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IS GHANA'S BUDGET DEFICIT SUSTAINABLE?

A COINTEGRATION ANALYSIS

***BY***

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## DECLARATION

I declare that I have personally, under supervision, undertaken the study herein submitted and that it contains neither material previously published by me or another person nor material which has been presented for the award of any degree except where due acknowledgement has been made in the text .

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I declare that I have supervised the student in undertaking the study submitted herein and confirm that the student has my permission to present it for assessment.

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DATE .....

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## **DEDICATION**

I dedicate this work to “King” Emmanuel Amenuveve, “Sister” Vanessa Eyram and my wife Blessing Asamoah for supporting me spiritually, financially and morally throughout the study.

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## ABSTRACT

The study evaluates budget deficit sustainability of Ghana between 1960 and 2007 using the present value budget constraint approach. By applying annual time series data, the ADF and PP tests for unit root rejected the null hypothesis at 1 percent significance level after first difference. Hence, both government expenditure and revenue of Ghana are stationary and integrated of order one. The Granger causality test supported a bi-directional causation such that both expenditure and revenue of Ghana have temporal precedence over each other. This means past and present values of government revenue provide important information to forecast future values of expenditure. The test for cointegration favoured the sustainability of budget deficit of Ghana at 10 percent significance level in the strong sense. In this case, government can continue to service its past accumulated deficits without large future correction to the balance of income and expenditure.

Again, the study achieved the conventional negative sign of the speed of adjustment to long run equilibrium following shocks to the system at 5 percent significance level. It indicates that 53 percent of disequilibrium is restored every year following shocks to the system. This means that any disequilibrium within the budget deficit of Ghana in the short run is quickly adjusted and converged back to equilibrium in the long term.

The CUSUM and CUSUM Q tests failed to detect the existence of possible structural breaks in the annual data of Ghana at 5 percent significance level. In this case, we conclude that government expenditure-GDP and revenue-GDP series during the study period exhibit stable long run cointegration. Hence, the budget deficit of Ghana is sustainable over the entire study period.

## LIST OF ABBREVIATIONS

ADF	-	Augmented Dickey and Fuller
AIC	-	Akaike Information Criteria
CUSUM	-	Cumulative Sum
CUSUM Q	-	Cumulative Sum of Squared
ERP	-	Economic Recovery Programme
GDP	-	Gross Domestic Product
GNP	-	Gross National Product
HIPC	-	Heavily Indebted Poor Countries
IBC	-	Intertemporal Budget Constraint
IEA	-	Institute of Economic Affairs
IMF	-	International Monetary Fund
ISSER	-	Institute of Statistical, Social and Economic Research
lnEXPG	-	Log of Government Expenditure-GDP ratio
lnREVG	-	Log of Government Revenue-GDP ratio
$\Delta \ln EXPG$	-	First Difference of the Log of Government Expenditure-GDP ratio
$\Delta \ln REVG$	-	First Difference of the Log of Government Revenue-GDP ratio
NPG	-	No Ponzi Game
OECD	-	Organisation for Economic Co-operation and Development
OLS	-	Ordinary Least Squares
PP	-	Phillip-Perron
PVBC	-	Present Value Budget Constraint
SAP	-	Structural Adjustment Programme
VECM	-	Vector Error Correction Model

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1 Background of the study**

Fiscal deficit has gathered substantial attention in macroeconomic theory due to its effect on macroeconomic performance and the proceeding debt dynamics. The size of budget deficit and ways of financing it determine the fiscal constraints that a country will be subject to in the long term. In this sense, the budget deficit of Ghana and its sustainability becomes important factor that occupy the attention of policy makers [Kustepeli and Onel, 2004: 1].

Budget deficit arises when the demand for government expenditure far exceeds government revenue that needs to be financed by net lending. For the economy of Ghana, there has been persistent tendency towards budget deficit since independence as a result of ever expanding government expenditure, inadequate revenue generation capacity of government and increasing debt levels [Pomeyie, 2001: 162]. For instance, the deficit-GDP of Ghana increased from 7.8 percent in 2005 to 8.1 percent in 2006 and 9.6 percent in 2007 and 14.5 percent in 2008 [IEA, 2008: 23-29]. As the economy of Ghana grows, policy makers have been concerned with the extent to which the budget deficit is sustainable.

For most years, government expenditure has exceeded government revenue in Ghana leading to deficits on the budget. Expenditure has been rising steadily due to increase demand for infrastructure and payment of interest on debt. For instance, total expenditure to GDP increased from 31.62 percent in 2005 to 33.71 percent in 2006 and 35.9 percent in 2007 [Bank of Ghana, 2007: 2]. Yet, it is important that the government of Ghana run some

fiscal deficits in order to stimulate economic growth by building up enough capital stock. This would place the economy on its steady state growth path so that debt can be issued to cover the deficits and repaid in the future [Xiomara and Greenidge, 2003: 2-3].

Contrary, the various sources of Ghana's revenue have become highly inadequate due to narrow tax base, high rate of tax evasion and corruption in the revenue collection agencies. This has led to over spending by the government which tends to create deficit on the budget. For instance, total government revenue to GDP increased marginally from 23.87 percent in 2005 to 24.1 percent 2006 but declined to 23.6 percent in 2007 [Bank of Ghana, 2007]. The persistent deficit in Ghana means that the debt level and its servicing will continue to grow without limit unless constrained. This may lead to explosion of the debt-GDP ratio of Ghana due to higher interest payment such that large and costly adjustment must be made in future to correct the budget. In this regard, it is important to examine the problem of study.

## **1.2 Statement of the Problem**

Budget deficit in Ghana plays a central role in achieving economic and social objectives including macroeconomic stability, sustainable growth and poverty reduction. However, in recent times the deficit position of Ghana's budget and other developing countries has worsened, drawing attention to its long term sustainability [Bank of Ghana, 2005: 2-4]. As Ghana consistently operates budget deficit, it leads to accumulation of government debt. As past deficit adds up to current borrowings, it creates higher interest payments. This calls for further borrowing to cover the interest payment and the increasing primary deficit which affects the rate of future borrowing. For Ghana, the stock of government debt to GDP has

been rising steadily from 17.2 percent in 2006 to 24.9 percent in 2007 and to 28.1 percent in 2008 [Bank of Ghana, 2007: 4]. Clearly, Ghana cannot use new borrowing indefinitely to finance interest payments since changes in taxes and government spending is followed by adjustment in future taxation and spending [Luporini, 1999: 9].

Even if Ghana meets its interest payment on debt by borrowing more, it must roll over its debt indefinitely because tax revenue is not enough to pay for other expenditure. This has led to growing debt and increasing tax rate. As Ghana approaches its future tax capacity limit and the private sector becomes reluctant in holding increasing amounts of government debt, it places constraint on the sustainability of budget deficit [Luporini, 1999: 9; Aristovnik and Bercic, 2007: 1]. In this case, government ought to pursue fiscal policies that targets deficit and debt reduction. However, reduction in these variables will be an issue only when they rise beyond certain limit and it becomes difficult to repay. Therefore, as Ghana runs budget deficit persistently over time, it must ensure that the deficit does not continue indefinitely [DeLong, 2002: 398; Mahendra, 2006: 2].

Contrary, it is argued that as Ghana incurs large budget deficit in the form of public expenditure, it serves as engine of growth that propels the economy on the path of development. For instance, irrespective of the size of Ghana's budget deficit, expenditure on infrastructure in the area of communication, education, research and development provide input to stimulate growth of the private sector [Straub and Tchakarov, 2007: 7]. This has increased national output, employment and government revenue such that the debt-GDP ratio does not explode. Thus, if fiscal policy is well chosen, there is little economic reason not to increase the deficit [Tatom, 2005: 8-9].

In this case, Ghana can run primary deficit occasionally but not permanent interest-exclusive deficits because optimizing individuals will not continuously lend to a defaulting government [Arestis and Sawyer, 2006: 2]. Hence, large budget deficit cannot be condemned outright. The government can adopt strategic fiscal policies to manage the deficits that may occur but the question is, to what extent can government maintain a given level of budget deficit in the future in spite of shocks to the system? A government that runs persistent deficit over time must ask the question ‘is it possible to continue to run a budget deficit indefinitely or should there be a policy change possibly for the better’? This study therefore, attempts to investigate the sustainability of budget deficit in Ghana.

### **1.3 Objectives of the Study**

This study is concerned with the intertemporal relationship between government revenue and expenditure. The overall objective is to evaluate the sustainability of budget deficit in Ghana between 1960 and 2007. Specific objectives pursued in this study include:

1. To determine the extent to which government expenditure and government revenue of Ghana are cointegrated over the period between 1960 and 2007.
2. To examine the sustainability of budget deficit of Ghana.
3. To find out whether there have been changes in Ghana’s fiscal history that might fundamentally shift the sustainable or unsustainable deficit process.

### **1.4 Justification of the Study**

The following argument justifies the purpose of the study. Ghana lacks the capacity to raise sufficient revenue from domestic and external sources. This is due to narrow tax base, structural characteristics of the Ghanaian economy and unsophisticated nature of tax

administration. Efforts to widen the tax base led to the introduction of Value Added Tax, communication tax and flat rate tax for retailers [PriceWater Coopers, 2006: 3]. Yet, downward trend in world prices of cocoa and high rate of tax evasion, together with corruption of the revenue collection agencies has constrained the revenue targets of Ghana [ISSER, 1994: 20]. For instance, tax revenue decreased from 23.81 percent of GDP in 2005 to 22.25 percent in 2006 [ISSER, 2007:29]. There is therefore, a limit on the ability of Ghana to raise increasing amounts of tax for development.

Contrary, there is a lack of government will to restrain expenditure due to increasing public demand for infrastructure. The statutory duty of government to provide more roads, electricity, schools and markets continue to expand the rate of growth of government expenditure. For instance, development expenditure of Ghana rose from 6.26 percent of GDP in 2002 to 12.18 percent in 2006 whilst total expenditure increased from 26.8 percent of GDP in 2002 to 33.71 percent in 2006 [ISSER, 2007: 45].

It is therefore expected that budget deficit will consistently widen. Actually, Ghana's economy has persistently been saddled with the tendency towards budget deficit since the 1960's. The deficit level has been rising steadily in recent years. For instance, budget deficit to GDP increased from 1.6 percent in 2002 to 8.1 percent in 2006 and rose further to 9.6 percent in 2007 [ISSER, 1994: 17; IEA, 2008: 23-29]. The rising deficit implies that national debt will be increasing and may explode as a result of higher interest payment unless the deficit is constrained. It also implies that high debt will call for higher tax in future to pay for higher interest charges which will further discourage economic activities. This therefore calls for an evaluation of the dynamics of the relationship between

government expenditure and revenue of Ghana.

It is hoped that the study will evaluate the extent to which budget deficit is sustainable in Ghana. This will reveal whether Ghana is able to pay its interest on debt and so avoid rolling over accumulated debt forever. In this case, a large estimated cointegrating vector will show that Ghana is able to reduce interest payment on debt and therefore do not unequally shift the debt burden to future generations.

Also, the study will provide recommendations to guide policy-makers in formulating policies directed at efficient allocation of resources. For instance, in times of high deficit government will direct expenditure towards productive sectors such that more returns can be gained from the investment to pay off interest that may accrue. In this case, government can maintain large budget deficits in the future without major structural changes in the economy. This is likely to stir up the interest of other stakeholders.

Again, the study will provide useful information for further study. This will contribute to the stock of literature and policy issues relating to budget deficit sustainability of Ghana, in particular. The consequences of fiscal deficit on debt and other macroeconomic variables will be noted. This study is therefore relevant since Ghana's deficit and debt have been rising rapidly. The study appropriately, serves as added supplement for researchers to investigate actions taken by government to manage and sustain the budget deficit of Ghana.

## **1.5 Hypotheses**

To achieve the objectives of this study, we test the following hypotheses:

1. Government revenue does not granger-cause government expenditure in Ghana.
2. Budget deficit is not sustainable in Ghana.
3. The sustainability of budget deficit is not affected by structural breaks in government revenue and government expenditure series of Ghana.

## **1.6 Organization of the Study**

The study is divided into five chapters. Chapter one covers general introduction to the study sub-divided into background of the study, statement of the problem, objectives of the study, justification of the study, hypotheses and organization of the study. Chapter two presents the literature review of the work of other authors. It deals with both theoretical and empirical literature. This covers government budget deficit and sustainability of budget deficit.

The third chapter deals with the method of study. It includes the variables of the study, the model specification, data sources and data analysis. Chapter four discusses the estimation, analysis and interpretation of the results. This includes presentation of test results of unit root, granger causality and cointegration between government revenue and expenditure series. Also, stability test is conducted to check for structural breaks. Finally, chapter five outlines the summary of findings and conclusion of the study. Recommendation for policy making is also highlighted together with limitation of the study.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Overview**

For government to achieve its policy objectives it requires increasing amounts of finance. In the case of deficit financing, this tends to generate and/or increase the national debt but enhances economic growth. For this reason, the Keynesian school justifies deficit financing in the sense that deficits can reduce unemployment and increase economic growth through a rise in aggregate demand [Mokoena, 2005: 1]. The position of the school is that changes in government expenditure or revenue or both can be used as important instruments to mitigate short-run fluctuations of output and employment and bring the economy closer to its potential output [Carneiro *et al*, 2005: 107-108]. In essence, a deficit policy is a short-run issue but it can have lasting macroeconomic consequences on the economy. This chapter reviews the literature on theoretical as well as empirical issues relating to sustainability of budget deficit.

#### **2.2 Theoretical Review**

##### **2.2.1 Government Budget Deficit**

A deficit policy plays a vital role in assisting countries achieve macroeconomic stability, poverty reduction, income redistribution and sustainable growth. For this reason, most governments use the budget as effective tool in achieving their economic objectives. This means that large and accumulating budget deficit may not necessarily be a bad policy objective if such deficits are effectively utilized to enhance economic growth. It is in line

with this that an appropriate operational definition and measure of budget deficit must be clearly stated. Otherwise, the occurrence of large nominal budget deficit may be misleading depending on the operational measure adopted by the particular country.

#### 2.2.1.1 What does the Budget Deficit Measure?

Fiscal deficit has been at the forefront of macroeconomic adjustment policies in both developing and industrial countries in recent years. For developing countries, fiscal deficit has been blamed for high indebtedness, inflation and poor investment and growth performances over the years. It is therefore important to examine the measure of budget deficit as used in various countries and international organizations such as the IMF and World Bank [Wetzel and Roumeen, 1991: 8]. This will help appreciate the extent of the measure of budget deficit and its policy implications on the economy of Ghana.

There are several alternative definitions of budget deficit as used in the literature. The most commonly accepted definition by most governments and international organizations relate to the measure of resources utilized during a fiscal year that need to be financed after computing the difference between revenues and expenditure. This way of measuring budget deficit reflects the financing gap that needs to be closed by way of net lending. In line with this, the World Bank defines budget deficit as the difference between expenditure items including interest on government debt, transfers and subsidies, and revenue items including grants and sale of assets. In support of this line of argument, the IMF gives a functional definition of budget deficit as follows:

Fiscal deficit = [(expenditure on goods and services + transfers) — (revenue + grants) + (lending – repayments)].

