the short and long run impact of public debt on the empirical determinants of economic growth which is important for policy guidance.

2.5.3 Choosing Appropriate Methodology

To investigate the relationship between the debt variables and economic variables, various methods such as Ordinary Least Square (OLS); Engle-Granger Co-integration test and Johansen Maximum Likelihood Co-integration test specified under a VEC and GMM technique have been applied in econometric analysis.

As shown in the empirical literature discussed under Section 2.4.1 and 2.4.2, the OLS and GMM requires inclusion of Instrumental Variables to address the problem of endogeneity in time series data. Additionary, the GMM technique works very well with panel data. The Engel-granger co-integration test specified under a VECM only identifies a single co-integrating relation, among what might be many such relations, therefore cannot be used to estimate a model with multiple co-integrating relations. Since we are not using panel data and the variables being estimated in the two models are more than two, the application of GMM technique and Engle-Granger Co-integration test will not apply in this case. Equally, OLS estimation techniques, would not be appropriate given the challenges already discussed under Section 2.4.2 of this study.

Empirical studies that have applied GMM or OLS to analyse the growth effects of public debt as shown above have not indicated the direction of causality between the debt variable and economic growth which according to Erdal Karagol (2002) would be necessary to come up with targeted policy variables. In order to capture the feedback effects and come up with targeted policies to guide debt management in Zambia, this study applied the Johansen Maximum Likelihood Co-integration test specified under the Vector Error Correction Model to analyse the effects of public debt on economic growth. Further, the Johansen Maximum

Likelihood is able to detect more than one Co-intergrating vectors as well as determine the short-run and long-run relationships between variables.

2.5.4 Underlying Weakness of the VEC Model

Notewithsatnding the above, one of the weakness of the application of a VECM to estimate multivariable (i.e. "n" variables) parameters requires that all the "n" variables are jointly stationary. If after transformation, some variables are still non-stationary, and the model contains a mix of I(0) and I(1), then the application of the VECM for analysis will not be easy.

Additionary, application of a VECM based on a VAR Framework in econometric analysis relate to defining the appropriate number of lags of each variable in the model in relation to the sample size. According to Lütkepohl (1993), if many lagged parameters are included in the analysis when the sample size is small, it results in loss of data points and reduces Degrees of Freedom. By implication the power of the test statistics will be downward. If on the other hand, you don't include enough lag length, there will be serial correlation in the errors and the test results will be unbiased and inconsistent. Johansen (1991) and Gonzalo (1994) advanced that VAR order selection can affect proper inference about co-integrating vectors and rank.

In order to address the weakness alluded to above, selection of an appropriate lag order becomes paramount before carrying out the analysis and subjecting the model to diagnostic test to see if the model is well specified. On the basis of the Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hanna and Quinn Information Criteria (HQIC) and Schwartz Bayesian Information Criterion (SBIC), the study chose the lag length for the two models specified under the VAR in levels that minimizes the information criteria. The study also carried out diagnostic test to ascertain if the two models are well specified and has desired fit implying that they satisfy the BLUE assumptions (Gujarati, 1995). Chapter four (4) of this study explains in detail the econometric procedure that were followed to estimate the results.

2.5.5 Measurement of the Public Debt and Growth Variables

Most of the empirical studies reviewed under Section 2.5 have either employed real Gross Domestic Product (GDP) or per capita GDP to measure the growth variable while the public debt variable that is the stock of public debt or public debt service have been measured as ratios of GDP (Deshpande, 1990; Jayaraman et al, 2006; Syed, 2010; etc). In this study, the growth variable is measured as real GDP while the stock of public debt and public debt service are used to measure the debt burden. Except for real GDP, all the variables employed are measured as ratios of real growth.

All the variables were deflated at 2005 constant local prices to remove the effects of inflation. The variables were specified in their natural logs to eliminate the effects of multicollinearity among explanatory variables according to Syed (2010).

CHAPTER THREE

3.0 METHODOLOGY

3.1 CHOICE OF METHODOLOGY

Our interest is to analyze the relationship between public debt and economic growth in their short and long-run trajectory in Zambia. Therefore, application of traditional OLS on time series data that is either stochastic or deterministic (non-stationery data) to analyze our model would yield results that are spurious (Eagles & Granger, 1987). In this case, the regression analysis will apply the Vector Error Cointegration Model (VECM) specified under the VAR Framework.

3.2 MODEL SPECIFICATION

In terms of our model specification, the said research will specify two equations. The first equation will be used to explain the relationship between public debt and economic growth while the second equation will be used to explain the impact of a growing public debt on the determinants of economic growth.

3.2.1 Analysis of the Relationship of Public Debt and Economic Growth

The first model will be specified according to the model employed by Isu (2010) who investigated the impact of external debt on Nigeria's economic growth using an error correction approach. The study argued that a framework linking the various sectors of the economy was required to analyse effects of external debt on growth. As such the national income identity model augmented with a debt variable was employed in this study.

This study however, focuses on total public debt (both domestic and external public debt) as opposed to analysis of public external debt alone. The model is simplified further by excluding consumption and includes Foreign Direct Investment (FDI) to capture the effects of the external sector given a positive outlook in this sector. The model is therefore specified as follows:

$$Y_t = \beta_0 + \beta_1 L_t + \beta_2 Z_t + \mu_t \quad \text{(Eqn 1)}$$

Where t is the time, *Y* is GDP in real terms, *L* is a vector of explanatory variables that have been empirically shown to be robust determinants of real growth, Z represents the stock of public debt-to-GDP ratio and μ is the error term which is assumed to have a zero mean and constant variance.

The mathematical model for the growth equation has been specified below and the expected direction of the relationship of each explanatory variable with Real GDP in the model is positive except for the public debt to GDP.

$$RGDP = f\left\{\underset{GFCFGDP'}{+}\ \underset{FDIGDP'}{+}\ \underset{TGEGDP'}{+}\ \underset{PDGDP'}{-}\right\} \quad \text{(Eqn 2)}$$

Where:

RGDP: Real GDP Growth

GFCFGDP: the ratio of Stock of Gross Fixed Capital Formation to Gross Domestic Product

FDIGDP: the ratio of Foreign Direct Investments to Gross Domestic Product

TGEGDP: the ratio of total Government Expenditure to Gross Domestic Product

PDGDP: the ratio of total Public Debt to Gross Domestic Product

3.2.2 Analysis of the Impact of Public Debt on the Determinants of Growth Rate of Real Gross Domestic Product

Theoretically, public debt does not affect growth directly but does so through variables that empirically determine growth namely public investment domestic savings, total factor productivity and human capital (Krugman, 1989; Elmendorf & Mankiw, 1999; Cohen, 1993). In analysing the public debt model, the study however focused on investment (disaggregated into private & public) and domestic savings. Specification of the public debt model below was informed by Syed (2010).

Save for the public debt service, all the explanatory variables in the equation shows a negative relationship with public debt as their excepted outcome. The mathematical equation with expected outcome relationship is specified as;

$$PDGDP = f\left\{\overset{-}{PGDFIGDP},\ \overset{-}{GGDFIGDP},\ \overset{-}{DSGDP},\ \overset{-}{REER},\ \overset{+}{PDSGDP}\right\} \dots\dots\dots\dots\dots (Eqn\ 3)$$

Where:

PDGDP:	the ratio of Public Debt Stock to Gross Domestic Product
PGDFIGDP:	the ratio of Gross Domestic Fixed Investments (GDFI)-Private to Gross Domestic Product
GGDFIGDP:	the ratio of Gross Domestic Fixed Investments (GDFI)-Public to Gross Domestic Product
DSGDP:	the ratio of Domestic Savings to Gross Domestic Product
REER:	the Real Effective Exchange Rate
PDSGDP:	the ratio of Public Debt Service to real GDP Growth

Using the VAR Framework the two stochastic models of regression (the growth and the public debt models) cardinal in our regression analysis will therefore be specified as follows:

3.2.3 The Growth Equation

$$\ln RGDP = \delta_0 + \delta_1 \ln GFCFGDP + \delta_2 \ln FDIGDP + \delta_3 \ln TGEGDP + \delta_4 \ln PDGDP + \mu_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (Eqn\ 4)$$

Where:

lnRGDP:	the log of Real GDP Growth
lnGFCFGDP:	the log of Stock of Gross Fixed Capital Formation to Gross Domestic Product
lnFDIGDP:	the log of Foreign Direct Investments to Gross Domestic Product
lnTGEGDP:	the log of total Government Expenditure to Gross Domestic Product
lnPDGDP:	the log of total Public Debt to Gross Domestic Product

Following Johansen & Juselius (1992), the Vector Autoregressive (VAR) model for the multivariate cointegrating test for the growth model would be expressed by:

$$ln\,RGDP_t = \delta_0 + \delta_1\, ln\,GFCFGDP_t + \delta_2\, ln\,FDIGDP_t + \delta_3\, ln\,TGEGDP_t + \delta_4 ln\,PDGDP_t + \mu_t \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (Eqn\ 5)$$

By taking the first-differencing the growth model can be written in its Vector Error Correction (VEC) form as:

$$\Delta\, ln\,RGDP_t = \delta_1 \Delta\, InRGDP_{t-1} + \delta_2 \Delta\, InGFCFGDP_{t-1} + \delta_3 \Delta\, InFDIGDP_{t-1} + \delta_4 \Delta\, InTGEGDP_{t-1} + \delta_5 \Delta\, InPDGDP_{t-1} + \xi_{t-1} + \mu_t \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (Eqn\ 6)$$

Where Δ is the difference operator and $\boldsymbol{\xi}_{t-1}$ is the lagged value of the error correction term derived from the long-run cointegration relationship and is used to capture the short-run dynamics.

3.2.4 The Public Debt Equation

From the mathematical equation for the public debt model in equation (3), we specify our regression stochastic model in its log form as:

$$ln\, PDGDP = \beta_0 + \beta_1\, ln\, PGDFIGDP + \beta_2\, ln\, GGDFIGDP + \beta_3\, ln\, DSGDP + \beta_4\, ln\, REER$$
$$+\beta_5\, ln\, PDSGDP + \mu_t \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.\dots\dots\dots...Eqn\ (7)$$

Where:

lnPDGDP:	the log of Public Debt Stock to Gross Domestic Product
lnPGDFIGDP:	the log of Gross Domestic Fixed Investments (GDFI)-Private to Gross Domestic Product
lnGGDFIGDP:	the log of Gross Domestic Fixed Investments (GDFI)-Public to Gross Domestic Product
lnDSGDP:	the log of Domestic Savings to Gross Domestic Product
lnREER:	the Real Effective Exchange Rate
lnPDSGDP:	the log of Public Debt Service to real GDP Growth

The multivariate co-integration approach advanced by Johansen will be based on the following VAR process:

$$InPDGDP_t = \beta_0 + \beta_1\, ln\, PGDFIGDP_t + \beta_2\, ln\, GGDFIGDP_t + \beta_3\, ln\, DSGDP_t +$$
$$\beta_4\, ln\, REER_t + \beta_5\, ln\, PDSGDP_t + \mu_t \ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (Eqn\ 8)$$

In a Vector Error Correction form, equation (8) will now be rewritten as:

$$\Delta InPDGDP_t = \beta_1 \Delta InPDGDP_{t-1} + \beta_2 \Delta InPGDFIGDP_{t-1} + \beta_3 \Delta InGGDFIGDP_{t-1} +$$
$$\beta_4 \Delta InDSGDP_{t-1} + \beta_5 \Delta InREER_{t-1} + \beta_6 \Delta InPDSGDP_{t-1} + \xi_{t-1} + \mu_t \ \cdots\cdots\cdots (Eqn\ 9)$$

Where Δ is the difference operator and ξ_{t-1} is the lagged value of the error correction term derived from the long-run co-integrating vector and is used to capture the short-run dynamics.

3.3 ECONOMETRIC PROCEDURES

3.3.1 Augmented Dick Fuller (ADF) Test of Unit Root

It is important to determine the characteristics of the individual series before conducting the co-integration analysis. This is important because in the absence of non-stationery of time series variables, the normal properties of t-statistics and measures such as R-squared break results, hence a problem. The econometric methodology applied will therefore begin by examining the rank of integration for the series of the dependent and explanatory variable in their natural log format using the Augmented Dickey-Fuller. Transforming of data in the natural logs allows for interpretation of results in their percentage term and possibly eliminates serial correlation and the problem of multicollinearity (Muoghalu & Ezirim, 2007; Syed, 2010). The regression equation for the ADF test of unit root can be written as follows:

$$\Delta Y_t = \alpha + \beta_t + \delta Y_{t-1} + \sum \delta_i \Delta Y_{t-1} + \mu_t \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (Eqn\ 10)$$

Where, the t symbol denotes time trend, Y is the variable in estimation procedure, μ represent the distributed random error tem with zero value of mean and constant variance. Assuming that μ_t is serially uncorrelated and using the AR(ρ) process, the hypothesis for the ADF test will be specified as follows;

H_0: $\delta = 1$ is the Null Hypothesis implying unit root, and

H_1: $\delta < 1$ is the Alternative Hypothesis implying stationery

The outcome of the above hypothesis test highlights the trend of the variables and therefore the modus operandi of estimation that will be applied in our model.

3.3.2 Cointegration Test

Long-run equilibrium analysis underlines the concept of cointegration of variables in a model which the study is trying to investigate between the debt variables and economic growth. To determine the long run relationship among the unit root variables, it is important to test empirically that the series are cointegrated. So far there are two major procedures to test for the existence of cointegration, namely, the Engle-Granger (1987) two step procedures and the Johansen Maximum Likelihood Estimation procedure. The Johansen MLE (1990) procedure is however preferred to the Engle-Granger methodology because it can estimate and test for the presence of multiple co-integrating vectors. Johansen procedure also allows for testing both restricted and unrestricted versions of co-integrating vector(s) and speed of adjustment parameters. On the basis of the existence of cointegration relationship between variables, a Vector Error Correction Mechanism (VECM) which according to Johansen (1990) avoids the arbitrary selection of endogenous and exogenous will be employed.

