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**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

**THE CURRENT ACCOUNT - BUDGET DEFICITS LINK IN
SUB-SAHARAN AFRICA COUNTRIES: PANEL VECTOR
AUTOREGRESSIVE (VAR) MODELING APPROACH**

By

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TABLE OF CONTENTS

	Page
List of Tables -----	i
List of Figures-----	i
List of Annexes-----	i
Abstract -----	ii
CHAPTER ONE	
1. INTRODUCTION-----	1
1.1. Background-----	1
1.2. Statement of the problem-----	2
1.3. Objective of the study-----	5
1.4. Working Hypothesis-----	5
1.5. Data Source and Methodology-----	6
1.5.1.Data Source-----	6
1.5.2.Methodology-----	6
1.6. Limitation of the Study-----	7
1.7. Scope and Organization of the Study-----	7
1.7.1.Scope of the Study-----	7
1.7.2.Organization of the Study-----	8
1.8. Significance of the Study-----	8
CHAPTER TWO	
2. REVIEW OF THEORETICAL AND EMPIRICAL WORKS-----	9
2.1. Review of Theoretical Frameworks-----	9
2.1.1. Theoretical Basis for the Twin Deficits Hypothesis-----	9
2.1.2. The Ricardian Equivalence Hypothesis-----	11
2.1.3. The Mundell-Fleming Framework to the Twin Deficits Hypothesis-----	13
2.1.4. Budget Deficit Financing and the Current Account-----	14
2.2. Review of Empirical Works-----	16
2.3. Review of Empirical Works in African Countries-----	18

CHAPTER THREE

3. MODEL SPECIFICATION AND ESTIMATION TECHNIQUES-----	21
3.1. Government Budget Deficits in an Overlapping Generation	
Model-----	21
3.1.1. Individual Behaviour-----	21
3.1.2. Aggregate Behaviour-----	22
3.1.3. The Timing of Taxes-----	23
3.2. Government Budget Policy in the Absence of Overlapping Generations-----	25
3.3. Taking the Question of the Twin Deficits to Data from Sub-Saharan Africa Countries: Some stylized facts-----	26
3.3.1. Graphical Analysis of Fiscal and Current Account Balances-----	27
3.3.2. Current Account Balance and Economic Growth-----	28
3.4. Model Specification-----	29
3.5. Estimation Technique-----	30
3.6. Panel Unit Root Test-----	31
3.7. Panel Co integration Test-----	32
3.8. Granger Causality-----	34
3.9. Specification of a Reduced-Form Consumption Function-----	35

CHAPTER FOUR

4. DISCUSSION OF ESTIMATION RESULTS-----	37
4.1. Panel Unit Root Test Results-----	37
4.2. Panel Co integration Test Results-----	40
4.3. Panel VAR Granger Causality Results-----	41
4.4. Reduced-Form Consumption Function Estimation Results-----	45

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATION-----	47
5.1. Conclusions-----	47
5.2. Policy Recommendation-----	49
References-----	51
Annexes-----	57
Declaration-----	



List of Tables

	page
Table 4-1: Im, Pesaran and Shin (IPS) panel unit root test results-----	38
Table 4-2: Pedroni panel co- integration test result-----	40
Table 4-3: VAR lag order selection criterion-----	41
Table 4-4: Panel VAR Granger Causality results-----	41
Table 4-5: Co- integration Vector and Restrictions on the long run coefficients-----	42

List of Figures

Figure 3-1: Trends in BB and CAB (Oil-exporting countries) -----	27
Figure 3-2: Trends in BB and CAB (Oil-importing countries) -----	27
Figure 4-1: Direction of causal relationship summarized from Table 4-4(panel-B) and Annex-3-----	44

List of Annexes

Annex-1: List of sampled countries and variations in key economic Variables-----	57
Annex-2: Graphical illustration of the Mundell-Fleming Model-----	59
Annex -3; Pair wise Granger Causality Test results for oil-importing and Oil-exporting countries-----	60
Annex -4: Pair wise Granger Causality Test results for individual Countries (oil-importing) -----	61
Annex-5: Pair wise Granger Causality Test results for individual Countries (oil-exporting) -----	62



Abstract

Many economists have argued that prolonged fiscal expansions contribute to current account imbalances. The purpose of this paper is to explore this phenomenon in the case of Sub-Saharan Africa countries during the period 1980 to 2007. In the framework of panel cointegration test, panel VAR Granger Causality analysis and a reduced-form consumption function, the paper evaluates the validity of the conventional (Keynesian) view and the Ricardian Equivalence Hypothesis in Sub-Saharan Africa economies. The major findings of this study are: First, as a priori expectation, a unidirectional causality that runs from current account deficits to budget deficits (termed as *current account targeting* by Summers (1988)) has been found for oil-importing Sub-Saharan Africa countries. In these countries exchange rate is found to be the main mediating variable in linking the two deficits. Second, for oil-exporting countries, while the findings from Granger causality test is in accordance with the Ricardian Equivalence Hypothesis, the restriction test from the estimation result of the reduced-form consumption function shows rejection of the pure Equivalence Hypothesis. One line of argument for the acceptance of the Keynesian Proposition for oil-exporting countries is that a rising consumption (both private and government) fueled by rising oil revenues eventually leads to current account deterioration. A policy implication resulting from these findings is that managing the current account deficit as well as the debt burden offers a scope for improvement in the budget deficits.

CHAPTER ONE

1. Introduction

1.1. Background

Analysts and politicians have shown concern over the state of the current account and budget imbalances in the last three decades. They consider growing fiscal and current account imbalances to have been the cause of macro-economic imbalances and are important to the long-term economic progress of a country. In attempts to study the current account imbalances, numerous researchers have explored the possible link between budget deficit and current account deficit. An example in history is the so-called “twin deficits hypothesis” which erupted in the 1980s in the United States. It marked a period of strong appreciation of the dollar and an unusual shift in current account, not in favour of the United States. The large deficits are viewed as harmful to the domestic and world economies. This close connection between current account and budget deficits, however, is not unique to the United States. In Europe, Germany and Sweden faced similar problems that emerged in the early part of the 1990s when the rise in the budget deficits was accompanied by a real appreciation of their national currencies, and this adversely affected the current account of those countries (Zubaidi et al., 2003).

Developing countries are no exceptions. Most have also experienced problems with external debts in the early 1980s. A vast amount of literature have documented that the unsustainable budget deficit during this period widened the current account deficit. Indeed, authors like Laney (1984) argued that the relationship between these two variables is even much stronger in developing economies. With regard to Sub-Saharan Africa (SSA) countries, current account and fiscal imbalances are a persistent feature. Yet, there have been limited previous works that attempted to address the twin deficits hypothesis in the region. The study by Fonseca (2006)



for Egypt, Laney (1984) for 59 developing countries (including some SSA countries), and Olugbenga A, and Oluwole O. (2004) for Nigeria are notable ones regarding the issue.

1.2. Statement of the Problem

African countries still face the critical challenge of raising the rate of GDP growth and sustaining high growth rates over an extended period. While growth has recovered over the past few years, very few countries have achieved and maintained the growth rates necessary to reduce poverty.

Africa still tails behind other regions in most measures of human development. The continent is largely plagued by shocks from the vagaries of international markets and climatic changes as well as the expansion of HIV/AIDS pandemic. In particular, Sub-Saharan Africa is the lowest income region in the world (Collier and Gunning, 1999). The growth pattern in Sub-Saharan Africa countries has special characteristics; ranging from bad policies to poor education, political instability, inadequate infrastructure and others. The persistent extent of low school attainment, political instability, fragile financial system, large black market exchange rate premiums, large government deficits, and inadequate infrastructure are significantly correlated with low economic growth and capital formation in the region (Alemayehu and Befekadu, 2005; Easterly and Levine, 1997).

The dismal growth performance of Sub-Saharan Africa is a popular topic in economic and historical literature. Sachs and Warner (1995) and Gallup et al. (1998) argue that primarily geographical factors explain the poverty trap. Others stress the importance of colonial policy and the continuity of institution overtime (North, Summerhil and Weingast, 2000). La Porta et al., (2004) point more specifically at the legal system implemented by the colonial powers.

Current account and budget deficits are a persistent feature of African economies. The average current account balance has mostly remained in negative territory for a large sample of Sub-Saharan Africa countries. For example, Patrick O. and Sher V (2007), using a sample of 38 Sub-Saharan Africa countries for the period 1970-2005 found that the average current account deficit as a ratio of GDP was 5.6%. According to their study, there is also considerable country variation in the current account deficit-GDP ratio, which ranges from a deficit of 15.08% in Mozambique to a surplus of 2.92% in Gabon during the study period.

On the other line, the fiscal situation in Sub-Saharan Africa countries is still fragile (World Bank, 1994). Most countries still rely heavily on grants to avoid fiscal imbalances, and the median deficit excluding grants has remained large (about 8% of GDP) since 1980s.

Fiscal deficits are usually associated with over indebtedness, high inflation, and poor investment performance and growth, which are characteristic features of most African economies. For example, Easterly and Schmidt (1993), found strong evidence that over the medium term, money financing of the fiscal deficit, leads to high inflation, while debt financing leads to higher real interest rates or increased repressions of financial markets. They also found strong evidence that fiscal deficits spill over into external deficits. Recently, Patrick and Sher (2007) observed in their study of current account deficits in Sub-Saharan Africa countries that countries with very high current account deficits also have higher fiscal deficits and that the difference is statistically significant at conventional levels.

The emergence of the current account deficit and budget deficit phenomena in many countries in the past decades has rekindled the debate on the problem of twin deficits. But this paper



differs from the existing literature in the following ways. First, to the best of my knowledge, the body of knowledge on the region regarding the issue is very limited. This is surprising since the two deficits in Sub-Saharan Africa countries were large in size and volatile.

Second, most of the earlier studies have focused on the twin deficits hypothesis in the developed countries. This study chooses Sub-Saharan Africa because the issue seems to be relevant to these economies and that they finance their investment mainly from foreign sources.

Third, Sub-Saharan Africa countries are heterogeneous in a number of aspects such as types of merchandise export, level of indebtedness, degree of openness, political stability, governance, and other macro-economic variables. To see the impact of merchandise export that would have key role in determining terms of trade, on budget and current account deficit movements, this study takes two groups of countries as oil-exporting and oil- importing Sub-Saharan Africa countries.

