

**ADDIS ABABA UNIVERSITY**  
**SCHOOL OF GRADUATE STUDIES**

**DEVALUATION, BALANCE OF PAYMENT AND OUTPUT  
DYNAMICS IN DEVELOPING COUNTRIES: (THE CASE OF  
ETHIOPIA)**

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**Devaluation, Balance of Payment and Output Dynamics in  
Developing Countries: (The Case of Ethiopia)**

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## **Abstract**

*The objective of the study is to investigate the theoretical and empirical relationship between currency devaluation, balance of payment and output in Ethiopia. The study employed Johnson co-integration analysis, and Granger causality tests. The analysis was made using impulse response function and variance decomposition by adopting Structural Vector autoregressive (SVAR) and Vector Error correction model (VECM). The models were estimated using quarterly data for the period ranging between 2000/2001Q1 to 2016/17Q4.*

*The study found that devaluation has negative impact on the balance of payment. A great variation in real GDP emanates from the balance of payment variation and the variation in exchange rate comes from real GDP. This designates, in the long run, the balance of payment affects exchange rate through real output. Therefore, there is a linkage between exchange rate, the balance of payment and output. The contractionary effect of devaluation on output comes in different ways. First, devaluation increases money supply, a rise in the money supply has inflationary pressure on market prices and this intern forces output to decline. Second, devaluation increases interest rate, an increase in interest rate forces output to decline. Third, devaluation reduces foreign asset reserve, a reduction in foreign asset reserve leads to a fall in the balance of payment. A reduction in the balance of payment led to a decrease in output. Finally, devaluation increases external debt burden. The study recommends that before devaluating its currency the government should consider a policy that encourages productivity, diversification of the export sectors and expansion of import substituting industries which are alternative policies for devaluation.*

## **List of Acronyms and Abbreviations**

ADF:	Augmented Dickey-Fuller Test
AIC:	Akaike Information Criterion
ARDL:	Autoregressive Distributed Lag Model
BOP:	Balance of Payment
CPI:	Consumer Price Index
DGP:	Data Generating Process
GDP:	Gross Domestic Product
GTP II:	Growth and Transformation Plans II
HQ:	Hannan-Quinn Criterion
IMF:	International Monetary Fund
ISID:	Sustainable Industrial Development
LDCs:	Least Developing Countries
MSE:	Mean Squared Error
MSPE:	Mean Squared Prediction Error
NBE:	National Bank of Ethiopia
ODA:	Official Development Assistance
OLS:	Ordinary Least Square
PP:	Phillip-Perron Unit root test
PPP:	purchasing power parity
SIC:	Schwarz Information Criterion
SNA:	system of national accounts
SVAR:	Structural Vector autoregressive
UNECA:	United Nations Economic Commission for Africa
UNIDO:	United Nations Industrial Development Organization
VAR:	Vector Autoregressive
VECM:	Vector Error Correction Model
WB:	World Bank

# CHAPTER ONE

## INTRODUCTION

### 1.1. Background of the study

As one of the widely used macroeconomic indicators, devaluation can be simply defined as the loss of competitiveness a country's exchange rate on its value when measured in terms of foreign currency. On the other hand, it can be explained as a deliberate downward adjustment in the official exchange rate. Having a weaker currency relative to the rest of the world can help to boost exports, shrink trade deficits and reduce the cost of interest payments on its outstanding government debts. But it may have some adverse effects of the rise in recessions (Hayes, 2016).

An exchange rate is one of the most important macroeconomic policy variables; which has its own impact on macroeconomic variables; such as, foreign exchange reserve, and balance of payment, inflation, employment, aggregate demand and aggregate supply of any country. Moreover, Kamal (1999) devaluation is considered as a tool for stabilizing the foreign sector of an economy. In Addition, Allen (2006) the effect of exchange rate movements in developing country significantly rests on the nature of the country's principal export type (i.e. Manufactures, non-oil commodities, or oil). Because the Marshall-Lerner condition governs whether nominal exchange rate depreciation (appreciation) will improve (deteriorate) trade balance respectively. That is, it governs trade balance based on the elasticity of export and imports.

Morely (1992) devaluation in developing country decreases output, increases terms of trade deficit, and it leads to the growth of import and the money supply. The reason is that; first, a nominal devaluation can reduce the aggregate demand through the negative real balance effect due to a higher price level, which in turn may decrease the level of output. Second, devaluation can generate a redistribution of income from the groups with a lower to a higher marginal propensity to save. This may lead to a lower aggregate demand and output (Krugman and Taylor, 1978). Third, if the price elasticity of exports and imports are very low, then the trade balance expressed in terms of domestic currency may deteriorate causing a contractionary effect in the economy.

Additionally, Bilson (1978) most economists agree that devaluation will not have any long-run impact on output, employment, or the balance of payments. This result follows from the presumption that domestic prices and costs will eventually increase sufficiently to offset the effect of the devaluation on the competitive position of the country. On the other hand, few countries ever devalue for long-run reasons; devaluation is generally part of an attempt to move the economy more rapidly towards a sustainable equilibrium.

Moreover, in 1970s and 1980s many developing countries' balance of payment was highly deteriorated with overvalued currency and highly rate of unemployment was observed (Stambuli, 2006). These lead nations to search financial and non-financial aid from international organizations. However, Tamirayehu (2015) international organizations like the International Money Fund (IMF) and The World Bank were not interested to give their money without preconditions. That is, structural adjustment program (SAP) was asked to be implemented. SAP was a program that encouraged finance seeking countries to privatize all state owned properties, less government intervention, devaluation of the overvalued currency, applying "free market economy" and many others were proposed. From these measures the study concentrates only on devaluation of currency.

According to World Bank (WB) (1990) report, All over Africa, countries are adopting SAP with the hope of arresting decades of economic deterioration. Later on in 1991, the government of Ethiopia accept partially or fully to implement SAP and other preconditions of the World Bank and IMF (NBE, 2009). Hence, before 1991 the country was used a fixed exchange rate with a rate of 2.07 Birr per US dollar. That is, Birr was overvalued which leads to a trade and public budget deficit (Kidane, 1994). This overvaluation of currency highly discouraged the export as well as domestic production by making the price of imported goods cheap.

Since 1992, Ethiopia followed managed floating exchange rate system by considering the fundamental economic situations of the country. That is, the National Bank of Ethiopia frequently intervenes to avoid excessive appreciation/depreciation of its currency. Following this policy in 2007/08 fiscal year the rate of depreciation against other foreign currencies increased compared to the previous years. In the 2009/10 and September 2010/2011 the Ethiopian Birr was depreciated to 23.7 percent and 16.5 percent respectively against the US dollar. The overall

balance of payments in 2009/10 recorded USD 1.37 billion in surplus compared to USD 316.6 million in the preceding year. In this period GDP is grown by 10.4 percent. This growth was also continuous with 11.3 percent annual average growth during 2003/04- 2015/16 (NBE, 2011). However, in 2015/16 the balance of payment account faces higher deficit 830.9 million USD dollars and annual average growth was 10.5 percent. However, country's exchange rate is still deprecating and reached to 21.1059 Birr/USD, on average.

Even though, recently Ethiopia is in a process of producing manufacturing products that are finished and semi-finished; which are exportable and substituting imported goods; the current account of the country is still in deficit. Recently (October 2017) the National Bank of Ethiopia devalues its currency by 15 percent to solve the problem of external imbalances. That is, to increase the export performance of the country as well as its competitiveness and solve the shortage of foreign currency.

As Edward et al (2017) the National Bank also intervenes in the foreign exchange market to ensure stability of the exchange rate through implementation of a gradual devaluation of the Ethiopian Birr to ensure alignment of the exchange rate with market fundamentals. Ethiopia is one of the developing countries that export earnings are low and fluctuating, the import of high priced goods is increasing over time. These disproportional growth rates of export and import value contributed to the deteriorating balance of payment of the country and it also affects the recent fast economic growth of Ethiopia in the long run.

Since 1992 Ethiopia has devaluated its currency many times with the force of international financial institutions and hoping for solve the external imbalances. This study specifically focus on devaluation and its effectiveness in achieving the objective as well as its effect on the balance of payment and output; in addition, its transmission to inflation, money supply, external debt servicing and foreign exchange reserve could be clearly presented.

## **1.2. Statement of the problem**

Exchange rate plays an important role in international economic relations among countries. Which is the change in the exchange rate has different effects on macroeconomic variables such as interest rate, inflation rate, unemployment rate, money supply, and output etc. Hence,

exchange rate links the price systems of two different countries through international trade to make a direct comparison of traded goods. That is, it links domestic prices with international prices (Oladipupo and Onotaniyohuwo, 2011) through its effects on the volume of imports and exports. And it also influences on a country's balance of payments position and output.

The standard macroeconomic literature (i.e. Mundell-Fleming) suggests that currency devaluations are expansionary. However, there is a strong presumption among economists that devaluations of the nominal exchange rate are contractionary in terms of output. This is particularly true in the light of the 2008 financial crises (Calimo 2008). In fact, referring to the Asian crises Krugman (1999) argued that the worsening of firms' balance sheets after devaluation could lead to a contraction of output. [Céspedes, Chang and Velasco (2004, 2003); Gilchrist, Gertler and Natalucci (forthcoming), Cook (2004)].

This paper presents new evidence on the relationship between currency devaluation, the balance of payment (external sector) and output in developing nations, especially in Ethiopia. A literature that goes back to Gebreegziabhier (2003) views as historically indicated starting from the emperor regime to the current government the current account of Ethiopia is facing very weak performance. Even though, Ethiopia has experienced large deficits in its current account since at least the late 1990s; (Naod 2010) showed there is a little improvement of BOP due to the profitability of service sector and official foreign assistance and remittances.

International Money Fund (IMF) (2014) encourages developing countries to devalue their currency; as a means to spur economic growth of the country in addition to providing financial aid and loans to their member countries for the development of domestic firms. It will increase the competitiveness of firms and increase the production of domestic products and output. However, some researchers focusing on developing countries showed that the adverse effect of devaluation on output (see Krugman & Taylor, 1978, Acar (2000), and Seid, 2010,). The effect of currency devaluation on economic growth of Ethiopian economy is not clear. That is, the effect of devaluation on GDP per capita has a time varying effect; negative effect on the same year and positive effect one year later (Tirsit, 2011). And Yilkal (2012) on the contrary to IMF's argument devaluation have contractionary effect on the Ethiopian economy. Though empirical

studies are ambiguous devaluation has been used as a growth encouraging strategy by many developing countries.

Yilkal (2012) using quarterly time series data over the period ranging from 1997/98 to 2009/10 and employing a Vector Autoregression model analysed the effect of currency devaluation on output growth in Ethiopia. By controlling for monetary and fiscal policy, the study found that currency devaluations are contractionary in the long run and neutral in the short run.

Since 2003 Ethiopia followed highly aggressive expansionary macroeconomic policy initiating extended fixed investment, much beyond a narrow public expenditure boom. This is considered as the cause for the country's two digit growth. As a result, the growth is driven by heterodox monetary and fiscal policies. Despite two heavy inflation episodes; inflation and the emerging high current account deficit seem to be under control until 2016. The main weakness of the strategy followed by Ethiopian authorities is the persistent appreciation of the real effective exchange rate and the unclear consequences of the past commodity price boom (Priewe 2016). This leaves the country to external imbalance. An option which has to be taken in order to overcome this external imbalance requires external finance, currency devaluation including the correction of the exchange rate and promoting manufacturing industries. Hence, recently the National Bank of Ethiopia is forced to devalue its currency.

Policy-makers may face a dilemma in achieving simultaneously both high output growth and a strong balance of payment position. To solve this controversy this paper introduces new evidence about the relationship between devaluation, balance of payment, and output, and it will show how monetary policy shock is transmitted to macroeconomic variables. This makes the study different from the previous papers in Ethiopia and also on other developing countries. Hence, earlier studies are mostly focused on showing the impact of devaluation on output and/or trade balance. Therefore, understanding the relationship between devaluation, the balance of payment and output; and the transmission channel of monetary policy shock is important.

Depending on pieces of literature the researcher motivated to answer the research questions and tests hypothesis. The research questions in the study could be: - Does devaluation improve the balance of payment and solve the imbalance of external finance of Ethiopia? What is the effect of devaluation on output and its transmission to other macroeconomic variables? And finally,

what is the link between devaluation, the balance of payment and output? To answer the above questions, this paper used a theoretical and empirical model about the nexus between the exchange rate, the balance of payment and output dynamics.

### **1.3. Research Objectives**

The overall objective of the study is to investigate the theoretical and empirical relationship between currency devaluation, balance of payment and output. The specific objectives are:

- To examine the effect of currency devaluation on the balance of payment.
- To assess empirically the impact of devaluation on output dynamics and its transmission channel to other macroeconomic variables in Ethiopia
- Finally, to give policy recommendation to the government on the area of on exchange rate policy.

### **1.4. Hypothesis of the study**

To address the above specified objectives the study develops the following hypothesis:

- Devaluation improves the balance of payment by raising the demand for domestic products by residents of the country and foreigners.
- The impact of devaluation on output dynamics is contractionary and it is transmitted to other macroeconomic variables (interest rate, money supply, debt, inflation) in Ethiopia.
- There is a relationship between devaluation, the balance of payment and output in the long run.

### **1.5. Scope of the Study**

Specifically, the scope of the study is to answer two questions; the first is whether currency devaluation improves the balance of payment deficit, and has its own effect on output dynamics or not in the Ethiopian economy. The second question is to examine the relationship between devaluation, BOP and output dynamics, and its transmission channel to other macroeconomic variables. To address the objectives, the study extensively examined both theoretical and empirical analyses by using quarterly data from 2000/01Q1 up to 2016/17Q4 for exchange rate, the balance of payment and output model.

## **1.6. Limitations of the study**

The study has mainly three limitations related to: period of the study, data and methodology.

First, on the availability of data the period of study is limited from 2000/01Q1 to 2016/17Q4 for first and second objectives, respectively. Second, since there is a great limitation of finding quarterly data for real gross domestic product and the balance of payment data which are generated by interpolating annual data using Eviews 10. In addition, to find the full data figure for all variables we are forced to take the data from different sources. Third, the method employed to answer the objective, the VAR model, has its limitations; mainly has less theoretical foundation and forced to use structural VAR model for first and the second objectives.

## **1.7. Significance of the study**

Currently managing exchange rate not only in developing country, but also in developed nations is one of the most important issues that are used in stabilizing the economy. It also considered the macroeconomic variable that determines the level of output, the balance of payment, foreign exchange reserve and the relationship between nations economy. Recently, Ethiopia devalues its currency to improve its competitiveness with other nations on export of goods and services, the balance of payment and solve the problem of external imbalance.

This study will serve two basic purposes. First, investigating the theoretical and empirical relationship between currency devaluation, the balance of payment and output, helps policymakers with the appropriate ways of intervention on the exchange rate and BOP. Second, it may be useful for further research in the related area.

## **1.8. Organization of the paper**

This paper consists of six chapters with different sections and sub-sections. Chapter one presents the introduction of the paper, and chapter two provides that theoretical and empirical literature review of the nexus between devaluation, the balance of payment and output dynamics in line with how the economy responds to macroeconomic shocks. Chapter three presents data, methodology and model specification. Chapter four focuses on macroeconomic overview and examination of the inter-linkage between devaluation BOP and output for monetary policy

objectives and other related issues in Ethiopian case. Chapter five presents the interpretation of structural VAR model and VECM outcomes and then finally the last chapter as usual gives conclusions and recommendation with policy implication.

## **CHAPTER TWO**

### **REVIEW OF RELATED LITERATURE**

#### **2.1. Theoretical literature on devaluation, the balance of payment and output**

A central objective of theoretical models of exchange rate devaluation, the balance of payment and output dynamics ought to be a clearer understanding of the economic situations that governing the actual behaviour of exchange rates, the balance of payment and output in the real world and of the relationships between exchange rates, and other important economic variables. In surveying theoretical models of exchange rate, BOP and output relationships, therefore, it is appropriate to examine the empirical regularities that have been characteristic of the behaviour of exchange rates, BOP, output and other related variables under managed floating exchange rate regimes. It is also relevant to discuss the minimum requirements for any theoretical model of exchange rate, BOP and output nexuses, and the transmission channel of macroeconomic shocks to be consistent with these empirical regularities. Here, as the explanation of Manure (1998), managed (Dirty) floating exchange rate regime; the exchange rate is basically to be determined by the market forces of supply of and demand for foreign exchange; but it allows government intervention into the foreign exchange market to, what one may sell, set right or “smoothen” the ups and downs in the exchange rate movements the world’s international exchange rate mechanism is currently on; what may be described as a dirty floating system that it makes different from other regimes. In other words, from considering a fixed rate with fluctuation bands, it is easy to foresee a system, or rather a non-system, where the authorities manipulate the exchange rate to suit their own (usually unannounced) objectives, sometimes intervening to fix the rate, sometimes staying on the side lines (Copeland, 2005).

##### **2.1.1. Theory of devaluation**

Before reviewing the theory of devaluation, it is important to see what determines the exchange rate, and its definition and types. The spot and forward exchange rates are two types of nominal exchange rates; mostly used extensively throughout the literature in international finance. The bilateral spot exchange rate;  $S$ , is the rate at which foreign exchange can be bought and sold for immediate delivery, conventionally 1 or 2 days. The bilateral forward rate,  $F$ , is that rate

negotiated today (time  $t$ ) at which foreign exchange can be bought and sold for delivery sometime in the future (when a variable appears without a time subscript it is implicitly assumed that it is a period- $t$  variable). The most popularly traded forward contract has a maturity of 90 days and contracts beyond one year are relatively scarce. In general, throughout the paper we define nominal exchange rates as home currency price of a unit of foreign exchange. This definition has been chosen since it is the most widely used in the exchange rate literature; that is the monetary approach to exchange rate (Chinn, 2011). It implies that an increase in the exchange rate (a rise in the price of foreign currency) represents depreciation and a decrease in the exchange rate represents an appreciation.

In general, devaluation can be defined as (Folks and Stansell, 1979) an official currency of a nation can be a downward adjustment of its value relative to another currency, group of currencies or standard. Devaluation takes place under fixed, managed floating or floating exchange rate regimes through the intervention of government body or central bank.

According to Lent (2018), nominal exchange rate is determined by Interest rate differentials (the difference between domestic and foreign interest rates), 'excess returns' (or risk), real exchange rate, and domestic prices. Current and anticipated real interest rate differentials; other things equal, higher real interest rates in the domestic economy now and/or in the future, appreciates nominal exchange rate. Current and anticipated 'excess returns' in nominal terms; which a high current and anticipated returns appreciates the domestic currency. The real exchange rate in the long run; anticipation of a weak real exchange rate in the long run causes the currency to depreciate today. The different in current price levels; a high domestic price tends to be associated with a depreciated currency.

In the Balassa-Samuelson model, the relative price of nontradable goods in terms of tradable goods is increasing in the productivity differential between the traded and nontraded. Those deviations from purchasing power parity (PPP) (i.e., variations in the real exchange rate) are due to differences in relative productivity growth rates across countries. Therefore, productivity differential among nations is a key determinant for real exchange rate.