The Johansen approach involves two tests namely; the trace test ($_{\text{Trace}}$) which is the likelihood ratio test for the hypothesis that there are at most "r" co-integrating vectors and the Maximum Eigen Value ($_{\text{Max-Eigen}}$). The Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hanna and Quinn Information Criteria (HQIC) and Schwartz Bayesian Information Criterion (SBIC) will also be extended to determine the maximum lag order for the cointegration test. Equations 5 and 8 using the Johansen-Juselius approach for testing co-integration is specified as follows:

$$\Delta Y_t = \prod Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \, \Delta Y_{t-1} + \beta x_t + \mu_t \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (Eqn\ 11)$$

Where:

$$\prod = \sum_{i-1}^{p} A_j - 1 \quad \& \quad \Gamma_i = - \sum_{j-t+1}^{p} A_j$$

And:

Y_t is a K vector of non-stationery variables

X_t is a vector of deterministic variables

μ_t is a vector of white noises with zero mean and finite variance

The Π matrix represents the coefficient matrix Π to be estimated by the Johansen' method in unrestricted form and denotes the number of the cointegrating vectors. If Π has reduced rank $r < k$ where r and k denote the rank of Π and the number of variables constituting the long-run relationship, respectively, and two $k \times r$ matrices (α) and (β) exists, each with rank r, such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is stationary. Thus "r" is called the cointegration rank and each column of (β) is a cointegrating vector (representing a long-run relationship). The elements of the (α) matrix represent the adjustment or loading co-efficients, and indicate the speed of adjustment of the endogenous variables in response to any dis-equilibrating shocks, while the elements of the Γ matrices captures the short-run dynamic adjustments. Using the VECM approach we express equation 6 and 9 above as follows:

$$\Delta Y_t = \mu + \Gamma \Delta Y_{t-1} + \cdots\cdots + \Gamma_{k-1} \Delta Y_{t-k+1} - \prod \Delta Y_{t-1} + \mu_t \cdots\cdots\cdots\cdots\cdots (Eqn\ 12)$$

Where Γ is estimable parameters, Δ is a difference operator, and μ_t is a vector of impulses which represent the unanticipated movements in Y_t.

3.3.3 Reverse Causality and Endogeneity

Engel and Granger (1987) identify that if cointegration exists between two variables in the long-run then there must be either unidirectional or bi-directional granger causality between these two variables. The debt variables is argued to have a strong potential for endogeneity especially with respect to reverse causation where low or negative GDP growth rates are likely to induce issuance of more debt. While on the other hand, excessive debt hampers economic growth rate by impacting negatively on determinant of economic growth (Checherita & Rother, 2010). In this case, the granger causality analysis can identify whether two variables move one after the other or contemporaneously. When they move contemporaneously, one provides no information for characterizing the other. If "X causes Y", then changes in X should precede changes in Y.

These feedback effects will be analysed by a Wald test using the chi-square statistics for joint significance of parameters or through the significance of the error term in its lag.

The hypotheses for testing granger non-causality for the two models are specified below:

Model I

1 RGDP does not Granger-cause other explanatory variables
2 Other explanatory variables do not Granger-cause RGDP

Model II

1 PDGDP does not Granger-cause other explanatory variables
2 Other explanatory variables does not Granger-cause PDGDP

3.4 SAMPLE DATA

Data employed in this research cover the period 1980 to 2008. The World Development Indicators (WDI) provided invaluable statistical data for most of the macro-economic variables. There was a preference for statistical data from the WDI given the inconsistence of the data in Zambia from the main data sources namely Central Statistics Office under the Ministry of Finance and Bank of Zambia. The public debt statistical data was however obtained from the Ministry of Finance and Bank of Zambia.

In both sources of data, there were a number of limitations particularly relating to missing values for at least one or two variables though not for extended periods. Particularly, public debt service had missing values and based on the passed trends data had to be interpolated. The limitation of missing values is also mitigated given the fact that the time series of 1980 to 2008 for sample data is adequate enough to capture any data lapses if not for a long period and therefore suffices to give a true picture of how variables relate to each other overtime. This study also acknowledges the limitation relating to the sample size. Data particularly for domestic public debt and Gross Fixed Domestic Investment (GDFI) for both private and public was only available from 1980 while data for most of the macroeconomic indicators

for 2009 to 2010 was not available at the time of writing this thesis hence the study was limited to only 29 observations over the period of study.

The challenge of using limited sample size is noteworthy in this study particularly when it comes to defining the lag order length. This affects the estimation of results when data points are lost and the Degree of Freedom is reduced as alluded to earlier due to inclusion of more lags or can result in errors being correlated if the appropriate lag order is not defined. The application of lag selection order criteria based on the Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hanna and Quinn Information Criteria (HQIC) and Schwartz Bayesian Information Criterion (SBIC) was critical to ensure that the appropriate lag length in the two models were used before estimating the results.

Notwithstanding the above, some of the studies reviewed in our literature that had applied similar methodology were able to obtain estimates that are consistent and unbiased. Studies that have analyzed the growth effect of debt using small sample size include among many others; Chikuba (2003) who used a sample size of 30, Jayaraman, (2006) utilised a sample size of 35, El-Mahdy (2009) utilised 25 observations and Isu (2010) employed a sample size of 31. The unbiased and consistent results obtained in the studies referred to above gave compelling reasons to believe that the results of this study would be expected to be unbiased and consistent.

Justification of variables employed in this study and their expected outcome is presented in Appendix E.

CHAPTER FOUR

4.0 ECONOMETRIC ANALYSIS AND INTERPRETATION OF RESULTS

4.1 DESCRIPTIVE ANALYSIS OF STATISTICS

4.1.1 Growth Model

A statistical analysis of the raw data employed in our analysis showed an in-built trend on some of the important variables. For instance, an upward trend is depicted in RGDP variable from 2000 upwards. This is indicative of the positive growth averaging 5.4% recorded in the economy and largely attributed by the irrevocable debt relief extended to Zambia under the MDRI and HIPC Initiative. A further augmenting factor in the growth is the inflow of Foreign Direct Investment especially in the mining sector following the privatization reforms that were embarked upon in 1991. Government expenditure (TGEGDP) on the other hand has an upward trend indicating a positive influence on economic growth especially if a bigger part of it is spent on capital goods, which is argued to crowd-in private investment.

The ratio of Public debt-to-GDP (PDGDP) also depicts a geometric increase reaching a record high in 2004. During this period the Country experienced a debt crisis that greatly impacted negatively on the economic growth of the Country. The period was also characterized by macro-economic instability and sometimes recording negative growth with high inflation rates as alluded to earlier in the study. Following the debt relief in 2005, PDGDP experienced a geometric reduction. In this regard, a downward trend continued to characterize the ratio of public debt-to-GDP but only for a short period from 2005 to 2007 after which the variable is depicted to rise again.

The ratio of PDGDP and the RGDP variables in their log form are presented in Figures 5 and 6 below while other variables used in the study have been presented in Appendix A and B.

Figure 5: Zambia's Public Debt to GDP from 1980-2008

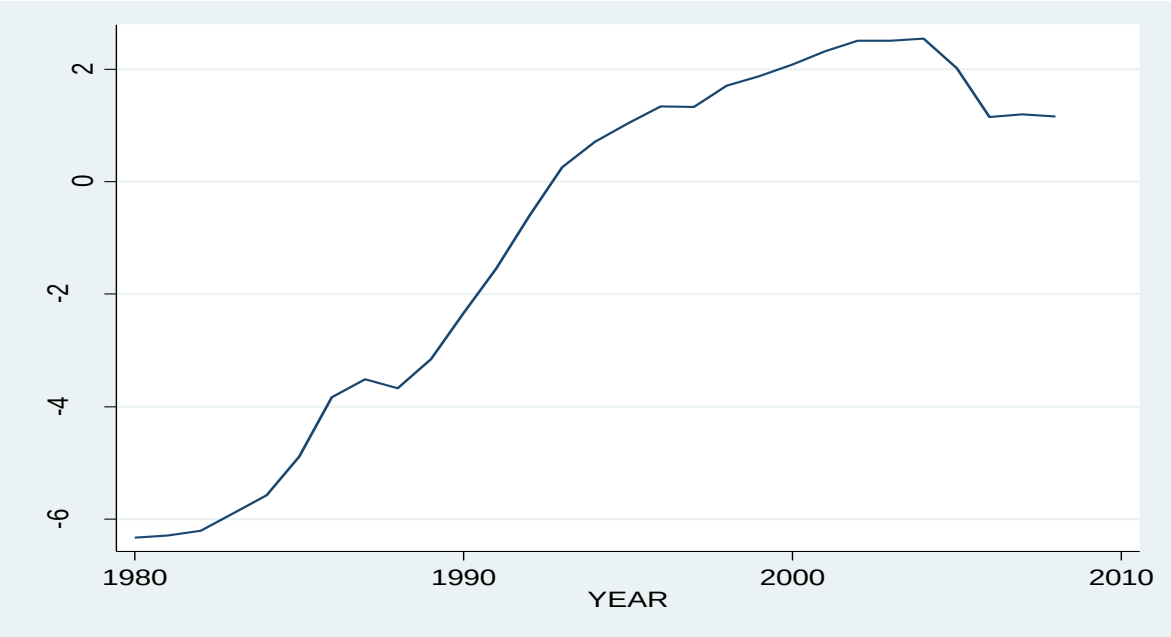
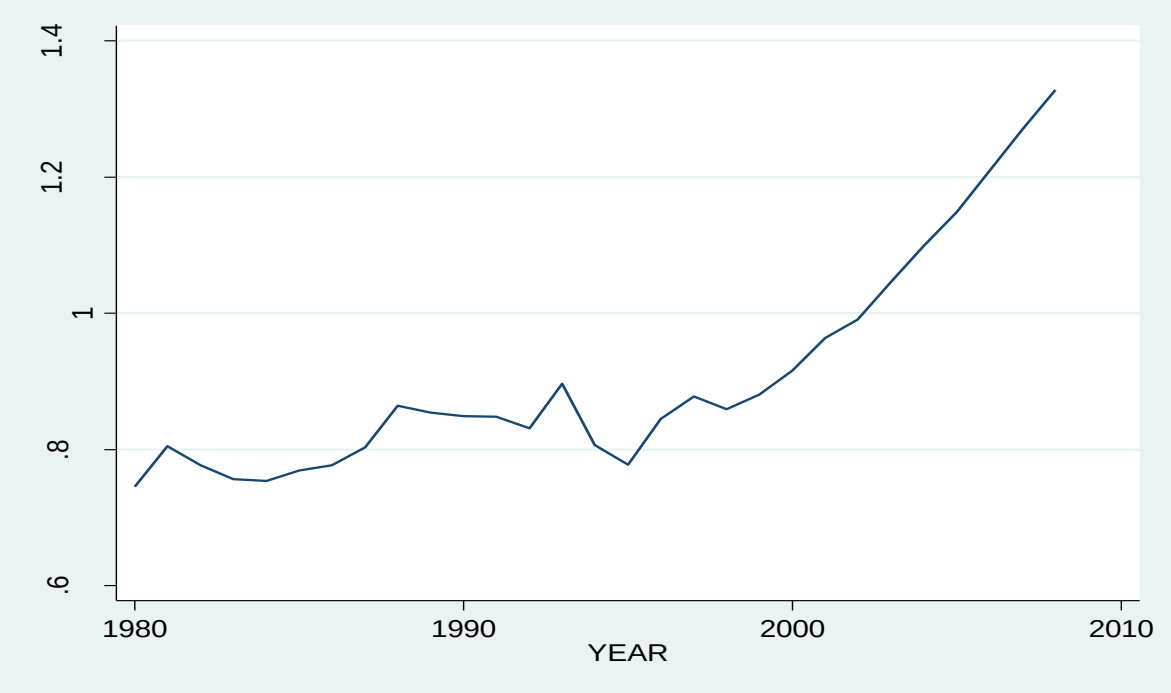


Figure 6: Zambia's RGDP from 1980-2008



The result of the summary of descriptive statistics of the variables used in our growth model is given in Table 2 below;

Table 2: Summary of Descriptive Statistics of Variables for the Growth Model

Variables	Obs	Mean	Std. Dev	Min	Max
RGDP	29	2.513728	0.4467722	2.106976	3.772799
GFCFGDP	29	0.1523427	0.0518245	0.066013	0.241805
FDIGDP	29	0.0408966	0.0291343	0.0063	0.116
TGEGDP	29	0.1832891	0.0618514	0.080431	0.304489
PDGDP	29	3.442557	4.21639	0.001776	12.76713

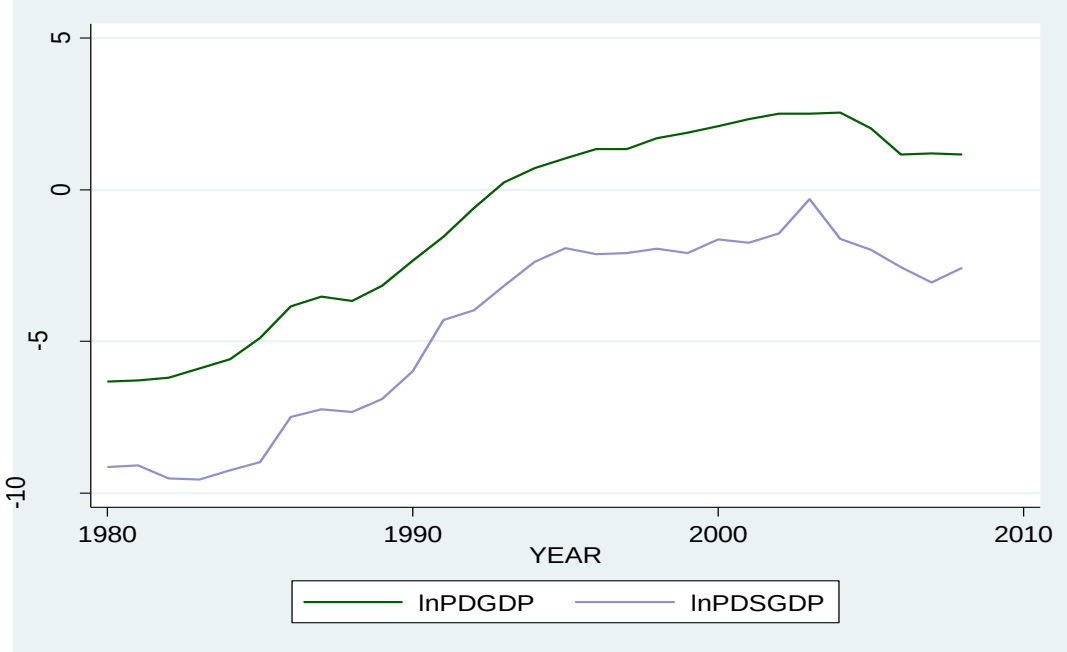
4.2. IMPACT OF PUBLIC DEBT BURDEN ON THE EMPIRICAL DETERMINANT OF ECONOMIC GROWTH

4.2.1 The Public Debt Model

A statistical analysis of the data employed in this model reveals that there is an in built trend in the ratio of Public Investment-to-GDP (GGDFIGDP) and Real Effective Exchange Rates (REER). The ratio of GGDFIGDP shows fluctuations during the period under review. The ratio of Private Investment-to-GDP (PGDFIGDP) is characterized by a downward trend from 1980 to 2000 and an increase thereafter.

