The Effect of Real Effective Exchange Rate on Balance of Payments in Ethiopia: *A Co-Integrated VAR Approach*

A Thesis Submitted to The School of Graduate Studies of Jimma University in Partial Fulfillment of the Requirements for the Award of the Degree of Master of Science in Economic Policy Analysis.

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Declaration

I hereby declare that this thesis entitled "*The Effect of Real Effective Exchange Rate on Balance of Payments in Ethiopia: A Co-Integrated VAR Approach",* has been carried out by me under the guidance and supervision of Mr. Muhdin Muhammedhussen and Mr. Sisay Tolla.

The thesis is original and has not been submitted for the award of any degree or diploma to any university or institutions.

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This is to certify that the thesis entitles "The Effect of Real Effective Exchange Rate on Balance of Payments in Ethiopia: A Co-Integrated VAR Approach", submitted to Jimma University for the award of Degree of Master of science in Economic Policy Analysis is a record of bonafide research work carried out by Mr. Teamrat Kahssay, under our guidance and supervision.

Therefore, we hereby declare that no part of this thesis has been submitted to any other university and institutions for the award of any degree or diploma.

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Abstract

The paper investigated the relationship between real effective exchange rate and balance of payment in Ethiopia using annual data spanning the period 1976 - 2015. The analysis is based on a cointegrated vector autoregressive approach. The methodology of the study begins with Augmented Dickey-Fuller stationarity tests of the data and the Johansen cointegration rank test that revealed current account, real gross domestic product, real effective exchange rate, budget deficit, interest rate and inflation rate to be cointegrated with one cointegrated relationship and thus share long-run equilibrium relationships. Empirical results suggest that real effective exchange rates do play a role in determining the short and long-run behavior of the Ethiopian current account. Thus, there is strong indication for the Marshall-Lerner condition to hold in Ethiopia, as the current account improves in the long run in response to a devaluation in the real effective exchange rate. The result of the long run relationship from the vector error correction model, together with the impulse response functions signify that, following devaluation in the real effective exchange rate current account first deteriorates before it later improves, i.e. exhibiting the J-curve pattern. Accordingly, the major policy implication of this study is devaluation of the real effective exchange rate by taking the macroeconomic realities of the country into account while advocating export promotion and import substitution strategies.

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ACRONYMS/ ABBREVIATIONS

AD	Aggregate Demand
ADF	Augmented Dickey-Fuller
AR	Autoregressive
ARMA	Autoregressive Moving Average
ARDL	Autoregressive Distributed Lag
BOP	Balance of Payment
CA	Current Account
EFY	Ethiopian Fiscal Year
ETB	Ethiopian Birr
FEVD	Forecast Error Variance Decomposition
GDP	Gross Domestic Product
IIP	International Investment Position
IMF	International Monetary Fund
IRF	Impulse Response Function
LM	Lagrange Multiplier
MABOP	Monetary Approach to Balance of Payment
MLC	Marshal-Lerner Condition

NBE	National Bank of Ethiopia
OLS	Ordinary Least Square
TB	Trade Balance
TD	Trade Deficit
USD	United States Dollar
VAR	Vector Autoregressive
VEC	Vector Error Correction
VECM	Vector Error Correction Model

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CHAPTER ONE

1. INTRODUCTION

1.1 Background of the Study

A macroeconomic policy set up is primarily aimed to achieve sustainable economic growth, full employment, price stability and balance of payments position. Because countries can achieve satisfactory growth and employment under an environment of moderate Inflation and balance of payments disequilibria, price stability and balance of payments equilibrium are regarded as secondary objectives to satisfactory economic growth and full employment. However, a continuous balance of payments disequilibria will eventually affect economic growth, employment, and price stability. This, therefore, justifies the case for considering the balance of payments equilibrium an important objective of economic policy (Bank of Uganda, 2003).

The balance of payments is a macro variable and a statistical statement that systematically summarizes the economic transaction of an economy with the rest of the world for a specific period. It records transactions that give rise to sets of accounts that indicates all the flows of value between residents of one country and the residents of other countries of the world that they enter into economic dealings (IMF, 1996).

Economists and policy-makers are interested in a nation's balance of payments because it provides much useful information about a degree of openness of the economy, exports and production structure, private transfers and labor market, among others. Above all, the account may indicate whether the nation's external economic position is in a healthy state, or whether problems exist which may be signaling a need for corrective action of some kind. To find out whether a nation suffers from disequilibrium in its balance of payments or is in external balance, periodic assessment of the balance of payments is needed (Dunn and Mutti, 2004).

Many developing countries can face the balance of payment deficit because of persistent deficits in their trade with developed countries. To realize their growth and development programs developing countries has to make huge imports from developed countries but they are deficient in making as many exports out of their domestic production to finance their imports. To solve this problem, some nations try to find a balance of payment support from external sources including the International Monetary Fund (IMF), debt relief from creditors, getting short-term loans from other countries, selling foreign currencies from country's foreign exchange reserves and planned adjustment process. Exchange rate adjustment is essentially part of this adjustment process (Rehman and Rashid, 2015).

Ethiopia has experienced large deficits in its current account. According to the data compiled by the National Bank of Ethiopia (NBE), the services sector has shown consistent surpluses, reflecting revenues from Ethiopian Air Lines and to a lesser extent from tourism and shipping services, having risen from ETB 309.8 million in 2002/03 to an estimated ETB 11,090 million in 2010/11. Similarly, transfers of funds from official donors and remittances from nationals living abroad have been strong, amounting to ETB 5,147.4million in 2002/03 and more than ETB 29,991 billion in 2003–04. These surpluses, however, have not been enough to offset large shortfalls in merchandise trade and debt-service payments. In 2011–12, the current account deficit was ETB 78,778 million. It fell to ETB 78,423.2 million in 2012–2013 before rising to an estimated ETB 109,451.1 million in 2013/14. These deficits have been covered by exhaustion of foreign exchange reserves and by debt forgiveness. Moreover, the overall balance of payment deteriorated from a surplus of Birr 3,596 million during 2009/10 fiscal year to a deficit of Birr 17,536.1 million in the year 2015/2016. This implies that the issue of balance of payment and its determinants in our country requires an intensive study with a sound methodology so that it may be easy to reduce the deficit.

1.2 Statement of the Problem

The balance of payments is a record-keeping book that shows the international transaction of the resident country with the rest of the world. Any transaction payments to

the rest of the world entered into the balance of payments account as a debit with negative sign whereas a receipt from the rest of the world entered into the balance of payments accounts as a credit with a positive sign (Krugman and Odstfeld, 2003). Every transaction automatically enters the balance of payments twice, once as credit and second as debit. Therefore, the balance of payments is a double entry bookkeeping record.

This account helps us understand how people of Ethiopia trade the Birr for that of another country as well as the flow of human capital across as indicated by net private non-official capital flows and flows of official reserves. In other words, balance of payments records trade in financial assets and all those international transactions, which involve the exchange of money for something else and even including employees' compensation. Overall, the balance of payments displays the nation's international economic position and its relationships with the rest of the world.

All countries in the world strive to achieve balance of payments equilibrium. However, due to many reasons to almost all economies securing balance of payments at equilibrium becomes difficult. As in our case, Ethiopia has experienced chronic balance of payments difficulties with the exception of a few years. The major factor in the deteriorating balance of payments was the worsening situation of merchandise trade. The trade deficit that existed during the imperial years continued to grow following the revolution, despite the introduction of import controls. Since EFY l981/82, the value of merchandise imports has been roughly doubled the value of exports (WB, 1987). This continuous deficit has an implication on the international relation, currency, foreign currency reserve and generally on the overall economy of the country.

A continual deficit in the balance of payment may cause a variety of problems. Fundamentally, there is the question of the adequacy of foreign exchange reserves and of what happens if reserves come close to exhaustion. If the deficit persists, all the country's foreign reserves may be exhausted, which could lead to loss of confidence, as the country is declared unable to repay its foreign debts and to make payment for imports (Dunn and Mutti, 2004).

> *"Countries that face the exhaustion of foreign exchange reserves often find themselves dependent on lenders such as the International Monetary Fund. The typical result is emergency loans extended under rather stringent terms, widely known as conditionality. The country's ability to manage its own economic and financial affairs can be compromised by such conditions, a situation that is politically embarrassing" (Dunn and Mutti, 2004: page 331).*

In addition, a recent past economic events asserted that many macroeconomic crises have caused by an imbalance in the current account: among others: the 1994/95 Mexican "Tequila" crisis, the 1997/98 Asian financial crisis and the Russian financial crisis of 1998. A current account imbalance (especially a deficit) has thus become an acknowledged indicator of undesirable macroeconomic developments and, in the case of deficits, a recognized indicator of crisis (Martin, 2014). Hence, as long as the balance of payments deficit in Ethiopia is persistent, a critical study regarding the determinants of balance of payments is essential. Theoretically and in fact practically, exchange rate, being the price of one currency (the domestic currency) in terms of another (the foreign currency), is a key determinant of the balance of payments position of an economy.

The recent issue of persistent balance of payments imbalances has led to a renewed interest in better understanding the effect of exchange rates on international trade and thereby balance of payments. In spite of the increasing number of studies on the topic, the actual effect of exchange rates on balance of payments is still an open and controversial question. In international stage, different studies have made a great effort to analyze the impact of devaluation and exchange rate volatility on trade balance and balance of payments using a panel, cross-sectional and time-series data.

Nicholas et.al (2016) examines the effect of exchange rate on balance of payment in Nigeria. The result shows that an increase in the exchange rate will result in a decrease in BOPs. Further, Azra et al. (2015) indicated that real exchange rate inversely influences the balance of payments both in the long run and in the short run. Moreover, although it is contrary to the theory that devaluation improves the balance of payments, according to

Khan (2008), Felipe et.al (2009), Umer et.al (2010), Eita and Gaomab (2012), Kennedy (2013) and Ajayi (2014) real exchange rate is found to be negative and insignificant.

Nawaz (2014) investigated the impact of exchange rate on balance of payments of Pakistan economy. The study concluded that there is a significant and positive relation between exchange rate and balance of payments. More to the point, studies conducted by Abraham (2012), Anthony (2012), Nazeer (2015) and other researchers revealed that a nominal devaluation improves the balance of payments. In addition, a study by Zelalem (2014) revealed that there is long-run relationship among variables; however, estimation results indicated that the sign of real effective exchange rate is positive and insignificant.

The literature reviews of the previous researchers have mixed results on the factors in questions. The inconsistency in the research results of the various studies reviewed therefore motivated this study. In addition, most of the research studies are centered on monetary approach to balance of payments. This approach has been criticized many times because it considers only monetary variables and ignores real factors which also play an important task.

Therefore, this study devoted to investigate if exchange rate has any significant effect on the external sector (balance of payment) of Ethiopian economy by considering major explanatory variables comprises of the amalgam of both monetary and fiscal variables.

1.3 Objectives of the Study

1.3.1 General Objective

To investigate empirically the effect of real effective exchange rate on Ethiopian balance of payments.

1.3.2 Specific Objectives

- To briefly look at the trend of balance of payments and exchange rate in Ethiopia.
- To examine short run and long run relationship between the exchange rate and the balance of payments in Ethiopia.

1.4 Significance of the Study

To the best of the researcher's understanding, this paper is the first to study the effect of exchange rate on balance of payments in Ethiopia. The significance of this study is therefore: to make known the relationship between exchange rate and balance of payments, policy implications and recommendations, which will be of immense help to policy makers to devise appropriate and scientific exchange rate policy to improve the balance of payment of the country. It also serves as a starting point for subsequent researchers on the same and related topics.

1.5 Scope and limitation of the Study

In this study, the effect of real effective exchange rate on balance of payments in Ethiopia is studied. We used current account as a proxy for the overall balance of payment. The study also focuses on the analytical framework for the analysis of the determinants of balance of payments: inflation rate, budget deficit, real GDP, real effective exchange rate and interest rate. Additionally, the study covers the period from 1976 up to 2015 founded upon prior information and common practice.

This study is limited in the sense that it is not easy to include all of the relevant variables that can determine the balance of payments of the country. This is partly because of the existing of numerous variables that have indirect impact on balance of payments and partly because of difficulties to obtain statistical information for some of these variables. Further, the study did not consider the capital and financial accounts of the balance of payments.

1.6 Structure of the Thesis

For the purpose of logical sequence, this paper is organized in five chapters. The first chapter presents introductory part of the study. The second chapter deals with the review of theoretical and empirical literature on the research topic. Chapter three presents methodology of the study. The fourth chapter deals with descriptive analysis and

estimation results of the econometric model. The last chapter presents conclusion and policy implications.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

2.1. Theoretical Literature Review

2.1.1. The Concept of Balance of Payment and Its Components

The balance of payments (BOP) is a statistical statement that systematically summarizes the economic transactions of an economy with the rest of the world for a specific period of time. BOP statistics are arranged within a coherent structure to facilitate analysis, which is undertaken for many reasons—including policy formulation, policy monitoring, projections, studies of the behavior of real and financial markets, and bilateral and multilateral comparisons. The standard components are grouped under two major headings: the current account and the capital and financial account (IMF, 1996).

2.1.1.1. Current Account

According to Kindleberger (1982), the current account of a country consists of all transaction relating to trade in goods and services and unilateral (or unreturned) transfers. This account comprises of both visible and invisible items. The visible flows constitute trade in goods, whereas, invisible flows include services such as insurance, transportation, banking, tourism and many others. Merchandise of good exports and imports are visible since they consist of tangible things that can be seen. Invisible trade, on the other hand, includes payments for overseas embassies and military bases, travels and transportation, interest, profit and dividends from overseas investments. The difference between visible exports and imports is regarded as the trade balance or visible balance, while the difference between invisible exports and imports is called the invisible balance.

In most developing countries, the trade balance is the most important. Thus, the sum of the trade balance, balance on invisible items and transfer payments gives the current account balance. In practice, it is usually common to consider one account of the BOP as

an indicator of the performance of the country's BOP. Most studies have traditionally focused on the current account or trade balance as an indicator in this respect (Ames, 2002). The trade balance is considerably the largest component of Ethiopia's current account. In fact, a shortfall in the trade balance is the primary cause for the persistent current account deficit of the country. A deficit on the current account of a nation means that the nation has imported more goods and services than sold to the rest of the world; while a surplus means, more goods and services have been exported than imported.

2.1.1.2. Capital Account

The capital account, which is a subdivision of the capital and financial account, includes an economy's transactions with nonresidents in non-produced, nonfinancial assets (such as patents, copyrights, and licenses) and in capital transfers. These transactions are separated from transactions recorded in the current account because capital account transactions are not directly related to the processes of production and consumption. The capital account of the balance of payments is synonymous with the capital account of the national accounts. Gross credit and gross debit entries should be shown separately for capital account transactions (Pilbeam (1992) and IMF (1996)).

There is an important distinction between

- Non-produced, nonfinancial assets and
- Services produced from these assets.