According to Mussa (1984) most of the observed fluctuations in exchange rates cannot be explained by a naive "payments flows" model, which suggests that exchange rates adjust either

immediately or gradually to maintain balance of payments equilibrium. A naive monetary model that relates exchange rate movements to differential rates of monetary expansion (with or without some form of lagged adjustment) does not perform appreciably better in explaining the bulk of exchange rate movements, except possibly for highly inflationary economies. In simple purchasing power parity (PPP) explanation of exchange rate; which is theoretical, exchange rate movements are explained poorly. Exchange rates share many of the general behavioural characteristics of the prices of assets that are traded on organized exchanges, such as common stocks, long-term bonds, and various metals and agricultural commodities. The change in this asset prices are highly correlated with exchange rate.

The traditional approach to exchange rate behaviour focuses on the condition of the balance of payments equilibrium as the proximate determinant of the equilibrium exchange rate which satisfies of elasticity conditions. The (momentary) equilibrium exchange rate in such a model is the exchange rate at which the net inflow of foreign exchange arising from current account transactions is balanced by the net outflow resulting from capital account transactions.

The balance of payments approach to the determination of the exchange rate treats the exchange rate as a price just like any other price, and utilizes the so-called Marshallian scissors of supply and demand in order to analyse its determination. This view is typically known as the balance of payments approach to the determination of the exchange rate because the demand and supply for a currency arise out of the transactions recorded in the balance of payments.

There is an argument on the effectiveness of devaluation in improving the nation's balance of payment and expanding output in their theoretical and empirical researches. The application of devaluation in an economy might result contraction of both aggregate demand and aggregate supply (Solomon 2010). Basically countries adopt devaluation as a policy measure; devaluation results in a redistribution of income towards those with high marginal propensity to save. This makes aggregate demand to contract. According to Medina (2015):

*“Exporters who have high marginal propensity to save would be beneficiary from devaluation and the nation's aggregate demand would remain constant.”*

Again on the other hand, devaluation leads to a low government marginal propensity to spend out of tax revenue. This hinders infrastructures and other government projects due to developing

nations import heavy machineries (intermediary input) and other infrastructural (construction) commodities.

Medina (2015), the real income of a country declines when the country immediately adopts devaluation. That is, both importers and export suppliers will not react immediately either to decrease the volume of imports or increase the level of export since contracts has to be signed couple of days before trade therefore, the nation's trade balance would face deficit immediately after devaluation and leads real income to decrease. This touches balance of payment on the side of current account. Devaluation could also results in reduction of real wealth in the short run. Therefore, there is no immediate response of devaluation on balance of payment through trade balance.

Devaluation hinders aggregate supply of the country through more expensiveness of imported production inputs, confidence erosion of exporters due to continuous devaluation and the price of importing nation. However, as expenditure - switching policy devaluation can improve aggregate supply due to the expensiveness of imported goods.

In general, currency devaluation have a relation with output (Mundell – fluming model), which it posits that expansionary in nature. However, some literatures indicates that currency devaluation is contractionary and others show devaluation depends on the macroeconomic nature whether it is expansionary or not. To see this effect in developing country especially in Ethiopia based on this theoretical background, this paper attempts to answer which effect happen by employing actual data. There is also a link between the balances of payment of the country through expenditure switching, that is, the difference between domestic price and foreign price for the consumers.

The J-curve effect of trade balance associated with the depreciation of the currency of a country is one of the highly debatable issues in international trade now-a-days. It is based on the ground of the Marshall-Lerner conditions which explains why a reduction in value of a nation's currency (depreciation) need not immediately improve its balance of trade. The condition states that, for a currency devaluation to have a positive impact on trade balance, the sum of price elasticity of exports and imports (in absolute value) must be greater than one. This depends on price elasticity and if this condition is violated, then currency depreciation will not bring forth any improvement

in trade balance. And devaluation has its effect on the balance of payment through currency pass through relationship, the extent to which changing currency values lead to changes in import and export prices. The above linkage shows there is a relationship between currency devaluation, BOP and output.

### **2.1.2. Definition of balance of payment**

In a definition of international monetary fund (IMF) (1996), the balance of payment (BOP) is a statistical record of all economic transactions between residents of the reporting country and residents of the rest of the world during a given period time (usually over a year). The record includes how many goods and services that the country been exporting and importing and whether the country has been borrowing from or lending money to the rest of the world. In addition, whether or not the central monetary authority (usually the central bank) has added to or reduced its reserves of foreign currency is reported in the statistics. The records of transactions between the residents from the same country are excluded.

#### **2.1.2.1. Classification and Standard Components of the Balance of Payments**

For the purpose of national and international policy formulation; the balance of payments statistics must be arranged clearly within a coherent structure. Hence, the external aspects of balance of payment play a leading role in economic and other policy decisions in the increasingly interdependent world economy. Furthermore, the balance of payment data used for analytical studies; that is, to determine the causes of payments imbalances.

According to the IMF balance of payment manual; the structure and classification of balance of payments standard components reflect conceptual and practical considerations, take into account views expressed by national balance of payments experts, and are in general concordance with the system of national accounts (*SNA*) and with harmonization of the expanded classification of international transactions in services with the Central Product Classification. The classification of balance of payment is based on the link between the structure of the financial account to that of the income accounts and that of the international investment position. And it also incorporates errors and omissions. Basically in a more detailed form balance of payment can be classified as current account, capital account and financial accounts.

Generally, as per the explanation of Grohe and Uribe (2014), any change in the current account must be reflected in an equivalent change in the country's financial account, that is, the current account equals the difference between a country's purchases of assets from foreigners and its sales of assets to them, which is the financial account preceded by a minus sign. This relationship is known as the fundamental balance-of-payments identity. Formally;

$$\text{Current Account Balance} = - \text{Financial Account Balance}$$

### **2.1.2.2. The balance of payment surplus and deficit**

To define balance of payment surplus and deficit economists make distinction between autonomous; transactions that take place regardless of the size of other items in the BOP and known as 'above the line transactions', and accommodating: transactions which are undertaken deliberately to correct disequilibrium in BOP and also called as 'below the line transactions' items the result of balance of payments situation. The autonomous items are transactions that take place independently of the balance of payments, whilst the accommodating items are those transactions which finance any difference between autonomous receipts and payments. A surplus in the balance of payment defined as an excess of autonomous receipts over autonomous payments, while a deficit is an excess of autonomous payments over autonomous receipts. However, classifying items into autonomous and accommodating is difficult because of the motive that underling with transaction (Pilbeam, 2006). Following this idea we shall see some of the most important concepts related to this which considered an important economic indicator.

**Surplus in BOP** – When the autonomous receipts (credits) are greater than autonomous payments (debits), the balance of payments will be in surplus or favourable. In other words, if total credits are more than total debits in the current and capital account (including errors & omissions), the net credit balance measures the surplus in the nation's balance of payments. This surplus is settled with an equal amount of net debit in the official reserves account.

**Deficit in BOP** – When the autonomous receipts (credits) are smaller than autonomous payments (debits), the balance of payments will be in deficit or unfavourable or adverse. In other words, if total debits are more than total credits in the current and capital accounts (including errors & omissions), the net debit balance measures the deficit in the nation's balance of

payments. This deficit is settled with an equal amount of net credit in the official reserve account.

Moreover, current account balance considered both the visibles and invisibles it is generally considered to be the more important of the two accounts. What really makes the current account surplus or deficit important is that a surplus means that the country as a whole is increasing its stock of claims on the rest of the world; while deficit means the country is reducing its net claims on the rest of the world. In general; the changes in current account have its effect on macroeconomic variables such as real exchange rate, domestic and foreign economic growth and relative price inflation.

### **2.1.2.3. Review of alternative approaches to balance of payments theory**

A literature presented on a country faces the balance of payment problems for many reasons: among other things constant, expansionary monetary policies, a deterioration in terms of trade, price distortions, high debt servicing, shortage of foreign exchange reserve or a mix of these factors. To solve these problems, many countries seek balance of payments support from outside sources including the International Monetary Fund (IMF) and debt relief from creditors in the framework of a planned adjustment process. Exchange rate adjustment (devaluation) is essentially part of this adjustment process.

Within the international economics literature, there have been three principal approaches to analysing devaluation. In international literature elasticity approach and the absorption approaches to the BOP are known as Keynesian or fiscal approaches. Because they are based on the work of John M. Keynes; the most well-known theories are ‘elasticity theories’ and ‘absorption theories’ of balance of trade and payments in the twentieth century. And the third one is monetary approach. Differences among these approaches have occasionally been the focus of sharp argument, most notably in the case of elasticity and absorption, and recently in the case of the monetary approach as contrasted with the others. It should be noted that each approach has its own sets of arguments:

## A. The elasticity approach

The elasticity approach to the balance of payment provides an analysis of what happens to the current account balance when a country devalues its currency. It is based on the assumption of the demand conditions and assumes that the supply elasticities for the domestic export and foreign import goods are perfectly elastic. So that change in demand volume has no effect on prices. In other words, domestic and foreign prices are fixed so that the change in relative prices comes from the change in nominal exchange rate (Pilbim 2006).

In its simplest form, the elasticity approach focuses on the current account of the balance of payments and is concerned with 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 through (Hoontrakul (1999) improving the trade balance which directly improves the balance of payment. 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. Whether an improvement in the balance of payments occurs as a result of devaluation depends crucially on the foreign elasticity of demand for exports and home elasticity of demand for imports denoted by  $e_x$  and  $e_m$ , respectively.

If the elasticity condition, that is,  $e_x + e_m > 1$  hold, devaluation would improve the balance of payments (assuming that the foreign exchange market was stable). This is called the Marshall-Lerner condition. On the other hand, if the sum of elasticity is lower than one, devaluation affects the balance of payment adversely and appreciation affects positively. And, if the sum of elasticities equal to one, the change in the exchange rate leaves the balance of payment as it is.

The logic behind this condition assuming that the elasticity of demand for exports is zero; 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.

However, there are considerable suspicions about the effectiveness 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 (see, for instance, Alemayehu 2014; and Dorosh et al 2009). 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 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 devaluation, the balance of trade appears worse before it improves.

Moreover, the elasticity approach ignores any direct effects devaluation may have on the domestic price level and domestic nominal wages. However, it shows us the pass through effect of deprecation /appreciation in import prices.

**B. The Absorption Approach**

We have seen that in the elasticity approach to the analysis of devaluation, the effect of exchange rate adjustments on the balance of payments depends principally on the elasticities of imports for home and foreign goods. This means that the relative price changes due to devaluation will be a pointer to the substitution effects that will happen. In this analysis income is assumed fixed. Thus, the income multiplier effects of devaluation are ignored. In other words, it is based up on the assumption of all other things being equal that is considered as the criticism levelled against the elasticity approach.

Alexander (1952) criticizes the elasticity approach as a partial equilibrium analysis. Instead, he proposes the absorption approach as an alternative. The central tenet of the absorption approach is that a favourable configuration of price elasticities may not be sufficient to produce a positive balance of payments effect resulting from devaluation, if devaluation does not succeed in reducing domestic absorption.

The starting point of the absorption approach is the national income identity equation:

$$Y = C + I + G + X - M \quad \text{----- (2.1)}$$

Where;  $Y$  is the national income;  $C$  is the private consumption of goods and services purchased at home and from abroad;  $I$  is the total investment, by firms as well as by government;  $G$  is government expenditure on goods and services;  $X$  refers to the exports of goods and services; and  $M$  is imports of goods and services.

It should be noted that recently this national income identity has been used to explain the current account as the difference between optimal savings and investment decisions (see Jayaraman, 1994; Rosensweig and Tallman, 1993). Combining  $C + I + G$  expenditure terms into a single term,  $A$ , representing domestic absorption (i.e., total domestic expenditure) and  $X - M$  terms into net exports/trade balance, we get:

$$Y = A + X - M \text{ ----- (2.2)}$$

Equation (2.1) states that national income equals absorption plus the trade balance, or alternatively

$$CA = X - M = Y - A \text{ ----- (2.2')}$$

Here equation (2.2') the current account balance represents the difference between the domestic output and domestic absorption. And Equation (2.2') can be expressed in changes as shown below:

$$dCA = dY - dA \text{ ----- (2.2'')}$$

Here, the effect of devaluation on current account balance depends upon how it affects national income relative to domestic absorption. However, changes in absorption depend on real income and other factors related to devaluation. Taking these into account, changes in absorption  $dA$  can be expressed as:

$$dA = c dY - dD \text{ ----- (2.3)}$$

Where;  $c$  is the marginal propensity to absorb; and  $D$  indicates the direct effect of devaluation on absorption. Substituting Equation (2.3) into Equation (2.2'') the result is

$$dCA = (1 - c) dY + dD \text{ ----- (2.4)}$$

Equation (2.4) indicates how devaluation affects output ( $Y$ ); how does devaluation affect domestic absorption ( $D$ ) at any level of income; and in turn the change in output and domestic absorption can affect the balance of payment through current account, that is, trade balance.

Machlup (1943) postulates that the principal effect of devaluation on income is associated with the increased exports of the devaluing country and the induced stimulation of domestic demand through the multiplier effect provided the economy are operating below full capacity. Alexander (1952) postulates two effects of the income, namely the idle resources effect and the terms of trade effect. The idle resources effect will result in an improvement in the balance of payments as long as the marginal propensity to absorb,  $c$ , is less than unity.

*If  $c$  is equal to or greater than unity, the foreign balance will not be improved as a result of improved output. Under such circumstances, the devaluation will be effective in stimulating recovery, but not improving the foreign balance except possibly through direct effects...(Alexander, 1952, p.267).*

On the other hand, the effect of income on the change in terms of trade is assumed to worsen the balance of payments. Thus, when the devaluing country is at full employment, or  $c$  is equal to or greater than unity, devaluation will improve the balance of payments through the direct effect on absorption, that is, the expenditure reducing effect of devaluation. This expenditure reducing effect occurs through three channels, namely, the real cash balance (the most important effect), income redistribution and money illusion effects. The real balance effect occurs when money holders accumulate cash when the general price level increases as a result of devaluation. This will result in a fall in real expenditure. This increase in demand for cash holdings will also result in a rise in interest rates, further reducing absorption through a reduction in investment. Thus, the real balance effect has a direct and indirect effect.

The income redistribution effect occurs when wages lag behind prices, such that prices increase at the expense of profit. If income is shifted from individuals with high propensity to absorb to those with low propensity, absorption will decline, and the balance of payments will improve. However, high profits may stimulate investment demand, so absorption may not decline (Alexander, 1952). The money illusion effect occurs when individuals pay more attention to money prices rather than money income. This scenario will result in a reduction in expenditure

as prices increase with devaluation. If the decline in consumption is more than the real cash balance effect of devaluation, then money illusion may improve the balance of payments.

The foregoing suggests that the overall effects of devaluation can be summarized as:

$$\frac{dCA}{dE} = (1-c)\frac{dY_m}{dE} + (1-c)\frac{dY_t}{dE} + \frac{dD}{dE} \text{-----(2.5)}$$

Where,  $dCA$  is the change in the trade balance;  $dE$  refers to the change in the exchange rate (the rate of the devaluation);  $c$  referred to as marginal propensity to absorb;  $dY_m$  indicates the effect of devaluation on income through the multiplier effect;  $dY_t$  is the effect of devaluation on income through the terms of trade effect; and  $dD$  is direct effect on absorption.

Equation (2.5) shows that the effect of devaluation on the balance of payments depends on three factors, namely, the income multiplier effect, the terms of trade effect and the direct effect on absorption.

At the beginning absorption approach was an alternative to elasticity approach that is elasticity approach focused on the change in price effects while absorption approach concentrated on the change in income effects; however economists argue that they are not substitute approaches rather they are complimentary. And these two approaches consider only the real side of the economy.

At full employment devaluation alone will not solve the balance of payment problems. Instead, devaluation should be combined with deflationary policies. It is interesting to note that in Equation (2.5) above, when there are no income multiplier or terms of trade effects,  $\frac{dY_m}{dE} = \frac{dY_t}{dE}$ , that is the only effect of devaluation on the trade balance is the direct or real balance effect. Thus, devaluation will affect the trade balance only when the money supply is fixed. This is the view of the monetary approach discussed below.

### **C. The monetary approach**

The presentation of Alexander (1952) on the absorption approach considers as a base line for the monetary approach to the balance of payments, which sprang out in the 1960s as part of the monetarist anti-Keynesian revival (Dhliwayo, 1996). According to Mussa (1974), the theoretical analysis of the monetary approach comes from the writings of Mundell (1968), even though the arguments for the relationship between the foreign sector and the domestic sector of an economy through the working of the monetary sector can be traced to Hume's (1752) price specie flow mechanism. The monetary approach views imbalances in the balance of payments in terms of imbalances between the demand for and supply of money stock. Thus the approach focuses its analysis on the monetary account of the balance of payments in the context of a general equilibrium analysis. Therefore the balance of payment is a monetary phenomenon not real. In other words, this disequilibrium of the balance of payment is a monetary phenomenon which is the disequilibrium of money market. That is, BOP analysed in terms of the adjustment of monetary stocks.

The monetary approach to balance of payments postulates that the overall balance of payments measured by international reserves is influenced by imbalances between the demand for monetary stock and the supply for money in the money market. Under a system of fixed exchange rates 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 out flow of foreign exchange reserves. An excess demand for money leads to an opposite adjustment, which in turn induces foreign exchange reserves inflow, domestic monetary expansion and eventually a restored balance of payments equilibrium position (Giancarlo 2002).

The formal monetary approach to balance of payments model based on Johnson (1976) and Pilbeam (2006) specifies a money supply identity, a money demand function and an equilibrium condition. This model is built on three basic assumptions which are stable monetary demand

function, vertical aggregate supply schedule, and the purchasing power parity. Having these assumptions the domestic money supply model consists of the following set of equations:

$$M_s = (R + D) \text{ ----- (2.6)}$$

Where,  $M_s$  is money supply;  $R$  is international reserves; and  $D$  is domestic credit; in this model money supply is determined by the availability of international reserves and the level of domestic credit created by the country's monetary reserve; the authorities operate this system through open market operation and foreign exchange operation. As presented in Pilbeam (2006) the real demand for money as a function of real income, the inflation rate and the interest rate, that is:

$$M_d = L(Y, P, I) \text{ ----- (2.7)}$$

Where  $Y$  indicates the level of real domestic income;  $P$  is referred to us the price level; and  $I$  is the rate of interest;

$$M_s = M = M_d \text{ ----- (2.8)}$$

Where;  $Md$  is money demand; and  $M$  is equilibrium stock of money.

The monetary theory states that there is a positive relationship between money held and income ( $\frac{dMd}{dY} > 0$ ) and money held and the price level ( $\frac{dMd}{dp} > 0$ ), and a negative relationship between money held and the interest rate ( $\frac{dMd}{di} < 0$ ). Finally Equation (2.8) is the equilibrium condition in the money market.

By combining the above three equations (Equations (2.6), (2.7) and (2.8)), placing the variables in percentage changes, and isolating reserves as the dependent variable, we may write the reserve flow equation as follows

$$\Delta R = \Delta [L(Y, P, I)] - \Delta D \text{ ----- (2.9)}$$

Equation (2.9) 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  $\Delta D$  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. Most of the empirical studies on the monetary approach confirm this result (Dhliwayo, 1996).

The above relationship can be expressed in the other way (Pilbeam, 2006) to show the effect of change in authorities foreign currency reserve based on the view of monetarists; the balance of payment consists of current account, capital account and foreign currency reserve. That is given as:

$$BOP = CA + KA + dR - - - - - (2.10)$$

Where BOP, is the balance of payment; CA is current account; KA is capital account and  $dR$  is the change in foreign currency reserve.

### **2.1.3. The effect of Devaluation on the balance of payment**

Depending on the analysis of elasticity approach (Pilbeam, 2006), devaluation affects the balance of payment by changing the current account side of the BOP through the price effect and volume effect.