Plotting PDGDP and PDSGDP in their log form shows an upward trend of both variables indicating a positive relationship. This reinforcing relationship helps us to understand that as the stock of public debt increases, there is an increase in the principle and interest repayments. However, between the periods 2005 to 2008, there is a sharp decline in the public debt stock and public debt service. The decline in the debt burden is indicative of the positive benefits arising from the MDRI and HIPC Initiatives. Reviewing the period 2008 onwards, PDGGP is depicted with a rising trend and consequently an increase in the PDSGDP. The ratio of Public Debt Service-to-GDP in its log form is graphically presented in Figure 7 below while the rest of the variables are graphically presented in Appendix A and B.

Figure 7: ***Trends in lnPDGDP and lnPDSGDP: 1980-2008***



A summary of descriptive statistics for the public debt model is presented below in Table 3.

Table 3: Summary of Descriptive Statistic of Variables in the Public Debt Model

Variables	Obs	Mean	Std. Dev	Min	Max
PDGDP	29	3.442557	4.21639	0.001776	12.76713
PGDFIGDP	29	0.0954685	0.0482056	0.017474	0.215471
GGDFIGDP	29	0.068804	0.0237841	0.034687	0.108595
DSGDP	29	0.1638033	0.098561	0.006467	0.315096
REER	29	0.1054577	0.0275324	0.051365	0.179955
PDSGDP	29	0.0929989	0.1432759	0.00007	0.730282

4.3 TESTING FOR UNIT ROOTS USING THE AUGMENTED DICK-FULLER (ADF) TEST

It is necessary to verify the stationarity properties of variables included prior to attempting a multivariate cointegration analysis. This is vital because econometric analysis of non stationary variables affects the efficiency and consistency of estimation results (Granger, 1974). To determine the order of integration, ADF unit root test was carried out on levels and differences for variables used in both models. The null hypothesis underlying unit root testing is that the variable under investigation has a unit root and the alternative is that it does not (Dick and Fuller, 1979). The results of the unit root test for variables used in the analysis in their log form are reported in Table 4 below;

Table 4: ADF Unit Root Test of Variable at Levels & Difference with a Trend included

Variables in their log form	**Levels**		**Difference**	
	Lag(0)	**Lag(1)**	**Lag(0)**	**Lag(1)**
RGDP	0.161	0.076	-5.738*	-4.449*
GFCFGDP	-2.292	-2.321	-6.073*	-5.508***
FDIGDP	-5.565*	-4.006*	-8.316*	-6.408*
TGEGDP	-0.898	-1.742	-4.101*	-4.171**
PDGPD	-1.090	-0.513	-3.113**	-3.565***
PGDFIGDP	-2.732	-2.209	-7.645*	-4.975*
GGDFIGDP	-3.934**	-2.605	-8.150*	-5.530*
DSGDP	-3.052	-2.011	-7.380*	-4.481*
REER	-2.446	-2.900	-4.743*	-5.761*
PDSGDP	-0.248	-0.636	-4.257**	-3.443***

Asterisk (*), (**) & (***) indicate significance at 1%, 5% & 10% respectively

The ADF unit root test above show that at levels we cannot reject the null hypothesis of unit root for almost all the variables implying that they were non-stationary. FDIGDP and GGDFIGDP were nevertheless stationary at levels. However, the null hypothesis of unit root

test applied to the variables in their first differences was rejected for all the variables showing that they were stationary and integrated of order one-1(I).

Inferring from the results in Table 4 above, we can conclude that all the variables are stationary at first differencing and are integrated of the same order, giving rise to the possibility of the existence of a long-run relationship among the variables. To identify the long-run relationship among the variables included in both models, Johasen (1988) multiple cointegration test was employed.

4.4 JOHANSEN TEST FOR COINTEGRATION

Underlying a VAR framework is the lag order selection criteria which is done on the basis of Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hanna and Quinn Information Criteria (HQIC) and Schwartz Bayesian Information Criterion (SBIC). According to Johasen (1988), the procedure for selecting the lag length entails choosing an optimal lag with the minimum value using the above four selection criteria. The lag length of three (3) passed this test for both models and was therefore selected.

4.4.1 Cointegration Test for the Growth Model

On the basis of the optimal lag length of three, the Johansen test for cointegration was applied to analyse the presence of cointegration in the growth model. Table 5 below gives the results of the cointegration test;

Table 5: Johansen Cointegration Test using Trace Statistics

Number of Cointegrating Vectors	**Eigen Value**	**Trace Statistic**	**5% Critical Value**
$r = 0$	.	86.5787**	68.52
$r \leq 1$	0.78115	47.0749**	47.21
$r \leq 2$	0.61874	22.0040	29.68
$r \leq 3$	0.47505	5.2484	15.41

Asterisks (**) denote acceptance of the $H_0 : r \leq 1$ at 5% level of significance

Table 6: Johansen Cointegration Test using the Maximum Eigen Value Statistic

Number of Cointegrating Vectors	Eigen Value	Max-Eigen Statistic	5% Critical Value
$r = 0$	.	39.5038**	33.46
$r = 1$	0.863	25.0710**	27.07
$r = 2$	0.828	16.7556	20.97
$r = 3$	0.471	0.47505	14.07

Asterisks (**) denote acceptance of the H_0 : $r = 1$ at 5% level of significance

The results of the test of cointegration in Table 6 above signify maximum and trace test statistics and their associated critical values. These test statistics help evaluate the null hypothesis of ϒ=0 against the general alternatives of ϒ>0, 1, 2, or 3. The test for rank of cointegration was carried out with the optimal lag length of 3 determined by the AIC SBIC and HQIC. At 5% critical values for both the maximum and trace test statistics, we fail to reject the null hypothesis of ϒ≤1 which shows that the model has at least one cointegrating Vector. On the basis of the above results, we thus conclude that a long-run relationship exists among RGDP, GFCFGDP, FDIGDP, TGEGDP and PDGDP.

4.5 A VECTOR ERROR CORRECTION FOR THE GROWTH MODEL

The VEC model enables us to measure not only the parameters of the cointegrating equations(β), but also the short-term adjustment parameters(α). The coefficient of the lagged error-correction term, according to (Miller & Russek, 1990) is the short-term adjustment coefficient that shows the speed at which the long-term disequilibrium in the dependent variable is being adjusted in each short term period. Theoretically, it is expected that the error-correction term should have value between zero and one showing that the system has been brought back to equilibrium (Johansen & Juselius, 1992).

Accordingly, a VECM was conducted to estimate both models using Case IV (unrestricted intercepts and unrestricted linear trend and coefficients) of Johansen cointegration approach. The outcome of the empirical analysis for both the long-run and short run dynamics of the growth model are presented in the Tables 7 and 8 below respectively;

Table 7: Long Run Normalised Cointegration Equations for the Growth Model

Identifications: beta is exactly identified

Johansen normalization restrictions imposed

Beta (β)	Coef.	Std Err	Z	P>|z|	[95%Conf. interval]	
lnRGDP	1					
lnGFCFGDP	-2.989969*	.2569012	-11.64	0.000	-.3.493486	-2.486452
lnFDIGDP	-2.158693*	.1657233	-13.03	0.000	-2.483505	-1.833882
lnTGEGDP	-1.292991*	.3781421	-3.42	0.001	.2025301	.3393352
lnPDGDP	0.2709326*	.0348999	7.76	0.000	.2025301	.3393352
_CONS	-25.61727*					

Asterisks (*), (**) and (***) denote significance at 1%, 5% and 10% respectively

4.5.1 Analysis of the Long-run Normalized Co-integration Equation for the Growth Model

Literature review showed that normalized co-integrating coefficients have been used to interpret the long-run elasticity of dependent and independent variables (Erdal, 2002; El-Mahdy, 2009; Isu, 2010). In this study, we normalize the co-integration with respect to the variables of interest so as to get better interpretation. Using the error correction results, the normalized cointegrating vector (β) for the growth model can be written as:

$$\hat{\beta} = \begin{bmatrix} 1 \\ -2.989969 \\ -2.158693 \\ -1.292991 \\ 0.2709326 \\ -25.61727 \end{bmatrix}$$

Thus we formulate the long- run equation with respect to this model as follows;

$$InRGDP_t = 25.617\ 27 + 2.989969InGFCFGDP_t + 2.158693InFDIGDP_t + 1.292991InTGEGDP_t - 0.2709326InPDGDP_t \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (Eqn\ 13)$$

The long-run equation above shows that GFCF, FDI, TGE are positively correlated with RGDP in the long-run while PDGDP and RGDP are negatively correlated. The outcome of the results in the growth model are statistically significant at all levels, thus supports the theory and our expected hypothesis.

Deriving from the estimated elasticises of these variables as contained in the long-run normalized vector(β), a 10% increase in GFCF, FDI and TGE would bring about an increase in RGDP by 29.8%, 21.5% and 12.9% respectively. According to theory, the negative relationship between RGDP and PDGDP suggests that a decline in RGDP of 2.7% is accounted for by a 10% increase in PDGDP.

4.5.2 Analysis of the Short-Run Co-integration Equation for the Growth Model

In order to study the short-run behaviour of each variable in response to the residual from the co-integrating equation in the growth model, the short-run model is imperative in this study. As noted by Johansen (1988), the ECT or co-efficient given by the short-run model measures the speed of adjustment of each variable in response to a deviation from the steady state equilibrium relationship. The results indicating the speed of adjustment are therefore presented in Table 8 below;

Table 8: Short Run Cointegration Equations for the Growth Model (Adjustment Parameters)

Alpha (α)	**Coef.**	**std. Err**	**Z**	**P>|z|**	**[95% Conf. Interval]**	
lnRGDP	-.0133579	.0121604	-1.10	0.272	-.0371919	-.0104761
lnGFCFGDP	.144915**	.0700197	2.07	0.038	.007679	.2821511
lnFDIGDP	.5521503**	.2480904	2.23	0.026	.065902	1.038399
lnTGEGDP	.0032135	.0708356	0.05	0.964	-1.1356218	.1420487
lnPDGDP	0.1512308	.1394814	1.08	0.278	-.1221478	.4246093

Asterisks (*), (**) and (***) denote significance at 1%, 5% and 10% respectively

From the vector error estimation results in Table 8 above, the short-run adjustment vector (α) for the growth model can be specified as follows:

$$\hat{\alpha} = \begin{bmatrix} -0.0133579 \\ 0.1449150 \\ 0.5521503 \\ 0.0321350 \\ 0.1512308 \end{bmatrix}$$

The short run model will be specified as follows:

$$ln\, RGDP_t = 0.144915\, ln\, GFCFGDP_t + 0.55215\, ln\, FDIGDP_t + 0.03213\, ln\, TGEGDP_t$$
$$+0.15123\, ln\, PDGDP_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots . Eqn\ 14$$

The estimate of the coefficients on the adjustment matrix (α) helps to understand the co-movement of the variables in the short-run. The adjustment coefficients for the growth model are: -0.0133579, 0.144915, 0.5521503, 0.032135 and 0.1512308. This means that given any disequilibrium in the short-run the variables RGDP has 1.34%, GFCF (14.50%), FDI (55.21%), TGE (3.21%) and PDGDP (15.12%) speed of adjustment towards long-run equilibrium condition. By implication, this means that when the average level of RGDP is too high, it falls back towards the PDGD by 1.34%. Similarly, given any disequilibrium in the previous period PDGDP adjust itself upwards towards RGDP by 15.12%.

4.6 POST ESTIMATION DIAGNOSTIC TESTS

The post estimation tests to ascertain the validity and stability of the specified model in a VEC were carried out. This is important because inference on the results of the diagnostic test would help to see if the estimates of a VEC satisfy the BLUE assumptions implying that they have the minimum variance, unbiased, consistent, linear and normally distributed in class of all linear, unbiased estimators (Gujarati,1995). In this regard, the study carried out important diagnostic tests in order to ascertain if the models employed have a desired fit. The results of the diagnostic test are indicated in Tables 9 and 10 and Figure 8 below;

4.6.1 Test for Serial Correlation

Table 9: Lagrange Multiplier Test Results for the Growth Model

Lag	X^2	p-value
1	22.6178	0.59987
2	20.7232	0.70794
3	35.6771	0.07664**

Asterisks (**) denote acceptance of H_O at 5% level of significance

To ascertain that the residuals were not serially correlated, the Lagrange Multiplier (LM) test was employed. According to the test results the null hypothesis of no autocorrelation was not rejected at 5% level of significance and at the optimal lag length of 3.

4.6.2 Test for Normality of Residuals

Table 10: Jarque-Bera Test Results for the Growth Model

Equation	Jarque-Berra Statistic	p-value
Δ lnRGDP	0.287	0.86635*
Δ lnGFCFGDP	0.491	0.78248*
Δ lnFDIGDP	0.019	0.99051*
Δ lnTGEGDP	1.588	0.45211*
Δ lnPDGDP	1.557	0.45915*
ALL	3.941	0.94007*

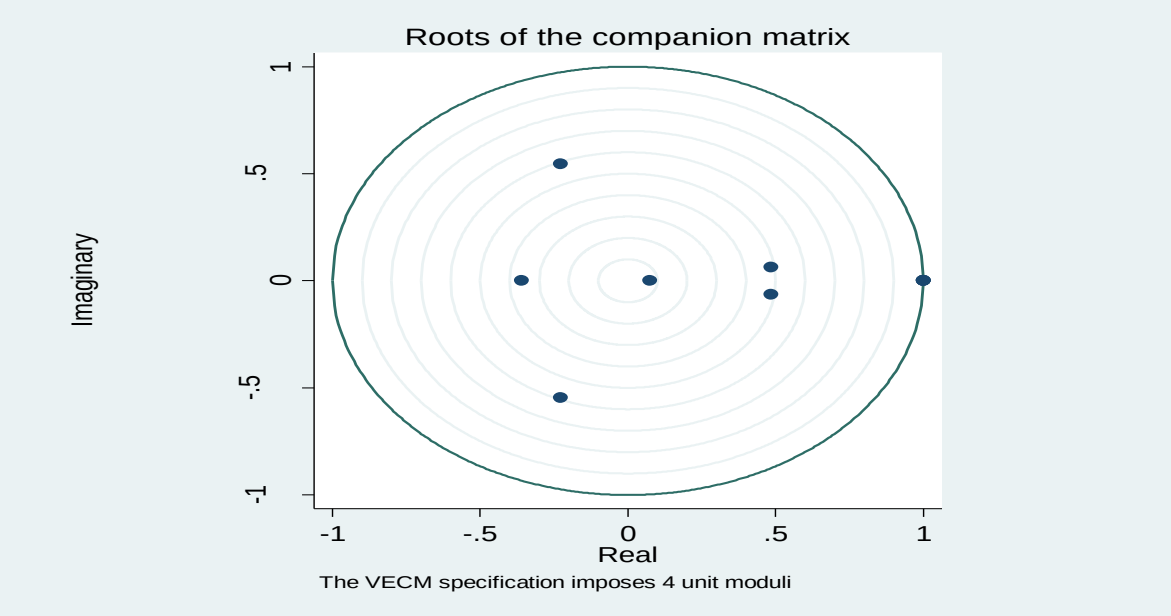
Asterisks (*) denote acceptance of H_O at all levels of significance

To test for normality of residuals, the Jarque-Bera normality test was employed. The test showed that the null of independently and normally distributed errors was not rejected at all levels of significance.