These services, which are generally called royalties and licensing fees, are recorded (along with all other transactions in services involving residents and nonresidents) in the services component of the current account. For example, the copyright to Beatles songs is a non-produced, nonfinancial asset, and transactions in this asset are recorded in the capital account. However, royalty payments made to the owner of the copyright reflect productive output from the use of the asset. In other words, the royalties are payment for a service provided by the owner of the copyright to the user of the songs (IMF, 1996). A transfer is classified as capital if the transfer involves the provision of a capital asset or if the transfer involves the provision of a financial asset and that financial asset is linked to

the acquisition or disposal of a capital asset. A capital asset is any nonfinancial asset that can produce a stream of services over time.

2.1.1.3. Financial Account

According to Krugman and Obstfeld (2003), transactions in the compiling economy's financial assets and liabilities are recorded in the financial account, which is a subdivision of the capital and financial account. The financial account shows how an economy's BOP transactions are financed. If an economy's savings exceed its investment, the surplus must be reflected in net financial outflow or net financial investment in the rest of the world. This financial outflow finances, in turn, the acquisition of nonfinancial resources by other economies. If an economy's savings are less than its investment, the economy will be a net importer of nonfinancial assets from the rest of the world. These net imports must be financed by a net financial inflow from the rest of the world.

Three criteria must be met for a transaction to be included in the financial account. These criteria are: (I) a transaction involves a change of ownership, including the creation or liquidation of an asset or liability. The pledging, authorization, commitment, or setting aside of funds for the purchase of an asset or repayment of an obligation does not alter the ownership of an asset or liquidate a claim. (II) An asset or liability must represent actual claims that are legally in existence. Therefore, the authorization of a loan or the incurrence of a contingent liability is not sufficient to establish, respectively, a claim or liability. (III) A transaction involves an external financial asset or liability. The external financial assets of an economy are comprised of holdings of monetary gold, special drawing rights (SDRs), and claims on nonresidents. The external liabilities of an economy are comprised of indebtedness to nonresidents (IMF, 1996).

2.1.2. Theories of Balance of Payment

Theories of BOP are concerned with identifying possible determinants of BOP, and specifically analysis of policies for preserving BOP equilibrium. There are two competing theories of balance of payments: the Keynesian or fiscal (which includes elasticity and the absorption approaches) and the monetary theories. Each of the two

approaches provides distinct explanations on how the determinants of the balance of payments could lead to equilibrium and disequilibrium of the balance of payments account.

2.1.2.1. Keynesian or Fiscal Approach

The Keynesian approach (KA) to balance of payments was developed and based basically on the work of John M. Keynes in the twentieth century. The most well known theories are elasticity and absorption theories of balance of trade and payments. The elasticity approach provides an analysis of how devaluations of exchange rate and price level will affect the balance of trade depending on the elasticities of supply and demand for foreign exchange and foreign goods. The theory of elasticity leads to what is called the "J-curve effect", which refers to the pattern of the balance of trade following a devaluation. The absorption approach to the balance of trade is a theory that emphasizes how domestic spending on domestic goods changes relative to domestic output. In other words, the balance of trade is viewed as the difference between what the economy produces and what it takes for domestic use or absorbs (Melvin, 1992).

2.1.2.1.1. The Elasticity Approach

This is a theory that is associated with Robinson. As Salvatore (1998) put forward, the elasticity approach is concerned with the following three questions. First, what are the conditions for currency devaluation to improve a country's BOP on current account? Second, what will be the effect of currency devaluation on the level of domestic activity, how will this affect BOP, and what are the conditions for devaluation to be successful? Third, what will be the effect of devaluation on terms of trade of the devaluing country?

Clearly stated, the elasticity approach emphasized on the current account of the balance of payments and the condition under which exchange rate changes can compensate for price distortions in international trade, which are assumed to be the major cause of the value of imports exceeding exports. The Marshallian partial equilibrium analysis is applied to markets for exports and imports. Capital movements are assumed away and the domestic price level varies with respect to the world price level. To claim whether an

improvement in the balance of payments occurs because of devaluation depends crucially on the foreign elasticity of demand for exports and home elasticity of demand for imports denoted e_x and e_m, respectively. If the sum of foreign elasticity of demand for exports and home elasticity of demand for imports, that is, $e_x + e_m > 1$, devaluation would improve the balance of payments (assuming of course that the foreign exchange market was stable). This is called the Marshall Lerner condition. If the sum is equal to unity, a change in the exchange rate will leave the balance of trade unchanged. If the sum is smaller than unity, a depreciation will make the balance unfavorable and an appreciation will make it more favorable (Ames, 2002).

The rationale behind Marshall Lerner this condition is as follows. Suppose the elasticity of demand for exports is zero. In this case, exports in domestic currency are the same as before devaluation. If the sum of the elasticities is greater than one, the elasticity of demand for imports must be greater than one, so that the value of imports falls. With no fall in the value of exports and a fall in the value of imports, the balance of payments improves. Now, suppose the demand for imports has zero elasticity. The value of imports will rise by the full percentage of devaluation. If the elasticity of demand for exports is greater than unity, the value of exports will expand by more than the percentage of devaluation. Therefore, the balance of payments will improve. If each element of the elasticity of demand is less than unity, but the sum is greater than unity, the balance of payments will improve because expansion of exports in domestic currency will exceed the value of imports.

However, there are considerable doubts about the efficacy of devaluation in developing countries. It is argued that the elasticities of exports and imports are sufficiently low; therefore, devaluation cannot be expected to lead to an improvement of the balance of payments. A similar source of pessimism surrounds the lags in the response of the current account to relative price changes. The argument is that trade volumes respond sluggishly to price changes because of the inertia of importers switching domestic expenditure away from imports, and the existence of contracts. Thus, in the short run, it is unlikely that domestic export earnings following a devaluation will increase by enough to offset the initial increase in the value of expenditure on imports. This is the "J Curve effect" on the

current account, where, following a devaluation, the balance of trade appears worse before it improves (Meade, 1988). Moreover, the elasticity approach ignores any direct effects devaluation may have on the domestic price level and domestic nominal wages.

2.1.2.1.2. The Income - Absorption Approach

This is a Theory by Alexander that analyzes trade balance as difference between aggregate domestic income and aggregate domestic expenditure (absorption). In the elasticity approach, the effect of exchange rate adjustments on the balance of payments depends principally on the elasticities of imports for home and foreign goods. In this analysis, income is assumed fixed. Thus, the income multiplier effects of devaluation are ignored. Alexander criticizes the elasticity approach as a partial equilibrium analysis and developed an alternative approach, which is known as the income absorption or the aggregate spending approach, to analyze the effect of devaluation on the trade balance. This approach takes into account the effects of changes in both price and income following devaluation. The central tenet of the absorption approach is that a favorable configuration of price elasticities may not be sufficient to produce a positive balance of payments effect resulting from a devaluation, if a devaluation does not succeed in reducing domestic absorption (Johnson, 1976).

The absorption approach is based on the national income identity;

$Y = C + I + G + X - M$……. (1)

Where Y = National income.

C = private consumption of goods and services purchased at home and abroad.

G = Government expenditure.

I = Total investment by firms and government.

X = Exports of goods and services.

M = Imports of goods and services.

National income identity can be used to explain the current account as the difference between optimal savings and investment decisions. Combining C + I + G expenditure terms into a single term, A, representing domestic absorption (i.e., total domestic expenditure) and X - M terms into B, net exports/trade balance, we get:

$Y = A + B$……... (2)

Thus, national income is the sum of absorption and the trade balance. It follows that the trade balance must always be the difference between income and absorption, as given by

$B = Y – A$……. (3)

Thus if $Y > A$, the trade balance is in surplus, while if $Y < A$, it is in deficit. If devaluation is to affect the trade balance, it can do so in two ways: (I) it can change production as a result of an induced change in absorption and (ii) it can change the amount of real absorption associated with any given level of real income. Thus, a change in the trade balance (dB) is equal to the difference between the change in output (dY) and the change in absorption (dA):

$dB = dY – dA$…… (4)

Devaluation leads to two effects on the absorption of goods and services in a devaluing country. First, devaluation leads to an increase in real income, which boosts real consumption (absorption) proportionately to the increase in income (that is, cdY). Second, devaluation has a direct effect on absorption (DE):

$dA = cdY – DE$…… (5)

Where c is the propensity to absorb, which is equal to the propensity to consume plus the propensity to invest, and DE is the direct effect of devaluation on absorption. Substituting equation (5) into equation (4), we obtain

$dB = (1 - c)dY + DE$…….. (6)

Equation (6) is useful because it provides answers to three basic questions pertaining to the processes whereby (I) devaluation affects income, (II) a change in income affects

absorption, and (III) devaluation affects absorption directly at any given level of income (Salvatore, 1998). These questions also pertain to the values of c and DE. To provide answers to these questions in precise terms, one has to take into consideration the entire economic structure of the devaluing country and of the rest of the world.

2.1.2.2. The Monetary Approach

The monetary approach was first introduced by Hahn in 1959 and further developed by Mundell (1968), Johnson (1972), Swoboda (1973), Dornbusch (1973) and Mussa (1974). This approach views imbalances in the balance of payments in terms of imbalances between the demand for and supply of money stock. The approach focuses its analysis on the monetary account of the balance of payments in the context of a general equilibrium analysis. Thus, the balance of payments is a monetary and not a real phenomenon and balance of payments disequilibria are stock and not flow disequilibria (Levacic and Rebmann, 1982).

The monetary approach to balance of payments postulates that the overall balance of payments measured by international reserves is influenced by imbalances prevailing in the money market. Under a system of fixed exchange rate excess money supply induces increased expenditure, which shows itself in increased purchases of foreign goods and services by domestic residents. These purchases have to be financed by running down foreign exchange reserves, thereby worsening the balance of payments. The outflow of foreign exchange reserves reduces money supply until it is equal to money demand, thereby restoring monetary equilibrium and halting an outflow of foreign exchange reserves. An excess demand for money leads to an opposite adjustment, which in turn induces foreign exchange reserves in low, domestic monetary expansion and eventually a restored balance of payments equilibrium position.

The monetary approach to balance of payments model specifies a money supply identity, a money demand function and an equilibrium condition. The model consists of the following set of equations:

$M^s = (R+D)$…….. (7)

$M^d = L(Y, P, I)$……..…….... (8)

$M^s = M = M^d$..... (9)

Where M^s = money supply;

R = international reserves;

D = domestic credit;

M^d = money demand;

V = level of real domestic income;

P = price level;

I = rate of interest; and

M = equilibrium stock of money.

Equation 7 postulates that money supply is determined by the availability of international reserves and the level of domestic credit created by the country's monetary reserves, while Equation 8 sets out the real demand for money as a function of real income, the inflation rate and the interest rate. The monetary theory states that there is a positive relationship between money held and income ($\delta M^d / \delta Y > 0$) and money held and the price level ($\delta M^d / \delta P > 0$), and a negative relationship between money held and the interest rate ($\delta M^d / \delta I < 0$). Equation 9 is the equilibrium condition in the money market.

By combining Equations 7, 8 and 9 placing the variables in percentage changes, and isolating reserves as the dependent variable, we may write the reserve flow equation as follows:

$\Delta R = \Delta [L(Y, P, I)] - \Delta D$…… (10)

Equation 10 is the fundamental monetary approach to balance of payments equation. It postulates that the balance of payments is the outcome of the divergence between the growth of the demand for money and the growth of domestic credit, with the monetary consequences of the balance of payments bringing the money market into equilibrium.

An increase in domestic credit will cause an opposite and equal change in international reserves, given a stable demand function for money. The coefficient of ΔD is thus known as an offset coefficient. It shows the extent to which changes in domestic credit are offset by changes in international reserves. The monetary approach predicts a value of minus unity for this coefficient in the reserve flow equation (Dhliwayo, 1996 and Frenkel and Johnson, 1977).

2.1.3. Exchange Rate

The exchange rate is the rate at which one currency exchanges for another. One may regard the exchange rate as indicative of the relative price of goods and services denominated in the currencies of the two countries concerned. Therefore, if a domestic resident wants to buy the currency of another country, the exchange rates states the price for each unit of foreign currency. In any case, conversion from one currency unit to another is the task of the exchange rate (Mankiw, 2003).

There are two conventions for measuring the exchange rate:

- Domestic currency units per unit of foreign currency: for instance, if the Birr is the home currency and the dollar ($) is the foreign currency, and 1 Birr exchanges for $2 then the exchange rate is 0.5 or ½. The domestic currency is in the numerator of the ratio. This definition means that whenever exchange rate rises the home currency gets weaker.

- Foreign currency units per unit of domestic currency: this is the opposite of the first convention. The domestic currency is in the denominator. If 1 Birr is exchanged for $2, then the exchange rate is 2. In this case, when the exchange rate rises, the home currency gets stronger and vice versa.

In the past, exchange rates were measured only bilaterally and as the local price of foreign money. The US exchange rate in terms of sterling might be $1.65 or whatever. This practice had two disadvantages: First, it did not provide any way of measuring the average exchange rate for a currency relative to a number of its major trading partners;

and second, it meant that if a currency fell in value or depreciated, its exchange rate would rise. A decline of the dollar would mean an increased US cost of purchasing sterling and an increase in the US exchange rate.

Because this practice was found to be confusing, informal usage has now changed. An exchange rate now means the foreign price of the currency in question or the number of foreign currency units required to purchase the currency in question.

The nominal exchange rate is the relative price of currency of two countries. For example, if the exchange rate between the Ethiopian Birr and the US dollar is 20 Birr per dollar, then we can exchange one dollar for 20 Birr in the world markets for foreign currency.

The real exchange rate is the ratio of foreign to domestic prices, measured in the same currency. It measures a country's competitiveness in international trade. The real exchange rate RER, is usually defined as

$$\mathbf{RER} = \frac{\mathbf{eP_f}}{\mathbf{P}}$$

Where P and P_f are the price levels here and abroad, respectively and e is the Birr price of foreign exchange (the nominal exchange rate). If the exchange rate equals 1, currencies are at purchasing power parity (PPP). A real exchange rate above 1 means that goods abroad are more expensive than goods at home (Dunn and Mutti, 2004).

According to Mark in the foreign exchange market at a particular time, there exists, not one unique exchange rate but a variety of rates depending upon the credit instruments used in the transfer function (cited in Glorious (2012)). Major types of exchange rates are as follows.

Spot rate

Spot rate of exchange is the rate of which foreign exchange is made available on the spot. It is also known as cable rate or telegraphic transfer rate because at this rate cable or telegraphic sale and purchase of foreign exchange can be arranged immediately. Spot rate is the day-to-day rate of exchange. The spot rate is quoted differently for buyers and

sellers. This difference is due to the transport charges, insurance charges, dealer's commission etc. These costs are to be borne by the buyers.

Forward rate

Forward rate of exchange is the rate of which the future contract for foreign currency is made. The forward exchange rate is settled now but the actual sale and purchase of foreign exchange occurs in future. The forward rate is quoted at a premium or discount over the spot rate.

