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By *ZENEBECH ADMASU*

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ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

THE DYNAMICS OF CURRENT ACCOUNT AND BUDGET DEFICITS THE CASE OF ETHIOPIA

BY

ZENEBECH ADMASU

JULY, 2010

ADDIS ABABA

ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

THE DYNAMICS OF CURRENT ACCOUNT AND BUDGET DEFICITS: THE CASE OF ETHIOPIA

A Thesis *S*ubmitted to *S*chool of *G*raduate *S*tudies of *A*ddis *A*baba *U*niversity in *P*artial *F*ulfillment of the *R*equirements *F*or the *D*egree of *M*aster of *S*cience in *E*conomics (*E*conomic *P*olicy *A*nalysis).

BY

ZENEBECH ADMASU

JULY, 2010
ADDIS ABABA

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SCHOOL OF GRADUATE STUDIES

"The Dynamics of Current Account and Budget Deficits: The Case of Ethiopia."

By

Zenebech Admasu Gebreamilack

Approved by the Board of Examiners:

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Advisor	Signature
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Examiner	Signature
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Examiner Signature

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Table of Contents

Page

Acknowledgement…….....i

Tables of content…….....ii

List of Tables …….....vi

List of Figures.....vii

List of Appendices.....vii

List of Acronyms…….....viii

Abstract…….....ix

1. Introduction.....1

1.1. Background.....1

1.2. Statement of the Problem.....4

1.3. Objective of the Study.....6

1.4. Significance of the Study.....6

1.5. Limitation of the Study.....7

1.6. Organization of the Study.....7

2. Theoretical and Empirical Literature.....8

2.1. Theoretical Literature.....8

2.1.1. The Twin Deficit Hypothesis.....8

2.1.2. The Conceptual Framework.....8

2.1.3. Saving , Investment and the Current Account.....13

2.1.4. The Government Budget and the Current Account....14
2.1.5. The Current Account and the Public Debt....15
2.1.6. The Mundell- Fleming Framework....17
2.1.7. The Ricardian Equivalence Hypothesis....18
2.2. Empirical Literature....19
2.2.1. Empirical Evidence from Developed Economies....20
2.2.2. Empirical Evidence from Developing Economies....21
3. Macroeconomic Overview of Ethiopian Economy....25
3.1. Introduction....25
3.2. Growth Performance....25
3.3. The Fiscal Stance....28
3.3.1. Government Revenue....28
3.3.2. Government Expenditure....30
3.3.3. Fiscal Balance....31
3.3.4. Deficit Financing....32
3.4. The Components of Current Account....33
3.4.1. Trade Balance....33
3.4.2. Current Account Balance....34
3.5. Money Supply....36
3.6. Investment and Saving....37
3.7. External Public Debt....38

4. Methodology.....40
4.1. Model Specification.....40
4.2. Data Sources.....42
4.3. The Econometric Model.....43
4.3.1. The Vector Auto Regression (VAR) Model.....43
4.3.2. Stationary and Non-Stationary Series.....44
4.3.3. Unit Root Tests.....45
4.4. Cointegration.....48
4.4.1. Engle-Granger Approach.....48
4.4.2. The Johansen Approach.....49
4.4.3. Cointegration and VECM.....49
4.5. VAR (Granger) Causality.....52
4.6. Dynamic Analysis of VAR.....54
4.6.1. Impulse Response Functions.....54
4.6.2. Forecast Error Variance Decomposition.....54
5. Model Estimation and Interpretation of Results.....55
5.1. Introduction.....55
5.2. Unit Root Test Results.....56
5.3. VAR Model Specification.....58
5.3.1. Optimal Lag Length.....58
5.3.2. Diagnostic Test.....59
5.3.3. Lag Exclusion Test.....60

5.4. Cointegration Analysis: the Johansen Approach....61
5.5. Weak Exogenity Test....64
5.6. Vector Error Correction Model....66
5.7. Granger Causality Test....69
5.8. Model Stability Test....72
5.9. Dynamic Analysis of VAR....73
5.9.1. Impulse Response Analysis....73
5.9.2. Variance Decomposition Analysis....76
6. Conclusion and Policy Implications....79
6.1. Conclusion....79
6.2. Policy Implications....81
References....82
Appendices....88
Declaration

List of Tables

Table 3.1: Percentage Distribution of GDP by Major Sector.....27

Table 3.2: Importance of Tax and non-Tax Revenue to Domestic Revenue.....28

Table 3.3: Sources of Deficit Financing as a Percentage of Deficit.....33

Table 3.4: The Evolution of Money Supply to GDP.....36

Table 3.5: Summary of External Public Debt.....38

Table 5.2 A: ADF Unit Root Test Results (for level variables).....55

Table 5.2 B: Phillips-Perron Unit Root Test Results (for level variables).....56

Table 5.2.C: ADF and PP Unit Root Tests Results (for first difference series).....57

Table 5.3.1: Statistic for VAR Lag Order Selection.....59

Table 5.3.2: VAR Residual Analysis.....60

Table 5.3.3: VAR Lag Exclusion Wald Tests.....60

Table 5.4A: Johansen Cointegration Test (Trace) Result.....61

Table 5.4B: Johansen Cointegration Test (Maximum Eigen value) Result.....62

Table 5.5: Weak Exogenity Test Result.....64

Table 5.6A: The Results of VEC Model Estimate.....68

Table 5.6B: Summary of Post-estimation Diagnostic Test Statistics.....69

Table 5.7: VEC Granger Causality Wald Test Results.....71

Table 5.8A: Variance Decomposition of Current Account Deficit.....77

Table 5.8B: Variance Decomposition of Budget Deficit.....78

List of Figures

Figure 3.1: Growth Rate of Agriculture and GDP.....26

Figure 3.2: Growth Rate of GDP by Major Economic Sector.....27

Figure 3.3: Components of Revenue as Share of GDP.....29

Figure 3.4: Trend in Recurrent and Capital Expenditure.....30

Figure 3.5: Budget Balance.....31

Figure 3.6: Trend in the Components of Current Account.....33

Figure 3.7: Component of External Sector as Percentage of GDP.....34

Figure 3.8: Trends of Current Account and Budget Deficits.....35

Figure 3.9: Gross Fixed Capital Formation and Domestic Saving.....37

Figure 5.1: Inverse Roots of AR Characteristic Polynomial.....73

Figure 5.2: The Impulse Response Functions.....74

List of Appendices

Appendix -1: Correlation Coefficients.....88

Appendix -2: Unrestricted Cointegrating and Adjustment Coefficients.....88

Appendix -3: Cointegrating Equation.....89

Appendix-4: Chow Breakpoint Test.....90

Appendix -5: Pair-wise Granger Causality Tests.....91

Appendix-6: Diagnostic Tests.....92

Appendix-7: VEC Stability Check.....96

List of Acronyms

ADF	Augmented Dickey-Fuller
AERC	African Economic Research Consortium
AfDB	African Development Bank
AIC	Akaike Information Criterion
AR	Auto Regressive
BOP	Balance of Payments
CSA	Central Statistical Agency
EEA	Ethiopian Economic Association
GDP	Gross Domestic Product
GNI	Gross National Income
FDI	Foreign Direct Investment
FY	Fiscal Year
HDR	Human Development Report
I (0)	Integrated of Order Zero
I (1)	Integrated of Order One
IMF	International Monetary Fund
MDRI	Multilateral Debt Relief Initiative
MoFED	Ministry of Finance and Economic Development
NBE	National Bank of Ethiopia
PP	Phillips-Perron
SAP	Structural Adjustment Program
SC	Schwartz Criterion
UNDP	United Nation Development Program
VAR	Vector Auto Regressive
VECM	Vector Error Correction Model
WB	World Bank
WDI	World Development Indicator

Abstract

Analysts and politicians have shown concern over the state of macroeconomic imbalances. They consider the growing fiscal and current account imbalances have been the cause of macroeconomic imbalances which could affect the long term economic progress of a country. Here, the dynamics, causality and long run relationship between the current account and budget deficits along with other key macroeconomic variables are investigated; in a small open economy, Ethiopia. It adopts a VAR based Granger-causality tests, impulse response functions and variance decompositions analysis using annual data for the period of 1970/71 to 2008/09.

It has found evidence that suggests the consequences of a large budget deficit on current account deficit become noticeable only in the short run while the effect of persistent current account deficit on budget deficit is far and wide. It follow that policies aiming at reducing the budget deficit could only solve the current account deficit in the short run whereas reducing current account (trade) deficit sustainably may help reducing the budget deficit and hence restoring macroeconomic balances. Therefore, policy makers should give more emphasis to reduce the external deficit. This requires implementing prudent monetary and fiscal policy. In addition, policies must be put in place to increase the capacity, efficiencies and competitiveness of domestic industries in the export sector as well as policies that aimed at broadening the export base to benefit from trade liberalization policies.

1. Introduction

1.1. Background

The issue of budget deficits and current account imbalances has attracted a serious attention from academics and policy-makers in both developed and developing countries. It started in 1980's and still the subject of much debate and controversy. In attempts to study the current account imbalances numerous researchers have explored the possible link between budget deficit and current account deficit. An example is the so-called 'twin deficits hypotheses'.

On the other hand, it is a recent past that many developing countries have embarked on major structural reforms[1] in order to reduce public sector deficit, eliminate unsustainable external deficits, reduce inflation and create a stable macroeconomic environment conducive to growth (Olugbenga and Oluwole, 2006). Despite the reforms, trade and fiscal balance remain in deficit in many developing countries, including Ethiopia.

Budget deficit in developing countries can be attributed to many factors. Primarily, low government revenue results from low level of development, narrow tax base, and large size of the informal sector. Further, taxation systems in these countries remain highly inefficient owing to

[1] Structural adjustment policies were most effective in countries with an institutional framework that allowed these policies to be implemented easily. For some countries, particularly in Sub-Saharan Africa, economic growth regressed and inflation worsened. By the late 1980s, international organizations began to admit that structural adjustment policies were worsening life for the world's poor. In 1999, the World Bank and the IMF introduced the Poverty Reduction Strategy Paper approach to replace structural adjustment loans (WDI, 2009).

severe administrative and sometimes political constraints on the ability of tax authorities to collect revenue which led to a high degree of reliance on monetary financing, seigniorage[2] revenue (Agénor, 2006).

In order to achieve fast growth, governments in these countries may also end up running fiscal deficit. They undertake activities that are potentially growth promoting. These include: the construction of essential infrastructure and services like roads, electricity, and telephones; the provision of education and public health facilities; maintenance of Law and order; the development of irrigation; and agricultural research and extension services (Krueger and Orsmond, 1990). Given that governments in such countries have limited capacity to finance these activities, they usually opt for deficit financing methods. The ways of financing deficit can be from various sources which include: issuing debt in the country and abroad, through the banking system (deficit monetization) as well as through privatization proceeds.

Economic theories argue that large budget deficits tend to have harmful effects on many macroeconomic variables such as saving, interest rates, investments, inflation, and trade balance. In fact, the effect on these variables depend on the way(s) how deficit has been financed. First, massive budget deficits may result in high interest rates as government attempt to finance deficits through issuing domestic debt. Eventually, high interest rates discourage (crowding–out) private investment since the government's demand for funds conflict with private financing requirements. Second, if deficit is monetized (financed through money creation), it may prove to be inflationary. Inflationary pressure may in turn lessen the international competitiveness of the nation's export as inflation raises the relative price of domestically produced products.

[2] Seigniorage consists of inflation tax:-the reduction in the purchasing power of private holding of cash money balance due to inflation. It consists of the amount of the real amount of resource extracted by the government by means of base money creation (Agénor, 2006).

Alternatively, if budget deficit is financed through issuing external debt, it results accumulation of debt. As debt stock enlarges which scares off potential lenders and investors and create further burden on the performance of economy. That is, a 'debt overhang' effect. Moreover, servicing of external debt creates further problem. First, it erodes foreign exchange reserves which might otherwise be available for purchase of imports (import compression effect). Second, it puts fiscal pressure and creates a second round effect on budget deficit (Clements et al., 2005).

In addition to budget deficit, there is a growing concern among developing countries about the potential adverse impact of persistent current account deficit. The current account balance could be a reflection of the stance of macroeconomic policies, a source of information about the behavior of economic agents and their environment.

Persistent current account deficit is owing to the structural problems inherent in many developing countries principally the poor performance of exports to finance the growing import bills. Further, unstable export market, deteriorating terms of trade, unpredictable export demand, concentration on primary and agricultural exports; as well as fast growing demand for imports and the concomitant need for foreign exchanges.

Apparently, such problem is worse for oil importing developing countries like Ethiopia. In fact, Ethiopia is highly vulnerable to the rise in the world oil prices. For instance, oil imports on one year basis (as of 2007/08) were equivalent to 5.5 percent of its GDP and its foreign exchange reserves were too low and just 1.5 months of imports (IMF Country Report, 2008). Hence, the surge of world oil prices is also placing further strain on Ethiopian's balance of payment.

1.2. Statement of the Problem

Analysts and politicians have shown concern over the state of macroeconomic imbalances. They consider the growing fiscal and current account imbalances have been the cause of macroeconomic imbalances which could affect the long term economic progress of a country. Despite the growing concern, such imbalances remain unchecked in developing countries like Ethiopia.

The Ethiopian economy has performed strongly in recent years. Growth has averaged 11.2 percent per annum over last five years (MoFED, 2009). Despite a record run of good growth, macroeconomic imbalances are intensifying. Macroeconomic imbalances are manifested as economy's internal and external balances remain in deficit, international reserves are eroded, inflationary pressures are intensified and level of indebtedness is still distressing. Moreover, growth is threatened by high world oil prices which partly responsible for the widening budget and current account deficits (AfDB, 2007). Unless these imbalances are firmly addressed, it would threaten the sustainability of economic growth.

Persistent internal and external deficits render the country to be highly reliant on foreign aid. The increased indebtedness is also another source of economic uncertainty which has negative consequences for economic growth. Moreover, the economy becomes highly vulnerable to external shocks. Indeed, following the recently intensified global economic downturn, the planned growth path has been exposed to considerable risks and uncertainties. For instance, considering the 2008 price shocks of fuel, fertilizer, and cereals that considerably weakened Ethiopia's international reserves position and contributed to inflationary pressure (IMF: African Department, 2009).

Apparently, issues relating to deficits have important policy implications on the economic performance of a country. Large and persistent current account and budget deficits are troublesome exhibits unhealthy economic performance of a country that could necessitate some kind of policy responses. Hence, to promote the planned targets of economic growth, macroeconomic stability, and attaining a reasonable internal and external imbalance; a prudent combination and coordination of fiscal, monetary, and exchange rate policies are crucial. Thus, understanding the dynamics, causality and long run relationship between the two deficits along with other macroeconomic variables are essential and are a major concern that would help policy responses mitigating the possible harms in a harmonized manner.

Therefore, this study will differ from the existing literature in the following ways. First, it uniquely examine the twin deficits hypothesis in the presence of money supply, income (GDP), external public debt, and openness using Vector Auto Regressive (VAR) model for Ethiopia's data that covers from 1970/71 to 2008/09. Second, the study is not only different in its data set but also in using the recent innovation accounting techniques (impulse response functions and variance decompositions analyses) to investigate causality and to trace the effect of shock(s) in the system. Thus, this study tries to address the following research questions:

1. Does persistent budget deficit contribute to the current account deficit? Or vice versa?
2. What role is played by macroeconomic variables in budget-current account deficit nexus?
3. What response of a variable for its own shock vis-à-vis shocks arising from other variables in the system?

1.3. Objective of the Study

The main objective of the study is to examine the dynamics, causality and long run relationship between the current account and budget deficits; and contribute further on the twin deficit debate in a highly indebted developing economy, Ethiopia. Specifically, it focuses on the following:

i. To determine the direction of causality among variables,
ii. To analyze the relationships of variables in budget-current account deficit nexus,
iii. To assess the response of model variables to shock(s) in the system, and
iv. To provide strategies to stabilize budget and current account deficits.

1.4. Significance of the Study

This study contributes to the existing literature in the following ways: First, the study act as a case study in the twin deficit debate using Ethiopian data that integrate time periods from 1970/71-2008/09. This enables to have a look over the economic policy stances of different regimes and the subsequent impacts on internal and external balances. Second, the issues relating the two deficits have important policy implications on economic performance of the country in designing an appropriate policy mix; hence the essence of problems has to be examined thoroughly. Third, examining the twin deficit hypothesis in multivariate framework where addressing the issues of debt on the imbalance help to develop more concrete policy measures to tackle such imbalances otherwise policy responses could be biased and misleading. Further, understanding the adjustment process is quite helpful in evaluating policy changes and responses that likely to lead to improved predictions that can benefit the policy makers and economic agents in employing scarce resources. Finally, the study is keen to provide strategies to stabilize the budget and current account deficits.

1.5. Limitation of the Study

National data are not without problems. Data inconsistencies were very common for same variable in different institution and even by different departments of same institution made difficult which figure to take. However, by sticking to a specific institution/department for a specific variable helped the consistency of data. Moreover, more would have been learned if quarterly data were available for variables and if it were possible to find data on private saving-investment gap.

1.6. Organization of the Study

This paper is organized in six chapters. Following the introductory chapter, chapter two provides important theoretical and empirical literatures on related topics. Chapter three presents the macroeconomic overview of the Ethiopian economy over the study period. Chapter four take parts in discussing the methodology and chapter five devotes to estimation of the model and interpretation of the results. Finally, chapter six concludes and provides important policy implications.

2. Theoretical and Empirical Literature

2.1. Theoretical Literature

2.1.1. The Twin Deficit Hypothesis

An economy is deemed to have a double deficit also known as a twin deficit if it has a current account deficit and a fiscal deficit. The twin deficit hypothesis is a concept from macroeconomics that contends there is a strong link between a national economy's current account balance and its government budget balance. It asserts that an increase in budget deficit will cause a similar increase in current account deficit. In effect, the economy is borrowing from foreigners in exchange for foreign made goods.

Historically, the 'twin deficits hypothesis' arose during the "Reagan fiscal experiment" in the 1980s. It marked a period of strong appreciation of the dollar with a significant deterioration in the U.S. current account balance that accompanied by a sharp rise in the federal budget deficit (Bartolini and Lahiri, 2006:Lau and Tang, 2009).

2.1.2. The Conceptual Framework

The conceptual understanding of the twin deficits hypothesis is mathematically built from the commonly documented national income identity which provides the basis of the relationship between budget deficit and current account (trade) deficit. The model starts with the national income identity for an open economy that can be represented as:

$Y = C + I + G + (X-M)$ ……..... [2.1]

Where Y= Gross Domestic Product (GDP),

C = Consumption,

I = Investment,

G =Government Expenditure,

X = Export and M = Import.

Alternatively, $Y = C + S + T$ ……..... [2.2]

Where S is savings, T is tax revenue for government.