4.6.3 Test for Stability of the Model

To ascertain that the specified growth model was stable, a VEC stability test was undertaken. Analysis of the results showed that 4 unit moduli were imposed with a value of unity (1) and the Eigen-values are strictly less than one. The VEC stability graph below also shows that none of the Eigen-values appear close to the unit circle. The stability check thus confirms that the Growth model is well specified.

Figure 8: Eigen Stability Test for the Growth Model



Note: the dots represent the eigen-values that do not appear close to the unit circle

Overall results of the three most important diagnostic test indicates that the growth model employed in this study have the desired fit and is well specified. Eigen values obtained after the stability test are presented in Appendix C.

4.7 ESTIMATES OF A VECTOR ERROR CORRECTION FOR THE GROWTH MODEL

According to Engle and Granger (1987), if two series are co-integrated of order one, *i.e.* I(1), then there must exists VECM representation in order to govern joint behaviour of the series of the dynamic system. In a VECM specification, short run as well as long run adjustments are made. VECM also provides information about the causal factors that may affect

variables. Pre-requisites for the application of a VECM is that, all variables must be integrated of the same order and then there should exist at least one co-integrating relationship among the variables. A VECM was estimated without restrictions and results of the VEC estimates for the growth model are presented in Table 11 below;

Table 11: Estimates of a Vector Error Correction Model

EQNS:	lnRGDP	lnGFCFGDP	lnFDIGDP	lnTGEGDP	lnPDGDP
Constant	0.264**	-0.090	-0.035	0.046	0.216
	(0.014)	(0.081)	(0.290)	(0.082)	(0.163)
$\Delta(lnRGDP)_{t-1}$	0.169	-1.017	1.290	1.308	-1.231***
	(0.297)	(1.710)	(0.989)	(1.730)	(3.407)
$\Delta(lnRGDP)_{t-2}$	-0.213	2.505***	3.837	-1.512	-0.438
	(0.239)	(1.380)	(4.890)	(1.396)	(2.749)
$\Delta(lnGFCFGDP)_{t-1}$	-0.065	0.260	1.442	-0.137	0.483
	(0.048)	(0.233)	(0.989)	(0.282)	(0.556)
$\Delta(lnGFCFGDP)_{t-2}$	-0.029	0.386***	0.105	0.164	0.227
	(0.040)	(0.233)	(0.829)	(0.236)	(0.466)
$\Delta(lnFDIGDP)_{t-1}$	-0.014	0.171	-0.121	0.172	0.072
	(0.018)	(0.108)	(0.383)	(0.109)	(0.215)
$\Delta(lnFDIGDP)_{t-2}$	-0.019	0.011	-0.149	0.151***	-0.001
	(0.015)	(0.085)	(0.302)	(0.086)	(0.170)
$\Delta(lnTGEGDP)_{t-1}$	0.080***	0.185	-0.071	0.581**	-.299
	(0.049)	(0.285)	(1.010)	(0.288)	(0.576)
$\Delta(lnTGEGDP)_{t-2}$	0.013	0.196	0.262	-0.517**	-0.050
	(0.053)	(0.307)	(1.088)	(0.310)	(0.612)
$\Delta(lnPDGDP)_{t-1}$	-0.028	-0.002	-0.136	0.175	-0.732**
	(0.029)	(0.171)	(0.607)	(0.173)	(0.341)
$\Delta(lnPDGDP)_{t-2}$	0.040	-0.118	0.817	-0.045	-0.654
	(0.036)	(0.209)	(0.740)	(0.211)	(0.416)
$(ECT_1)_{t-1}$	-0.013**	0.144**	0.552**	0.032	0.151
	(0.012)	(0.070)	(0.248)	(0.070)	(0.139)
R^2	0.663	0.510	0.6263	0.5932	0.6863

Asterisks (*), (**) and (***) denote significance at 1%, 5% and 10% respectively

In the table above, (Δ) is the first difference operator and "ECT_{t-1}" is the lagged error correction term. R^2 indicates the goodness of fit and measures how much of the variations between the dependent and independent variables have been explained by the model (Gujarati, 1995). The term ECT_{t-1} shows the degree of disequilibrium level of the variables in the previous period. Thus above specification of the VECM states that change in a variable depends on other variables, on its own past values as well as on the degree of disequilibrium among the variables. The VEC specification above has five equations explaining the short-run and long-run dynamics in the growth model. In order to have a stable long-run equilibrium path, the ECT in its lag form should be negative and statistically significant (Johansen, 1988).

Analysis of the results in Table 11 indicates that equation 1 has a stable long-run relationship between RGDP and the explanatory variables since the ECT_{t-1} carried the correct sign and was statistically significant at 5% level of significance. The results from equation 1 also affirm absence of no short-run relationship except for past values of TGEGDP which exhibited a significant short-run relationship with RGDP at 10% level of significance. The inverse relationship between our variables of interest RGDP and PDGDP supports theoretical argument that in the long-run, growth effects of public debt on economic growth are negative (Mankiw, 1956). However, the coefficient of ECT_{t-1} is given by -0.013 showing a very low speed of adjustment towards long-run equilibrium. This indicates that given any disturbance in the system in the long-run, in every short period only 1.3% correction to equilibrium would take place.

In the case of equation 2, the coefficient of ECT_{t-1} for gross fixed capital formation was statistically significant but it carried a positive sign which indicated that in case of any disturbance there would be divergence from the equilibrium making the whole system helpless in achieving equilibrium position. In the case of short-run relationship, it is indicated that gross fixed capital formation exhibit a positive relationship with its passed values and Real GDP at 10% level of significance respectively. The equation shows that 51% of the variations between the dependent variables and regressors are explained.

The ECT for equation 3 is also significant but has a positive sign and thus does not warrant stability of the whole system of equation in case of any disequilibrium. No short-run relationship is deduced between Foreign Direct Investment and its determinants. The

equation shows that 63% of the variations between the dependent variables and regressors in equation 3 have been explained.

Equation 4 and 5 does not indicate any long-run relationship between variables as the error terms are not statistically significant and do not carry the expected negative signs. However, total Government expenditure in equation 4 has shown to have significant positive relationship with its passed values and foreign direct investment respectively at their level of significance. In equation 5, the coefficient of Real GDP and public debt in the previous period are statistically significant at 10% and 5% level of significance indicating a significant impact on public debt in the short- run. R^2 of 59% and 69% for equation 4 and 5 respectively explains how much of the variations between the dependent and independent variables have been explained.

4.8 VECM BASED GRANGER CAUSALITY TEST FOR THE GROWTH MODEL

Eagle and Granger (1988) states that if two variables are stationary of order one and co-integrated, then either the first variable granger cause the second variable or the second variable granger cause the first variable. In this study, multivariate granger causality test based on a VECM is utilized in order to capture all possible channels of the causality among variables. The causality between dependent and independent variables was informed by conducting a Wald test, that is, by calculating the $\Sigma\chi 2$ based on the null hypothesis that a set of coefficients on the lagged values of the independent variables are equal zero. By adding the error correction term in a VECM, it provides an additional channel for long-run causality which is ignored in a standard Granger non-causality test. Long-run causality is confirmed through the significance of the coefficient of lagged error term and short-run causality is confirmed through the joint significance of coefficients of lagged variables as well as the overall significance of $\chi 2$. The VECM based granger non-causality results are presented in Table 12 below;

Table 12: VEC Granger Non-Causality Test Results for the Growth Model

Null Hypothesis: Independent Variable (X) does not Granger Cause Y	Dependent Variable(Y)	Chi2	Prob>chi2	Decision for the Null
lnGFCFGDP	lnRGDP	1.90***	0.0386	Rejected
lnFDIGDP	lnRGDP	1.71	0.4254	Cannot be Rejected
lnTGEGDP	lnRGDP	4.76***	0.0926	Rejected
lnPDGDP	lnRGDP	1.62	0.4451	Cannot be rejected
ALL	lnRGDP	15.16***	0.0164	Rejected
	ECT_{t-1}	1.21**	0.0272	Rejected
lnRGDP	lnGFCFGDP	3.69**	0.1584	Rejected
lnFDIGDP	lnGFCFGDP	3.92	0.2380	Cannot be rejected
lnTGEGDP	lnGFCFGDP	1.97**	0.1409	Rejected
lnPDGDP	lnGFCFGDP	0.38**	0.8287	Rejected
ALL	lnGFCFGDP	10.50***	0.3975	Rejected
	ECT_{t-1}	4.28**	0.0385	Rejected
lnRGDP	lnFDIGDP	0.66	0.7204	Cannot be rejected
lnGFCFGDP	lnFDIGDP	2.29	0.3179	Cannot be rejected
lnTGEGDP	lnFDIGDP	0.07	0.8850	Cannot be rejected
lnPDGDP	lnFDIGDP	1.67	0.9680	Cannot be rejected
ALL	lnFDIGDP	7.93	0.6352	Cannot be rejected
	ECT_{t-1}	4.95**	O.0260	Rejected
lnRGDP	lnTGEGDP	1.77*	1.4124	Rejected
lnGFCFGDP	lnTGEGDP	0.55	0.7595	Cannot be rejected
lnFDIGDP	lnTGEGDP	3.40	0.1829	Cannot be rejected
lnPDGDP	lnTGEGDP	1.42***	0.4918	Rejected
ALL	ALL	18.65*	0.0449	Rejected
	ECT_{t-1}	0.00	0.9638	Rejected
lnRGDP	lnPDGDP	0.15***	0.9258	Rejected
lnGFCFGDP	lnPDGDP	0.80***	0.6715	Rejected
lnFDIGDP	lnPDGDP	0.20	0.9038	Cannot be rejected
lnTGEGDP	lnPDGDP	0.50**	0.7780	Rejected
ALL	lnPDGDP	11.79	0.2994	Cannot be rejected
	ECT_{t-1}	1.18***	0.2783	Rejected

Asterisk *(**) *** indicates rejection of H_0 at 1%, 5% and 10% respectively

The equation of Real GDP in equation 1 indicates that gross fixed capital formation and Government expenditure individually granger cause Real GDP in the short-run at 10% level of significance while long-run granger causality running from Real GDP to other variables in the equation has been indicated to exist at 1% level of significance. All variables are said to jointly granger cause Real GDP in the short-run.

Equation 2, long-run causality of variables is indicated at 5% level of significance while in the short-run all variables except foreign direct investment are said to granger cause gross fixed capital formation. The cause effects of Government expenditure on gross fixed capital formation could indicate that significant expenditure by Government is channelled toward education and health resulting in Human Capital Development (HCD), which according to Solow (1956) is an important component of capital formation. The causal effect of public debt on gross fixed capital formation in the short-run was also empirically confirmed by Cholifihani (2008) in a study done on Pakistan. This outcome also supports theoretical argument that in the short-run public debt if channelled to productive sector would contribute to accumulation of capital stock. All variables are however said to jointly granger cause gross fixed capital formation in the short-run.

The third equation shows that all variables do not granger cause Foreign Direct Investment. The significance of the ECT_{t-1} at 5% level of significance does however indicate the long-run causality from foreign direct investment to other variables in the equation. In the fourth equation, Public Debt and Real GDP have shown to granger cause Government expenditure in the short-run. On the overall, all variables are said to jointly granger cause Government Expenditure in the short-run. The equation however does not exhibit any long-run causality effects for the fourth equation.

The last equation informs existence of long-run causality of variables given that the ECT_{t-1} is statistically significant at 10% level of significance. In the short-run, only Real GDP, Gross Fixed Capital Formation and Government Expenditure have shown to statistically granger cause Public Debt.

4.8.1 Analysis of Direction of Granger Causality in the Growth Model

In the case of uni-direction granger causality, Real GDP is said to granger cause Public Debt in the short-run. Granger causality in the short-run is also indicated to run from Government

Expenditure to Gross Fixed Capital Formation. Given the direction of causality in this case and the outcome of the relationships of these variables in the model, Real GDP and Government Expenditure would then be our target variables to guide policy decision.

Gross Fixed Capital Formation is said to exhibit bi-granger causality with Real GDP and Public Debt in the short-run respectively. This outcome is also supported by the positive relationship between Public Debt and Gross Fixed Capital Formation shown in equation 13 above. Government Expenditure and Public Debt have also shown to granger cause each other. And by implication, this shows that borrowing has been an important component of GRZ's budget to finance the deficit. To the extent that this will contribute to economic growth will largely depend on how Government utilises the debt component within the budget.

4.9 SUMMARY OF RESULTS FOR THE GROWTH MODEL

The overall results of the Growth Model confirms our earlier expectation of long-run negative effect of Public Debt on growth and supports the theoretical argument given by the neoclassical economists. The estimates of the normalised long-run equation were also statistically significant thus fulfilling the objective of this study to guide policy decision. The long-run inverse relationship and the presence of feedback effects from Real GDP to Public Debt informs the negative effect that the accumulative stock of Public Debt could have on growth.

4.10. COINTEGRATION TEST FOR THE PUBLIC DEBT MODEL

The Johansen test for cointegration was also applied on the Public Debt Model to investigate the number of cointegrating vectors. The results of the test of cointegration are indicated in the table 13 and 14 below;

Table 13: Johansens Cointegration Test using the Trace statistic

Number of Cointegrating Vectors	Eigen Value	Trace Statistic	1% critical Value
$r = 0$	.	121.2628*	103.18
$r \leq 1$	0.78755	79.4380*	54.46
$r \leq 2$	0.61294	53.8101*	35.65
$r \leq 3$	0.49938	35.1283	20.04

Asterisks (*) denote acceptance of the $H_0 : r \leq 2$ at 1% level of significance

Table 14: Johansens Cointegration Test using the Maximum Eigen Value statistic

Number of Cointegrating Vectors	Eigen value	Max-Eigen Statistic	1% critical value
$r = 0$	.	41.8248*	45.10
$r = 1$	0.78755	25.6280*	38.77
$r = 2$	0.61294	18.6818*	32.24
$r = 3$	0.49938	14.2373	25.52

Asterisks (*) denote acceptance of the $H_0 : r = 2$ at 1% level of significance

The above results show that at the optimal lag length of 3, we failed to reject the null hypothesis of $\Upsilon \leq 2$ for both statistics given by the maximum and trace test statistics. This is an indication that the cointegrating matrix Π has full rank at 1% level of significance.