Fourth, the majority of empirical studies employed either cross-sectional or time series analysis to examine the causal linkage between current account and budget deficits. As various researchers argued, these techniques of analysis are inappropriate. Chandra and Sen (2001) argued that cross-country regressions analysis is based implicitly on the restrictive assumptions of homogeneity in the observed relationship across countries. However, there is considerable variation among developing countries in relation to various structural features and institutional aspects. On the other hand, empirical studies that use aggregate time-series data alone can, even for relatively homogenous groups of countries, miss out an important cross-sectional effect (Baltagi, 1995).



The problems of cross sectional and time-serious data sets can be overcome by using panel data sets (Dunne and Mohammed, 1995). Unlike cross-section and time-series data, panel data recognize that individuals, households, firms, countries, etc are heterogeneous. Panel data sets give more informative data, more variability (e.g., within and between variation) more degrees of freedom and efficiency (Greene, 2003).

1.3. Objective of the Study

The general objective of this study is to investigate the issue of causality between current account deficits and budget deficits in Sub-Saharan Africa countries by applying relatively recent and advanced econometric techniques. Specific objectives of the study include:-

- Exploring whether there exist a causal linkage between the two deficits in Sub-Saharan Africa countries
- Identifying the transmission mechanisms (if any) between budget and current account deficits
- Examining the validity of the Ricardian Equivalence Hypothesis, and the Keynesian view for SSA countries.

1.4. Working Hypothesis

Based on the theoretical and empirical literature; the following hypotheses are developed:

- For heavily indebted poor Sub-Saharan Africa countries, a unidirectional causality that runs from current account to budget deficit (current account targeting) is expected. This outcome occurs when the deterioration in current account leads to a slower pace of growth and hence an increase in the budget deficit.
- Exchange rate is expected to be the relevant variable in bridging the two deficits.

1.5. Data source and Methodology

1.5.1. Data Source

This paper uses a balanced panel of 15 Sub-Saharan Africa countries for the period 1980-2007 to analyse the dynamic relationship between fiscal balance and current account balance. The data used in this study are, annual observations of budget balance and current account balance excluding grants, both as a percentage of GDP, lending interest rate (percent per annum), real effective exchange rates (annual average; index, 2000=100), percapita GDP (USD), percapita government consumption (USD), and per capita private consumption (USD). The main data source is the IMF International Financial Statistics (IFS) CD-ROM. World Development Indicators data base has also been visited. The criterion for including a country in the sample is principally of data availability for all variables for the study period.

1.5.2. Methodology

Most of the empirical literature on the analysis of the twin deficits employed a single structural equation framework, assuming implicitly or explicitly variables stationarity and exogeneity. The assumption of stationary variables appears to be troublesome in view of inclination of macroeconomic data to exhibit unit roots. Endogeneity problem or simultaneity bias may also raise special concern.

Endogeneity and non-stationarity problems may be overcome by adopting a system of equations such as the Vector Autoregressive (VAR) system. The central feature characterizing the VAR technique is that it poses less restrictive structural modeling as it imposes no a priori endo- exogenous division of variables; all variables entering equations system are assumed to be endogenous. Second, no zero restrictions are imposed on individual variables to attain identification, which is the case under simultaneous equation modeling. Third, when

supplemented with co-integration analysis, the VAR technique allows for a rigorous modeling of the long-run relationship of non-stationary variables (Johansen, 1988; Davidson, 1998).

Therefore, the study attempts to explore the twin deficits debate by applying Vector Autoregressive (VAR) estimation technique, a reduced form consumption function and Panel VAR Granger causality tests on annual data of current account deficits, budget deficits, annual interest rate, real exchange rate, percapita GDP, percapita private consumption, and percapita government consumption of Sub-Saharan Africa countries.

1.6. Limitation of the study

In analyzing the causal linkage between the two deficits in Sub-Saharan Africa countries, this study has its own limitations of which the following are no exceptions. First, as the data is collected from different sources, it is difficult to find, at least similar, unit of measurement and scale for the variables. This makes difficult in pooling different cross-sections into one panel. Second, a number of Sub-Saharan Africa countries had not been included into the sample mainly because of missing data for those countries for the given period. Third, different countries in Africa adopt Structural Adjustment Program at different times that have a significant impact on movements of major macro variables of those countries. Thus, it is difficult to find a sample of counties with similar macro-economic environment.

1.7. Scope and organization of the study

1.7.1. Scope of the study

Any research problem has to be delimited in scope to manageable size. Thus, this study covers the dynamics and causal relationships between the current account and budget deficits in Sub-Saharan Africa countries during the period 1980 to 2007. A sample of 10 non-fuel and 5 fuel



countries has been considered in the analysis. This classification is based on the IMF's World Economic Outlook publication groupings of countries. Since the past two decades or so, the continuing rise in oil prices continues to be the key factor behind higher government expenditures in oil-importing countries and a trade surplus for oil-exporting ones. In other words, oil-exporting countries have recorded increasing trade surpluses, while oil-importing counter parts experienced deepening trade deficits. This is the main justification behind these groupings of sampled countries (Annex-1).

1.7.2. Organization of the study

The rest of this paper is structured as follows. Chapter two provides the relevant literature in the research area. In chapter three, appropriate models are specified, and estimation techniques are discussed. The fourth chapter is devoted to conducting specification tests and discussion of estimation results. Finally, chapter five provides conclusion and policy recommendation.

1.8. Significance of the study

This study contributes to the existing literature in the following ways; first, since the past two decades an ever increasing trend of oil price in world market contributes significantly to foreign earning revenues of oil-exporting countries and government expenditure for oil-importing countries. Thus, if the findings are found to be different for the two categories of countries, more attention has to be given to oil price movements and hence terms of trade. Second, in analyzing the causal relationship between the two deficits in a panel data setting, this study would provide some information in selecting cross-sections and minimizing heterogeneity. Third, the findings of this study would help policy makers and planners in managing deficits based on the direction of causation.

CHAPTER TWO

2. Review of Theoretical and Empirical Works

The theoretical and empirical literature is replete with different hypothesis regarding the relationship between the “twin deficits”. This sub-section summarizes relevant literatures pertaining to this phenomenon.

2.1. Review of Theoretical Frameworks

The “twin deficits” has its origin in the United States, which erupted during the ‘Reagan Fiscal experiment’ in the 1980s. It marked a period of strong appreciation of the dollar and an unusual shift in current account, as well as fiscal deficits not in favour of the United States (Zubaidi,et al; 2003). Since then the issue bears a more general interest and concerns a broader set of countries. The emergence of the current account deficit and the budget deficit phenomena in many other countries in the past decades has rekindled the debate on the problem of twin deficits.

2.1.1. Theoretical Basis for the Twin Deficits Hypothesis

To analyze the relationship between the ‘twin deficits’ in a small open economy, the study uses the usual national income accounting identity:

$$Y = C+I+G+ (EX-IM)..... (2.1)$$

Where Y stands for national income, C is private consumption, I is investment spending, G is government expenditure on final goods and services, Ex is export of goods and services, and IM is import of goods and services.

We define the current account (CA) as:

$$CA = EX - IM + NFI, (2.2)$$



Where, NFI stands for net factor income and transfer flows. For simplicity, here let us assume that NFI is insignificant figure.

The current account shows the size and direction of international borrowing. When a country imports more than it exports, it has a current account deficit, which is financed by foreign credit in the form of external debt, aid, foreign direct investment, portfolio investment, and other forms of capital flows.

According to the national income identity, national saving in the open economy equals:

$$S = Y - C - G + CA \dots\dots\dots (2.3)$$

Where $Y - C - G = I$

And $S = S^p + S^g \dots\dots\dots (2.4)$

Where, S^p is saving by the private sector, and S^g is saving by the government.

We can write further the saving identity as:

$$S^p = Y - T - C \dots\dots\dots (2.5)$$

Where T stands for tax.

And $S^g = T - G - TR \dots\dots\dots (2.6)$

Where TR stands for government transfers.

From definitions of national saving we have:

$$S = Y - C - G = (Y - T - C) + (T - G - TR) = S^p + S^g = I + CA \dots\dots (2.7)$$

From identity (2.7), we have:

$$S^p = I + CA - S^g = I + CA - (T - G - TR) \dots\dots\dots (2.8)$$

Rearranging identity (2.8), we have:

$$CA = (S^p - I) - (G + TR - T) \dots\dots\dots (2.9)$$

The first set of terms on the right hand side of identity (2.9) is the saving-investment gap, and the second set of terms is the government budget balance or government budget deficits (BD), Equation (2.9) states that an increase in government spending will either crowd – out private investment or lead to an inflow of foreign capital (or both) provided that there is no increase in taxes and private savings. In other words, if private savings and domestic investment are equal, or at least move in the same amount, then fiscal and external balances would be twin (see also Laney, 1984).

2.1.2. The Ricardian Equivalence Hypothesis

Ricardian Equivalence Hypothesis (REH), named by American Economist Robert Barro (1974) after English Economist David Ricardo (1772-1823) asserts that, for a given expenditure path, the substitution of debt for taxes has no effect on aggregate demand nor on interest rates. The reasoning of this theory is as follows. The government's inter-temporal budget constraint implies that, for an unaltered level of government outlays, a tax cut now implies a tax increase in the future. Therefore, as government borrowing only postpones taxes into the future, consumers, who are simultaneously taxpayers, fully anticipating the increase in future taxes, do not consider the current tax cut, and the consequent increase in disposable income, as being permanent. Hence, consumers' inter-temporal budget constraint is left unchanged by the government financing decisions, and as a result, the consumption path is also unaffected: the increase in disposable income, resulting from the tax cut, is entirely saved.

Under Ricardian equivalence, consumers react to the tax cut by increasing their savings. This increase in private saving is used to buy the newly issued government bonds, enabling

consumers to have the resources to pay for the increase in future taxes.¹ Therefore, as private saving increases by the same amount as does the budget deficits, the national saving remains unaffected; this in turn leaves the interest rate unaltered. Moreover, in an open economy, the deficit has no effect on the current account balance because the increase in private saving is enough to avoid the need of (additional) external financing. In short, the REH claims the absence of any causal relationship between budget deficits and current account deficits.