Long rate

The long rate of exchange as the rate at which a bank purchases of sells foreign currency bills which are payable at a fixed future date. The basis of the long rate of exchange is in the interest on the delayed payment. The long rate of exchange is calculated by adding premium to the spot rate of exchange in the case of credit purchase of foreign exchange and deducting premium from the spot rate in due case of credit sales.

Flexible rate

Flexible or floating exchange rate refers to the system in which the rate of exchange is determined by the forces of demand and supply in the foreign exchange market. It is free to fluctuate according to the changes in the demand and supply of foreign exchange.

Fixed rate

Fixed or pegged exchange rate refers to the system in which the rate of exchange of the country is fixed or pegged in terms of gold to another currency.

Multiple rate

Multiple rates refer to a system in which a country adopts more than one rate of exchange for its currency. Different exchange rates are fixed for importers, exporters and for different countries.

Two-tier rate system

Two-tier rate system is a form of multiple rate system in which a country maintains two rates, a higher rate for commercial transactions and a lower rate for capital transactions.

2.1.3.1. Exchange Rate Regimes

According to the NBE (2009), the exchange rate regime is the way a country manages its currency in respect to foreign currencies and the foreign exchange market. It is closely related to monetary policy and the two are generally dependent on many of the same factors. There are various types of exchange rate regimes being practiced by countries. The main types include floating, pegged floating and fixed.

Floating Exchange Rate are the most common exchange rate regimes today. For example, the dollar, euro, yen, and British pound all float. However, since central banks frequently intervene to avoid excessive appreciation/depreciation, these regimes are often called managed float or a dirty float. In the case of pegged floating exchange rate**,** the currency is pegged to some band or value, either fixed or periodically adjusted. Pegged floats are:

- *Crawling bands*: the rate is allowed to fluctuate in a band around a central value, which is adjusted periodically. This is done at a preannounced rate or in a controlled way following economic indicators.
- *Crawling pegs*: Here, the rate itself is fixed, and adjusted as above. Pegged with horizontal bands*:* The currency is allowed to fluctuate in a fixed band (bigger than 1%) around a central rate.

Fixed rates are those that have direct convertibility towards another currency. In case of a separate currency, also known as a currency board arrangement, the domestic currency is backed one to one by foreign reserves. A pegged currency with very small bands (< 1%) and countries that have adopted another country's currency and abandoned its own also fall under this category. The choice of exchange rate regime is determined by various factors, such as the objectives pursued by the policy makers, the sources of shocks hitting the economy and the structural characteristics of the economy. However, once the choice is made, the authorities are presumed to adjust their macroeconomic policies (especially

fiscal and monetary policies) to fit the chosen exchange rate policy. Considering the underlying economic situation of the country**,** managed floating exchange rate regime is being practiced in Ethiopia since 1992 (NBE, 2009).

2.1.3.2. Exchange Rate Dynamics

Since the early 1980s, there has been a great deal of exchange rate volatility (variability) and overshooting. Exchange rate overshooting refers the tendency of exchange rates to immediately depreciate or appreciate by more than required for long run equilibrium and then to partially reverse their movement as they move toward their new long run equilibrium level (Salvatore, 1990).

According to Krugman and Obstfeld (2003), appreciation and depreciation depict a situation where the market forces at demand and supply determine the exchange rates. This is often associated with a freely floating exchange rate system. A currency is said to be depreciate when under floating rates it becomes less expensive in terms of foreign currency. On the other hand, a currency is said to be depreciate when under floating rates it becomes more expensive in terms of foreign currency.

The monetary authorities may however, determine the exchange rate decree or executive flats based on their perceptions of macroeconomic condition in the country Devaluation takes place when the price of foreign currencies under fixed exchange rate regime is increased by official action. Revaluation is the opposite of devaluation, i.e. it occurs when the price of foreign currencies under fixed exchange rate regime is decreased by official action.

2.2. Empirical Literature Review

There are numbers of empirical studies on the impact of exchange rates on balance of payment, though with mixed results. Cooper (1978) examined the effect of devaluation on the balance of payments of some developing countries. The study discovered that three quarter of the cases examined shows that the current account of the balance of payments improved. This implies that devaluation leads to higher exports and lowers imports, which in the long run would improve the balance of payments position of a

country. Gafar (1980), using Jamaica as a case study, tested for the effect of devaluation on the balance of payments adjustment using the elasticity approach based on the Marshall-Lerner's condition. The study concluded that while devaluation is a useful policy device to correct balance of payment deficits, it could possibly produce clashing effects f used in isolation of other monetary and fiscal measures. Ghei and Kiguel (1993) also asserted that exchange rate affects balance of payments, using the ratio of non-gold reserve to import to study the impact of devaluation on the balance of payments. The results revealed that the reserve position of the devaluing country improves as a result of devaluation. This means that devaluation improves the balance of payments, since an improvement on the reserve position constitutes an improvement on the balance of payments position.

Likewise, Drama, Shen and Ahmed (2010) investigated the effect of real exchange rate on the balance of trade of Cote d'Ivoire using multivariate cointegration tests and vector error correction models with time series data covering the periods of 1975-2007. Estimated results also showed that the real effective exchange rate has a significant positive influence on Cote d'Ivoire's trade balance in both short and long run. Oladipupo and Onotaniyohuwo (2011), investigated the impact of exchange rate on the Nigerian external sector (the balance of payments position) using the ordinary least square method for data covering the period between 1970 and 2008. The result revealed that exchange rate has a positive and significant impact on the balance of payment position. Ogbonna (2011) examined the empirical relationship between the real exchange rate and aggregate trade balance in Nigeria. The study tested Marshall-Lerner conditions to see if it is satisfied for Nigeria. The results further revealed that depreciation/devaluation improves balance of payment and Marshall-Lerner (ML) condition holds for Nigeria. Imoisi (2012), examined the trends in Nigerian's Balance of payments position from 1970-2010. The study carried out a multiple regression analysis using the ordinary least square method for both linear and log linear form. Conform to economic theory, the result discovered that the existence of positive relationship between exchange rate and balance of payment.

Umoru and Odjegba (2013) analyzed the relationship between exchange rate misalignment and balance of payments mal-adjustment in Nigeria over the sample period of 1973 to 2012 using the VECM technique and Granger Causality Tests. The study revealed that exchange rate misalignment exhibited a positive impact on the Nigeria's balance of payments position. Salasevicius and Vaicious (2003) used the VECM to test for Marshall-Lerner condition in the exchange rate-trade balance relationship in the Baltic States. The study found that Lithuania met the Marshall Lerner condition, but Estonia did not, while the result of Latria was ambiguous. Rawlins and Praveen (2000) examined the impact of devaluation on trade balance of a sample of 19 countries in Sub-Saharan Africa by specifying and estimating an Almon Distributed lag process of trade balance using annual data. They found in no case did real exchange rates revert to their pre-devaluation levels and in seventeen of nineteen countries real exchange rate depreciation did improve a country's trade balance in the year of the devaluation.

Contrary to the above empirical evidences, Bahmani-Oskooee and Alse (1994) studied the short run versus long run effects of devaluation for nineteen developed countries and twenty-two least developed countries through error correction modeling and cointegration. They used quarterly data and indicated only for six countries trade balance and real effective exchange rate are cointegrated. For most countries, the two variables were not found to be cointegrated indicating that devaluations cannot have any long run effects on the trade balance. Alawattage (2002) examined the effectiveness of exchange rate policy of Sri Lanka in achieving external competitiveness since liberalization of the economy in 1977. The outcome confirmed that the real effective exchange rate does not have a significant impact on improving the trade balance particularly in the short run. Even though the cointegration tests reveal that there is a long run relationship between trade balance and the real effective exchange rate, it shows very marginal impact in improving trade balance in the long run. Azra et al. (2015) has been utilized robust ARDL structure to develop the bound testing approach to co-integration and error correction models on data set for 1972-2013 to analyze the effect of exchange rate on balance of payment. The result indicated that real exchange rate inversely influences the balance of payments both in the long run and in the short run. Further, Nicholas (2016) observed the effect of exchange rate on balance of payment in Nigeria by using OLS

method for data analysis. The result demonstrated that an increase in exchange rate would result in a decrease in BOPs.

When we come to the case of Ethiopia, few researchers tried to look into the relationship between exchange rate and trade balance partially. Hailemariam (2011) studied the effect of devaluation on Ethiopian trade balance using VAR model, the estimated long run and short run equations have showed that currency devaluation, which is proxied by real exchange rate, has a positive and significant impact on the trade balance of Ethiopia. Therefore, the study confirmed that Marshal-Learner condition holds in Ethiopia. Dessalegn (2013) investigated the effect of exchange rate movement on trade balance in Ethiopia. The study found that changes in the exchange rate affect the balance of trade in the long run and the short run. Accordingly, in the long run, depreciation succeeds in improving the trade balance deficit of Ethiopia. Similarly, the short run dynamic error correction model indicated that a change in the trade balance in the short run is explained by changes in the real effective exchange rate. Similarly, Temesgen (2016) examined the short run and long run effect of real effective exchange rate on trade balance of Ethiopia using the autoregressive distributed lag approach. The result revealed that, both in the short run and long run, real exchange rate have positive and significant effect on trade balance of the country.

On the other hand, Zelalem (2014) analyzed the relationship between exchange rate and trade balance of Ethiopia employing cointegration technique using annual data from 1974/75 to 2011/12.The cointegration tests discovered that there is long-run relationship among variables; however, estimation results indicated that the sign of real effective exchange rate is positive and insignificant. Further, Nega (2015) tried to assess the movement of the real effective exchange rate and external sector development such as export, import & trade balance of Ethiopia using descriptive analysis to incorporate the two major devaluation period from the year 1985/86 to 2012/13. The result revealed that the depreciation of the real effective exchange rate improves the export performance however; it does not discourage our import. As a result, even if there is higher growth of export after a depreciation of the real effective exchange rate, since the growth rate of imports outweighs, there is no improvement in the trade balance of the country.

Moreover, Fikreyesus and Menasbo (2012) analyzed the effect of Birr devaluation on trade balance of Ethiopian economy using 30 years of time serious data. The results of the OLS estimates revealed that real GDP and real effective exchange rate index were positively correlated with the nation's trade balance.

CHAPTER THREE

3. METHODOLOGY OF THE STUDY

3.1. Data Source

In this study, annual data for the period 1976–2015 were employed. The choice of annual data is informed by their availability throughout the study period, in addition to the overriding advantage of using annual data, which has been proven to be resistant to short-run transitive and seasonal shocks (Beetsma, 2008). The data were obtained from the NBE and the country underwent both current account and government budget deficits during the study period. After the researcher have changed the data for current account and budget deficit into positive, current account (CA) real effective exchange rate index (REERI), real gross domestic product (RGDP) and budget deficit (BD) have been transformed into natural logarithms, just for the purpose of removing possible heteroscedasticity and capturing non-linear properties.

3.2. Model Estimation Technique

3.2.1. The Co-integrated Vector Autoregressive Model

It was Sims (1980) who first introduced a new macro econometric framework that held great promise as an alternative to the large-scale macroeconometric models called vector autoregressions (VARs). A univariate autoregression is a single-equation, single-variable linear model in which the current value of a variable is explained by its own lagged values. A VAR is an n-equation, n-variable linear model in which each variable is in turn explained by its own lagged values, plus current and past values of the remaining n-1 variables. This simple framework provides a systematic way to capture rich dynamics in multiple time series, and the statistical set of tools that came with VARs was easy to use and interpret. As Sims (1980) and others argued in a series of high-ranking papers, VARs held out the promise of providing a coherent and credible approach to data description, forecasting, structural inference, and policy analysis.

The vector autoregressive (VAR) model estimation technique was employed for this study. If economic variables share a common stochastic trend and their first differences are stationary, then they are co integrated. Cointegration analysis helps to identify long run economic relationships between two or more variables. It is important to test for co integration because if two non-stationary variables are cointegrated, a vector autoregressive (VAR) model in first difference may lead to misspecification and invalid inferences of the model (Masih and Masih, 1996). Such a time series is modeled using vector error correction model (VECM) approach. The Johansen trace test and the maximum eigen value test are used. The test proposals by Johansen (1988, 1995) are based on the following Data Generating Process.

$$y_t = D_t + X_t \qquad (1)$$

Where y_t is a k ×1 vector time series of observable variables (including LCA, IF, LREERI, LBD, LR LRGDP), D_t is a deterministic term, for example $D_t = \mu_0 + \mu_1 t$ may be a linear trend term, and X_t is a VAR (P) process generally represented by

$$X_t = \phi_1 X_{t-1} + \phi_2 X_{t-2} + \ldots + \phi_p X_{t-p} + \varepsilon_t \qquad (2)$$

If X_t is cointegrated of order one (i.e. X_t~ CI (1, 1)) and with co integrating rank r, then VAR (p) may be represented in vector error correction model form as

$$\Delta X_t = \pi X_{t-1} + \sum_{j-1}^{p-1} \Gamma_j \Delta X_{t-j} + u_t \qquad (3)$$

Where$\pi = \alpha\beta'$, and $\alpha$is the response speed of the last period's deviation from equilibrium level and β are columns of a matrix of linearly independent cointegrating vectors.

$$\Gamma_j = -\left(\phi_{i+1} + \ldots + \phi_p\right) = -\sum_{i=j+1}^{p} \phi_i \text{ forI} = 1 \ldots p-1$$

$u_t = (\varepsilon_{1t}, \ldots, \varepsilon_{kt})'$ is a vector white noise process with u_t~ $(0, \Sigma_u)$ (Lutkepohl, 2005 and Juselius, 2006).