Since $Y = C + I + G + (X-M)$, and $Y = C + S + T$, then

$C + I + G + (X-M) = C + S + T$, which simplifies to

$(X - M) = (S - I) + (T - G)$ ……..... [2.3]

The balance of trade, defined by (X-M) is what is generally referred to as the current account balance (CAB). Here, X-M represents current account deficit if it is negative and surplus if it is positive. By definition, the current account balance, hereafter CAB, is equal to the value of trade balance, X-M, plus net factor income and transfers. Thus, equation [2.3] can be rewritten as:

$CAB = (I-S) + (G-T)$ ……..... [2.4]

Equation [2.4] informs that the current account balance (deficit) is the sum of excess investment over saving and the fiscal deficit in a given time. If $T > G$ indicates budget surplus (BS). But for

the case T < G, the Government budget is in deficits (BD). The balance budget occurred when T=G. Equation [2.4] states any current account imbalance is attributable to either private savings–investment imbalance and/or fiscal imbalance. If private saving and investment are broadly in balance, equation [2.4] indicates that a budget and trade/current account deficit will be found together. However, which way causality runs cannot be determined from this equation since strictly speaking; it is an identity (MacDonald, 2000).

From an accounting perspective, holding investment and private saving constant, a deterioration of the fiscal position (an increase in the budget deficit) worsens the external balance. In that case equation [2.4] represents the twin deficit hypothesis. From an economic perspective, however, private saving and investment will adjust in response to changes in the fiscal stance. There are different mechanisms through which the private sector may partially offset the consequences of a loose fiscal policy on the external account. First, private savings will typically increase in response to fiscal shocks raising public debt, as a higher debt generates expectations of higher taxes in the future. The strength of this mechanism depends on the extent to which households internalize the government's intertemporal budget constraint (a point stressed by proponents of Ricardian Equivalence). Second, to the extent that a loosening of fiscal policy raises interest rates, a fall in public saving may crowd out investment. However, it is usually thought that these mechanisms cannot 'undo' the negative impact of budget deficit on the external account (Corsetti and Müller, 2006).

Again, upon rearranging the national income identity Y= C + I + G + (X-M) it could be written as: (X-M) = Y - C - G - I and defining national saving, S is the national income after subtracting the spending on goods and services by private (C) and public (G) sectors [S= Y - C - G].

Thus, the external account has to equal the difference of national savings and investment as:

$(X- M) = S - I$ ……..……..[2.5]

This relation implies that the current account balance is directly related to saving and investment in the economy. Therefore, policies supporting investment have a negative impact on the current account, while policy measures reducing private or public consumption have a positive impact on the current account, because they increase national savings (Fidrmuc, 2002).

Further insights for policy implications are given by separating public from private savings. Total saving in an economy has three components: the amount saved by private sector, the amount saved by the public sector, and the amount saved by foreigners and invested in the national economy. Private saving (S_p) is the difference between disposable income (income less taxes) and consumption (S_p=Y- T- C). Public savings is the difference between tax revenues and government spending (S_g= T- G). Foreign savings is the amount of extra imports in the national economy can buy above the value of the exports sold abroad (S_f=M-X), which is approximately the negative of the current account balance. Therefore, starting from saving investment equality and substitute the identities one can land up an identity that relate the two deficits:

$I = S = S_p + S_g + S_f = (Y- T- C) + (T-G) + (M-X)$ and this could be rewritten as:

$(X-M)= S_p + (T-G) - I$ ……..... [2.6]

Thus, the twin deficits hypothesis can be expressed as:

$CAB = S_P + (T-G) –I$……..... [2.7]

After changing sign, we can rewrite equation [2.7] as:

Current Account Deficit = Investment – Private Saving + Budget Deficit.

A current account deficit implies that a country accumulates external liabilities as it finances its deficit with foreign credit in the form of external debt, aid, foreign direct investment (FDI), portfolio investment and other forms of capital flows, which make up the capital and financial account of the balance of payments equation (Osakwe and Verick, 2007). Thus, it is important to keep in mind that the external account has to equal the capital and financial account;

$X_t - M_t = B_{t+1} - B_t$ ..... [2.8]

Where, the capital and financial account is given as the change of an economy's net foreign assets, B. Thus, countries may accumulate foreign assets or sell domestic assets to foreigners. Therefore, countries which experience large inflows of foreign capital (including FDI) necessarily face a negative current account of the same size if we ignore the changes in foreign exchange reserves. It follows that the accumulated current account deficits are equal to external debt associated with a particular period T.

$\sum^{T}_{i=1}(X_t - M_t) = \sum^{T}_{i=1}(B_{t+1} - B_t)$……..... [2.9]

Thus, it is true that the accumulated debt generates a continuous flow of interest payments to creditors and possibly a repayment of debt or debt rescheduling at some later point. Therefore, export surpluses from debtor country are required to meet these obligations. In fact, the issue of current account sustainability is not a concern only at a particular point in time; rather, the whole trajectory of the current account has to be considered (Fidrmuc, 2002). Therefore, it is pretty much important to differentiate between investment induced and consumption induced current

account deficits. If the government uses the proceeds from borrowing to invest on sectors that can increase the productive capacity of the economy (that can build or boost the capacity of the export sector), it could able to repay long term external liabilities.

$(X - M) - R_f = (S - I) + (T - G)$ ……..... [2.10]

Where R_f is the payment of interest on external debt. For a net indebtedness not to increase trade surplus should increase or it requires a positive net saving.

2.1.3. Saving, Investment and the Current Account

Unlike closed economy, in an open economy a nation's residents trade goods and financial assets with residents in other economies. Therefore, it is no longer true that a nation's saving must always equal the investment at home and it is possible for a nation to invest more than it saves through borrowing from rest of the world and thereby accumulate net liabilities. It is seems imperative to have a look at nation's balance of payment.

In a nation's balance of payment, trade flows and financial flows are two sides of each transaction. BOP = current account + capital/financial account; a current account deficit must be offset by inflows under the capital and financial account. Thus, current account imbalances have their counterpart an accumulation or decumulation of net international assets. An increase in the country's net foreign asset is called a capital outflow; a decrease in net foreign asset is called a capital inflow. In principle, double entry bookkeeping ensures that a current account deficit (surplus) is matched by an equivalent capital account surplus (deficit) (Sachs and Larrain, 1993).

Countries run current account deficits when they spend or absorb more than they earn (absorption is greater than income) or when it "invests in excess of its own saving. It requires them either to run down its holdings of foreign asset or to increase its foreign indebtedness (Gibsonn, 1995).

When economists want to complain about a current account deficit, they tend to say that the country is living beyond its means; when they want to defend a current account deficit, on the other hand, they say that the country's investment climate is highly favorable (causing investment in excess of national saving).

It is also important to mention that current account deficit by itself is neither a bad thing nor a good thing. The appropriateness of the current account position must be evaluated in terms of the intertemporal prospects facing an economy (Sachs and Larrain, 1993). If the economy runs a current account deficit today, its residents are increasing of their net debt to the rest of the world. Eventually, the country will have to cut back on domestic consumption in order to pay interest on the accumulated debt. As domestic consumption is cut back, national output that used for consumption is increasingly used for net export which is a method of paying the interest debt burden on liabilities while running current account deficit.

2.1.4. The Government Budget and Current Account

The public sector has already integrated to the current account through national income accounting under the conceptual framework above. Though government saving and investment policy is as a part of overall fiscal policy, the role of a government in the economy is far beyond fiscal policy, includes monetary and exchange rate policies.

Many, though not all, aspects of fiscal policy are determined by the government budget which establishes public income and outlays in a particular period. The difference between government outlays and revenues determine is the budget deficit or surplus which in turn determines the amount of borrowing or lending of the public sector (Sachs and Larrain, 1993).

The government has options of reducing the budget deficit by curtailing its expenditure or by raising taxes so as to generate more revenue or pursuing both options simultaneously. However, reducing government expenditure is not an easy task since government expenditure is generally considered as the engine of growth in developing countries. Governments in these countries undertake activities that are potentially growth promoting. These include: the construction of essential infrastructure services such as roads, electricity, and telephones; the provision of education and public health facilities; maintenance of Law and order; the development of irrigation; and agricultural research and extension services (Krueger and Orsmond, 1990). There is also limited scope for increased tax revenue due to the low level of development, together with the large size of the informal sector that is exceedingly difficult to tax. As a result, there is heavy reliance on bank credit to finance budget deficits (Egwaikhide et al., 2002).

2.1.5. The Current Account and Public Debt

The current account shows the direction and size of international borrowing. As long as a country runs a current account deficit (when it imports more than it exports), it must borrow (capital inflow) to cover that deficit by increasing its net foreign debt, or run down its foreign exchange reserves. However, large inflow of capital or debt accumulations affects the budgetary stance of a country and ultimately will lead to budget deficit. Besides, the accumulation of net foreign debt which creates a burden for the future generation and a debt overhang for the economy. Debt overhang creates further restraint for the performance of the economy unless the country finds ways to build up its reserve and be able to service its debt sustainably. It also depresses growth by undermining the confidence of investors and increase uncertainty about actions that the government might take to meet its onerous debt servicing obligations.

As the stock of public sector debt rises, investors may wary that the government will finance its debt-service obligations through distortionary measures, such as rapidly increasing the money supply and the associated inflation. Amid such uncertainty, wary would be private investors tend to remain on the sidelines and even when they do invest, they are more likely to opt for projects with quick returns rather than for projects that enhance growth on a sustainable basis over the long run (Clements et al., 2005).

Alternatively, when the governments increase their debts, local investors anticipate that the government will impose future taxes on their assets to finance the growing budget deficit; expectations about future taxes plus the increased riskiness of holding domestic assets in face of uncertain government led capital flight[3]. Moreover, debt overhang may also discourage efforts by the government to carry out structural and fiscal reforms that could strengthen the country's economic growth and fiscal position, because a government whose financial position is improving almost inevitably finds itself under increasing pressure to repay foreign creditors. This disincentive to reform would exist in any country with a heavy external debt burden, but it is of special concern in low income countries, where structural reforms are essential to sustain higher growth (IMF working paper No.03/249, 2003).

However, at low level of debt additional foreign borrowing could stimulate growth, to the extent that the additional capital financed by this new borrowing enhances the country's productive capacity. Higher external interest payment can increase a country's budget deficit, thereby reducing public savings. It also inhibits growth by squeezing the public resources available for investment in infrastructure and human capital (Clements et al., 2005).

[3] See more in Rivera-Batiz and Rivera-Batiz, 1994.

It is not always true that government expenditure promote growth in developing countries. Government activities like the construction of parastatal enterprises to undertake manufacturing activities, usually at very high costs; the monopolization of economic activities such as agricultural distribution by the public sector with gross inefficiencies in the delivery of inputs and the collection of outputs; price controls over economic activities; regulation of private investments through licensing; maintenance of overvalued exchange rates and import licensing regimes with strong disincentives for exports and consequent "foreign exchange shortage". It also regulating the financial system in ways such that real interest rates paid by those receiving funds are strongly negative while many other producers are precluded from borrowing channels (Krueger and Orsmond, 1990).

2.1.6. The Mundell-Fleming Framework

The theoretical explanation for the twin deficit hypothesis can be found in the well known Mundell-Fleming framework. According to this framework, an increase in budget deficit, in small open economy, would cause an increase in aggregate demand which results an upward pressure on domestic interest rates above the world rate. This pressure induces capital inflows and the subsequent appreciation of domestic currency if the case is flexible exchange rate system or rising prices under a fixed exchange rate system. Eventually, all this have an adverse effect on the current account balances.

Given that the public considered the government bond that issued to finance the deficit as increasing their wealth, private saving remains unaffected. The response of domestic investment and current account deficit significantly depends on the degree of capital mobility. In the case of high capital mobility, domestic interest rate is less responsive to the fiscal shocks. Hence, there is

no crowding-out effect on domestic investment since foreign capital will quickly offset the fall in domestic investment. However, large inflow of capital or debt accumulations affects the budgetary stance of a country and ultimately will lead to budget deficit.

Therefore, the Mundell-Fleming framework predicts a positive relationship between the two deficits. In addition to this, there is the Keynesian absorption approach[4]. According to Keynesian approach, an increase in budget deficit would increase domestic absorption and thus imports and the expansion of imports leads to the worsening of the trade (current account) balance. Hence, like the Mundell-Fleming model, the Keynesian absorption approach suggests that there exist a unidirectional causality that runs from budget deficit to current account deficit.

2.1.7. The Ricardian Equivalence

The more controversial and probably least accepted view is the Ricardian Equivalence Hypothesis, initially developed by Ricardo (Buchanan, 1976). In his articulation of the "equivalence theory", classical economist, David Ricardo (1817) suggests that government budget deficits should not alter capital formation and economic growth or the level of aggregate demand including demand for imports due to the fact that far-sighted individuals fully capitalize the implied future tax liabilities associated with budget deficits. Thus, fiscal measures designed to influence aggregate demand will prove fruitless as individuals reduce consumption in anticipation of future tax liabilities.

[4] The original formation of the absorption approach is found in Alexander (1952). It states that a country's trade balance will improve if its output of goods and services increases by more than its "absorption"—the expenditure by domestic residents of goods and services.

According to this hypothesis, an intertemporal shift between taxes and budget deficits does not matter for the real interest rate, the quantity of investment or the current account balance. In fact, neither a crowding out effect of domestic investment nor a trade deficit necessarily emerges from a budget deficit. Hence, there is no Granger causality relationship between the two deficits. Meanwhile, the empirical evidence found in Enders and Lee (1990), Evans and Hasan (1994), among others are proponents of Ricardian Equivalence Hypothesis. Blanchard (1985) has rejected the Ricardian argument by showing that utility maximizing tax-payers would behave differently under a finite horizon as opposed to an infinite horizon as assumed by Ricardo. Blanchard suggested a positive correlation between sustained budget deficits and a country's external debt.

2.2. Empirical Literature

There is neither general consensus nor consistent evidence regarding the relationship between budget deficits and current account imbalances; it remains a great concern among academician and policy-makers. Indeed, testing the twin deficit hypothesis turned out different for different countries. Moreover, the results differ even in case of using different econometric technique and model specification for same country (Muktar et al., 2007).

Literature on the underlying association of the two deficits documented four competing scenarios. These are (1) budget deficit cause trade deficit (the twin deficit hypothesis), (2) a reverse causality that trade deficit cause budget deficits (current account targeting), (3) there is bi-directional causality between the two variables, the causality between the two variables run in both directions, and (4) the two deficits are independent (are not causally related at all).

The first linkage is the Keynesian (conventional) proposition often associated with the Mundell-Fleming model. It argues that there exists a positive relationship between the two deficits and that causality runs from the budget deficit to the trade deficit. In the context of this model, an increase in budget deficit would cause an increase in domestic interest rate above the world rate, with capital inflows and appreciation of the domestic currency as effects. These effects, in turn, result in an increase in trade (current account) deficit.

The second scenario is the reverse unidirectional causality that runs from current account deficit to budget deficit. This outcome occurs when the deterioration in current account leads to a slower pace of economic growth and hence increases the budget deficit. This is especially true for a small open developing economy that highly depends on foreign capital inflows (for example, foreign direct investment) to finance their economic developments. In other words, large inflow of capital or debt accumulations affects the budgetary stance of a country and ultimately leads to budget deficit. This reverse causation is designated by current account targeting in the terminology of Summers (1988) and suggests that external adjustments may be sought through budget (fiscal) policy (Arize and Malindretos, 2008).

2.2.1. Empirical Evidence from Developed Economies

Keynes was the pioneer in talking about the relationship between budget deficit and trade deficit. However, deficits became a question later in 1980s with the increase of both deficits in the USA. Indeed, it became a concern in many European countries a decade later (Celik and Deniz, 2007).

In meantime, empirical literature gave some insight on the behavioral relationship between fiscal and trade deficits. Bartlett (1999) in his investigation on the relationship of the twin deficit using

US data he concludes that the relationship between the two deficits is not consistent overtime. The evidence presented by Bartlett suggests that during the 1980s, the budget deficit and the current account deficit moved together. However, he discovered that during the 1990s, the two deficits moved in opposite direction. Others like Darrat (1988) also documented the relationships and causes of deficits. He employed the Granger causality test using quarterly data drawn for the US for the period of 1960:1 to 1984:4 and found that the movement in the dollar exchange rate was the most powerful factor causing changes in trade deficits. Similarly, 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. Further, Enders and Lee (1990) also observed the relationship of the two deficits using vector auto regression (VAR) for the US quarterly data by including variables like, real government spending, real public debt, for real consumption, current account, real interest rate, and the exchange rate. They found evidence that support Ricardian Equivalence Hypothesis that budget deficit do not affect current account deficit.

On the other hand, Abell (1990) employed a vector auto regression (VAR) for first differenced monthly data on seven macroeconomic variables include: inflation rate, nominal narrow money supply (M1), budget deficit, gross domestic product (GDP), interest rate, weighted exchange rate, and the merchandise trade balance. He found that budget deficit influences the trade deficit indirectly via interest rate to capital inflows and exchange rate appreciation.

2.2.2. Empirical Evidence from Developing Economies

The twin deficit hypothesis has been well examined in developed economies. However, relatively less is so far examined in developing economies where persistent deficit is very common. Anoruo and Ramchander (1998) examined the twin deficits issue in five developing countries includes

India, Indonesia, Korea, Malaysia and Philippines. They documented a unidirectional Granger causal link that run from current account to budget deficits for four of sample countries, except for Malaysia where a bi-directional causality is documented. Moreover, Baharumsha et al.(2004), examined data for Indonesia, Malaysia, the Philippines and Thailand (ASEAN-4 countries), and found a unidirectional relationship which runs from budget deficit to current account deficit for Thailand, reverse causation for Indonesia while a bidirectional causality for Malaysia and the Philippines. Similarly, Muktar et al. (2007) using Turkish data, and Pahlavani and Salehn (2009) for cases of Philippines, they found bi- directional causality between budget deficits and current account deficits. Similar result was found by Lau and Baharumshah (2004) for Malaysia. Hence, these finding casts doubt on the validity of the use of single equation approach to analyze the twin deficit hypothesis.

On the other hand, Chowdhury and Saleh (2007) examined the long-run and short run relationships between the current account deficit, budget deficit, savings and investment gap and trade openness in Sri Lanka using the autoregressive distributive lagged (ARDL) approach. They found evidence that supports the Keynesian view that a link exists between the current account, budget deficit and savings and investment gap. Similarly, Baharumshah and Lau (2007) for Thailand found evidence that support the twin deficits hypothesis.

In a recent study, Hakro (2009) using vector autoregressive model demonstrate the causality link of deficits in Pakistan and found that causality link flowing from budget deficits to prices to interest rate to capital flows to exchange rates and then to trade deficits.