**The price effect:** - exports become cheaper as measured in the foreign currency and imports more expensive measured in domestic currency which may deteriorate the current account balance. **The volume effect:** - in fact cheaper exports encourage the volume of export and more expensive imports lead to a decrease in the volume of imports. Therefore the volume effect clearly improves the current account balance. However the net effect on the current account balance as well as the balance of payment of the country depends on whether the price effect or the volume effect dominates means the type of the product a country export or import.

However, Pilbeam (2006), the ideas of export and import volumes are clearly explained by the J-curve effects; in the short run export and import volumes do not change much so the country receives less export revenue and spends more imports leading to the deterioration of current account balance. However, after some time lag export volumes start to increase and import volumes start to decline and consequently the current account deficit starts to improve and eventually moves to surplus. Because of a time lag in consumer responses and producer responses, and imperfect competition improves the trade balance of the country in the long run.

#### **2.1.4. The effect of devaluation on national income (output)**

Pilbeam, (2006) on the view of absorption approach currency devaluation can influence output by affecting employment and terms of trade. But it is important to see whether employment is full employment level or not; because devaluation has an impact on the economy is less than full employment. If the marginal propensity to absorb is less than unity then a rise in income will raise the income level to absorption ratio and so improve the current account and the converse is true.

**Employment effect:** - if the economy is less than full employment (i.e. idle resources), and the Marshal–Lerner condition is fulfilled there will be an increase in net exports following devaluation which lead to an increase in national income through the foreign trade multiplier. However, the Marshal–Lerner condition is not fulfilled then net exports would fall implying that the national income falls. Hence it is not clear whether the employment effect will raise or lower the national income.

**The terms of trade effect:** - is the ratio of the price of exports to the price of imports which devaluation tends to make imports more expensive in domestic currency terms which is not matched by a corresponding rise in export prices; in other words terms of trade deteriorates. A deterioration in terms of trade indicates that the loss of real national income due to the more units of exports have to be given to obtain a unit imports. Hence, the terms of trade lowers the national income.

Overall, the effect of devaluation on the income of devaluing country is ambiguous because it depends on the situation whether Marshal–Lerner conditions fulfilled or not as well as the negative effect of terms of trade.

#### **2.1.5. Devaluation, the balance of payment and output dynamics**

The effect of devaluation on the economy is a great of concern, in particular, since in the 1970s when the world experienced the first oil price shock. And in recent years it is debatable whether devaluation is contractionary or expansionary. According to Groh´e et al (2016), to investigate the effect of devaluation on the economy economists are interested to reinvestigate macroeconomic shocks on the side of aggregate demand and aggregate supply. If devaluation of the domestic currency improves the balance of payments and increases employment, it will have

both expansionary demand side and contractionary supply side effects. The reason is that, when there is devaluation that means domestic products are cheaper than foreign products that leads to increase the demand of domestic product (expansionary effect). If a country produce products using imported materials (intermediate goods), price increase due to devaluation is contractionary. However, these effects depends up on the commodities that a nation would produce; hence developed nations produce more processed products but developing nations produce mostly raw materials (agricultural products) that is insensitive to the change in prices. To show the dynamic relationship between devaluation, the balance of payment and output, it is important to develop a theoretical model basically by considering the national income identity equation and the aggregate supply equations.

From the national income identity in equation (2.1) by elaborating more, one can show the demand side of the economy. The private consumption level (C) in the model can be determined by autonomous consumption, disposable income and nominal exchange rate. Hence, the fluctuation of nominal exchange rate affects the consumption level of consumers on imported goods. Domestic investment can be affected by domestic interest rate and imported intermediate inputs for production purpose. Export can be influenced by export price and foreign income; and also imports are influenced by domestic income level and import prices. However government expenditure is exogenously determined. Therefore, the elaborated model is given as:

$$Y = C\left(Y^d, \frac{ep^m}{p}\right) + I\left(r, \frac{ep^m}{p} IN\right) + G + \left[X\left(\frac{ep^x}{p}, Y^f\right) - \left(\frac{ep^m}{p}\right) M\left(Y^d, \frac{ep^m}{p}\right)\right] \quad (2.11)$$

Where; Y is in the above model indicates that the gross output;  $Y^d$  indicates the disposable income;  $Y^f$  is the foreign income; C is the consumption made by private agents; I is the investment demand by the domestic residents; G is the government expenditure; X indicates exports of the good Y; M is the imports of the final good; r is the rate of interest; p shows the price of the domestic good Y;  $p^x$  is the export price of good X;  $p^m$  is the import price of the final good imported; e is the nominal exchange rate which is the domestic price of the foreign currency.

This equation shows the equality between supply and demand for the domestically produced good, Y, whose price is, p. Demand is the sum of spending by domestic households, firms and



Thus, the dynamics of the model balance of payments is explained by combining both aggregate demand and supply functions is given as:

$$b\dot{o}p = p \left[ X\left(\frac{ep^x}{p}\right) - \frac{ep^x}{p} M\left(Y^d, \frac{ep^m}{p}\right) - \frac{ep^m}{p} IN(p, e, p^n) \right] + H(r - r^f) \text{ --- (2.15)}$$

Where; H is the net capital inflow and  $r^f$  foreign rate of interest;

Equation (2.15) introduces some intrinsic dynamics into the system. It measures the balance of payments which is defined as the sum of current account and the capital account. It also shows the sources and uses of foreign exchange.  $X\left(\frac{ep^x}{p}\right) - \frac{ep^x}{p} M\left(Y^d, \frac{ep^m}{p}\right) - \frac{ep^m}{p} IN(p, e, p^n)$ ;

That is, the trade balance (current account balance). This aggregate measures the net earnings of foreign exchange which stems from exports of domestic goods and imports of both final goods and of intermediate inputs. If the money value of exports exceeds (falls short) the money value of imports then it is said that the trade balance is in surplus (deficit) or the current account is positive (negative).  $H(r - r^f)$ , on the other hand, measures the net inflow of the foreign exchange which stem from the net purchase of domestic financial instruments by foreigners. The yield on the domestic bond, is measured by the domestic rate of interest,  $r$ , and the expected yield on the foreign bond is measured by  $r^f$ .

### 2.1.6. Transmission channel

According to Yilkal (2012), though devaluation has contractionary effect, developing countries intensively devaluation their currency as the basic policy programs to boost their output. However, the impact of devalue on output is depends on the state of the economy of the country. When developing countries are dominantly dependent on imported raw materials (intermediate input for production) devaluation exercise may have contractionary effect on output.

In the modern approach devaluation has contractionary effect through the aggregate supply side channel. When countries relay more on imported materials especially petroleum and heavy machinery; devaluation increases the price of these imported items significantly. This will affect not only the price of imported goods but also domestically produced items. Eventually

devaluation is contractionary rather than expansionary. This contractionary effect of devaluation can be summarized with the transmission channels in the following table.

**Table 2.1.Channels of Devaluation that makes Contractionary**

Number	Channel	Effect of devaluation
1	The balance of payment channel	When a country initially is in trade deficit, following devaluation value of import exceeds export. Price increase in traded goods reduces the home countries real income; hence raise real income of rest of the world.
2	Real balance channel	Devaluation increases the general price level, inducing in real money supply. Hence, reduce total expenditure and contract output.
3	The price channel	Devaluation increases the price of imported commodity in domestic currency which intern makes demand for domestic product and the domestic commodity price to rise.
4	External debt channel	Devaluation increases external debt. Most of the time external debt is denominated in dollar. When countries have huge external debt and devalue its currency the debt burden increases in terms of domestic currency. Thus, devaluation has contractionary effect on output for countries with external debt and denominated in foreign currency such as the USD.
5	Interest rate channel	Devaluation influences the central banks to increase interest rate. This rise in the nominal interest rate result in an increase in real interest rate as price expectations and prices are likely to remain unchanged in the short run, or a decrease in money supply will result an increase in real interest rate, and this increase in real interest rate leads to a reduction in consumption and investment. This reduction in consumption and investment leads to a reduction in aggregate demand again which intern decreases output.

6	Foreign asset reserve channel	Devaluation increases interest rate; an increment in interest rate reduces the money supply and cause stock prices to fall. This situation limits the ability of firms to finance their activities as the cost of capital increases due to rise in interest rate and rise in the cost of equity from issuing stocks. Consequently, a reduction in investment is likely to occur and cause output to fall (Thi Nhat , 2017).
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**2.2. Empirical literature review**

There are various literatures which argue about the impact of devaluation on the balance of payment and output. As this study focused on the impact of devaluation on the balance of payment and output, emphasis will be given to the impact of devaluation on the balance of payment and output and the monetary policy shocks.

**2.2.1. Currency devaluation and balance of payment in developing countries**

Some studies support the positive effect of devaluation; Oladipupo, A. (2011), and argued that the exchange rate depreciation can actually lead to improved balance of payments position; and improper allocation and misuse of domestic credit, fiscal indiscipline, and lack of appropriate expenditure control policies due to centralization of power in government are some of the causes of persistent balance of payments deficits.

However, in the long run (Adeyemi et al, 2013), trade balance deteriorates as currency devaluation continues in developing nations. Though inelastic coefficient of nominal exchange rate in line with the theoretical Marshall-Lerner condition, i.e. “the demand for import and export is inelastic, and then devaluation would further increase the trade deficit”. Kedir (2017) supports this argument by employing the panel co-integration and panel group fully modified least square estimation technique from 1990-2014; in East African countries.

A study held on 14 Asian countries found that there is no evidence for the effect of depreciation to improve trade balance. Hence, exports did not respond as expected, mainly due to a decline in

terms of trade for primary commodities and manufactured products or due to heavy dependence on import goods which may be more expensive in the local currency. However, the study attempted to narrow down the number of countries under study into 8 countries that are relatively bigger, industrialized and stable, and in this case depreciation improved trade balance.

Empirical studies taken from developing countries focused on the effect devaluation/ depreciation on trade balance, (i.e. one part of the balance of payment) (Damoense and Agbola, 2004; Hernan Rincon, 1998; Rawlins and Praveen, 1993; and Lizando and Montiel, 1989) and states that the effect of devaluation does not improve trade balance. Rose (1990), found that changes in real exchange rate do not have a significant effect on changes in the balance of trade of developing countries.

Damoense and Agbola (2004) using the Johansen co-integration technique and vector error correction model (VECM) their study indicate that devaluation/depreciation of the exchange rate worsens the trade balance of South Africa in the long run. And also Frank Agbola (2004) examined the impact of depreciation/devaluation on trade balance of Ghana and made use of data spanning the period 1970 and 2002 in his analyses. The Johansen multivariate co-integration procedure revealed that Ghana's trade balance and key determinants are co-integrated, and thus share a long-run equilibrium relationship. And the empirical result supported the fact that depreciation/devaluation does not improve the trade balance of Ghana in the long run.

A research conducted on Sub-Saharan Africa employing econometric analysis found that depreciation/devaluation in the real exchange rate improves a country's trade balance in the year of devaluation/depreciation but with smaller changes over time, and that expansionary fiscal policies work to negate the beneficial effects of a devaluation/depreciation on a country's trade balance.

However, Bhagwati and Onitsuka (1974) also, after having an empirical study in 46 African countries which devalued their currencies, concluded that imports continued to grow after devaluation and in the majority of cases, the growth rate exceeds the pre-devaluation growth rate, that is, conditions that requires the elasticity of export and import demand to be more than unity is not satisfied. This is because of the very strong demand for imported necessities and inelastic foreign demand for African exports. Thus, with relatively inelastic demand for exports and

imports, devaluation has little or no effect in changing trade balance in the contest of African countries (UNECA, 1990).

On the other hand, Hadero (1993) found that devaluation can also cause both the exports and imports in least developing countries (LDCs) to increase. The countries which had such an effect were Zaire (1967), Senegal, Cotedivore (1970) and Malawi (1976). As the effect of devaluation increases both exports and imports we cannot get a clear conclusion.

To sum up, in the discussion of the relationship between devaluation and the balance of payment, the above literature focuses on the current account side of the balance of payment, i.e., is the trade balance. Therefore, we can conclude that currency depreciation/ devaluation has a strong relationship with trade balance and the impact on developing nation is contractionary.

### **2.2.2. Currency devaluation and output**

The importance of understanding the effect of devaluation on output cannot be ignored, as it provides important policy insights. For example, in a classic model, adverse external shocks lead to a depreciation of the real exchange rate that, by stimulating net exports, boosts aggregate demand and offsets the effects of the initial shock. If devaluation genuinely contractionary, the benefits of exchange rate flexibility may be overvalued.

The accepted insight on the exchange rate-output relation is that a competitive exchange rate encourages exports and hence, encourages growth. However, the empirical evidence usually suggests the contrary. As Kamin and Klau (1998), many developing countries tended to resist devaluation, because such policy would be contractionary, rather than expansionary. For example, depreciation of the Mexican peso has been consistently associated with decline in output, while appreciation has been linked to expansion (Kamin & Klau, 1998). Not only developing countries but also developed countries face contractionary currency devaluation (Lian et al 2014). The increment or decrement of output depends on whether the current account balance of a country after improves devaluation. For example, Latin American countries current account generally improves when output decreases following real exchange rate devaluation (Lian et al 2014).

According to the oldest Mundel-Fluming expenditure switching model devaluation has an expansionary effect on output because it increases the price of foreign products that leads to an increase in the consumption of domestic products. In this situation the demand for domestic products increases and the output of the country rises. However, Tovar (2006) found that in the Asian crisis devaluation reduces output (Krugman (1999) and Calvo (1999)) and there was capital outflow from the country.

Earlier studies taken from developed and developing countries showed that devaluation/depreciation may cause a negative effect on the trade balance in the short run but an improvement in the long run; that is, the trade balance followed a time path which looked like the letter “J”. The main explanation for this J-curve has been that, while exchange rates adjust instantaneously, there is a lag in the time consumers and producers take to adjust to changes in relative prices (Pilbeam 2006). However, Adeyemi et al (2013) has shown that devaluation of the currency worsens the trade balance in the long run on the Nigerian economy.

A study by Tovar (2006) found that in the absence of other shocks in the economy devaluation has an expansionary effect on output and the balance sheet is considered as a secondary transmission mechanism. The transmission channels are through the expenditure switching, the balance sheet and the monetary channel. However, Kamin, Rogers (2000), using a VAR model found that devaluation has a contractionary effect on output, even if policies are designed to keep the real exchange rate highly competitive in order to promote exports and output growth.

Employing an autoregressive distributed lag model (ARDL) on the effect of exchange rate variability on agricultural products especially oil seeds (1992-2010), (Abule and Abdi (2012)) found that there is a negative relation between devaluation and output of agricultural products in the long run.

Hala (2008) conducted a research on the relationship between exchange rate changes and output in the Egyptian economy by employing a Vector Autoregressive model using annual data for Egypt over the period 1982-2004. The results of the study indicate that devaluations have an initial contractionary effect on output but four years later the expected positive effect of the devaluation starts to materialize. Moreover, the study found that real exchange rate variations explain a considerable part of real output changes in Egypt.

### **2.2.3. Empirical evidence in Ethiopia**

Most empirical studies in Ethiopia focused on the relationship between trade balance and devaluation. And these studies concludes that the effect of devaluation on trade balance can have opposing conclusions; while in some case devaluation has positive and expansionary and in some other case the effect is contractionary. However, Trsit (2011) and Yilkal (2012) focused their study on the impact of devaluation on output growth.

Abule and Abdi (2012) found that a continuous reduction in exchange had no significant effect on trade balance. Additionally Zelalem (2014) analysed the relationship between exchange rate and trade balance of Ethiopia employing structural break cointegration technique using annual data from 1974/75 to 2011/12. The impact of real exchange rate devaluation contradicts Marshal-Lerner condition; that is currency devaluation only cannot improve trade balance as well as balance of payment.

Haile (2008) investigates the impact of devaluation on trade balance of Ethiopia using the data from the period 1980 to 2003. The demand for export and the demand for imports are estimated using the ordinary least square (OLS) and instrumental variable respectively. And also he employed the cointegration approach and error correction model because nonstationarity in time series data may cause a spurious regression problem. Finally he concludes that devaluation of a country's currency worsens trade balance.

Abebe (2014) focused on the relationship between trade balance and exchange rate in Ethiopia using VAR and VECM methodology. He posits that trade balance in Ethiopia after real depreciation of currency follows J-curve pattern. The study found that real depreciation deteriorates trade balance during the first three years ('short run') and subsequently improves. The forecast error variance decomposition for each variable reveals the proportion of the movement in variable due to its own shocks versus the shocks in other variables. The variance decomposition of trade balance reveals that a change in its own shock is the predominant source of variation in the logarithm of trade balance. The result showed own series shock of trade balance explain most of the forecast error variance of the series in both the VAR and VECM.

A study done by Zelalem (2014) focused on the relationship between exchange rate and trade balance of Ethiopia employing cointegration technique using annual data from 1974/75 to 2011/12. The study conducted Zivot-Andrews and Perron unit root test with structural break and Gregory-Hansen structural break cointegration test besides the conventional unit root and cointegration tests. The cointegration tests 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 which confirms against Marshall-Lerner condition.

However, Fikreyesus and Menasbo (2012) analysed the effect of Birr devaluation on trade balance of Ethiopian economy using 30 years of time series data. Descriptive statistics and regression analysis were employed as analytical tools. Based on OLS estimates they found that real GDP and Real Effective Exchange Rate Index were positively correlated with the nation's trade balance while currency devaluation (dummy) was negatively correlated with trade balance. In Their finding is that currency devaluation may not improve trade balance so they recommended a need to introduce import substitutions and export oriented strategy of industrialization scheme so as to improve the country's competitiveness on the external world and to correct trade balance deficit.

Similarly, Lulit (2011) examined the impact of exchange rate on the trade balance of Ethiopia using two approaches. First, using the original elasticity model and second, employing a modified version by incorporating other sources of income such as Official Developmental Assistance (ODA) and remittances. The Ordinary Least Squares (OLS) econometric procedure is used for data analysis. The main conclusion of this study is that exchange rate devaluation does not have an impact in improving the Ethiopian trade balance. This is due to other means of income inflows, such as ODA and Remittances; counteract the intended positive effect of devaluation.

Samuel and Tarekegn (2011) worked on how to narrow the widening trade deficit of Ethiopia. The study didn't apply econometric technique rather desk and field research methods is used to analyse the data. They point out options to narrow the trade deficit, such as transformation of the export of primary commodities into export of high value added manufactured products through the development of proper upgrading strategies and introduction of new import substituting

commodities and increasing the production volume and the competitiveness of existing domestic manufacturing industries.

Yilkal (2012) conducted a research on the short and long run effect of currency devaluation on output growth in Ethiopia. The researcher used quarterly time series data over the period ranging from 1997/98 to 2009/10 and employing a Vector Auto regression model. By controlling for monetary and fiscal policy, the study found that currency devaluations are contractionary in the long run and neutral in the short run. And he also found that the monetary policy has the expected positive effect on output growth, while an increase in total government expenditure has negative effect. Moreover, this study found that devaluation explains a considerable part of real gross domestic product change in Ethiopia.