The result therefore shows that the model has at least 2 cointegrating Vectors, implying a long-run relationship among the variables. On the basis of the cointegration test, we proceed to estimate the long-run dynamics of the Public Debt model.

4.10.1 Analysis of a Vector Error Correction for the Public Debt Model

Application of a VEC model is premised on the fact that all the variables were stationary in their first differences i.e. thus integrated of order one I(1). The results for the long-run normalized cointegration equations are presented in Table 15 below;

Table 15: Cointergaration Normalised Equation for the Public Debt Model

Identifications: beta is exactly identified

Johansen normalization restrictions imposed

Beta	**Coef.**	**Std Err**	**Z**	**P>|z|**	**[95%Conf. interval]**	
lnPDGDP	1					
lnPGDFIGDP	-.4242044*	.0154151	27.52	0.000	.3939913	.4544175
lnGGDFIGDP	-1.014045*	.0190004	-53.37	0.000	-1.051285	-.9768045
lnDSGDP	.3269863*	.0095304	-34.31	0.000	.3083071	3.456656
lnREER	2.31128*	.0324137	71.31	0.000	2.24775	2.374809
lnPDSGDP	-.9410089*	.0020943	-449.32	0.000	-9451136	-.9369042
_CONS	-.4308151					

Asterisks (*), (**) and (***) denote significance at 1%, 5% and 10% respectively

Accordingly, we define the normalized co-integration Vector (β) for the Public Debt model as follows;

$$\hat{\beta} = \begin{bmatrix} 1 \\ 0.04242044 \\ -1.014045 \\ 0.3269863 \\ 2.31128 \\ -0.9410089 \\ 0.4308151 \end{bmatrix}$$

The long-run equation for the Public Debt model can then be written in this format;

$$InPDGDP_t = -0.4308 - 0.0424InPGDFIGDP_t + 1.0140lnGGDFIGDP_t - 0.3269InDSGDP_t$$

$$- 2.3112InREER_t + 0.9410InPDSGDP_t \cdots\cdots\cdots\cdots (Eqn\ 15)$$

Results for the normalized equation of the Public Debt model show that all independent variables are statistically significant at 1% level of significance. And the long-run normalized equation above shows a negative correlation between PGDFIGDP, DSGDP and REER. A positive correlation is however depicted between GGDFIGDP and PDSGDP with PDGDP respectively.

Explaining the elasticity of these variables shown in the long-run adjustment parameters above, a 10% increase/decrease in PGDFIGDP, DSGDP and REER would bring about 0.4%, 3.2%, and 23.1% decrease/increase in PDGDP. On the other hand, a 10.1% and 9.4% decrease/increase in PDGDP is accounted for by a 10% decrease/increase in GGDFIGDP and PDSGDP respectively.

The co-efficient for PGDFIGDP, DSGDP, REER and PDSGDP are in line with our hypothesis statement and supports theory. The outcome of the PGDFIGDP and DSGDP both supports the theoretical arguments of crowding out effect of public borrowing. Government is actually borrowing from the domestic savings which results in depleting investible funds and drives up interest rates.

The paradoxical outcome of the GGDFIGDP coefficient is however converse to theory**.** This outcome is however supported by Piana (2001) who argues that investment by Government especially on core functions (i.e. infrastructure, human capital development etc) has a positive effect on the economy even when financed through borrowing. And this scenario is true for Zambia because the loans contracted by Government save for programmes loans such as the PRBS are for project financing and not to finance operations of the public sector.

Table 16: Short Run Cointegrating Equations -Adjustment parameters (α)

Alpha	Coef.	std. Err	Z	P>|z|	[95% Conf.	Interval]
lnPDGDP	-.682296*	.2658831	2.57	0.010	-.1611747	1.203417
InPGDFIGDP	-.2950631	.4817329	-0.61	0.540	-1.239242	.649116
lnGGDFIGDP	.3132044	.27734491	1.13	0.259	.2303899	.8567987
lnDSGDP	.7184559	.7408697	0.97	0.332	-.7336221	2.170534
InREER	-.694559*	.087612	-7.93	0.000	-.8662668	-.5228341
InPDSGDP	.19048179**	.4514632	2.00	0.045	-.4008739	.0327273

Asterisks (*), (**) and (***) denote significance at 1%, 5% and 10% respectively

Table 16 above gives results for the short-run cointegrating equation or adjustment parameters which measure the speed of adjustment toward the long-run equilibrium for the Public Debt model.

From Table 16 the short-run speed of adjustment vector ($\hat{\alpha}$) as follows;

$$\hat{\alpha} = \begin{bmatrix} 0.682296 \\ -0.2950631 \\ 0.3132044 \\ 0.7184559 \\ -0.6945504 \\ -0.9048179 \end{bmatrix}$$

The short-run model is therefore specified below;

$$ln\,PDGDP_t = -0.29506\,ln\,PGDFIGDP_t + 0.31320 ln\,GGDFIGDP_t + 0.71845 ln\,DSGDP_t$$

$$- 0.69455 ln\,REER_t - 0.90481\,ln\,PDSGDP_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots Eqn\ 16$$

The adjustment coefficients for the variables in the Public Debt model are given as: -0.682296, 0.2950631, -0.3132044, -0.7184559, 0.6945504 and 0.9048179. The results show that PDGDP has 68.23%, PGDFIGDP (29.51%), GGDFIGDP (31.32%), DSGDP (71.85%), REER (69.46%) and PDSGDP (90.48%) speed of adjustment to long-run equilibrium if there is disequilibrium in the short-run. In this case, the estimate of the adjustment Vector of PDGDP in cointegrating equation 1 is -0.682296. This implies that when the average level of PDGDP is too low, it quickly adjusts upwards by 68.2% towards the average level of

PGDFIGDP at -0.2950631. PGDFIGDP will similarly adjust downward by 29.50% towards the long-run relationship with PDGDP.

4.11 POST ESTIMATION TESTS

The post estimation tests were also applied in the public debt model to ascertain if the specified model has a desired fit. Similar to the growth model the LM test for serial autocorrelation, the Jacque-Berra test for normality of residual and the model stability test were employed and the results are presented and discussed in Table 17 below;

4.11.1 Test for Serial Correlation

Table 17: Lagrange Multiplier Test Results for the Public Debt Model

Lag	Chi-Square (X^2)	p-value
1	29.2621	0.77931
2	67.3815	0.00117
3	44.3008	0.16131*

Asterisks (*) denote acceptance of H_O at 1% levels of significance

With respect to the LM test, the null hypothesis of no autocorrelation could not be rejected at 1% level of significance and at the optimal lag length of 3. No serial correlation of errors is therefore present in the public debt model.

4.11.2 Test for Normality of Residuals

Table 18: Jarque-Bera Test Results for the Public Debt Model

Equation	Jacque-Berra Statistic	p-value
Δ lnPDGDP	0.718	0.69849*
Δ lnPGDFIGDP	0.081	0.96010*
Δ lnGGDFIGDP	0.142	0.93160*
ΔlnDSGDP	1.792	0.40812*
Δ lnREER	0.205	0.90256*
Δ lnPDSGDP	0.454	0.79684*
ALL	3.392	0.99208*

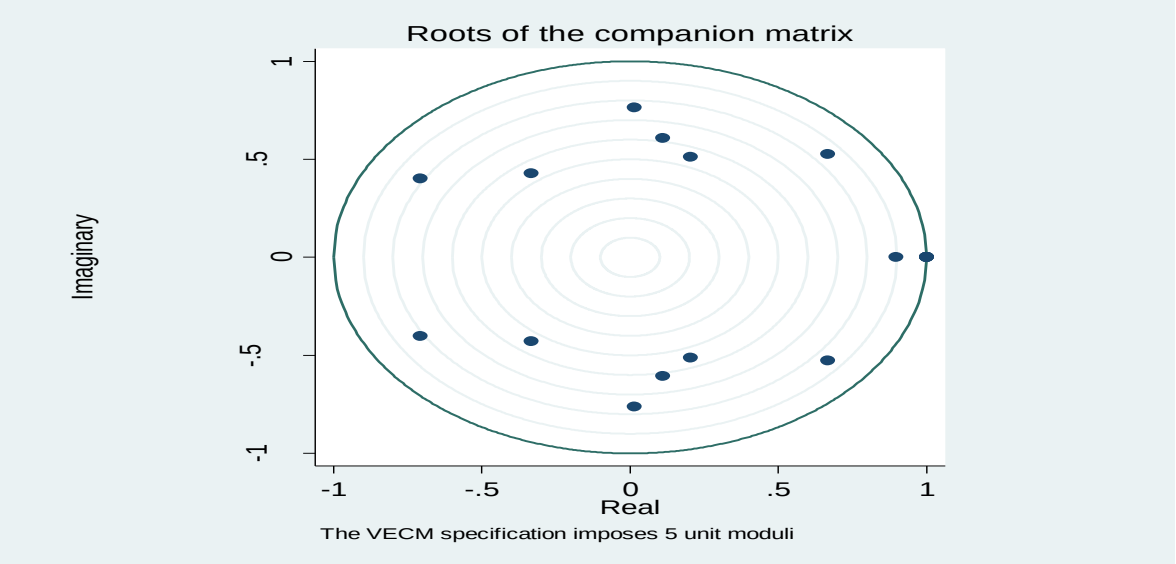
Asterisks (*) denote acceptance of H_O at all level of significance

To test for normality of residuals, the Jarque-Bera normality test was employed. The test results in Table 18 shows that the null of independently and normally distributed errors are not rejected at all levels of significance.

4.11.3 Test for Stability of the Public Debt Model

A 5 unit moduli with value of unity (1) was imposed in the stability test result for the Public Debt model. Since all the eigen-values appear close to unit, the Public Debt model is therefore said to have a desired fit and is well specified. The VEC stability graph in Figure 9 below confirms this ascension. Eigen values obtained after the stability test are presented in Appendix D.

Figure 9: Eigen Stability Test for the Public Debt Model



Note: the dots represent the eigen-values that do not appear close to the unit circle

4.12 ESTIMATES OF THE VECTOR ERROR CORRECTION FOR THE PUBLIC DEBT MODEL

The system of equations specified in the VECM for Public Debt model were also analysed to see the long-run and short-run dynamics of the model. The six equations for Public Debt model in a VECM specification have been presented in Table 19 below;

Table 19: Estimates of the Vector Error Correction Model for the Public Debt Model

Equation	lnPDGDP	lnPGDFIGDP	lnGGDFIGDP	lnDSGDP	lnREER	lnPDSGDP
Constant	0.071 (0.414)	0.044 (0.569)	0.111 (0.091)	-0.060 (0.244)	0.010 (0.028)	-0.094 (0.149)
$\Delta(lnPDGDP)_{t-1}$	0.403 (0.314)	-0.215 (0.736)	O.767*** (0327)	-0.599 (0.875)	-0.047 (0.103)	1.161** (0.533)
$\Delta(lnPDGDP)_{t-2}$	0.261 (0.406)	-0.215 (0.736)	-0.092 (0.423)	1.523 1.131)	-0.353* (0.133)	0.941 (0.689)
$\Delta(lnPGDFIGDP)_{t-1}$	-0.356*** (0.186)	-0.236** (0.331)	0.003 (0.190)	-1.007** (0.509)	0.270* (0.060)	-0.244 (0.310)
$\Delta(lnPGDFIGDP)_{t-2}$	0.209 (0.160)	0.064 (0.291)	0.085 (1.676)	-0.352 (0.447)	0.062 (0.052)	-0.261 (0.272)
$\Delta(lnGGDFIGDP)_{t-1}$	0.790*** (0.438)	-0.196 (0.794)	0.0.093 (0.457)	0.227 (1.221)	-0.727* (0.144)	0.760 (0.744)
$\Delta(lnGGDFIGDP)_{t-2}$	-0234 (0.376)	0.574 (0.681)	-0.098 (0.392)	1.789*** (1.047)	-0.445* (0.123)	0.323 (0.638)
$\Delta(lnDSGDP)_{t-1}$	-0.164*** (0.102)	0.124 (0.185)	-0.073 (0.106)	-0.360 (0.285)	0.119* (0.033)	-0.168 (0.173)
$\Delta(lnDSGDP)_{t-2}$	-0.196** (0.044)	0.212 (0.158)	0.1O5 (0.911)	-0.140 (0.243)	0.099* (0.028)	-0.182 (0.148)
$\Delta(lnREER)_{t-1}$	0.855 ** (0.304)	-0.001 (0.693)	0.405 (0.399)	-0.335 (1.066)	-0.201 (0.126)	0.729 (0.650)
$\Delta(lnREER)_{t-2}$	0.304 (0.416)	1.033 (0.754)	0.464 (0.434)	0.693 (1.159)	-0.239** (0.137)	1.047 (0.706)
$\Delta(lnPDSGDP)_{t-1}$	0.859* (0.248)	-0.109 (0.450)	0.3I5 (0.259)	0.120 (0.692)	-0.572* (0.081)	0.446*** (0.421)
$\Delta(lnPDSGDP)_{t-2}$	0.532* (0.667)	0.130 (0.412)	0.162 (0.237)	0.441 (0.634)	-0.360* (0.075)	0.283 (0.386)
$(ECT_1)_{t-1}$	-0.682* (0.265)	0.295*** (0.481)	0.313 (0.277)	0.718 (0.740)	-0.694* (0.087)	-0.904** (0.451)
R^2	0.852	0.498	0.527	0.601	0.904	0.761

Asterisk (*), (**) & (***) indicates level of significance at 1%, 5% and 10% respectively.

According to the growth model, the study analysed the estimates of the VEC specification for the Public Debt model as follows;

The six (6) equations in Table 19 above helps to explain the short-run and long-run dynamics of the Public Debt model. For instance, equation 1 for Public Debt indicates a long-run stable equilibrium between the dependent variable and the regressors as shown by the ECT_{t-1} which has a negative co-efficient and is statistically significant at 10% level of significance. Equally, the co-efficients of the past values for Private Investments (-), Domestic Savings (-), Real Exchange Rates (+) and Public Debt Service (+) significantly affect Public Debt according to their respective signs. According to the error term, any disequilibrium in the past values of variables in this equation is quickly re-adjusted by 68% to a long-run equilibrium path. The equation also shows that 85% of the variations between the dependent and independent variables have been explained in the model.