In India, fiscal deficit is functionally defined by the government budget document as follows:

Gross fiscal deficit = Total Expenditure – Recovery of Loans and Advances – Revenue Receipts – Non Debt Capital Receipts - Repayment of debt.

A budget deficit therefore, measures the extent to which government expenditure exceeds government revenue that needs to be financed. In this case, it measures the overall gap in the expenditure and revenue of government that represents a liability which needs to be covered either by borrowing or through monetization. In essence, it measures the debt-financed and money-financed deficit. This reflects the current cash flow position of the government. Hence, budget deficit provides a measure of government’s contribution to aggregate demand in the economy. It also helps measure the crowding out of the private sector in the financial markets [Dholakia and Navendu, 2005: 2-3; Jacobs, Schoeman and Heerden, 2002: 5].

Table 2.1: Alternative Definitions of Budget Deficit

<b>Item of Budget Deficit</b>	<b>Their Meaning</b>
1. Conventional budget deficit	Total Expenditure – Total Receipt
2. Total budget deficit without grants	Conventional deficit (1) – grants
3. External budget deficit	Government expenditure – receipts (externally financed)
4. Domestic budget deficit	Total deficit – external deficit
5. Primary budget deficit	Total deficit – interest payments
6. Operational budget deficit	Primary deficit + real interest payments
7. Current budget deficit	Current revenue – current expenditure

Source: Jacobs, Schoeman and Heerden [2002]

The set of definitions in table 2.1 have been chosen as the workable measure of budget deficit for Ghana, given the lack of appropriate data. Each of the definitions highlights a particular aspect of fiscal exposure and can serve as a valuable purpose in terms of policy making and investment. Comparisons among the definitions show that they do not differ so much in magnitude. They all rely heavily on the level and size of economic growth, interest rate and inflation. In fiscal analysis, it is common practice to use operational deficit to measure fiscal sustainability because it includes primary deficit and real interest payments. This is a good choice since other definitions only differ marginally in terms of their relationship to GDP. It also includes interest payments which ultimately limits the deficit finance through growth of accumulated debt [Jacobs, Schoeman and Heerden, 2002: 5].

Thus, countries use different definitions of budget deficit mainly because of the structure of their budget, the relationship with other levels of government and conventional reasons. However, the most important determining factor in the choice of budget deficit should consider whether the fiscal policy would be sustainable in the longer term. This measure should focus on interpretation and management of fiscal policy. Hence, the most appropriate measure of budget deficit depends upon the purpose of the analysis. This means that no single measure of budget deficit is superior to the other [Wetzel and Roumeen, 1991: 8; Jacobs, Schoeman and Heerden, 2002: 3-4].

In all cases, the measure of budget deficit raises conceptual and practical issues which are compounded by lack of uniformity in usage among countries. For instance, budget deficit can be measured on cash or accrual basis. On cash basis, it equals the difference between total cash flow expenditure and total fiscal revenue whilst the accrual basis measures budget

deficit in terms of accrued income and spending flows, regardless of whether they involve cash payments or not. Therefore, budget deficit on cash basis does not provide direct measure of monetary expansion nor of the pressure due to increased demand for financial instruments in short-term markets. However, public debt management and open market transactions can greatly influence the size of budget deficit [Jacobs, Schoeman and Heerden, 2002: 2].

Another problem associated with the measure of budget deficit includes the problem of arrears. This becomes relevant in cases of repayment of foreign debt where interest payment is rescheduled as is the case of many heavily indebted poor countries. This means that current generation would be relieved of outstanding interest payment but future generations would surely pay back the rescheduled interest together with the accumulated debt. Again, the argument arises whether fiscal deficit would go down if government delays payment of public wage bill but takes in all revenues. This action reduces current deficit levels of government but such deficits must be paid in the future. The issues of arrears become particularly relevant during periods of high inflation when delayed payments in nominal terms have significant impact on the real value of such payments [Raghbendra, 2001: 9]. It is therefore important for governments to know the causes and determinants of rising deficits, so as to overcome any measurement problems.

#### 2.2.1.2 Causes and Determinants of Budget Deficit Growth

In general, changes in budget deficit is attributed to changes in government spending or tax revenue or both. Government receives revenue in its daily transactions and on capital items in the form of taxes and interests. On the other hand, government pays for daily activities

and capital items such as administrative expenses, loans and grants. Thus, budget deficit increases when government spending persistently exceeds its revenue. If expenditure continue to mount up throughout the years whereas revenues especially taxes are poorly collected, it widens the budget deficit position of the country. In this case, the accumulated value of past deficit creates increase debts which must be financed together with the accompanying interest payments.

With reference to political-economic models of government behaviour, it is recognized that incumbent administrations tend to stimulate their economies on the eve of political elections through tax cuts, increase spending and transfer payments. This occurs in countries where political power changes frequently between rival parties. In such cases, each rival administration spends over and above its budget and deliberately wait until after election before implementing policies to reduce the deficit. These ad hoc policies tend to widen the overall budget deficit and debt levels of the countries [Sachs and Larrain, 1993: 213-214].

However, the extent of budget deficit on an economy is determined by macroeconomic factors such as expected inflation, cyclical position of the economy which influences tax revenues and changes in expenditure. Theory predicts that cyclical fluctuations in output which is caused by economic boom and/or recession impact significant on budget deficit. In periods of recession when output is low, budgets tend to be in deficit because direct taxes fall sharply due to contraction in tax base. Also, certain categories of government spending become countercyclical and rise during business cycle downturn. Yet, such fluctuations in output growth are endemic in free market economies [Gebhard and Silika, 2006: 18-21; Sachs and Larrain, 1993: 213-214].

### 2.1.3 Effects of Budget Deficit Growth

Fiscal deficit has gathered substantial attention in the literature in the area of macroeconomic theory due to its impact on the indicators of macroeconomic performance. When budget deficit is financed by borrowing, it expands government's demand for credit through competition with households and business firms. This puts upward pressure on interest rate and slows down the rate of capital formation. In Keynesian models, this occurs through a rise in real interest rate which reduces investment purchases through the transmission mechanism. However, this depends on the responsiveness of interest rate to increased demand for credit and the reaction of private investors to higher interest rate. For instance, if investment demand is unresponsive to changes in interest rate, the effect on investment will be very small. Also, if the economy is in deep recession, any extra borrowing by government may put little upward pressure on interest rate because the supply curve for funds will be quite flat. Yet, if the return on private investment exceeds the return on government investment particularly on infrastructure, the rise in public investment would crowd in private investment [Hyman, 1994: 801; Barua, 2005: 5].

Also, large budget deficit increases the debt crisis in terms of its services and levels. As the national debt grows, interest payment also grows which serves as tax on investment. This reduces private investment, increases unemployment, lowers tax revenue and leads to higher future deficits. Hence, the economy continues to incur mounting debts which may lead to its collapse. Most countries trapped in debt servicing difficulties did run huge budget deficits at some point in time. Yet, it is argued that public debt growth compels government to target higher economic growth and revenue in order to finance any rising debt obligations. Otherwise it will force the economy into a deficit trap [Barua, 2005: 4-5].

On the burden of future generations, most economists agree that financing budget deficit through external debt means the postponement of tax increases. However, it is asserted that such burden depends on how the contracted loan is utilized. If the funds are spent on current consumption expenditure, future generations are likely to be worse-off but if it is spent on productive activities such as education and health then future generations are likely to be better-off [Mankiw, 2003: 422-423; Blanchard and Fischer, 1989: 126].

In addition, if budget deficit is monetized, it increases aggregate demand through increase in government purchases without a corresponding increase in taxes. Hence, governments need to run fiscal deficit particularly in the early stages of development to lead the economy in the path of growth and development [Xiomara and Greenidge, 2003: 2-3]. Secondly, it increases money supply. This exerts downward pressure on interest rate and upward pressure on equilibrium money stock and price level unless the economy is in deep recession. This leads to higher inflation, uncertainty and instability of real interest rate which tends to lower real tax revenue. Hence, monetized deficit should be kept low and effectively managed in the short-to-medium term [Hyman, 1994: 801; Bebi, 2000: 11; Turnovsky, 2000: 279-281].

#### 2.2.1.4 Influence of Revenue-Expenditure Relationship on Budget Deficit

A method of determining sustainable budget deficit is to check whether government revenue and expenditure are cointegrated. This implies that there may be significant long-term economic relationship between these two variables. There are four hypotheses that examine the influence of revenue and expenditure on budget deficit. The tax-spend hypothesis postulates that raising taxes in an attempt to reduce deficit also causes

expenditure to rise. It means that government raises tax revenue ahead of engaging in new expenditure. Hence, it is not possible to reduce budget deficit by increasing taxes. In this case, changes in revenue precede expenditure and hence, past and present values of revenue provide important information to forecast future values of expenditure [Barua, 2005: 8-11; Nyamongo, Sichei and Schoeman, 2007: 257-258].

Contrary, the spend-tax hypothesis predicts that government initially incurs expenditure and then increases tax revenue to finance the deficit. This means there are various interest groups within government who prefer to finance increase expenditure by borrowing and gradually raise tax to pay the deficit. Thirdly, the fiscal synchronization hypothesis suggests that revenue and expenditure decisions are determined simultaneously in the process of equalizing marginal benefit and marginal cost of government services. Thus, as government determines equilibrium marginal benefit and cost of its services, it affects the level of budget deficit [Barua, 2005: 8; Carneiro *et al*, 2005: 111].

Finally, the institutional separation hypothesis postulates that government decision to spend is independent of its decision to tax. Hence, there is no relationship between government revenue and expenditure. This is possible if government determines expenditure on the basis of requirements of citizens and imposes tax up to a tolerable limit of the citizens [Moalusi, 2004: 3; Barua, 2005: 9]. The above discussion means that if revenue and expenditure are non-stationary but there exists a linear combination of the two series which is stationary, then in the long run these series do not drift apart. In this case, government obeys its inter-temporal budget constraint which implies the budget deficit is sustainable.

### 2.2.2 Sustainability of Budget Deficit

A sound fiscal policy is mandatory for macroeconomic stability and sustainable growth which is a major goal of most emerging market countries such as Ghana. Yet, the size of budget deficit and ways of financing it determine the fiscal constraint of the country in the long term. In this sense, sustainable budget deficit becomes an important factor for which government authorities should pay particular attention [Kustepeli and Onel, 2004: 1-2].

The government's ability to borrow is constrained by the size of its permanent income just like an individual, even if it remains in authority infinitely. This implies that whatever debt it accumulates has to be repaid in the future. Thus, sustainability has three important elements. First, government needs enough resources to carry out its functions. So, sustainability analysis determines whether budget deficit can be maintained in the longer run. The second element deals with implications for other macroeconomic variables. This considers the direct effect of budget deficit on economic growth and development. The third element relates to the issue of affordability. Thus, policy makers should ensure that the cost of budget deficit and the accumulated debt is in line with the country's economic and fiscal base [Mahendra, 2006: 2]. Hence, sustainable budget deficit involves examination of the budget position over time and whether or not government violates its intertemporal solvency constraint. This means that at some time in the future, some policies will have to be changed otherwise government will become insolvent. Sustainable budget deficit therefore must be considered as a long-term issue [Bebi, 2000: 16]. In particular, the method of measuring sustainable budget deficit must be factored into making meaningful economic policies.

### 2.2.2.1 The Meaning of Sustainable Budget deficit

Sustainability of budget deficit has been defined in several ways. Generally, it is referred to the ability of government to maintain a given budget deficit in the future in spite of shocks to the system. This translates into a situation where current deficit policy by government can be continued indefinitely with a stable debt-to-GDP ratio. This means that government has the ability to raise the necessary funds by borrowing or balance its budget in present value terms [Xiomara and Greenidge, 2003: 2-4; Kustepeli and Onel, 2004: 2]. In line with this, the IMF defines budget deficit as sustainable if government is able to continue to service its debts which accumulates from budget deficit without large future correction to the balance of income and expenditure. Therefore, the main priority of a sustainable deficit relates to whether a continuation of the present policy stance as expressed in the present relation between the levels of expenditure and revenue causes the debt/GDP ratio to explode, implode or remains stable [IMF, 2002: 4].

By implication if interest is paid on debt whilst primary deficit is a constant ratio of GDP, then it is only interest payments that can cause the overall budget deficit to change. Hence, changes in debt/GDP ratio depend on the relationship between interest rate and economic growth rate. In this case, where there is an initial debt, further creation of primary deficit will cause the debt/GDP ratio to explode. This is because when budget deficit is persistent, government's ability to service its debt by further borrowing decreases and may become unfeasible in the long run [Kustepeli and Onel, 2004: 2]. So, government needs to run primary surplus sufficient enough to cover excesses caused by real interest rate over real growth rate. This allows for a permanent budget deficit that should not grow faster than GDP. In line with this, sustainable budget deficit can be defined as the product of economic

growth rate and the debt/GDP ratio such that the budget deficit does not respond negatively to increases in public debt [Gebhard and Silika, 2006: 1]. It means that if budget deficit in any year is too high, the stock of government debt expands. This will increase until the private sector ceases from being willing or able to supply government with credit which will force government either to monetize or repudiate the debt. Therefore, to improve the intertemporal budget deficit, government should compensate an increase in debt by reducing the non-interest expenditure and/or increasing taxes.

Alternatively, sustainable budget deficit requires that the present discounted value of all current and expected future tax revenues be equal to the present discounted value of all current and expected future spending plus current outstanding debt, including interest on the debt. In this case, sustainable budget deficit is defined in terms of net fiscal burden of current and future generations. Therefore, a deficit policy becomes sustainable whenever the net debt of government does not exceed the sum of discounted net taxes which should be paid by current and future generations [Amir, 2005: 1-3; Auerbach and Kotlikoff, 1995: 231-232]. This means government must plan to raise sufficient revenue, in present value terms, to repay its existing debt and finance any planned expenditure. In such a case, the financial strategy of government is to avoid rolling over its initial debts with the interest forever. The above measure of sustainable budget deficit implies that the intertemporal budget constraint links the budget deficit and public debt.

In light of this, budget deficit becomes sustainable if it leads to solvency of the budget constraint such that the future path of spending and revenue satisfy the intertemporal budget constraint of government. However, solvency is only a necessary condition for budget

deficit sustainability because it can be achieved with large and costly future adjustments. Yet, sustainability requires the achievement of solvency with unchanged policies. This means that sustainable budget deficit must fulfill two conditions. First, government should satisfy its current period budget constraint without resorting to default or excessive debt monetization. In this case, the flow of government revenue and expenditure must equal changes in the stock of debt and monetary base. Hence, it shows the means by which budget deficit is financed. Theoretically, it means that any value of budget deficit would be possible if government could raise its liabilities without limit. However, this does not impose a strong constraint on a government that is able to issue public debt. It is in this regard that Wilcox [1989: 291] points out that “*virtually any pattern of deficit would be sustainable if it were possible to borrow money and pay the interest by borrowing more*”. Clearly, this is impossible since government is faced with the present value of its own budget constraint.