For cointegration to hold π must have reduced rank r (r < k) and satisfy the I(1) condition, $\pi = \alpha\beta'$. There is no cointegration if π has full rank k or zero rank. Equation (3) can be written in terms of moving average with $\mathbf{p} - \mathbf{r}$ common stochastic trends as follows:

$$X_t = C\sum_{i=1}^{t} u_i + C\sum_{i=1}^{t} \Psi D_i + C_{\mu t} + C^*(L)(u_t + \Psi D_t + \mu \qquad (4)$$

Where $C = \beta_\perp(\alpha_\perp'\beta_\perp)^{-1}\alpha_\perp'$,

$$C^*(L) = (1-L)^{-1}[C(L) - C(1)], C(1) = C,$$

$C(L) = (C_0 + C_1 L + C_2 L^2 + \ldots)$, $\alpha_\perp$ and $\beta_\perp$ are kx(k − r) matrices of full rank orthogonal to α and β ($\alpha'\alpha_\perp$ and $\beta'\beta_\perp = 0$) respectively and $\Gamma = I_k - \sum_{i=1}^{p-1}\Gamma_i$. Both the cointegrated VAR representation (3) and the moving average representation (4) are important. The former enables us to single out long-run relations while the latter is useful for the analysis of common stochastic trends. The kx 1 vectors μ_0 and μ_1 can be decomposed into two new vectors α and $\alpha_\perp$ as follows:

$$\mu_t = \alpha\beta_i + \alpha_\perp\gamma_i, \quad i = 0,1 \qquad (5)$$

Where $\beta_i = (\alpha'\alpha)^{-1}\alpha'\mu_i$ and $\gamma_i = (\alpha_\perp'\alpha_\perp)^{-1}\alpha'\mu_i$. Johansen (1995) gave five different ways by which the deterministic terms can be restricted to lie inside or outside the cointegration space. To test for the number of cointegration relations the hypothesis

H_0: rank(π) = r is tested against

H_1: rank(π) > r. The maximum log-likelihood function is given in Johansen and Juselius (1990) as

$$LR(H(r)|H(k)) = -T\sum_{i=r+1}^{k} \log(1-\lambda_i) \qquad (6)$$

This is called the trace test. Alternatively, the rank is obtained by examining the eigenvalues one by one, thus testing the null hypothesis H_0: rank(π) = rcointegrating

relations, againstH_0: $\mathrm{rank}(\pi) = r + 1$ cointegrating relations. The likelihood ratio test in this case is called the maximum eigenvalue test written as

$$LR_{max}\big(H(r)\big|H(r+1)\big) = -T\log(1-\lambda_{r+1}) \qquad (7)$$

The test is performed either in the descending order r = K-1, …, 0 or ascending order r = 0, … , K-1. The former case corresponds to testing for the number of common stochastic trends. The testing terminates if the null hypothesis is rejected for the first time in the descending case or if it is not rejected for the first time in the ascending case. The maximum eigenvalue test and the trace test are equal when K- r =1. The limiting distributions depend on the deterministic terms (Johansen, 1995, Johansen et al., 2000).

Saikkonen and Lutkepohl (2000) also proposed a series of tests for the pair of hypotheses (6) which proceed by estimating the deterministic term Dt first, then subtracting it from the observations and applying a Johansen type test to the adjusted series. The test is based on a reduced rank regression of the system.

$$\Delta\widetilde{X}_t = \pi\widetilde{X}_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta\widetilde{X}_{t-j} + \tilde{u}_t \qquad (8)$$

Where $\widetilde{X}_t = y_t - \widetilde{D}_t$ and $\widetilde{D}_t$is the estimated deterministic term. The parameters of the deterministic term are estimated by the generalized least squares procedure proposed by Saikkonen and Lutkepohl (2000). The rank r_0 is the tested rank of the matrix π under$H_0, r_0 = 0, \dots, k-1$. In the case of orthogonal trend $r_0 = 0, \dots, k-2$. The rank of $\pi$is taken as the rank at which the null hypothesis is rejected for the first time.

A typical VAR analysis proceeds by specifying and estimating a model and then checking its adequacy. If defects are observed in the model, the process is repeated until a satisfactory model is found. The VAR model may be used for forecasting, causality or structural analysis. The analysis was undertaken using the latest version of EViews software that is EViews 9.

According to Sims (1980), this model has advantages over the single equation based Engel-Granger two-step procedure in the sense that time series can be modeled

simultaneously. Further, the VAR methodology corrects for autocorrelation and endogeneity parametrically using vector error correction model (VECM) specification. In addition, it prevents substantial bias that takes place in OLS estimates of cointegration relations when the Engle Granger two-step procedure is used. Moreover, it has good forecasting capabilities.

3.3. Model Specification

Kallon has developed a very essential approach to the balance of payments in 1994. Kallon (1994) described the general framework of the balance of payments. To derive the long-run balance of payments equation, the simple open economy LM model is employed. Therefore, the equation is specified as follows:

$$Y_t = \alpha_1 R_t + \alpha_2 G_t + \alpha_3 P_t^m + \alpha_4 Y_{t-1}; \quad (\alpha_1 < 0; \alpha_2; \alpha_3; \alpha_4 > 0) \tag{3.1}$$

Equation (1) is the commodity market equilibrium. It is assumed to depend on the domestic interest rate (R_t), government expenditure (G_t), relative price of imported goods (P_t^m), and the real income of the previous period (Y_{t-1}). The money market equilibrium (LM) is specified in the following equation as:

$$M_t = \beta_1 Y_t + \beta_2 R_t + \beta_3 P_t (\beta_1 > 0;\ \beta_2; \beta_3 < 0) \tag{3.2}$$

The money market equilibrium in Equation (2) depends on real income (Y_t), domestic interest rate (R_t) and domestic Inflation rate (P_t). Thus, according to Kallon, the balance of payments equilibrium depends on real income (Y_t), relative price of imported goods (P_t^m) and the differential between domestic interest rate and the summation of foreign interest rate and expected change in the exchange rate. The balance of payments equilibrium is specified as follows:

$$BOP_t = \delta_1 Y_t + \delta_2 P_t^m + \delta_3 R_t^N (\delta_1 < 0; \delta_2; \delta_3 > 0) \tag{3.3}$$

Where $R_t^N = f(R_t, R_t^*, E_t);\ R_t, R_t^*, E_t$are domestic interest rate, foreign interest rate and exchange rate.

Model specification shows mathematical and economic relationships that exist between the dependent and independent variables stressed the importance of expressing the relationship under study in mathematical form. Both theoretical and empirical literatures propose a number of key variables that have significant effects on balance of payments. Following Iyoboyi and Muftau (2014), this study considers some important monetary and fiscal factors for building the model. This study was estimated the following functional relationship.

$$CA = f(REERI, IF, RGDP, BD, LR) \qquad (3.4)$$

The multiple linear regression equation of the functional form of the model expressed in natural logarithm is of the form.

$$LCA = \beta_0 + \beta_1 LREERI + \beta_2 IF + \beta_3 LRGDP + \beta_4 LBD + \beta_5 LR + \beta_6 PC + u_t \qquad (3.5)$$

Where $\left\{ \begin{array}{l} \beta_6 = 0 \text{ for the period pre 1991} \\ \beta_6 = 1 \text{ Otherwise} \end{array} \right\}$

L = the natural logarithm

CA = Current Account

REERI = Real Effective Exchange Rate Index

IF = Domestic Inflation Rate

RGDP = Real Gross Domestic Product

BD = Budget Deficit

LR = Lending Rate

PC = Policy Change

U_t*= Stochastic error term*

$\beta_0, \ldots, \beta_6$ *= Regression coefficients of the parameters.*

3.4. Variable definition and Hypothesis

Current account: The current account of the balance of payments is a statistical record of exports and imports of goods and services and transfers (Sodersten and Reed (1994)). It measures the extent to which an economy is a net borrower or net lender in relation to the rest of the world over a particular period. A current account can be positive or negative. A deficit on the current account of a nation means that the nation has imported more goods and services than sold to the rest of the world, while a surplus means, more goods and services have been exported than imported. Current account can be taken as an indicator for balance of payment (Ames, 2002). It is also one of the major indicators of a country's status in international trade.

Real Effective Exchange Rate Index: the real effective exchange rate is defined as the units of the home currency per a unit of the foreign currency taken accounts of trade partner countries' trade weight and relative Inflation. The REERI is usually taken as measure of competitiveness of an economy. According to NBE's compilation, a decrease in the REERI implies a real deprecation and an increase in the REERI is a real appreciation. From economic theory, a fall (depreciation) in the real effective exchange rate index will improve the current account position since net export is increased.

Inflation means a rising trend in the general price level of a country. It is sustained increase in the price level at least for consecutive three years (Dornbusch et al., 1996). Country's transactions with the other countries, which are recorded in balance of payments, get adversely affected if the domestic price rise is high. High rate of inflation in the domestic market makes domestic goods unattractive to the foreigners and therefore, reduces demand for exports. Moreover, because of high domestic prices, residents prefer to buy foreign goods which imply increase in imports.

Real Gross Domestic Product (GDP) is a macroeconomic measure of the value of output economy adjusted for price changes (that is, Inflation or deflation). The adjustment transforms the money-value measure, called nominal into an index for quantity of total output. In other words, it is an Inflation-adjusted measure that reflects the value of all goods and services produced in a given year, expressed in base-year

prices, often referred to as "constant price" or "Inflation-corrected" GDP (Mankiw, 2003). In this research, though the real GDP is taken as proxy for economic size, the impact of economic size on balance of payment is uncertain. The expected signs under the absorption and monetary approaches are a negative and positive respectively with some bold assumptions. Higher income levels stimulate increased import demand as well as increased domestic production of tradable, leaving the ultimate impact on the trade balance somewhat indeterminate. However, it is argued that the former effect dominates the latter.

Budget Deficit exists when government expenditure exceeds government revenue. Government expenditure includes all government consumption, investment but excludes transfer payments made by a country. It is used to raise the level of aggregate demand (Hassan, 2002).A fiscal deficit implies an injection into the circular flow. A budget deficit leads to an increase in consumer spending and an increase in aggregate demand (AD). This leads to higher economic growth. With higher consumer spending, there will be an increase in imports and therefore a larger trade deficit (Hutchison and Pigott (1998) Leachman and Francis (2002)).

Interest rate is defined as a proportion of an amount loaned which a lender as interest to the borrower, normally expressed as an annual percentage. In this study, we use nominal simple average lending rate as a proxy to interest rate. An increase in the nominal lending rate generates less investment this in turn reduces domestic production thereby lowers exports of goods and services. Hence, current account will be distorted.

Policy change includes competitiveness policies and other reforms (other than exchange rate) that include liberalization and financial sector reforms, among others. Though it is recognized that these policy changes improve exports, they advance imports too. Hence, it is expected to improve trade balance thereby the current account by increasing export supply by more than import demand.

3.5. Diagnostic Tests

Stationary and Non-stationary Test

The importance of the stationary arises from the fact that virtually all the entire body of statistical estimation theory is based on asymptotic convergence theorem that is the weak law of large numbers, which assumes that all data series are stationary. However, in real life non-stationary is extremely common in macroeconomic time series such as real GDP, Inflation, money supply. Treating non-stationary series as if they were stationary will bias the result in economic analysis. For instance, the model will systematically fail to predict outcomes and can also lead the problem of spurious (misleading) regression where R squared is approximating unit and t and f statistic look significant and valid (Wooldridge, 2013).

In essence, the problem lies with the present of spurious regression of non-stationary series, which are known to be uncorrelated, indicates that series are correlated. Since there is often a problem of falsely concluded that relationships exist between two unrelated non-stationary series. This problem generally increases with sample size, and it is not normally saved by including deterministic time trend as one of the explanatory variables in order to induce stationary. In order to avoid the spurious regression problem, with its related to non-stationary pattern of the variables, differencing has become the common method of bringing non-stationary series into stationary. If the variables are stationary without differencing, then they are integrate of order zero, I(0). A variable is said to be integrated of order one I(1) if it becomes stationary after differencing ones, and a variable is said to be integrated of order two I(2) if it becomes stationary after differencing two times (Gujarati, 2004). Hence, prior to estimation of the long-run models the time series properties of the variables, unit root test, should be conducted.

The Unit Root Test

The unit root test has become a widely popular approach to test for stationarity. Several tests are usually employed to test whether time series variables are stationary or non-stationary; the Dick-Fuller (DF), the Augmented Dickey-Fuller (ADF) test, Ng Peron test and Phillips-Peron test (PP). This study was employed the ADF test to determine the

existence of a unit root. By incorporating the autoregressive process of order p, this model becomes superior to DF. Basically this test has been chosen for its consistency, accuracy and resourcefulness**.** The general form of the ADF equation where only an intercept is included is as follows:

$$\Delta Y_t = A_0 + \rho Y_{t-1} + \sum_{i=2}^{p} \beta_i \Delta Y_{t-i+1} + \varepsilon_t$$

For the case where the auto regression includes the intercept and a trend, the equation is of the following form:

$$\Delta Y_t = A_0 + A_1 t + \rho Y_{t-1} + \sum_{i=2}^{p} \beta_i \Delta Y_{t-i+1} + \varepsilon_t$$

Where, Yt is any variable in the model to be tested for stationary, A_1 is coefficient of a trend,$\varepsilon_t$is an error term, Δ is the first difference operator and A_0 is a constant.

The null hypothesis of ADF is ρ= 0 against alternative hypothesis that ρ< 0. A rejection of this hypothesis means that the time series is stationary or it does not contains a unit root while not rejecting means that the time series is non-stationary (Enders, 1995).

We have to be care full also in determining p of the lagged variables because too few lags will leave autocorrelation in the errors and distort the test and too many lags will reduce the power of the test. Economists suggest the use of information criteria such as Akaike Information criteria, Schwarz Bayesian criteria and recursive t-statistics procedure to determine the optimal lag length.

Granger Causality Test

Causality in the sense defined by Granger (1969) and Sims (1972) is inferred when lagged values of a variable, say Xt, have explanatory power in a regression of a variable Yt on lagged values of Yt and Xt **(**Greene, 2003). Although regression analysis deals with the dependence of one variable on other variables, it does not necessarily imply causation. In other words, the existence of a relationship between variables does not prove causality or the direction of influence (Gujarati, 2004). The purpose of causality

test in multivariate time series analysis is to identify which variable causes (precedes) another variable. Given two variables X and Y, X is said to Granger cause Y if lagged values of X predict Y well. If lagged values of X predict Y and, at the same time, lagged values of Y predict X, then there is a bi-directional causality between X and Y. In general, a time series X is said to Granger-cause another time series Y if it can be shown that the series X values provide statistically significant Information about the future values of series Y; if not, X does not Granger-cause Y (Verbeek, 2003).

$$\Delta Y_t = \eta_1 + \sum_{i=1}^{n} \alpha_i \, \Delta X_{t-i} + \sum_{i=1}^{n} \beta_i \, \Delta Y_{t-j} + u_{1t}$$

$$\Delta X_t = \eta_2 + \sum_{i=1}^{n} \lambda_i \, \Delta X_{t-i} + \sum_{i=1}^{n} \delta_i \, \Delta Y_{t-j} + u_{2t}$$

Where $u_{1t}$and $u_{2t}$are the disturbance terms that are not correlated with one another, $\eta_1$and η_2 are constant terms, and α_i, β_i, λ_i, $\delta_i$are coefficients.

It should be noted that Granger-causality really represents only a correlation between the current value of one variable and the previous values of others. It does not mean that movements of one variable cause movements of another (Brooks, 2002). Moreover, although causality in VAR examines whether the current value of variable X can be explained by the past values of variable Y, it still does not explain the sign of the relationship or how long these effects last.