Based on the above theoretical and empirical foundations about the relation between devaluation the balance of payment and output; monetary policy shocks like exchange rate policy, interest rate policy, and debt policies including the money supply policy of the country can affect not only the balance of payment but also the output level. This motivates the researcher to ask a question what will be the relationship between devaluation, BOP and output after a monetary policy shock. And how this macroeconomic monetary policy shocks transmitted from one to the other through transmission channels. Therefore, the researcher employ VAR and vector error correction (VECM) model to show the dynamic relationship between exchange rate, BOP and output dynamics and Structural VAR for showing the transmission channels of monetary policy shocks. The main thing that this paper differs from others is methodological difference to show the dynamics and the transmission channel which have not been done by other researcher. In Ethiopian case most literatures focused on the relation between trade balance and devaluation but this paper adds a new thing that is more elaborating the nexus between devaluation, BOP and output.

## **CHAPTER THREE**

### **DATA AND METHODOLOGY**

#### **3.1. Data**

To analyse the impact of devaluation on the balance of payment and output dynamics; and its transmission to other macroeconomic variables, the study include data on variables such as exchange rate, the balance of payment, real gross domestic product, money supply, external debt servicing, inflation, interest rate and foreign asset reserve.

Exchange rate, money supply, inflation interest rate and foreign exchange reserve are quarterly data which are obtained from the National Bank of Ethiopia. However, the balance of payment is annual data. Gross domestic product (GDP) and external debt servicing are collected from Ministry of Finance and Economic Cooperation annually. The annual data is changed in to quarterly data by using EViews 10.

The original series collected in quarterly frequency and the changed data covers 68 observations over the period 2000/01-2016/17. According to Blanchard and Perotti (2002) the use of quarterly data facilitates identification of structural shocks, minimizes the likelihood of structural break and allows for important intra-year dynamics.

Widely used standard econometric software packages for the models include EViews 10; which makes it possible to make use of this methodology in relatively simple and straight forward ways.

#### **3.2. Methodology**

In the context of the objectives of this study, the availability and quality of data in Ethiopia, approaches which are relatively appropriate for the study were employed. These include vector autoregressive (VAR), vector error correction model (VECM), and structural vector autoregressive (SVAR). Before directly going to this methodologies first we have develop theoretical frame works which will clearly answer the objectives of the study.

### 3.2.1. Theoretical Framework and Model Specification

The first and the most important thing that helps to construct a model which shows certain relationships among economic variables is the identification and determination of independent variables that should be included in the regression equation (Lütkepohl, 2005); depending on what the economic theory has to say about these relationships. In line with theoretical framework and empirical literature, the models that capture the effect of devaluation on the balance of payment and output dynamics. And the nexus between devaluation, the balance of payment and output through imposing structural shocks can be specified as follows.

#### 3.2.1.1. Devaluation, the balance of payment and output

There are different ways of specifying the relationship between devaluation, the balance of payment and output dynamics based on theories, which try to explain how a national bank responds to macroeconomic shocks and the transmission channel of monetary policy shock. However; Zerayehu (2006), due to lack of latitude to engage in discretionary activities, and characterized absence of broad and active financial markets; in developing countries the monetary policy models that are applicable in developed countries may not have full satisfactory outcomes when applied to developed economies.

For our case, we are grounding ourselves originally on the identity equation (aggregate demand). In the aggregate demand equation; output is the sum of the level of consumption, total investment of the country, government expenditure and net export (export minus import). The starting point for specifying the model for our analysis from the identity equation for an open economy is given:

$$Y = C + I + G + X - M \text{ --- (3.1)}$$

From equation (3.1) consumption is a function of autonomous consumption and disposable income. Investment can be explained as a function of saving rate that means marginal propensity to save multiplied by disposable income; government expenditure is determined by the amount of tax collected and expenditures of the government for the society and finally net export is a function of domestic price and foreign price.

According to the elasticity approach the balance of payment, devaluation works for balance of payment on the side of current account balance ( $X - M$ ); the central component of BOP, by one of which works to reduce a deficit, whilst the other actually contributes to making the deficit worse than before. Here, the balance of payment is the sum of current account balance, financial account balance, capital account and financial account. That is, mathematically

$$BOP = CA + KA + FA \text{ ----- (3.2)}$$

Where; CA is current account (the difference between the value of export and import), KA is capital account and FA is financial account.

Let's as express the current account balance in terms of domestic currency, and is given by

$$CA_t = P_t X_v - S_t P^* M_v \text{ ----- (3.3)}$$

Where t is time, p is domestic price level,  $X_v$  is the volume of domestic exports, S is the exchange rate (domestic currency units per unit of foreign currency),  $P^*$  is foreign price level, and  $M_v$  is the volume of imports. Assuming that domestic and foreign price levels are unity; the value of domestic exports  $P_t X_v$  is given by  $X_t$ ; while the foreign currency value of imports  $P^* M_v$  is given by  $M_t$ . By using these simplification equation (3.2) becomes

$$CA_t = X_t - S_t M_t \text{ ----- (3.4)}$$

Equation (3.4) shows us what will happen to the balance of payment by changing exchange rate by a certain magnitude; say  $\partial S_t$  (in our case devaluation or revaluation of currency) through current account. That is

$$\frac{\partial CA_t}{\partial S_t} = ? \text{ ----- (3.41)}$$

If the change (say depreciation/ devaluation of  $S_t$ ) can improve the BOPs,

$$\frac{\partial CA_t}{\partial S_t} \geq 0 \text{ ----- (3.42)}$$

This can be true by holding the assumptions that both domestic and foreign price levels will not change as a result of devaluation; however, price levels also respond to the change in exchange rate.

An economy in an equilibrium position in the current account, devaluation will improve the current account only if the sum of the foreign elasticity of demand for exports and the home country elasticity of demand for imports is greater than unity (that is, Marshall-Lerner condition) ( Pilbeam (2006), Abbas et al (2014) and Groh´e et al (2016). That means devaluation have the price effect, exports become cheaper and imports became expensive, and the volume effect; encourage more exports (volume of export increase) and discourage imports (volume of import decrease).

Empirically, the above models, equation (3.1) through equation (3.4) show us there is a relationship between devaluation, balance of payment and output which can be written in the form of equation (3.5); that is obtained by inserting equation (3.4) in to equation (3.1):

$$Y = C + I + G + X - SM \text{ --- (3.5)}$$

Form this equation we can get the effect of devaluation on output through differentiating equation (3.5) with respect to exchange rate (s). However, the elasticity approach to the balance of payment has its own defect on the ground that all other things equal; changes in export and import volumes will by definition have implications for national income and consequently income effects need to be incorporated in a more comprehensive analysis of the effects of devaluation. The absorption approach attempts to address this weakness by dividing the identity equation, which is national income; equation (3.1) into two parts; absorption (A) and current account (CA). Where absorption represents;

$$A = C + I + G \text{ --- (3.6)}$$

Combining this with the national income identity equation and after some rearrangement we have

$$CA = Y - A = X - M \text{ --- (3.7)}$$

This equation argued that current account is as the gap between national income and domestic absorption defined as in (3.6); i.e. the sum of private consumption, government consumption, and investment.

Taking the differential of this equation we have

$$dCA = dY - dA \text{ ----- (3.8)}$$

This relationship implies that the effects of devaluation on the current account balance will depend upon how it affects national income relative to how it affects domestic absorption. As indicated by Pilbeam (2006), absorption can be divided up into two parts: a rise in income will lead to an increase in absorption which is determined by the marginal propensity to absorb,  $a$ , but there will also be a direct effect; on absorption i.e. all the other effects on absorption resulting from devaluation denoted by  $A_d$ . This implies that

$$dA = a dY - dA_d \text{ ----- (3.9)}$$

Inserting equation (3.9) in to equation (3.8) gives:

$$dCA = (1 - a)dY - dA_d \text{ ----- (3.10)}$$

This equation, (3.10) argued that there are three factors that can be discussed when we are talking about the impact of devaluation. A devaluation can influence on the current account balance only by changing the marginal propensity to absorb,  $a$ , changing the level of income,  $dY$ , and by affecting direct absorption,  $dA_d$ . The conditions to be fulfilled for devaluation improve the current account balance of the country is that  $(1 - a)dY > dA_d$ , any change in income not spent on absorption must exceed any change in direct absorption.

From equation (3.10) we have learnt that devaluation has its own impact on the national income (GDP) through employment and terms of trade, and it also affects absorption by real balance, income redistribution and money illusion effects.

On the ground of monetary phenomenon the balance of payment disequilibrium is merely a reflection of disequilibrium in the money market, which is the ideology of monetary approach, which relates the demand and supply of money. In a simple monetary model there are three key assumptions that underlie the monetary model; these are a stable money demand function, a vertical aggregate supply schedule, and purchasing power parity (PPP). The simple monetary model invokes the three assumptions set out above and then proceeds with the use of some accounting identities and behavioural assumptions to develop a theory of the balance of



Where  $S$  in the above equation indicates the exchange rate defined as domestic currency per unit of foreign currency, where a rise is depreciation and a fall is appreciation of domestic currency;  $p$  is the domestic price in the domestic currency  $p^*$  is foreign price in foreign currency.

In equilibrium the demand for money equals the supply of money in each country (i.e.  $M_d = M_s$  and  $M_d^* = M_s^*$ ). Using this equilibrium relationship together with the relationships derived on the earlier, we have

$$\frac{M_s}{M_s^*} = \frac{kPY}{k^*P^*Y^*}$$

This implies that  $\frac{M_s}{M_s^*} = \frac{kSY}{k^*Y^*}$  ----- (3.15)

Solving for the exchange rate,  $S$ , we have

$$S = \frac{M_s k^*Y^*}{M_s^* kY}$$
 ----- (3.16)

Where  $M_s$  is domestic money supply and  $M_s^*$  is foreign money supply; the exchange rate is determined by the relative supply and demand for the different national money stocks.

Having the above theory the balance of payment is affected by the change in nominal exchange rate real output level and; can be considered as endogenous variable. However, other variables are included such as the change in money supply, central bank's reserve, inflation, domestic interest rate and external debt servicing.

$$bop = f(e, rGDP, ms, inf, deb, i, re)$$
 ----- (3.17)

Where  $rGDP$  is output (real GDP),  $e$  is nominal exchange rate,  $bop$  is balance of payment,  $M_s$  is money supply,  $inf$  is inflation,  $deb$  refers to external debt servicing,  $i$  is domestic interest rate, and  $re$  is foreign asset reserve.

$$bop_t = \alpha + \beta_1 \ln rGDP_t + \beta_2 e_t + \beta_3 \ln ms_t + \beta_4 \ln inf_t + \beta_5 \ln deb_t + \beta_6 i_t + \beta_7 \ln re_t + \varepsilon_{it}$$
 ----- (3.18)

Where,  $\ln rGDP_t$ ,  $\ln ms_t$ ,  $\ln deb_t$ ,  $\ln re_t$  are logarithm of output, money supply, external debt service and foreign asset reserve respectively; and the balance of payment is scaled by one thousand, hence, it includes both positive and negative signs. Whereas exchange rate, interest rate and inflation rate are naturally in percent forms therefore no need of logarithm for these data.  $\beta$ 's are the coefficients of explanatory variable that is included in the regression equation;  $\varepsilon_{it}$  white noise assumed to be normally and independently distributed with zero mean and constant variance and which captures the influence of all other explanatory variables in the model.

Given the definition of variables the study expects the signs of exchange rate, foreign asset reserve and inflation rate are expected to negative and significant. And real GDP, money supply, money supply, external debt servicing, and interest rate expected to be positive and significant.

More theoretically; we understand that an increase in money supply lowers interests, reduces borrowing costs, and promotes investment which might enhance domestic output. The improvement in investment leads to increase in output which intern promotes a country to export more. In addition, a higher money supply will reduce the value of currency. This relation shows money supply affects the balance of payment (Shahbaz, et al., 2012). Thus, we include money supply in the model.

One fundamental variable in open economies not included on monetary approach to the balance of payment is borrowing resources from the rest of the world (RoW) or lend them abroad. With the aid of loan from foreigners, an economy with a temporary income shortfall can avoid a sharp contraction of consumption and investment (Arturo et al 2013). In our case, Exchange rate fluctuation has its impact on borrowing and debt servicing because much of the macroeconomic action in an open economy is connected with its intertemporal trade resource exchanges across time which is measured by the current account of the BOPs. Therefore, including debt servicing into our model is important.

According to Grohe et al (2016), in a small open economy with free capital mobility, in equilibrium the domestic interest rate must equal the world interest rate, thus we can find the equilibrium level of the current account simply by equating domestic interest rate and world interest rate. However, in our economy interest rate is not determined through this mechanism rather fix by the central bank. The higher domestic interest rate encourages domestic saving and



According to Fang Yu and Lu Lili (2011), there is a long term relationship between foreign reserve and exchange rate. Moreover; any changes of foreign reserves would lead to the fluctuation of exchange rate but not vice versa.

$$e_t = \alpha + \beta_1 \ln rGDP_t + \beta_2 bop_t + \beta_3 \ln ms_t + \beta_4 inf_t + \beta_5 \ln deb_t + \beta_6 i_t + \beta_7 \ln re_t + \varepsilon_{it} \quad (3.20)$$

The expected signs of the explanatory variables depending on a piece of literatures except the balance of payment all variables expected to be positive.

From the above theoretical background we can develop the model that fulfils one of the research objectives of this paper, and is given as:

$$rGDP = f(e, bop, ms, inf, deb, i, re) \quad (3.21)$$

The existence of exchange rate devaluation has both contractionary and expansionary effects on output through employment effect and the terms of trade balance effects Pilbeam (2006). To show which effect will happen when the country devalues its currency; adding nominal exchange rate into the model is necessary. An increase in money supply lowers interests, reduces borrowing costs, and promotes investment which might enhance domestic output. The improvement in investment leads to increase output which intern promotes a country to export more. In addition, a higher money supply will reduce the value of currency. This relation shows money supply affects the balance of payment (Shahbaz, et al., 2012). Thus, we include money supply in the model.

As literatures indicated the relationship between inflation and output is negative. To show the effect of general price level in the output model we include inflation and foreign asset reserve have their own impacts on output. Therefore, including the above variables into the model is important.

$$\ln rGDP_t = \alpha + \beta_1 e_t + \beta_2 bop_t + \beta_3 \ln ms_t + \beta_4 inf_t + \beta_5 \ln deb_t + \beta_6 i_t + \beta_7 \ln re_t + \varepsilon_{it} \quad (3.22)$$

Here given our definition we are expected the signs of exchange rate, interest rate external debt servicing and inflation rate is negative and the balance of payment, money supply, and reserve are positive.

To show the effect of dynamic relationship between devaluation, BOP and output; we employ vector error correction model (VECM) analysis and the structural shocks can be shown by structural VAR model of analysis and how this macroeconomic shocks are transmitted.

### **Definition and Measurement of Variables**

**Nominal exchange rate (e):** nominal exchange rate is defined in this paper as home currency price of a unit of foreign exchange.

**Balance of payment:** A country's international transactions are recorded in the balance of payments accounts. A country's balance of payments has two main components: the current account and capital account. The current account records exports and imports of goods and services and international receipts or payments of income. Exports and income receipts enter with a plus and imports and income payments enter with a minus. And the BOP capital account records all such transactions between residents of a country and the rest of the world which cause a change in the assets or liability status of residents of a country or its government. It represents the international flow of loans and investments that change the country's foreign assets and liabilities. However, the financial account measures changes in a country's net foreign asset position. Thus, the financial account keeps record of sales of assets to foreigners and purchases of assets located abroad. It can't be considered as a major part of balance of payment in the country (Ethiopia) because the country has no significant participation in foreign asset market.

**Gross Domestic Product (GDP):** Higher GDP values in the exporting country imply increased capacities for export. It is expected to have a positive impact on exports. For instance, Kumar (1998) in his study on the determinants of export growth in developing countries con-firmed that GDP has a significant positive impact export volumes. He also underlined that higher level of production is the main cause of export expansion. So, a higher GDP implies a higher production and hence larger volume of exports. Therefore, we expect a positive relationship between the dependent variable and GDP.

**Nominal Money Supply ( $M_s$ ):** Money supply is the total amount of monetary assets (entire stock of currency and other liquid instruments) available in an economy at a specific time. Increasing money supply may have inflationary tendencies in the economy which impacts negatively on the gross domestic product. Monetary economists argue that the increases in money supply should be absorbed in government's development projects. In this study, real money supply is measured in million Ethiopian Birrs.

**Inflation:** Inflation is the rate at which the general level of prices for goods and services is rising and, consequently, the purchasing power of currency is falling. Inflation is generally measured in terms of a consumer price index (CPI) which tracks the prices of a basket of core goods and services over time.

**Interest Rate (i):** Interest rate is the rate at which interest is paid by a borrower (debtor) for the use of money that they borrow from a lender (creditor). High interest rate crowds out private investment leading to reduced economic growth. On the contrary, it may attract foreign capital inflows which may result into increased debts. It is measured in percentages but will be converted to decimal points for easier analysis.

**Foreign asset reserve (re):** foreign exchange reserves consist of any foreign currency held by a central monetary authority; the national bank of Ethiopia. Foreign exchange reserves include foreign banknotes, bank deposits, bonds, treasury bills and other government securities. Especially, the term can also encompass gold reserves (IMF funds) and reserve tranche position. Foreign reserve assets serve a variety of purposes, but are primarily used to give the central government flexibility and resilience; should one or more currencies crash or become rapidly devalued, the central banking apparatus has holdings in other currencies to help them withstand such market shocks. It is also deposited in the form of either the world currency (Dollar) or nation's currency (Birr)

**External debt servicing (deb):** in this study external debt is used on the side of debt servicing that is on accrual basis; includes repayments of Trust Fund Loans, and repurchases from IMF.

### 3.3. Econometric model and Analysis

In this study basically we employ three econometric approaches which are vector autoregressive (VAR), structural vector autoregressive (SVAR) and vector error correction model (VECM). And additionally co-integration models using the Johansen technique based on VARs and Granger causality model that will clearly answer the research questions and meet the objectives of the paper.

#### 3.3.1 Vector autoregressive (VAR) model specification

According to Ragnar (2011) vector autoregressive (VAR) model has become widely adopted in macroeconomics due to the so called Sims' critique, in Sims (1980) and it is one of the most successful, flexible, and easy to use models for the analysis of multivariate time series. The VAR model has proven to be especially useful for describing the dynamic behaviour of economic and financial time series and for forecasting. It often provides superior forecasts compared to those univariate time series models and elaborate theory-based simultaneous equations models. Forecasts from VAR models are quite flexible because they can be made conditional on the potential future paths of specified variables in the model.

In addition to data description and forecasting, the VAR model is also used for structural inference and policy analysis. In structural analysis, certain assumptions about the causal structure of the data under investigation are imposed, and the resulting causal impacts of unexpected shocks or innovations to specified variables on the variables in the model are summarized. These causal impacts are usually summarized with impulse response functions and forecast error variance decompositions. Hendry (1995), this structural econometric analysis is important both for the stationary case and for the case with unit-roots and (potential) co-integration.

For the set of  $K$  time series variables  $y_t = (y_{1t}, \dots, y_{kt})$ , a VAR model captures their dynamic interactions. The basic model of order  $p$  (VAR ( $p$ )) has the form:

$$y_t = \alpha + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + \varepsilon_{it} \text{ --- (3.23)}$$

Where  $y_t = [Y, e, bop, ms, inf, deb, i, re]$ ; where  $\alpha$  is the vector of  $k \times 1$  constant matrix;  $A_i$  ( $i = 1, 2, \dots, p$ ) is  $(K \times K)$  coefficient matrices and the innovation vector  $\varepsilon_t$  is the linearly unpredictable component of  $y_t$ , given an information set consisting of the lagged values of all model variables. And  $\varepsilon_t \sim iid(0, \Omega)$ .