Second, government should not adopt a policy of keeping accumulating debt when major future adjustment will be needed to service the debt. Otherwise this will constrain government’s borrowing powers. For this reason, the intertemporal budget constraint imposes a limit on government’s ability to borrow indefinitely. It requires net initial debt plus present value of expected future government expenditure to be equal or not greater than the present value of expected future government revenue. This implies that over a long time into the future (as we approach infinity), the present value of a country’s debt in the terminal period should be zero. This restriction, known as the transversality or No-Ponzi-Game (NPG) condition, means that government cannot continue to borrow indefinitely.

Consequently, sustainability analysis requires that the NPG condition should be satisfied without radical change in policies. This is tested by checking whether current deficit stance eventually leads to violation of the transversality condition. This implies that the expected present value of resources available to government for servicing of debt must be, at least, equal to initial stock of debt. Secondly, public sector debt cannot continuously be rolled over since the principal must be repaid at some point in time. Thirdly, it does not rule out large fiscal deficit but government must run some primary surpluses in the future.

However, there is an objection to the condition imposed by the intertemporal budget constraint of government. It explains that the sum of initial outstanding debt plus discounted future budget positions must not necessarily sum up to zero. Hence, for a government with outstanding debt, this may not necessarily require that budget surpluses will have to be run. It objects to the argument that continuing budget deficit would be unsustainable as a result of large borrowing adding up to government debt with the debt and interest payment rising over time. It argues that sustainability of budget deficit has to be considered from the perspective of the purpose for which the deficit is incurred and the effects of expenditure that is undertaken [Arestis and Sawyer, 2006: 2]. It is therefore important to look at the various dimensions of budget deficit sustainability in formulating economic policies.

#### 2.2.2.2 Dimensions of Budget Deficit Sustainability

The controversies regarding conditions of intertemporal budget constraint and the shift to long-term horizon has expanded the way governments and international organizations think about budget deficit sustainability. Although it has retained its original meaning as a measure of the solvency of government, it has acquired several dimensions in relation to

governments that have no difficulty in meeting present obligations. Current sustainability analysis focuses on fiscal conditions that may retard economic growth, increase tax burdens or transfer significant costs to future taxpayers. These dimensions reflect concerns that governments accumulate long-term liabilities that do not appear in current budgets but may disadvantage future generations when they are due [Díaz, Izquierdo and Ugo, 2004: 6].

Four dimensions of sustainability have been outlined. First, budget deficit must be solvent in the sense that government must have the ability to pay its financial obligations. For solvency to be achieved, present discounted value of current and future expenditure should not be greater than the present discounted value of current and future path of income, net of initial indebtedness. However, solvency is a problem in most underdeveloped countries, particularly those with high public spending but inadequate tax base. In such countries, when there is cyclical downturn or capital flees, government must rollover debt at very high interest rate and still borrows to stay afloat. As the growth of debt accelerates due to government's attempt to finance interest payment through the issue of more debt, it leads to a vicious circle where ever-larger amounts of debt are issued to pay ever-higher interest charges. Eventually, the cost of servicing debt outstrips government's ability to pay for the debt. The deficit policy then becomes unsustainable. Hence, solvency becomes an issue in countries that take on excessive debt [Luporini, 1999: 9].

Second, budget deficit should sustain economic growth. In this regard, government should manage its finances prudently to ensure future growth. Third, the capacity of government to meet future obligations with existing tax burden should be stable. So, government needs to adopt prudent fiscal measures that avert pressure on future increase in taxes so as to sustain

tax burden at current level or lower. The final version views budget deficit as sustainable when tax burdens and expenditure benefits are equitable across generations. This means budget deficit policy should promote fairness in the distribution of resources between generations and that no generation should be disadvantaged in terms of paying higher taxes relative to receipt of resource benefits [OECD, 2005: 3-5]. Hence, when sustainable budget deficit is perceived from different perspectives and dimensions, it will help government meet and sustain its economic growth pattern as well as being able to pay all financial obligations. This will prevent the situation whereby government has to rollover its debts at very high interest rate. Therefore, a review of the various techniques of analyzing budget deficit will help assess the impact of such policies on government fiscal capacity.

### 2.2.2.3 Methods of Analyzing Budget Deficit Sustainability

The most commonly used means to evaluate budget deficit sustainability begins with the balance sheet of the consolidated public sector or government budget constraint. They show the sources and uses of funds of the consolidated public sector. In this case, the methods focus on major programmes that have long-term implications for government budget deficit. The various techniques therefore, indicate that if sustainability becomes an ongoing issue, it is highly likely that budget practices will evolve to incorporate an elongated time frame into analyzing revenue and spending proposals [OECD, 2005: 6]. In a one-period budget identity where  $P_t = G_t - R_t$ , government budget constraint is written as:

$$P_t + i_t B_{t-1} = B_t - B_{t-1} + M_t - M_{t-1} \dots\dots\dots 2.1$$

Where  $P_t$  is primary deficit,  $R_t$  is government revenue,  $G_t$  is government expenditure excluding interest payments,  $B_t$  is stock of government debt,  $M_t$  is stock of money supply

and  $i_t$  is nominal interest rate at time  $t$  respectively. The equation shows that the uses of government funds must equate the value of funds obtained by government from the various sources. In this case, the expression indicates that government obtains its sources of funds through increased money finance and expansion in debt levels. These sources of funds are then used in the payment of interest on debt and the primary deficit.

One technique of analyzing budget deficit is the Accounting Approach. This method is grounded in accounting rules and analyzes the future by means of a balance sheet. It focuses on fairness of fiscal policy across generations in relation to benefits that each generation will receive in terms of transfer payments and taxes it will pay. This approach uses the primary gap indicator, which focuses on stabilising the ratio of public sector debt to output. The method specifies a benchmark primary deficit ( $S_t^*$ ) consistent with an unchanged debt to GDP ratio given below:

$$S_t^* = \left( \frac{r_t^\infty - g_t^\infty}{1 + g_t^\infty} \right) b_{t-1} \dots\dots\dots 2.2$$

Where  $r_t^\infty$  is long-run real interest rate,  $g_t^\infty$  is long-run growth rate of GDP and  $b_{t-1}$  is stock of debt in time  $t - 1$ . Primary deficit therefore, becomes sustainable if it is greater than the benchmark [Xiomara and Greenidge, 2003: 9-10].

In this case, the accounting approach attempts to determine sustainable budget deficit by making assumption that liabilities can continue to grow at the growth rate of the economy's GDP, such that the debt/GDP ratio remain constant. This makes the interpretation relatively simple. On the contrary, it does not distinguish between countries with varying degrees of

indebtedness and fiscal imbalance. It is therefore, more useful in the case of countries characterized by high debt and primary deficit.

In order to overcome the above problem, the present value budget constraint approach attempts to incorporate the role of lenders in determining sustainable budget deficit strategies. It has, in recent years, been the major technique for analyzing budget deficit since it is built on standard budget methods to project the future. The analysis begins with government budget constraint, with seignorage or money finance ( $M_t - M_{t-1}$ ) assumed negligible as follows:

$$G_t + (1 + r_t)B_{t-1} = R_t + B_t \dots\dots\dots 2.3$$

where  $r_t$  is the real interest rate. The equation indicates that payment of government in terms of expenditure and interest is constrained by its receipts in the form of revenues and debt default. It is then rewritten for subsequent and infinite periods, and recursively solved to produce the present value budget constraint as expressed in the equation below:

$$B_{t-1} \equiv \sum_{s=0}^{\infty} \left( \frac{1}{1+r} \right)^{s+1} (R_{t+s} - E_{t+s}) + \lim_{s \rightarrow \infty} \left( \frac{1}{1+r} \right)^{s+1} B_{t+s} \dots\dots\dots 2.4$$

Where  $E_t = G_t + (r_t - r)B_{t-1}$ , and the interest rate  $r_t$  is assumed to be stationary around a mean,  $r$ . However, intertemporal sustainability requires that the “no Ponzi game” (NPG) condition holds. This is represented in the equation below:

$$\lim_{s \rightarrow \infty} \left( \frac{1}{1+r} \right)^{s+1} B_{t+s} = 0 \dots\dots\dots 2.5$$

The condition states that the present discounted value of all future public debt balances must sum up to zero. This is because if lenders behave optimally and rationally, government

must pay off its debt at some point in time. In this case, the state cannot continue to roll over its debts perpetually into the future since lenders are rational. Thus, public debt in real terms cannot increase indefinitely at a growth rate beyond the real interest rate. This fulfils the intertemporal budget constraint of government which tests the validity of the NPG condition for the set of time series data on government spending and revenue. It attempts to find out if the fiscal data violates the present value budget constraint [Diaz, Izquierdo and Ugo, 2004: 6-8; Bajo-Rubio, Díaz-Roldán and Esteve, 2005: 2-4].

Hence, a common practice in the literature is to establish whether there is cointegration between government revenue ( $R_t$ ) and government expenditure ( $G_t$ ). This means that  $G_t$  and  $R_t$  series must be stationary and cointegrated as per the regression function below:

$$R_t = \alpha + \beta G_t + \mu_t$$

Where  $\alpha$  and  $\beta$  are coefficients, and  $\mu_t$  is the error term. Yet, this result is possible if the series of residuals ( $\mu_t$ ) is stationary and displays no unit root whilst the cointegrating vector  $\beta$  is statistically equal to one. In this case, if the cointegration result rejects the null hypothesis, the PVBC holds and the budget deficit is sustainable.

### **2.3 Empirical Review**

There have been significant contributions from writers on sustainability of budget deficit and debt. This covered diverse range of economies, including developing and developed countries. Results from these studies have been varied. The differences in the use of methodology have produced results and conclusions that are diverse and conflicting. Yet, these results will help to come up with robust analysis.

### 2.3.1 Government Budget Deficit

#### 2.3.1.1 Causes of Budget Deficit Growth

Generally, developing countries including Ghana face dual challenge in respect of fiscal policies. This arises from lack of capacity to raise sufficient revenue from domestic sources to finance deficits primarily due to narrow tax base. The structural characteristics of these low income countries and the prevalence of unsophisticated tax administration, limits their ability to raise taxes from domestic sources [Barua, 2005: 3].

In Ghana, the most profound reason for growth of budget deficit and national debt has been the role of shortfall in tax revenue due to lower tax mobilization. For instance, the ratio of tax revenue to GDP declined from 21.74 percent in 1989 to 15.37 percent in 1991. Again, it fell from 23.87 percent in 2005 to 22.25 percent in 2006 [ISSER, 2007: 28]. This is attributed to corruption of the revenue collection agencies and increase in effective tax rate on domestic commodities, which affected local industries' competitiveness in the face of liberalization [ISSER, 1994: 20]. As a result, the major sources of Ghana's tax revenue made up of domestic taxes on goods and services, taxes on international trade and transactions have shown declining trend. This constrains the revenue capacity of Ghana to raise enough revenue for development, though total revenue and grants as share of GDP increased from 27.8 percent in 2006 to 31.8 percent in 2007 [ISSER, 2007: 29-30; IEA, 2008: 24]. This means that low revenue is an important source of increasing budget deficit.

On the other hand, the big challenge arises from increasing demand for public expenditure in terms of infrastructure and social sector investment. The government of Ghana tries to boost its competitive capacity by investing large portion of its revenue in building physical

infrastructure. The consistent fiscal deficit of Ghana since independence is the result of increased provision of public goods such as health and education. As a result, total expenditure per GDP increased from 30.62 percent in 2005 to 33.71 percent in 2006 whilst capital expenditure per GDP increased from 12.12 percent in 2005 to 12.18 percent in 2006 [ISSER, 2007: 45; Pomeyie, 2001: 162-164]. For Ghana, increase government expenditure is the main source of widening budget deficit levels.

#### 2.3.1.2 Determinants of Budget Deficit Growth

A model involving variation in inflation, government expenditure during wartime, cyclical fluctuation in output during economic boom and recession in the postwar period was tested if it differs significantly from those during the world wars in the Swiss federal state. The estimate showed some cyclical fluctuation in the world war periods. This supports the assertion that significant determinant of budget deficit is increase in state expenditure during wartime. In this case, civilian expenditure was reduced and/or taxes increased to finance military expenditure during the war [Gebhard and Silika, 2006: 18-21].

In Ghana, changes in inflation, interest rate and real GDP have reacted negatively to changes in budget deficit. For instance, high inflation in 1983 caused budget deficit to increase by 35.8 percent due to decline in direct tax revenue. Also, changes in real interest rate increased budget deficit by 11.3 percent of GDP in 1984. Again, high wage bill increased the deficit by 2.5 percent in 1985. Thus, changes in macroeconomic variables have had strong impact on the fiscal deficit in Ghana. However, these effects have become less pronounced over the past years as the Ghanaian economy has grown more stable [Wetzel and Roumeen, 1991: 48].

### 2.3.1.3 Effects of Budget Deficit Growth and Economic Sustainability

Financing of budget deficit in Ghana have had diverse macroeconomic burden on the economy. Central bank financing for instance, have expanded the monetary base and money supply. According to Wetzel and Roumeen [1991: 48], it distorted the distinction between monetary and fiscal policies whereas the sale of domestic bond increased interest rate. This led to increase in the net domestic financing from 0.49 percent of GDP in 2004 to 4.15 percent in 2006. As a result, money supply (currency and deposits) increased from 6.84 percent in 2005 to 34.4 percent in 2006. However, domestic interest and bank rate reduced due to low demand for bonds [ISSER, 2007: 30, 60, 65].

Also, Ghana has accumulated large external debt and so borrow externally only on short term bases at high interest rate. This is because foreign financing raises the cost of servicing external debt. For this reason, Ghana's access to external borrowing prior to 1984 had been limited, ranging between -0.74 and 1.62 percent of GDP. In recent times however, debt levels have been falling. External debt fell from 72.5 percent in 2004 to 26.9 percent in 2006 with debt service to GDP reducing from 6.8 percent in 2004 to 6.0 percent in 2006. [Wetzel and Roumeen, 1991: 48; ISSER, 2007: 50, 101]. This is attributed to the adoption of HIPC initiative which aims at reducing the net present value of external debts. For instance, in 2002 Ghana received debt relief of US\$275.2 million and US\$290.8 million in 2003 and US\$318.3 million in 2004 [Bank of Ghana, 2005: 3]. The report indicates that the HIPC initiative led to increase in poverty-related expenditure from 27.29 percent of total government expenditure in 2003 to 29.24 percent in 2004. Also, the share of primary health care to total expenditure of the health sector increased from 77.91 percent in 2003 to 84.44 percent in 2004. This significant improvement reflects the impact of freed resources made

possible through the HIPC debt relief to Ghana. Yet, it is argued that the volume of debt servicing has not decreased.