Serial Correlation LM Test

This test is an alternative to the Q-statistics for testing serial correlation. The test belongs to the class of asymptotic (large sample) tests known as Lagrange multiplier (LM) tests. Unlike the Durbin-Watson statistic for AR(1) errors, the LM test may be used to test for higher order ARMA errors, and is applicable whether or not there are lagged dependent variables. The null hypothesis of the LM test is that there is no serial correlation up to lag order p, where p is a pre-specified integer. The local alternative is ARMA(r,q) errors, where the number of lag terms p = max{r,q}. Note that the alternative includes both

AR(p) and MA(p) error processes, and that the test may have power against a variety of autocorrelation structures (Godfrey, 1988)

White's Heteroskedasticity Test

White's test is a test of the null hypothesis of no heteroscedasticity against heteroscedasticity of some unknown general form. The test statistic is computed by an auxiliary regression, where we regress the squared residuals on all possible (non redundant) cross products of the regressors (White, 1982). For example, suppose we estimated the following regression:

$$y_t = b_1 + b_2 x_t + b_3 z_t + e_t$$

The test statistic is then based on the auxiliary regression:

$$e_t^2 = \alpha_0 + \alpha_1 x_t + \alpha_2 z_t + \alpha_3 x_t^2 + \alpha_4 z_t^2 + \alpha_5 x_t z_t + v_t$$

Impulse Response Functions and Variance Decomposition

Impulse response functions

Impulse response functions show the effects of shocks on the adjustment path of the variables. This technique involves measuring unexpected changes in one variable X (the impulse) in time t and predicting its effect on the other variable Y in time t, t+1, t+2… (the responses). The impulse response function (IRF) defines the response of the dependent variable in the VAR model to shocks in the error terms. In other words, the IRF detects the impact of a onetime shock in one of the innovations on current and future values of the endogenous variables. The general form for the IRF would be:

$$y_t = \alpha + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \ldots + \theta_i \varepsilon_{t-i}$$

Where y_t is a vector of the considered dependent variables, α is a vector of the constants, ε_i is a vector of innovations for all variables that have been included in the VAR model, and θ_i is a vector of parameters that measure the reaction of the dependent variable to innovations in all variables included in the VAR model (Merza et al., 2012). The IRF is interesting for several reasons. First, it is another characterization of the behavior of our

models. Second, and more importantly, it allows us to start thinking about "causes" and "effects".

Variance decomposition

In econometrics and other applications of multivariate time series analysis, a variance decomposition or forecast error variance decomposition (FEVD) is used to aid in the interpretation of a vector autoregression (VAR) model once it has been fitted. The variance decomposition indicates the amount of Information each variable contributes to the other variables in the autoregression. It determines how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables. According to Brooks (2002), Variance decompositions trace out the proportion of the movements in the dependent variables that are due to their own shocks against shocks to the other variables. It shows the components of variances of dependent variables clearly.

Therefore, by breaking down this forecast error it is possible to determine the degree to which the variable in question is being influenced by its past and present values and to the other variables in the system (Handa, 2009). The variance decomposition determines how much of the n-step ahead forecast error variance of a given variable is explained by innovations (shocks) to each explanatory variable.

CHAPTER FOUR

4. DESCRIPTIVE AND ECONOMETRIC ANALYSIS

4.1. Descriptive Analysis

4.1.1. Foreign exchange regime in Ethiopia

The world has experienced different exchange rate regimes and experimented with various types of exchange rate arrangements within each ever since the emergence of the international Gold Standard by 1870 to the emergence of the floating rate of 1973. Pugel and Lindert (2000) obviously pointed out that the success or the failure of these different exchange rate regimes depends historically on the severity of the shocks with which those systems have had to cope with.

According to Felleke (1994), Ethiopia has experienced and passed through different exchange rate regimes: inter alia: fixed, flexible and auction exchange rate policy. Exchange rate of the Ethiopian currency has been changed many times since the emergence of the IMF. In this system the currency of every IMF member country was attached to some fixed par value in terms of US dollar, which was equivalent to gold (35 US dollar was equal to one ounce gold). For about seventeen years (1942 -1959), the official exchange rate was about 2.44 Ethiopian dollars (Ethiopian currency was called Ethiopian dollar in emperor regime) per one US dollar. Thereafter, the exchange rate was slightly devalued to 2.5 Ethiopian dollars per one US dollar in 1960. This value was used until the early 1970's.

Following this, Ethiopia followed a fixed predetermined nominal exchange rate pegged to the US dollar. That is, the exchange rate of Ethiopian currency against its reference currency, the US dollar, was determined by government decree. This fixed official exchange rate was left unaltered for two decades despite the floating of the major world currencies including the US dollar. According to Haile and Asmerom (1994), as a result of fixation of exchange rate, Birr became over-valued in terms of the US dollar as well as

many other foreign currencies. This overvaluation had adverse effect on national economy such as misallocation of resources, loss of international competitiveness, development of illegal parallel market for foreign exchange and unlawful cross border trade. The military government (1974-1991) took a policy measure of foreign exchange allocation and exchange control to mitigate the problems of shortage in foreign currency, and trade deficits. But the exchange control and foreign exchange allocation did not give a solution for the problem of trade deficits and problem at the considerable degree because of the emergence of the parallel exchange markets.

In an attempt to solve the problems related to the fixed exchange rate, the Ethiopian People Revolutionary Democratic Front (EPRDF) devalued the Ethiopian Birr by 241.5% in 1992 in nominal terms. Following this considerable devaluation, in an attempt to liberalize foreign exchange market, the National Bank has taken a number of initiatives. Accordingly, the biweekly auction market for foreign exchange was introduced on May 1, 1993 with two rates, namely the Dutch auction system (official rate) and marginal pricing auction system (marginal rate). These two rates were unified in July 1995. In August 1996, the fortnightly auction market was changed to weekly to accommodate the growing demand for foreign exchange and commercial banks were allowed to establish foreign exchange Bureaus. In September1998, the retail auction system was replaced by wholesale system .In the same year, the inter- bank foreign exchange market was introduced and worked alongside the auction system until October 25,2001 when the daily inter-bank has fully replaced wholesale auction system (Deresse, 2001).

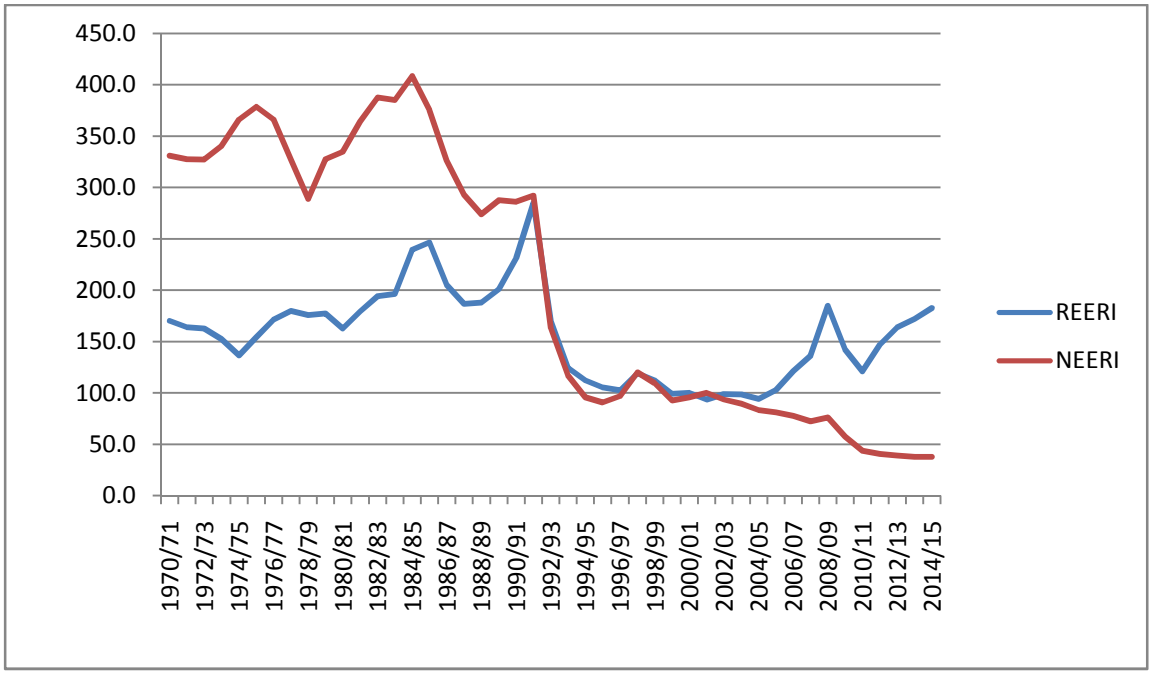
4.1.2. Trends of Real Effective Exchange Rate and Current Account in Ethiopia

4.1.2.1. Real Effective Exchange Rate Index (REERI)

The Real Effective Exchange Rate (REER) during Derg regime was clearly appreciated due to rigid exchange rate policy and other restrictive policies. This index indicates that the export sector during that regime was less competitive due to overvalued exchange rate. On the other side, the regime experienced balance of trade deficit due to overvalued exchange rate though the regime has had adopted too restrictive trade policies. As can be

seen in Figure 4.1, the real effective exchange rate has reached its peak in the year 1991/92 mainly attributed to arise in domestic price level in time of regime change. After the regime change i.e. the current government, relatively REERI has been depreciating due to a competitive exchange rate policy measures. Since October 1992, real effective exchange rate index has decreased due to a series of devaluation policies to boost the external economy.

Figure 4.1: Trend of real and nominal effective exchange rate indices



Source: Own computation using the NBE data.

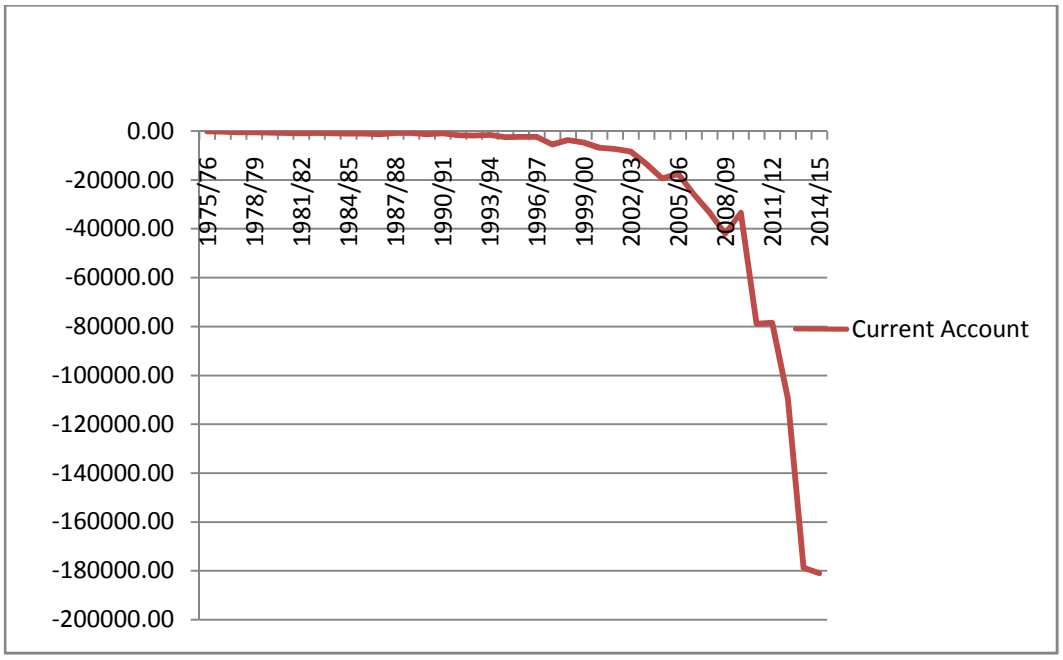
Examination of the trend of real effective exchange rate index from 1970/71 through 2014/15 reveals a range of distinctive periods with few exceptions: depreciation from 1970/71 through 1974/75, appreciation from 1975/76 through 1985/86 but 1978/79 and1980/81, depreciation in 1986/87and 1987/88, appreciation from 1988/89 through 1991/92, depreciation by about 64 % in 1992/93 and kept through 1995/96, appreciation in 1996/97 and 1997/98 and depreciation continued thereafter but the year 2002/03 and 2003/04, appreciation from 2004/05 through 2008/09, depreciation in 2009/10 and appreciation continued from then on.

4.1.2.2. Current Account Balance (CA)

The current account consists of the goods balance, the service balance, net income receipts, and net international transfers. A current account can be positive or negative. A current account can be positive (surplus) if the monetary value of a country's export is greater than its imports and negative (deficit) if the monetary value of its imports greater than its exports. Ethiopia's current account balance has generally been in deficit (Figure 4.2). This means that Ethiopian imports exceed its exports or unable to cover its import bills. The reasons to such a deficit current account might be the level of development, policies and strategies of the country.

As can be depicted in Table 4.1, the deficit becomes widened to stand at about 10 and 24.2 percent of real GDP in 2009 and 2015 respectively and largely reflecting a faster growth in imports of goods and services into the country relative to exports. The imports have been largely in machinery and transport equipment, manufactured goods and oil products for industrial purposes. These are essential goods whose demand is not responsive to price changes. Growth in exports has been slow moving with little diversification away from the traditional exports of coffee, tea and horticulture. International trade in services, which form part of the current account balance, has been in a surplus over the years, mainly due to improved earnings in export of transportation services, tourism services, among others. Net current transfers also increased, supported largely by rising emigrant remittances. However, the growth in the services account and net current transfers was not sufficient to offset the deficit in the merchandise or goods account. The huge import bill in the current account increases demand for foreign currency, while slowdown in exports of goods reduces the inflow of foreign currency. The combined effect exerts pressure on the exchange rate to depreciate (weaken).

Figure 4.2: Trend of Current account balance (In millions of Birr)



Source: Author's computation using the NBE data.

Table 4.1: Current account deficit as a ratio of real GDP

Year	Current account deficit as a ratio of real GDP	Year	Current account deficit as a ratio of real GDP
1976	0.1	1996	1.3
1977	0.1	1997	1.2
1978	0.3	1998	3
1979	0.3	1999	1.8
1980	0.4	2000	2.2
1981	0.5	2001	3.1
1982	0.7	2002	3.3
1983	0.5	2003	3.8
1984	0.7	2004	5.5
1985	0.8	2005	7
1986	0.8	2006	5.7
1987	0.8	2007	7.6

1988	0.5	2008	8.9
1989	0.4	2009	10.3
1990	0.8	2010	7.3
1991	0.6	2011	15.2
1992	1.2	2012	14
1993	1.1	2013	17.6
1994	0.9	2014	26.2
1995	1.5	2015	24.2

Source: own computation from the NBE data

4.2. Econometric Analysis

4.2.1. Unit root tests

The reason for knowing whether a variable has a unit root (that is, whether the variable is nonstationary) is that, under the alternative hypothesis of stationarity, variables exhibit mean reversion characteristics and finite variance, and shocks are transitory and the autocorrelations die out as the number of lags grows, whereas under nonstationarity they do not. Since this study employs a time series data, it is mandatory to test stationarity of the variables. A unit root test is conducted by employing the standard augmented version of the Dickey-Fuller (Dickey, 1976; Dickey and Fuller, 1979) referred to as Augmented Dickey Fuller (ADF) test to prove whether the variables in the model are stationary or not.