A few studies on Africa also added some evidence on the twin deficit debate. To mention few, Egwaikhide et al. (2002) employing ordinary least square regression (OLS) regression for a

sample of African countries, they found for Benin, Burkina Faso, Ghana, Nigeria and South Africa, unidirectional causality exists from the budget deficit to the current account deficit. The reverse is however the case for Kenya, Mauritania, Niger, Senegal and Sierra-Leone. In addition, they discovered evidence of bilateral causality in Togo while from Cameroon, Cote d'Ivoire, Gambia, Guinea-Bissau and Mali found a result that suggest independence of the two deficits.

On the other hand, Olugbenga and Oluwole (2006) investigated the temporal causal relationship between trade and budget deficit for Nigeria, an oil exporting developing country, by employing a multivariate cointegration analysis, Granger-causality tests and impulse response innovation accounting technique. They found a unidirectional causality runs from trade deficits to budget deficits, contrary to the conventional proposition of the twin deficit hypothesis which states budget deficits cause trade deficits. Whereas, Abebe (2008) examined the link between current account and budget deficit using panel vector autoregressive approach for 15 Sub-Saharan countries. For oil importing Sub-Saharan countries, he found evidence that support the twin deficit hypothesis while for oil exporting he found no evidence. Further, Arize and Malindretos (2008) examined cases of Africa and they found evidence that suggest the existence of a positive long-run relationship between the trade deficit and the budget deficit; however, in the short run, they found weak evidence that these deficits are closely linked and that the budget deficit causes trade deficit.

Though deficits are chronic and persistent, studies that investigate cases of Ethiopia are very scant, except by Mulu (1999) for the study period lasted from 1970-1995. He concentrated on the effect of budget deficit on current account using Rodriguez's model to formulate the current account function. The two stage least square regression result showed that more than half of the changes in the budget deficit were found to spillover to the same direction in current account

deficit. He showed that budget deficit has a strong and significant effect on current account deficit both in the short run and in the long run and concludes that fiscal adjustment should be taken as a prerequisite for current account imbalance. However, he did Granger causality test in bivarate setting-only including lags of current account and budget deficits.

Later, Gebreegziabher (2003) on his studies on the determinant of current account for the study period from 1961/62 to 1999/00, he included variables include: current account to GDP ratio, budget balance to GDP ratio, broad money to GDP ratio, young dependency ratio, relative income, terms of trade, ratio of capital account to GDP, trend and dummy variables as a determinant while fitting current account function. He built his model based up on the works of Debelle and Faruqee (1966), Calderon et al. (1999) and Chinn and Prasad (2000). He found the positive coefficient for budget balance and statistically significant both in the long run and in the short run, among other variables he included. Further, Mehret (2006) on same issue and adopting same approach as Gebreegziabher but included more explanatory variable. These additional variables include: real exchange rate, black market premium, foreign capital inflow, and output growth rate. Similarly, Mehret found significant coefficient for budget balance.

It is worth noting that the experiences of a developing country can sometimes be very different from that of developed nations. This may be attributed due to poor infrastructural network, less liberalized trade and highly regulated financial sectors in addition to political uncertainty and frequent regime shifts that usually cause these problems. Therefore, it is sensible to expect some differences in the macroeconomic dynamics governing budget and current account deficits between developing and developed economies.

3. Macroeconomic Overview of Ethiopian Economy

3.1. Introduction

Ethiopia is among the poorest countries in Africa. It has over 81 million people with the lowest GNI per capita of $281.8 (WDI, 2009). It is ranked 171 out of 182 countries in the Human Development Index (UNDP's HDR, 2009). The mainstay of the majority of the population is agriculture which is highly vulnerable to the vagaries of the nature. However, it remains the major source of employment and export earnings. In fact, it contributes almost half of GDP, 60 percent of exports, and 80 percent of total employment (IMF, 2010).

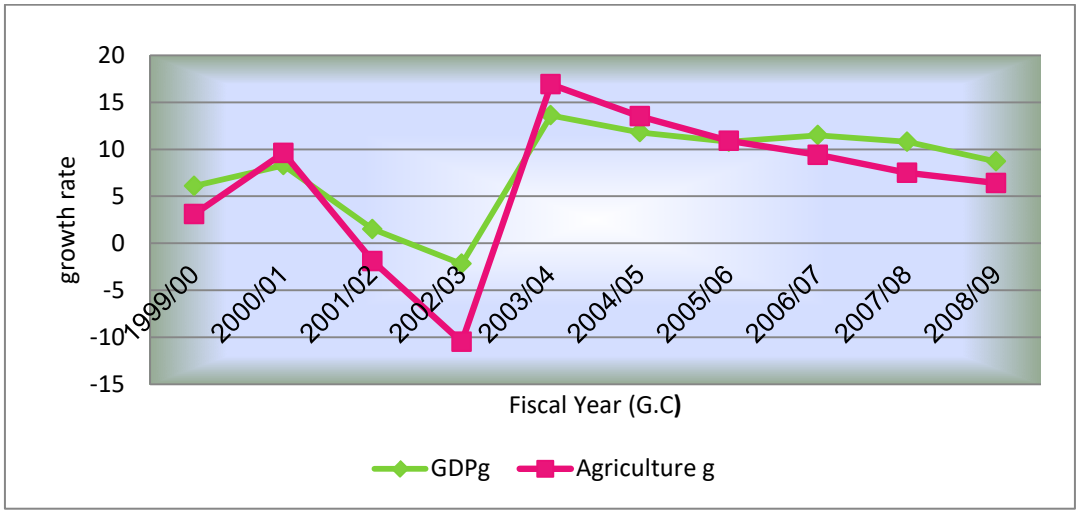
The country has been experienced different political regimes with different economic policy orientation. Before 1974 of the imperial regime, its macroeconomic policy was largely informed by a market oriented economic system. The period 1974/75–1990/91 witnessed a centralized economic system of the Derg military regime, where the state played a significant role in all spheres of economic activity. Soon after the demise of the military regime, in 1991, the new government introduced various reforms aimed at transforming the country from a centrally planned economy to a market-oriented economic system.

3.2. Growth Performance

GDP growth rate over the study period was extremely irregular and strictly linked to agricultural growth which in turn affected by vagaries of nature. During 1991–2003, overall GDP grew to 4.0 percent from 2.8 percent during the Derg rule (Alemayehu, 2001). Growth performance of the

country is highly challenged by frequent drought, war, and population growth among others. Nevertheless, it performed well in recent years. Growth has averaged an impressive 11.2 per cent over 2003/04-2008/09, driven mainly by agricultural growth (MoFED, 2009/10).

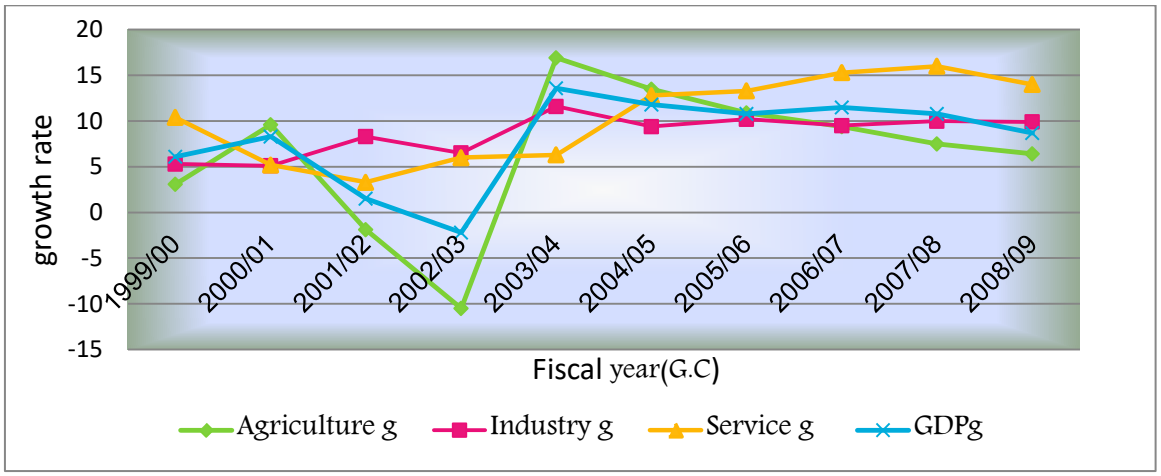
Figure 3.1: Growth Rate of Agriculture and GDP



Source: Own computation based on MoFED (2009/10)

Though GDP growth was decelerated to 2.2 as agricultural growth decelerated by 10.5 percent in 2002/03 owing to severe drought of the period; whereas, the peak growth was 13.6 percent as agriculture grew by 16.9 percent in 2003/04 (MoFED, 2009/10). The agricultural value added was driven mostly by increases in the area under cultivation, rather than improvements in productivity (IMF African Department, 2005). Thus, GDP growth in this period is mainly attributed to high growth in agriculture though low inflation and recovery from the negative growth in 2002/03 had also contributed. In addition to agriculture, industry and service contribute to the GDP growth. For the fiscal year 2008/09, agriculture, industry and service grew by 6.4, 14 and 9.9 percent while the figure for the last ten years average varied as 6.4, 10.2 and 5.5, respectively (MoFED, 2009/10).

Figure 3.2: Growth Rate of GDP by Major Economic Sector



Source: Computed from MoFED (2009/10)

The contribution of agriculture to real GDP fallen from 57 percent in 1991 to 50 percent in 2000 and to 43 percent in 2008/09. Alternatively, services rose from 34 percent to 38 and to 45 percent for the respective periods which shows the increase in contribution of service sector to GDP.

Table 3.1: Percentage Distribution of GDP by Major Sector[5]

Sector	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09
Agriculture	49.9	50.9	49.1	44.9	47.0	47.4	47.1	46.1	44.6	43.2
Industry	12.4	12.2	12.9	14.0	14.0	13.6	13.4	13.2	13.0	13.0
Service	38.7	38.0	38.6	41.7	39.7	39.7	40.4	41.7	45.1	45.1
Less FISIM	1.0	0.9	0.6	0.7	0.7	0.8	1	1	1.1	1.3
GDP	100	100	100	100	100	100	100	100	100	100

Source: MoFED 2009/10

[5] Note that 1999/2000=99/00; and sectoral contribution is not summing up to GDP due to financial intermediary service indirect measurement (FISIM).

Nevertheless, the contributions of industry remained essentially unchanged or only show a marginal increase and contribute 13 percent (MoFED, 2009). There remains a great need to develop the manufacturing (industry) sector to spur growth.

3.3. The Fiscal Stance

3.3.1. Government Revenue

The government consolidates its revenue from domestic revenue and Grant. The domestic revenue consists of direct and indirect taxes (for instance, foreign trade tax) as well as non-tax revenue. Over the study period, tax revenue constitutes the major share of domestic revenue. The relative importance of tax revenue to total domestic revenue and share of GDP is 63.4 percent and 9.5 percent, respectively (MoFED, 2009). The second important component of domestic revenue is foreign trade tax which accounts 24 percent of total domestic revenue and 3.7 percent of GDP. However, for the period 1970/71 -1979/80 it averaged 32 percent of total domestic revenue though it shows a decrement in a year basis and during 1980/81-1990/91 it averaged 17 percent, again for the period between 1991/92-2008/09, it shows an increment and averaged 24 percent (MoFED, 2009). This trend shows different polices were followed by different regimes that affect their foreign trade tax revenue.

Table 3.2: Importance of Tax and non- tax revenue to Domestic Revenue

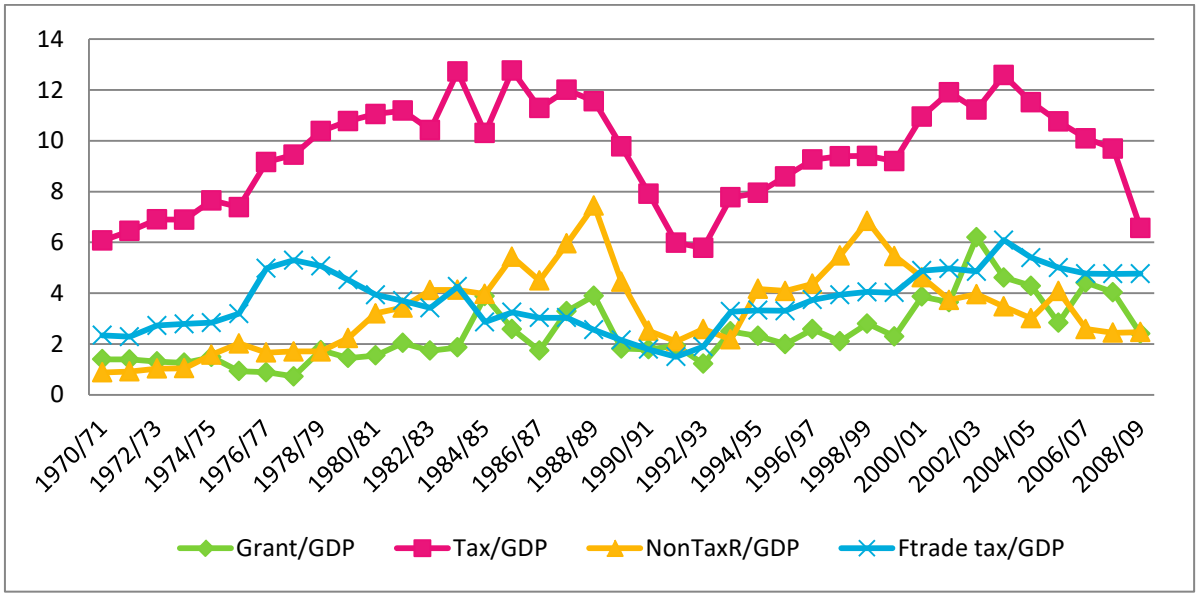
Period Average	Foreign Trade Tax	Tax revenue	Non-tax revenue
1970/71-1974/75	28.06	73.42	11.44
1975/76-1979/80	36.42	74.35	14.92
1980/01-1990/91	17.43	62.75	24.84
1991/92-2008/09	24.7	57.98	23.29

Source: Own computation based on MoFED (2009/10)

Unlike the imperial regime, the military Derg regime followed an import substitution strategy hence its foreign trade tax revenue had declined. Alternatively, after the downfall the Derg, the relative importance of foreign trade tax revenue has risen owing to a relatively liberalize trade policy that permit imports and thereby raised the revenue from import duties. Similarly, non tax revenue[6] shows an increasing trend over the study period and increment since 1990's is partly attributed to privatization measures. The government has enacted a series of tax reforms starting in 2001 to boost tax revenues through improved tax administration and compliance (AfDB, 2007). However, inefficiencies in tax collection still a problem hence tax revenues remains low. On the other hand, grant accounts for 15 percent of total revenue and 2.4 percent of GDP over the study period. However, it jumped to 29 percent of total revenue in 2002/03 and for the last ten years average it accounts 22 percent of revenue (MoFED, 2009/10). This shows the increase in importance of grant in financing government expenditure.

[6] Non tax revenue includes charges and fees, employees pension contribution, fines, revenue from sales of government goods and services, and from privatization of public enterprises.

Figure 3.3: Components of Revenue as Share of GDP

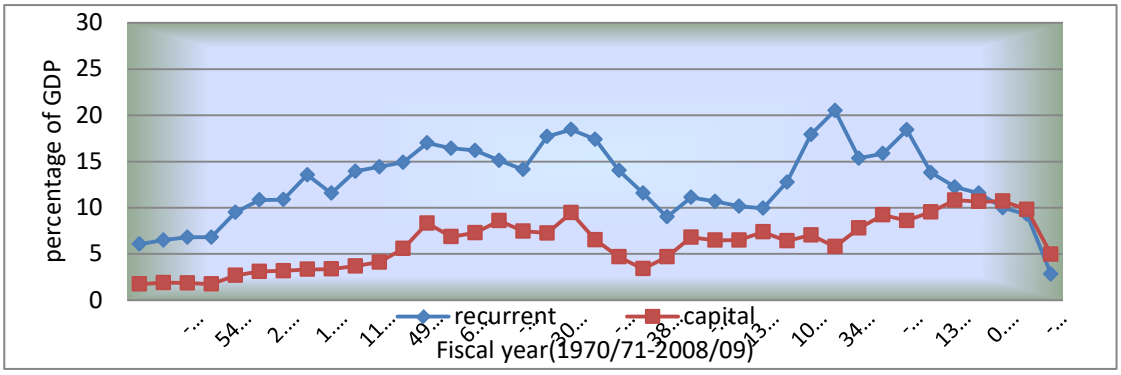


Source: MoFED (2009/10) and NBE (various annual reports)

3.3.2. Government Expenditure

Broadly, the structure of government expenditure categorized as recurrent (current) expenditure and capital expenditure. Over the study period, recurrent expenditure accounts the largest share of government expenditure. It increased considerably during the Derg period (1974/75-1990/91) which attributed to civil wars and defense expenditure, illiteracy campaign, increase in salaries of government workers, and increase in debt service (Wendaferahu, 2002). Even after the demise of the derge, the current expenditure continues to be the major expenditure component due to increase in government outlays in social service and poverty reduction expenditures in the main sectors of health, education and agriculture as well as defense expenditure (the Ethio-Eritrea war 1997/98-1999/00 contributed to the rise in recurrent expenditure).

Figure 3.4: Trend in Recurrent and Capital Expenditure



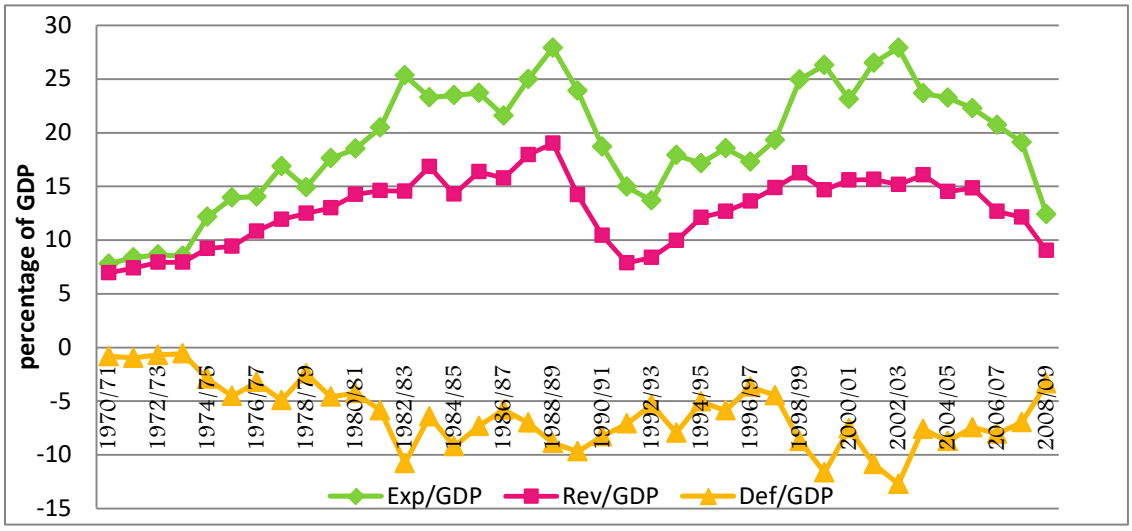
Source: EEA (2009/10) and NBE (various annual reports)

Capital spending increased only in the recent year's budget with large budget increases for agriculture, food security, education, and road construction. Over the study period, the share of capital and recurrent expenditure to total expenditure stand at an average of 31 percent and 67 percent while 12 and 6 percent to GDP, respectively. However, the figure for the period 1990/91-2008/09, the share of capital expenditure increased to 36 percent while that of recurrent expenditure decreased to 60 percent on average. Recently in 2007/8 differences in the relative shares of the two expenditure reached minimum before the both expenditures start fall.