Easterly and Schmidt-Hebbel [1993: 215-230] argue that increase budget deficit through expansion in public investment have significantly crowded-out private investment in Mexico and Ghana. However, they observe that government must accelerate private sector investment by building the infrastructural base. This is because private sector productivity expands only when structures are in place. Hence, the study noted that infrastructure accessibility and rural banks play crucial role in expanding private agricultural investment. This requires substantial government intervention which increases budget deficit and debt levels. However, in recent times low public sector investment in Ghana has led to downward trend in private domestic investment from 58.1 percent in 2002 to 36.3 percent in 2006 [Barua, 2005: 5; ISSER, 2007: 73]. Hence, large deficit may crowd-out private investment if public investment is not put to productive activity.

On the contrary, Straub and Tchakarov [2007: 7] argue that budget deficit enhances economic growth. By investigating thirty developing countries between 1970 and 1980, they show that as budget deficit increases the share of capital expenditure to GDP also rises. The study revealed that the persistent increase in Ghana's deficit has led to increase in capital expenditure-GDP ratio from 6.26 percent in 2002 to 12.47 percent in 2004. This occurred mainly in the area of transportation and communication infrastructure. However, the level of capital expenditure must be reduced during periods of growth since excessive aggregate demand can generate inflation [Barua, 2005: 1-4].

#### 2.3.1.4 Influence of Revenue-Expenditure Relationship on Budget Deficit

Although several countries have investigated the long run relationship between government revenue and expenditure, no consensus has been reached. A tax-spend analysis in Taiwan found cointegration relationship between GDP, government revenue and expenditure in real terms. It concludes that government expenditure normally adjusts for deviations from long-run equilibrium in budget deficit [Carneiro *et al*, 2005: 108; Barua, 2005:10].

In Guinea-Bissau, the use of annual data between 1981 and 2002 indicates that expenditure and revenue exhibit unilateral causality from expenditure to revenue and stable relationship in the long-run. This supports the spend-tax hypothesis, whereby government spends and then raises tax revenue or receives grants to finance the expenditure. The study concludes that the risk of budget deficit explosion in the long-run is limited but government should control spending to restore fiscal discipline in the short-term [Carneiro *et al*, 2005: 115].

The long-run relationship between tax rate and budget deficit for four developing countries (Benin, Cote d'Ivoire, Niger and Togo) shows a strong bi-directional causation. This means that changes in tax rate significantly affects the level of deficit [Barua, 2005: 9]. However, a study in Bangladesh using annual data from 1974 to 2004 shows no causal relationship between revenue and expenditure in the short run but extends its relationship from both revenue and expenditure to GDP. It indicates that deviation from long-run equilibrium relationship between government expenditure, revenue and real GDP is corrected by short-run adjustment of expenditure and GDP. It concludes that expenditure, especially in unproductive sectors, is a key variable that increases budget deficit due to structural constraints of raising revenue [Barua, 2005: 19].

### 2.3.2 Sustainability of Budget Deficit

Sustainable budget deficit depends on its size and how fast the economy is growing. This means that budget deficit in high growth economies can be large if the economy continues to grow. For instance, India, Malaysia, Pakistan and Thailand with more than 5 percent growth between 1980 and 1986 were able to run sizable domestic deficits while maintaining single digit inflation. Thus, countries can progress over long periods with large deficits if domestic saving rate is high, since individuals would be willing to absorb relatively large amounts of government debt in their portfolios [Fischer and Easterly, 1990: 137].

#### 2.3.2.1 Management of Budget Deficit and Sustainability

The continuously widening budget deficit level in Fiji was financed by increased borrowing which led to high debt levels beyond sustainable limits. When the debt level hit 53 percent of GDP, government responded by selling off some national assets. This practice however, has limitations since government cannot always resort to asset sales to bring debt levels to sustainable limits. This means government should grow the economy, so that more revenue would be available to finance increase expenditure thereby lowering the deficit. Also, borrowing must be made in line with growth levels of the economy [Mahendra, 2006:10].

In Zambia, the government embarked on adjustment programmes such as liberalizing exchange and interest rates, abolishing price controls and subsidies in an effort to maintain sustained budget deficit. As a result, budget deficit and debt rescheduling reduced from 7 percent of GDP in 1991 to 2.3 percent in 1997. During this period, the government increased tax revenue by 19 percent of GDP and expenditure level was prudently brought down [Dinh, 1999: 19-22].

For Ghana, the persistent deficit led to the adoption of structural adjustment programme (SAP) and economic recovery programme (ERP) in 1983. The overriding purpose of these programmes was focused on reducing government expenditure and Ghana's debt, and reversing the serious economic decline characterized by high inflation rates and extensive government involvement in the economy. This intervention led to the reduction in budget deficit from 6.3 percent of GDP in 1982 to 0.1 percent by 1986. It also halted the downward trend of growth by recording solid growth between 1987 and 1992 of 5.5 percent. Again, the government divested many assets through privatization of state owned enterprises between 1987 and 1989, which increased government total receipts [Oshikoya and Tarawalie, 2008: 7; Mutasa, 2008: 15]. However, Abdul-Nashiru [1999: 1] argues that the ERP and SAP led to increased exploitation of natural resources in non-sustainable ways, exacerbating rural poverty, foreign dependence and Ghana's external debt situation.

The re-emergence of fiscal imbalances in later years after the ERP resulted in Ghana's domestic primary balance shifting from a surplus of 1.9 percent of GDP in 1991 to a deficit of 4.9 percent in 1992 [Government of Ghana, 2005: 1]. Then, in 1999, the economy was subject to a combination of shocks especially sharp decline in cocoa and gold prices, rising oil prices and short falls in expected external inflows. This was exacerbated by government spending, especially in election years of 1992 and 1996. It created the platform for the accession to the HIPC initiative in 2001 by the government of Ghana [Mutasa, 2008: 15-16]. The HIPC initiative led to the cancellation of large amount of Ghana's external debt. For instance,  $\text{¢}13.65$  trillion of Ghana's stock of debts was cancelled and a total debt relief of  $\text{¢}31.85$  trillion was granted. Ghana also saved  $\text{¢}2.093$  trillion annually in debt service cost and this will continue for the next twenty years. Again, there was 20 percent reduction in

domestic debt. Total public debt, in this case, declined substantially from 24 percent of GDP in 2002 to 10.8 percent of GDP in 2005. The ratio of debt service-to-revenue also decreased substantially from 61.3 percent in 2001 to 9.0 percent in 2007. It also led to increase in poverty reduction spending of 43.1 percent in 2004 [IMF, 2001: 9, 20]. However, Oduro [2002: 13] observed that one effect of going HIPC is that Japan no longer gave Ghana loans, but still maintained grants. This indicates that the debt relief provided by the IMF and World Bank is not adequate to guarantee debt sustainability for countries exporting primary commodities that face volatile commodity prices. In this case, the management of budget deficit and debt levels must involve multiple fiscal policy options.

#### 2.3.2.2 Long-run Cointegration Relationship between Revenue and Expenditure

The work of Gerbhard and Silika [2006: 6-7] reveal that Hamilton and Flavin examined the stationarity properties of the US budget deficit but excluded interest payments on debt and assumed a constant real interest rate. Applying ADF test to budget deficit series, they argue that a sufficient condition for the validity of present value budget constraint is stationarity of primary deficit. The result shows stationarity between levels of debt and primary deficit. Hence, it is suggested that government budget should be balanced in present-value terms.

However, when Wilcox employed the same data it indicates that present value budget constraint may be satisfied even if the level of primary deficit is non-stationary. Hence, this analysis extends beyond the test for unit roots. The writer then questions the assumption of constant real interest rate and allows for time-varying real interest rate. He also assumes non-stationarity in the non-interest surplus of the budget. An ADF test was then applied to the discounted debt series. It concludes that fiscal policy of the US was non-stationary. In

addition, the application of Engle-Granger and Johansen cointegration methods failed to find evidence for cointegration between budget deficit and government debt. The analysis concludes that, over the entire period, the US budget deficit is not consistent with the intertemporal budget constraint. Yet, it states that stationarity of government revenue and expenditure is a necessary condition for the present value budget constraint [Wilcox, 1989: 262-305].

Again, on testing the sustainability of budget deficit in Spain, it was found that the process followed by government revenue, government expenditure and budget deficit are stationary. The debt to GDP ratio also fulfilled the transversality or NPG condition in its strong sense. This result is therefore consistent with fiscal policies that are characterized by gradual declines in budget deficit due to drop in spending and slight declines of total revenue over GDP [De Castro and De Cos, 2002: 20-21].

Oshikoya and Tarawalie [2008: 7-21] tested the sustainability of fiscal policy in the West African Monetary Zone made up of The Gambia, Ghana, Guinea, Nigeria and Sierra Leone. The study observed that Ghana's fiscal position had remained weak during the review period mainly due to persistent fiscal deficits. Government expenditure accelerated between 1980 and 2008 due to loose expenditure outlay and high interest payments on government loans. However, the adoption of the ERP in the mid 1980's helped cushion the increase in government expenditure. Yet, substantial increase in salaries to civil servants in the run up to elections in 1992 and 1996 accounted for huge expenditure outlay during the 1990's.

Using the PVBC model and annual time series data of Ghana for the period 1980-2008, they estimated the cointegration between total government revenue and government spending inclusive of interest payments on debt. The unit root test using ADF and PP statistics showed that both series are integrated of order one at 1 percent significant level after first difference. The Johansen cointegration test rejected the null hypothesis indicating that the variables are cointegrated. This means that fiscal policy in Ghana is sustainability but in the weak sense. The result also shows bi-directional causality between government expenditure and revenue. In this case, decision to spend-and-tax or tax-and-spend are determined jointly. This means that stationarity of the variables is a necessary condition for sustainability of fiscal policy.

### 2.3.2.3 Cointegration Relationship and Structural Breaks

Quintos [1995: 409-417] applied cointegration test between total government revenue ( $R_t$ ) and total government expenditure ( $G_t$ ) to the same data used by Wilcox but introduced strong and weak conditions for intertemporal budget balance. Strong sustainability is defined as cointegration between expenditure and revenue with cointegrating vector [1 -1]. This indicates that government deficit series including interest payment is stationary. Weak sustainability, on the other hand, involves cointegration with  $0 < \beta < 1$  and unsustainable budget deficit is satisfied if  $\beta \leq 0$  for the test equation given below:

$$R_t = \alpha + \beta G_t + \varepsilon_t$$

Using the data in their quarterly form, it was concluded that the US budget deficit is weakly sustainable for the entire sample. This means that government's solvency condition holds, but the undiscounted debt process is exploding at a rate that is less than the growth rate of

the economy. It becomes inconsistent with government's ability to market its debt in the long run. However, using stability test to estimate structural breaks in the data, it was concluded that government revenue and expenditure are cointegrated with cointegrating vector [1 -1] in the first sub-period but not cointegrated in the second sub-period.

Gerbhard and Silika [2006: 10-14] also applied unit root test to government expenditure, revenue and budget deficit of the Swiss federal state. However, the entire sample was split into two sub-samples by eliminating observations during World War II, the great depression and legislative changes in the budgetary process. These variables were considered exogenous shocks in the model, which is relevant for fiscal sustainability. This is because if time series have significant break in the trend function, the power of the standard unit root tests substantially decreases.

The unit root tests favoured the stationarity of the deficit-GNP ratio for the entire sample. Contrary, quite different findings were obtained for the sub-periods when they allowed for structural break. The pre-war sub-period suggests non-stationarity of the deficit-GNP ratio. However, hypothesis for the post-war sub-period was rejected when PP test was used, but it was accepted for ADF test. Therefore, these results provide no evidence for the pre-war period and weak evidence for sustainability after the war. Hence, it is concluded that results of the sub-periods are incompatible with that of the entire period. Yet, it is asserted that failure to reject the null hypotheses for the sub-periods might be due to the small number of observations and low power of these tests. This indicates that the test for structural breaks is important to ensure stability of parameters through the whole study period.

## **2.4 Chapter Summary**

Budget deficit and debt level are two variables that most governments try to deal with in their fiscal and monetary policies. Increase in budget deficit will increase government debt and interest payment overtime. However, government debt must grow at a rate lower than interest rate. This will occur if government runs surpluses at certain periods. Hence, the present value of all future primary deficits plus initial stock of national debt must sum up to zero. This restriction on the growth rate of national debt imposes a budget constraint on government, which can be tested by establishing the long-run cointegration relationship between government expenditure and government revenue.

Most of the work reviewed found diverse evidence for the sustainability of budget deficit depending on the economy and method adopted. Using econometric methods, most writers tried to analyze sustainability of budget deficit and its effect on government debt. No general conclusion has been drawn, and therefore sustainability of budget deficit is dependent on the variables, data, economy and methodology adopted.

## **CHAPTER THREE**

### **METHOD OF STUDY**

#### **3.1 Overview**

This chapter presents the methodology of the empirical model of the study. The chapter is divided into two broad sections. Section one focuses on the definitions of the variables used in the study and how they are measured. It also looks at the theoretical background to the model specification. The second section focuses on the data sources and the analysis. This looks at the time series properties of the data and the econometric methods used in estimating the model.

#### **3.2 Variables of the Study**

The main variables employed in the study include government revenue, government expenditure and real gross domestic product (GDP).

1. Government revenue includes all amounts of money or income received from sources outside the government entity. This includes taxes, loan repayments, direct income, interests and grants obtained locally and externally.
2. Government expenditure involves spending by government authorities on goods and services. This includes spending on road maintenance, health, administration and security. It also includes subsidies, grants and debt servicing.
3. Real gross domestic product is the measure of changes in physical output in an economy between different time periods by valuing all goods and services at the

same constant price. Thus, it measures the value of final goods and services produced in a given year when valued at constant prices [Parkin and Bade, 2003].

These variables are relevant to the study because changes in government spending or revenue create changes in fiscal deficits. For instance, rapid increase in government expenditure coupled with shortfalls in tax revenue will persistently create budget deficit. This study however, uses government expenditure-GDP and government revenue-GDP ratios in their log forms because as the economy grows, government expenditure and revenue grows in proportion to real GDP. Hence, the ratios give a better view of government performance of the economy. Also, the use of logarithm removes growth in the variances of the variable series [DeLong, 2002: 399; Barua, 2005: 10].

### **3.3 Model Specification**

This study adopts the present value budget constraint model used by Kustepeli and Onel [2004: 7-8] in specifying a model for budget deficit sustainability of Ghana. It is the most commonly used model in the study of budget deficit sustainability base on intertemporal budget constraint (IBC) of government [Gebhard and Silika, 2006: 5]. The basic idea of the IBC is that government, like any other economic agent, faces a budget constraint in which borrowing can be undertaken in some but not all periods so that the overall debt position of government sum up to zero. Such model shows the relationship between taxes, expenditure and other sources of financing budget deficit. In this case, it underpins the impact of fiscal deficit on the economy and shows the relationship between fiscal and monetary policies.