However, as presented on Pham (2016), VAR methodology has some critical limitations such as the difficulty to reach any conclusions from a large number of estimated coefficients and to understand the economic implication of estimated parameters.

Vector error correction model (VECM) was developed for understanding of short run and long run dynamics of economic variables. Hence, it accounts both short run and long run effects and it can eliminate trends existing in variables, and also corrects errors of the regression in the long run by adjustment coefficients (Asterious and Hall, 2011). However, one major weakness of this method is that misspecification of the effect of temporary effects; that is, it assumed that all shocks are permanent (Nguyen, 2014).

### **3.3.1.1. Tests of VAR models**

Even if the tests of VAR models can be performed in a similar way of univariate AR models, it is important to check whether the  $m$  residual series (*where*  $m = \varepsilon_1, \varepsilon_2, \dots, \varepsilon_n$ ) in the VAR model are white noise or not; because of the dynamic correlations between the variables. A simple check is to perform tests on serial correlation, exogeneity and homoscedasticity properties of time series data, unit root test is important for the residual series separately.

#### **Stationarity Test**

Regression analysis of time series data uses data from the past to quantify the dynamic historical relationship among economic variables (Stock and Watson, 2006). Since the classical econometric theory is built upon the assumption of covariance stationarity, to apply standard estimation or testing procedures in a dynamic time series model, it is typically required that the variables in our analysis should be stationary, (Verbeek, 2004). According to Gujarati (2004:797), as stochastic process is said to be stationary if its mean and variance are constant over time and the value of covariance between two time periods depends only on the distance or

gap between the two time periods and not on the actual time at which the covariance is computed.

Regression with non-stationary variables often leads to a problem of spurious regression; residual from a spurious regression behaves like a unit root process. A spurious regression is one that the model result has a high  $R^2$  and significant *t-statistics*, but extremely low Durbin-Watson (DW) statistics that indicates the results are without any economic meaning (Granger and Newbold, 1973). In addition, it implies that the variables have only contemporaneous relationship rather than meaningful causal relation (Harris and Sollis, 2003). One source of non-stationarity is the presence of a unit root in a series. Hence, through testing the presence of unit root we know the behaviour of the series.

As Sjö (2008) indicates, test for unit root (stationarity) is important at least for two reasons. First, knowing the behaviour of variable through the order of integration is crucial for setting up an econometric model and does inferences. Second, it helps to investigate the properties of the prior to the construction of an econometric model and do inference. Therefore, it is vital to test the presence of unit root before any empirical estimation.

The formal test of whether the variable is stationary or not is through testing for the presence of unit root in a series. The conventional methods of unit root tests those applied in empirical works are Augmented Dickey-Fuller (ADF) tests.

Diagnostic tests that includes Breusch-Godfrey test for test of autocorrelation; Jarque-Berra test for normality test; and CUSUM square test is used for model stability tests included in the model.

### **3.3.1.2. Choosing the optimal lag length for a VAR**

Often, financial theory will have little to say what an appropriate lag length is for a VAR and how long changes in the variables should take to work through the system. In such instances, there are broadly two methods that could be used to arrive at the optimal lag length: cross-equation restrictions and information criteria.

According to Christian et al (2004), the order of lags can be determined by the OLS or ML estimators that have the usual asymptotic statistical properties, provided that the VAR process is stationary. Therefore, we can apply conventional t- and F-tests on the significance of the coefficients. For instance, the lag order  $p$  of the VAR model can be selected by applying F-tests or LR-tests on the significance of additional lags. These tests follow (asymptotically) the standard F- and  $\chi^2$ -distributions respectively. Another method (Alemayehu et al.; 2006), in the applied empirical work, the order of the VAR or the optimal lag length is determined based on data congruency judged by some information criteria such as Akaike Information Criterion (AIC), Hannan-Quinn (HQ) or Schwarz Information Criterion (SIC), which are defined for VAR ( $p$ ) models and they are computed based on the following formula:

$$AIC = \log|\hat{\Sigma}| + \frac{2K}{T}; SIC = \log|\hat{\Sigma}| + \frac{2K}{T} (\log(T)); HQ = \log|\hat{\Sigma}| + \frac{2K}{T} \log(\log(T))$$

Where,  $\hat{\Sigma}$  is the variance covariance matrix of residuals ( $\Sigma = \frac{1}{T} \sum_{t=1}^T \hat{e}_t \hat{e}_t'$ ),  $T$  is the total number of observation,  $K$  is the total number of freely estimated parameters  $K = pK^2$ ,  $p$  is the number of lags. Based on these three criteria we will choose the number of lags that minimize the value of information criterion.

### 3.3.1.3. Granger Causality or block Granger causality tests

One of the main uses of VAR models is forecasting. The structure of the VAR model provides information about a variable's or a group of variables' forecasting ability for other variables. The following intuitive notion of a variable's forecasting ability is due to Granger (1969). If a variable, or group of variables,  $y_1$  is found to be helpful for predicting another variable, or group of variables,  $y_2, y_3$  then  $y_1$  is said to Granger-cause  $y_2$  and  $y_3$ ; otherwise it is said to fail to Granger-cause  $y_2$  and  $y_3$ . Formally,  $y_1$  fails to Granger-cause  $y_2$  if for all  $s > 0$  the mean squared error (MSE) of a forecast of  $y_{2,t+s}$  based on  $(y_{2,t}, y_{2,t-1}, \dots)$  is the same as the MSE of a forecast of  $y_{2,t+s}$  based on  $(y_{2,t}, y_{2,t-1}, \dots)$  and  $(y_{1,t}, y_{1,t-1}, \dots)$ . Clearly, the notion of Granger causality does not imply true causality (Kilian and Lütkepohl, 2016)



Estimation of the matrix  $B_0$  requires additional restrictions on the data generating process (DGP) based on economic theory. If the matrix  $B_0$  can be solved for, given these restrictions and the data, we say that the structural VAR model parameters,  $(B_0, B_1, \dots, B_p, \Sigma w)$ , are identified or, equivalently, that the structural shocks  $w_t = B_0 u_t$  are identified.

In compact form, an SVAR system relates to the following relations:

$$A_0 u_t = B w_t \text{ --- (3.26)}$$

The equation (3.26) is known as the AB model (Amisano and Giannini 1997). Where  $A_0$  is  $(n \times n)$  matrix of contemporaneous relations between endogenous variables,  $B$  is  $(n \times n)$  matrix that linearly relates the SVAR residuals to the structural innovations,  $u_t$  is vector of reduced-form residual, and  $w_t$  is vector of structural shocks. The residual  $u_t$  in the reduced form is presumed to be white noise. Therefore, we can estimate the AB model by OLS (ordinary list square).

The structural innovations  $w_t$  can be derived from errors  $u_t$  of the reduced form, but certain restrictions must be placed on the system. In details,  $\frac{n(n-1)}{2}$  Where  $n$  is the number of variables in the model; restrictions must be imposed on  $A_0$  matrix to be able to identify the structural shocks (McCoy, 1997).

The existence of a structural VAR model allows us to think of the variation in the data as being driven by the cumulative effects of economically interpretable structural shocks. Current observations of the data may be viewed as a weighted average of current and past structural shocks. This insight is important because it helps researchers quantify causal relationships in the data that are not well known in reduced form VAR analysis.

The main advantage of the structural VAR model compared with alternative econometric approaches is that it tends to fit the data well and only involves minimal identifying restrictions. In particular, it does not impose cross-equation restrictions or exclusion restrictions on the reduced form that tend not to be robust across alternative specifications of the underlying economic model (see Hamilton, 1995; Kilian, and L'utkepohl, 2016).

---

<sup>1</sup> The contemporaneous matrix requires  $\left(\frac{8(8-1)}{2} = 28\right)$  restrictions for exact identification more than 28 restrictions were imposed, leading to over identification.

### 3.3.2.1. Recursively identified structural VAR model

According to Kilian, and Lütkepohl, (2016) in estimating the response of economic variables to the temporary shocks, this paper employed recursively identified structural model. This means current structural shocks cannot be simultaneously affected by the preceded ordering variables. We can assume that variables are affected by following a sequential chain of shocks, or the matrix  $A_0$  is diagonal (that is, the structural shocks are orthogonal) and takes the form of a lower triangular matrix as follows:

$$\begin{pmatrix} u_t^e \\ u_t^{re} \\ u_t^{deb} \\ u_t^i \\ u_t^{ms} \\ u_t^{inf} \\ u_t^{bop} \\ u_t^{rgdp} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{21} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{31} & b_{32} & 1 & 0 & 0 & 0 & 0 & 0 \\ b_{41} & b_{42} & b_{43} & 1 & 0 & 0 & 0 & 0 \\ b_{51} & b_{52} & b_{53} & b_{54} & 1 & 0 & 0 & 0 \\ b_{61} & b_{62} & b_{63} & b_{64} & b_{65} & 1 & 0 & 0 \\ b_{71} & b_{72} & b_{73} & b_{74} & b_{75} & b_{76} & 1 & 0 \\ b_{81} & b_{82} & b_{83} & b_{84} & b_{85} & b_{86} & b_{87} & 1 \end{bmatrix} * \begin{pmatrix} w_t^e \\ w_t^{re} \\ w_t^{deb} \\ w_t^i \\ w_t^{ms} \\ w_t^{inf} \\ w_t^{bop} \\ w_t^{rgdp} \end{pmatrix}$$

Where,  $(u_t^e, u_t^{re}, u_t^{deb}, u_t^i, u_t^{ms}, u_t^{inf}, u_t^{bop}$  and  $u_t^{rgdp})$ , are the structural disturbance, that is, exchange rate shocks, foreign asset reserve shocks, external debt shocks, interest rate shocks, money supply, the price shocks, the balance of payment shocks, and output shocks respectively; and  $(w_t^e, w_t^{re}, w_t^{deb}, w_t^i, w_t^{ms}, w_t^{inf}, w_t^{bop},$  and  $w_t^{rgdp})$ , are the residuals in the reduced form equations, which represent unexpected movements (given information in the system) of each variable.

Precisely in the above recursive model, the first variable is assumed to response to its own shocks. The second one is affected by shocks of the previous variable and its own, and so forth. When using recursive model, researchers make assumptions that policy makers only use the available information to design monetary policy (Raghavan et al., 2012).

Identification of restrictions for the recursive model is based on the economic theory that postulates and by employing over identified restrictions. In over identified restrictions methodology; it is important not to stick one model which may be wrong. However, this type of structural VAR model no longer admits a Cholesky representation and must be estimated by alternative numerical methods (Kilian, and Lütkepohl, 2016).

In some cases, conditions that will not available fully developed theoretical model, in this case identification may be achieved by using extraneous information or by using selective insights from economic theory. Based this information of Kilian, and L'utkepohl, we develop the above recursive form of SVAR model.

In our model, the data vector is  $\{e, re, deb, i, ms, inf, bop, rgdp\}$ , where,  $e$  is nominal exchange rate expressed the form of foreign currency to domestic currency (\$/Birr);  $re$  foreign asset reserve,  $deb$  is external debt servicing,  $i$  indicates domestic interest rate;  $m_s$  is money supply ( $M_0 + M_1$ );  $inf$  is general inflation rate;  $bop$  is the balance of payment and  $rgdp$  indicates is output.

Assuming that exchange rate is contemporaneously unaffected by the shocks of other variables in the system. Foreign exchange reserve in the system is assumed to be affected by the contemporaneous shocks of exchange rate and the lags itself. In the external debt servicing equation, we assumed external debt servicing is contemporaneously affected by the positive innovations of exchange rate, foreign asset reserve and its own lag. Positive innovation shocks such as exchange rate, foreign asset reserve, external debt, and lagged of interest rate are assumed to be affect the current interest rate in the system. In the fifth equation money supply is assumed to be contemporaneously affected by the shocks of exchange rate, foreign asset reserve, external debt, interest rate and its lag in the system. Inflation in the system assumed to be contemporaneously influenced by the positive innovations of exchange rate, foreign asset reserve, external debt, interest rate, money supply and its lag in the system. The balance of payment equation can be contemporaneously influenced by the positive innovations of exchange rate, foreign asset reserve, external debt, interest rate, money supply, interest rate and its own lag in the system. Finally in the output equation, output is assumed to be contemporaneously influenced by all variables in the system.

After identifying the structural shocks it is important analysing and interpreting these macroeconomic shocks by using structural VAR tools in the structural model, that is, structural impulse responses and forecast error variance decompositions.

### 3.3.2.2. Structural impulse responses

As presented by Kilian, L. and H. Lütkepohl, (2016), the structural impulse responses in the structural VAR model can be analysed and interpreted in the following form. Given  $\beta_0$  and  $u_t$ , we immediately obtain  $w_t = \beta_0 u_t$ . Having identified the structural shocks  $w_t$ , in the responses of each element of  $(y_t = y_{1t}, \dots, y_{kt})'$  to a one-time impulse in  $w_t = (w_{1t}, \dots, w_{kt})'$

$$\frac{\partial y_{t+i}}{\partial w_{t'}} = \Theta_i, i = 1, 2, 3, \dots, H$$

Where  $\Theta_i$  is a  $K \times K$  matrix. The elements of this matrix for given  $i$  are denoted as

$$\theta_{jk,i} = \frac{\partial y_{j,t+i}}{\partial w_{kt}}$$

Such that  $\Theta_i = [\theta_{jk,i}]$ . Usually the objective is to plot the responses of each variable to each structural shock over time. Since there are  $K$  variables and  $K$  structural shocks, there are  $k^2$  impulse response functions, each of length  $H + 1$ , where  $H$  is the maximum propagation horizon of the shocks.

A starting point for the structural impulse responses  $\theta_{jk,i}$  are the responses of  $y_{t+i}$  to the reduced-form errors  $u_t$ . They can be obtained by considering the VAR (1) representation of the VAR( $p$ ) process. And the dynamic multipliers (simply as reduced-form impulse responses) that are obtained from responses to VAR forecast errors are:

$$\Phi_i = [\Phi_{jk,i}] = JA^i J';$$

Where,  $\Phi_i$  is  $k \times k$  matrix which shows the forecast error of the VAR model;

$J \equiv (I_k, 0_{k \times k(p-1)})$ , the response of the variable  $j = 1, \dots, K$  in the VAR( $p$ ) system to a unit shock  $u_{kt}$ ,  $k = 1, \dots, K$ ,  $i$  periods ago.

As Lütkepohl (2005) the response of an economic variable to a shock in period  $t$  at horizon  $h$  is obtained as the sum

$$\sum_{i=0}^h \theta_{mk,i}$$

### 3.3.2.3. Forecast Error Variance Decompositions

After analysing the structural impulse responses, practically the important question that a structural VAR model can answer is how much of the forecast error variance or prediction mean squared error (MSPE) of  $y_{t+h}$  at horizon  $h = 0, 1, \dots, H$  is accounted for by each structural shock  $w_{kt}$ ,  $k = 1, \dots, K$ . In a stationary model, the limit of the forecast error variance decomposition, as  $h \rightarrow \infty$ , is the variance decomposition of  $y_t$  because the forecast error covariance matrix or MSPE converges to the unconditional covariance matrix of  $y_t$ . Thus, for stationary systems one may construct MSPE decomposition for horizon infinity. In integrated systems the MSPE diverges when the forecast horizon goes to infinity, but the forecast error variance decomposition remains valid up to a finite maximum horizon of  $H$ . All we need to compute in this decomposition is the  $\Theta_i$  matrices, which we already described for the structural impulse response analysis (Kilian and Park, 2009) as cited in Kilian, L. and H. Lutkepohl, (2016).

The contribution of shock  $j$  to the MSPE of  $y_{kt}$ ,  $k = 1, \dots, K$ , at horizon  $h$  is

$$MSPE = MSPE^K_j (h) = \sum_{j=0}^k (\theta^2_{kj,0} + \dots + \theta^2_{kj,h-1})$$

The fraction of the contribution of shock  $j$  to the forecast error variance of variable  $k$  will be in the structural variance decomposition:

$$\frac{MSPE^K_j (h)}{MSPE^K (h)}$$

By multiplying these fractions by 100 we obtain percentages.

## Chapter Four

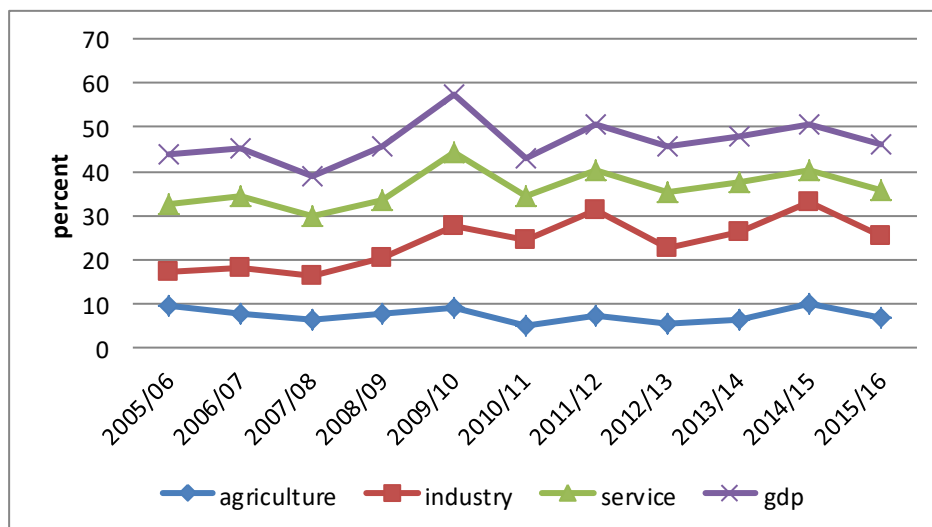
### The Macroeconomic performance of Ethiopia

In this section, we will present the general overview of the development and performance of Ethiopian economy from 2000/01 to 2016/17 with emphasis given to variables those included in our study.

#### 4.1. Overall macroeconomic development from 2000 to 2017

In general, Ethiopia has achieved a notable and sustained economic growth over the past decade. Figure 4.1 shows the pattern of gross domestic product (GDP) growth and the contribution of the major three (agriculture, service and industry) sectors towards this growth. Between 2005/06 and 2015/16, Ethiopian GDP grew by an annually on an average of 10.5 percent. The major sectors, including agriculture, industry, and services, have also shown outstanding growth over the same period. The main contributors to this impressive economic growth have been the service sector and agriculture, which is about 51.5 and 32.5 percent respectively. In contrast, the industrial sector contribution to GDP growth remained small at only 16.3 percent (National Bank of Ethiopia (NBE), 2016). However, this strong and continuous growth does not solve the balance of payment deficit as expected.

**Figure 4. 1 Contribution of the different sectors to Ethiopia’s real GDP growth**



Source: based on NBE annual reports.

But currently these growth rates GDP is not long lasting which is declined from 10.5 percent to 8.0 percent on average in 2015/16; and the growth was projected to 8.1 percent in 2016/17. The reason behind this declining is that which was explained by the African Development Bank report of (2017) Public protests disrupted the nation in 2016 in the Oromia and Amhara regions, with the protestors citing concerns about political and economic marginalization. The authorities declared a six-month state of emergency in October 2016, enacting a variety of measures to restore peace. And growth in the agriculture sector was negatively affected by the El Niño induced drought in 2015/16. This problem worsens not only the balance of payment deficit but also shortage of foreign currency. And it forces the country to devalue its currency in 2017.