3.3.3. Fiscal Balance

Throughout the study period, the government run budget deficit as the government revenue fall short of its expenditure needs in each period. The budget deficit to GDP, which stood at less than 1 percent between 1970/71-1973/74, increased persistently after 1974/75 and during the Derg regime. In 1999/00 it went up to 13 percent (NBE, 2000/01).

Figure 3.5: Budget Balance



Source: Computed from MoFED and EEA (2009/10)

In 2001/02 fall to 10 percent and again grew to 12 percent in 2002/03 with an annual average increase of 9 percent for the last nine years (EEA, 2009). In recent periods, overall fiscal deficit of the general government (excluding grants) was birrr17.1 billion or 7 percent of GDP in 2007/08 compared to 8 percent in 2006/07 (NBE annual report, 2007/08).

3.3.4. Deficit Financing

Having analyzed the extent of fiscal deficit, it is imperative to look at the ways of financing that the government opts for. To finance this deficit, the government relied on both domestic (through banking system and non banking sources as well as from privatization) and foreign sources (aid). Deficit financing frequently swings from external to domestic sources and vice versa over the study period (see table 3.2 for detail).

Table 3.3: Sources of deficit financing as a percentage of deficit (after Grant)

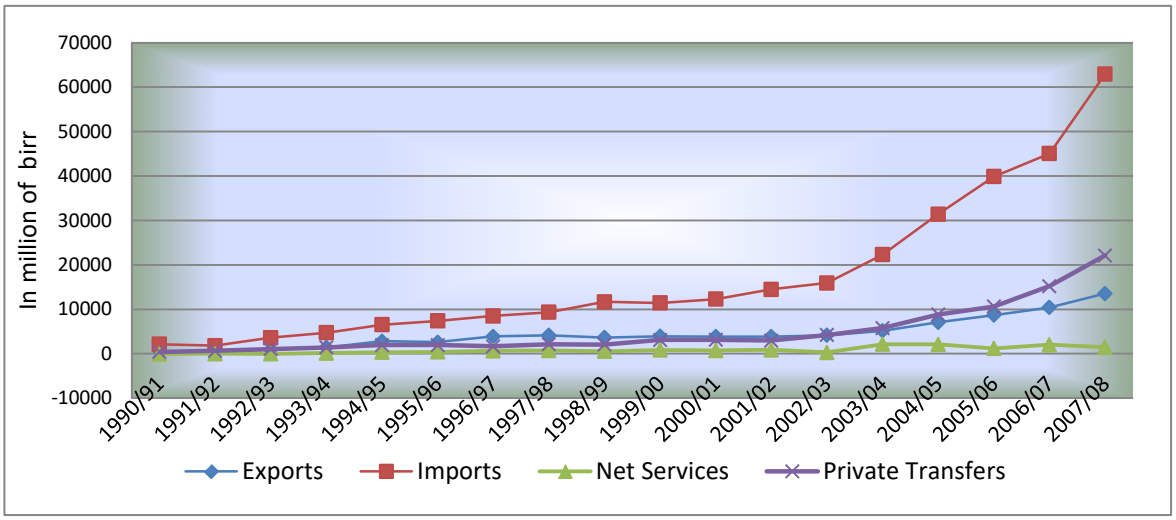
Period	External	Domestic	Privatization
1979/80-1984/85	47	52	-
1985/86-1988/89	56	43	-
1989/90-1991/92	24	75	-
1992/93-1998/99	69	30	-
1999/00	18	81	-
2001/02-2006/07	67	52	0.36
2007/08-2008/09	65	38	13.8
1979/80-2008/09	56	48	3.7

Source: Own computation based on MoFED (2009/10)

3.4. The Components of Current Account

The major components of current account includes: imports (M), exports (X), private transfers and net services. The export sectors dominated by few agricultural exports which have inelastic demand include: coffee, oilseeds, hide and skins, pulses, chat and recently cut flowers. On the other hand imports mainly of fuel, capital goods, and consumer durables among others which eroded the foreign exchange reserves while remittance the major form of transfer. Trends of the components are presented in figure 3.9. As one can deduct from the figure below, in recent periods, private transfer increased more than the rise in exports and contributed in narrowing down the current account deficit while net-service slightly decreased. However, the increase in exports together with private transfers failed to offset the surge of imports.

Figure 3.6: Trend in the Components of Current Account



Source: Own computation based on NBE (various annual reports)

3.4.1. Trade Balance

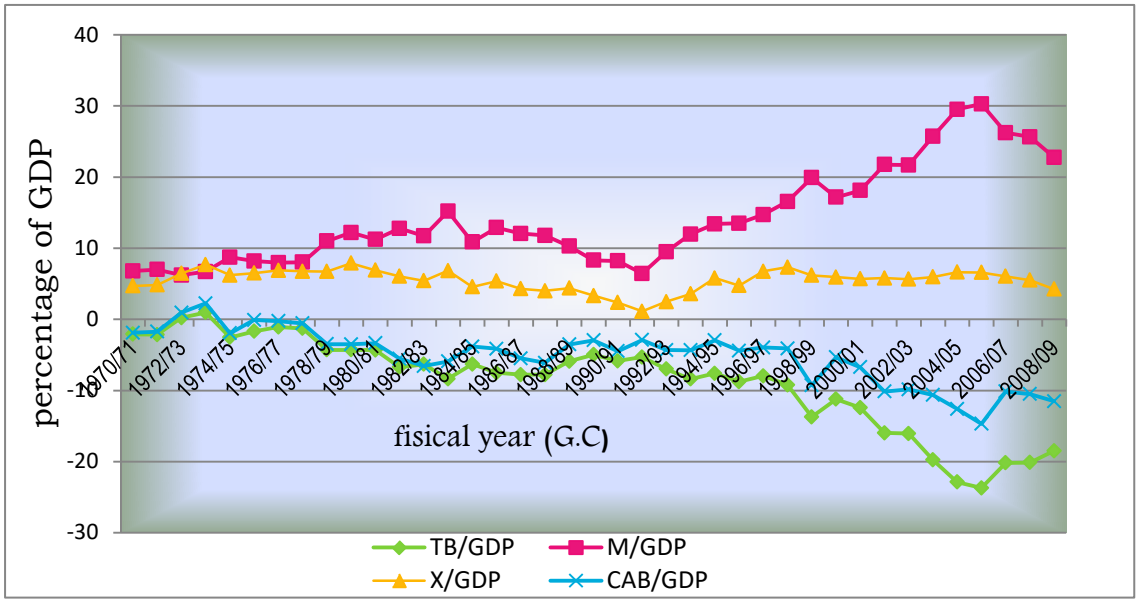
The merchandise trade balance (TB) is the difference between exports and imports. For periods between 1970/71 to 1971/72 the trade deficit which accounts only 2 percent of GDP and for the subsequent two years it was in surplus. However, after 1974/75, it shown a persistent deficit and it reached 4 percent in 1978/79 and doubles to 8 percent in 1983/84, then it remain in deficit average of 6.5 percent for the period 1984/85-1990/91. After 1991/92, trade deficit persistently increased and average for the period 1991/92 to 2008/09 went up to 13.8 percent. In 2005/06 it further widened to 23.7 percent of GDP (USD 3.59 billion) (NBE, 07/08), and for the last five years, it averaged 22 percent of GDP (NBE, 2009/10). An explanation for large trade deficit is a continuous surge in imports which more than offset the considerable rise in exports.

3.4.2. Current Account Balance

Current account balance in Ethiopia has shown persistent deficit over the study period mainly due to the poor performance of exports to finance the growing import bills. In fact, current account

deficit more pronounced as trade deficit widens. The trade deficit widened from 20.8 percent of GDP in the 2006/7 to 23.8 percent in 2007/08 while imports jumped by 32.8 percent offsetting a 23.7 percent increase in export earnings. Similarly, as a result of the widening trade deficit and decline in net services (16.3 percent), the current account deficit (including official transfers) went up to USD 1,479.8 million (6.6 percent of GDP) compared to USD 782.9 million (4 percent of GDP in 2005/06 despite the respective rises of 38.4 and 9.5 percent in net private and official transfers (NBE, 2007/08). Moreover, the trends of current account and trade balance show the importance of trade balance in determining the current account balance.

Figure 3.7: Component of External Sector as Percentage of GDP



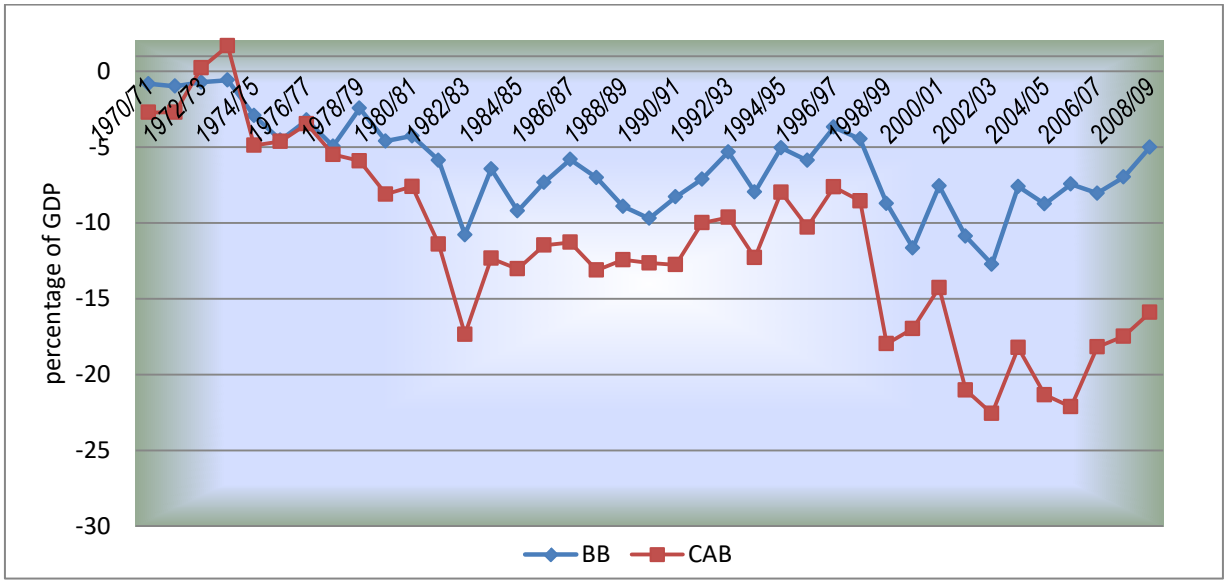
Source: Own computation based on data from EEA (2009)

The current account deficit to GDP were only 1 percent in 1970/71-1971/72 whereas in 1972/73 and 1973/74, it turned to a surplus of average 1.5 percent. After 1974/75 it shown persistent deficit. For periods between 1974/75-1990/91 deficit averaged 3.62 percent while it reached 6 percent in 1982/83 and 1987/88. Even after the reform the deficit persists and the figure for the

period 1992/93-2008/09 reached 7.86 while for the last ten years average it went up to 11 percent and its peak were 15 percent in 2005/06 (NBE, various annual reports).

After looking current account and budget deficit separately, the relationship of the two deficits over time is presented in figure 3.8 below. It is apparent from the figure, the two deficits move together overtime. However, it doesn't tell which way the causality is move.

Figure 3.8: Trends of Current account and Budget deficit



Source: Computed from EEA and MoFED (2009/10)

3.5. Money supply

The evolution of money supply is presented in table 3.4 below. Both narrow money (M1/GDP) and broad money (M2/GDP) increase steadily over the study period especially after 1974[7]. In

[7] Narrow money (M1) includes currency in circulation and demand deposits while broad money (M2) includes (M1), savings deposits and time deposits.

1999/00-2003/04 M1/GDP and M2/GDP reached 21 and 38 percent, respectively. The ratios were higher in 2002/03 as 22 and 41 percent of GDP, respectively (EEA, 2009).

Table 3.4: The Evolution of Money Supply to GDP

Period	**M1/GDP**	**M2/GDP**	**M1 growth**	**M2 growth**
1970/71-1973/74	5.76	9.12	-2.11	4.66
1974/75-1990/91	13.89	19.79	15.39	14.00
1991/92-2008/09	19.30	32.65	12.55	14.65

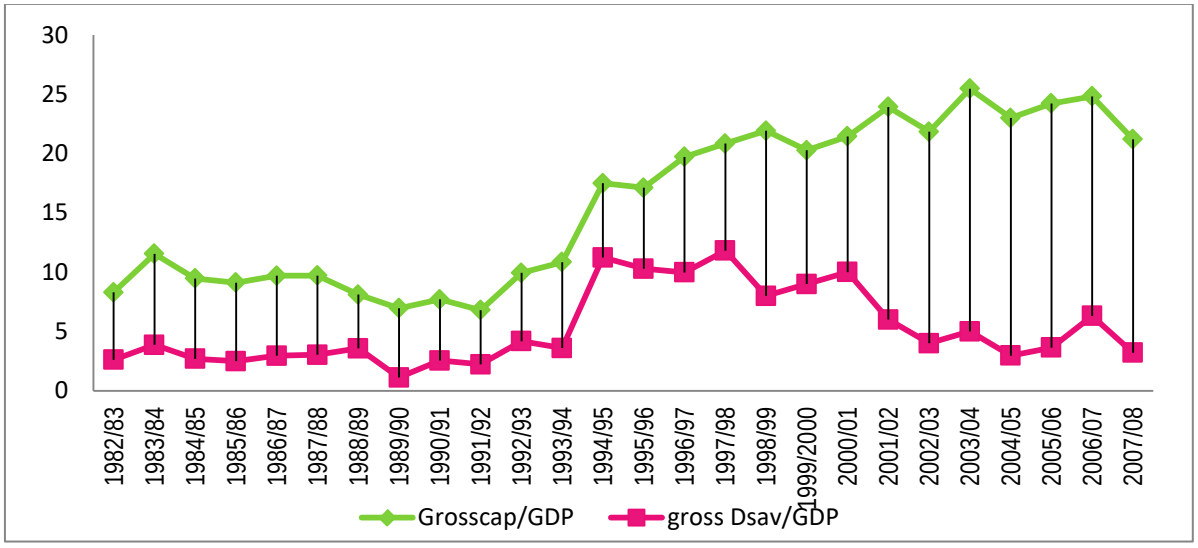
Source: EEA (2009/10)

3.6. Investment and Saving

Gross investment was very low till 1991/92, however, it shown an impressive growth trend on wards. Similarly, the share of private investment was minimal in the pre-reform period due to nationalization policy of the Derg regime that deliberately discouraged the formation of private capital. Following the privatization and other reform programs of 1992/93, private investment shown an increasing trend as compared to the pre-reform period. (Rajan et al., 2005).

Although private investment has been increasing in recent years, following the privatization and other reform programs of 1992/93, Public investment still constitute the major share of total investment.

Figure 3.9: Gross Fixed Capital Formation and Domestic Saving



Source: Own computation based MoFED and NBE

The saving investment gap widened as gross investment always outweigh gross domestic saving which shows the growing investment is being financed from foreign sources which contributes for current account imbalance and accumulation of debt.

3.7. External Public Debt

As the country runs a continuous deficit, it ends up accumulating debt. Ethiopia's external debt had been accumulating in the Derg regime owing to huge fiscal deficits from its spending priorities. Both the debt stock and the debt to GNP ratio have increased steadily and makes the country one of the Sub-Saharan African countries that have a total debt exceeding their GNP, having debt to GNP and debt to export ratios of 159.0 and 962.3 percent respectively in 1997 (Alemayehu, 2001). The external debt to GDP had also continued increasing in the post Derg period. However, it moved down from 184.40 per cent in 1991/92 to 78.07 percent in 2001/02 due to a waiver of a substantial portion of debt by the donors (Rajan et al., 2005).

Table 3.5: Summary of external public debt

Period	External Debt to GDP	Debt Servicing Ratio[8]
1986/87-1990/91	40.4	55.2
1991/92-20001/02	73	36.68
2001/2002	102	16.01
2002/03-2004/05	71	17.10
2005/06-2008/09	12.5	5.11

Source: NBE (various annual reports)

Indeed, Ethiopia has been a beneficiary of the International Monetary Fund's and the World Bank's Heavily Indebted Poor Countries (HIPC) Initiative for debt relief in 2001, it had also received supplementary debt relief commitments from the Paris Club of official donors in the same year and further from Multilateral Debt Relief Initiative (MDRI) in 2005/06. As a result, a sizable portion of the external debt has been written down, which has been lessened though temporarily its impact, and thereby increasing the likelihood that the current account to be sustainable. Following debt relief the debt service ratio of the country halved to 5.11 percent in 2005/06 to 2008/09, from about 16 per cent in 2001. Similarly debt to GDP ratio also reduced to an average of 12.5 for the period between 2005/06-2008/09 (EEA, 2009). It is important also to see the country remains dependent on foreign loans as large financing needs of the public enterprises persisted and thus continued to accumulate debt.

[8] It is the ratio of total amortization and interest payments to total export of goods and nonfactor services

4. Methodology

4.1. Model Specification

Economic literatures documented variables that can affect the current account and that may also related to budget balance such as investment, money supply, gross domestic product, consumption, level of indebtedness, terms of trade, degree of openness, interest rate, exchange rate, among other. However, most of the twin deficit studies employ the Granger causality test in bivariate setting. The contributions of other macroeconomic variables relevant to the current account deficit are considered minor and often naively ignored, though some include exchange rate and interest rate as transmission variables. Apparently, research into the twin deficits require explicit examination of the entire set of variables that may relate meaningfully to current account (trade) and government deficits behavior (Tallman and Rosensweig, 1991).

Therefore, in this work, an attempt is made to consider both current account and fiscal balance determinants in the VAR model while the majority of studies concentrated on only one of these factors. It has been already explained from Mundell-Fleming open economy framework, the interaction between current account and budget deficit occur directly through domestic absorption. Absorption also affected by the level of domestic income hence real GDP included as a proxy for domestic income/a measure of economic performance. Besides, current account and budget deficit interact indirectly through monetary channels consequently monetary variables like money supply, interest rate and exchange rate can be included in the model as proxies for this channel. Money supply is measured by broad money (M2) which is an important indicator of macroeconomic performance of a country as it is interrelated with fiscal, external sector and monetary policies of the country.