Since the publication in 1974 of Barro's seminal paper on the equivalence proposition, there has been published an extensive amount of literature on the subject (Fonseca, 2001). In order Ricardian equivalence to hold, a number of requirements must be fulfilled. It is necessary that: the individual must have the same time horizon (usually assumed to be finite) as the government, the service of the debt (interests and repayment of the principal) must be financed by taxes levied in later periods, government consumption stays unaltered at its initial level, taxes are lump-sum, capital markets are perfect and individuals may borrow and lend at the same rate as the government, there is no uncertainty about future income, and individuals fully anticipate the future-period tax liabilities that are implicit in the debt issue.

Despite the large number and strength of those assumptions, theoretical restrictiveness of Ricardian equivalence does not constitute a practical refutation of its validity (Fonseca, 2001).

¹ Future taxes have to increase because the government needs the revenue to service this newly issued government debt.

2.1.3. The Mundell-Fleming Framework to the Twin Deficits Hypothesis

This model owes its origin to paper published by James Fleming (1962)² and Robert Mundell (1962/63).³ Their major contribution was to incorporate international capital movements into formal macro-economic models based on the Keynesian IS-LM framework.

According to this model, an increase in budget deficit induces upward pressure on interest rates that in turn triggers capital inflows and appreciation of the domestic currency. Ultimately, this appreciation in the domestic currency leads to an increase in the demand for imports which in turn leads to an increase in current account deficits (for graphical illustration, Annex-2)

Private saving remain the same as the public perceived the government bond issue to finance the deficit as increasing their wealth (Zubaidi and Lau, 2007). The response of domestic investment and current account deficits to a large extent depends on the degree of capital mobility. In the case when capital is highly mobile, domestic interest rate is unresponsive (inelastic to a fiscal shock). Hence, there is no crowding out effect on domestic investment, as foreign capital will quickly offset the fall in domestic investment. Capital inflow in turn puts upward pressure on exchange rate through either a rising nominal exchange rate in the case of a flexible exchange rate regime or rising prices under a fixed exchange rate system. Therefore, the conventional Mundell – Fleming model predicts a positive relationship between the two deficits⁴.

² Flemin J. (1962) 'Domestic financial policies under Floating exchange Rates, IMF staff papers, Nov. 1962

³ Mundell R. (1962/63) "Capital mobility and stabilization under fixed and flexible exchange rates, Canadian Journal of Economics & Political science.

2.1.4. Budget Deficit Financing and the Current Account

In the 1980s and 1990s, large budget deficits were a primary topic of debate among policy makers in the United States and Europe (Mankiw, 2000). Most economists take the traditional view of government debt for the issue. According to this view, a budget deficit leads to lower national saving, lower investment, and a trade deficit. In the long run, it leads to a smaller steady-state capital stock and a larger foreign debt. Those who hold the traditional view conclude that budget deficits place a burden on future generations. Yet not all economists agree with this assessment. Advocates of the Ricardian view of government debt are skeptical. They stress that a budget deficit merely represents a substitution of future taxes for current taxes. As long as consumers are forward-looking, they will save today to meet their or their children's future tax liability. These economists believe that budget deficits have only a minor effect on the economy. Still other economists believe that the budget deficit is an imperfect measure of fiscal policy. They agree that the government's choices regarding taxes and spending have great influences on the welfare of different generations (Mankiw, 2000).

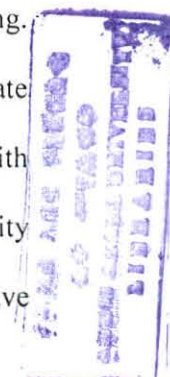
According to economic theory, budget deficit in any given economy influences a number of macro-economic variables including private saving, investment and current account balance as mentioned above. The impact of budget deficit on those macro-economic variables depends, in part, on how the deficit is financed. There are several possible ways of financing budget deficit.

One possible way of financing is by increasing money supply and collecting Seigniorage. By printing money, the government collects Seigniorage. Seigniorage can be decomposed into a "pure Seigniorage" component and an "inflation tax" component (Quanes and Thankur, 1997).

⁴Based on the Mundell-Fleming framework, Keynesians demonstrated that an increase in budget deficits would increase domestic absorption (an increase in aggregate demand) and hence imports. The expansion of imports in turn leads to the worsening of current account balances. This is called in the literature as 'The Keynesian Absorption Theory'.

The pure Seigniorage component is the change in real cash balances that comes from real growth of the economy or a favourable shift in the demand for money. While the inflation tax component is just the inflation rate that acts in this case as the “tax rate” times the stock of real cash balances held by the public (tax base). As a way of budget deficit financing, Seigniorage revenue has a certain limit. As inflation becomes very high, household may use foreign currency for transactions and dollarization occurs (Olga. V., 2001).

Another possible way of financing a budget deficit is through domestic borrowing. Government borrowing reduces the credit that would otherwise be available to the private sector, putting pressure on domestic interest rates. If the economy is well integrated with international capital markets, the high domestic interest rate, under perfect capital mobility assumption, induces capital inflow and an appreciation of the exchange rate that would have adverse effects on the current account.



The link between budget deficit and current account deficit is closer if foreign exchange reserves and foreign borrowing are used to finance a budget deficit. Using foreign exchange reserves and foreign borrowing to finance budget deficit appreciates the domestic currency that encourage imports and discourages exports leading to deterioration in the current account balance.

In general, whatever the means, budget deficit financing in an open economy inevitably has its impact either on exchange rate or an interest rate or on both, depending on the degree of capital mobility and exchange rate regimes that prevails in the economy.

2.2. Review of Empirical Works

The twin deficits relationship has been extensively investigated in the US and other developed countries by different authors at different times. The body of evidence however does not yield a consensus on the causal relationship between the two deficits. In this regard, four testable hypotheses arise from the twin deficits phenomena.

The first testable hypothesis is based on the Keynesian (conventional) proposition. Based on the well-known Mundell-Fleming framework, Keynesian demonstrated that an increase in budget deficit would induce upward pressure on interest rates, causing capital inflows and exchange rate to appreciate (Zubaidi, et al, 2003). The appreciated exchange rate would make exports less attractive and increase the attractiveness of imports, subsequently worsening the current account under a flexible exchange rate system. Under a fixed exchange rate regime, the budget deficit stimulus would generate higher real income or prices and this would worsen the current account deficits. Researchers like Vamvoukas (1999), Piersanti (2000), and Leachman and Francis (2002) found strong evidence to support the Keynesian view.

Second, Buchanan (1976) rediscovered the Ricardo proposition known as the Ricardian Equivalence Hypothesis (REH) in the seminal work of Barro (1974). Barro's seminal paper has originated a huge amount of theoretical and empirical literature on the Ricardian equivalence issue. According to this view, an inter temporal shift between taxes and budget deficits does not matter for the real interest rate, the quantity of investment or the current account balance. In other words, the absence of any Granger causality relationship between the two deficits would be in accordance with the REH (Zubaidi, et al, 2005). The empirical evidence in Miller and Russek (1989), Enders and Lee (1990), Evans & Hassan (1994) and Kaufmann et al (2002) concluded that there is no link between the two deficits and hence is supportive of REH.

Third, it is also possible to find a unidirectional causality running from the current account to the budget deficit. This reverse causation is designated in the terminology of Summer (1988) by *current account targeting*. This is the case when deterioration in the current account results into a slower economic growth, and subsequently leads to deterioration in the budget balance, Fonseca (2006). Recently, Alkswani (2000) provided empirical evidence on reverse causation between the two deficits for Saudi Arabia. The study by Anoruo and Romchander (1998), found trade deficits to cause fiscal deficit in some Asian countries.

Finally, a bi-directional causality might emerge between the two deficits, that is, budget deficit Granger cause current account deficit and vice-versa. The works by Darrat (1988), Biswas et al (1992), and Normandin (1999) provided sufficient evidence to support this view.

On the other hand, there are also authors who arrived at a different conclusion other than the above mentioned hypotheses. For example, in a recent study, Bernheim (1989) employed a standard reduced form regression approach and concludes that the relationship between the twin deficits depends critically on the country and time-period, as well as the prevailing information set. Laney's (1984) study for the United States and 58 other developed and developing countries found that fiscal balances as a determinant of the external balance is statistically significant, more frequently, in the developing country group than in the industrial country group. Enders and Lee (1990) reached similar conclusion when they used a two-country macro-theoretical model to examine the observed relationship between the two deficits. Similarly, Khalid and Guan (1999), applied the cointegration technique to annual data from a group of developing and developed countries. They observed the absence of a long-run



co-integrating relationship between fiscal and current account deficits for the developed countries while the data for the developing countries do not reject such a relationship.

2.3. Review of Empirical Works in African Countries

During the last two decades or so, many developing countries in Africa embarked on major structural reforms in order to reduce public sector deficits, eliminate unsustainable external deficits, reduce inflation and create a stable macro-economic environment conducive to growth. Despite the reforms, positive fiscal and trade balances remain elusive because governments in many developing African countries, continued to run deficits.

A recent study by Patrick O. and Sher V. (2007) on the sustainability of current account deficits in Sub-Saharan Africa countries show that a number of African countries have been on occasions in the ‘twin deficits’ situation. The fact that deficits persists in a large number of countries calls for a re-examination of the temporal causality and the long-run relationship between trade deficits and government budget deficits using modern time-series econometric techniques.

The continent of Africa remains relatively unstudied in the current account- budget deficits debate. Nevertheless, some researchers attempted to incorporate some African countries into their sample in their analysis of the twin deficits debate. Still others tried to see the issue using individual African countries as summarized below.

Nozar H. and Loretta W. (2006), using a compact VAR model and a sample of nine Middle East and North Africa countries (Egypt and Morocco), they found that the dynamic relationship between the two deficits is subject to change depending on the underlying tax

system, trade patterns and barriers, the exchange rate, and a complex host of internal and international forces that help to shape a country's economic status in the global setting.

Kouassi, et al (2004), by testing for Granger non-causality between budget deficit and current account deficits, for a sample of twenty countries including South Africa, they found evidence of causality (unidirectional or bi-directional) between the two deficits. Leonardo B. and Amartya L. (2006), using a sample of 26 countries including South Africa and Morocco, found some support for the twin deficits hypothesis.

In addition to the cross-sectional studies cited above, few empirical case studies have been conducted. Olugbenga A. and Oluwole O (2006), using Nigerian annual data from 1970-2001, and by employing co-integration and vector error-correction (VEC) techniques, Granger causality tests and generalized impulse response analysis to examine the twin deficits phenomena in Nigeria, they found evidence of positive relationship between trade and budget deficits in both the short and long-run.