Table 4.2: Augmented Dickey-Fuller Stationarity Test Result

Variable	Test Statistic Under Different Assumptions			Order of Integration
	Intercept	Trend and intercept	No trend and no intercept	
LBD	-0.278201	-4.478052	2.407304	I(1)
D(LBD)	-9.471246*	-9.343671	-7.509752	
LCA	1.490544	-0.566522	4.881746	I(1)

D(LCA)	-5.443875*	-8.669255	-3.292252	
LRGDP	2.728078	-0.117194	3.204364	I(1)
D(LRGDP)	-4.143399*	-6.526186	-2.314866	
LREERI	-1.503093	-1.481390	0.082851	I(1)
D(LREERI)	-4.984858*	-4.958636	-5.053551	
IF	-4.109983	-4.153512	-1.615005	I(1)
D(IF)	-8.479386*	-8.416415	-8.582744*	
LR	-2.040129	-2.415087	-0.139161	I(1)
D(LR)	-6.709980*	-6.616821	-6.781981	

Note: D shows the variable is differenced once. Note: MacKinnon (1996) one-sided critical values for rejection of a unit root are used here. * shows significance at 1%.

From table 4.2, it can be observed that all variables are not stationary at level. However, they all become stationary after differencing once implying that they are integrated of order one I(1). The ADF result demonstrate that only an intercept must be included in all variables (LCA, LNBD, LRGDP, LREER and LR) in testing for stationarity, while IF is tested without the trend and intercept.

4.2.2. Lag Order Selection for Endogenous Variables

The Johansen co-integration test results could be highly sensitive to the number of lags included for the endogenous variables in the estimation of the VAR, which necessitates the determination of an optimal lag order prior to the test of co-integration. The optimal lag order is determined with the sequential modified Likelihood Ratio test statistics [LR], the Final Prediction Error [FPE], the Akaike Information Criterion [AIC], the Schwarz Information Criterion [SIC], and the Hannan-Quinn Information Criterion [HQ]). As shown in Table 4.3, LR, FPE, SIC, and HQ suggest an optimal lag of one, all at a 5% level of significance.

Table 4.3: Optimal Lag Order Selection Criteria

Lag	Log-Likelihood	LR	FPE	AIC	SC	HQ
0	-264.7093	NA	0.091241	14.63293	14.89416	14.72503
1	-87.66530	287.0983*	4.58e-05*	7.008935	8.837545*	7.653606*
2	-49.61604	49.36120	4.81e-05	6.898164	10.29415	8.095410
3	-5.216220	43.19983	4.84e-05	6.444120*	11.40749	8.193940

* indicates lag order selected by the criterion

LR: sequential modified Likelihood Ratio test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike Information criterion

SC: Schwarz Information criterion

HQ: Hannan-Quinn Information criterion

4.2.3. Lag Exclusion Test

A number of the lags (of some endogenous variables) that are chosen as optimal may have insignificant contributions to movements in current account deficit, individually as well as jointly. Therefore, whether the first lags (chosen as optimal) of all variables are individually and jointly important and should be included in the testing for co-integration and estimation of the VECM should be evaluated. This approach was taken with the Wald form of the lag-exclusion test (which is asymptotically chi-square distributed). Appendix 1 shows that the first lags of all of the endogenous variables are significant both individually and jointly. This suggests that the use of the first lags of the variables in the model is valid.

4.2.4. Granger Causality Tests

The research apply Granger causality test among the variables in order see if one variable is Granger-causal for another, that is, if it contains useful Information for predicting the latter set of variables. The outcome of the Granger causality test is shown in Table 4.4.

The result of the test shows that at 5% level, the existence of bi-directional causality between current account deficit and budget deficit and real GDP and Inflation. This result shows that current account deficit can be used to forecast budget deficit and vice-versa and real GDP can be used to forecast Inflation and vice-versa. On the other hand, there is one directional relationship. Real GDP Granger causes current account deficit, budget deficit (at 10% level of significance), real effective exchange rate and Inflation. The interest rate does Granger cause the real effective exchange rate and Inflation. The real effective exchange rate Granger causes the current account deficit and Inflation. Moreover, the strong exogeneity (i.e. the overall causality in the system) shows that the null hypothesis that all the variables in the system (i.e. RGDP, BD, REER, IF and MLR) do not Granger cause CA is rejected at 1% level of significance.

Table 4.4: Results of the Granger Causality/Block Exogeneity Wald Tests

Equation Excluded	LCA	LBD	LRGDP	LREERI	IF	MLR
LCA		13.27480 (0.0003)	1.582221 (0.2084)	0.221165 (0.6382)	0.391337 (0.5316)	0.047296 (0.8278)
LBD	5.553928 (0.0184)		0.002163 (0.9629)	0.726768 (0.3939)	0.012410 (0.9113)	1.085187 (0.2975)
LRGDP	6.686482 (0.0097)	3.201333 (0.0736)		9.733517 (0.0018)	4.747519 (0.0293)	1.293107 (0.2555)
LREERI	10.68483 (0.0011)	0.757465 (0.3841)	0.039477 (0.8425)		4.947910 (0.0261)	1.386123 (0.2391)
IF	6.540440 (0.0105)	0.074105 (0.7855)	6.810786 (0.0091)	0.063681 (0.8008)		2.261636 (0.1326)

MLR	0.645260 (0.4218)	0.118895 (0.7302)	0.225297 (0.6350)	7.318348 (0.0068)	6.884631 (0.0087)	
All	44.81831 (0.0000)	16.85005 (0.0048)	21.67373 (0.0006)	12.32385 (0.0306)	16.89486 (0.0047)	10.55909 (0.0609)

NB: The numbers in parenthesis show the P-values for the corresponding Chi-square statistics.

This finding also entails that the lagged values of the variables have significant roles in explaining the current and future values of some other variables, and this effect occurs in both directions in some of the cases. Thus, due to the implied dynamic interaction among the variables, it may not be valid to consider current account deficit in Ethiopia as purely endogenous and the other variables as exogenous. This in turn confirms the legitimacy of using the VAR model and the Johansen Procedure.

4.2.5. Johansen Cointegration Test

The Augmented Dickey Fuller (ADF) stationarity test results demonstrate that all of the variables are stationary at first difference, and this result can be further strengthened by the Johansen Co-integration test. Thus, the presence and the number of such co-integrating relationships are evaluated with the trace and the maximum eigenvalue.

The results from the Johansen method of co-integration rank test may also be sensitive to the deterministic trend assumption (in addition to the number of lags of the endogenous variables) in the underlying VAR structure. Because the results may vary with the alternatives, a decision must be made as to which one to choose for the purpose of further analysis. Case 2 is chosen as appropriate for this case because none of the series appear to exhibit a linear trend; case 2 assumes an intercept (no trend) in the co-integration equation. It should also be noted that such pre-tests and justifications would increase the credibility of the results. The VECM is estimated based on the number of cointegration

rank obtained from case 2. Accordingly, both the trace and the maximum Eigen value tests identified one co-integrating relationship at the 5% level of significance (see Tables 4.5 and 4.6). These results also legitimize the use of the VECM to measure short-run as well as long-run behavior.

Table 4.5: Johansen's Cointegration Rank Test (Trace) result

Hypothesized No. of CE(s)	Eigen value	Trace Statistic (λ_{trace})	0.05 Critical Value	Prob.**
None *	0.682490	113.1548	95.75366	0.0019
At most 1	0.543608	69.55949	69.81889	0.0524
At most 2	0.460334	39.75220	47.85613	0.2315
At most 3	0.264035	16.31362	29.79707	0.6900
At most 4	0.115492	4.663875	15.49471	0.8434
At most 5	9.57E-06	0.000364	3.841466	0.9868

NB: Trace test indicates 1 cointegrating equation(s) at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values.

Table 4.6: Johansen's Cointegration Rank Test (Maximum Eigenvalue) result

Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic (λ_{max})	0.05 Critical Value	Prob.**
None *	0.682490	43.59530	40.07757	0.0193
At most 1	0.543608	29.80729	33.87687	0.1419
At most 2	0.460334	23.43858	27.58434	0.1555
At most 3	0.264035	11.64974	21.13162	0.5825
At most 4	0.115492	4.663512	14.26460	0.7836
At most 5	9.57E-06	0.000364	3.841466	0.9868

NB: Trace test indicates 1 cointegrating equation(s) at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values.

4.2.6. Vector Error Correction Model (VECM)

After the vector autoregressive model is estimated, an optimal lag of one is chosen based on the Information criteria results, and the VECM is estimated by making use of these and the results of the Johansen co-integration test. The VECM consists of two parts: the matrix of long-run co integrating coefficients (used to derive the long-run co-integrating relationship), and the short-run coefficients (for the short-run analysis). The result of the vector error correction estimates is depicted in Appendix 7.

4.2.6.1. Long-run Relationship

Table 4.7: The Estimated Long-Run Model for LCA

Variable	Coefficient	Standard error	t- statistic
LRGDP	-2.222528	(0.32669)	[-6.80309]
LBD	-0.398262	(0.15635)	[-2.54717]
LREERI	0.537604	(0.23325)	[2.30484]
IF	-0.000360	(0.00771)	[-0.04664]
LR	-0.041874	(0.02724)	[-1.53708]
Constant (C)	19.84475		

$$LCA = 19.8447\ 5 - 2.2225\ 28LRGDPt - 0.3\ 9826\ 2LBDt + 0.5\ 3\ 7\ 6\ 04LREERt + 0.0003\ 6\ 0IFt - 0.04187\ 4LRt \quad (4.1)$$

This equation is the long-run equation for current account that relates current account deficit to real GDP, budget deficit, real effective exchange rate, inflation rate and interest rate and upon which the long-run analysis is based. This result shows that in the long run, current account in Ethiopia can be explained by real GDP, real effective exchange rate and budget deficit.

The long-run impact of real GDP on current account deficit is found to be negative and is highly significant, which means that other things remains constant, a 10-percentage-point increase in real GDP will drop the current account deficit by 22.2 percentage points in the long run. This finding is in line with the theoretical prediction of the Absorption approach. Hence, real GDP is declared as major determinant of balance of payments. The positive impact of real GDP is a sign of export expansion. Increase in real income will increase the exports and better will be the current account balance. Furthermore, this result is similar with empirical findings of Azra et.al (2015), (Adamu and Itsede 2010), Choudhary and Shabbir (2005), Eita and Gaomab (2012), Dhliwayo (1996) and Felipe et.al (2009).

The budget deficit is another variable found to be significant and negatively related with the current account deficit. That is, ceteris paribus, a 10 percent increase in the government budget deficit will result in a fall in current account deficit by 3.9 percent. This result is similar to the empirical finding of Kim and Roubini (2003) but contrary to the theoretical expectations of the Ricardian Equivalence Hypothesis (REH) that says that the budget deficit does not affect current account deficit and the Keynesian Proposition Hypothesis (KPH) that states that these twin deficits (budget and current account) are directly and closely linked and the budget deficit causes the current account deficit.

Coming to the major objective of this study, that is, investigating the impact of change in exchange rate on balance of payment of Ethiopia, the coefficient of the real effective exchange rate index, is positive and statistically significant at a 5 percent level of significance confirming the hypothesis that real depreciation succeeds in improving current account balance of Ethiopia in the long run. The coefficient of real effective exchange rate, 0.53, indicates that other things remains constant, a depreciation of real effective exchange rate by 10 percent would result in about 5.3 percent decrease in

current account deficit per year. The result also suggests that the Marshall-Lerner (ML) condition holds for Ethiopia. This result is not only consistent with the theoretical expectation but also in line with empirical results of Falk (2008), Abraham (2012), Anthony (2012), Nawaz (2014), Nega (2015), Dessalegn (2013) and Nazeer (2015) among others.

4.2.6.2. Short-run Relationship

Table 4.8: The estimated short-run model for LCA

Error correction	Coefficient	Std. Error	t-Statistic	Prob.
CointEq1	-0.688246	0.148200	-4.644043	0.0001
D(LCA(-1))	-0.077833	0.097648	-0.797084	0.4319
D(LGD(-1))	-0.929951	0.930860	-0.999023	0.3260
D(LBD(-1))	-0.220469	0.156657	-1.407337	0.1700
D(LREERI(-1))	0.732674	0.387957	1.888542	0.0690
D(LR(-1))	0.007750	0.031816	0.243577	0.8093
D(IN(-1))	-0.005385	0.004974	-1.082652	0.2879
Constant (C)	0.266625	0.086682	3.075889	0.0045
DPC	0.003113	0.104860	0.029688	0.9765

The error correction coefficient shows the speed of adjustment of variables return to equilibrium and it should have a statistically significant coefficient with negative sign. As can be seen in Table 4.8, the error correction term, which measures the speed of adjustment to restore equilibrium in the dynamic model, appears with negative sign and it is statistically significant at a 5 percent level, ensuring that the long-run equilibrium can be attained. This guarantees that although the actual current account balance may temporarily deviate from its long-run equilibrium value, it would gradually converge to its equilibrium. The error correction term of -0.6882 shows that 68.82 percent of the deviation of the actual current account balance from its equilibrium value is eliminated every year; hence, full adjustment would require a period of less than two years. Further, though it is statistically insignificant, the coefficient of the dummy for policy change has unexpected positive sign denying the fact that the economic liberalization improves trade balance.

According to Bannerjee et al. (1998), a highly significant error correction term is further proof of the existence of a stable long-run relationship. Furthermore, testing the significance of the ECt-1 is a relatively more efficient way of establishing cointegration.

4.2.7. Diagnostic Tests of VECM

In the study, different post-estimation diagnostic tests were performed to guarantee that the residuals from the model are Gaussian that the assumptions are not violated and the estimation results and inferences are trustworthy. The diagnostic test results could also be used as indicators of the validity of employing impulse-response functions and variance decomposition analyses.

The adequacy of the model was checked by applying the following tests to the residuals such as the vector residual serial correlation LM test, vector residual normality and vector residual heteroscedasticity test.

4.2.7.1. Vector Residual Serial Correlation LM Test

Table 4.9 shows that there is no evidence that reveals the presence of autocorrelation at the first through the third lags. The large p-values imply that the chi-squared statistics at

all lags are not large enough to help reject the null of no autocorrelation at any of the usual critical values. Thus, the study could not find any evidence of autocorrelation problem in the residuals.

Table 4.9: Vector Residual Serial Correlation LM Test

Lags	LM-Stat	Prob.
1	35.66689	0.4843
2	37.09497	0.4183
3	27.72050	0.8370

4.2.7.2. Vector Residual Normality Test

Normality is checked mainly by using the Jarque-Bera test. The result (in table 4.10) shows that the residual vector of the model is found to be jointly normal at the 5% level. For additional information, the complete VEC residual normality test result is presented in Appendix 3.