Headline inflation is projected to remain consistent with the central bank's (National Bank of Ethiopia's [NBE], 2017) price stability objective of single digit inflation in 2016/17. Inflationary pressures are expected to fall due to subdued food prices. Import-intensive public infrastructure investments are expected to continue in the near term as the government sustains the implementation of energy and road transport infrastructure projects to improve the business enabling environment. The current account deficit is projected to remain in double digits in the short term as export earnings continue to account for about 30 percent of imports. Uncertainty about international commodity prices and weak global demand are key downside risks. The 2004 Industrial Development Strategy guides Ethiopia's ambition of achieving agricultural and export-led industrialisation. However, the share of the industrial sector in GDP remains low, averaging 12.2 percent between 2006/07 and 2015/16. The expansion in industry has been led by construction, while the contribution of manufacturing to GDP remains small at 5.4 percent in 2015/16.

Even though, the country plans the second Growth and Transformation Plans (GTP II) 2015/16–2019/20 prioritises export-led industrialisation, export is not as such promoted more and it does not solve the current account deficit.

## **4.2. Balance of payments developments in Ethiopia**

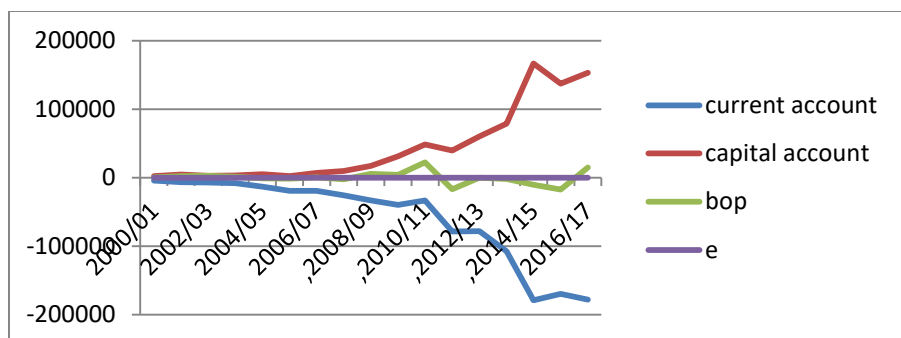
According to the report of National Bank of Ethiopia, historically the balance of payment passes through deficit. The report indicates in 2004/05, there is a slight improvement of the balance of payment. Hence, there are improvements in domestic saving and investment inflows (FDI).

Even though these improvements don't improve the balance of payment of a country due to import prices hike and it is still complicated. This situation forced the country to be dependent on foreign aid and debt though the country receive smallest amount of aid per capita of the Sub-Saharan Countries. However, this improvement does not continue in the next year. That is, after narrowing in 2004/05, the deficit in the overall balance of payments widened to USD 326 million in 2005/06 from USD 101.4 million in the preceding year, reflecting the widening of the trade deficit (21.4 percent increase) and the slowdown in the surpluses of the services account.

The overall balance of payments in 2009/10 recorded USD 1.37 billion in surplus compared to USD 316.6 million in the preceding year. This achievement was the result of vigorous growth in net service receipts, private transfers, and long term official loan disbursement and estimated foreign direct investment inflows. Following this growth, the current account deficit narrowed by 21.3 percent and the capital account 21.1 percent higher than the previous year. In this period GDP is grown by 10.4 percent. This growth was also continuous with 11.3 percent annual average growth during 2003/04- 2009/10.

In 2010/11 the current account balance shows a surplus of USD 234.4 billion; higher income from private transfers and service income. And the capital account surplus reached USD 2.5 billion, because there is a strong growth in official long term loan disbursements (33 percent) and estimated foreign direct investment inflows (30 percent).

In 2015/16 the balance of payment account faces higher deficit 830.9 million USD dollars when it is compared to that of 2014/15 fiscal year; 521.4 million USD dollar. Because merchandise import bills are five times greater than merchandise export and net service decline by 721.5 USD dollar. According to the national bank report, recently, in the first quarter of 2017/18 in the first quarter the country's overall balance of payment registered USD 321.0 million deficits compared to USD 336.3 million deficits in 2016/17. This growth was mainly comes from 2.4 percent improvement in merchandise trade deficit, 158.1 percent rise in net services and 36.9 percent increase in net private transfers. The figure below indicates that the trend of the balance of payment from 2000/01 to 2016/17 with its components, that is, the current account and capital account.



Source: own computation based on National Bank data

Figure 4.3. The balance of payment trend from 2000/01 up to 2016/17

### 4.3. Developments in foreign asset reserve, external debt and nominal exchange rate.

In 2004/05 fiscal year, the country's reserve account declines in to USD 17.6 million as compared to the previous two years. It is sufficient to cover 3.6 months of imports of goods and non-factor services of next year. The external debt stock was reduced by 16.4 percent from the previous year. That is, from USD 1179.3 million in 2003/04 in to USD 6021.0 million in 2004/05. This debt stock is about 81 percent was owned from multilateral creditors, 13 percent owned from bilateral creditors and the remaining 6.0 percent was owned from commercial lenders. In the same fiscal year, nominal exchange rate was depreciated but the depreciation rate is at a lower rate when we compared to the previous year. That is, 0.372 and 0.826 percent in 2003/04 and 2002/03, respectively.

Following the balance of payment surplus, the country recorded USD 1.37 billion reserves build up at the end of 2010/11. That is, adequate to cover 3.1 months of imports of goods and non-factor services. However, external debt stock reached USD 7.3 billion, depicting a 31.4 percent growth over 2009/10. In the same year, the weighted average exchange rate of the Birr in the inter-bank market depreciated by 25 percent to Birr 16.1178/USD with respect to Birr 12.8909/USD recorded.

The net foreign asset reserve in the banking system was recorded drawdown in to USD 830.9 million in 2015/16. Thus, it was adequate to cover 2.6 months of imports of goods and non-factor services. In this year the external debt stock of reached USD 21.7 billion. That is, the

country's external debt stock to GDP ratio mounted to 30.7 percent. This shows the country's external debt becomes increasing from year to year. The weighted average nominal exchange rate is depreciated by five percent. That is, depreciated from USD 20.0956 to USD 21.1059.

To sum up, from the above trend we conclude that nominal exchange rate is continuously depreciate whereas external debt is increasing from time to time. The foreign asset reserve also increases but the ability to cover the import of goods and non-factor services decrease (coverage time).

#### **4.4. Developments in Money Supply, Interest rate and Inflation**

In 2004/05 fiscal year broad money grown by 19.6 percent and in the same year GDP is grown by 14.6 percent. There is no significant change in interest rate. That is, average deposit rate is 3.08 percent and on average time deposit rate reached 3.71 percent. However, head line inflation is decreasing from 8.6 percent to 6.8 percent in 2004/05. This shows core inflation (NBE, 2005).

As at end the of 2009/10, broad money supply (M2), which measures domestic liquidity, is grown by 22.2 percent and reached Birr 104.4 billion as compared with the same period last year. This increment comes largely due to the increase in net foreign assets and domestic credit by 51.2 and 17.1 percent respectively. The components of this broad money are narrow money supply (currency outside banks and demand deposit (net)) and Quasi money (time deposits and saving deposit). The growth of narrow money went up by 24.5 percent and similarly quasi money rose by 28.7 percent.

The developments of interest rate on saving deposits in 2009/10 were unchanged as the same as of the previous year (4.5 percent) and lending deposit 12.25 remained the same. However, the interest rate of time deposit decreased to 4.7 percent from 5.26 percent during the same period. At this period the head line inflation was 2.8 percent (NBE, 2010).

In 2015/16 report of National Bank broad money supply (M2) expanded to Birr 445.3 billion, mainly due to the growth of domestic credit by 24.6 percent. The annual average interest rate on savings remains unchanged as compared to 2014/15. That is, 5.38 percent. However, the average

lending rate is increased from 11.88 percent to 12.75 percent. And the head line inflation is 7.5 percent. This shows negative real rate of interest rate except lending rate (NBE, 2016)

To conclude that the above discussion broad money increases from time to time and interest rate is also increasing but the increment is no more significant. However, the headline inflation of the country has decrease in one time and increases in the other.

## Chapter Five

### Empirical result and discussion

In this section, the empirical estimation result of both structural vector autoregressive (SVAR) and vector error correction model (VECM) models are discussed. Following estimation and discussion, the diagnostic test result that check model adequacy are presented.

#### 5.1. Stationarity Test

Even when the objective of this paper is the analysis of the nexus between currency devaluation, the balance of payment and output dynamics as well the transmission channel of macroeconomic variables, as a set of time series, it is usually a good idea to start with exploring the special properties and characteristics of the series individually. That is, checking which is whether the variables are stationary or not. One of the simple diagnostic methods to test stationarity of variable is plotting of the data. In account of this, we have plotted the included variables against time. From graphical point of view, the trend of the variables indicates most of them are non-stationary at level (see Appendix-A1<sup>2</sup>). Next, we have tested the presence of a unit root in a series of all the variables using the formal statistical test. To make the test more robust the presence of unit root is tested using Augmented Dickey Fuller (ADF) and Phillip- Perron (PP) test. In all tests, we assume that the series contain both trend and intercept. For all variables, Akaike Information Criterion (AIC) and likelihood ratio automatically selects the lag length. The result of unit root test from the Augmented Dickey Fuller and Phillip- Perron tests are summarized in table 5.1 and table 5.2.

**Table 5. 1 Augmented Dickey Fuller unit root test**

Variable	ADF test				Order of integration
	At level		At first difference		
	t- stat	Critical value	t- stat	Critical value	
LrGDP	-1.316029	-4.124265	-4.956089	-4.124265***	I(1)
E	-1.787306	-4.103198	-5.937178	-4.103198***	I(1)
bop	-2.563728	-4.110440	-6.337891	-4.110440***	I(1)
I	-1.999106	-4.100935	-7.851057	-4.103198***	I(1)
Ldc	-3.217404	-4.100935	-8.337648	-4.103198***	I(1)

<sup>2</sup> See the plot of variables at level in the appendix part, which shown as the mean, the variance and standard errors are not constant over time

Lre	-2.430083	-4.103198	-6.680812	-4.103198***	I(1)
Inf	-1.790816	-3.489228	-3.816253	-3.489228**	I(1)
Lms	-3.343068	-4.100935	-8.503442	-4.105534***	I(1)
Ldeb	-2.712015	-4.103198	-4.429919	-4.103198***	I(1)

Source: own computation from Eviews 10.

Note: \*, \*\*, \*\*\* represents significant at 10%, 5% and 1% level of significance respectively.

The result of Augmented Dickey Fuller (ADF<sup>3</sup>) test shows all variables in the VAR model are not stationary at level. That is, the null hypothesis of unit root, both with trend, and trend and intercept are not rejected. However, these variables turn out to be stationary at their first differences. The Phillip-Perron test indicated on table 5.2 below also shows that all variables are stationary at first order I(1).

**Table 5. 2 Phillip-Perron (PP) unit root test**

Variable	PP test				Order of integration
	At level		At first difference		
	t- stat	Critical value	t- stat	Critical value	
LrGDP	-3.466485	-3.166788	-3.242396	-3.167404*	I(1)
E	-1.713048	-4.100935	-5.984825	-4.103198***	I(1)
Bop	-2.834403	-4.100935	-6.098261	-4.103198***	I(1)
I	-2.042927	-4.100935	-7.851015	-4.103198***	I(1)
Ldc	-3.195892	-4.100935	-8.325851	-4.103198***	I(1)
Lre	-2.103109	-4.100935	-6.691490	-4.103198***	I(1)
Inf	-2.835182	-4.100935	-5.013367	-4.103198***	I(1)
Lms	-3.341733	-4.100935	-10.83177	-4.103198***	I(1)
Ldeb	-2.267705	-4.100935	-4.424315	-4.103198***	I(1)

Source: own computation from Eviews 10.

Note: \*, \*\*, \*\*\* represents significant at 10%, 5% and 1% level of significance respectively.

The Augmented Dickey-Fuller and Phillip-Perron test shows that time series variables in the model have a unit root at the level, and this result implicates that these variables should be differencing before used to estimate the models. Moreover, testing at first difference, the null hypothesis that unit root exists can all be rejected at the five percent significance level.

<sup>3</sup> If the estimated Augmented Dickey-Fuller statistic is greater than the critical value we reject the null hypothesis that the series is non-stationary in favour of stationary.

## 5.2. Determination of Optimal Lag Length

After discussing stationarity of the data, it is important to identify the optimal lag length to estimate the VAR/SVAR model. The length selection criteria, which are the sequential modified Likelihood Ratio test statistic (LR), Final Prediction Error (FPE), Akaike Information Criteria (AIC) and the Hannan-Quinn Information Criterion (HQ), is used in this study. All these information criteria in this study are shown in Table 5.3 given below and an optimal lag length of two at the 5 percent level of significance is chosen.

Table 5. 3 VAR Order Selection Criterion

VAR Lag Order Selection Criteria  
 Endogenous variables: E BOP1 LRGDP LNMS LNDEB INF I  
 LNRE  
 Exogenous variables: C  
 Date: 05/24/18 Time: 15:56  
 Sample: 1 68  
 Included observations: 65

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-655.6802	NA	0.102073	20.42093	20.68855	20.52652
1	39.30904	1197.520	3.83e-10	1.005876	3.414428*	1.956204*
2	127.0902	129.6461	2.01e-10*	0.274147*	4.823634	2.069212
3	196.3933	85.29616*	2.15e-10	0.110974	6.801396	2.750774

\* indicates lag order selected by the criterion  
 LR: sequential modified LR test statistic (each test at 5% level)  
 FPE: Final prediction error  
 AIC: Akaike information criterion  
 SC: Schwarz information criterion  
 HQ: Hannan-Quinn information criterion

Table 5.3 shows the results of different lag-length criteria. Therefore, whether the first lags (chosen as optimal) of all variables is individually and jointly important and should be included in the testing for co-integration and estimation of the VAR should be evaluated. This approach was taken in the Wald form of the lag-exclusion test (which is asymptotically chi-square distributed). This exclusion test shows that the second lags of all of the endogenous variables are significant both individually and jointly for both models; as indicated by Akaike information criterion. This suggests that the uses of the first lags of the variables in the models are valid<sup>4</sup>.

<sup>4</sup> The lag exclusion table is presented in the appendix A2

Due to limited data, the most parsimonious model should be chosen to reduce the number of estimated parameters (Ouliaris et al., 2016).

### **5.2.1. Co-integration Test**

To capture the linear interdependence between these variables, the VAR model is a dynamic multivariate model and treats a set of variables equally. The relationship between currency devaluation, the balance of payment and output dynamics can be addressed using VAR models which are established to show the short-run dynamic disequilibrium among these variables. To develop long term relationship the cointegrating vectors are assessed by using Johansen's cointegration technique.

After testing for unit root and the optimal lag length; it is important to check whether the variables are co-integrated or not at the same order, in our case order one  $I(1)$ . If the series are integrated of the same order they may have a long-run relation among these co-integrated variables. Johansen integration approach provides the exact number of co-integration relation, which is the basis for model setup and an inference procedure (see Lütkepohl *et al.*, (2001)). And it is also important for evaluating many co-integrating vectors.

In the table below trace test statistics indicates that the null hypothesis of no, co-integrating vector is rejected at 5 percent critical value. However, the result of the existence of three or less number of co-integrating equations cannot be rejected at conventional level of significance. Hence, from trace test we can conclude that there is three co-integrating relationship in the VAR model. And also the maximum eigenvalue confirms the existence of three cointegrating vectors. According to the Johansen co-integration test there are three co-integrating vectors in the model thus it confirms a long run relationship between these macroeconomic variables.

Table 5. 4 Johansen's co-integration tests

Date: 06/01/18 Time: 18:40  
 Sample (adjusted): 3 68  
 Included observations: 66 after adjustments  
 Trend assumption: Linear deterministic trend  
 Series: LNRE E LNDEB I LNMS INF BOP1 LRGDP  
 Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.656938	244.4978	159.5297	0.0000
At most 1 *	0.577494	173.8881	125.6154	0.0000
At most 2 *	0.515495	117.0256	95.75366	0.0008
At most 3	0.374566	69.20020	69.81889	0.0559
At most 4	0.270190	38.22579	47.85613	0.2923
At most 5	0.133976	17.43771	29.79707	0.6077
At most 6	0.105814	7.944068	15.49471	0.4714
At most 7	0.008487	0.562556	3.841466	0.4532

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.656938	70.60973	52.36261	0.0003
At most 1 *	0.577494	56.86247	46.23142	0.0026
At most 2 *	0.515495	47.82544	40.07757	0.0055
At most 3	0.374566	30.97441	33.87687	0.1069
At most 4	0.270190	20.78808	27.58434	0.2892
At most 5	0.133976	9.493645	21.13162	0.7907
At most 6	0.105814	7.381512	14.26460	0.4450
At most 7	0.008487	0.562556	3.841466	0.4532

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

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

Thus, the next step which is taken before the discussion of the impulse response function checking normality of residuals and stability of the Structural Vector Auto regression (SVAR) Model, and the temporal causality of variables. The graph of the root of the VAR proved the stability of the model given all the points appeared to be within the main circle<sup>5</sup>, and no unit root

<sup>5</sup> See appendix B1

lies outside the unit circle. The resulting VAR does not suffer from autocorrelation at the 5 percent level for the selected lags, and the parameter estimates appear stable, as illustrated by CUSUM square plots and recursive parameter estimates<sup>6</sup>. So the SVAR models with two lags satisfy the stability condition and can be estimated.

The test of normality of the residuals is one of the important post-estimation diagnostic tests in empirical studies. This study uses the multivariate extension of the Jarque-Bera (JB) test for residual normality. As a literature presented on Tamirayehu (2015), Jarque-Bera is a test statistic for testing whether the series is normally distributed. The test statistic measures the difference of the skewness and kurtosis of the series with those from the normal distribution. Therefore, residuals of our model are normally distributed.

### **5.2.2. Granger Causality Test**

As the explanation of Kilian, and Lutkepohl (2016), the VAR model describes the joint data generating process (DGP) of the variables under consideration. A study made by Granger (1969) for assessing the dynamic relationship between economic variables based on the VAR model is grounded on a notion of linear predictability. That is, known as Granger causality. In this study Granger causality test can be conducted as a Wald test of the null hypothesis of no Granger causality. The possible results explained by (Kilian, and Lutkepohl, 2016) will be; Granger non-causality cannot be rejected in either direction; unidirectional Granger causality, or bi-directional Granger causality. Having this information we can check Granger causality in the system.

Table 5.5 shows the results of Granger causality between the variables in the system. Result reveals the existence of unidirectional Granger causality between external debt servicing and foreign asset reserve in the short run. The causality comes from external debt servicing. This implies the current change in foreign asset reserve is affected by the past history of external debt servicing (lagged value).

External debt servicing, money supply and real GDP Granger causes exchange rate in the short run. In the short run interest rate is Granger caused by foreign asset reserve, external debt servicing, inflation and real GDP. Money supply is Granger caused by external debt servicing

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<sup>6</sup> Available at appendix B1

Table 5. 5 Granger causality test/ Block exogeneity test.