Equation 2 for the Private Investment does not give evidence of the long-run equilibrium. The positive and significant sign of the ECT_{t-1} alludes to the fact that given any disequilibrium or disturbance there would be divergence from the long-run equilibrium path. In the short-run, past values of Private Investments have a significant negative impact on Private Investments. Compared to other systems of equations in the model, the speed of adjustment and the R^2 are statistically lower for equation 2.

In the third equation (column 4), Public Debt has a positive and significant relationship with Public Investment in the short-run. This is confirmed by our findings in equation 15 and is converse to theoretical expectation. The empirical finding by Armone et al (2007) also supports this outcome. In the same line, Piana (2001) advanced that a possible explanation for a positive impact of a higher Public Debt on Public Investment would be if the debt contracted was used to finance productive public projects. There is no evidence of a long-run relationship between variables.

Under the Domestic Savings equation, there is no long-run relationship, however, Private Investment and Public Investment have a significant negative and positive impact on Domestic Savings respectively in the short-run. The equation also shows that at least 60% of the variations between the independent and dependent variables in the equation have been explained.

The error term for equation 5 under column 6 carries a negative sign and is statistically significant indicating a long-run stable equilibrium relationship. The independent variables

given PDGDP (-), PGDFIGDP (+), GGDFIGDP (-) DSGDP (+), REER (-) and PDSGDP (-) have a significant impact on Real Exchange Rates in the short-run. The equation also shows a high speed of adjustment given by the ECT_{t-1} of 69%. This implies that any disequilibrium in the short-run arising from the past values is quickly adjusted by 69% restoring the model to its long run equilibrium path. The R^2 given by 90% also informs that most of the variations between the dependent variable and regressors have been well explained.

Equation 6 for Public Debt Service informs us of a long-run stable equilibrium path given by a significant ECT_{t-1} which also bears the correct negative sign. In the short-run, passed values of Public Debt and Public Debt Service are said to have a significant positive impact on Public Debt Sservice. The ECT_{t-1} co-efficient of 0.90 indicates that adjustment towards the long-run equilibrium is about 90% per annum, suggesting that any deviation from the long-run equilibrium is corrected substantially in the following year. In terms of the goodness of fit, 76% of the variations have been explained in the model.

4.13 VECM BASED GRANGER NON-CAUSALITY TEST FOR THE PUBLIC DEBT MODEL

The Johansen test for cointegration informs of a long-run relationship among the variables in the Public Debt model, therefore causal relationship should exist at least in one direction. Equally we analyse the long-run and short-run feedback effects for the Public Debt model. The VECM based granger non-causality results are presented in Table 20 below;

Table 20: VEC Granger Causality Test Results for the Public Debt Model

Null Hypothesis: Independent Variable (X) does not Granger Cause Y	Dependent Variable(Y)	Chi2	Prob>chi2	Decision for the Null
lnPGDFIGDP	lnPDGDP	4.10	0.1289	Cannot be rejected
lnGGDFIGDP	lnPDGDP	4.20	0.1224	Cannot be rejected
lnDSGDP	lnPDGDP	5.23***	0.0730	Rejected
lnREER	lnPDGDP	6.59**	0.0370	Rejected
lnPDSGDP	lnPDGDP	11.97*	0.0025	Rejected
ALL	lnPDGDP	33.50*	0.0008	Rejected
	ECT_{t-1}	6.59**	0.0103	Rejected
lnPDGDP	lnPGDFIGDP	0.10	0.9518	Cannot be rejected
lnGGDFIGDP	lnPGDFIGDP	2.23	0.6618	Cannot be rejected
lnDSGDP	lnPGDFIGDP	1.81	0.3285	Cannot be rejected
lnREER	lnPGDFIGDP	1.97	0.4053	Cannot be rejected
lnPDSGDP	lnPGDFIGDP	0.51	0.3726	Cannot be rejected
ALL	ALL	9.31	0.7760	Cannot be rejected
	ECT_{t-1}	0.38	0.5402	Cannot be rejected
lnPDGDP	lnGGDFIGDP	0.09***	0.0954	Rejected
lnPGDFIGDP	lnGGDFIGDP	0.31	0.8580	Cannot be rejected
lnDSGDP	lnGGDFIGDP	1.34	0.5112	Cannot be rejected
lnREER	lnGGDFIGDP	1.78	0.4106	Cannot be rejected
lnPDSGDP	lnGGDFIGDP	1.53	0.4661	Cannot be rejected
ALL	lnGGDFIGDP	9.95	0.6201	Cannot be rejected
	ECT_{t-1}	1.28	0.2588	Cannot be rejected
lnPDGDP	lnDSGDP	1.83	0.4010	Cannot be rejected
lnPGDFIGDP	lnDSGDP	3.91	0.1418	Cannot be rejected
lnGGDFIGDP	lnDSGDP	5.18**	0.0451	Rejected
lnREER	lnDSGDP	0.39	0.8220	Cannot be rejected
lnPDSGDP	lnDSGDP	0.67	0.7170	Cannot be rejected
ALL	lnDSGDP	18.02	0.1149	Cannot be rejected
	ECT_{t-1}	0.94	0.3322	Cannot be rejected
lnPDGDP	lnREER	13.02*	0.0015	Rejected
lnPGDFIGDP	lnREER	20.66*	0.0000	Rejected
lnGGDFIGDP	lnREER	25.35*	0.0000	Rejected
lnREER	lnREER	15.59*	0.0004	Rejected
lnPDSGDP	lnREER	48.86*	0.0000	Rejected
ALL	lnREER	106.25*	0.0000	Rejected
	ECT_{t-1}	62.85*	0.0000	Rejected
lnPDGDP	lnPDSGDP	15.23*	0.0005	Rejected
lnPGDFIGDP	lnPDSGDP	1.15	0.5620	Cannot be rejected
lnGGDFIGDP	lnPDSGDP	1.62	0.4441	Cannot be rejected
lnDSGDP	lnPDSGDP	1.62	0.4441	Cannot be rejected
lnREER	lnPDSGDP	4.42***	0.0951	Rejected
ALL	lnPDSGDP	30.29*	0.0025	Rejected
	ECT_{t-1}	4.02**	0.0450	Rejected

Asterisk *(**) *** indicates rejection of H_0 at 1%, 5% and 10% respectively

Equation for Public Debt indicates that Domestic Savings, Real Exchange Rates and Public Debt Service individually granger cause Public Debt in the short-run at their indicated level of significance. On the overall, all variables have shown to jointly granger cause Public Debt at 1% level of significance. The significance of the error term at 5% level of significance also indicates that long-run causality runs from Public Debt to other variables in the equation.

No evidence of both long- run and short-run causality has been indicated in the second and third equation. However, equation three shows that short-run causality runs from Public Debt to Public Investment. This outcome is consistent with theoretical arguments and supports the empirical findings by Cholifihani (2008) who advanced that debt in the short-run has a positive impact on public investment.

Equation 4 also gives no evidence of long-run causality, though only Public Investment has been shown to individually granger cause Domestic Savings at 5% level of significance.

Analysis of equation 5 indicates that all regressors individually and jointly granger cause Real Exchange Rrates in the short-run at their respective level of significance. Equally, the significance of the ECT at 1% level of significance indicates existence of long-run causality.

Equation 6 shows that all variables jointly grangers cause Public Debt Service at 5% level of significance. However, only Public Debt and Real Exchange Rates are said to individually granger cause Public Debt Service in the short-run. The significance of the ECT given by the significance level of 5% confirms the existence of long-run causality among variables in the equation.

4.13.1 Analysis of Direction of Granger Causality for the Public Debt Model

Analysis of uni-direction granger causality has informed this study that Public Investment granger causes Domestic Savings and Real Exchange Rates respectively. Causality is also shown to run from Public Investment to Real Exchange Rates while Domestic Savings granger causes Real Exchange Rates in the short-run. Table 20 above also show that causality in the short-run runs from Public Debt to Public Investment. The table above has also shown that Domestic Savings, Real Exchange Rates and Public Debt Service does granger causes Public Debt.

The short-run causal effect from Public Debt to Public Investment has important policy implication especially if the cause effect is positive as observed in our study. This study has also observed that in the short-run there is no evidence of feedback effect between Private Investment with any of the debt variables. The possible explanation for this could be that Public Debt affect investment indirectly either through high interest rates or reduced savings. According to Christensen (2005), reduced Domestic Savings mainly attributed by public borrowing would drive interest rates up making the cost of capital to buy machinery and equipment expensive. Additionally, distortionary tax measure to finance the budget deficit that is compounded by additional borrowing creates dissaving behaviour in the economy. This consequently reduces the national savings and becomes a binding financing constraint on the private sector (Diamond, 1965).

In the case of bi-direction causality, the study has shown that the debt variables (PDGDP and PDSGDP) granger causes each other. This outcome confirms the theoretical argument by Adam and Bevan (2005) that a high debt stock exacerbates the adverse consequences of high deficits. And in the long-run this can result in debt overhang. Significant feedback effects between Public Debt and Public Debt Service with Real Exchange Rates respectively have also been observed both in the short-run and lon-run. This has serious consequence especially in the long-run where continuous devaluation of the local currency would result in higher debt stock and increase the cost of servicing the debt especially for the foreign component of Public Debt. A further argument is that, devaluation of the local currency could trigger higher interest rates thus increasing the possible crowding out effect (Hanson, 2007).

As mentioned earlier, the short-run and long-run feedback effects can help to guide targeted policy decision. Given the short-run effects observed in this study, Public Investment, Public Debt and Domestic Savings could possibly be our policy variables.

4.14 SUMMARY OF RESULTS FOR THE PUBLIC DEBT MODEL

Econometric results for the Public Debt Model have confirmed our expectation except for the Public Investment which has shown to be converse to theory. On the overall, the results for the normalised long-run equation were statistically significant for making inference and

necessary policy recommendation could be made. The long-run positive relationship between Public Debt and Public Debt Service gives an indication of the presence of debt overhang in Zambia while the feedback effects between the two variables advises the need for necessary policy intervention. The feedback effect between Real Exchange Rates with Public Debt and Public Debt Service respectively is also worth noting as it indicates the compounding effect of variations in the exchange rate that can either increase the stock of public debt or the amount required to service debt given the composition of the external debt.

CHAPTER FIVE

5.0 SUMMARY AND CONCLUSION

5.1 SUMMARY OF EMPIRICAL RESULTS

The paper investigated the relationship between public debt and the economic growth over the period 1980 to 2008. The aim of the study was to analyse the growth effect of public debt stock as well as its impact on empirical determinant of economic growth namely; private investments, public investments and domestic savings in Zambia. In order to understand the extent of the debt burden, the study also analysed the impact of a rising public debt stock on public debts service. The huge public debt accumulation recorded in the last two decades (i.e. 1980's and 1990's) coupled with low and sometimes negative growth rates prompted the need to undertake this study. The summary results for the two models considered in this study are discussed hereunder.

5.1.1 Growth Model

The study analysed both the short-run and long-run impact of growth on economic growth using a VAR framework to take into account feedback effects between public debt and economic growth. On the basis of cointegration among variables which indicates a long-run relationship, a VECM was applied to analyse both the short-run and long-run dynamics of the model. VEC based granger non-causality test was also applied to investigate the presence of causality and direction of causality in the model. To ensure that the model had a desired fit the LM, Jacque-Berra and VEC stability tests were applied.

The outcome of the analysis shows that all the explanatory variables had their prior expectation. Observing our variables of interest, shows that public debt and economic growth has a negative long-run stable equilibrium. The long-run elasticity's which indicate the extent of the impact of public debt stock on real growth show that a 10% increase in the stock of public debt results in 2.7% reduction in real growth. The model also shows the presence of short-run feedback effects running from economic growth to public debt while

in the long-run, public debt is said to have a significant negative impact on growth. The post estimation test confirms that the LM test for serial correction, test for normal distribution and stability graphs renders the model to have a desired fit. Overall results of the model support theoretical arguments and most of the results were statistically significant thus inference can be made to guide policy decision.

5.1.2 Public Debt Model

Theoretical argument inferring to growth effects of public debt asserts that the impact of public debt on growth is not explicit (Mankiw, 1956). The effects are however indirect through the empirical determinants of growth namely investment, domestic savings, interest rates and total factor productivity. The study employed the public debt model to analyse the impact of public debt on growth focusing on investment disaggregated into Public and Private Investment and Domestic Savings. Public Debt Service was also included to help understand the debt burden effects in Zambia. Equally the stability and validity of the model was checked by applying the LM test for the serial correlation, Jacque-Berra test for normality of residuals and the VEC stability test.

The result of the Public Debt model shows that all the variables had their expected signs and had significant long-run impact on public debt. The outcome of the results for Public Investment was however converse to theoretical argument. This outcome shows that a 10% increase in Public Investment would be accounted by a 10.1% increase in the stock Public Debt. A 10% increase in Public Debt Service would also result in an increase of 9.4% in the stock of Public Debt, thus explaining the compounding effect of a rising public debt stock on growth.

The estimates of the short-run and long-run granger non-causality test were also insightful for policy. For instance, the uni-causality effects was found present running from Public Investment to Domestic Savings. Bi-granger causality was also shown to run between Real Exchange Rates with Public Debt and Public Debt Service respectively. This outcome is important to note as continuous depreciation of the kwacha would have a compounding effect on the stock of public debt and increase the debt burden. The cost relating to exchange

rate variations would further worsen the debt burden for Zambia. A bi-directional granger-causality is however evident between Public Debt and Public Debt Service respectively showing a compounding effect of arising public debt stock. This outcome indicates a rising debt burden for Zambia which can consequently hamper growth.

5.2 POLICY IMPLICATION OF RESULTS

The significance of the results in this study gives strong foundation to guide policy in the area of public debt management in Zambia.

The long-run inverse relationship between public debt and economic growth calls for policies that will promote conservative borrowing in order to reduce the negative growth effects of public debt on the economy. In this regard, Government should come up with policies aimed at broadening the tax base to reduce the deficit which is financed by debt. There is also need for a public debt law to ratify any borrowings requirements. This will help to monitor all borrowings and ensure that all borrowings are directed towards the financing of capital projects that contributes to economic growth. Insight from the long-run causality between Public Investment and real GDP as well as the short-run causality from Government Expenditure and real GDP helps to explain that public debt is not the only factor affecting the output level in Zambia.