Fonseca (2006), using annual data of Egypt from 1974-2002, estimated a vector error correction model (VECM), to examine the Ricardian Equivalence, twin deficits, and the Feldstein-Horioka puzzle in Egypt. He concluded from his result for the presence of a (weak) long-run relationship between the two deficits. Furthermore, the researcher found evidence infavour of a reverse Granger-causality running from the external deficit to the budget deficit.

It is apparent from discussions of the empirical literature above that the evidence on the "twin deficits" is inconclusive. The results differed across countries, but more significantly, they differ with the use of different econometric techniques and model specification for the same

country data. Equally apparent is the fact that most of the studies concentrated on the experiences of industrialized countries particularly the United States. There are relatively few empirical studies of the "twin deficits" for the developing countries. The scarcity of evidence from developing countries is surprising because fiscal balance and current account position are typically used as some of the main leading indicators to predict the future behaviour of the economy.

CHAPTER THREE

3. Model Specification and Estimation Techniques

This section proceeds as follows. First, it presents a model based on the work by Obstfeld and Rogoff (1999), to show cases where the Ricardian Equivalence holds and cases where the hypothesis fails. Then, using time series data of relevant variables from the model, the paper investigates empirically the validity of the twin deficits hypothesis for selected Sub-Saharan African countries.

3.1. Government Budget Deficits in an Overlapping Generations Model

3.1.1. Individual Behaviour

Consider first a small open economy in which each generation of individual lives for two periods, and a new generation is born each period. For convenience, population is normalized to one. A person born on date t is assumed to have the utility function:

$$U(C_t^y, C_{t+1}^o) = \log(C_t^y) + \beta \log(C_{t+1}^o) \dots\dots\dots (1)$$

Where, C_t^y denotes consumption during youth and

C_{t+1}^o denotes consumption of the same person while old in period $t+1$. In addition β represents time preference of consumption.

Assuming that inheritance is ruled out for the time being, the individual's budget constraint is:

$$C_t^y + \frac{C_{t+1}^o}{1+r} = y_t^y - T_t^y + \frac{Y_{t+1}^o - T_t^o}{1+r} \dots\dots\dots (2)$$



Where, r is the interest rate and is given by the world capital market and assumed to be constant. Furthermore,

T_t^y and T_{t+1}^o denote net lump-sum taxes paid by an individual during his young and old age periods respectively.

Maximizing equation (1) subject to equation (2) yields the inter temporal Euler equation:

$$C_{t+1}^o = (1+r)\beta C_t^y \dots\dots\dots (3)$$

Equation (3) and budget constraint (2) imply the consumption demands:

$$C_t^y = \left(\frac{1}{1+\beta}\right) \left[Y_t^y - T_t^y + \frac{Y_{t+1}^o - T_{t+1}^o}{1+r} \right] \dots\dots\dots (4)$$

$$C_{t+1}^o = (1+r) \left(\frac{\beta}{1+\beta} \right) \left(Y_t^y - T_t^y + \frac{Y_{t+1}^o - T_{t+1}^o}{1+r} \right) \dots\dots\dots (5)$$



3.1.2. Aggregate Behavior

To study the economy's aggregate behaviour, we have to add up over the two generations alive each period. Aggregate consumption C_t in period t is given by:

$$C_t = C_t^y + C_t^o \dots\dots\dots (6)$$

The change in government assets between the ends of dates t and $t-1$ is the difference between government revenues and government consumption:

$$B_{t+1}^{G_t} - B_t^{G_t} = T_t^y + T_t^o + rB_t^{G_t} - G_t \dots\dots\dots (7)$$

Where $rB_t^{G_t}$ = public asset interest income.

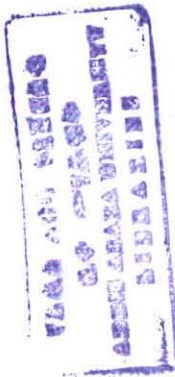
Now, how do changes in the government's budget deficit affect the nation's current account balance? The current account is the change in the economy's total net foreign assets, and is the sum of private and government assets.

$$CA_t = B_{t+1} - B_t = B_{t+1}^p + B_{t+1}^g - (B_t^p + B_t^g) \dots\dots\dots (8)$$

Or $CA_t = Y_t - C_t - G_t + rB_t \dots\dots\dots (9)$, assuming no investment.

3.1.3. The Timing of Taxes

As in the work of Obstfeld and Rogoff (1999), suppose that in period $t=0$, the government lowers the per capita taxes paid by both the young and the old by $d/2$, financing its higher budget deficit in period 0 by selling bonds worth d to each of the current young. That is, the current tax bill of the young falls to $T_0^y - (\frac{d}{2})$ and the current tax bill of the old falls to $T_0^o - (\frac{d}{2})$, but the government's new end-of-period assets decline to B^G-d as a result. Assume further that the tax burden due to future interest payments on the added debt, rd , is split evenly between young and old generations. That is, for all $t \geq 1$, per capita taxes on the young and old rise to $T_t^y + (\frac{rd}{2})$ and $T_t^o + (\frac{rd}{2})$, respectively.



Now, let variables with primes (') denote the economy's path after the fiscal policies have been implemented. The period 0 old obviously consumes their entire windfall transfers, so:

$$C_0^{\prime o} = C_0^o + \frac{d}{2} \dots\dots\dots (10)$$

Though the young of period 0 receive the same windfall $d/2$, the net benefit to them is not quite as large as that to the date 0 old since the young will face added taxes $rd/2$ in their old age. Thus, by equation (4), the consumption change for the period 0 young is:

$$C_0^y = C_0^y + \frac{1}{1+\beta} \left(1 - \frac{r}{1+r}\right) \frac{d}{2} = C_0^y + \frac{1}{1+\beta} \left(\frac{1}{1+r}\right) \frac{d}{2} \dots\dots\dots (11)$$

Adding equations (10) and (11), we see that aggregate date 0 consumption C_0 rises.

$$C_0^o + C_0^{y'} - (C_0^o + C_0^y) = \left[1 + \frac{1}{(1+\beta)(1+r)}\right] \frac{d}{2} \dots\dots\dots [12]$$

Using equation (5), it can be shown that, the period 1 old who were young in period 0, still have higher consumption, equal to:

$$C_1^o = C_1^o + (1+r) \frac{\beta}{\beta+1} \left(1 - \frac{r}{1+r}\right) \frac{d}{2} = C_1^o + \left(\frac{\beta}{1+\beta}\right) \frac{d}{2} \dots\dots\dots (13)$$

The period 1 young generation, and all generations born afterward, are the losers, of course. For all these generations, lifetime income changes by:

$$- \left(1 + \frac{1}{1+r}\right) \frac{rd}{2} \dots\dots\dots (14)$$

Under the overlapping generations demographics we have assumed so far, Ricardian equivalence fails because government borrowing can shift current taxes from today's generation to those who will be born later.

We can also solve for the path of the current account using equation (9). Assuming that output and government spending are constant, the period 0 current account change is just the change in consumption.

$$CA_0^1 - CA_0 = - \left[C_0^o + C_0^{y'} - (C_0^o + C_0^y) \right] = - \left[1 + \frac{1}{(1+\beta)(1+r)} \right] \frac{d}{2} \dots\dots\dots (15)$$

To find the period 1 current account change, we note that the rise in net foreign assets entering period 1 is equal simply to change in the period 0 current account. Thus;

$$CA_1^* - CA_1 = r(CA_0^* - CA_0) - [C_1^0 + C_1^y - (C_1^0 + C_1^y)] \dots\dots\dots (16)$$

Using equations (14) and (16), we have

$$CA_1^* - CA_1 = -\left(\frac{\beta}{1+\beta}\right)(1+r)\left(\frac{d}{2}\right) \dots\dots\dots (17)$$

The higher current account deficits for periods 0 and 1 imply that increased government indebtedness has reduced the net foreign asset position of the economy. Higher consumption by those alive in period 0 thus is financed through the accumulation of a foreign debt that future generations must service (Obstfeld and Rogoff, 1999).

3.2. Government Budget Policy in the Absence of Overlapping Generations

A number of very strong assumptions underpin the Ricardian equivalence hypothesis. It may fail to hold if individuals can't borrow at the same interest rate as the government, when taxes are distorting, when there is uncertainty about future income, when there is Ponzi games, and when consumers and the government have different planning horizons. However, Ricardian equivalence holds provided that the above requirements are ruled out. To see this, write the asset-accumulation identity for a private individual as:

$$B_{t+1}^p - B_t^p = Y_t + r_t B_t^p - T_t - C_t - I_t \dots\dots\dots (18)$$

Now, using a sequence of iterative substitution method as well as applying the concept of limit⁶, under a constant interest rate r , the individual's life time inter temporal budget constraint is given by:

$$\sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} (C_s + I_s) = (1+r)\beta_t^0 + \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} (Y_s - T_s) \dots\dots\dots (19)$$

A similar argument based on the government asset accumulation identity:

$$B_{t+1}^G - \beta_t^G = T_t + r_t B_t^G - G_t \dots\dots\dots (20)$$

leads to the government's inter temporal budget constraint (under a constant interest rate),

$$\sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} G_s = (1+r)B_t^G + \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} T_s \dots\dots\dots (21)$$

Now, combining equations (20) and (21) yields:

$$\sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} (C_s + I_s) = (1+r)\beta_t + \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} (Y_s - G_s) \dots\dots\dots (22)$$

The implication of equation (22) is that the time path of taxes does not affect individual consumption or investment demands, and hence in accordance with the Ricardian equivalence.

3.3. Taking the Question of the Twin Deficits to Data from Sub-Saharan Africa

Countries: *Some Stylized facts*

Overlapping generations model suggest that in realistic cases, government budget deficits will induce current account deficits by redistributing income from future to present generations. Let us first draw some stylized facts from the data before we proceed to test whether such a

⁶ For the detail derivation, see Obstfeld and Rogoff (1999), *Foundation of International Macroeconomics*.



tendency is apparent from the data using a dynamic panel VAR model. Average current account Balance (CAB) and fiscal positions (BB) as a share of GDP over the period 1980-2007 for oil exporting and oil-importing Sub-Saharan Africa countries are plotted in fig 2 and 3 to provide a visual perspective on the twin deficits hypothesis.