		D(lnre(-1))	D(e(-1))	D(lndeb(-1))	D(i(-1))	D(lnms(-1))	D(inf(-1))	D(Bop1(-1))	D(lnrgdp(-1))	Joint	ECT (-1)
D(lnre(-1))	( $\chi^2$ )		0.008690	3.639385*	0.092635	1.750490	0.000195	0.032375	0.467576	5.877163	-0.026447
	Prob.		0.9257	0.0564	0.7609	0.1858	0.9888	0.8572	0.4941	0.5542	0.3245
D(e(-1))	( $\chi^2$ )	2.661525		8.121309**	1.052416	2.955130*	1.757478	0.001835	8.953258**	19.21393*	-0.118141**
	Prob.	0.1028		0.0044	0.3050	0.0856	0.1849	0.9658	0.0028	0.0075	0.0060
lndeb	( $\chi^2$ )	1.473395	0.844137		0.107956	2.555705	0.778164	0.381815	0.011160	5.422235	-0.053998
	Prob.	0.2248	0.3582		0.7425	0.1099	0.3777	0.5366	0.9159	0.6086	0.1343
D(i(-1))	( $\chi^2$ )	4.018364**	0.464758	2.860662*		0.511071	6.518871**	0.506788	20.94140***	31.11633***	-0.070902
	Prob.	0.0450	0.4954	0.0908		0.4747	0.0107	0.4765	0.0000	0.0001	0.1836
D(lnms(-))	( $\chi^2$ )	2.702804	1.385839	12.75479**	0.093245		2.275350	1.926424	0.016272	21.02057**	0.035982***
	Prob.	0.1002	0.2391	0.0004	0.7601		0.1314	0.1652	0.8985	0.0037	0.0000
D(inf(-1))	( $\chi^2$ )	3.976504**	7.236129**	0.213984	0.493217	1.825590		0.337486	0.007259	14.81358**	-0.816122
	Prob.	0.0461	0.0071	0.6437	0.4825	0.1766		0.5613	0.9321	0.0385	0.4867
D(Bop1(-1))	( $\chi^2$ )	1.893242	0.149004	3.778735*	0.286257	0.197701	1.559163		2.457510	12.04135*	-1.965079**
	Prob.	0.1688	0.6995	0.0519	0.5926	0.6566	0.2118		0.1170	0.0992	0.0269
D(lnrgdp(-1))	( $\chi^2$ )	8.378059	0.843445	3.657332*	2.182927	0.000208	1.267387	0.036452		17.99302**	0.004782***
	Prob.	0.843445	0.3584	0.0558	0.1395	0.9885	0.2603	0.8486		0.0120	0.0001

Source: own computation from Eviews 10.

Note: \*, \*\*, \*\*\* represents significant at 10%, 5% and 1% level of significance respectively

unidirectional in the short run. Foreign asset reserve and exchange rate Granger causes inflation in short run. In the short run external debt servicing Granger causes the balance of payment and real GDP. In the short run exchange rate, interest rate, inflation, the balance of payment and real GDP jointly Granger caused by all variables in the system. The error correction term indicates that there is long run granger causality between independent variables (exchange rate, money supply, the balance of payment and real GDP) and dependent variables in the system.

### **5.2.3. The response of monetary variables to the change in policy shocks**

Next we estimate recursively identified SVARs model with two lags suggested by using the Akaike Information Criteria for the model including an intercept and time trend. We used the lagged variables. Differencing produces no gain in asymptotic efficiency in an autoregression even if it is appropriate. Moreover, differencing throws away information, hence a VAR on differences cannot capture co-integration relationship and produces almost no gain (Ncube and Ndou 2011). And any co-integration can be determined by the model. The restrictions in SVAR were imposed and estimated by a maximum likelihood method. Therefore, we tried to see the impulse responses of the variable to each random innovation shocks in the SVAR model by employing sixteen quarter data. The broken lines in the figure show the two standard error confidence band and the solid line shows the effect of shocks to the variable.

#### **The response of exchange rate to shocks**

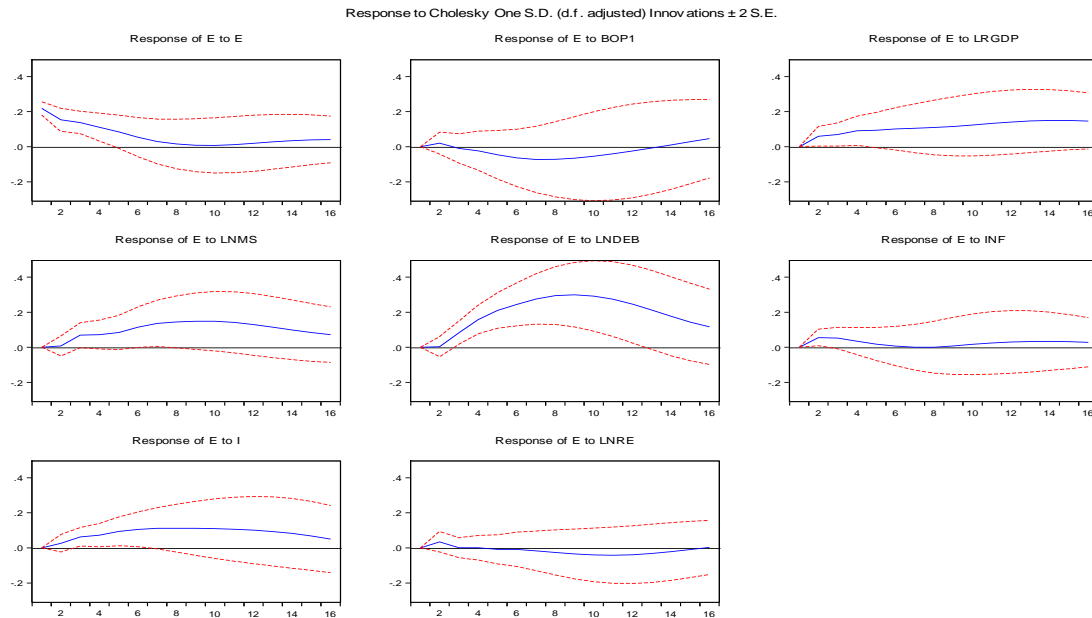
According to Figure (5.1) below, positive innovations to the balance of payment caused a positive impact on exchange at the beginning. But after three quarters, the exchange rate declines (appreciates) due to the balance of payment surplus. An increase in the nominal exchange rate (depreciation of currency) here is reasonable. Theoretically in the traditional approach of analysing exchange rate behaviour focuses on the condition of balance of payments equilibrium as the proximate determinant of the equilibrium exchange rate. In this case exchange rate is affected by the inflow and out flow of capital. That is, the relative price of a country's imports to exports (the Marshal-Lerner conditions) arises from the current account balance.

The response of the exchange rate to the natural innovations of positive shocks of output is positive and significant in the forecasting time horizon. Theoretically this finding is supported by the analysis of Balassa- Samuelsson model. That is, the deviations from PPP (i.e., variations in

real exchange rate) are due to differences in relative productivity growth rates across countries. In particular, if in the domestic country the relative productivity of the traded sector is growing faster than that of the foreign country, then the real exchange rate will appreciate over time (nominal exchange rate will fall/depreciate over time), this is because in the home country nontradables are becoming relatively more expensive to produce than in the foreign country, forcing the relative price of nontradables in the domestic country to grow at a faster rate than in the foreign country.

A positive shock in interest rate influences nominal exchange rate positively. In the monetary approach, a higher interest rate causes a lower money demand, relative to money supply, and hence a weaker currency. Additionally, uncovered interest rate parity (UIP) implies that a higher domestic interest rate implies a weaker currency in the future. Thus, the finding coincides with an economic theory.

Figure 5. 1 The response of exchange rate to other macroeconomic shocks



Source, own completion from Eviews 10

Note:

- On the x-axis is the time period in quarters
- The broken line shows the 95% confidence interval, while the solid lines represent the response rate of each of nominal exchange rate to shocks to a respective variable

The response of nominal exchange rate to a percentage change in money supply is directly related. That is, positive relationship; a positive shock in money supply led to the positive response of exchange rate. This finding related to the monetary theory of exchange rate determinations. That is, exchange rate is determined on the ground of the equilibrium in the demand for and supply of money. Theoretically, other things remain constant, an increase in the supply of money in the foreign exchange market leads to decline in the value of that currency (i.e. the exchange rate is depreciated due to excess supply of money).

A positive shock in external debt service (increase in payment of external debt) led to depreciation of domestic currency. Hence, the demand for foreign currency increases to pay debts. The increase in the demand for foreign currency (USD) in the foreign exchange market by a nation led to depreciation of the domestic currency; because of excess domestic currency in the market. In this case nominal exchange rate increases.

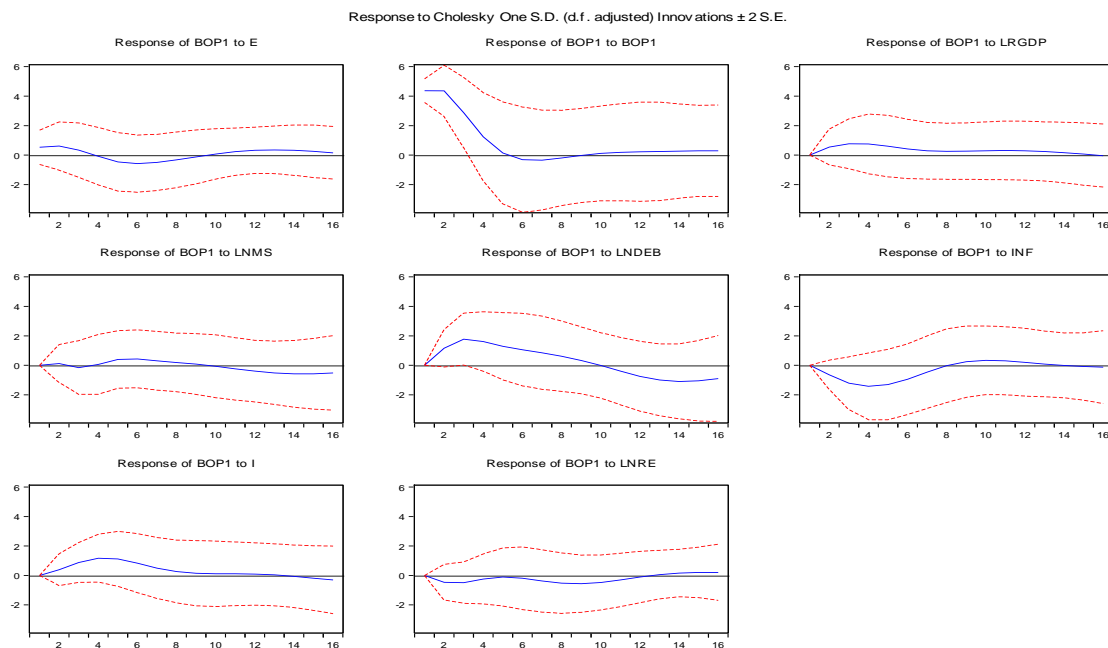
Shocks in inflation rate have a positive effect up to the seventh quarter, that the point where higher inflation leads to currency depreciation. A positive innovation to the foreign asset reserve has a positive impact up to the third quarter. This shock leads to increase the nominal exchange rate (to depreciate); however, after third quarter the positive innovations to the foreign asset reserve have a negative impact, that is, an accumulation of foreign asset leads to appreciating domestic currency because there is an excess supply of foreign currency. Finally, positive shocks in exchange rate itself affects highly.

### **The response of the balance of payment to shocks**

In this study the innovation of positive shocks on currency (devaluation) is negative but not long lasting. That is, the rejection of the null hypothesis of this paper; devaluation improves the balance of payment. It deteriorates the balance of payment as the time horizon increases. The effectiveness of devaluation to improve the balance of payment in developing country depends on the elasticities of exports and imports. Since, the elasticity is sufficiently low in Ethiopia; therefore devaluation is not being expected to lead to an improvement in the balance of payments. This finding also agrees with (Alemayehu 2004; and Dorosh et al 2009). 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 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 devaluation, the balance of trade appears worse before it improves after 10<sup>th</sup> quarter.

The response of the balance of payment to the shocks in output is positive. A positive shock in money supply does not affect up to third quarter but after third quarter it improves the balance of payment. A rise in external debt servicing led to improve the balance of payment, when a country wanted to pay foreign debt the domestic currency depreciated this intern attract foreign investor to invest, that is, an attraction of foreign direct investment (the inflow of capital). A positive shock in inflation innovations is consistent with the findings of Kibrom (2008), that is, the response of balance of payment is negative due to the erosion of country's competitive advantage. And foreign asset reserve has a negative impact; however, a positive shock in interest rate improves the balance of payment in the short run.



Source, own completion from Eviews 10

Figure 5. 2 The response of balance of payment to positive innovations

## **The response of real GDP (output) to shocks**

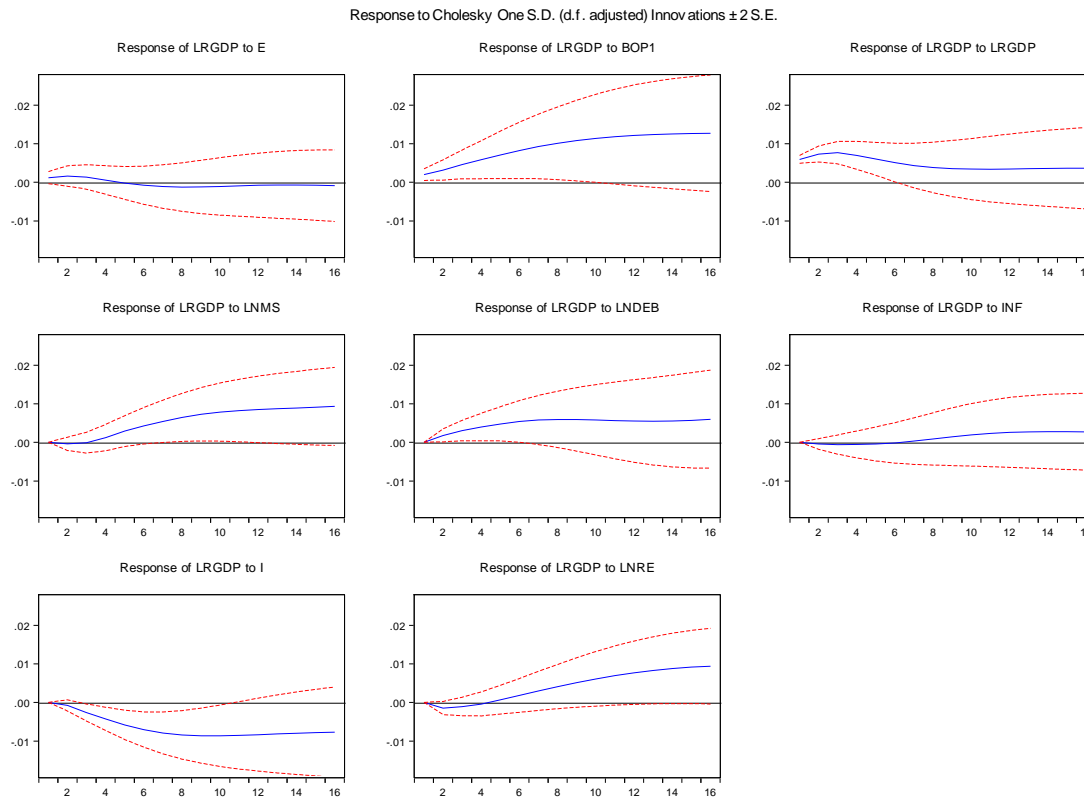
Figure 5.3 shows the contemporaneous response of output to the macroeconomic shocks. A positive innovation of nominal exchange rate caused a negative impact on output. This shows that a positive shock on exchange rate has contractionary effect on output. This finding coincides with Medina (2010), Tirsit (2011) and Yilkal (2012) result. This finding also led to accept the null hypothesis of devaluation is contractionary effect on output. The contemporaneous response of output to positive shocks in the balance of payment is positive. The balance of payment surplus improves the level of output. A positive innovation of money supply led to positive response of output. The response of output to a contemporaneous positive innovation in debt is a positive. According to Ramakrishna (2002) Ethiopian debt is progressively increasing from time to time and it has negative impact towards the economic growth. That is, his conclusion supports the debt overhang hypothesis for Ethiopia as the country is on the wrong side of the debt Laffer curve<sup>7</sup>. On the other hand, an increase in external debt servicing and debt forgiveness led to decreases external debt burden in the short time period. Therefore, a reduction in external debt burden has positive and significant effect on output growth in the long time horizon.

On the other hand, a rise in inflation has a significant negative impact on output up to the seventh quarter, which is consistent with Kibrom (2008) finding. And also this positive innovation in interest rate has an inverse effect on output. The finding supports the monetary theory. That is the negative relationship between output and interest rate. Initially, a positive shock in foreign asset reserve affects output negatively. However, after three quarters the effect is positive.

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<sup>7</sup> Debt Laffer curve is first introduced by Jeffrey Sachs (1989) and Paul Krugman (1989) in the context of debt overhanging. The curve illustrates a situation a country is borrowing too much, that it surpasses a certain endogenous threshold of level of debt, which may result in efficiency losses. Hence, excess debt burden and a country unable to invest part of their income because of servicing external debt burden. In this case debt forgiveness is advisable, which reduces the cost of creditors. (S. Bachvarova, 2008)

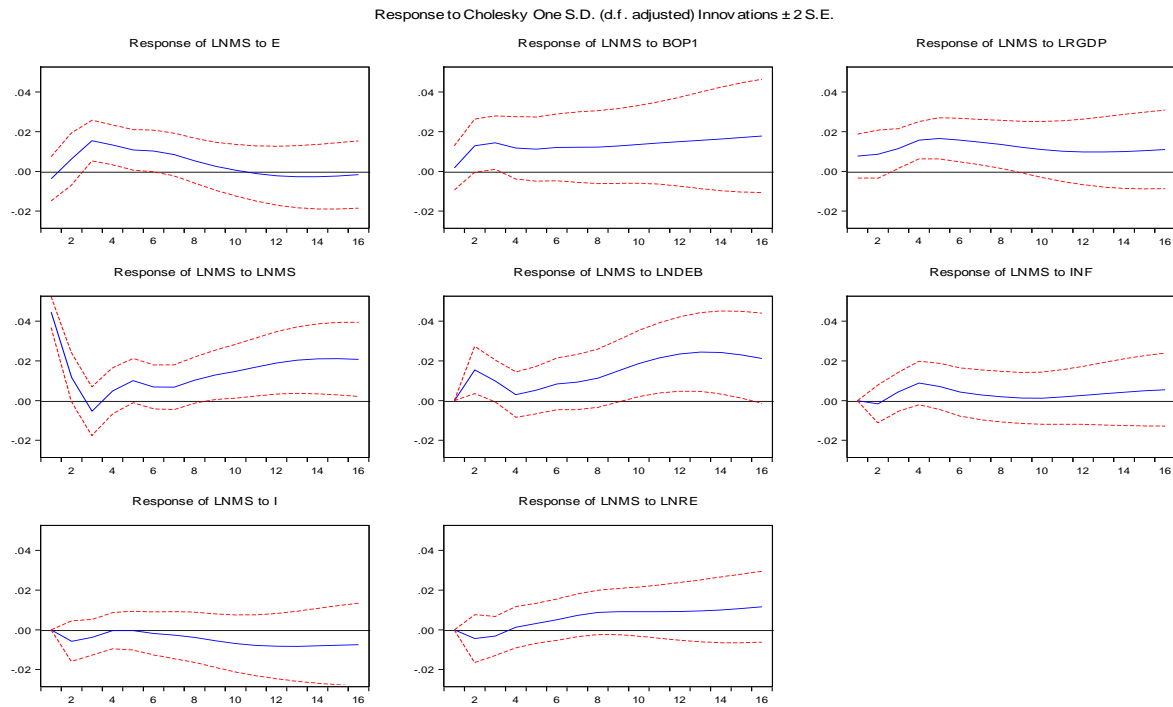
Figure 5. 3 The contemporaneous response of real GDP to shocks



### The response of money supply to shocks

Figure (5.4) below shows the response of money supply to the contemporaneous positive shock to innovations. The response of money supply ( $m_2$ ) to a positive innovation of nominal exchange rate is positive in the first three quarters. However, after third quarter the response is declines, though positive. A positive shock in the balance of payment led to increase money supply. That is, it shows the positive relationship between balance of payment and money supply. The response of money supply to the positive shocks in output is positive, that is, a positive shock to output led to rise in money supply. An increase in foreign debt servicing increases money supply. When a country's debt payment increase due to an increase of output (that is, economic development), the monetary authority devalues currency and reduce interest rate to attract investment. In this case, there is a direct effect on the money. A positive innovation on inflation has a significant effect to increase money supply. As economic theory dictates interest rate and money supply have inverse relationship.