Table 4.10: Vector Residual Normality Test

Residual Vector Normality (Jarque-Bera)	
Chi-sq (Joint)	Prob.
11.21519	0.5106

4.2.7.3. Vector Residual Heteroskedasticity Test

The levels and square terms (and no cross terms) of the residuals are included in performing this test. The result in table 4.11 suggests that there is no enough evidence to help reject the null of no heteroscedasticity. Therefore, the residuals of the model are found to be homoskedastic. This, together with the results of the other pre and post estimation diagnostic tests such as AR Roots graph (Appendix 2), suggests the validity

and robustness of the estimated results. For additional information, the complete VEC heteroscedasticity test result is presented in Appendix 4.

Table 4.11: Vector Residual Heteroskedasticity Test

Heteroskedasticity test	**Chi-sq**	**Prob.**
No Cross Terms (only levels and squares)	355.4289	0.0579

4.2.8. Impulse Response

Impulse response analysis is used to analyze the dynamic interactions between the endogenous variables of a VAR (P) process. The relevant impulse or innovations are traced out in an impulse response analysis. Consider the estimated impulse response functions based on the estimated VECM. Impulse response functions could tell us how the current account deficit at any point in time may respond to a one standard deviation innovation (impulse) generated from any of the variables earlier times and how that effect may be multiplied (lasts for long or is transitory). To take into account the ordering of the variables and the lag length, the results in this study are based on the generalized impulse response functions (GIRFs) based on the works of Pesaran and shin (1998).

The generalized impulse response functions of the current account deficit can be depicted in Table 4.12. To save space, emphasis is on the current account balance over the sample period. The complete table are however available in appendix 5. As seen from the fifth column of Table 4.12, it is obvious that the effect of one standard deviation shock of real effective exchange rate on current account deficit is negative in the short run almost over the whole period. It can be observed that one generalized standard deviation innovation on REER in the short run does not improve current account balance in the 10-year forecast horizon. Accordingly, the short-run effect of exchange rate depreciation on Ethiopian current account tends to be negative. This result**,** together with the long-run positive impact of exchange rate on the current account is in line with the economic theory that states that a depreciation in local currency will worsen the current account in the short run. That is, the "J Curve effect" on the current account, where, following a

devaluation / depreciation, the current account gets worse before it improves. This result is similar with that of Abebe (2014).

Table 4.12: Impulse response of LCA

Response of LCA	LCA	LRGDP	LDB	LREERI	MLR	IF
1	0.273563	0.116292	-0.007667	0.027547	0.019562	0.034106
2	0.080412	0.073069	0.008407	-0.010712	0.044027	-0.021694
3	0.099438	0.128357	0.088889	-0.031085	0.067076	-0.015603
4	0.121450	0.146370	0.063835	-0.071089	0.070726	-0.050511
5	0.112211	0.140120	0.051716	-0.077506	0.081747	-0.059957
6	0.114784	0.133456	0.058497	-0.062252	0.080939	-0.044780
7	0.113314	0.130967	0.058737	-0.059951	0.077158	-0.042748
8	0.111080	0.132571	0.058845	-0.063499	0.077922	-0.046053
9	0.112140	0.133836	0.059142	-0.064591	0.078835	-0.046762
10	0.112575	0.133523	0.058607	-0.064352	0.078845	-0.046607

4.2.9. Forecast Error Variance Decomposition

The variance decomposition analysis indicates how much of the uncertainty surrounding the predictions of one variable can be explained by the uncertainty surrounding the other variables. The variance decomposition (at VEC level) of the major variable of interest i.e. current account deficit at the end of 10 years horizon alongside with the Monte Carlo standard errors is presented in Table 4.13 (the results of other variables are not reported here to conserve space, but are provided Appendix 6).

Table 4.13: Variance decomposition of LCA

Variance decomposition of LCA							
Period	S.E.	LCA	LRGDP	LBD	LREERI	MLR	IN
1	0.273563	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.292306	95.15473	1.742092	0.038852	0.418290	1.684240	0.961798
3	0.339359	79.18290	7.667588	6.017036	1.792013	4.581706	0.758761
4	0.385628	71.24049	9.719138	7.647210	6.103736	4.696403	0.593020
5	0.424036	65.92198	10.71129	8.063115	9.479052	5.294585	0.529979
6	0.458275	62.71322	11.32930	8.679512	10.73626	6.068426	0.473272
7	0.488922	60.46876	11.79061	9.188459	11.58458	6.540517	0.427074
8	0.517927	58.48557	12.21782	9.592563	12.42407	6.888895	0.391080
9	0.545915	56.86190	12.55524	9.916522	13.13474	7.170415	0.361181
10	0.572486	55.57294	12.81220	10.16608	13.70961	7.401633	0.337528

The result in Table 4.13 reveals that all the variation in current account is explained by the lagged value of the variable itself in the first period. Additionally, the result suggests that 55 percent of the variation in current account deficit is explained by its own shocks, with only 14 percent due to exchange rate. Accordingly, a considerable variation in Ethiopia's current account is due to changes in exchange rate movements next to a variation in itself. Further, the shocks due to real GDP are mainly informative. This is because it is more than the shocks originating from budget deficit, interest rate and inflation. The innovations in real GDP contribute 13 percent, budget deficit contributes 10 percent while interest rate contributes 7 percent and inflation contributes almost 0.5 percent.

CHAPTER FIVE

5. CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Conclusions

In Ethiopia, in the face of series macroeconomic problems, which includes continuously rising money supply, huge debt servicing, persistence budget deficit, rising unemployment and inflationary process, the current account deficit is elevated. Recently, despite the fact that a continuous growth in GDP has been recording, the current account deficit trend does not decline as expected but it shows a persistent increase. Given this macroeconomic environment, analyzing factors that determines the deficit in current account is important.

The central purpose of this study was to investigate the effect of real effective exchange rate on balance of payment in Ethiopia during the period 1976 - 2015. To determine this long-run and short-run relationship among the dependent and independent variables the vector error correction model (VECM) was applied. The paper used real effective exchange rate, real GDP, inflation rate, budget deficit and nominal simple average lending rate as determinant variables.

Before applying the VECM model, all the variables were tested for their time series properties (stationarity properties) using the Augmented Dickey Fuller (ADF) tests. The study carried out unit root test under such different assumptions as intercept, trend and intercept and no intercept and trend. As a result all variables are stationary at first difference or they are integrated of order one. The presence of stable long-run equilibrium relationship is further strengthened by the Johansen Co-integration test. Accordingly, both the trace and the maximum Eigen value tests identified one co-integrating relationship between the dependent and independent variables at a 5% level of significance. Further, the Granger causality test was performed in order to observe if one variable is Granger-causal for another. The result of the test shows that at 5% level, the existence of bi-directional causality between current account deficit and budget deficit

and real GDP and Inflation. On the other hand, one directional relationship also found. The overall causality in the system shows that the null hypothesis that all the variables in the system do not Granger cause CA is rejected at 1% level of significance. Moreover, the adequacy of the model was checked by applying the vector residual serial correlation LM test, vector residual normality and vector residual heteroscedasticity test. The results of these diagnostic tests, together with the results of the other pre and post estimation tests, suggests the validity and robustness of the estimated results.

The major finding of the study is that, in the long run, real depreciation succeeds in improving current account balance of Ethiopia. This result suggests that the Marshall-Lerner (ML) condition holds for Ethiopia. Further, the long-run impact of real GDP on current account deficit is found to be negative and is highly significant which can be justified as a sign of export expansion. Moreover, the result of the impulse response revealed that the effect of one standard deviation shock of real effective exchange rate on current account deficit is negative in the short run almost over the whole period. It can be observed that one generalized standard deviation innovation on REER in the short run does not improve current account balance in the 10-year forecast horizon. Accordingly, the short-run effect of exchange rate depreciation on Ethiopian current account tends to be negative. This result, together with the positive long-run impact of exchange rate, is in line with the economic theory that states that a depreciation in local currency will worsen the current account in the short run. That is, the J Curve effect on the current account. Finally, the variance decomposition of current account balance result has suggested that 55 percent of the variation in current account deficit is explained by its own shocks, with only 14 percent and 13 percent due to exchange rate real GDP respectively. The innovation in budget deficit contributes 10 percent while inflation contributes almost 0.5 percent and interest rate contributes 7 percent.

5.2 Recommendations

Based on the findings of the study, the following measures may help in reducing current account deficit in Ethiopia.

- Exchange rate management in Ethiopia must be seen from the long run perspective rather than short-run effect because depreciation/devaluation improves current account balance of the country in the long run.
- Government should harmonize monetary and fiscal policies to boost the non-agricultural sectors such as the tourism and transportation sectors and pay more attention to export promotion and diversification strategies.
- Promoting import substitution strategy through subsidies to the domestic industries to discourage over-reliance on imported goods and substitute their imported inputs and reducing taxes to their imported semi-finished products. This strategy should essentially be implemented based on the law of comparative advantage.
- Awareness creation in favor of the home-produced substitutes should be made.

5.3 Future Research Direction

The recent issue of persistent balance of payments imbalances led to a renewed interest in better understanding the effect of exchange rates on international trade and thereby balance of payments. Even though there is increasing number of studies on the topic, the actual effect of exchange rates on balance of payments is still an open and controversial question. Given this fact, some directions for future research are suggested in this paper. One direction is to use alternative econometric techniques. Another direction is extending the econometric methodology to a sample of countries. In addition, emphasis should be given to the capital and financial account component of the balance of payment.

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Appendices

Appendix 1: VAR Lag Exclusion Wald Tests

VAR Lag Exclusion Wald Tests

Date: 05/15/17 Time: 22:05

Sample: 1976 2015

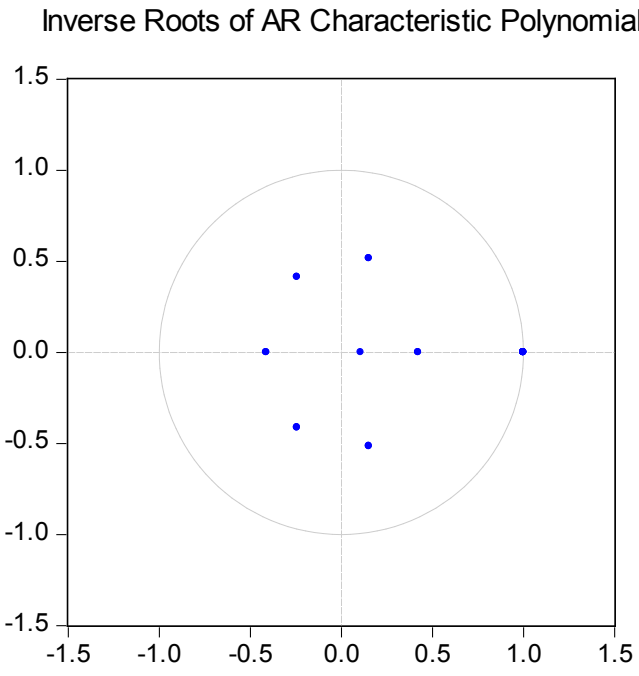
Included observations: 39

Chi-squared test statistics for lag exclusion:

Numbers in [ ] are p-values

	LNCA	LNGD	LNBD	LNREER	MLR	INF	Joint
Lag 1	1736.148	5727.051	937.0002	149.3387	81.76072	18.09373	8434.025
	[0.000000]	[0.000000]	[0.000000]	[0.000000]	[1.55e-15]	[0.006002]	[0.000000]
Df	6	6	6	6	6	6	36

Appendix 2: AR Roots Graph



Appendix 3: VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 05/21/17 Time: 21:39
Sample: 1976 2015
Included observations: 38

Component	Skewness	Chi-sq	df	Prob.
1	-0.550086	1.916435	1	0.1663
2	-0.557855	1.970951	1	0.1603
3	0.539618	1.844189	1	0.1745
4	-0.521992	1.725682	1	0.1890
5	0.183787	0.213925	1	0.6437
6	-0.233848	0.346337	1	0.5562
Joint		8.017518	6	0.2368

Component	Kurtosis	Chi-sq	df	Prob.
1	2.547379	0.324370	1	0.5690
2	2.931090	0.007519	1	0.9309
3	2.898621	0.016273	1	0.8985
4	2.855119	0.033235	1	0.8553
5	4.243466	2.448163	1	0.1177
6	2.517823	0.368116	1	0.5440
Joint		3.197676	6	0.7837

Component	Jarque-Bera	df	Prob.
1	2.240805	2	0.3261
2	1.978469	2	0.3719
3	1.860462	2	0.3945
4	1.758917	2	0.4150
5	2.662088	2	0.2642
6	0.714453	2	0.6996
Joint	11.21519	12	0.5106

Appendix 4: VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Date: 05/21/17 Time: 21:41
Sample: 1976 2015
Included observations: 38

Joint test:

Chi-sq	Df	Prob.
355.4289	315	0.0579

Individual components:

Dependent	R-squared	F(15,22)	Prob.	Chi-sq(15)	Prob.
res1*res1	0.232504	0.444309	0.9450	8.835150	0.8860
res2*res2	0.421191	1.067271	0.4341	16.00524	0.3817
res3*res3	0.560276	1.868760	0.0888	21.29049	0.1278
res4*res4	0.658501	2.828127	0.0132	25.02305	0.0496
res5*res5	0.752984	4.470871	0.0008	28.61339	0.0180
res6*res6	0.436232	1.134878	0.3841	16.57683	0.3448
res2*res1	0.332150	0.729435	0.7322	12.62170	0.6315
res3*res1	0.591089	2.120099	0.0532	22.46139	0.0963
res3*res2	0.348797	0.785577	0.6802	13.25430	0.5827
res4*res1	0.390216	0.938557	0.5405	14.82821	0.4639
res4*res2	0.489727	1.407611	0.2272	18.60962	0.2320
res4*res3	0.708202	3.559646	0.0035	26.91169	0.0295
res5*res1	0.516305	1.565549	0.1652	19.61960	0.1870
res5*res2	0.613891	2.331919	0.0348	23.32787	0.0774
res5*res3	0.607667	2.271654	0.0392	23.09135	0.0822
res5*res4	0.638753	2.593345	0.0208	24.27262	0.0606
res6*res1	0.381289	0.903853	0.5713	14.48899	0.4888
res6*res2	0.336852	0.745006	0.7178	12.80037	0.6177
res6*res3	0.487961	1.397697	0.2317	18.54251	0.2352
res6*res4	0.505871	1.501521	0.1881	19.22311	0.2038
res6*res5	0.517400	1.572425	0.1629	19.66118	0.1853