3.3.1 Graphical Analysis of Fiscal and Current Account Balances

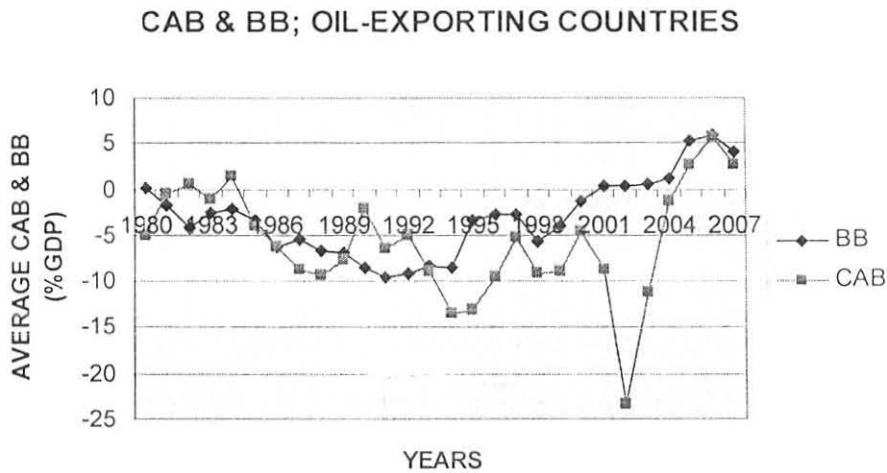


Fig .3.1; BB and CAB: Oil Exporting Countries

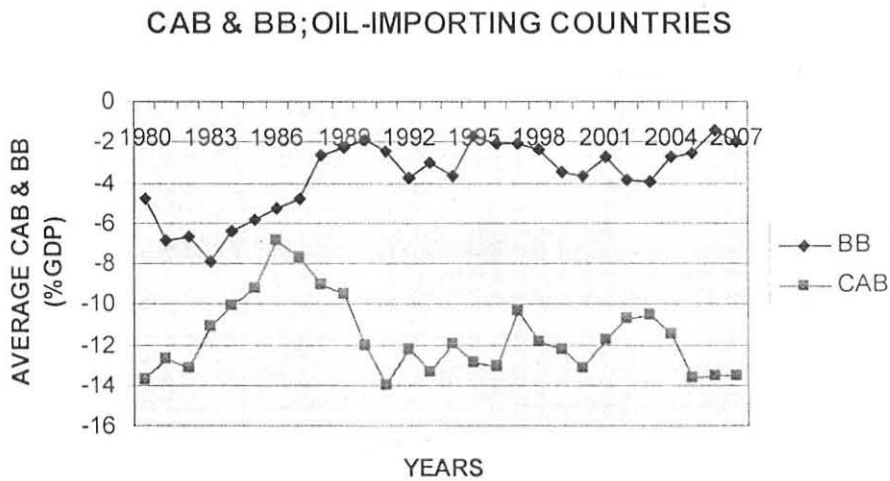


Fig.3.2; BB & CAB: Oil Importing Countries

Visual inspection of the above figures shows that for oil-exporting countries, there is no clear cut relationship between the two curves, that is, the two curves cross each other in a number of points. Further more, current account and fiscal balances has been in a positive territory before the period 1983 and after 2003. This is mainly because of a rising trend in oil price and hence large foreign exchange inflows from oil exports. On the other hand, the two balances seem to move together for the case of oil-importing countries. In addition, for this category of countries, both BB and CAB are almost in a negative territory for the period considered.

3.3.2 Current Account Balance and Economic Growth

Basic growth theory suggests that poor countries grow faster and have more potential for catch-up, either through capital accumulation, or technological progress⁷. Thus, poor countries should see an increase in investment and a decrease in saving. In this regard they should run larger current account deficits with growth. To see the relationship between output per capita growth and the current account balance, the paper takes a simple OLS regression as presented below.

Oil-exporting countries

$$CA/GDP = -23.9 + 0.02 Y/N, \text{ where } Y = GDP$$

$$(-3.38) \quad (5.26)$$

N = Population and figures in

$$R^2 = 0.15$$

brackets are t-ratios..... (23)

⁷ For empirical evidence on convergence, see for example Barro and Sala-i- Martin, 1992.

Oil-importing countries:

$$CA/GDP = -13.4 + 0.001 Y/N$$

$$(-14.72) (4.06)$$

$$R^2 = 0.08 \dots \dots \dots (24)$$

Note that: - the residuals from the above two simple regression results are found to be I (0) process. Furthermore, Durbin-Watson test ($\rho=0.00013$ for equation (23) and $\rho= 0.0018$ for equation (24)) shows the absence of serial correlation.

The above regression result has two striking features:

- For both groups of countries, current account balance and per capita GDP are positively related that shows an improvement in economic growth would lead to an improvement in current account balances and the other way round.
- The relationship between the two variables is strong and statistically significant for oil-exporting SSA countries than oil-importing countries may be due to higher growth in GDP mainly generated from oil.

3.4. Model Specification

As discussed in the literature review section of this paper, different researchers adopted different methodology and arrived at different conclusion regarding the relationship between current account and budget deficits. To mention a few, Roubini (1988) for example, based on an inter- temporal model with distortionary taxation, shows that tax smoothing implies a one-to-one relationship between the current account and the fiscal deficit. Normandin (1994, 1999), studies the causal relationship between the twin deficits using an overlapping generations model. Enders and Lee (1990), Abell (1990), Kearney and Monadjemi (1990), Rosenweig and Tallman (1991), to name a few, estimated a Vector Autogressive mode. Still others employed



numerical simulations of dynamic general equilibrium models to analyze the twin deficits relationship.

As we may recall from Mundell-Fleming open economy model, with international capital mobility, interaction between the trade deficit and budget deficit can occur directly through domestic absorption and indirectly through monetary channels. A number of previous empirical studies documented that micro and macro variables such as rate of saving and investment, money supply, GDP, interest rate, exchange rate, terms of trade, consumption, level of indebtedness as well as institutional arrangements of a given country are important determinants of current account and budget balance movements. But the purpose of this paper is to investigate the extent, if any, that budget deficit affects trade deficit (or the other way) and the channels through which budget deficits do affect trade deficits. In other words, a better understanding of the causal linkages is important to the formulation and implementation of macro-economic policies necessary for removing macro-economic imbalances. In this regard, as documented in the works of Abell (1990), Anoruo and Ramchander (1998), and Ahmad and Evan Lau (2005), this paper includes two mediating variables, namely the interest rate and exchange rates that influence the twin deficits process.

3.5. Estimation Technique

As mentioned so far, the Vector Autoregression (VAR) model is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables. The VAR approach sidesteps the need for structural modeling by treating every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system. The basic framework for the discussion is a regression of the form:

$$Y_{i,t} = \sum_{k=1}^p \gamma^k Y_{i,t-k} + \sum \beta_i X_{i,t-k} + \alpha_i + \varepsilon_{i,t} \dots\dots\dots (25)$$

$i=1, \dots\dots\dots N,$ and $t=1, \dots\dots\dots T$

Where, y = endogenous variable

X = exogenous variable

α_i = unobserved individual specific effect

ε = a random term.

And it is assumed that, for all $i \in [1, N]$, and for all $t \in (1,T]$;

- i) $E(\alpha_i) = E(\varepsilon_{i,t})=0$
- ii) $E(\alpha_i \alpha_j) = \begin{cases} \sigma^2, i=j \\ 0, i \neq j \end{cases}$
- iii) $E(\alpha_i X_{i,t}) = E(X_{i,t}, \varepsilon_{i,t})=0$
- iv) $\varepsilon_{i,t} \sim iid(0, \sigma_\varepsilon^2)$

3.6. Panel Unit Root Test

As in time series analysis, the first step in the estimation of dynamic panels is to test whether the variables at hand contain unit roots. Panel unit root procedures such as the Im, Pesaran and Shin (IPS, 1997) have become popular in recent years to analyze issues such as convergence and Purchasing Power Parity (PPP). Unlike ADF (single equation unit root procedure) and Lin and Levin’s panel raw unit root test that assumes homogenous coefficients, IPS procedures allows for the heterogeneity of dynamics and error variances across groups in the panel, which has superior power performance. To this end, the study applied the mean group approach of t-bar test of Im et al (1997).

The IPS tests possess substantially more power than single-equation ADF test by averaging N independent ADF regressions. Suppose that the stochastic process, y_{it} , is generated by the first order autoregressive process:

$$y_{it} = (1 - \phi_i)\mu_i + \phi_i y_{i,t-1} + \varepsilon_{it} \dots\dots\dots (26)$$

$$i=1 \dots\dots\dots N, \quad t=1 \dots\dots\dots T,$$

Equation (26) can be expressed as:

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \varepsilon_{it} \dots\dots\dots (27)$$

Where $\alpha_i = (1 - \phi_i)\mu_i$, $\beta_i = - (1 - \phi_i)$ and $\Delta y_{it} = y_{it} - y_{i,t-1}$

The null hypothesis of unit roots then becomes:

$$H_0: \beta_i = 0 \text{ for all } i$$

Against the alternative, $H_A: \beta_i < 0$ for at least one i .

The test statistics of t -bar are given as:

$$t_{IPS} = \frac{\sqrt{N} \left[\bar{t}_{NT} - E(t_i / B_i = 0) \right]}{\sqrt{\text{var}(t_i / B_i = 0)}} \Rightarrow (0,1) \dots\dots\dots (28)$$

Where $\bar{t}_{NT} = \frac{1}{N} \sum_{i=1}^N t_{it}$

And $E(t_i / B_i = 0)$ and $\text{Var}(t_i / B_i = 0)$ are the finite common mean and variance of the individual ADF statistics t_{iT} tabulated in IPS. The test statistics converge to the standard normal distribution as T and N approaches to infinity.