The model begins with government budget constraint expressed as follows:

$$G_t + (1 + r_t)B_{t-1} = R_t + B_t \dots\dots\dots 3.1$$

where money finance ( $M_t - M_{t-1}$ ) is assumed to be negligible and  $B_t$  is stock of government debt,  $R_t$  is government revenue,  $G_t$  is government expenditure excluding interest payments and  $r_t$  is real interest rate. The expression shows that the public sector finances its fiscal deficit through borrowing. Hence, it indicates the sources and uses of public sector funds. It is therefore suitable for this study since Ghana finances its fiscal deficits mainly through borrowing [ISSER, 1994: 30].

Equation 3.1 is then solved recursively by including subsequent and infinite periods. This generates the present value budget constraint (PVBC) expressed as follows:

$$B_{t-1} \equiv \sum_{s=0}^{\infty} \left( \frac{1}{1+r_t} \right)^{s+1} (R_{t+s} - E_{t+s}) + \lim_{s \rightarrow \infty} \left( \frac{1}{1+r_t} \right)^{s+1} B_{t+s} \dots\dots\dots 3.2$$

Where  $E_t = G_t + (r_t - r)B_{t-1}$ , and the interest rate  $r_t$  is assumed to be stationary around a mean,  $r$ . The expression means that the stock of government debt must be equal to the present value of primary budget surpluses with no issue of new debt to finance the deficit. Yet, intertemporal sustainability requires that the no Ponzi game (NPG) condition holds. Therefore, the PVBC is reduced to NPG condition represented in equation 3.3;

$$\lim_{s \rightarrow \infty} \left( \frac{1}{1+r} \right)^{s+1} B_{t+s} = 0 \dots\dots\dots 3.3$$

This means that present discounted value of all future debt balances must sum up to zero because if lenders behave optimally and rationally, government must pay off its debt at some point in time. Thus, government cannot continue to roll over its debt perpetually into

the future since lenders are rational. Therefore, sustainable budget deficit constrains debt level to grow indefinitely, no faster than real interest rate. This fulfils the IBC of government which implies an implicit promise to creditors that government will run surpluses in the future to offset prevailing deficits. Thus, compliance with the IBC implies that government is balancing its budget intertemporarily by setting current market value of its debt equal to the discounted sum of expected future surpluses without resorting to Ponzi scheme financing [Kustepeli and Onel, 2004: 2].

In this case, the study attempts to find out whether the process that generates fiscal data eventually violates the PVBC. This is a test of the validity of the NPG condition for the set of data on government expenditure and revenue. Hence, a test that establishes the existence of cointegration between government revenue and expenditure is considered evidence consistent with the IBC. This is because the IBC imposes restriction on the long-run relationship between expenditure and revenue, which implies that expenditure cannot move too far away from revenue [Kustepeli and Onel, 2004: 3; Holmes, Jesús and Panagiotidis, 2007: 3].

In this study, we test the cointegration between government revenue ( $R_t$ ) and government expenditure ( $G_t$ ) in the following testable regression function:

$$R_t = \alpha + \beta G_t + \mu_t \dots\dots\dots 3.4$$

Where  $\alpha$  is a constant which shows the degree of drift in the parameters,  $\mu_t$  is the error term whilst  $\beta$ , shows the extent to which changes in government expenditure affects the value of government revenue [Bajo-Rubio, Díaz-Roldán and Esteve, 2005: 2-4].

### **3.4 Data Sources**

The study employed annual time series data on government revenue-GDP and government expenditure-GDP of Ghana for the period 1960 to 2007. The data was obtained from World Bank development indicators' CD-ROM and the state of the Ghanaian economy. In this case, the study used secondary data from two main sources.

The use of annual data is dictated by the unavailability of quarterly data for most of the years whilst the choice of study period is depended on the availability of well-documented data for Ghana. The period is also characterized by the interruption of different political regimes. These processes of governance suggest the possibility of the existence of structural breaks. Also, Ghana introduced ERP in 1983 and HIPC initiative in 2001 which were aimed at increasing growth of revenues and managing expenditure levels. Again, in 1973-74 and 1979 there were oil price hikes that took a heavy toll on the economy. This led to massive injection of foreign capital which increased Ghana's total external debt by \$6.7 billion at the end of 2000 [Mutasa, 2008: 6]. These are years of possible break points that may destabilize the constancy of the parameters.

### **3.5 Data Analysis**

The analysis of this study is mainly quantitative. This involves the use of time series techniques to determine the presence of unit roots and cointegration. Time series analysis is used because it concerns the analysis of data collected overtime such as monthly, quarterly or yearly values. It deals with sequence of observations which have been ordered in time or space. The purpose of such analysis is meant to discern whether there is some pattern in the values collected with the intention of forecasting economic trends. This permits the

adjustment of economic time series for influences impairing the detection of medium to long-term trend of a series. In this case, it provides useful information about the development of the systems of the economy [Dolado, Jesús and Marmol, 1999: 2-3].

Thus, many macroeconomic data are not differenced stationary time series and hence contains unit root. This data series must be differenced prior to any meaningful econometric estimation; otherwise they may render the hypothesis test unreliable because the resulting error terms become serially correlated. This means that time series with unit root has a long term component that is purely non-predictable and needs to be differenced to stationarity [Dolado, Jesús and Marmol, 1999: 2-3; Mahendra, 2006: 8]. In case of Ghana, the series of government expenditure and revenue must be stationary and integrated of the same order. This stems from the restriction imposed by the IBC on time series properties of government revenue and expenditure. This agrees with the assertion that sustainability test based on examination of stationarity properties of primary deficit is equivalent to a test for cointegration between government revenue and expenditure under condition that these series are of the same order of integration. Such procedure is consistent with the method employed by Trehan and Walsh [De Castro and De Cos, 2002: 15].

In this case, we employ the augmented Dickey and Fuller (ADF) and Phillip-Perron (PP) tests to examine the presence of unit root. They involve testing the null hypothesis of non-stationarity of government expenditure-GDP and government revenue-GDP series against the alternative hypothesis of stationarity of the variables. These tests will verify the stationarity properties of government revenue and expenditure series of Ghana.

Then, in order to determine the causal link between government expenditure-GDP and revenue-GDP series of Ghana, we apply the Granger causality test as stated in the following expression below:

$$\ln EXG_t = \alpha_0 + \sum_{i=1}^n \alpha_{1i} \ln EXG_{t-i} + \sum_{i=1}^n \alpha_{2i} \ln REVG_{t-i} + \varepsilon_{1t} \dots\dots\dots 3.5$$

$$\ln REVG_t = \beta_0 + \sum_{k=1}^m \beta_{1k} \ln REVG_{t-k} + \sum_{k=1}^m \beta_{2k} \ln EXG_{t-k} + \varepsilon_{2t} \dots\dots\dots 3.6$$

Where  $\ln EXG_t$  and  $\ln REVG_t$  are log of government expenditure-GDP and log of government revenue-GDP at time t;  $\alpha_0$  and  $\beta_0$  are intercepts,  $\alpha_{1i}$  and  $\beta_{1i}$  are slope coefficients of own lagged values,  $\alpha_{2i}$  and  $\beta_{2i}$  are slope coefficients of lagged values of other variables in equation 3.5 and 3.6 respectively whilst  $\varepsilon_t$  is error term. Equation 3.5 means that the log of government expenditure-GDP ratio at a particularly time is influenced by its past values and past values of the log of government revenue-GDP series; whilst equation 3.6 means that the log of government revenue-GDP ratio at any time is influenced by its past values and past values of the log of government expenditure-GDP series. This means that in a regression of the variables on their own lagged values, the inclusion of lagged values of the other variable significantly improves the prediction of that variable. In estimating the causal link between government expenditure-GDP and revenue-GDP series of Ghana, the null hypothesis of no Granger causality is tested against the alternative of Granger causality. In this case, the null hypothesis is not rejected if  $\sum \alpha_{2i}$  and  $\sum \beta_{2i}$  are statistically equal to zero simultaneously. This means past and present values of government revenue provide no important information to forecast future values of expenditure [Barua, 2005: 11].

Also, cointegration test is performed to establish econometric properties of the time series data. This is because cointegration shows a linear combination of non-stationary variables based on the idea that there may be a long-run co-movement between the time series data with a common equilibrium relation. Hence, the rationale for using cointegration is that if government spending and revenue are non-stationary but there exists a linear combination of the two series which is stationary, then in the long run these series do not drift apart. In this case, we can then infer the level of sustainability or otherwise of the budget deficit of Ghana. Cointegration is therefore, a means of correctly testing hypotheses concerning the relationship between government expenditure and government revenue having unit roots. Hence, cointegration analysis provides a more powerful tool when the data set is of limited length which is common with most economic time series. Also, if the variables are cointegrated, a test can be made to check the causality between them. For instance, if the series of government revenue and expenditure are cointegrated, an error correction representation of the cointegrated series can be estimated to examine the causality between the variables. In this case, cointegration test is viewed as a statistical expression of the nature of long-run equilibrium relationships [Dolado, Jesús and Marmol, 1999: 2-3].

In this study, the test for cointegration uses the two stage procedure of Engle-Granger. This helps establish the relationship between government revenue and expenditure, and hence the sustainability or otherwise of the budget deficit of Ghana. The Engle-Granger test is used because it is very simple and widely accepted as a reliable test for causality between two or more variables. Also, this test estimates long-run models using ordinary least squares (OLS) which provide reliable coefficients of the model [Gebhard and Silika, 2006: 14].

In applying the Engle-Granger test, the long run cointegration relation between government expenditure-GDP and government revenue-GDP series of Ghana is estimated by using OLS method. This is expressed in the following testable function:

$$\ln EXG_t = \alpha + \beta \ln REVG_t + \mu_t \dots\dots\dots 3.7$$

where variables are as defined. In this case, the hypothesis to be tested in support of the objective of this study is stated as follows:

$H_0$  : Government revenue and expenditure are not cointegrated.

$H_1$  : Government revenue and expenditure are cointegrated.

This result is possible if the series of residuals ( $\mu_t$ ) is stationary and displays no unit root. Hence, we apply the estimated cointegration relationship to generate residual errors. The estimated OLS residual errors are then tested for unit root. In respect of this, the following hypothesis is tested to find out the stationarity of the residuals:

$H_0$  :  $\varepsilon_t$  is not stationary (no cointegration)

$H_1$  :  $\varepsilon_t$  is stationary (cointegration)

Also, a linear restriction test for statistical significance of the cointegrating vector ( $\beta$ ) is performed. As noted by Quintos [1995: 413], it is important to test the linear restriction for statistical significance of  $\beta = 1$ . By implication, we test whether the coefficient of the independent variable in the long-run cointegration model is statistically different from one. However, the value of  $\beta$  need not necessarily be one in absolute terms, but in statistical terms. In as far as government revenue and expenditure are cointegrated, if the coefficient (

$\beta$ ) is statistically equal to one, it indicates the case of strong sustainability of budget deficit of Ghana. On the other hand, the budget deficit of Ghana will be weakly sustainable if government revenue and expenditure are cointegrated but  $0 < \beta < 1$ . Lastly, if  $\beta \leq 0$  then irrespective of the cointegration relationship between government expenditure and revenue, the budget deficit of Ghana will be unsustainable as confirmed by Quintos [1995: 413]. For the budget deficit of Ghana, the following hypothesis is tested to establish the statistical significance of the cointegrating vector:

$$H_0 : \beta = 1$$

$$H_1 : \beta \neq 1$$

Also, the short-run relationship between government expenditure and revenue of Ghana is estimated by using error correction model (*VECM*). Thus, in the presence of cointegration relationship between government revenue and expenditure, there always exists a corresponding error correction representation. This helps infer about the cointegration relationship between the variables because changes in government revenue do not only depend on changes in the government and its own past values, but also on the extent of disequilibrium between the levels of these variables. The model uses the first difference of the variables. For Ghana, the testable function is specified as follow:

$$\Delta \ln EXG_t = \alpha + \beta \Delta \ln EXG_t(-1) + \delta \Delta \ln REVG_t(-1) + \phi \Delta ECT(-1) + \varepsilon_t \dots\dots\dots 3.8$$

where  $\Delta$  is the first-order time difference,  $\Delta ECT$  is the first difference of the error correction term and  $\alpha$  is the intercept.  $\varepsilon_t$  is the error term with zero mean whilst  $\delta$  is the coefficient of the period change in government revenue which tends to capture the short-term effects. Also,  $\phi$  is the coefficient of the error correction term which incorporates

feedback in the relationship between government revenue and expenditure. In this case, the coefficient of the error correction term represents speed of adjustment to long run equilibrium following shocks to the system. Hence, it captures the transitional dynamics of the system to the long-run equilibrium [Carneiro *et al*, 2005: 113].

Finally, it is possible, in reality, that the long-run relationship between government expenditure and revenue can change, which will shift the cointegrating vector. Thus, though time series with unit root has long term component that is purely non-predictable, Gregory and Hansen argue that rejection of cointegration may be due to shift in the cointegration vector during the sample period [Gerbhard and Silika, 2005: 15; Dolado, Jesús and Marmol, 1999: 22]. In this regard, movement towards the long-run equilibrium need not occur in every period especially when the sample period is long. This means structural breaks and regime shifts within the time series data may lead to rejection of cointegration. Thus, the possibility of fiscal variables to be subject to structural shifts may create incorrect results of the analysis on sustainability of budget deficit [Kustepeli and Onel, 2004: 3]. In this case, we account for changes in the parameters due to changes in fiscal policy to avoid bias conclusion towards accepting the null [Afonso and Rault, 2007: 4-5; Gerbhard and Silika, 2006: 15-17].

For Ghana, there have been changes in fiscal policy as a result of changes in government programmes. In 1983, the ERP and the SAP were introduced in Ghana to mitigate the severe economic downturn in the 1980's. Again, in 2001 Ghana opted for HIPC in order to claim debt forgiveness. Again, there had been several political changeovers since 1960 made up of both constitutional and military regimes. These unusual events are regime shifts

that indicate specific and possible sources of structural breaks in the parameters of government revenue and expenditure series of Ghana.

This study uses cumulative sum (CUSUM) and cumulative sum of squared (CUSUM Q) tests to check for structural break in the parameters of government revenue and expenditure series of Ghana. This is because they are recursively estimated from OLS regression. In this regard, the hypothesis tested in support of our objective is:

$H_0$ : There is no structural break in government revenue and government expenditure series of Ghana.

$H_1$ : There is structural break in government revenue and government expenditure series of Ghana.

The various diagnostic tests such as the normality, heteroscedasticity and autocorrelation tests are also performed. In this study, the test for normality of the variables uses Jarque-Bera test. This test is based on OLS residuals and the test statistic follows the chi-squared distribution with 2 degrees of freedom. It jointly tests skewness ( $S = 0$ ) and kurtosis ( $K = 3$ ) of the OLS residuals usually for large samples. We test the null hypothesis that the residuals are normally distributed against alternative that the residuals are not normally distributed.

In testing for heteroscedasticity, it confirms the OLS assumption that the variance of each of the disturbance term is equal. In this respect, if we persist in using the usual testing procedures despite heteroscedasticity, whatever conclusion is drawn or inferences made may be very misleading [Gujarati, 2004: 399]. For the budget deficit of Ghana, the study

tests whether there is heteroscedasticity based on the following hypothesis:

$H_0$ : There is no heteroscedasticity.