Theories also suggest that there is a link between the current account deficit, budget deficit, and public debt. Thus, it is also worth to include external public debt. Indeed, Ethiopia is among highly indebted poor countries (HIPC). Therefore, this study employs a multivariate framework by including the aforementioned variables in order to keep away from possible distortion of causality inferences, owing to the omission of relevant explanatory variables. Yet, inclusion of variables is subject to the constraint that not to over parameterized the model given small sample.

It follows from the theoretical literatures as well as the lead from previous empirical studies the current account balance/deficit (CAB) in Ethiopia can be specified as a function of the country's fiscal position/budget deficit (BB), domestic income/GDP (GY), private investment (PI), money supply (MS), interest rate (IR), exchange rate (EX) and external public debt (PD). Therefore, it can be expressed in an equation form as:

$$CAB = f(BB, GY, PI, MS, PD, IR, EX) \quad [4.1]$$

Where CAB, BB, GY, MS, PI and PD are measured in real terms. Despite some liberalization measures in the structural adjustment programs (SAPs) in 1992/93, regulations in financial and exchange rate are still prevalent in Ethiopia which precludes inclusion of variables like interest rate and exchange rate. Instead, trade openness measured by the sum of imports and exports divided by GDP (OPEN) is used as a surrogate to capture the impact of these variables on the current account. The degree of openness is also a reflection of the degree of trade liberalisation of an economy. Hence, the current account deficit equation can be rewritten as:

$$CAB_t=\beta_0+\beta_1 BB_t+\beta_2 GY+\beta_3 MS_t+\beta_4 PI+\beta_5 PD+\beta_6 OPEN_t+\varepsilon_t \quad [4.2]$$

Where, ε_t is the disturbance (error) term.

The expected sign for β_1 is positive following the twin deficit hypothesis that asserts a positive relationship between budget and current account deficit. The sign of β_2 could be positive or negative same for β_3. This owing to growth in GDP could reduce current account deficit if the economy produce more of exportable or import substituting goods and services. Alternatively, as income increase the demand for imports increase and it may worsen the external balance. Similarly, money supply tends to worsen the current account balance when output growth is less the growth of money or if it is found to be inflationary. The sign of β_4 is expected to be negative as investment inflows tend to deteriorate the current account as the large portion of investment is being financed from foreign savings partly due to lack of domestic savings and partly due to acute foreign exchange shortages. The sign of β_5 is expected to be negative since accumulation of external public debt tends to deteriorate the current account since the country is expected to repay the principal and the interest on external debt to potential creditors. The expected sign of β_6 is also negative since the developing economy could be vulnerable as it faces foreign competition.

4.2. Data Sources

For this study annual secondary data covering the time period from 1970/71 through 2008/09 were extracted from various sources. These include NBE, MoFED of Ethiopia and CSA. Moreover, IMF 2009 CD-ROM also visited. The national accounts of MoFED do not report private savings and investments separately. Therefore, an attempt was made to derive private investment as Gross capital formation less government capital expenditure-a proxy for public investment. Nevertheless, inclusion of this variable resulted implausible coefficients and hence excluded.

4.3. The Econometric Model

This work uses a multivariate cointegrated Vector Auto Regression (VAR) modeling framework to capture the dynamics of the relationship between budget and current account deficit whilst avoiding the pitfalls of endogeneity and integration of the variables.

4.3.1. Vector Auto Regression (VAR) Model

Vector auto regressions (VARs) were introduced into empirical economics by Sims (1980), who demonstrated that VARs provide a flexible and tractable framework for analyzing economic time series. Sims developed VAR system as an alternative to the traditional simultaneous equations system approach which requires prior 'identification' of variables and imposing some restriction. 'Identification' problem had confronted immediately in VARs, since these models don't dichotomize variables in to 'endogenous' and 'exogenous' (Watson, 1994).

In a reduced form VAR of order p (VAR(p)), each component of the vector (say) X depends linearly on its own lagged values up to P periods as well as the lagged values all other variables up to order P and a serially uncorrelated error term (Stock and Watson, 2001: Kirchgässner and Wolters, 2007). Succinctly stated, in a VAR model, every equation has the same right hand variables, and those variables include lagged values of all the endogenous variables. The inclusion of lagged values of the endogenous variables is intended to eliminate estimation bias associated with simultaneity and serial correlation.

The cointegrated VAR helps to account for spurious correlations and exogenity bias as it is designated for nonstationary time series, and it assumes all variables in the system are potentially endogenous (Harris, 1995). It has to be mentioned that the number of variables that can jointly be analyzed in such system has to be small; this is limited by the number of observations which are available, otherwise loss of degrees of freedom if sample size is small. VAR estimation is also sensitive to the choice of lag length since including many lags reduced the power of the test. Nevertheless, VAR system plays a crucial role in modern approaches to analyze economic time series. In view of the considerations outlined above, it is possible to establish a VAR of order k, VAR (k) system that takes the following form:

$$X_t = \delta + A_1X_{t-1} + A_2X_{t-2} + ... + A_k X_{t-k} + \varepsilon_t \quad [4.3]$$

Where X_t is $(n \times 1)$ vector of possible endogenous variables, that is X_t= {BB_t, GY_t, CAB_t, MS_t, PD_t, $OPEN_t$}; $A_1 - A_k$ is an $(n \times n)$ matrix of coefficients, δ is a vector of constants and ε_t is $an\ (n \times 1)$ a vector of random disturbances.

4.3.2. Stationarity and Non-Stationarity Series

There are several preliminary steps when we use time-series data in econometric analyses. Visual inspection of the plot of the data can tell us something about the behavior of the series. A stationary series exhibits mean reversion meaning it oscillates around the mean, has finite variance that is constant over time in addition, the correlogram (estimated autocorrelation function) diminishes as the number of lags increases. Whereas a non stationary series has different mean at different points in time, its variance is increases with time and the correlogram diminishes slowly as the number of lags increases.

Initially it is essential to determine the form in which the data can be used for any subsequent estimation; in many instances using macroeconomic data in their levels leads to serious econometric problems. Time-series data typically contains a trend, which must be removed prior to undertaking any estimation. The traditional de-trending procedure separates the trend from the cyclical component of the series. This procedure is appropriate for trend stationary (TS) time-series. Nevertheless, de-trending does not always yield a stationary variable and in practice many macroeconomic time-series are difference stationary (DS) (Wassell and Saunders, 2006). DS type time-series are non-stationary and they contain unit roots. The DS type sequences must be differenced prior to any meaningful econometric estimation. If not performing a standard regression technique with non-stationary series results in 'spurious' regression involving invalid inferences based on t and F tests (Harris and Sollis, 2003).

However, the mere use of non-stationary variables not necessarily results in invalid estimators. An important exception arises when two or more I(1) or non stationary variables are co-integrated, that is, if there exists a particular linear combination of these non-stationary variables which is stationary or I(0) (Verbeek, 2004). Therefore, the first task in analyzing econometric time series data thus should be testing for the presence of unit roots. In this case, it is important to test the order of integration of each variable to know how many times the variable needs to be differenced to result in a stationary series[90].

[90] A series Y_t said to be integrated of order d, that is $Y_t \sim I(d)$, if it becomes stationary after differencing d times, so Y_t contains d unit root(s). A series that is I(0) is stationary in level. A series is called integrated of order d, denoted as $y_t \sim I(d)$, if it becomes stationary after differencing d times.

4.3.3. Unit Root Tests

To determine the maximum order of integration for each series the standard unit root tests could be used. A commonly applied test for existence of a unit root in the data is the Dickey-Fuller (DF) test and its simple extension being the Augmented Dickey Fuller (ADF) test, Phillips and Perron (PP), and Kwiatkowsi et al. (KPSS) tests. These tests could be performed both in level and in the first difference for models with intercept and/trend alternatively.

The Dickey- Fuller Test

The simplest form of the DF test amounts to estimating:

$y_t = a y_{-1} + u_t$ ..... [4.4]

One could use some t-test to test the hypothesis a = 1 against a < 1: Alternatively one can rearrange the model as follows:

$y_t - y_{t-1} = \Delta y_t = (a-1) y_{t-1} + u_t$.....[4.5]

Where $ut \sim IID(0, \sigma^2)$ with $\rho = a - 1$.

The test hypotheses are $\rho = 0$ (H0) against $\rho < 0$(H1). However, using regression equation like [4.4] is valid when the overall mean of the series is zero. When the underlying data generating process is not known, it is better to allow a constant or / and a time trend and then test for a unit root. In that case, the model needed to be test for the null hypothesis of stochastic trend (non stationarity) against the alternative a deterministic trend (stationary). In practice, the model may involve a constant or a trend. Dickey and Fuller (1979) actually consider three models:

a) $\Delta y_t = \rho y_{t-1} + u_t$

b) $\Delta y_t = \mu + \rho y_{t-1} + u_t$

c) $\Delta y_t = \mu + ct + \rho y_{t-1} + u_t$

For each model, one will need to use different critical values; the reason is that, under non

stationarity the statistic computed does not follow a standard t-distribution, but rather a DF distribution. Moreover, the distribution of the τ −test will be different if a constant or a trend is included.

The Augmented Dickey- Fuller Test

The ADF test is comparable with the simple DF test, but it is augmented by adding lagged values (p) of first differences of the dependent variable as additional regressors which are required to account for possible occurrence of autocorrelation. Consider for AR (p) model:

$yt = \mu + a_1\, yt - 1 + a_2 yt - 2 + \ldots + a_{\mathrm{p}}\, yt - p + u\mathrm{t}$ ..... [4.6]

Further, we can rewrite [4.6] as:

$\Delta\mathrm{yt} = \mu + \rho\mathrm{yt\text{-}1} + \sum_{i=2}^{p} \psi i\ \Delta yt - p + ut$ ..... [4.7]

Where: $\rho = -(1 - \sum_{i=2}^{p} ai)$ and $\psi i = \sum_{j=i}^{p} aj$

Under the null hypothesis of non stationary (Ho: ρ=0) against the alternative stationarity (HA: $\rho < 0$). For the test to be reliable one need to choose the correct model to estimate, that is, any constant or trend must be used only when relevant. Moreover, the correct number of lags must be used and selected using model selection criteria like Akaike Information Criterion.

The Phillips and Perron (PP) Test

An alternative approach to ADF test (adding lagged first differences of the dependent variables) is applying non parametric correction to the t- test statistics is undertaken to take account of any possible autocorrelation. One has to take to consideration the presence of structural breaks within the data since unit root tests like ADF are sensitive to structural breaks. The Phillips- Perron unit root test provides relatively more reliable test result in the presence of structural break.

4.4. Cointegration

An important issue in econometrics is the need to integrate short run dynamics to long run equilibrium. In the preceding section, it is pointed out that estimating non-stationary data and analyzing the short run dynamics is often done by first eliminating trends in the variables, usually through the process of differencing till one achieves stationary. This procedure, however, throws away potential valuable information about long run relationships which economic theories have a lot to say (Maddla, 1992). These problems of losing long run information can easily be amended if it is possible to find a co-integrating vector through a co-integration analysis.

The concept of cointegration mimics the existence of a long-run equilibrium to which an economic system converges over time whereas the absence of cointegration leads back to the problem of spurious regression (Harris, 1995: Harris and Sollis, 2003). Two broad approaches for testing for cointegration have been developed. The Engle and Granger (1987) method and the Johansen approach due to Johansen (1998) which is based on VAR (Green, 2003).

4.4.1. The Engle and Granger

The Engle and Granger is based on assessing whether single equation estimates of the equilibrium errors appear to be stationary. In the Engle-Granger approach to cointegration, two time series say Y_t variable and X_t are nonstationary in levels but stationary in the first difference that is $Y_t \sim I(1)$ and $X_t \sim I(1)$, and there exists a linear combination between these two series that is stationary ($\varepsilon_t = Y_t - \alpha - \beta X_t \sim I(0)$). It follows that these two series are cointegrated implying they have reasonable long run relationships.

4.4.2. The Johansen Approach

The Johansen approach is superior due to the following reasons. It does not require a priori distinction of endogenous or exogenous among variables; it can deal with I(0) and I(1) variables avoiding much of the pre-testing problem; it can capture a wide range of data generating processes. In addition, it identifies multiple co-integrating vectors (if any) unlike Engel-Granger representation which assumes only one co-integrating vector. The Johansen procedure applies a maximum likelihood estimation technique for determining the presence of co-integrating vectors using vector error correction mechanism (VECM). Hence, in this paper a VAR-based cointegration tests using the methodology of Johansen is adopted.

4.4.3. Cointegration and VECM

Starting from the VAR of order k, the co-integrating vector in Johansen's procedure is as follows:

$$X_t=A_1X_{t-1}+A_2X_{t-2}+...+A_kX_{t-k}+\varphi D_t+\varepsilon_t \quad [4.8]$$

$$\varepsilon_t \sim IN(0, \Sigma) \quad t=1\ldots T$$

Where X_t is a vector of n potentially endogenous variables at time t, A_i is (n x n) dimensional parameter matrices; φ is an (n x m) matrix of coefficients of D represents the deterministic terms (such as a constant term, a trend and dummies) and ε denotes a normally distributed n-dimensional white noise process.

When the variables are cointegrated, the corresponding error correction representations must be included in the system by doing so one can avoid misspecification and omission of the important constraints. Thus, the VAR in [4.8] can be reparametrized as a Vector Error Correction Model (VECM) form:

$$\Delta \mathcal{X}t = \sum_{i=1}^{k-1} \Gamma i \, \Delta \mathcal{X}t - i + \Pi \mathcal{X}t - k + \varphi Dt + \varepsilon_t \quad \text{..... [4.9]}$$

$\Gamma_i = -(1 - A_1 - \ldots - A_i)$, i = 1,..., k-1 and

$\Pi = -(1 - A_1 - \ldots - A_k)$

The above specification of VECM contains information contains information on both the short and the long run adjustment to changes in $\mathcal{X}_t$ via the estimating Γ and Π, respectively. Matrix Π can be decomposed as $\Pi = \alpha\beta'$, where α is n×r matrix of speed of adjustments, and β is an n×r matrix of parameters which determines the cointegrating relationships matrix of long-run coefficients such that $\beta' X_{t-k}$ represent the multiple cointegration relationships. The columns of β are interpreted as long-run equilibrium relationships between the variables. Matrix α determines the speed of adjustment towards this equilibrium. Values of the α close to zero imply slow convergence and r, $0 \leq r \leq n$ is the rank of the martrix Π and represents the number of cointegrating vectors in the system which can be determined using the Johansen Maximum Likelihood method.

Assuming $\mathcal{X}_t$ is a vector of non stationary I(1) variables, then all terms in [4.9] which involve $\Delta \mathcal{X}_{t-i}$ are I(0) while $\Pi \mathcal{X}_{t-k}$ must also be stationary for $\varepsilon_t \sim I(0)$ to be 'white noise'. There are three instances when this requirement that $\Pi \mathcal{X}_{t-k} \sim I(0)$ is met; first, when all variables in $\mathcal{X}_t$ are in fact stationary, which is an uninteresting case in the present context since it implies that there is no problem of spurious regression and the appropriate modelling strategy is to estimate the standard Sims- based type VAR in levels (equation 4.8). The second instance is when there is no cointegration at all, implying that there are no linear combinations of the $\mathcal{X}_t$ that are I(0), and consequently Π is an (n x n) matrix of full of zeros. In this case, the appropriate model is a VAR of first difference involving no long run element. Thirdly, for $\Pi \mathcal{X}_{t-k}$ to be I(0) is when there

exists up to (n-1) cointegration relationships: $\beta' X_{t-k} \sim I(0)$. In this instance r< (n-1) cointegration vector exist in β (that is, r columns of β form r linearly independent combinations of the variables in $\mathcal{X}t$, each of which is stationary) together with (n-r) non stationary vectors. Only the cointegrating vectors in β enter (4.9), otherwise $\Pi\mathcal{X}_{t-k}$ would not be I(0) which implies that the last (n-r) columns of **α** are effectively zero. Thus, the typical problem is determining how many r<(n-1) cointegration vectors exist in β, amounts to equivalently testing which columns of α are zero.

Consequently, testing for cointegration amounts to a consideration of the rank of matrix Π that is finding the number of r linearly independent columns in Π (Harris, 1995: Harris and Sollis, 2003). The Johansen procedure is thus based on an examination of matrix Π. If Π has full rank (that is, if rank ((Π)=n, all variables are stationary while if the rank of Π is zero, then there are no cointegration relationships. However, the most interesting case is when Π has reduced rank (that is, r≤(n-1) cointegration vector present) (Harris, 1995). Tests for the (reduced) rank of Π are equivalent to testing which columns of α are zero. Rewriting 4.9 as:

$$\Delta\mathcal{X}t + \alpha\beta'\mathcal{X}t - k = \sum_{i=1}^{k-1} \Gamma i\, \Delta\, \mathcal{X}t - i + + \varphi Dt + \varepsilon_t \quad [4.10]$$

It is possible to correct for short run dynamics by regressing $\Delta\mathcal{X}t$ and $\mathcal{X}_{t-k}$ separately on the right hand side of [4.10]. The vectors R_{ot} and R_{kt} are obtained from:

$$\Delta\mathcal{X}_t = P_1\Delta\mathcal{X}_{t-1} + \ldots + P_{k-1}\Delta\mathcal{X}_{t-k+1} + R_{0t} \quad [4.11]$$

$$\mathcal{X}_{t-k} = T_1\Delta\mathcal{X}_{t-1} + \ldots + T_{k-1}\Delta\mathcal{X}_{t-k+1} + R_{kt} \quad [4.12]$$

Then the above can be used to form residual matrices:

$$S_{ij} = T^{-1}\sum_{i-1}^{T} R_{it}\, R'_{jt} \;\; ; i,j=0, \quad [4.13]$$

The Johansen maximum likelihood estimate of β is obtained as the eigenvectors corresponding to the r largest eigenvalues from solving the equation:

$|\lambda S_{kk} - S_{ko} S^{-1}_{oo} S_{ok}| = 0$ ..... [4.14]

This provides n eigenvalues $\hat{\lambda}_{1>}\hat{\lambda}_{2>\ldots>}\hat{\lambda}_{n}$ and their corresponding eigenvector $\hat{V} = \hat{v}_{1,}\ldots, \hat{v}_{n}$.

Johansen derives a test on the number of characteristic roots that are statistically different from zero thereby determining the (reduced) rank of Π by considering the two statistics. These are the maximum eigenvalue test (λ_{max}) and trace test (λ_{trace}). The null in the case of maximum eigenvalue test is that there exist r distinct cointegrating vectors against the alternative r+1 cointegrating vectors. While in trace test, the null hypothesis is that the number of cointegration vector is less or equal to r=0 to n, in each case the null hypothesis is tested against a general alternative. Thus, the test statistic is given by:

$\lambda_{trace} = -T\sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_{i})$ ..... [4.15]

$\lambda_{max} = -T\ln(1-\hat{\lambda}_{r+1})$ ..... [4.16]

Where: $\hat{\lambda}$ are estimated eigenvalues obtained from estimated Π matrix and T is sample size.