3.7. Panel Co-integration Test

If the relevant variables in the panel are non-stationary, the system can be tested for co-integration. This is achieved by applying the test developed by Pedroni (1997, 1999) that arguably represent a significant advancement in addressing the low power of conventional single equation co-integration tests for a single time series by exploiting both the cross sectional and time series information. Pedroni proposes several tests for co-integration that

allow for heterogeneous intercept and trend coefficients across cross sections. Consider the following regression.

$$y_{it} = \alpha_i + \delta_i t + B_{1i} X_{1i,t} + B_{2i} X_{2i,t} + \dots + B_{mi} X_{mi,t} + e_{it} \dots\dots\dots (30)$$

For t=1, T; i= 1, N; m= 1, M

The parameters α_i and δ_i are individual and trend effects, which may be set to, zero if desired. Equation (30) implies that all coefficients, and hence the co-integrating vector, vary across countries thus permitting full heterogeneity (B_i) and fixed effects (α_i). The general approach of this test is to obtain residuals from equation (30) and then to test whether residuals are I (1) by running the auxiliary regression:

$$e_{it} = \theta_i e_{i,t-1} + U_{it} \dots\dots\dots (31)$$

$$\text{Or } e_{it} = \theta_i e_{i,t-1} + \sum_{j=1}^{p_i} \lambda_{ij} \Delta e_{i,t-j} + U_{it} \dots\dots\dots (32)$$

for each cross-section.



Pedroni describes various methods of constructing statistics for testing the null hypothesis of no co-integration ($H_0: \theta_i = 1$ for all i) against:

The homogenous alternative, $H_1: (\theta_i = \theta) < 1$ for all i (which Pedroni terms the within dimension or panel statistics test), and the heterogeneous alternative $H_2: \theta_i < 1$ for all i (also referred to as the between dimension or group statistics test).

Pedroni's (1997, 1999) test is based on the OLS estimation of the residual in equation (31 or 32) with the assumption that there is a single co-integrating vector. Based on this estimation, Pedroni develops four panel cointegration statistics (within-dimension based statistics which are constructed by summing both the numerator and denominator terms over

the N dimensions separately) and three group mean panel cointegration statistics (between-dimension based statistics which are constructed by first dividing the numerator by the denominator prior to summing over the N dimension).⁸

Pedroni (1997) shows that the group ADF statistic and the panel ADF statistic perform best for smaller panels with shorter time spans, and hence these are preferred statistics for this study.

Pedroni shows that the standardized statistic is asymptotically normally distributed,

$$\Xi = \frac{\varphi_{N,T} - \mu\sqrt{N}}{\sqrt{V}} \Rightarrow N(0,1) \dots\dots\dots (33)$$

Where μ and V are Monte Carlo generated adjustment terms and $\varphi_{N,T}$ is the respective panel/group cointegration statistic.

3.8. Granger Causality

Definition: As originally specified, the general formalization of Granger (1969) causality for the case of two scalar-valued, stationary and ergodic time series (X_t) and (Y_t) is defined according to Craig and Jonathan (1994) as follows:

Let $F(X_t/I_{t-1})$ be the conditional probability distribution of X_t given the bivariate information set I_{t-1} consisting of an L_x length lagged vector of X_t and an L_y - length lagged vector of Y_t .

Given lags L_x and L_y , the time series Y_t does not strictly Granger cause X_t if:

$$F(X_t/I_{t-1}) = F[X_t / (I_{t-1} - Y^{L_y}_{t-L_y})], t = 1, 2 \dots\dots\dots (34)$$

Where $Y^{L_y}_{t-L_y} = (Y_{t-L_y}, Y_{t-L_y+1}, \dots\dots Y_{t-1})$

⁸ For a detailed description of the computations for all the panel cointegration statistics, see Pedroni (1999, Table-1)



If the equality in equation (34) does not hold, then knowledge of past values of Y helps to predict current and future X values and Y is said to strictly Granger cause X. Given this definition, let us consider a time stationary VAR representation, adapted to a panel data context.

For each country i we have, for all t (1, T):

$$CAB_{it} = A_1(L) CAB_{it} + B_1(L)BB_{it} + C_1(L) IR_{it} + D_1(L) EXR_{it} + \varepsilon_{1it} \dots\dots\dots (35)$$

$$BB_{it} = A_2(L) CAB_{it} + B_2(L)BB_{it} + C_2(L) IR_{it} + D_2(L) EXR_{it} + \varepsilon_{2it} \dots\dots\dots (36)$$

$$IR_{it} = A_3(L) CAB_{it} + B_3(L) BB_{it} + C_3(L) IR_{it} + D_3(L) EXR_{it} + \varepsilon_{3it} \dots\dots\dots (37)$$

$$EXR_{it} = A_4(L) CAB_{it} + B_4(L) BB_{it} + C_4(L) IR_{it} + D_4(L) EXR_{it} + \varepsilon_{4it} \dots\dots\dots (38)$$

Where, L is the lag operator.

To test for strict Granger causality from BB to CAB, for example, in this linear framework, a standard joint test (F- test or χ^2 tests) of exclusion restriction is used to determine whether lagged BB has significant linear predictive power for current CAB.

- The null that BB does not strictly Granger cause CAB is rejected if the coefficients on the elements $B_1(L)$, are jointly significantly different from zero.
- Bi-directional causality exists if Granger causality runs in both directions, in which case, the coefficients on the elements in both $B_1(L)$ and $A_2(L)$ are jointly different from zero. The same argument holds for the other variables too.

3.9 Specification of a Reduced-form Consumption Function

The empirical literature on the Ricardian Equivalence hypothesis and Keynesian Proposition is vast and ever increasing. Most studies base their attention on the reaction of private

consumption to government financing decisions. Such studies usually estimate a reduced form consumption functions or Euler equations. This study uses the Bernheim (1987) consumption function adapted to a panel data context given by;

$$C_{it} = \beta_0 + \beta_1 Y_{it} + \beta_2 (TX_{it} - G_{it} - rGB_{it}) + \beta_3 G_{it} + \beta_4 GB_{it} + \beta_5 W_{it} + X_{it} \beta + \xi_{it} \dots \dots \dots (39)$$

where, C=real per capita private consumption

Y=Real per capita GDP

G=Per capita public consumption

GB=end of period government debt

W=private wealth

X=a vector of other exogenous variables

r=interest rate



The pure Keynesian view implies $\beta_2 = -\beta_1$, while the Ricardian view implies $\beta_2 = 0$. By testing these restrictions it is possible to accept (or reject) these two competitive theories.

CHAPTER FOUR

4. Discussion of Estimation Results

In this section the study summarize the results based on panel unit root test, panel co-integration test, panel VAR causality test and a reduced-form consumption function.

4.1 Panel Unit Root Test

It is well documented in the empirical literature that time series data could change over time and do not have fixed or stationary means. The presence of non-stationarity may invalidate standard tests used in inference testing and thereby lead to erroneous conclusions. Thus, as a preliminary step, the paper examines the stationarity property of the individual series using the Im et.al (IPS) test at level and first difference. The results summarized in table 4-1 below show that all the series are stationary in first difference allowing for a time trend or all the series are generated by an I(1) process when the individual country data are pooled together for both oil-importing and oil-exporting categories.

Table 4.1: IPS Panel Unit Root Test Results: Eviews-5 output

Panel- A: Oil-exporting countries

At level

Variables	Without trend	With trend
BB	-0.469(0.319)	-0.729(0.232)
CAB	-2.124(0.016)	-1.601(0.054)
IR	-0.436(0.331)	1.441(0.925)
EXR	-1.150(0.125)	1.524 (0.936)
Y	2.265(0.988)	2.382(0.991)
G	0.561(0.712)	1.096(0.863)
C	0.584 (0.720)	-0.119(0.452)
First Difference		
Δ BB	-3.908(0.000)	-9.166(0.000)
Δ CAB	-8.451(0.000)	-7.303 (0.000)
Δ IR	-5.787(0.000)	-8.453(0.000)
Δ EXR	-7.886(0.000)	-6.558(0.000)
Δ Y	-1.406(0.074)	-2.287(0.010)
Δ G	-2.152(0.015)	-4.920(0.000)
Δ C	-3.525 (0.000)	-3.194(0.000)

Panel. B: Oil-Importing countries

Level

Variables	Without trend	With trend
BB	-3.003(0.013)	-1.404(0.080)
CAB	-1.830(0.133)	0.509(0.694)
IR	-0.839(0.200)	1.478(0.930)
EXR	-2.011(0.022)	-0.137(0.445)
Y	11.090(0.998)	4.750(0.998)
G	12.088(1.000)	6.600(1.000)
C	8.803(1.000)	3.209(0.998)
First Difference		
Δ BB	-14.386(0.000)	-8.990(0.000)
Δ CAB	-7.821(0.000)	-11.178(0.000)
Δ IR	-8.036(0.000)	-6.587(0.000)
Δ EXR	-11.554(0.000)	-11.534(0.000)
Δ Y	1.156(0.876)	-4.787(0.000)
Δ G	0.866(0.807)	-5.073(0.000)
Δ C	-0.834(0.199)	-4.628(0.000)



Notes: -The parenthesized values are the probability of rejecting the null of unit root which are computed assuming asymptotic normality

-The estimates of the standardized t-bar statistics are based on the normal ADF statistics.

- Selection of lag length is based on Modified Akaike Information criterion (MAIC).

4.2 Panel Co-integration Test

On determination of the presence of unit roots (non-stationarity) in the variables, the study proceeds to the panel co-integration tests. The purpose of the co-integration test is to determine whether a group of non-stationary series is co-integrated or not. The presence of a co-integrating relation forms the basis for a VEC specification. From the Co-integration test result presented in Table 4-2 below, the null hypotheses of no-cointegration is rejected by the two ADF statistics provided by Pedroni (1997, 1999) for both oil-importing and oil-exporting categories.

Table 4.2: Panel Co-integration Test Result (Pedroni): Eviews-6 output

Panel-A: The VAR model variables

Dependent variable: Current account balance (CAB)

<i>Within-dimension</i>	Statistics	
	Oil-Exporting	Oil-Importing
Panel ADF statistic	-1.771	-2.216
<i>Between-dimension</i>		
Group ADF-statistic	-3.661	-4.801

Panel-B: The reduced-form consumption function variables

Dependent variable: Per capita private consumption (C)

<i>Within-dimension</i>	Statistics	
	Oil-exporting	Oil-importing
Panel ADF statistic	-1.694	-2.031
<i>Between-dimension</i>		
Group ADF statistic	-2.815	-3.653

Note: - The number of lag truncations used in the calculation of all Pedroni statistics is 3.

- The 5% critical value is -1.645. Since the residual based test is a one tailed test a value less than -1.645 (<-1.645) leads to the rejection of the null of no cointegration.