$H_1$ : There is heteroscedasticity.

In the case of Ghana, the hypothesis test is conducted by employing the white heteroscedasticity test.

For efficiency of the estimates, the study also tests for autocorrelation since the classical linear regression model assumes the existence of no autocorrelation in the disturbance term. This is important because, in the absence of the assumption, the OLS estimator may no longer have minimum variance among all linear unbiased estimators. In this case, the estimates may not be as efficient as other linear unbiased estimators and that the t, F and  $\chi^2$  tests may give misleading conclusions [Gujarati, 2004: 442]. In testing for autocorrelation, the following hypothesis is stated:

$H_0$ : There is no autocorrelation in the disturbance term.

$H_1$ : There is autocorrelation in the disturbance term.

The test for autocorrelation in this study uses the Durbin-Watson  $d$  test because it is best suited for small samples.

The advances in time series econometrics, especially in testing for non-stationarity and cointegration between time series data have provided new insights to empirical economic analyses. As a result, testing for the existence of unit roots and cointegration have become standard procedures. Hence, they are essential in modern empirical research because cointegration requires some economic parameters to be constant or stationary over time.

## **CHAPTER FOUR**

### **ESTIMATION, ANALYSIS AND INTERPRETATION**

#### **4.1 Overview**

The most common practice, among the set of methods to evaluate budget deficit sustainability, is to investigate past fiscal data to establish if there is cointegration between government revenue and expenditure. For the economy of Ghana, we perform the econometric analysis by using the OLS estimator. This chapter discusses the estimation, analysis and interpretation of the empirical results. The theoretical and empirical evidence of the study reviewed have guided the model estimation.

#### **4.2 Examination of Time Series Properties**

##### **4.2.1 Stationary and Unit Root Test**

The initial step to examine stationarity properties of government revenue and expenditure series of Ghana requires that we establish the presence of unit root by verifying the non-stationarity in the variables. In this case, it avoids the failure to account for appropriate specification [Dolado, Jesús and Marmol, 1999: 2-3; Mahendra, 2006: 8]. In this study, ADF and PP tests are applied since they provide more convenient procedures to determine the properties of time series data. Also, these tests are simple to understand. The tests have been carried out using E-Views 5 software. In the choice of optimal lag length, the Akaike Information Criteria (AIC) is used in respect of ADF test whilst the Bartlett Kernel lag length is used for the PP test. These tests are based on the Mackinnon one-sided P-values.

The unit root and stationarity tests are conducted using the log levels and first differences of government expenditure-GDP and revenue-GDP series of Ghana. It also takes into account trend and intercepts (or constants without trend) of the variables. This is because a visual examination of the data on government revenue-GDP and expenditure-GDP series of Ghana suggests the presence of time trend. Hence, if the time series is trend-stationary but the test does not account for the time trend, the test statistics may be inadequately calculated as a result of incorrect specification of the model.

Table 4.1 shows the results of the test statistics for both ADF and PP of government revenue-GDP and government expenditure-GDP series of Ghana in respect of the study period. The variables have been tested, with and without trend, in their log levels as per Panel A and first differences as per Panel B. Table 4.1 panel A indicates that the results of ADF and PP tests do not allow for rejection of the null hypothesis of non-stationarity for the log levels of government expenditure-GDP series ( $\ln EXG$ ) and government revenue-GDP series ( $\ln REVG$ ). This occurred both for the test with trend and the constant without trend. In this case, the test show that both government expenditure-GDP series and revenue-GDP series of Ghana supports the null hypothesis when ADF and PP tests are used. This means that government expenditure and revenue of Ghana are non-stationary in their log levels.

However, many time series data need to be appropriately differenced in order to achieve stationarity [Dolado, Jesús and Marmol, 1999: 3]. As a result, we proceed to test and confirm the stationarity of these variables after their first difference. The unit root test on the variables in their first difference produced estimates that show a reverse situation compared to the estimates in the log levels. Table 4.1 panel B shows the test for first

differences of government expenditure-GDP series ( $\Delta \ln EXG$ ) and government revenue-GDP series ( $\Delta \ln REVG$ ) of Ghana. From the estimation, both tests reject the null hypothesis of non-stationarity of the variables after first differencing. This is possible even at 1 percent level of significance for both ADF and PP tests with trend and without trend. This leaves no controversy in terms of both ADF and PP tests in achieving stationarity after first difference of government expenditure-GDP and government revenue-GDP series.

**Table 4.1: Results of the Unit Root Tests**

<b>Panel A: Log Levels</b>				
<b>Variable</b>	<b>ADF</b>		<b>PP</b>	
	Constant No Trend	Constant Trend	Constant No Trend	Constant Trend
Data Period: 1960-2007				
$\ln EXG$	-1.831012	-2.852240	-1.824912	-2.554048
$\ln REVG$	-1.668219	-2.914847	-1.754793	-2.523154
<b>Panel B: First Differences</b>				
<b>Variable</b>	<b>ADF</b>		<b>PP</b>	
	Constant No Trend	Constant Trend	Constant No Trend	Constant Trend
Data Period: 1960-2007				
$\Delta \ln EXG$	-5.620420***	-5.552860***	-6.633597***	-6.515187***
$\Delta \ln REVG$	-6.382306***	-6.318479***	-6.380414***	-6.308134***
Note: *** indicates rejection of the null hypothesis of non-stationary at 1 percent significance level based on the MacKinnon critical values.				

In this case, the estimation show that government expenditure-GDP and revenue-GDP series favour the existence of unit root in the log levels, but indicate stationarity after first differencing. Hence, we conclude that both government expenditure and revenue of Ghana are stationary and integrated of order one. Yet, before estimating the cointegration relation between the variables, we proceed to find the causal link between these variables.

#### 4.2.2 Granger Causality Test

The result of the Granger causality test is represented in table 4.2.

**Table 4.2 Granger Causality Test**

Null Hypothesis:	Obs	F-Statistic	Probability
In <i>EXG</i> does not Granger Cause In <i>REVG</i>	47	0.45684	0.50264
In <i>REVG</i> does not Granger Cause In <i>EXG</i>	47	2.20932	0.14431

The estimates from table 4.2 indicate that we reject the null hypothesis of no causality between government expenditure-GDP and revenue-GDP of Ghana in both cases. This means that the coefficients  $\sum \alpha_{2i}$  and  $\sum \beta_{2i}$  are statistically not equal to zero. In this case, there is bi-directional causality such that both government expenditure and revenue of Ghana have temporal precedence over each other. Yet, the existence of Granger causality does not imply that the occurrence of revenue is the result of expenditure. It means that changes in revenue precede changes in expenditure.

Hence, past and present values of government revenue provide important information to forecast future values of government expenditure. This can be very useful in understanding the nature of economic problems [Barua, 2005: 11]. This finding supports the work of Oshikoya and Tarawalie [2008: 21] that used annual time series data and found evidence of bi-directional causality in Ghana during the period 1980-2008. As a result, we proceed to perform the Engle-Granger cointegration test using the variables in their stationary form. This helps in proceeding without incurring the problem of spurious regression [Carneiro *et al*, 2005:111].

### 4.3 Cointegration tests

Once both variables are integrated of the first order, we continue to assess the potential short-run and long-run relationship between expenditure and revenue of Ghana. This is because stationarity of government expenditure and revenue is only a necessary condition for testing sustainability of budget deficit. As a result, we invoke the sufficient condition of sustainability. In this case, the cointegration vector ( $\beta$ ) should be statistically equal to one. In order to establish this sufficient condition, we apply the two step Engle-Granger procedure of cointegration. This estimates the long run cointegration relationship between government revenue and expenditure series.

#### 4.3.1 Long-Run Relationship between Government Expenditure and Revenue

Having confirmed the difference stationarity of government revenue-GDP and government expenditure-GDP series with the same order of integration, the next step is to test for cointegration between the variables. In a first step to applying the two step Engle-Granger procedure, the long run cointegration relationship between series of Ghana is estimated using OLS method.

Two estimations have been made for both government expenditure-GDP and government revenue-GDP being dependent variable in each case. This is to help specify the right functional long-run relationship between government expenditure and revenue of Ghana. In this case, it determines whether changes in revenue precede changes in expenditure or changes in expenditure precede changes in revenue. The results from the estimation are presented in tables 4.3 and 4.4.

**Table 4.3 Long Run Cointegration Results Using OLS Method**Dependent Variable: *LNEXG*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
<i>LNREVG</i>	0.991195	0.071018	13.95699***	0.0000
C	0.271404	0.203966	1.330633	0.1899
R-squared			0.808968	
Adjusted R-squared			0.804815	
F-statistic			194.7976	
Prob(F-statistic)			0.000000	
Durbin-Watson stat			1.895125	

Note: \*\*\* denotes the rejection of the null hypothesis at 1 percent significance level.

**Table 4.4 Long Run Cointegration Results Using OLS Method**Dependent Variable: *LNREVG*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
<i>LNEXG</i>	0.816155	0.058476	13.95699***	0.0000
C	0.322608	0.182514	1.767581*	0.0838
R-squared			0.808968	
Adjusted R-squared			0.804815	
F-statistic			194.7976	
Prob(F-statistic)			0.000000	
Durbin-Watson stat			1.885802	

Note: \* and \*\*\* denote the rejection of the null hypothesis at 10 percent and 1 percent significance level respectively.

The estimation of the long-run cointegration relationship between government expenditure-GDP and revenue-GDP series of Ghana show that both variables are statistically significant at 1 percent level. In this case, both variables depend on each other. We therefore proceed to test the statistical significance of the cointegration coefficients.

In a second step to the Engle-Granger procedure, the estimated cointegration relationship between government revenue-GDP and expenditure-GDP series is used to generate residual errors. The generated residuals are then subject to the test for unit roots. Within this procedure, the error term represents the deviation of government expenditure and revenue from their long-run equilibrium relationship. Rejecting the null hypothesis of the presence of unit root in the residuals implies rejection of the null hypothesis of no cointegration. The test result is represented in table 4.5:

**Table 4.5 Test for Unit Root in the Residuals**

<b>Panel A: Level</b>				
<b>Variable</b>	<b>ADF</b>		<b>PP</b>	
	Constant No Trend	Constant Trend	Constant No Trend	Constant Trend
Data Period: 1960-2007				
RESID	-3.866473***	-3.884572**	-3.866473***	-3.884572**

Note: \*\* and \*\*\* indicate rejection of the null hypothesis of non-stationary at 5 percent and 1 percent significance level respectively based on the MacKinnon critical values.

The estimations in table 4.5 show that the test for unit root in the residuals of Ghana's budget deficit fails to accept the null hypothesis at 5 percent significance level. Both the ADF and PP tests reject the null hypothesis at 5 percent significance level for stationarity of the residuals. It thus, assumes the presence of cointegration in the residuals of government revenue-GDP and expenditure-GDP series of Ghana when there is trend in the variables.

On the other hand, when no trend in the variables is considered, ADF and PP tests reject the null hypothesis of no stationarity at 1 percent significance level. Therefore, it can

confidently be concluded that the null hypothesis of the unit root test in the residuals of Ghana's budget deficit is rejected at 5 percent significance level. This result is achieved after testing the residuals in their levels. With this firm result of stationarity and cointegration of the variables at their levels, it does not therefore call for further tests of the variables at their first difference. By this conclusion, it means that the budget deficit and hence government revenue and expenditure of Ghana are cointegrated. This means that the variable series are trended together such that expenditure cannot move too far away from revenue [Kustepeli and Onel, 2004: 3].

However, as noted by Quintos [1995: 413], it is important to test the linear restriction for statistical significance of  $\beta = 1$ . By implication, we test whether the coefficient of the independent variable in the long-run cointegration model is statistically different from one. In this study, the Wald coefficient restriction test is used to determine the statistical value of the slope coefficient,  $\beta$ . The estimated results is presented in table 4.6.

**Table 4.6: Results of the Wald Restriction Test**

Equation	Coefficient	Null Hypothesis	F-Statistics
$\ln EXG = f(\ln REVG)$	0.991195	$H_0 : \beta = 1$	0.015373 [0.9019]
$\ln REVG = f(\ln EXG)$	0.816155	$H_0 : \beta = 1$	9.884251 [0.0029]

According to the results obtained, we fail to reject the null hypothesis at 10 percent significance level where government expenditure-GDP series depends on government revenue-GDP series [ $\ln EXG = f(\ln REVG)$ ]. It is therefore concluded that the coefficient

of  $\ln REVG$  ( $\beta = 0.991195$ ) is statistically not different from one at 10 percent level of significance. For this reason, Ghana's budget deficit is said to be sustainable in the strong sense. In this case, it means that the series of government expenditure and revenue move together in the long run and that the coefficient of government revenue is statistically equal to or not different from one.

However, when government revenue-GDP series is dependent on expenditure-GDP series [ $\ln REVG = f(\ln EXG)$ ], it rejects the null hypothesis and concludes that  $\beta$  is statistically different from one. This indicates that the budget deficit of Ghana will explode over the long run. Hence, it is not possible for government to continue experiencing stable debt-to-GDP ratio indefinitely in the long run [Xiomara and Greenidge, 2003: 2-4]. For this reason, government cannot continue to service its debt which accumulates from budget deficit without large future correction to the balance of income and expenditure. Thus, the revenue capacity of government will not be able to support government expenditure in the long run. This may call for large fiscal adjustments.

From the preceding analysis, it shows that the study have satisfied both sufficient and necessary conditions and, therefore concludes that government expenditure-GDP series of Ghana depends on government revenue-GDP series for the period 1960 to 2007. It is therefore important to find out the extent of adjustment of disequilibrium between government expenditure-GDP series and government revenue-GDP series of Ghana within the study period.

#### 4.3.2 Estimation of the Short-Run Dynamic Model

The vector error correction model (*VECM*) of Engle-Granger is then used to estimate the short-run dynamic relationship between government expenditure and revenue of Ghana. This helps to determine the extent of disequilibrium between the levels of these variables [Carneiro *et al*, 2005: 113-114; Dolado, Jesús and Marmol, 1999: 6-7]. In this case, changes in government expenditure of Ghana is a function of the level of disequilibrium in the cointegrating relationship, captured by the error-correction factor, as well as changes in government revenue. Hence, the study is able to capture all the short run relationships among the variables. The model uses the first difference of the variables. The results of the short-run model of the relationship between government revenue-GDP and government expenditure-GDP is presented in Table 4.7.

**Table 4.7 Estimation of Short Run Dynamic Model**

Dependent Variable:  $\Delta LNEXG$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.018320	0.031116	0.588761	0.5592
$\Delta LNEXG(-1)$	0.327530	0.211667	1.547384	0.0129
$\Delta LNREVG(-1)$	-0.274931	0.237208	-1.159029	0.0253
ECT(-1)	-0.526017	0.199678	-2.634327**	0.0118
R-squared			0.747201	
Adjusted R-squared			0.686287	
F-statistic			2.416531	
Prob (F-statistic)			0.007976	
Durbin-Watson stat			1.949101	

Note: \*\* denotes rejection of the null hypothesis at 5 percent significance level.