As indicated in the long-run equation, Public Investment (29.8%) has a significant positive impact on growth which outweighs the negative impact of Public Debt (2.7%) on growth. Due to this positive effect of public investment and other factors not captured in the model, Zambia's economy has been recording positive growth averaging 5.4% since 2000. To reverse the negative effects of a growing public debt stock, Government can enhance public investment in capital projects such as roads, rail and hydro plants and human development to attract private participation, and thus increase its revenue base.

The results of the second model indicate that in the long-run private investment has been affected by the crowding out effect of huge borrowings by the Government on the domestic market. This phenomenon can be explained by Commercial Banks' preference to lend to Government at high yield rates thus making the cost of capital expensive for local investors. As argued by (Mankiw, 1956), private capital is an important determinant of economic

growth but as the crowding out effect becomes greater, its contribution to GDP consequently reduces. When private sector returns are falling, Government's domestic tax revenue and export receipts are also likely to fall, leading to the widening of the fiscal gap. If no proper measure are put in place the fiscal gap is likely to necessitate more borrowing. In the long-run the issue of affordability and debt sustainability are likely to evolve. Government should therefore minimize its dominance on the domestic market so as to build up savings for investment funds which will consequently result in lower interest rates.

The positive effect of public debt on public investment can help explain Government's investment in capital projects such as roads and hydro-power which consequently crowds in private participation and thus contributing to economic growth. Government should therefore target debt financing towards capital projects in order to enhance the crowding in of private sector participation.

The study also reviewed that the feedback effects are strong between public debt and public debt service. This outcome confirms that both public debt and public debt service can have a compounding effect on the current stock which could result in debt overhang. Implying that, as public debt stock increases, the debt service also increases. To meet debt service obligation, a large component of tax revenue in this case has to be diverted from important sectors which would have positive effects on growth. As a policy measure, an increase in public investment and widening of the tax base as explained above would reduce the incident of debt overhang.

The inverse causality effect between the stock of public debt, public debt service with exchange rates respectively indicates that as the exchange rate depreciates by one-dollar, the local currency equivalent of foreign public debt stock rises proportionately and the cost of the foreign component of public debt equally increases. The long-run inverse relationship therefore indicates that currency variation can have an adverse implication on the stock of public debt, more so, if the large component of public debt is held in foreign currency. This scenario indicates the importance of Government putting in place a public debt management strategy that is aimed at minimising the risks and costs associated with exchange rate variations.

5.3 CONCLUDING NOTES

This study highlights some important findings for policy. The outcome of the results in the first model satisfactorily explains the long-run inverse relationship between public debt and economic growth thus supporting the neoclassical proposition. According to empirical literature, the study also affirms the positive relationship between economic growth and the explanatory variables. As regards the impact of public debt on the empirical determinant of economic growth, the results of the second model further confirms the presence of crowding out phenomenon and debt overhang effects. Given the positive relationship between public debt and public capital investment, the study strongly recommends that Government must ensure that loans are diverted to finance capital projects that enhances private sector participation. This will mitigate the negative effect of crowding out of private sector capital development as indicated by the regression results. In this regard, effective debt management policies and strategies aimed at reducing the cost and risks associated to public debt are a must for ensuring a sustainable path of public debt to promote economic growth.

5.4 RECOMMENDATIONS FOR FUTURE RESEARCH

An aspect worthy noting in this study is the dearth of data necessary to carry out an econometric analysis especially using cointegration procedure. The Country needs to seriously embark on putting in place a reliable macro-economic database to support more research necessary to provide policy guidance. Efficient management of public debt statistics would also warrant efficient estimation of results to support policy recommendation necessary to ensure that the progression of Zambia's public debt is maintained within a sustainable path. The presence of a negative long-run relationship of public debt and its effect on the economic growth indeed gives credence to the need for undertaking further research in this area, in particular to determine what drives the increase in public debt with a focus on policy recommendations and debt management strategies that tend to have a bearing on government borrowing. Another important aspect for future research is the quality of the legal and institutional framework as it relates to efficient management of public debt. Emphasis on undertaking the future research in this area is premised on the fact that the current existing structures for managing public debt in Zambia have serious weakness to warrant effective and efficiency public debt management.

Since this study focused on the impact of the stock of total public debt on economic growth, it would be important for future research to decompose the public debt into domestic and external to see how each component affects Zambia's growth rate.

5.5 LIMITATION OF THE STUDY

A major challenge of the study is non availability of a long span time series which actually affected specification of the model. In particular time series data for proxy variables that measure human capital development (i.e. secondary school enrolment ratio, HDI, or employment rates) in endogenous growth models and viewed to be important for undertakings such an analysis had missing variables for a long time span to warrant accurate estimates for economic inference. Notwithstanding this challenge, a national identity model was instead used on the basis of literature review. Most of the data on Zambia using both the African Development Indictors and the World Bank Development Indicators spans from 1980 while data for 2009 and 2010 was not ready at the time of analysis. Not so many studies have been done on Public debt in this area as such this research was mainly guided by literature review from studies focusing on either public external debt or public domestic debt.

A further limitation in undertaking this research and also future research is lack of a comprehensive database covering information for a long period of time. One has to rely on other data base from the internet in particular the WDI, ADI and OECD that had series which was not consistent.

REFERENCES

Abbas, A. S., & Christensen, J. (2010). The Role of Domestic Debt Markets in Economic.

Adam, C. S., & Bevan, D. L. (2005). Fiscal deficits and growth in developing Countries. *Journal of Public Economics , 4*, 571-597.

Alberto, A., & Tabellini, G. (1989). External Debt, Capital flight and Political risk. *Journal of International Ecnomics , 27(3-4)*, 199-220.

Anderson, P.A., Arne, B., & Persson, H. (2000). "*Foreign Aid, Debt and Growth in Zambia".* Sweden: Motala Grafiska.

Arellano Manuel, & Bond, S. (1991). Some Tests of Specification for Panel Data: MonteCarlo Evidence and an Application to Employment Equations. *Review of Economic Studies , 58(2)*, pp. 277-297.

Arnone, Marco, and Andrea F. Presbitero, (2007), "External Debt Sustainability and Domestic Debt in Heavily Indebted Poor Countries", *Rivista Internazionale di Scienze Sociali,*

Arnone, Marco, and Andrea F. Presbitero, (2010). "Debt Relief Initiatives-Policy Design and Outcomes", *Rivista Internazionale di Scienze Sociali,*

Aschauer, D., (1989)." Is Public Expenditure Productive?" Journal of Monetary Economics, 23 (March), 177-200.

Baum C. F, M. S. (2007). IVREG2: Stata Module for Extended Instrumental Variables.

Cerra, V., Meenakshi, R., & Saxena, S. C. (2008). "Robbing the Riches: Capital Flight Institutions and Debt". *Journal of Development Studies , 44(8)*, 1190-1213.

Checherita, C., & Rother, P. (2010). The Impact of High and Growing Government Debt on Economic Growth: An Empirical Investigation from the Euro Area.

Chikuba, S. M. (2003). "*The Impact of External Debt on Zambia's Economic Growth".* National Graduate Institute for Policy Studies. National Graduate Institute for Policy Studies.

Cholifihani, M. (2008). "A Cointegration Analysis of Public Debt Service and GDP in Indonesia". *Journal of Managment and Social Sciences , 2*, 68-81.

Chrietensen, J. (2005). Special Data Section Domestic Debt Markets in Sub-Saharan Africa. *52* (3), p. 7.

Cohen. (1993). Low Investment and Large LDC Debt in the 1980s. *American Economic Review , 83* (3), pp. 437-49.

Cordella, Tito, Luca A. Ricci, and Marta Ruiz-Arranz, 2005, "Debt Overhang or Debt Irrelevance? Revisiting the Debt-Growth Link", *IMF Working Paper*, No. 05/223.

CYMA, (2006). "*Domestic Debt Policy and Reduction Strategy".* Lusaka: ADF.

Deshpande, A. (1990). "The Debt Overhang and the Disincentive to Invest". *Journal of Development Economics , 52*, 169-187.

Diamond, P. (1965). "National Debt in a Neoclassical Growth Model". *American Economic Review , 55* (5), pp. 1126-1150.

Dickey, D. & Fuller, W. A. (1979), Distribution of the Estimates for Autoregressive Time Series with a Unit Root. *Journal of American Statistical Association*, 74, pp. 427-431.

Elmendorf, D. W., & Mankiw, G. (1999). *Government Debt in Handbook of Macroeconomics* (Vol. 1). North Holland, Armsterdam.

Erdal, K. (2002). The Causality Analysis of External Debt Service and GNP: The Case of Turkey, *University of York Department of Economics and Related Studies Heslington, York, Y010 5DD, UK*

Enders, W. (1995). *Applied Econometric Time Series.* USA: John Wiley & Sons, Inc.

Engel, R.F and Granger C.W.J. (1987), "Co-integration and Error Correction: Representation, Estimation and Testing," *Econometrica,* 55, 251-276.

Elbadawi, Ibrahim A., Benno J. Ndulu, and Njuguna Ndung'u, (1999). "Debt Overhang and Economic Growth in Sub-Saharan Africa", chapter 5 in *External Finance for Low-Income Countries,* ed. by Iqbal, Zubair, and Ravi Kanbur (Washington D.C: IMF Institute).

Fosu, K. A. (1996). The Impact of External Debt on Economic Growth in Sub-Saharan Africa. *Journal of Development Economics , 21* (1), 93-117.

Granger, C. W. J. & Newbold, P. (1974), Spurious Regression in Econometrics. *Journal of Econometrics*, 2, pp. 111-120.

Greene, W. H. (1993). *Econometric Analysis.* London: Prentice-Hall International.

Gujarati, D.N. (1995): *Basic Econometrics*. 3rd ed. Mcgraw-Hill International Editions.

Gonzalo, J. (1994). Five Alternative Methods of Estimating Long-Run Equilibrium Relationships. Journal of Econometrics, 60 issue 1-2, 203-233.

GRZ. (1996). *The Constitution of the Republic of Zambia.* Parliament. Lusaka: Government of the Republic of Zambia.

GRZ. (2000). *Economic Report.* Lusaka: Government of the Republic of Zambia.

GRZ. (2003). *Economic Report.* Lusaka: Government of the Republic of Zambia.

GRZ. (2004). *Economic Report.* Ministry of Finance. Lusaka: Government of the Republic of Zambia.

GRZ. (2005). *Economic Report.* Ministry of Finance. Lusaka: Government of the Republic of Zambia.

GRZ and MEFMI. (2007). *Debt Sustainability Analysis for Zambia.* Lusaka: Government of the Republic of Zambia.

GRZ. (2006). *Economic Report.* Ministry of Finance. Lusaka: Government of the Republic of Zambia.

GRZ. (2007). *Economic Report.* Lusaka: Government of the Republic of Zambia.

GRZ. (2007). *External Debt Operations Reports.* Ministry of Finance, Investments and Debt Management. Lusaka: Government of the Republic of Zambia.

GRZ. (2008). *Medium Term Debt Strategy and Management for Zambia.* Ministry of Finance, Investments and Debt Management. Lusaka: Government of the Republic of Zambia.

GRZ. (2008). *Economic Report.* Ministry of Finance. Lusaka: Government of the Republic of Zambia.

GRZ. (2008). *External Debt Operations Report.* Ministry of Finance, Investments and Debt Management. Lusaka: Government of the Republic of Zambia

GRZ. (2008). *Budget Speech.* Lusaka: Governmentb of the Republic of Zambia.

GRZ. (2010). *Budget Speech.* Ministry of Finance. Lusaka: Government of the Republic of Zambia.

Hanson, J. A. (2007). *The Growth in Government Domestic Debt: Changing Burdens and Risks.* World Bank.

Isu, et al (2010), "Nigeria's External Debt and Economic Growth: An Error Correction Approach" International Journal of Business and Management, Vol. 6, No. 5.

IMF. (June 2003). *External Debt Statistics: Guide for Compilers and Users.* IMF.

IMF. (2004a). *Joint IMF/WB Debt Sustainability Analysis Reports on Zambia.* IMF. Washington DC: IMF.

IMF. (2004b). *Zambia: Selected Issues and Statistical Appendix-Coutry Report.* IMF.

IMF. (2008). *Medium Term Debt Strategy (MTDS) Report for Zambia.* IMF.

IMF. (2009). *Joint IMF/WB Debt Sustainability Analysis Reports on Zambia.* Washington DC: IMF.

Isa, A. (2004). *The Impact of External Debt on Economic Growth and Public Investment: The Case of Nigeria.*

Johansen, & Juselius. (1992). Tesing Structural Hypotheses in a Multivariate Cointegration Analysis of the PPP and UIP for UK. *Journal of Econometrics , 53,* 211-244.

Johansen, S., & Juselius, K. (1990). Maximum Likelihood Estimation and Inference on Cointergration with applications to the Demand fro Money. *Oxford Bulletin of Economics and Statistics , 52* (2), 169-210.

Johansen, S. (1991). Estimation and Hypothesis Testing of Co-integration Vectors in Gaussian Vector Autoregressive Models. Econometrica, 59, 1551-1580.

Johasen. (1988). Statistical Analysis of Cointegrating Vectors. *Journal of Economic Dynamic and Control , 12,* 231-54.

Johasen. (1995). *Likelihood-Based Inference in Cointegration Vector Auto-Regressive Models.* Oxford: Oxford University Press.

Jayaraman, T.K. and Chee-Keong Choong (2006), "Macroeconomic Reform and Resilience Building in Small States," in L. Briguglio, G. Cordina, and E.Kisanga ed., *Building the Economic Resilience of Small States*, Malta: Islands and Small States Institute and London: Commonwealth Secretariat.

Krugman. (1988). Financing vs. Forgiving a debt overhang. *Journal of Development Economics , 29* (3), 253-268.

Krugman, P. (1989). *Private Capital Flows to Problem Debtors in Sachs, J. (ed) Developing Countries Debt and Economic Performance.* Chicago: University of Chicago Press.

Levy, D., & Chaudhary. (1993). Capital Stock Depreciation, Tax Rules and Composition of Aggregate Investment. *Journal of Economics and Social Measurment , 21*, 45-65.

Lütkepohl H. (1993). Introduction to Multiple Time Series Analysis. Springer, New York.

Maana, Isaya, et al. (2008). Domestic Debt and its Impact on the Economy: The case of Kenya. *13th Annual African Econometric Society Conference.* Pretoria, South Africa: African Econometric Society .

Mankiw, N. G. (1992). A Contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics , 107* (2), 407-37.

Mankiw, N. G. (1956). *Macroeconomics* (5th Edition ed.).