4.5. VAR (Granger) Causality

Standard practice in VAR analysis is to report results from Granger-causality tests, impulse responses, and forecast error variance decompositions. Because of the complicated dynamics in the VAR, these statistics are more informative than the estimated VAR regression coefficients or R^2's (Stock and Watson, 2001).

According to Granger causality, if the history (i.e. lagged observations) of variable x does not help to predict the future values of variable y (given lagged values of y and lagged values of other variables), we say that x does not Granger-cause y. If a pair of series is cointegrated then there

must be Granger causality at least in one direction, which reflects the direction of influence between series. Theoretically, if the current or lagged terms of a time series variable say, X_t, determine another time series variables, say Y_t, then there exists a Granger causality relationship between X_t and Y_t in which Y_t Granger caused by X_t. Other possible cases are unidirectional causality from Y_t to X_t, bidirectional causality (feedback effects), and independence.

Nevertheless, the procedure of Granger causality analysis is very sensitive to model specifications, such as the chosen lag length and stationary properties. If a VAR system is cointegrated, the Granger causality test may be conducted in the environment of vector error correction model (VECM) as cointegration always implies the existence of a Granger causal relation. Equivalently, it can be represented in VECM as:

$$\Delta CAB_t = a_0 + \lambda_1 \varepsilon_{t-1} + \sum_{i=1}^{n} a_{1i} \Delta CAB_{t-i} + \sum_{i=1}^{n} a_{2i} \Delta BB_{t-i} + \sum_{i=1}^{n} a_{3i} \Delta GY_{t-1} + \sum_{i=1}^{n} a_{4i} \Delta MS_{t-1} \ldots + V_{1t} \ldots [5.4]$$

$$\Delta BB_t = b_0 + \lambda_2 \varepsilon_{t-1} + \sum_{i=1}^{n} b_{1i} \Delta CAB_{t-i} + \sum_{i=1}^{n} b_{2i} \Delta BB_{t-i} + \sum_{i=1}^{n} b_{3i} \Delta GY_{t-1} + \sum_{i=1}^{n} b_{4i} \Delta MS_{t-1} \ldots + V_{2t} \ldots .. [5.5]$$

Where λ_1 and λ_2 are coefficients for error correction terms in equation 1 and 2. These coefficients are expected to capture the adjustment towards equilibrium. Equation [5.4] used to test the causation from budget deficit to current account deficit. That is, the null is budget deficit does not Granger cause current account deficit if all $a_{2i} = 0$ and/or $\lambda_1 = 0$. Similarly, equation [5.5] used to test the causality from current account deficit to budget deficit. That is, test current account deficit does not Granger cause budget deficit if all $b_{1i} = 0$ and /or $\lambda_2 = 0$. The VECM approach, besides showing the direction of causality among the variables, it enables us to distinguish between short run and long run Granger Causality.

4.6. Dynamic Analysis of VAR

A dynamic analysis consisting of forecast error variance decomposition and impulse response functions also termed as innovation accounting which permits an intuitive insight in to the dynamic relationships among variables.

4.6.1. Impulse Response Functions

Impulse responses trace out the response of current and future values of each of the variables to a one unit increase in the current value of one of the VAR errors (James and Watson, 2001). That is, tracing out the time path of the effect of 'shocks' of other variables contained in the VAR on a particular variable. This approach designed to determine how each variable responds over time to an earlier "shock'' in that variable and to "shocks" in the other variables within the system. The standard impulse response analysis uses orthogonalized impulse responses where the underlying shocks to the VECM are orthogonolized using Cholesky decomposition.

4.6.2. Forecast Error Variance Decomposition

Forecast error variance decomposition provides the percentage of the variance of the error made in forecasting a variable at a given horizon due to a specific shock. Thus, the forecast error variance decomposition is like a (partial) R^2 for the forecast error (Stock and Watson, 2001). It permits inferences to be drawn regarding the proportion of the movement in a particular time-series due to its own "shocks" vis-à-vis "shocks" arising from other variables in the VAR. The technique breaks down the variance of the forecast errors for each variable following a "shock" to a particular variable and in this way it is possible to identify which variables are strongly affected and those that are not.

5. Model Estimation and Interpretation of Results

5.1. Introduction

In the preceding section, under chapter three, it has been discussed the relationships and trends of selected macroeconomic variables over the review period. This chapter devotes to formal econometric analysis of those macroeconomic variables. It starts with determining the order(s) of integration of variables included in the model that is, test whether each series is stationary or not. Following this, it is important to determine the dynamic specification of the VAR model. It is widely known that the order of VAR (k) can affect the number of cointegrating vectors as well as the shape of the impulse function. Besides, before proceeding to the cointegration test, it is required to perform diagnostic tests for VAR (k) residual to assure that residuals are Gaussian, which are not auto-correlated and normally distributed. The Gaussian error terms are very important building blocks for the cointegration test (Alemayehu, et al, 2009).

Further, if variables are integrated, carry on determining the number of cointegrating (long run) relationship (if any) among variables. This is handled using VAR based Johansen's approach. Once the cointegrating vectors are identified the related notion of error correction model consisting of differenced endogenous variables and error correction term will be estimated. Cointegration technique confronts spurious regression while error correction provides the short run dynamics. In the presence of cointegration, Granger causality test will be conducted to detect the direction of influence between series. Finally, a dynamic analysis of impulse response function and variance decomposition analysis will also be presented to fortify the empirical evidence from causality analysis.

5.2. Unit Root Test Results

Prior to conducting a parametric analysis and make any meaningful inferences about the relationship of variables, the time series characteristics of the data have to be examined. That is, variables have to be tested for the presence of unit root(s) thereby the order of integration of each series is determined. To determine the maximum order of integration of the series, standard unit root tests are employed. The results of Augmented Dickey-Fuller (ADF) and Phillips and Perron (PP) unit root tests, with intercept but no trend, and with intercept and trend; both at level and first difference for each series is presented in table 5.2A, 5.2B and 5.2C below.

Table 5.2 A: ADF unit root test results for level variables

Variables	**ADF test at level**				**Order of Integration**
	DF t-statistic intercept	Prob.*	DF t-statistic Intercept and Trend	Prob.*	
CAB	2.655176	1.0000	0.529564	0.9990	I(1)
BB	-0.795948	0.8089	-3.020502	0.1401	I(1)
MS	5.625433	1.0000	4.022212	1.0000	I(1)
GY	0.663994	0.9897	-0.259432	0.9891	I(1)
PD	-1.310001	0.6150	-3.146609	0.1113	I(1)
OPEN	-1.594367	0.4756	-2.744428	0.2257	I(1)
Critical Value (5%)	-2.941145		-3.533083		

**MacKinnon (1996) one-sided p-values.*

Table 5.2 B: Phillips-Perron unit root test results for level variable

Variables	**PP test at level**				**Order of integration**
	PP t-statistic Intercept	Prob.*	PP t-statistic Intercept and Trend	Prob.*	
CAB	1.485165	0.9990	-0.997500	0.9324	I(1)
BB	-0.475962	0.8850	-3.052303	0.1321	I(1)
MS	7.85762	1.0000	2.637212	1.0000	I(1)
GY	0.898935	0.9944	0.613535	0.9993	I(1)
PD	-1.466133	0.5397	-1.531849	0.8006	I(1)
OPEN	-1.468815	0.5383	-2.780088	0.2130	I(1)
Critical values (5%)	-2.941145		-3.533083		

**MacKinnon (1996) one-sided p-values.*

The above unit root test results show that both ADF and PP test fail to reject the null hypothesis that says there is unit root. That is, the respective ADF and PP statistics are less than the critical values at 5 percent significance level. It lacks sufficient information to reject the null of unit root whereas at their first difference it is possible to reject the null in favor of the alternative (stationary). Thus, the results show that all series are stationary at first difference (with intercept and intercept/ trend), it follows that the maximum order of integration is one (that is, I (1)). Each series also pass chow break point test for possible structural break at the beginning of structural adjustment program of 1992, see appendix-4.

Table 5.2.C: ADF and PP Unit root tests results (for first difference series)

Test	**First difference Series**			
ADF	Constant, no trend	Prob.*	Constant, trend	Prob.*
CAB	-9.357429	0.0000	-10.83612	0.0000
BB	-6.196365	0.0000	-6.119428	0.0001
MS	-5.550802	0.0000	-5.502063	0.0004
GY	-4.884374	0.0003	-5.963315	0.0001
PD	-5.034840	0.0002	-5.061663	0.0011
OPEN	-6.814269	0.0000	-6.717092	0.0000
Critical values at 1%	-3.661661		-4.226815	
5%	-2.960411		-3.536601	
10%	-2.619160		-3.200320	
Phillips-Perron	Constant, no trend	Prob.*	Constant, trend	Prob.*
CAB	-8.772835	0.0000	-11.27218	0.0000
BB	-8.445329	0.0000	-9.397966	0.0000
MS	-5.331476	0.0001	-7.890743	0.0000
GY	-4.808711	0.0004	-5.680204	0.0002
PD	-5.020126	0.0002	-5.048979	0.0012
OPEN	-6.814269	0.0000	-6.717092	0.0000
Critical values at 1%	-3.621023		-4.226815	
5%	-2.943427		-3.536601	
10%	-2.610263		-3.200320	

**MacKinnon (1996) one-sided p-values*

Note: All test results are obtained using EViews 6 software.

Table 5.2C above shows the results of both ADF and PP unit root tests for the first difference. In all cases, the null of unit root is rejected implying that first difference series are stationary.

5.3. VAR Model Specification

As noted above, once the order of integration of variables are determined, the starting point in VAR based cointegration analysis is to run unrestricted VAR for variables CAB, BB, MS, GY, PD and OPEN. Then, proceed to determine the optimal lag length which is congruent to the data.

5.3.1. Optimal Lag Length

Determining optimal lag can be done through model reduction test. That is, starting from some larger lag and recursively reducing (excluding) the insignificant lag(s) till the exclusion of a specific lag length is rejected. Yet, maintaining uniform lag length for the VAR.

Alternatively, the appropriate lag length is determined using standard model selection techniques which also complemented by diagnostic test on VAR residual at a predetermined lag length. These alternative criteria for finding "best" model includes: Likelihood ratio (LR) test criterion (sensitive to errors being normal distributed), Final prediction error criterion (FPE), Akaike information criterion (AIC), Schwarz information criterion (SIC), Hannan-Quin (HQ) information criterion.

The "best" fitting model is the one that maximizes the LR, or minimizes the FPE criterion function (in essence, the overall sum of squared residuals) or AIC, SIC or HQ. Alternative criteria imply different tradeoffs between better fit (smaller residuals) and loss of degrees of freedom (due to number of estimated parameters).

Table 5.3.1: Statistic for VAR Lag Order Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	358.4512	NA	1.26e-16	-19.58062	-19.31670	-19.48851
1	**475.0284**	**187.8189***	**1.48e-18***	**-24.05713***	**-22.20970***	**-23.41233***
2	509.2398	43.71450	1.95e-18	-23.95777	-20.52681	-22.76027
3	533.2870	22.71124	6.28e-18	-23.29372	-18.27924	-21.54353

** indicates lag order selected by the criterion*[101]

The lag length suggested by the above criteria is lag one. In that case, one has to perform

[101] LR: sequential modified LR test statistic (each test at 5% level)

diagnostic test for VAR (1) residual. Similarly, starting from any lag then perform residual diagnostic test then select a specific lag in such a way that the model could pass diagnostic tests.

5.3.2. Diagnostic Test

Sometimes it is difficult to say which model is "best" hence additional requirement is that VAR residuals are not autocorrelated, has constant variance and normal distributed. Therefore, diagnostic tests on residuals are necessary to arrive at the optimal lag length of the VAR model which asserts that residuals are Gaussian. Consequently, tests of normality using Jarque-Bera test for the null of multivariate normal residuals, test of autocorrelation using Lagrange Multiplier (LM test) for the null of no residual serial correlation up to lag 12, test of hetroscedasticity using White's test with no cross terms (only levels and squares) are performed successively. The test summary is presented in table 5.3.2 below. The model passed all diagnostic tests as in each case the null cannot be rejected at the conventional level of significance. This implies that, the residuals of the VAR(1) model are homoskedastic, normally distributed and not autocorrelated. Therefore, test statistic based on assumptions of normality, homoskedastic, and no autocorrelation are valid.

Table 5.3.2: VAR residual Analysis

Tests	Null hypothesis	Statistic		Prob.
VAR residual Heteroskedasticity (White)	Homoskedastic residual	Joint	263.9279	0.2902
VAR residual Normality (Jarque-Bera)	Multivariate normal residual	Joint	13.95904	0.3033
VAR Residual Serial Correlation (LM)	No serial correlation at lag order h	LM-Stat	41.85835(1) 28.85091(2) 35.62684(3)	0.2315 0.7955 0.4862

Note: numbers in bracket indicate the lag length, Probs from chi-square distribution.

5.3.3. Lag exclusion test

To check whether the chosen lag is optimal, it is also made lag exclusion test using Wald lag exclusion test for the significance of the first lag in each individual variable as well as the joint.

Table 5.3.3: VAR Lag Exclusion Wald Tests

Variable	CAB	BB	GY	MS	OPEN	PD	Joint
Lag 1	161.3820 [0.0000]*	47.5281 [0.0000]*	172.4345 [0.0000]*	901.7489 [0.0000]*	138.7191 [0.0000]*	234.3464 [0.0000]*	1595.109 [0.0000]*
df	6	6	6	6	6	6	36

Note: Values in square brackets indicate probability value for the corresponding chi-square statistics.
** denote rejection at 1% significance level.*

Given that VAR modeling requires uniform lag length for each variable, the result shows that first lag is significant for all variables. Therefore, VAR (1) is found congruent to the data and hence adopted.

5.4. Cointegration Test: The Johansen Approach

Once determining the optimal lag of VAR, to determine the number of cointegrating relationships, the Johansen approach to cointegration is applied at the predetermined lag. Following Johansen's approach to cointegration test, the number of significant characteristic roots (eigenvalues) of a matrix determines its rank. The two test statistics for the number of roots are the trace test and the maximum eigenvalue statistics. Here, these two test statistics are computed to determine the number of cointegrating vector in the model. The results of the cointegration test statistics are presented in table 5.4A and 5.4B below.

Table 5.4A: Johansen Cointegration Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.744181	156.7223	117.7082	0.0000
At most 1 *	0.644310	106.2808	88.80380	0.0016
At most 2 *	0.546502	68.03408	63.87610	0.0214
At most 3	0.496366	38.77579	42.91525	0.1221
At most 4	0.261916	13.39728	25.87211	0.7068
At most 5	0.056719	2.160488	12.51798	0.9580

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

Under linear assumption, allowing intercept, trend and dummies (for regime and war) [111] to enter in the cointegration space, the trace test result shows that for the null of no cointegration, at most one and at most two cointegration are rejected as the trace statistics exceeds the respective critical values. In particular, trace statistic for the null of at most two (68.03) exceeds the critical value (63.87) and p-value (0.02). This implies that the null of at most two cointegration relations is rejected at 5 percent significance level in favor of the alternative three cointegration relations. The Johansen cointegration test procedure suggested more than one cointegration relation. Hence, the use of it is praiseworthy.

Table 5.4B: Johansen Cointegration Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.744181	50.44148	44.49720	0.0101
At most 1	0.644310	38.24670	38.33101	0.0511
At most 2	0.546502	29.25829	32.11832	0.1075
At most 3	0.496366	25.37851	25.82321	0.0571
At most 4	0.261916	11.23679	19.38704	0.4892
At most 5	0.056719	2.160488	12.51798	0.9580

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

[111] regime-1970/71-1973/74,1974/75-1990/91,1991/92-2008/09; war-1973/74-1977/78,1988/89-1990/91, 1997/98-1999/00.

On the other hand, with similar assumption that allows dummies, intercept and trend in unrestricted manner, the Max-Eigen statistic (50.44) exceeds the critical value (44.49) and p-value (0.01). Thus, maximum eigen value test suggests one cointegrating relationships since the null of no cointegrating vector is rejected at 5 percent significance level. Rejecting the null implies that variables do not drift apart and share at least a common stochastic trend in the long run. Other results on this ground are the unrestricted beta (β), long run coefficients and alpha (α) the adjustment coefficients are reported in the appendix- 2.

Since the objective of this study is analyzing the dynamics of current account and budget deficits, it follows that, it is made ad-hoc normalization on normalizing on current account deficit as[112]:

CAB-0.135BB+ 0.202GY+0.453MS-0.097PD+ 0.210OPEN-0.001t= 0……..... [5.1]

(0.02373) (0.03130) (0.11744) (0.01693) (0.03166) (0.00073)

Once the cointegration relationships are identified (and ad-hoc normalization is made), then impose a rank restriction on the cointegration space help to identify the variables that constitute the cointegration relationships. This restriction is a zero restriction on β_s and α_s coefficients. Restriction on β called *exclusion test* (identifying restriction) which helps to determine which variables are statistically significant in the cointegrating vector. The exclusion test is performed by placing zero restriction on the long run coefficients. If a variable is excluded from the cointegration space (fail to reject the null), it implies that it evolves independently of the other variables and hence it is not integrated with the other variables in the system. The variables in the current account equation are significant and cannot be excluded.

[112] Figures in parenthesis are Standard errors.

Exclusion test on β, long run coefficients: LR test $x^2(1)$:

CAB	BB	GY	MS	PD	OPEN	
	0.135	-0.202	-0.453	0.097	0.210	1.00
9.427	3.964	11.294	5.804	6.590	6.093	
[0.002]**	[0.046]*	[0.000]**	[0.044]*	[0.010]*	[0.013]*	

*** and * denotes significance at 1% and 5%.*

5.5. Weak Exogenity Test

Restriction on α, on the other hand, called test of *weak exogeneity* (test of significance of the speed of adjustment) which helps to determine which variable is exogenous to the system. Rejection of weak exogeneity implies that the variables under investigation are endogenous. If the null hypothesis of weak exogeneity cannot be rejected for a variable, this means that the variable is weakly exogenous to the system. Thus, there is no loss of information from not modeling its short-run behavior when estimating the parameters of the model.

In a co-integrated system, if a variable does not respond to the discrepancy from the long-run equilibrium relationship, it is weakly exogenous. Hence, zero restriction is imposed on the speed of adjustment parameter, α. The statistical significance of these restrictions is provided by the likelihood ratio (LR) test statistic with chi-square distribution. Restrictions are rejected when Chi-square statistic is too large and Probability too low. The result of weak exogenity test is presented in table 5.5 below. The α coefficients, chi-square statistic, and p-value are located in the last three rows while columns for the variables.