In the case of Ghana, the coefficient of the error correction term achieved the conventional negative sign. It is also statistically significant at 5 percent, which further confirms the long run cointegration relationship between the variables. This means that there exists a long-run cointegration relationship between government expenditure and revenue of Ghana. The implication is that in the long run when budget deficit, at any given time  $t$ , exceeds that of the previous period  $(t-1)$  for which  $EXG_{t-1}$  is greater than  $REVG_{t-1}$  because  $\delta$  is less than zero, the error correction term works to push government expenditure back towards equilibrium. This long term stability however, does not rule out the possibility of Ghana running short-term budget deficits as argued by Carneiro *et al* [2005: 113-114].

Also, with an estimated coefficient of -0.53, it indicates that approximately 53 percent of disequilibrium generated is restored every year following shocks to the system. In the case of Ghana therefore, the speed of adjustment parameter is relatively large with the right negative sign, indicating that there is a greater rate of convergence toward equilibrium. By this finding, it is concluded that any disequilibrium within the budget deficit of Ghana in the short run is quickly adjusted and converged back to equilibrium in the long run. Hence, the model combines flexibility in dynamic specification with desirable long-run properties. However, the parameters of the cointegrating regression model may not be constant through time because there may exist possible structural break in the annual data of Ghana [Dolado, Jesús and Marmol, 1999: 22]. Hence, we proceed to test for structural breaks in the variables series.

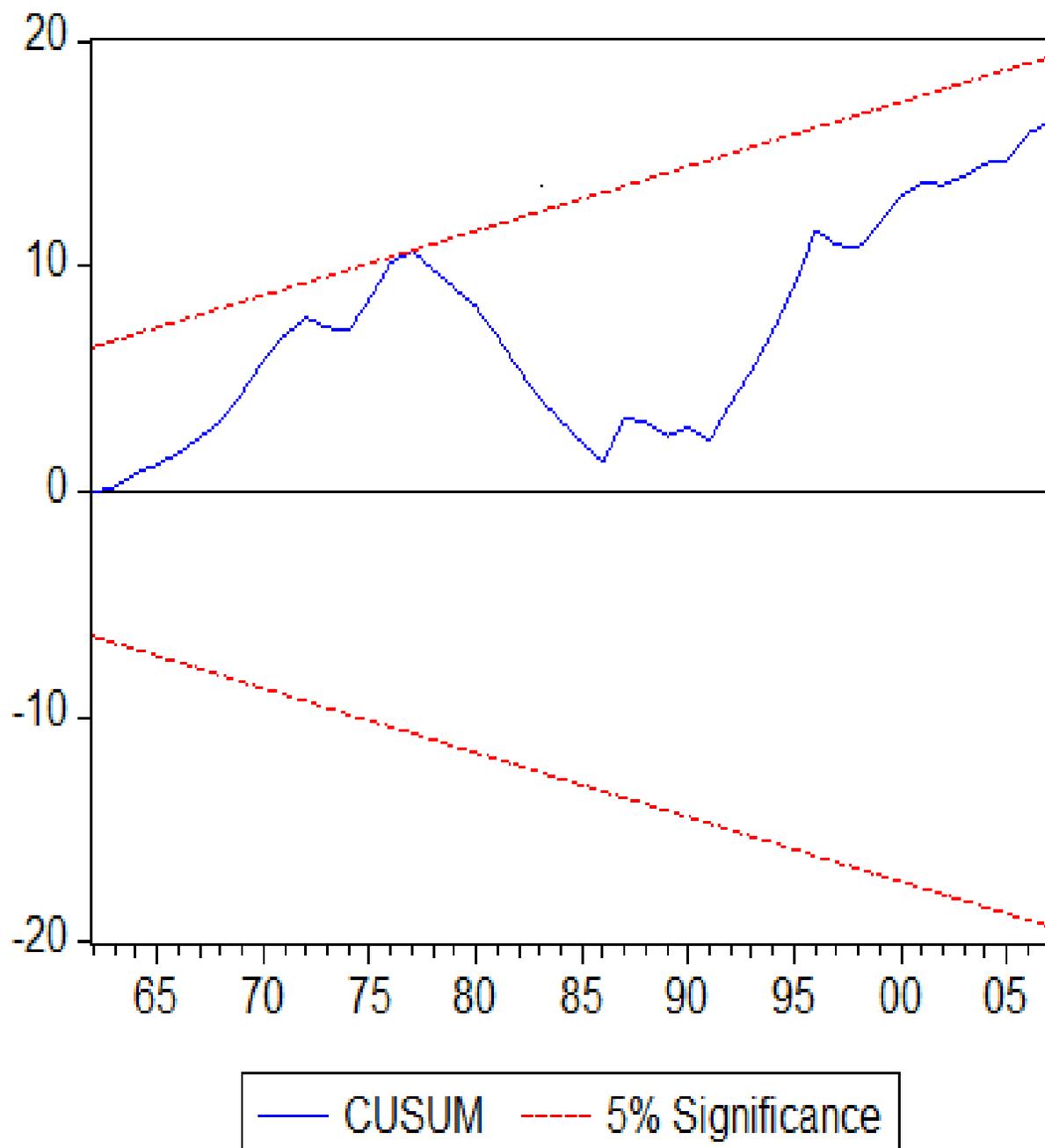
#### **4.4 Long Run Relationship and Structural Break**

The government of Ghana did change its fiscal policy due to political changeovers from military to constitutional rule, adoption of economic recovery programme/structural adjustment programme in 1983 and HIPC initiative in 2001. Definitely, if no account is taken of the changes in the parameters of the model, inference concerning the presence of cointegration can be affected by misspecification errors [Gerbhard and Silika, 2005: 15-17]. In this case, it shall be assumed that the cointegrating vector is constant throughout the period of study since the standard unit root and cointegration estimation procedures assume a tendency for the variables to move towards a long-run equilibrium in every time period.

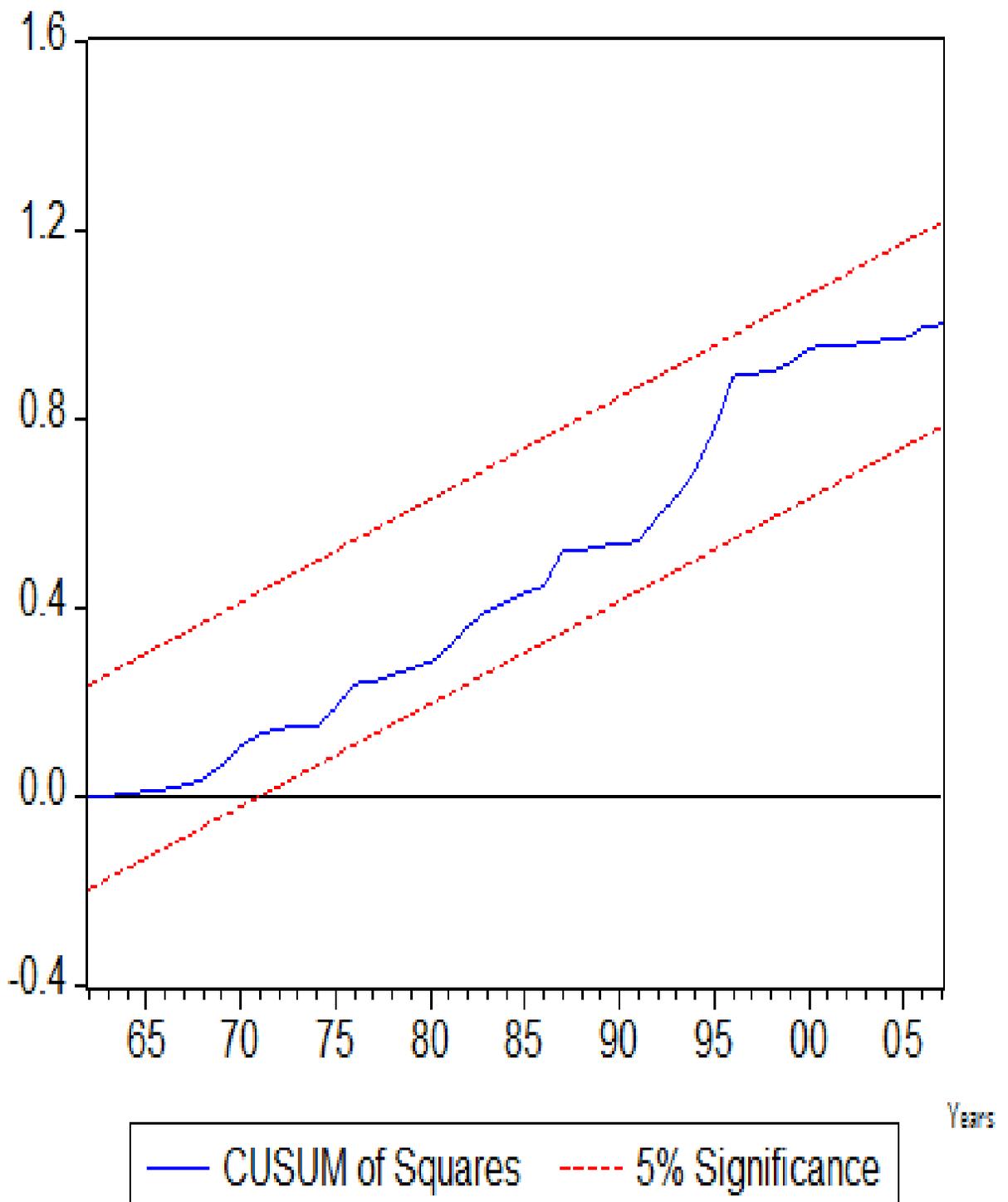
However, in reality, it is possible that the long-run relationship between government expenditure and revenue can change, which will shift the cointegrating vector. This is likely to be the case if the sample period is long. It is therefore, important to take this issue into account by introducing tests for cointegration with unknown structural break, otherwise it can bias conclusions towards accepting the null hypothesis of no cointegration [Afonso and Rault, 2007: 4-5; Kustepeli and Onel, 2004: 3]. Therefore, in order to check structural break in the parameters of government revenue-GDP and expenditure-GDP series of Ghana over the study period, we perform CUSUM and CUSUM Q tests. These are stability tests which have been recursively estimated from OLS regression. Figure 4.1 and 4.2 show the results of the two stability tests.

The CUSUM test for parameter stability in figure 4.1 shows that we fail to reject the null hypothesis of no structural break in the regression model. In this case, it is concluded that

the cointegrating vector that links government expenditure-GDP and revenue-GDP series of Ghana is stable at 5 percent level of significance. This indicates that there is no break point in the annual data of Ghana for the period between 1960 and 2007.



**Figure 4.1: Values of CUSUM test for parameter stability**

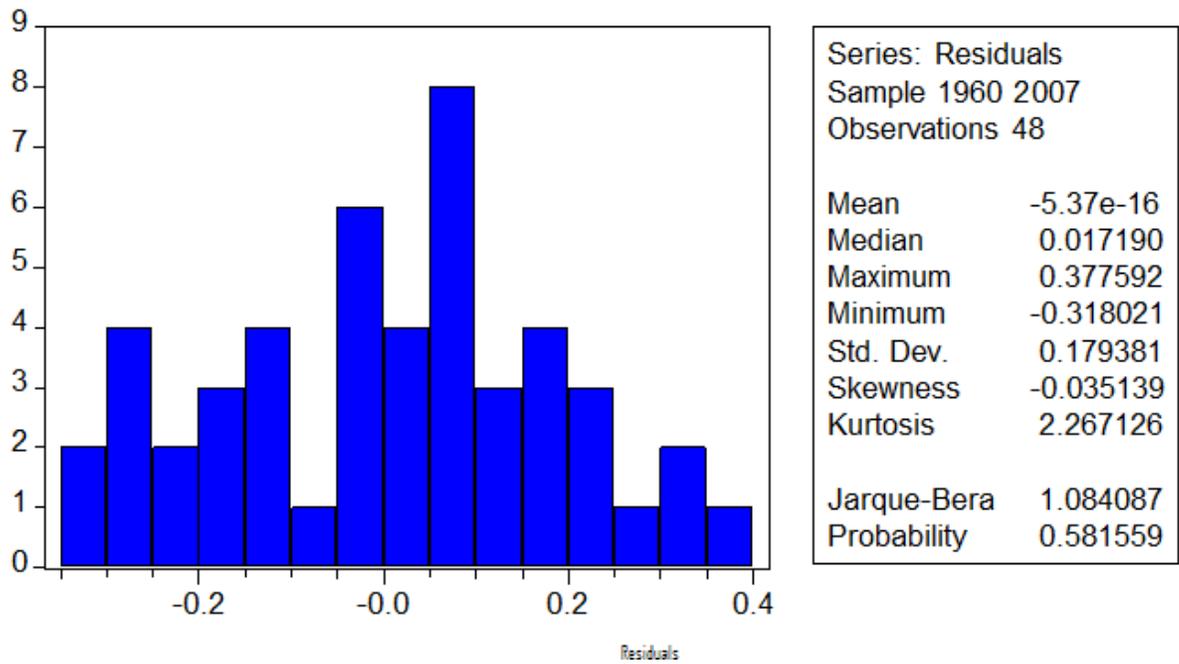


**Figure 4.2: Values of CUSUM Q test for parameter stability**

The CUSUM Q test in figure 4.2 indicates that we cannot reject the null hypothesis of no structural break at 5 percent significance level. This means that the economy of Ghana experienced a stable cointegrating vector between government expenditure-GDP and revenue-GDP series during the study period. By implication, it is concluded that government expenditure-GDP and revenue-GDP series of Ghana did not experience any break point between 1960 and 2007.

In this case, failure to reject the null hypothesis of stability in the cointegrating vector and hence stability in the variables implies that long-run relationship between government spending and revenue exists. In pursuit of our objectives it is concluded that there have not been significant changes in the country's fiscal history that might fundamentally shift the sustainable deficit process in Ghana during the study period. By this finding, we proceed to look at the various diagnostic tests.

The test for normality, in the case of Ghana, estimated  $S = -0.035139$ ,  $K = 2.267128$  and a Jarque-Bera statistic of 1.084087 at a probability of 0.581559. This means that the estimates clearly support the normality assumption as pictured in figure 4.3. In this case, the study fails to reject the null hypothesis that the residuals are normally distributed. It is therefore concluded that the residuals of Ghana's expenditure-GDP and revenue-GDP series between 1960 and 2007 are normally distributed.



**Figure 4.3: Residuals from the Regression of Expenditure-GDP series.**

From the analysis, it shows that the OLS estimate is linear, unbiased and normally distributed. However, it is important to test for heteroscedasticity and autocorrelation since the estimate may no longer be efficient. In testing for heteroscedasticity, the estimate indicates that the number of observations multiplied by R-square ( $n.R^2$ ) gives a value of 1.539232 at a probability of 0.463191.