Masengo, P. C. (2011). *Domestic Debt Sustainability Analysis: The case for Zambia.* UNZA, Department of Economics. Lusaka: University of Zambia.

Miller, S., & Russek, F. (1990). Cointegration and Error Correction Models: The Temporary Causuality between Government Taxes and Spending. *Southern Journal , 57*, 221-229.

Muoghalu, & Ezirim. (2007). Foreign Investment Burden, Exchange Rates and External Debt Crises in Nigeria: An Empirical Extension. *Bank and Bank Sytems , 2* (3), pp. 82-90.

Nickell, Stephen, 1981, "Biases in Dynamic Models with Fixed Effects". *Econometrica*, Vol. 49, No. 6, November 1981, pp. 1417 – 1426.

Omotoye, R. O., Ngassam, C., and Eseonu, M. (2006), "Sub-Saharan Africa's debt crisis: analysis and forecast based on Nigeria" in Journal of Managerial Finance, Vol.3 2 No.7. Chicago: University of Chicago Press

Pattillo, Catherine, Helene Poirson, and Luca Ricci, 2002, "External Debt and Growth", *IMF Working Paper,* No. 02/69.

Piana, V. (2001). Retrieved February 2012, from Economic Web Institute: www.economicwebinstitute.org

Reinhart, C., & Rogoff, K. S. (2010. Growth in a Time of Debt.

Romer, P. M. (1986). Increasing Returns and Long-run Growth. *Journal of Political Economy , 94*, 1002-37.

Sachs, Jeffrey D., 1989, "The Debt Overhang of Developing Countries". In *Debt, Stabilization*

Savvides, A. (1992). Investment Slowdown in Developing Countries during the 1980s: Debt Overhang or Foreign Capital Inflows, in Kyklos. *45* (3), pp. 363-78.

Schclarek, A. (2004). Debt and Economic Growth in Developing Industrial Countries.

Siddiqui, R. a. (2002). Debt and Economic Growth in South Asia. *17th Annual General Meeting of PSED.* Islamabad: State of Pakistan.

Solow, R. M. (1956). A contribution to the theory of Economic Growth. *Quarterly Journal of Economics , LXX*.

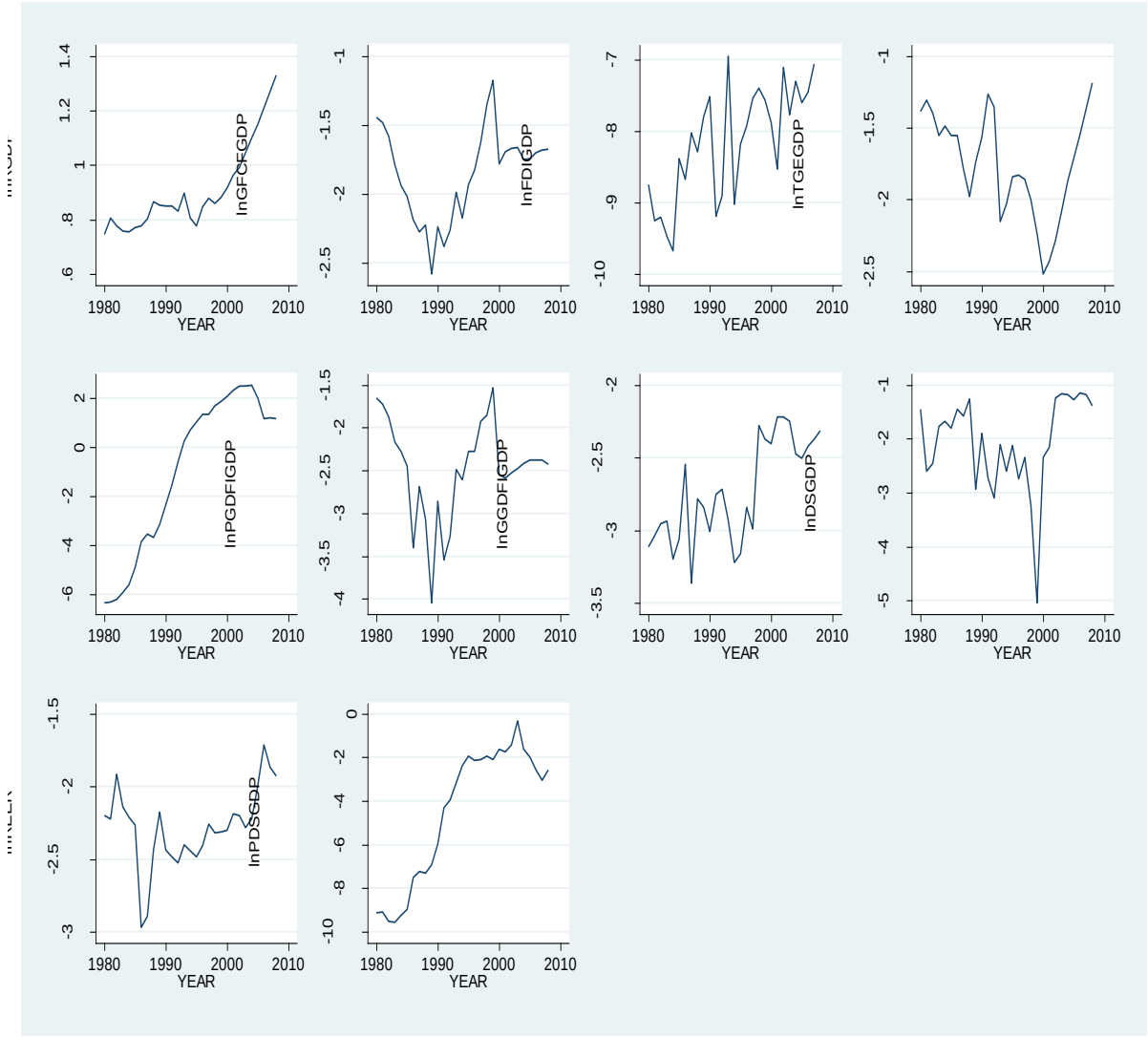
Syed, I.R. and Tanzeela, Anwar. , (2010) "Public Debt and Economic Growth in Pakistan", a Time Series Analysis from 1972 to 2010

Wijeweera, A. D. (2005). *Economic Growth and External Debt Servicing: A Conitergration Analysis of Sri Lanka, 1952 to 2002.* University of New England, School of Economics. Sri Lanka: University of New England.

World Bank, 2010." African Development Indicators-ADI," The World Bank, Washington, D.C.

APPENDICES

APPENDIX A: GRAPHS OF VARIABLES USED IN THE REGRESSION ANALYSIS AT LEVELS



APPENDIX B: GRAPHS OF VARIABLES USED IN THE REGRESSION ANALYSIS AT DIFFERENCE

APPENDIX C: Vecstability Table for the Growth Model

Eigen Value	Modulus
1	1
1	1
1	1
1	1
.1131411 + .861207i	868607
.1131411 - .861207i	.868607
.5397227 + .5624934i	.779551
.5397227 - .5624934i	.779551
. 7765701	.77657
-.7041254	.704125
.1831378 + .6697267i	.694315
.1831378 - .6697267i	.694315
-.4152944 + .5072808i	.655594
-.4152944 - .5072808i	.655594
1061583	.106158

The VECM specification imposes 4 unit moduli.
Note: the values are 1 or less than one showing correct model specification

APPENDIX D: Vecstability Table for the Public Debt Model

Eigen Value	Modulus
1	1
1	1
1	1
1	1
1	1
.8685237	.868524
-.7358517 +.3868746i	.831354
-.7358517 - .3868746i	.831354
-.5131208 + .60425i	.792724
-.5131208 - .60425i	.792724
.3094285 + .704574i	.769526
.3094285 - .704574i	.769526
-.2199261 + .6194193i	.657303
-.2199261 - .6194193i	.657303
.3466694 + .4681858i	.582561
.3466694 - .4681858i	.582561
-.1329354 + .2116453i	.249931
-.1329354 - .2116453i	.249931

The VECM specification imposes 5 unit moduli.
Note: the values are 1 or less than one showing correct model specification

APPENDIX E: JUSTIFICATION OF VARIABLES EMPLOYED AND THEORETICAL EXPECTATION

All the variables used in the growth and public debt models are measured as a ratio of real Gross Domestic Product expressed in their natural logs. Justification of the variables used in this study is discussed hereunder;

1.0 THE GROWTH MODEL

1.1 Gross Fixed Capital Formation

The study uses Gross Fixed Capital Formation (GFCF) as a proxy for investment. According to Khan, real investment has a significant impact on real economic growth which works through the Keynesian investment multiplier and the accelerator principle. And the neoclassical theory postulates that an increase in capital as an input in the production process leads to increase in Real GDP. It is therefore expected that GFCF will have a positive relationship with economic growth (Mankiw, 1992).

1.2 Foreign Direct Investment

Theoretically, it has been argued that Foreign Direct Investment (FDI) through its linkages with trade openness, capital formation, and economic growth tends to be positive. This assertion is supported by the neoclassical and endogenous growth theories which underline that FDI promotes economic growth in a capital scarce economy by increasing the volume as well as efficiency of physical investment (Romer, 1986).

In 1991, Zambia undertook liberalisation reforms and opened her economy to benefit from FDI with a view of expanding its revenue and accelerate economic growth through other externalities. The Zambia Development Agency was thus established to promote and facilitate private investment both from domestic and overseas sources. Among the strategies employed to enhance and retain FDI include among others, lifting up of restrictions on capital and profit repatriation, privatisation of state owned enterprises, adopting flexible exchange rate systems and extending tax incentives (i.e. tax holidays). This move has made Zambia to become an attractive destination of FDI as can be noted in the mining and tourism sectors and consequently the sector have greatly contributed to the revenue base. The

foregoing argument thus justifies the need to include FDI in our model. A positive relationship between RGDP and FDI is anticipated in this case.

1.3 Total Government Expenditure (TGE)

As one of the major components and determinant of GDP, Total Government Expenditure (TGE) is included in the growth model. This follows the argument by neoclassical economists that increases in government spending, can boost growth by injecting the purchasing power into the economy. Government could reverse economic downturns by borrowing money from the private sector and then returning the money to the private sector through various spending programs (Mankiw, 1992). As such we expect TGE to be positively related to RGDP.

1.4 Public Debt

As our focus variable in the study, public debt is included to help analyze its relationship on real GDP. According to the debt overhang theory public debt accumulation would promote investment and this can arguably enhance growth but only up to a certain threshold, while beyond such a point the debt overhang will start adding negative pressure on investors' willingness to provide capital and thus a reduction effect on growth (Cohen, 1993). In line with this underlying theory and given the rising stock of public debt in Zambia, we expect RGDP and PDGDP to have a negative relationship.

2.0 THE PUBLIC DEBT MODEL

2.1 Gross Investments

The study also analyses the direct impact of public debt on investment. Since investment is comprised of two components namely private and public investment, the study disaggregates these components to see the direct impact of an increasing debt stock on the two components of investments. The Gross Domestic Fixed Capital Investment (GDFI) disaggregated into private and public capital investments is used as a proxy.

An argument advanced by (Levy & Chaudhary, 1993) claim that an increase in the public debt can indirectly affect the level of GDP by discouraging capital formation and

encouraging capital flight due to tax-increase expectations. This implies that any increase in the public debt stock can lead to decreasing capital inflow. A further argument advanced by Savvides (1992) states that incentives to invest are weakened due to the compulsion of debt servicing which eat into the profits. And from the perspective of the debtor country, the levels of debt service compounded by a rising public debt stock are in fact seen as a tax on investment. Theoretically, we expect the link between public debt stock and capital inflow to be negative.

2.2 Domestic Savings

According to the Solow growth model, high savings rates could stimulate economic growth especially for a developing Country like ours. The theoretical framework is based on the concept that high savings rates could increase the amount of creditable capital available for investment opportunities at reduced interest rates and consequently raise the real GDP growth rates (Solow, 1956). The ability of the Country to raise savings can however be hampered by fiscal policies employed by the Government to raise the needed revenue to finance its deficit. A rising public debt stock and consequently public debt service can increase the fiscal deficit. In Zambia, the fiscal deficit explained by the financing gap is usually met by borrowing both externally and domestically. This increases the stock of Government debt leading to higher taxes and lower wages which ultimately reduces the available disposable income. In such a case, private saving behaviour can also adjust to offset public dissaving policy leading to lower demand and thereby lower growth rate. This is in line with the standard neoclassical model in which a fiscal deficit (other things being equal) is argued reduce national savings (Elmendorf & Mankiw, 1999). Therefore, a rising public debt can be hypothesized to have a reduction effect on the nation's ability to accumulate savings necessary to finance capital formation and thus raise a Country's productivity. In this case we expect the relationship between domestic saving and public debt burden to be negative.

2.3 Real Effective Exchange Rate (REER)

REER is defined as "a weighted average of bilateral real exchange rates, with the weight for each foreign currency determined by the Country's share in the domestic Country's

international trade". Therefore, REER is included in our model to reflect the impact on the cost of an increasing stock of public debt in Zambia.

The relationship between the exchange rate and public debt is essentially mediated by two mechanisms. On one hand, devaluation implies higher payments in local currency over debt denominated in foreign currency, and the reverse in the case of appreciation. On the other hand, the rise in public debt can increase the perception about the probability of a default and the Country risks. An increase in default and Country risks may lead to a significant outflow of foreign currency, and could thus result in large depreciation of the exchange rate. The dual relationship between the exchange rate and public debt also has some peculiar effects on decisions regarding monetary policy. For example, an increase in the rate of interest affects directly the financial burden of the public debt and consequently, raises the nominal deficit and eventually crowding out of private investments evolve (Hanson, 2007). The net effect will however depend on the relative forces of the two effects. A negative relationship will signal that exchange rate depreciation has in the long-run increased the cost of debt service and therefore the debt burden.

2.4 Public Debt Service

Increases in the GDP ratio of the public debt stock will lead to an increase in the Government's debt payment obligation. The increase in the debt service obligations will ultimately increase the budget outlays and can influence Government to raise taxes, borrow from the domestic market or reduce government spending in some important sectors.

According to the advancement by Savvides (1992), large debt service requirements dry up foreign exchange and capital, because they are transferred to principal and interest payments. Higher debt service can raise the budget deficit, reduce public savings and this in turn, may either raise interest rates or crowd out credit funds available for the private investment and ultimately dampen economic growth. Higher debt service payments can also have adverse effects on the composition of public spending by squeezing the amount of resources available for spending in the social sector of the economy. It is hypothesized that for a given interest rate on debt, the higher the debt stock, the higher the debt service will be. Thus we expect the coefficient of debt service to be positive.