Appendix 5: Impulse response functions

Response of LCA						
Period	LNCA	LNGD	LNBD	LNREER	MLR	INF
1	0.273563	0.116292	-0.007667	0.027547	0.019562	0.034106
2	0.080412	0.073069	0.008407	-0.010712	0.044027	-0.021694
3	0.099438	0.128357	0.088889	-0.031085	0.067076	-0.015603
4	0.121450	0.146370	0.063835	-0.071089	0.070726	-0.050511
5	0.112211	0.140120	0.051716	-0.077506	0.081747	-0.059957
6	0.114784	0.133456	0.058497	-0.062252	0.080939	-0.044780
7	0.113314	0.130967	0.058737	-0.059951	0.077158	-0.042748
8	0.111080	0.132571	0.058845	-0.063499	0.077922	-0.046053
9	0.112140	0.133836	0.059142	-0.064591	0.078835	-0.046762
10	0.112575	0.133523	0.058607	-0.064352	0.078845	-0.046607
Response of LRGDP						
1	0.023277	0.054756	0.005091	-0.019868	0.007518	-0.025296
2	0.045535	0.064914	0.009528	-0.004581	0.001688	-0.011402
3	0.048330	0.063660	0.005803	0.001135	-0.005797	-0.008352
4	0.046867	0.064823	0.006268	0.001559	-0.006990	-0.008663
5	0.048521	0.066547	0.007191	0.001583	-0.007461	-0.008445
6	0.049089	0.066925	0.006441	0.001186	-0.007689	-0.008964
7	0.049053	0.066846	0.006339	0.001394	-0.007676	-0.008869
8	0.049162	0.066783	0.006457	0.001707	-0.007799	-0.008574
9	0.049140	0.066790	0.006443	0.001701	-0.007877	-0.008592
10	0.049128	0.066839	0.006444	0.001639	-0.007860	-0.008650
Response of LBD						
1	-0.008307	0.027557	0.296381	0.043580	-0.045080	0.049049
2	0.049785	0.014708	0.168306	0.029865	-0.016584	0.044542
3	0.002456	-0.008001	0.198273	0.037954	-0.027934	0.041993
4	0.012176	-0.004518	0.198783	0.044434	-0.020718	0.053681
5	0.010673	-0.003674	0.201583	0.040171	-0.025560	0.049083
6	0.009653	-0.002421	0.197725	0.036067	-0.022022	0.045256
7	0.010496	-0.002740	0.199538	0.037685	-0.022059	0.046909
8	0.010650	-0.003406	0.198799	0.038298	-0.022404	0.047436
9	0.010076	-0.003492	0.199052	0.038202	-0.022492	0.047283
10	0.010208	-0.003287	0.199138	0.038067	-0.022392	0.047229

Response of LREERI						
1	0.015511	-0.055893	0.022650	0.154039	-0.065344	0.118155
2	-0.010336	-0.057043	0.050328	0.184621	-0.097139	0.144762
3	-0.006346	-0.022807	0.062476	0.151391	-0.099834	0.117256
4	0.004696	-0.007724	0.051936	0.131272	-0.091428	0.098755
5	0.008688	-0.011312	0.048420	0.137101	-0.089984	0.102958
6	0.008162	-0.016248	0.049124	0.145086	-0.092710	0.109829
7	0.006560	-0.016607	0.050402	0.145831	-0.094280	0.110481
8	0.006498	-0.015119	0.050630	0.143927	-0.093975	0.108884
9	0.007019	-0.014544	0.050322	0.143182	-0.093554	0.108232
10	0.007178	-0.014787	0.050117	0.143489	-0.093513	0.108466
Response of LR						
1	0.105700	0.202951	-0.224825	-0.627031	1.478136	-0.196005
2	0.465818	-0.209579	-0.085260	-0.163471	1.265921	0.263812
3	0.143939	-0.542512	-0.375268	-0.094819	1.280460	0.269463
4	0.028045	-0.542857	-0.151330	-0.050505	1.285371	0.335159
5	0.082179	-0.485482	-0.165381	-0.123946	1.295033	0.288605
6	0.066368	-0.477714	-0.194415	-0.176294	1.315048	0.233635
7	0.072085	-0.486674	-0.192566	-0.158960	1.326607	0.251077
8	0.072819	-0.497059	-0.188876	-0.143290	1.318445	0.265505
9	0.066884	-0.497660	-0.189263	-0.146113	1.317134	0.262489
10	0.066933	-0.494486	-0.187545	-0.149676	1.318716	0.259796
Response of IF						
1	1.281612	-4.748908	1.701232	7.885078	-1.363128	10.27977
2	-0.299452	-3.901928	1.312322	3.143578	-3.490613	5.543812
3	-0.813910	-2.920821	-0.490165	0.465189	-1.068414	3.067459
4	0.012234	-3.365284	0.284133	1.806156	-1.074292	4.417302
5	-0.113021	-3.971222	-0.095102	2.348716	-1.413210	4.846370
6	-0.490774	-3.982568	0.110874	2.269463	-1.455509	4.754804
7	-0.389949	-3.808213	0.171889	2.122441	-1.391302	4.668003
8	-0.349847	-3.782705	0.109079	2.048837	-1.371450	4.594145
9	-0.357900	-3.813469	0.090753	2.078105	-1.357222	4.614798
10	-0.359446	-3.832099	0.107839	2.115107	-1.370071	4.649895

Generalized Impulse

Appendix 6: Forecast error variance decompositions

Variance decompositions of LCA							
Period	S.E.	LNCA	LNGD	LNBD	LNREER	MLR	INF
1	0.273563	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.292306	95.15473	1.742092	0.038852	0.418290	1.684240	0.961798
3	0.339359	79.18290	7.667588	6.017036	1.792013	4.581706	0.758761
4	0.385628	71.24049	9.719138	7.647210	6.103736	4.696403	0.593020
5	0.424036	65.92198	10.71129	8.063115	9.479052	5.294585	0.529979
6	0.458275	62.71322	11.32930	8.679512	10.73626	6.068426	0.473272
7	0.488922	60.46876	11.79061	9.188459	11.58458	6.540517	0.427074
8	0.517927	58.48557	12.21782	9.592563	12.42407	6.888895	0.391080
9	0.545915	56.86190	12.55524	9.916522	13.13474	7.170415	0.361181
10	0.572486	55.57294	12.81220	10.16608	13.70961	7.401633	0.337528
Variance decompositions of LREERI							
1	0.054756	1.013983	0.000000	0.000000	98.98602	0.000000	0.000000
2	0.088706	0.574329	1.390405	0.450821	96.39329	0.291196	0.899963
3	0.113881	0.433361	3.987355	1.279149	91.27724	1.189213	1.833680
4	0.134933	0.365530	5.812619	1.445565	88.26433	1.864198	2.247760
5	0.154110	0.358527	6.699798	1.443520	86.95905	2.153514	2.385592
6	0.171339	0.343502	7.124036	1.419592	86.34519	2.301851	2.465825
7	0.186975	0.319083	7.459419	1.417593	85.82493	2.435324	2.543650
8	0.201429	0.300792	7.771271	1.424922	85.33431	2.554138	2.614569
9	0.214917	0.289679	8.025822	1.429100	84.93675	2.649443	2.669205
10	0.227614	0.281512	8.221221	1.429318	84.63488	2.722979	2.710094
Variance decompositions of LRGDP							
1	0.296381	18.07121	65.30470	0.000000	16.62408	0.000000	0.000000
2	0.346582	33.23546	58.88509	0.032542	7.413068	0.015330	0.418510
3	0.401096	38.17624	56.14684	0.087606	4.606317	0.436504	0.546490
4	0.449526	39.25744	55.98530	0.116896	3.336564	0.676314	0.627481
5	0.494137	40.00793	55.72446	0.113416	2.604232	0.838026	0.711934
6	0.533510	40.57466	55.41805	0.123506	2.155401	0.972176	0.756202
7	0.570873	40.95500	55.22640	0.132988	1.846311	1.057461	0.781845
8	0.605726	41.24541	55.07717	0.138655	1.617056	1.118544	0.803163
9	0.638737	41.45882	54.96636	0.143189	1.443524	1.168183	0.819921
10	0.670146	41.62093	54.88390	0.146705	1.308299	1.207187	0.832980

Variance decompositions of LBD							
1	0.154039	0.078556	4.235247	93.41727	2.268922	0.000000	0.000000
2	0.245953	2.120846	3.114911	92.57379	2.178676	0.008912	0.002865
3	0.299106	1.587270	2.364823	93.39409	2.519541	0.012381	0.121895
4	0.334814	1.337050	1.931375	93.58732	2.939264	0.096021	0.108970
5	0.367889	1.153187	1.636646	93.94748	3.064931	0.094833	0.102919
6	0.400817	1.021996	1.437204	94.26672	3.066380	0.103614	0.104083
7	0.431781	0.926398	1.283886	94.47737	3.094014	0.113855	0.104475
8	0.460226	0.853768	1.162768	94.62816	3.129766	0.120839	0.104703
9	0.486769	0.792685	1.066599	94.75242	3.157048	0.126239	0.105007
10	0.511975	0.743324	0.988413	94.85582	3.176654	0.130819	0.104974
Variance decompositions of LR							
1	1.478136	0.511356	0.747979	0.480291	18.80166	79.45871	0.000000
2	2.083111	5.257900	8.981761	0.421756	10.49712	74.73151	0.109954
3	2.592290	3.703550	15.38299	0.844590	6.958052	72.57608	0.534737
4	3.009692	2.756204	17.03302	0.626795	5.193630	73.80566	0.584690
5	3.364948	2.264595	18.09146	0.501535	4.310861	74.26628	0.565273
6	3.689095	1.916481	18.84886	0.419521	3.835114	74.38629	0.593732
7	3.994113	1.667519	19.36976	0.359673	3.446690	74.54013	0.616235
8	4.277101	1.483147	19.80265	0.314775	3.130977	74.63850	0.629945
9	4.541685	1.337061	20.13568	0.280232	2.891224	74.71545	0.640352
10	4.791566	1.220755	20.38874	0.252493	2.705186	74.78471	0.648113
Variance decompositions of IF							
1	10.27977	1.554340	6.483430	1.229225	57.50921	3.765324	29.45847
2	12.60002	1.091077	10.21904	2.242625	44.68861	6.507128	35.25152
3	13.65430	1.284409	13.24000	1.909684	38.21625	6.247660	39.10199
4	14.77493	1.097030	16.16268	1.858519	34.14656	5.492508	41.24271
5	15.97022	0.943969	19.07996	1.627801	31.43275	4.923661	41.99185
6	17.05798	0.910194	20.91999	1.506404	29.41866	4.514924	42.72983
7	18.05867	0.858742	22.23366	1.438268	27.69621	4.205754	43.56736
8	18.99522	0.810071	23.37494	1.371664	26.24853	3.972360	44.22244
9	19.88914	0.771271	24.34487	1.311527	25.08353	3.768470	44.72033
10	20.75058	0.738569	25.14901	1.263258	24.12997	3.593848	45.12534

Appendix 7: VEC estimates

Vector Error Correction Estimates
Date: 05/21/17 Time: 21:37
Sample (adjusted): 1978 2015
Included observations: 38 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNCA(-1)	1.000000
LNGD(-1)	-2.222528 (0.32669) [-6.80309]
LNBD(-1)	-0.398262 (0.15635) [-2.54717]
LNREER(-1)	0.537604 (0.23325) [2.30484]
MLR(-1)	-0.041874 (0.02724) [-1.53708]
INF(-1)	-0.000360 (0.00771) [-0.04664]
C	19.84475

Error Correction:	D(LNCA)	D(LNGD)	D(LNBD)	D(LNREER)	D(MLR)	D(INF)
CointEq1	-0.688246 (0.14820) [-4.64404]	0.054451 (0.02966) [1.83560]	0.171214 (0.16056) [1.06635]	-0.160592 (0.08345) [-1.92443]	1.837885 (0.80076) [2.29517]	0.370746 (5.56894) [0.06657]
D(LNCA(-1))	-0.077833 (0.09765) [-0.79708]	0.001004 (0.01955) [0.05138]	0.092102 (0.10579) [0.87059]	-0.017214 (0.05498) [-0.31307]	0.596493 (0.52762) [1.13054]	0.281384 (3.66934) [0.07669]
D(LNGD(-1))	-0.929951 (0.93086) [-0.99902]	0.343035 (0.18632) [1.84110]	-0.310375 (1.00850) [-0.30776]	0.450033 (0.52415) [0.85859]	-8.673212 (5.02969) [-1.72440]	-25.68766 (34.9792) [-0.73437]
D(LNBD(-1))	-0.220469	0.022325	-0.336522	-0.028813	1.429528	0.675972

	(0.15666)	(0.03136)	(0.16972)	(0.08821)	(0.84646)	(5.88675)
	[-1.40734]	[0.71196]	[-1.98277]	[-0.32664]	[1.68883]	[0.11483]
D(LNREER(-1))	0.732674	0.026124	-0.211746	0.129963	0.174758	-42.48958
	(0.38796)	(0.07765)	(0.42032)	(0.21845)	(2.09624)	(14.5784)
	[1.88854]	[0.33642]	[-0.50378]	[0.59493]	[0.08337]	[-2.91456]
D(MLR(-1))	0.007750	-0.000111	0.009149	-0.023129	0.027325	-3.249471
	(0.03182)	(0.00637)	(0.03447)	(0.01791)	(0.17191)	(1.19555)
	[0.24358]	[-0.01737]	[0.26543]	[-1.29103]	[0.15895]	[-2.71798]
D(INF(-1))	-0.005385	0.001048	0.000394	0.004124	-0.011719	-0.106666
	(0.00497)	(0.00100)	(0.00539)	(0.00280)	(0.02688)	(0.18692)
	[-1.08265]	[1.05269]	[0.07312]	[1.47241]	[-0.43603]	[-0.57065]
C	0.266625	0.007515	0.153932	0.025728	-0.511024	-0.880180
	(0.08668)	(0.01735)	(0.09391)	(0.04881)	(0.46837)	(3.25729)
	[3.07589]	[0.43316]	[1.63910]	[0.52711]	[-1.09107]	[-0.27022]
PC	0.003113	0.037390	0.014479	-0.054906	1.062845	3.025653
	(0.10486)	(0.02099)	(0.11361)	(0.05904)	(0.56659)	(3.94035)
	[0.02969]	[1.78143]	[0.12745]	[-0.92990]	[1.87588]	[0.76786]
R-squared	0.460979	0.335123	0.229425	0.233454	0.315398	0.370029
Adj. R-squared	0.312284	0.151708	0.016852	0.021993	0.126543	0.196244
Sum sq. resids	2.170271	0.086950	2.547412	0.688114	63.36167	3064.538
S.E. equation	0.273563	0.054756	0.296381	0.154039	1.478136	10.27977
F-statistic	3.100155	1.827134	1.079276	1.104007	1.670050	2.129231
Log likelihood	0.472286	61.60059	-2.572011	22.29668	-63.63385	-137.3309
Akaike AIC	0.448827	-2.768452	0.609053	-0.699825	3.822834	7.701627
Schwarz SC	0.836676	-2.380603	0.996903	-0.311976	4.210684	8.089477
Mean dependent	0.181100	0.051883	0.129950	0.001641	0.081053	-0.373654
S.D. dependent	0.329878	0.059451	0.298911	0.155762	1.581588	11.46625

Determinant resid covariance (dof adj.)	1.53E-05
Determinant resid covariance	3.02E-06
Log likelihood	-81.99348
Akaike information criterion	7.473341
Schwarz criterion	10.05900