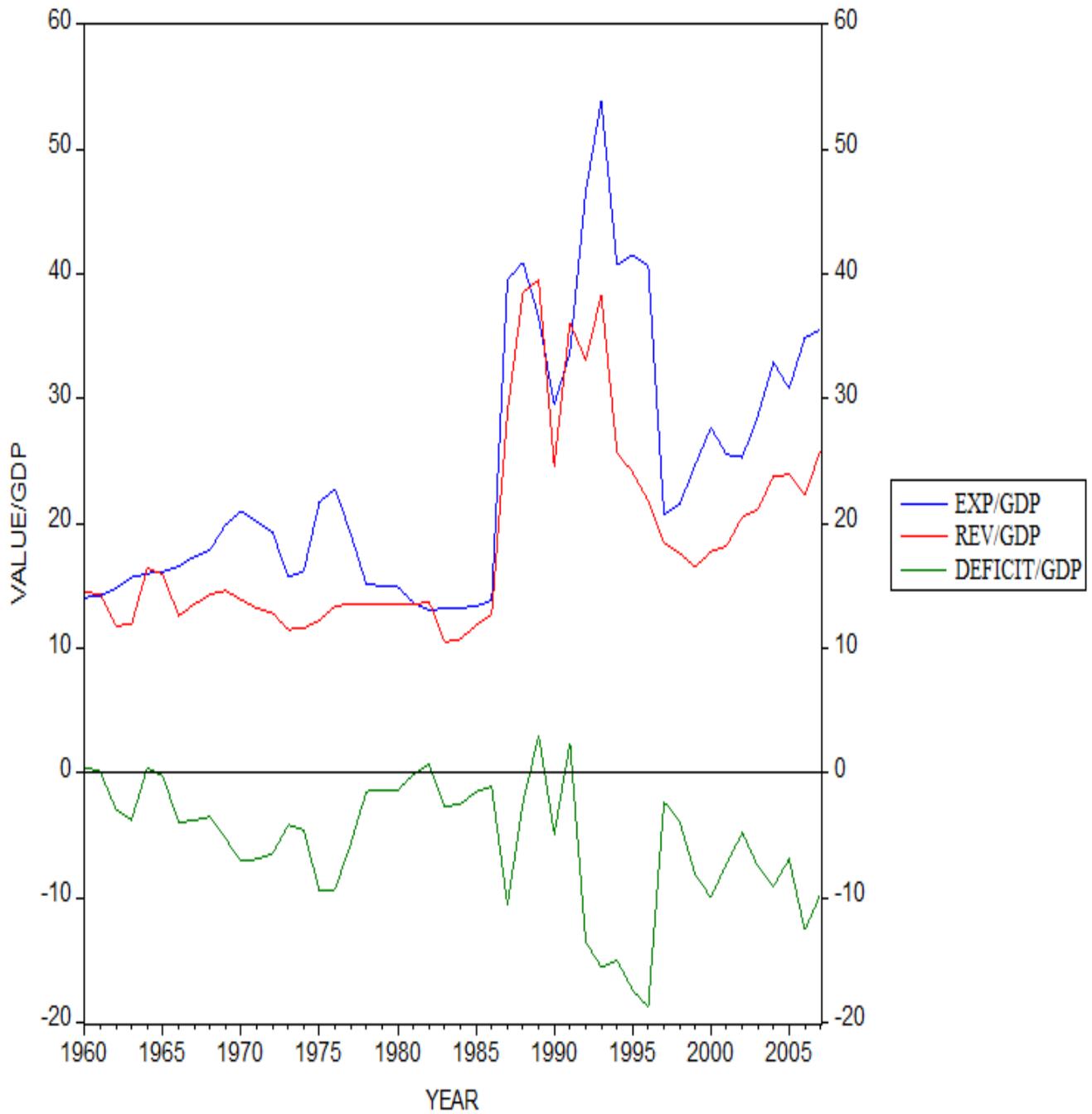
For all practical purposes, the study does not reject the null hypothesis. It is therefore, concluded that there is no heteroscedasticity in government expenditure-GDP and revenue-GDP series of Ghana over the study period. This means that the assumption of equal variance of the disturbance term hold for government expenditure and revenue of Ghana between 1960 and 2007.

The test for autocorrelation, in respect of Ghana, produces a Durbin-Watson statistic of 1.895125. This means that the test for autocorrelation of Ghana's budget deficit fails to reject the null hypothesis of no autocorrelation. Thus, government expenditure and revenue exhibit no autocorrelation and hence the budget deficit of Ghana exhibits minimum variance in the disturbance term. This makes it efficient in arriving at better conclusions.

Based on the estimation and analysis, the long-run cointegration relationship of Ghana shows that government expenditure-GDP series is dependent on government revenue-GDP series for the period between 1960 and 2007. The estimate in this case produces a long-run cointegration coefficient for government revenue-GDP series ( $\beta$ ) of 0.991195. This indicates that the long-run coefficient of Ghana's budget is statistically significant at 1 percent level. The estimated value of  $\beta$  being less than one means that anytime government revenue changes by 1 unit on the average, it leads to a corresponding change of 0.99 units in government expenditure of Ghana. By this finding, it indicates that the relationship is characterized by persistently higher government spending relative to revenues but spending and revenue share a long-run equilibrium relationship.

The positive long-run coefficient supports the traditional a priori of positive correlation between government revenue and expenditure. Hence, these two variables are said to be trended together and that anytime government expenditure increases, it compels government to increase revenue. This is supported by the persistent occurrence of deficit over the study period as shown in appendix 1.

The pattern of government expenditure-GDP and government revenue-GDP relationship of Ghana within the study period is shown in figure 4.4.



**Figure 4.4: Government Revenue, Expenditure and Deficit/Surplus (% of GDP)**

Consistent with the literature, the graph shows that Ghana has persistently experienced budget deficit with a few surpluses. Also, sharp increases in the deficit were recorded intermittently over the period. The persistent deficit pattern implies that government expenditure cannot move too far away from revenue [Kustepeli and Onel, 2004: 3]. This indicates that as government raises revenue in an attempt to reduce deficit, it stimulates expenditure to increase.

In addition, the estimate of the long-run cointegration relationship of Ghana's budget deficit indicates an R-squared value of 0.808968 and adjusted R-squared of 0.804815. This means that approximately 80 percent of the variations in government expenditure of Ghana are explained by variations in government revenue. In this case, large proportion of changes in government expenditure is influenced by changes in government revenue. By this exposition, it indicates that as government of Ghana engages in expansionary revenue drive its expenditure budget is also forced to increase. The estimates have been obtained with F-statistic of 194.7976 at a probability of 0.0000. This rejects the null hypothesis and confirms the long run cointegration relationship between government expenditure and revenue of Ghana between 1960 and 2007. This fulfills the intertemporal budget constraint of government which imposes restriction on the long run relationship between expenditure and revenue such that government runs some surpluses in the future to offset prevailing deficits. The restriction allows government to rule out Ponzi scheme where new issues of debt must necessarily be made to finance deficits. This gives government the ability to raise the necessary funds either by balancing its budget in present value terms or borrowing temporarily to be able to service its debt [Kustepeli and Onel, 2004: 2-3].

In this case, government of Ghana can maintain a certain level of budget deficit in the future even if there are shocks within the economy. Hence, government can continue to pursue a budget deficit policy indefinitely without causing the debt-to-GDP ratio to explode if it avoids rolling over its initial debt together with the interest payment forever. This clearly means that it is possible for government to continue servicing its debt accumulation from budget deficit without large future correction to the annual budget. In this regard, as government pursues budget deficit policy and services its debts accumulation, it will be able to satisfy its current period budget constraint without excessive debt monetization [Díaz, Izquierdo and Ugo, 2004: 6-7].

By this analysis, it shows that the budget deficit policy of Ghana, over the entire period, is sustainable and consistent with the intertemporal budget constraint. In light of this finding, we can safely conclude that there exists a stable long-term relationship between government expenditure and revenue of Ghana. By implication, government expenditure and revenue of Ghana did not experienced any break point between 1960 and 2007, and that there has been no significant changes occurring in the levels of these variables. However, insignificant changes might have occurred during the period but these were quickly adjusted to the long run equilibrium. This means that a budget deficit policy is a short run issue that can have long run growth implications. Hence, government must consider persistent budget deficit from the perspective of the purpose for which the budget deficit is incurred and the aftermath effects on the economy. In this case, the budget deficit of Ghana can have positive long-term impacts on the economy if they are used to finance growth enhancing expenditures such as infrastructure, research and development, education and health.

## CHAPTER FIVE

### SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

#### 5.1 Summary of Findings and Conclusion

The study sought to evaluate the sustainability of budget deficit in Ghana between 1960 and 2007. The estimation uses operational budget deficit due to the inclusion of real interest payment in primary deficit. This is a good choice since interest payment ultimately limits the deficit finance through growth of accumulated debt. Sustainability analysis requires government to be able to service its debts without large future correction to the budget. This would avoid rolling over initial debts with the interest forever.

The unit root tests favoured the stationarity of the variables at 1 percent significance level after first differencing. This means government expenditure and revenue are integrated of order one process. Also, a Granger causality test supported the existence of bi-directional causality between the variables. Hence, past and present values of government revenue provide important information to forecast future values of expenditure. The Engle-Granger cointegration test achieved a cointegration vector of 0.991195 at 1 percent level of significance indicating long run cointegration relationship between government expenditure and revenue. It shows that approximately 80 percent of variations in government expenditure of Ghana are explained by variations in government revenue. The linear restriction test showed that  $\beta$  is statistically not different from one at 10 percent

significance level. This indicates sustainability of budget deficit in the strong sense.

Also, the error correction model achieved the conventional negative sign at 5 percent significance level. This indicates that approximately 53 percent of disequilibrium is restored every year following shock to the system. This is relatively large indicating greater rate of convergence toward equilibrium. The diagnostic tests showed that government expenditure and revenue of Ghana exhibits no heteroscedasticity and autocorrelation. Also, a normality test based on Jarque-Bera supported the normality assumption. The CUSUM and CUSUM Q tests reject the null hypothesis at 5 percent significance level indicating long-run equilibrium stability. This means that the budget deficit of Ghana is sustainable over the entire study period.

## **5.2 Policy Implications and Recommendations**

Despite the sustainable budget deficit of Ghana between 1960 and 2007, it is important that government pursues effective fiscal and monetary policies to maintain or reduce the level of sustainability. This is because as the economy of Ghana grows, more resources are required to achieve sustainable deficit. In relation to the findings, the following recommendations are suggested.

Efforts should be made to consistently increase government revenue as revenue and expenditure must be stationary and integrated of the same order. Since reduction in government expenditure is not plausible, the tax net of Ghana should be expanded to capture all “taxable” individuals and firms. This would ensure that expenditure do not move too far away from revenue.

Any policy to increase expenditure in Ghana should consider past and present values of government revenue. This is because expenditure and revenue take temporal precedence over each other. Hence, past and present values of government revenue provide important information to forecast future values of expenditure.

With 80 percent of variations in government expenditure of Ghana being explained by variations in government revenue, government should adopt a combination of policy options such as monetizing or printing money to cover the debt, defaulting some of its debt or shifting between debt sources to take advantage of lower interest rates. This would ensure that interest on debt do not grow more than the growth rate of the economy.

The strong sustainability of the deficit of Ghana indicates that government should not continue to roll over interest payment together with the initial debt forever. In this case, government should spend more on investment expenditure and less on consumption expenditure. This would lead to the finance of growth enhancing spending categories such as infrastructure, education, health, research and development in Ghana which would help to efficiently allocate resources within the economy. As more resources are spent on productive activities, it would help market Ghana's debt. In this case, large deficit may not be a bad policy, if it is used to finance productive activities.

Though approximately 53 percent of disequilibrium in the short run is restored every year, it is important to realize that withdrawal of external donor finance would significantly reduce the speed of adjustment. In this case, the implementation of any fiscal policy need to consider the extent to which external donor financing partners would be prepared to part-

finance the deficit.

To maintain stability of the parameters of government expenditure and revenue series of Ghana, the annual budget should consider past changes in fiscal policies and their effect on current policies. For instance, incumbent governments tend to stimulate their economies on the eve of political elections through tax cuts, enlarge transfer payments and increase spending. This may lead to over spending above the budget. Government must therefore adopt policies that do not cause expenditure to drift unusually from revenues.

### **4.3 Limitations of the Study**

The overall deficit concept takes no account of developments in future years. Some intergenerational transfers may take place, but there is little about whether they will be continued, stopped or reversed. Thus, the deficit ignores the future which can provide serious misleading signals about the fiscal position of the economy and the consequences of borrowing. Yet, the present value budget constraint model of analyzing sustainability assumes infinite growth of the economy.

Also, sustainable budget deficit as an effective tool for policy evaluation depends on the stability of past data processes. A major limitation of the study relates to data discrepancy due to the different sources of data used. The differences in the values of the data from these sources can mislead conclusions and policy recommendations. This notwithstanding, efforts were made to reduce discrepancies in the data by using data from one source for a range of years. This was possible because of the same trend pattern of the data.

Again, the budget deficit position of Ghana is largely influenced by donor funding. Donor institutions such as the World Bank, IMF, African Development Bank and other development partners have supported Ghana over the years to finance the deficit. In this case, the extent of donor financing may significantly affect the sustainable level of the deficit. Thus, its inclusion in the model estimation may greatly improve the results and analysis. It is therefore important that future studies on sustainability of the budget deficit of Ghana take into consideration the influence of donor funding in the model.

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## APPENDIX

### Appendix I: List of Government Expenditure and Revenue (Percent of GDP)

<u>Year</u>	<u>EXG</u>	<u>REVG</u>	<u>Year</u>	<u>EXG</u>	<u>REVG</u>
1960	14.05	14.5	1984	13.24	10.73
1961	14.21	14.3	1985	13.34	11.82
1962	14.76	11.8	1986	13.82	12.72
1963	15.66	11.9	1987	39.5	28.9
1964	15.98	16.4	1988	40.9	38.5
1965	16.14	15.9	1989	36.5	39.5
1966	16.56	12.6	1990	29.5	24.6
1967	17.32	13.5	1991	33.7	36.1
1968	17.82	14.3	1992	46.6	33.1
1969	19.89	14.6	1993	53.9	38.3
1970	20.99	13.9	1994	40.7	25.7
1971	20.12	13.2	1995	41.5	24.1
1972	19.29	12.8	1996	40.6	21.8
1973	15.68	11.5	1997	20.7	18.4
1974	16.18	11.6	1998	21.5	17.6
1975	21.69	12.2	1999	24.7	16.5
1976	22.74	13.4	2000	27.7	17.72
1977	19.14	13.5	2001	25.5	18.2
1978	15.08	13.6	2002	25.3	20.5
1979	15.02	13.6	2003	28.6	21.1
1980	14.89	13.5	2004	32.9	23.8
1981	13.63	13.5	2005	30.8	23.9
1982	13.02	13.7	2006	34.9	22.3
1983	13.2	10.5	2007	35.5	25.8

Source: World Bank, World Development Indicators CD-ROM (2007) and the State of the Ghanaian Economy.

EXG = Government expenditure-GDP ratio

REVG = Government revenue-GDP ratio