Table 5.5: Weak Exogenity Test Result: LR test $x^2(1)$:

CAB	BB	GY	MS	PD	OPEN
-0.911	0.441	-2.707	-0.413	1.170	- 0.088
4.509	3.683	2.172	0.201	0.002	0.042
[0.0337]*	[0.0549]	[0.1405]	[0.6531]	[0.9568]	[0.8364]

** denotes significance at 1%.*

The above result shows that zero restriction on the adjustment coefficients of CAB using LR test for binding restriction (rank=1), is rejected at 5 percent significance level. Hence, it is endogenous and can be a dependent variable. However, coefficients of MS, BB, GY, PD, and OPEN are not rejected at the conventional significance level hence they are weakly exogenous.

If a variable is found to be weakly exogenous, it remains in the long run model (i.e., the cointegration vectors) although its short run behavior is not modeled because of its exclusion from the vector on the left hand side of the equation (Harris, 1995: Harris and Sollis, 2003). That is, it will not be possible to normalize the cointegrating vectors on that variable.

Therefore, long run current account deficit equation can be written as:

CAB=0.135BB-0.202GY-0.453MS+0.097PD- 0.210OPEN+0.001t……..... [5.2]

In general, the sign of the estimated parameter normalizing on CAB is consistent with a priori expectation. As suggested by economic theories, it is found a positive coefficient of BB in the CAB equation implying movements in government deficits would explain a portion of the movements in current account deficits in the same direction. The relation between income and current account deficit is found to be negative. One possible explanation could be that higher income tends to deteriorate the current account as income increase it tends to encourage imports (there is a propensity to import) which increases the current account (trade) deficit in the long run. Another possibility is that higher income may be regarded as a productivity shock may

increase investment strongly and thus worsen the current account.

The negative coefficient on broad money also suggests that an increase in money supply will deteriorate the current account balance. This could arise when monetary shocks create pressure on domestic price level that makes exports expensive while imports become relatively cheaper. For instance, monetization of budget deficit via credit creation boosts money growth, which may be inflationary. Inflation has implication for exchange rate, exports, and imports and therefore, the current account balance (Egwaikhide et al, 2002). The coefficient of PD suggest that the accumulation of debt tends to worsen the current account balance as the county is liable to repayment of the principal and interest payment (debt servicing) on its accumulated debt in the long run.

The effect of trade openness on the current account is negative, this implies the trade openness (liberalization policies) tend to worsen the current account (trade) which is principally the result the structural problems that rooted in the economy. In particular, poor performance of exports, unstable export market, deteriorating terms of trade, unpredictable export demand, concentration on primary and agricultural exports; as well as the ever growing demand for imports put together the country to become a net importer.

5.6. Vector Error Correction Model

The previous cointegration analysis shows that presence of cointegration analysis implies that the variables that constitute the cointegration space in CAB equation tend to move together in the long run. Short-run deviations, however, could occur due to shocks to any of the variables. The dynamics governing the short-run disequilibria of the current account deficit are differs from those in the long run. The Engle and Granger (1987) representation theorem showed that if

cointegration exists between non-stationary variables, then an error-correction representation exists for the variables. Therefore, to analyze the short run dynamics, the next logical step is to specify and estimate an appropriate Vector Error Correction Model (VECM), the restricted VAR that impose cointegration on variables[113]. That is, the changes in the dependent variable as a function of the level of disequilibrium in the cointegrating relationship, captured by the error correction term, as well as changes in other explanatory variables.

The short run model estimation is carried out in the context of the Hendry's general to specific approach which involves simplifying the model into a more parsimonious error correction mechanism. Hence, it is started from a model with lag three, due to small sample, and sequentially excluding insignificant lags. Finally, first difference lagged one is modeled. The vector error correction (VEC) model estimation result for changes in current account deficit (DCAB) is presented in the first column of table 5.6A below. D stands for differenced series. The result of VECM shows that the short run dynamics of current account deficit is only explained by the one period lags of budget deficit and the adjustment coefficient of CAB as they are significant at 5 percent significance level. Similarly, budget balance is explained by its own lag, lags of money supply and dummy for war.

The coefficient of vector error correction (ECM_1) indicates the speed of adjustment that any deviations in current account deficit from previous year will return to equilibrium. The estimated coefficient of the vector error correction term for DCAD is found not only statistically significant but it also carries the expected negative sign and less than unity (-0.911), a necessary condition for the stability of the estimated model. Therefore, any shock in the system will return back to its

[113] Note that, If time series are I(1) then one could run regression in their first difference; however, by taking first differences, we lose the long run relationship that is stored in the data. This implies that one need to use variables in levels as well. The advantage of VECM is that it incorporates variables both in their level and first differences.

long run steady state. The statistical significance of the ECM_1 further validates the presence of long-run equilibrium between the current account deficit and other macroeconomic variables. It also shows the role of current account balance in the short run adjustment. The exogenity of MS, BB, GY, PD and OPEN are also confirmed since their adjustment coefficients are statistically insignificant at the conventional level of significance.

Table 5.6A: The results of VEC model estimate

Dependent variables

Explanatory variables Error Correction:	D(CAB)	D(BB)	D(GY)	D(MS)	D(PD)	D(OPEN)
ECM_1	-0.911856**	0.441952	-2.707712	-0.413266	1.170082	0.088508
D(CAB(-1))	0.022645	0.425201	1.831808	0.048662	0.063037	0.129549
D(BB(-1))	-0.330692**	-0.468286**	-0.197869	-0.020768	-0.185000	0.926455**
D(GY(-1))	0.018875	-0.066507	-0.037103	0.073966	0.059777	0.183762
D(MS(-1))	-0.308736	-0.421316**	1.179218	0.142454	0.347857	0.558605
D(PD(-1))	-0.061743	0.035526	-0.224289	0.072222	0.437558	0.122494
D(OPEN(-1))	0.047942	0.028667	0.198213	-0.032584	-0.089609	-0.061727
C	-0.003779	0.006458	-0.028000	0.003547	-0.002611	0.004397
DREGIME	0.001641	0.001127	0.036515	-0.004332	-0.005285	0.008791
DWAR	0.005504	-0.017739**	0.025591	0.006194	0.012871	-0.016134

** and ** denotes statistically significant at 1 and 5 percent.*

Table 5.6B below reports a summary of diagnostic analysis for serial correlation, autocorrelation, heteroskedasticity, normality of residuals while its detail is provided in appendix-6. These indicate that the specified model passes all the diagnostic tests. There is no evidence of autocorrelation and serial correlation, and the model passes the test of normality. Roots of Characteristic Polynomial for VEC Stability Check is also presented in appendix-7

Table 5.6B: Summary of post-estimation diagnostic test Statistics

Test	Null hypothesis	Statistic	Prob.
VEC-residual Normality (*Jarque-Bera*)	Multivariate-normal residual	Joint 128.2271	0.9991
VEC-residual Heteroskedasticity (*White*)	Homoskedastic residual	Joint 342.2371	0.3956
VEC-residual Autocorrelations (*Portmanteau)*	No-residual autocorrelations up to lag h	Adj Q-Stat 11.14559(1) 38.60954(2) 75.10387(3)	NA* 0.3525 0.3781
VEC-residual Serial Correlation (Breusch-Godfrey)	No-serial correlation at lag order h	LM-Stat 26.87883(1) 30.54766(2) 39.17688(3)	0.8647 0.7252 0.3292

** The test is valid only for lags larger than the VAR lag order*

5.7. Granger Causality Test

The causal direction between the current account deficit and the budget deficit is one of the main focuses of this empirical investigation. Evidence about the presence cointegration in variables in the previous section of cointegration analysis does not resolve an important question about causality. Nevertheless, it gives an important signal about it. Therefore, there could exist either unidirectional or bidirectional Granger causality, for this at least one of the error correction term should be significantly different from zero by the definition of cointegration. In fact, it has been checked in the previous section. To test the hypothesis that "Granger causality from budget deficit to current account deficit", test whether the coefficients of budget deficit are significant jointly, in the current account balance equation. Similarly, for the hypothesis that "Granger causality from current account deficit to budget deficit", test joint significance the coefficients of current account deficit in the budget deficit equation.

Pair-wise Granger Causality Test Results

Null Hypothesis:	F-Statistic	Probability
BB does not Granger Cause CAB	0.15197	0.69903
CAB does not Granger Cause BB	5.09254	0.03038

From pair wise Granger causality test support that the causality runs from current account deficit to budget deficit as the null of CAB does not Granger causes BB is rejected at 5 percent level of significance. In the same way, money supply Granger causes current account deficit is also found[114]. The above result informs the direction of causality runs from current account deficit to budget deficit what is referred as current account targeting (Summers, 1988).

Alternatively, Granger Causality in Vector Error Correction (VEC) environment has been performed. Here, Wald Test (chi-square) statistics is used to test the significance of variables in each (six) equation. Table 5.7B below presents the Vector error correction (VEC) Granger Causality results.

[114] The full results of pair –wise Granger causality test is given in appendix-5

Table 5.7: VEC Granger Causality Wald Test Results

Excluded *Dep.Var*.*	D(CAB)	D(BB)	D(GY)	D(MS)	D(PD)	D(OPEN)
D(CAB)		3.127793 (0.0246)**	4.177875 (0.0410)**	4.214696 (0.0401)**	0.177826 (0.6732)	0.052569 (0.6022)
D(BB)	7.97628 (0.0047)*		0.289330 (0.5907)	6.572857 (0.0104)**	0.000257 (0.9872)	1.142740 (0.2851)
D(GY)	4.867531 (0.0274)**	1.202395 (0.2728)		1.845834 (0.1743)	1.674138 (0.1957)	0.580143 (0.4463)
D(MS)	0.29049 (0.5899)	0.22223 (0.6373)	0.61571 (0.4326)		6.420590 (0.0113)**	0.841621 (0.3589)
D(PD)	0.06031 (0.0430)**	0.05441 (0.4632)	0.35624 (0.73907)	0.22421 (0.5703)		0.019255 (0.8008)
D(OPEN)	0.16502 (0.3930)	6.1330 (0.0023)*	3.22579 (0.2400)	1.09204 (0.4059)	2.46301 (0.1130)	

Note: The first entry shows the chi-square statistics while the second for the corresponding p-value
Dep.Var. = Dependent variable
*** and * denotes rejection at 5% and 1% significance level*

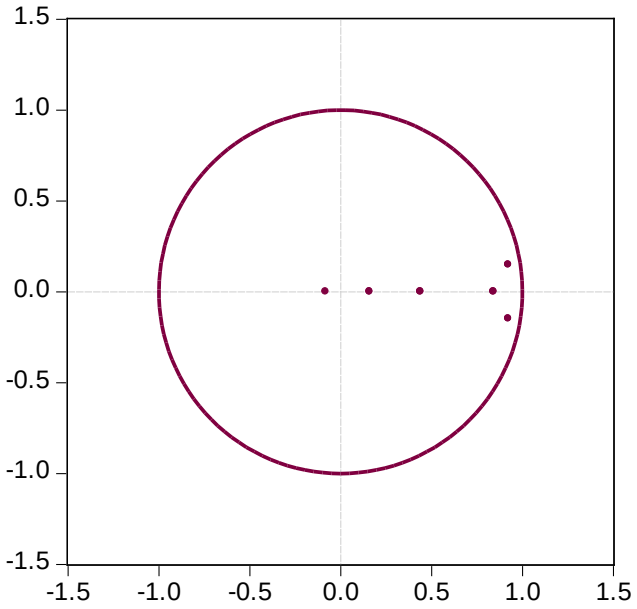
The above result shows that budget deficit doesn't Granger cause current account deficit and current account deficit doesn't Granger cause budget deficit is rejected at 5 percent significance level. Thus, budget deficit Granger causes current account deficit as well as current account deficit Granger causes budget deficit. Moreover, it is found that causality runs from MS to BB and CAB. Similarly, money supply and (GDP) income Granger cause budget deficit, which can be interpreted as economic growth is achieved while macroeconomic imbalances are intensifying. Government runs budget deficit when it spends on huge projects which are growth promoting yet, its revenues are not able to cover such expenditures. Thus, it resorts for financing means and may rely on foreign as well as domestic sources. Heavy reliance on domestic bank credit to

finance budget deficits could increase money supply. It is also found that causality runs from PD to MS and from MS to CAB (PD→ MS→ CAB). Therefore, similar explanation could be given for public debt Granger cause money supply. Government tends to shift its source of finance away from foreign towards domestic means through money creation (Seigniorage revenue) as the external debt stock enlarges. Consequently, monetary expansion put pressure on domestic price and hence tends to worsen the current account balance.

5.8. Model Stability Test

The VAR model is said to be stable if all the inverse roots lies inside the unit circle or modulus for Characteristic roots are less than unity. Stability of VAR is so important for the robustness of its estimation results. It affects the validity of the impulse response analysis and inferences based on it. Inverse Roots of AR Characteristic Polynomial are presented in figure 5.1 below. It indicates that roots are less than unity and it lies inside the unit circle. Thus, it attests that the VAR equation satisfies stability condition.

Figure 5.1: Inverse Roots of AR Characteristic Polynomial



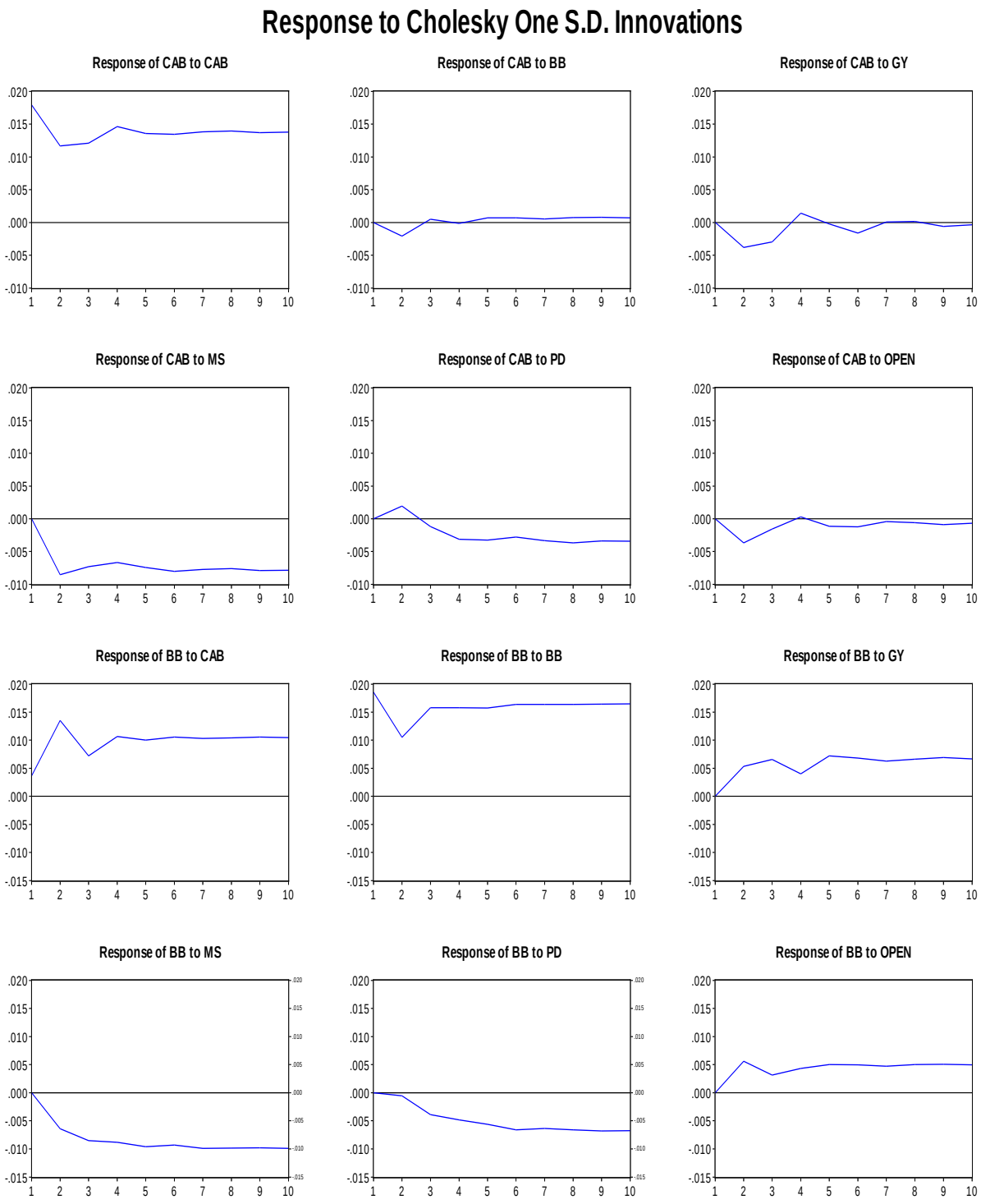
5.9. Dynamic Analysis of VAR

Although the Granger causality presented in the previous section provides a rich framework for causality, it is strictly within the sample test which may provide little evidence on the dynamic properties of the system (Masih and Masih, 1995 cited in Olugbenga and Oluwole, 2006). To overcome the drawback of Granger causality here an attempt is made to supplement the result through the impulse response function variance decomposition analysis.

5.9.1. Impulse Response Functions

Figure 5.2 below plots the impulse response functions of current account deficit and budget deficit to innovations in CAB, BB, MS, GY, PD and OPEN over a horizon of 10 years.

Figure 5.2: The Impulse response functions



It shows that response of current account deficit results from its own innovation is persistent. In addition, in response to shocks in budget deficit, the current account deficit worsens up to two years while responses of budget deficit to innovation in current account deficit is persistent, which shows shocks in current account affects budget deficit in t-time ahead. This result suggests current account deficit causes budget deficit. On the other hand, the impulse response suggests that positive monetary shocks worsen the current account persistently. It also indicates that a positive domestic income shock initially worsens the current account for three years, and then it improves it for the next three years before it slightly worsen the current account. This negative effect of domestic income shocks on the current account is consistent with theories of the current account. That is, an increase in domestic income increases import demand which worsens the (trade) current account balance. On the other hand, a positive domestic income shock could be regarded as productivity shock and may result in a robust increase investment and worsen the current account.

Furthermore, shocks in external debt improve the current account initially (for the first 2 years) and worsen it thereafter. Similarly, the responses of current account deficit to innovations related to openness (liberalization polices) is only pronounced in short run (worsen up to 3 years) then after it fades away. On the other hand, a response of budget deficit due to its own innovation is highly persistent. In fact, budget deficit is quite responsive of to innovations of other variables as well.