Rejecting the null hypothesis of no-co integration between the I(1) series in the panel implies that the variables do not drift apart in the long-run steady state relationship. Despite the disparities in the individual countries, the study found that CAB, BB, IR, and EXR in the VAR setting, and CAB, BB, IR, C, Y, and G in the VEC setting of the consumption function are co-integrated in the multi-country setting.

4.3 Panel VAR Granger Causality Results

The evidence of co integration between variables, however necessary, does not verify an important issue regarding Granger-causation. The causal direction between the budget deficit and current account deficit is one of the main focuses of this study.

An important factor in causality testing is the determination of the optimal lag-length on the variables. This is because the acceptance or rejection of the null hypothesis is sensitive to the lag length selected for the variables under consideration. This study relied up on Akaike's Information criterion (AIC) to find the optimal lag length as presented in Table 4-3 below.

Table 4.3: VAR Lag Order Selection Criterion (Eviews-5 output)

Lag	LR	AIC		
	Oil-exp	Oil-imp	Oil-exp	Oil-imp
1	523.878	1184.44	27.624	29.84
2	68.008	63.35	27.294	24.22
3	48.087*	26.27	27.121*	24.06
4	54.196	26.77	27.433	24.10
5	60.016	49.01*	28.192	23.99*
6	81.464	15.87	28.403	24.05

Note: ** indicates lag order selected by the criteria

AIC: Akaike Information Criteria

LR: Sequential modified LR test statistic (at 5% level)

The LM test for third and fifth order serial autocorrelation could not reject the null of no autocorrelation at 5% level with a Chi-squared statistic of 24.106 (0.087) and 23.84(0.09) for oil exporting and oil-importing categories respectively. Further more, White's heteroscedasticity test of the null of no-heteroscedasticity at the stated lag order has a Chi-squared statistic of 87.52 (0.102) for oil-importing countries and 82.68 (0.182) for oil-exporting countries.

Given the result that all the series under investigation are co-integrated, equations (36-38) are estimated using panel VAR estimation technique. The main interest of the whole exercise is to establish the causal linkages among the four variables (CAB, BB, IR and EXR). The empirical results of Granger causality tests for the two groups of countries are presented in Table-4 below.

Table 4:4. Panel VAR Granger Causality Results (Eviews-5 output)

Panel- A: Oil- Exporting Countries

	Δ CAB	Δ BB	Δ IR	Δ EXR
Dependent Variable	Wald(χ^2 statistics)			
CAB	-	1.530(0.675)	0.553(0.907)	0.328(0.954)
BB	0.862(0.834)	-	15.809(0.001)*	2.036(0.564)
IR	1.013(0.798)	6.065(0.107)	-	9.012(0.029)**
EXR	0.568(0.903)	25.357(0.000)*	5.811(0.121)	-



Panel: B. Oil-Importing Countries

CAB	-	4.884(0.298)	5.066(0.280)	9.629(0.041)**
BB	16.786(0.002)*	-	2.116(0.714)	11.461(0.021)**
IR	3.658(0.454)	6.160(0.187)	-	9.237(0.055)***
EXR	0.869(0.928)	17.307(.001)*	5.392(0.249)	-

Notes: *, ** & *** indicates significant at 1%, 5% & 10% level of significance respectively.

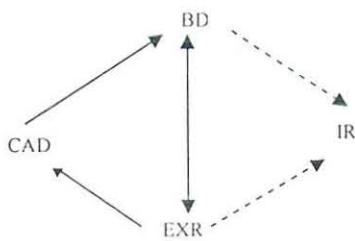
-Parenthesized values are the probability of rejection of Granger-non-causality.

-Estimations are based on the pooled data for 1980-2007 of 10 non-fuel and 5 fuel SSA countries with lags of five and three of first differenced explanatory variables respectively.

The empirical results portrayed in table 4-4 above suggest that the null hypothesis that budget deficit does not Granger-cause current account deficit can not be rejected at the 5 percent significance level for both categories of countries. On the other hand, the null hypothesis that current account deficit does not Granger-cause budget deficit is easily rejected at 1 percent significance level for oil-importing countries, but can not be rejected at 5 or 10 percent significance level for oil-exporting countries. This result suggests that the absence of any Granger causality for oil-exporting countries is in accordance with the Ricardian Equivalence Hypothesis. On the other hand, a unidirectional causal linkage that runs from current account deficit to budget deficit (What is termed by Summers (1988) as *current account targeting*) has been observed in oil-importing countries. As argued by researches such as Zubaidi et al (2003, 2005), this outcome occurs when the deterioration in current account leads to a slower pace of growth and hence an increase in the budget deficit. This result confirms the stated hypothesis that for heavily indebted countries (almost all sampled oil-importing countries in this case), a uni-directional causality running from current account to budget deficit is expected. This is mainly because large capital inflows due to debt accumulation and grants would cause the

domestic currency to appreciate that encourage imports and discourages exports leading to deterioration in the current account balance. Furthermore, as a result of the recent hike in oil prices, the share of fuel imports in the merchandise imports of oil importing African countries rose significantly leading to notable increases in the current account deficits and terms-of-trade losses. This deterioration will eventually lead to the worsening of fiscal balance.

It is evident from table 4-4 (panel. B) and Annex-3 that the causal linkage that runs from current account to budget deficits for oil-importing countries operates mainly through the exchange rate as depicted in figure 4.1 below.



Notes: \leftrightarrow indicates bi-directional causality.
 \rightarrow indicates uni-directional causality.
 \dashrightarrow indicates weak uni-directional causality.



Fig 4.1. Direction of causal relationship summarized from table.4 (panel-B) and Annex-3

Although several advantages of the panel based procedures exist especially in increasing power ability from the single equation counter parts and exploiting the cross-sectional variability among the sampled countries, the pool ability had to be interpreted with caution. In this study, this caution has been incorporated by estimating the relationship between the two deficits using country specific settings. This result (attached as Annex-4 and 5) suggested that six out of ten oil-importing countries and four out of five oil-exporting countries support the findings from the pooled data at 5% level of significance

4.4 Reduced form Consumption function Estimation Results

To see the validity of the restrictions imposed by the pure Keynesian view and the pure Equivalence view, equation (39) of Chapter-3 was estimated using a VEC specification estimation technique.

Table 4.5: Cointegration vector and restrictions on the long-run coefficients (Eviews-5 output)

Dependent variable: Per capita private consumption(C)

Panel A: Oil importing countries

	Y	BB	G	CAB	IR	Restriction	LR test
Basic regression	0.68 (18.75)	-0.25 (-0.5)	-0.009 (0.02)	-1.72 (1.99)	-0.059 (-1.0)		
Keynesian restriction	0.37	-0.37	-0.46	-1.84	-1.26	BB=Y	$\chi^2=327.77$ Prob.=0.000
Equivalence restriction	0.25	0	-0.06	-0.59	-0.24	BB=0	$\chi^2=14.63$ Prob.=0.000

Panel-B; Oil-exporting countries

	Y	BB	G	CAB	IR	Restriction	LR test
Basic regression	0.01 (0.37)	-1.06 (-3.0)	-0.02 (-0.9)	1.38 (1.24)	-1.22 (5.29)		
Keynesian restriction	0.03	-0.03	-0.05	1.62	-0.03	BB=Y	$\chi^2=1.018$ Prob.=0.312
Equivalence restriction	0.06	0	-0.09	1.59	-0.17	BB=0	$\chi^2=5.275$ Prob.=0.02

Notes: Values in parenthesis are t- statistics

The results in table 4.5 suggest that we can reject the null-hypothesis for both restrictions at 1% level of significance for Oil-importing countries. This finding is in line with the previous VAR Granger causality test results for the same group of countries. But with regard to Oil-exporting countries, we cannot reject the Keynesian restrictions. As documented in IMF's Africa Focus Bulletin (2008), for most oil-producing African countries, there is a rapid increase in government and private consumption fueled by rising oil revenues. This rise in consumption would lead to a rise in aggregate demand (domestic absorption) for those countries. This rise in demand in turn would lead to a rise in imports that causes a worsening of current account balances. This line of argument is in line with the above restriction test result for oil-exporting African countries. In this case causality runs from budget deficit to current account deficits.



CHAPTER FIVE

5. Conclusions and Recommendation

5.1 Conclusion

This paper empirically tested the "twin deficits" hypothesis for Sub-Saharan Africa countries using panel VAR Granger causality tests and a reduced-form consumption function. The following conclusions can be derived from the empirical evidence.

First, budget deficit, interest rate, exchange rate and current account are found to be co-integrated, suggesting that there exists an underlying equilibrium relationship linking all these macro-economic variables together.

Second, in oil-importing Sub-Saharan Africa countries, a causal linkage that runs from current account deficit to budget deficit has been found. This result is consistent with the hypothesized argument that for heavily indebted poor Sub-Saharan Africa countries an inflow of foreign capital and a continuing rise in oil prices would cause current account deficits which in turn leads to budget deficits. This is because foreign debt which means an inflow of foreign capital causes the domestic currency to appreciate that discourages export and encourages import. This phenomena, coupled with rising oil prices leads to a current account deficit for oil-importing countries.

Third, for oil-exporting Sub-Saharan Africa countries, the data show no evidence of causality between the two deficits which is in accordance with the Ricardian Equivalence Hypothesis.

Fourth, as depicted in figure 4.1, for oil-importing countries, exchange rate plays key role in bridging the two deficits. As shown from the figure, exchange rate does affect both deficits.

This may be because high commodity dependence that exposes African economies to terms-of-trade fluctuations and heavily indebtedness has a significant impact on the exchange rates in most Sub-Saharan Africa countries. For example, a study by an IMF group on African economic performance and its prospects for 2007 shows that in 2006, about 35 African currencies appreciated against the US dollar.

Fifth, the reduced form consumption function estimation result shows that for oil importing countries, we can reject both the pure equivalence restriction (that the government's financing decision does not affect private consumption) and the pure Keynesian restriction (that an increase/decrease in budget deficit by a certain value would cause per capital GDP to increase/decrease by the same amount) at 1% level of significance. This result strengthens the findings from Granger causality test that causality runs from current account deficit to budget deficit for the same group of countries. With regard to oil-exporting countries, the estimation result of the consumption function shows that while we can reject the equivalence restriction at 5% level of significance, we can not reject the Keynesian restriction at any relevant level of significance. Thus, for these groups of countries the evidence on the "twin deficits" phenomena is found to be inconclusive. This may be mainly due to greater heterogeneity in sampled oil-exporting countries. For example, oil-exploration and export is a recent phenomenon for Chad and Cote d'Ivoire. Moreover, the economy of Nigeria during the past few years was in a recession owing to successive cuts in Organization of Petroleum Exporting Countries(OPEC) quotas. Notwithstanding, for these group of countries, the empirical result point to a some what inconclusive outcome that deserves further research.