5.9.2. Variance Decomposition Analysis

After estimating the VAR, the impact of a shock in a particular variable is traced through the system of equations to determine the effect on all of other variables including future values of the "shocked" variable. Since this technique breaks down the variance of the forecast error of shocks to a variable into parts that is attributed to its own shock and to innovations of the other variables in the system, it allows identifying which variables are strongly affected and those that are not. For instance, if innovations to budget deficit explain significant portions of the movements in current account deficit or if the innovations to current account deficit explain significant portions of the variance in budget then the conventional twin deficit proposition is supported given data. Table 5.9A shows the proportion of the forecast error variance in current account deficit explained by their own shock and other shocks in the system.

Table 5.9A: Variance Decomposition of Current Account Deficit

Horizon		Typical shocks (innovations) in					
(Year)	S.E.	CAB	BB	GY	MS	PD	OPEN
1	0.017140	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.023905	74.42129	5.063439	1.839941	15.21018	0.770218	2.694928
4	0.031885	73.96769	5.676030	2.114111	15.25952	1.203167	1.779478
6	0.038968	71.94968	5.466141	1.692992	17.81392	1.522536	1.554725
8	0.044822	71.94890	5.355839	1.305547	18.16294	1.941761	1.285013
10	0.050045	71.42742	5.289373	1.129167	18.86735	2.112606	1.174084

Cholesky Ordering: CAB BB GY MS PD OPEN

The variance decomposition analysis result of table 5.9A shows that, at the first horizon variation of current account deficit explained only by its own shock. Budgetary shocks explain only 5 percent of the variance after a year and even after 10 years. Alternatively, monetary shocks explain relatively large portion of the variance in current account deficit and it explains 15

percent after 2 years and 18 percent after 10 years while income shocks explain 2 percent of variance at 4th horizon and 1percent after 10 years and OPEN 2 percent at 2nd horizon and 1 percent thereafter. Similarly, external public debt explains only 2 percent of the variance in current account deficit after 10 years.

Similarly, table 5.9B below shows the proportion of the forecast error variance in budget deficit explained by its own shock and other shocks in the system. After a year the forecast error in budget deficit explained by variation in current account deficit is 4 percent, however, it jumps to 29 percent in the second period. It slightly reduced and sustained with 26 percent, thereafter. Hence, the forecast error of budget deficit is fairly explained by variations in current account deficit.

Table 5.9B: Variance Decomposition of Budget Deficit

Horizon	Typical shocks (innovations) in						
(Year)	S.E.	CAB	BB	GY	MS	PD	OPEN
1	0.018958	4.574646	95.42535	0.000000	0.000000	0.000000	0.000000
2	0.025787	29.61179	64.32737	1.686744	2.693255	0.027036	1.653797
4	0.037087	26.97613	58.60148	2.153160	8.755569	2.037806	1.475853
6	0.046715	26.52680	54.90758	2.916358	10.25198	3.872318	1.524966
8	0.054730	26.27022	53.12370	3.106645	11.10794	4.842151	1.549348
10	0.061800	26.14897	52.02809	3.215256	11.59365	5.457953	1.556078

Cholesky Ordering: CAB BB GY MS PD OPEN

Similarly, innovations in money supply also explain the variation in current account deficit 2 percent at the 4th horizon and 11 percent after 10 years. External Public debt, income and openness explain 5, 3 and 1 percent of variation in budget deficit after 10 years, respectively. These results suggest that after the second period, the variation of current account deficit explained by budget deficit is only 5 percent while variations in budget deficit explained by

current account deficit is 26 percent. This suggests the direction of causality runs from current account deficit to budget deficits.

Putting in a few words, causality runs from current account to budget deficit both in the long run and in the short run while causality runs from budget deficit to current account deficit in the short run. Thus, the result supports the conventional twin deficit hypothesis as well as current account targeting while it refutes the Ricardian Equivalence Hypothesis.

6. Conclusion and Policy Implication

6.1. Conclusion

The objective of this study is to analyze the dynamics, causality and long run relationship between current account and budget deficits along with other macroeconomic variables. These include money supply, income (GDP), external public debt and openness in a highly indebted developing country, Ethiopia.

In attempts to study the current account imbalances, researchers have explored the possible link between budget deficit and current account deficit. An example is the so-called 'twin deficits hypotheses'. However, most of the twin deficit studies employed the Granger causality test in bivariate setting. The contributions of other macroeconomic variables relevant to the current account and budget deficit are considered minor and often ignored. Hence, in this work, an attempt is made to consider both current account and fiscal balance determinants, using annual macro data covering from 1970/71 to 2008/09.

The study is not only different in its data set but it also makes methodological improvement over previous works done in Ethiopia. It employed a VAR based Johansen's co-integration approach in finding long run relationship among variables, VAR techniques of innovation accounting of impulse response function and variance decomposition analysis as well as VAR Granger causality test; to investigate causality, to trace the effect of shock(s) in the system, and to provide a quantitative assessment of the relationship between current account deficit and budget deficit along with other macro variables.

The result from tests of Granger causality, impulse response function and variance decomposition summarized as causality runs from current account deficit (CAB) to budget deficit (BB) both in the long run and in the short run while causality runs from BB to CAB in the short run. According to variance decomposition test result CAB shock explain 29 percent of the variance BB, at the 2nd horizon and 26 percent after the second horizon. In contrast shocks associated with BB explain only 5 percent of variance in CAB (BB is strongly affected by CAB). Thus, the result supports the conventional twin deficit hypothesis in the short run. More importantly, it supports Summers (1988) current account targeting that is, causality runs from CAB to BB. In addition, evidences are found that suggest money supply and income Granger cause current account deficit as well as budget deficit. Moreover, current account deficit also causes income growth which implies that income growth is partly achieved while the current account balance is deteriorated (imports and capital inflows). Similarly, public debt (PD) deteriorates current account balance indirectly through money supply in addition to its direct effect via debt servicing. Besides, the impulse response function suggests that PD (in the long run) and MS persistently deteriorate CAB. The responses of current account deficit to innovations related to openness (liberalization polices) is also only pronounced in short run.

6.2. Policy Implication

Following the empirical result, attempts to reduce the budget deficit could only solve the current account deficit in the short run whereas reducing current account (trade) deficit sustainably may help in reducing the budget deficit hence to restore macroeconomic balances. Therefore, policy makers should give more emphasis to reduce the external deficit. Indeed, reducing current account deficit requires implementing prudent monetary and fiscal policy which help to mitigate inflationary pressures and may assist improving the current account balance.

In addition, attracting and encouraging export- oriented investments. Attracting FDI inflows ease foreign exchange constraint and also helps for the transfer of technology may facilitate export diversification and/or import substitution that saves foreign exchange. Similarly, measures for structural transformation, in such a way that, it can help broadening the export base. Moreover, policies must be put in place to increase the capacity, efficiencies and foreign competitiveness of domestic industries in the export sector. These could help the country to benefit from benefit from trade liberalisation policies and reducing the external deficit.

It is also supportive to enhance domestic revenue mobilization and to ensure efficiency of public spending which could reduce budget deficit. This would help to reduce government borrowing from banks and thereby to ease its inflationary impact and ultimately reducing current account deficit. Furthermore, minimizing government’s dependency on aid and improving external public debt sustainability will help to tackle the imbalances.

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Appendices

Appendix -1: Correlation Coefficient

	CAB	BB	GY	MS	PD	OPEN
CAB	1.000000	0.854539	-0.833217	-0.948648	-0.510987	-0.832244
BB	0.854539	1.000000	-0.629558	-0.935047	-0.772928	-0.825266
GY	-0.833217	-0.629558	1.000000	0.765708	0.228072	0.596875
MS	-0.948648	-0.935047	0.765708	1.000000	0.679638	0.802907
PD	-0.510987	-0.772928	0.228072	0.679638	1.000000	0.651732
OPEN	-0.832244	-0.825266	0.596875	0.802907	0.651732	1.000000

Appendix -2: Unrestricted Cointegrating and Adjustment Coefficients

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

CAB	BB	MS	PD	OPEN	GY	@TREND(2)
-98.45733	8.180940	-44.65386	9.595525	-20.72651	-19.89223	0.068982
-7.500741	63.18073	43.89811	-8.744389	-1.501366	-10.53462	-0.050039
88.47284	-65.66013	-1.020748	-2.515059	31.63964	-12.80993	-0.062938
12.69734	43.88375	13.07346	3.899005	16.36630	0.543906	-0.065530
-3.043320	-46.05781	10.17864	-7.373441	19.60432	5.036005	-0.227322
38.32061	-20.68261	-30.45255	-1.124380	19.62187	-0.261777	0.100856

Unrestricted Adjustment Coefficients (alpha):

D(CAB)	0.009261	-0.003593	-0.001515	-0.003149	0.005899	0.000665
D(BB)	-0.004489	-0.008133	0.003514	-0.005323	0.000845	-0.001996
D(MS)	0.004197	-0.008649	0.001350	8.65E-05	-0.005027	0.002317
D(PD)	-0.011884	0.028166	0.005995	-0.035141	-0.012907	0.010320
D(OPEN)	-0.000899	0.003018	-0.011240	-0.002236	-0.015349	-0.002599
D(GY)	0.027501	0.038753	0.031315	0.013476	0.002356	-0.008274

Appendix -3: Cointegrating Equation

1 Cointegrating Equation(s): Log likelihood 485.2857

Normalized cointegrating coefficients (standard error in parentheses)

CAB	BB	MS	PD	OPEN	GY	@TREND(2)
1.000000	-0.135091	0.453535	-0.097459	0.210513	0.202039	-0.001701
	(0.02373)	(0.11744)	(0.01693)	(0.03166)	(0.03130)	(0.00073)

Adjustment coefficients (standard error in parentheses)

D(CAB)	-0.911856
	(0.27744)
D(BB)	0.441952
	(0.30685)
D(MS)	-0.413266
	(0.33716)
D(PD)	1.170082
	(1.50958)
D(OPEN)	0.088508
	(0.67639)
D(GY)	-2.707712
	(1.46518)

Appendix-4: Chow Breakpoint Test

BB

Chow Breakpoint Test: 1992
Null Hypothesis: No breaks at specified breakpoints
Equation Sample: 3 39

F-statistic	0.280187	Prob. F(2,33)	0.7574
Log likelihood ratio	0.623023	Prob. Chi-Square(2)	0.7323
Wald Statistic	0.560374	Prob. Chi-Square(2)	0.7556

CAB

Chow Breakpoint Test: 1992
Null Hypothesis: No breaks at specified breakpoints
Equation Sample: 3 39

F-statistic	0.548336	Prob. F(2,33)	0.5831
Log likelihood ratio	1.209613	Prob. Chi-Square(2)	0.5462
Wald Statistic	1.096672	Prob. Chi-Square(2)	0.5779

GY

Chow Breakpoint Test: 1992
Null Hypothesis: No breaks at specified breakpoints
Equation Sample: 3 39

F-statistic	1.982834	Prob. F(2,33)	0.1537
Log likelihood ratio	4.198834	Prob. Chi-Square(2)	0.1225
Wald Statistic	3.965667	Prob. Chi-Square(2)	0.1377

PD

Chow Breakpoint Test: 1992
Null Hypothesis: No breaks at specified breakpoints
Equation Sample: 3 39

F-statistic	0.147211	Prob. F(2,33)	0.8637
Log likelihood ratio	0.328646	Prob. Chi-Square(2)	0.8485
Wald Statistic	0.294422	Prob. Chi-Square(2)	0.8631

OPEN

Chow Breakpoint Test: 1992
Null Hypothesis: No breaks at specified breakpoints
Equation Sample: 3 39

F-statistic	0.212943	Prob. F(2,33)	0.8093
Log likelihood ratio	0.474453	Prob. Chi-Square(2)	0.7888
Wald Statistic	0.425886	Prob. Chi-Square(2)	0.8082

Appendix -5: Pair-wise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Probability
BB does not Granger Cause CAB	38	0.15197	0.69903
CAB does not Granger Cause BB		5.09254	0.03038
MS does not Granger Cause CAB	38	13.1062	0.00092
CAB does not Granger Cause MS		2.16466	0.15015
PD does not Granger Cause CAB	38	1.77143	0.19181
CAB does not Granger Cause PD		2.49169	0.22492
OPEN does not Granger Cause CAB	38	0.47087	0.49711
CAB does not Granger Cause OPEN		0.35697	0.55404
GY does not Granger Cause CAB	38	0.26747	0.60829
CAB does not Granger Cause GY		14.1921	0.00061
PD does not Granger Cause BB	38	3.96898	0.05419
BB does not Granger Cause PD		0.03365	0.85552
MS does not Granger Cause BB	38	3.85057	0.05772
BB does not Granger Cause MS		2.39581	0.13066
OPEN does not Granger Cause BB	38	1.04157	0.31446
BB does not Granger Cause OPEN		2.94176	0.09516
GY does not Granger Cause BB	38	0.29907	0.58793
BB does not Granger Cause GY		3.89405	0.05639
MS does not Granger Cause PD	38	1.05958	0.31037
PD does not Granger Cause MS		0.00711	0.93328
OPEN does not Granger Cause PD	38	5.23130	0.02834
PD does not Granger Cause OPEN		6.62718	0.01443
GY does not Granger Cause PD	38	3.41083	0.07324
PD does not Granger Cause GY		2.32219	0.13653
OPEN does not Granger Cause MS	38	0.11595	0.73550
MS does not Granger Cause OPEN		4.93066	0.03295
GY does not Granger Cause MS	38	0.08423	0.77336
MS does not Granger Cause GY		7.84002	0.00826
GY does not Granger Cause OPEN	38	0.00343	0.95361
OPEN does not Granger Cause GY		6.21027	0.01759

Appendix -6: Diagnostic Tests

6a. Portmanteau Tests for Autocorrelations

VEC Residual Portmanteau Tests for Autocorrelations
Null Hypothesis: no residual autocorrelations up to lag h
Included observations: 37

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	10.84436	NA*	11.14559	NA*	NA*
2	36.82377	0.4306	38.60954	0.3525	36
3	70.35910	0.5327	75.10387	0.3781	72
4	113.2543	0.3457	123.1985	0.1505	108
5	138.6028	0.6113	152.5077	0.2978	144
6	156.1070	0.9005	173.3998	0.6244	180
7	206.0565	0.6750	235.0042	0.1786	216
8	230.7342	0.8278	266.4895	0.2537	252
9	270.8918	0.7579	319.5550	0.0973	288
10	303.0014	0.7931	363.5570	0.0642	324
11	324.4165	0.9111	394.0323	0.1047	360
12	352.2157	0.9444	435.1751	0.0850	396

*The test is valid only for lags larger than the VAR lag order.
df is degrees of freedom for (approximate) chi-square distribution

6b. LM Tests for Serial Correlation

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Sample: 1 39
Included observations: 37

Lags	LM-Stat	Prob
1	26.87883	0.8647
2	30.54766	0.7252
3	39.17688	0.3292
4	49.17162	0.0705
5	29.42881	0.7726
6	21.63943	0.9719
7	66.57356	0.0014
8	33.80682	0.5733
9	51.31846	0.0470
10	49.43441	0.0672
11	32.19381	0.6503
12	44.50510	0.1562

Probs from chi-square with 36 df.

6c. Normality Tests

VEC Residual Normality Tests
Orthogonalization: Residual Covariance (Urzua)
Null Hypothesis: residuals are multivariate normal
Sample: 1 39
Included observations: 37

Component	Skewness	Chi-sq	df	Prob.
1	-0.019819	0.002843	1	0.9575
2	-0.029857	0.006452	1	0.9360
3	-0.453407	1.487991	1	0.2225
4	0.383673	1.065481	1	0.3020
5	0.403391	1.177811	1	0.2778
6	-0.166122	0.199747	1	0.6549
Joint		3.940327	6	0.6848

Component	Kurtosis	Chi-sq	df	Prob.
1	0.947525	8.240294	1	0.0041
2	1.401327	4.765525	1	0.0290
3	2.509304	0.254265	1	0.6141
4	1.808033	2.454813	1	0.1172
5	3.369384	0.638259	1	0.4243
6	1.603075	3.524362	1	0.0605
Joint		19.87752	6	0.0029

Component	Jarque-Bera	df	Prob.
1	8.243137	2	0.0162
2	4.771978	2	0.0920
3	1.742257	2	0.4185
4	3.520295	2	0.1720
5	1.816071	2	0.4033
6	3.724109	2	0.1554
Joint	128.2271	182	0.9991

6D. Heteroskedasticity Test

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Sample: 1 39
Included observations: 37

Joint test:

Chi-sq	df	Prob.
342.2371	336	0.3956

Individual components:

Dependent	R-squared	F(16,20)	Prob.	Chi-sq(16)	Prob.
res1*res1	0.418847	0.900895	0.5788	15.49733	0.4886
res2*res2	0.372727	0.742753	0.7245	13.79090	0.6143
res3*res3	0.719567	3.207388	0.0076	26.62397	0.0459
res4*res4	0.468929	1.103735	0.4117	17.35038	0.3633
res5*res5	0.235730	0.385547	0.9711	8.722007	0.9244
res6*res6	0.387264	0.790032	0.6807	14.32878	0.5742
res2*res1	0.397342	0.824146	0.6490	14.70166	0.5466
res3*res1	0.465508	1.088667	0.4229	17.22378	0.3713
res3*res2	0.356551	0.692657	0.7699	13.19240	0.6586
res4*res1	0.304335	0.546841	0.8878	11.26039	0.7931
res4*res2	0.450220	1.023636	0.4736	16.65814	0.4080
res4*res3	0.462556	1.075823	0.4326	17.11457	0.3782
res5*res1	0.229697	0.372738	0.9751	8.498788	0.9326
res5*res2	0.268931	0.459825	0.9402	9.950451	0.8692
res5*res3	0.395595	0.818148	0.6546	14.63700	0.5514
res5*res4	0.454024	1.039477	0.4609	16.79888	0.3987
res6*res1	0.425716	0.926622	0.5559	15.75148	0.4704
res6*res2	0.594768	1.834652	0.0996	22.00641	0.1430
res6*res3	0.334188	0.627408	0.8262	12.36497	0.7185
res6*res4	0.254417	0.426541	0.9557	9.413432	0.8954
res6*res5	0.247227	0.410528	0.9622	9.147415	0.9072

Appendix-7: VEC Stability Check

Roots of Characteristic Polynomial
Endogenous variables: CAB BB GY MS PD OPEN
Exogenous variables: DWAR DREGIME
Lag specification: 1 1

Root	Modulus
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
-0.170215 - 0.669577i	0.690874
-0.170215 + 0.669577i	0.690874
-0.514982	0.514982
0.496504	0.496504
-0.264509 - 0.131109i	0.295220
-0.264509 + 0.131109i	0.295220
0.144992	0.144992

VEC specification imposes 5 unit root(s).

Declaration

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other university, and that all sources of materials used for the thesis have been duly acknowledged.

The examiners' comments have been duly incorporated.

Declared by:

Name: _____

Signature: _____

Date: _____

Confirmed by Advisor:

Name: _____

Signature: _____

Date: _____

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