5.2 Policy Recommendations

The empirical model incorporates many of the arguments in the literature concerning the sources of movements of the two deficits. Despite some what inconclusive finding for oil-exporting countries, the results obtained from the data of oil-importing countries are appealing. This is because being highly commodity dependent and heavy external debt burden, most Sub-Saharan Africa countries run a current account deficit. Moreover, pressure from oil price threatens price stability and large deficits for oil-importing Sub-Saharan Africa countries. Although African countries do have different economic experience and environment which may reflect that economic policies would be country-specific and their success depends on the effectiveness of the institutions, the following general policy areas are recommended.

The statistical analysis particularly for oil-importing countries suggests that managing the current account deficit offers a scope for improvement in the budget deficits. This may be done by adopting such policies as export promotion and accelerating the external sector through diversification.

Adopting a prudent monetary and fiscal policy instruments to manage both fiscal and current account imbalances would accelerate economic growth and this helps to reduce the debt burden so that the economy can easily grow itself out of the debt problem.

For most Sub-Saharan Africa countries, as long as they can finance their deficits through aid and debt accumulation, they face no immediate crisis. However, this allows these economies to continue with the status quo rather than addressing the structural causes of the deficits such as internal conflicts, poor governance, rising oil prices and export supply constraints. Therefore,

African leaders and policy makers should focus on removing such impediments, which would provide a boost to long-term growth and development prospects.

Oil-importing African countries need to reduce their dependence on oil by making use of alternative sources of energy such as hydropower and adopting strategies to rationalize the use of oil as well as improving the efficiency of their energy systems.

Oil-exporting African countries need to have oil stabilization funds to reduce cyclicity of expenditures. In other words, efficient management of oil revenues for economic diversification is essential for these economies to reduce their vulnerability to oil price shocks and achieve sustainable growth.

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ANNEXES

Annex 1 - List of sampled countries and variation in key economic variables.

a. List of sampled countries

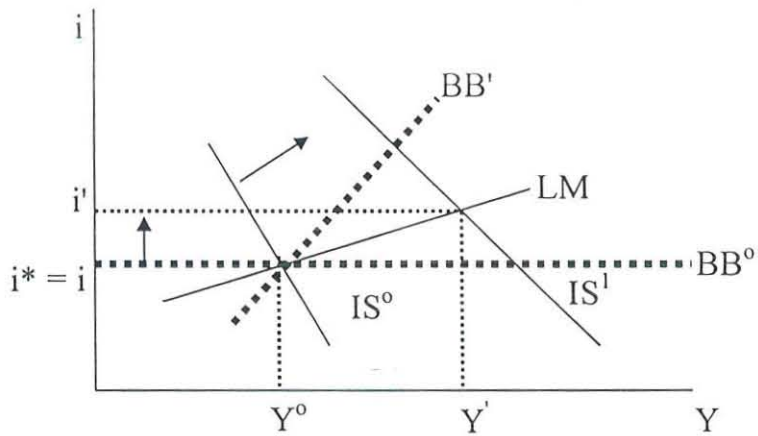
Fuel	Non Fuel
Cameroon	Burkina Faso
Chad	Burundi
Congo Republic of	Ethiopia
Cote d'ivoire	Kenya
Nigeria	Lesotho
	Madagascar
	Mauritius
	Sierra Leone
	Swaziland
	Uganda

b. variation in key economic variables.

Variable	Low deficit countries (CAD/GDP \geq -5%)	High deficit countries (CAD/GDP $<$ -5%)
Exports of goods & services/GDP (%)	33.26	29.47
Imports goods & services/GDP (%)	38.64	44.09
Trade balance/GDP (%)	-1.31	-8.34
Net current transfers/GDP (%)	6.18	5.86
Net factor income/GDP (%)	-0.14	-3.24
Gross capital formation/GDP (%)	19.41	21.26
Gross domestic savings/GDP (%)	33.23	7.73
Savings gap/GDP (%)	-6.17	-13.53
Remittances (Current US\$ million)	62.1	42.3
FDI/GDP (%)	1.36	2.37
Aid/GNI (%)	8.66	14.72
External debt/export of goods & Services (%)	307.56	493.58
External debt/GNI (%)	69.84	110.12
Debt service/export of goods & services (%)	15.04	18.67
Short term debt/total debt (%)	10.30	10.49
Fiscal balance	-1.30	-4.13
GDP growth rate (%)	3.54	3.19

Source: ECA, 2007

Annex 2 - Graphical illustration of the Mundell-Fleming model



Where i = domestic interest rate

i^* = world interest rate

Y = domestic income

IS = goods market equilibrium

LM = money market equilibrium

BB^0 = BOP equilibrium under perfect capital mobility

BB^1 = BOP equilibrium under limited capital mobility

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Annex - 3: Pair wise Granger Causality Tests (Oil importing countries)

Null Hypothesis	F-statistics	Probability
BB does not Granger Cause CAB	0.682	0.637
CAB does not Granger Cause BB	2.416	0.037**
IR does not Granger Cause CAB	1.072	0.376
CAB does not Granger Cause IR	0.862	0.507
EXR does not Granger Cause CAB	2.615	0.031**
CAB does not Granger Cause EXR	0.476	0.793
IR does not Granger Cause BB	0.586	0.710
BB does not Granger Cause IR	1.887	0.097***
EXR does not Granger Cause BB	2.241	0.051***
BB does not Granger Cause EXR	2.298	0.046**
EXR does not Granger Cause IR	2.001	0.079***
IR does not Granger Cause EXR	1.354	0.242

Pair wise Granger Causality Test (Oil Exporting Countries)

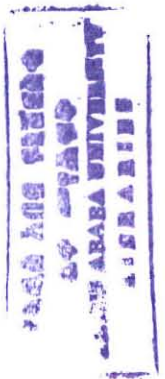
Null Hypothesis	F-statistics	Probability
BB does not Granger Cause CAB	0.522	0.667
CAB does not Granger Cause BB	0.646	0.586
IR does not Granger Cause CAB	0.178	0.910
CAB does not Granger Cause IR	0.449	0.717
EXR does not Granger Cause CAB	0.085	0.967
CAB does not Granger Cause EXR	0.430	0.731
IR does not Granger Cause BB	5.698	0.001*
BB does not Granger Cause IR	2.555	0.058***
EXR does not Granger Cause BB	0.457	0.712
BB does not Granger Cause EXR	7.859	0.000*
EXR does not Granger Cause IR	3.385	0.020**
IR does not Granger Cause EXR	0.967	0.410

Note: ‘*’, ‘**’, and ‘***’ shows rejection of the null hypothesis at 1%, 5% and 10% level of significance.



Annex - 4: Pair wise Granger Causality Tests for Individual Countries (Oil Importing)

Countries	Null Hypothesis	χ^2 Statistics	Probability	conclusion
Burkina Faso (k=5,d=1)	BB does not Granger Cause CAB	93.183	0.000	Reject Ho
	CAB does not Granger Cause BB	4.548	0.476	Accept Ho
Burundi (k=5,d=1)	BB does not Granger Cause CAB	19.185	0.001	Reject Ho
	CAB does not Granger Cause BB	14.655	0.011	Reject Ho
Ethiopia (k=5,d=1)	BB does not Granger Cause CAB	5.787	0.327	Accept Ho
	CAB does not Granger Cause BB	11.371	0.044	Reject Ho
Kenya (k=5,d=1)	BB does not Granger Cause CAB	2.691	0.747	Accept Ho
	CAB does not Granger Cause BB	1178.893	0.000	Reject Ho
Lesotho (k=5,d=1)	BB does not Granger Cause CAB	11.998	0.034	Reject Ho
	CAB does not Granger Cause BB	0.572	0.989	Accept Ho
Madagascar (k=5,d=1)	BB does not Granger Cause CAB	2.880	0.718	Accept Ho
	CAB does not Granger Cause BB	40.071	0.000	Reject Ho
Mauritius (k=5,d=1)	BB does not Granger Cause CAB	24.914	0.0001	Reject Ho
	CAB does not Granger Cause BB	3.835	0.573	Accept Ho
Sierra Leon (k=5,d=1)	BB does not Granger Cause CAB	8.674	0.122	Accept Ho
	CAB does not Granger Cause BB	3.304	0.050	Reject Ho
Swaziland (k=5,d=1)	BB does not Granger Cause CAB	23.488	0.060	Reject Ho
	CAB does not Granger Cause BB	116.450	0.000	Reject Ho
Uganda (k=5,d=1)	BB does not Granger Cause CAB	2.074	0.838	Accept Ho
	CAB does not Granger Cause BB	20.030	0.001	Reject Ho



Annex - 5: Pair wise Granger Causality Tests for Individual Countries (Oil Exporting)

Countries	Null Hypothesis	χ^2 -Statistics	Probability	conclusion
Cameroon (k=3,d=1)	BB does not Granger Cause CAB	0.264	0.876	Accept Ho
	CAB does not Granger Cause BB	0.460	0.794	Accept Ho
Chad (k=3,d=1)	BB does not Granger Cause CAB	0.120	0.941	Accept Ho
	CAB does not Granger Cause BB	5.180	0.081	Reject Ho
Congo Republic of (k=3,d=1)	BB does not Granger Cause CAB	5.032	0.099	Reject Ho
	CAB does not Granger Cause BB	2.563	0.277	Accept Ho
Nigeria (k=3,d=1)	BB does not Granger Cause CAB	1.969	0.373	Accept Ho
	CAB does not Granger Cause BB	5.116	0.077	Reject Ho
Coted'ivorie (k=3,d=1)	BB does not Granger Cause CAB	6.03	0.049	Reject Ho
	CAB does not Granger Cause BB	3.882	0.143	Accept Ho

Note: k=optimum lag length
d=maximum order of integration.



Declaration

I, the undersigned, declare that this thesis is my original work and has never been presented in any other university. All sources of materials used for this thesis are duly acknowledged.

Declared by:

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Place and Date of Submission:

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Faculty of Business and Economics

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