Figure 5. 4 The response of money supply to appositive random innovation shocks



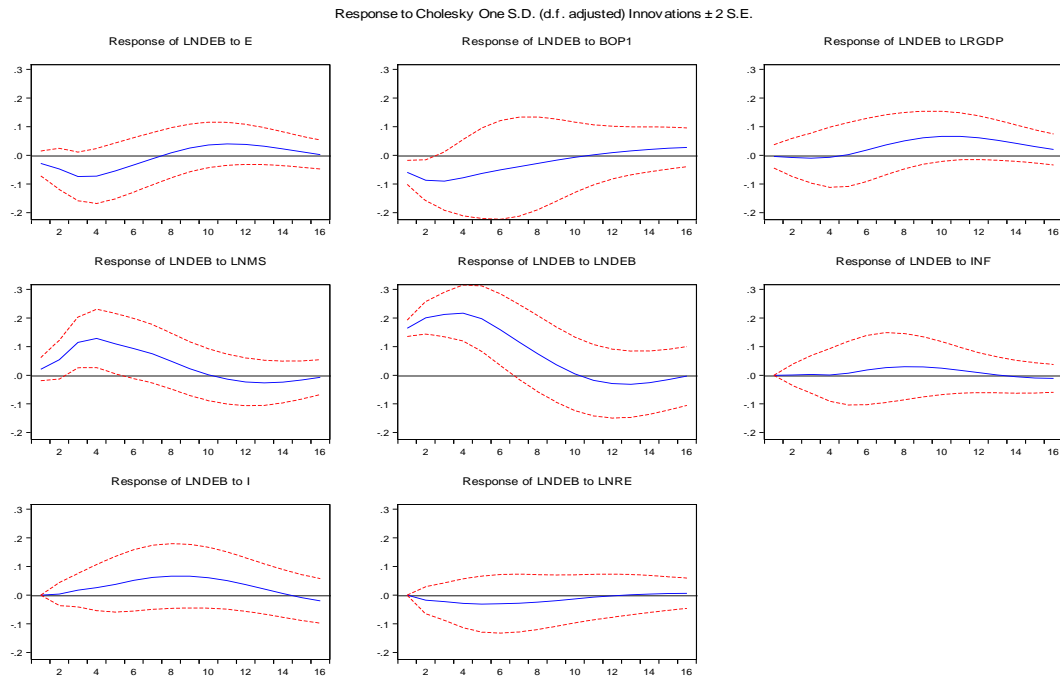
Source, own completion from Eviews 10

A positive shock in increase interest rate led to a fall money supply because an increase in interest rate led to a rise in saving and a decline in borrowing. A positive shock in foreign asset reserve results in a negatively respond by money supply in the first three quarters before it has positive effect.

### The response of debt to shocks

Figure (5.5) shows the response of external debt servicing to a positive innovations of a random shock. Devaluation reduces debt servicing which means the response of debt to a positive shock in nominal exchange rate is in the opposite direction in the first seven quarters. Because if the nations devalue its currency, the amount of debt increases in real terms whose payment is made in foreign currency (in dollar).

Figure 5. 5 The response of foreign debt servicing to a random innovation of a positive shock



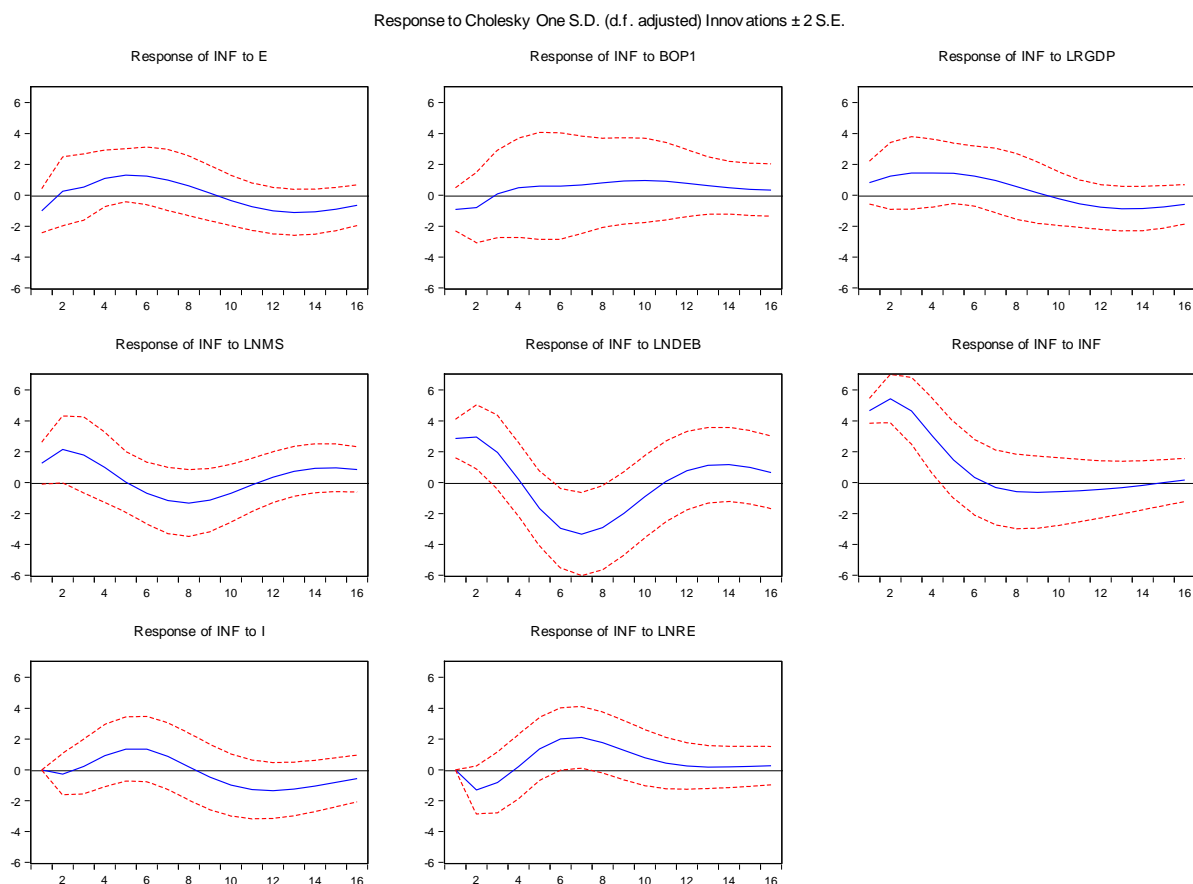
Source, own completion from Eviews 10

A positive innovation in the balance of payment led to fall external debt servicing. The positive random innovations on balance of payment mean the inflow of capital increases in a greater amount than the outflow of capital. These indicate an increase in foreign asset reserve; which reduce total debt of the country (because of no shortage of foreign currency). The reduction of external debt also indicates a reduction in external debt servicing.

A positive innovation in output led to a fall external debt servicing in the beginning, but the effect becomes positive in later periods. Debt servicing responds positively to a rise in money supply. The response of debt service to inflationary innovations is positive, but weak. The direction of debt response to positive random innovations of interest rate is positive and foreign asset reserve responds in the opposite.

## The response of inflation to shocks

Figure 5. 6 The response of inflation to a random innovation of a positive shock



Source, own completion from Eviews 10

Figure (5.6) shows the response of inflation to a positive shock in innovations of other variables in the system. An increase in the exchange (currency devaluation) highly increases inflation in the first four quarters, that is, devaluation exerts inflationary pressure in the economy. An improvement in the balance of payment leads to rising inflation. A positive random innovation of output led to increasing inflation but the response is low. This finding is similar to Tamirayehu (2015). A positive random shock in money supply led to increase in inflation. Because the excess money supply in the market led to increasing the demand for commodities and this in turn has positive effect on inflation. An increase in external debt servicing led to a decrease in inflation because external debt servicing slows money supply in the market. Inflation responds negatively to a positive random shock in innovation of interest rate. A policy measure

taken by a National Bank to increase foreign asset reserve in the market, that is, the reduction in money supply leads to reduce inflationary pressures.

### The response of interest rate

Figure (5.7) shows the responses of interest rate to positive shocks in innovations of other variables in the system. Initially, positive shocks on exchange rate have a positive effect, but it the effect declines after the second quarter. After the fourth or the fifth quarter, the effect of devaluation leads to a decline in interest rate. The balance of payment surplus made an influence on the domestic interest rate to decline. The responses to a positive innovation of output led to an increase in lending interest rate. The response of interest rate to money supply is negative. Initially, the response of interest rate to the positive shocks of external debt servicing is positive but declining. An increase in inflation leads to a decline in interest rate and the effects of foreign asset reserve initially increases interest rate but the interest rate declines few quarters later.

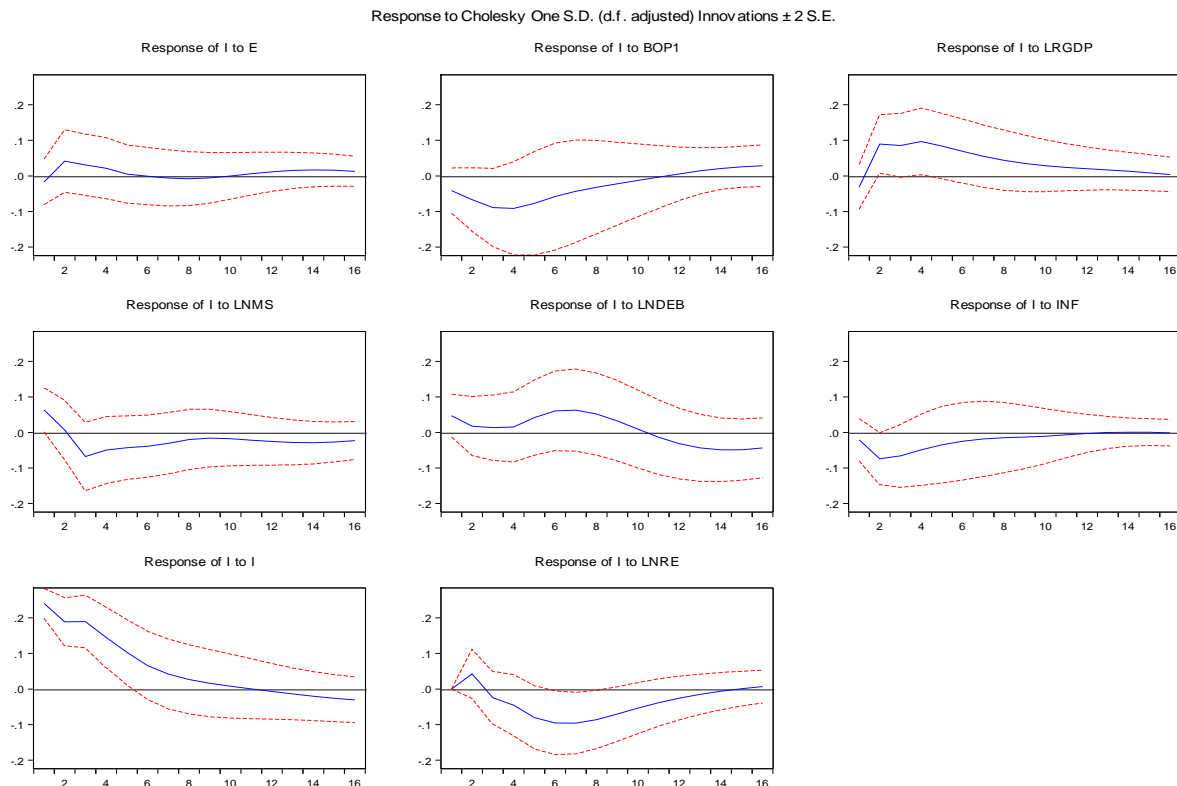


Figure 5. 7 The response of interest rate to positive random shocks

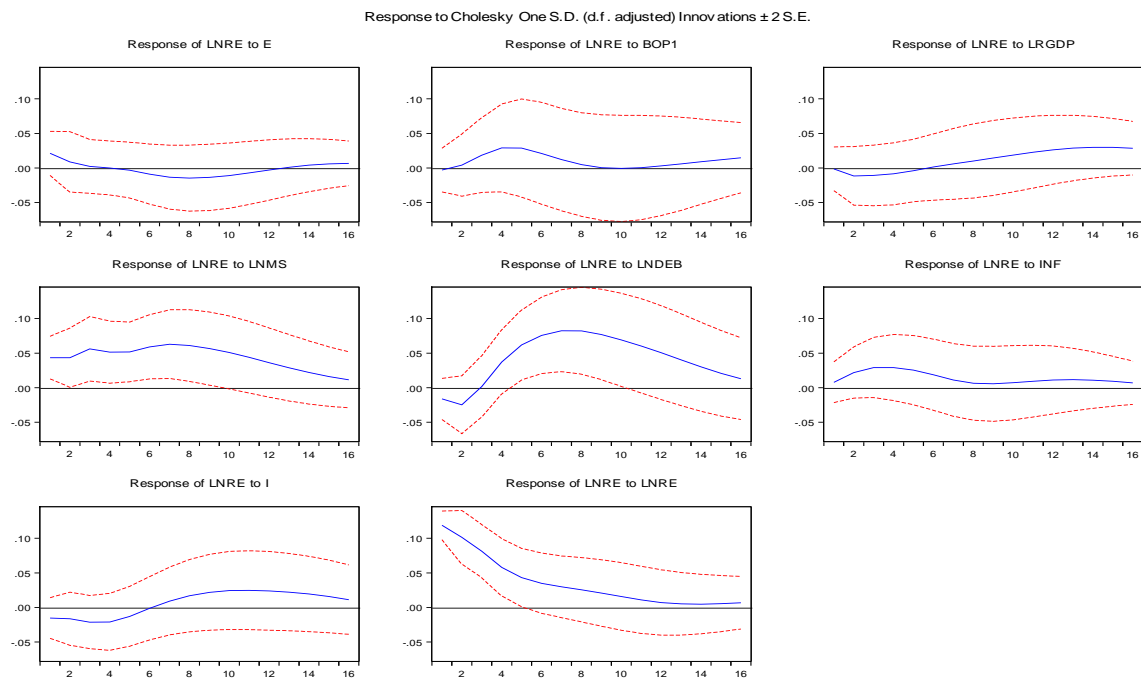
Source, own completion from Eviews 10

## The response of reserve

Devaluation of currency leads to a fall in foreign asset reserve. A positive random shock on the balance of payment improves the foreign asset reserve. At first the response of foreign asset reserve to the change in output is opposite but after a little time period it starts to increase. The linkage between the positive shocks of output and foreign asset reserve; that is, shocks that force output to rise leads foreign asset reserve to rise. The response of foreign asset reserve to the change in money supply is positive. In the first two quarters positive innovation in external debt servicing deteriorates the foreign asset reserve and soon after second quarter it improves the foreign asset reserve.

The relation between the positive shocks of inflation and foreign asset reserve is positive. That is, when inflationary pressure happens the central authority collects money to reduce inflation in this case reserve in banks increase. Initially, the response of reserve to the positive innovations of interest rate is negative and after few quarters adjustments it leads to rise. The positive innovations of its lag is highly affected the current performance foreign asset reserve.

Figure 5. 8 The response of reserve to shocks



Source, own completion from Eviews 10

#### 5.2.4. Variance Decomposition

Variance decomposition enables one to calculate the contribution (proportion) of the  $j^{th}$  orthogonalized innovation to the mean square of the S-periods-ahead forecast. In other words, the variance decomposition provides information about the relative importance of each orthogonalized random innovation in affecting the variation of the variables in each forecast error.

A table in appendix B4; presents the variance decomposition for period of sixteen quarters. According to the findings, for the first two years, variations in exchange rate are largely explained by its own shocks which accounts for more than 56 percent in the first year and 18 percent in the second year. During the same period, external debt servicing, real GDP, money supply, interest rate and the balance of payments are found to have pronouncing influence on exchange rate dynamics as well. However, the interests rate and foreign asset reserve does not have any significant influence on variation in the mean square error of the s-periods-ahead forecast.

As noted from the table the contribution (proportion) of the orthogonalized innovations of external debt servicing, inflation, interest rate, real GDP, exchange rate, foreign asset reserve and money supply to the mean square error of eight quarters-ahead forecast of balance of payments are 14.48, 8.87, 5.97, 2.83, 2.21, 1.3 and 0.68 (which are expressed in percent), respectively. However, a great variation in the balance of payment forecast error comes from its own shocks which accounts above 74 percent in the first year and 63 percent in the next year. Nevertheless the estimate shows that, unlike for other determinants, the magnitude of the balance of payment in response to its own shocks keeps diminishing with time. However, in comparison with the exchange rate, real GDP, interest rate, inflation rate, foreign asset reserve and money supply, variance of the forecast error shows that shocks in external debt servicing accounts for the highest percentage of the balance of payment fluctuations in Ethiopia. That is, shocks in foreign debt servicing contributed close to 19 percent of the balance of payment dynamics in the sixteenth quarter. Whereas within the whole forecast horizon, the variance decomposition results show that shocks on foreign asset reserve accounted the least in explaining variation in the counties' balance of payment.

The variance decomposition of real GDP reveals that changes in the changes in the balance of payment are the predominant source of variation in the rate of growth of output. The high explanatory power of the innovations in the balance of payment is sustained over the entire forecast horizon. As seen in appendix B4, the variation in the balance of payment (bop1) explains 21 percent of the forecast error variance for the change in the rate of growth of output in the first year. This percentage increases considerably to reach 35percent for the last forecasting horizons. The change in interest rate and money supply as a percentage of GDP represents the second and third source of variation in the real GDP (output) with a percentage of 18 percent and 15.5 percent in the last forecasting horizons respectively. Finally, the results also prove the ineffectiveness of devaluation in affecting real output since exchange rate accounts for a small percentage of the variation in the real output.

The variations in money supply is largely explained by its own innovations followed at by the variations in the balance of payment and real output during the first few quarters of the forecast horizon. However, variations in foreign debt service accounts for about 25 percent of variation in money supply by the end of the forecast horizon, i.e., after sixteen quarters

At the beginning of forecasting horizon a great variation comes from the variations of the balance of payment. However the variations in the balance of payments decline, while the variation in output, money supply and exchange rate rise when the forecasting horizon increases. But the variations in inflation are very small in explaining the variations of debt servicing. This is less than one percent in all other forecasting time horizons.

Large variations of inflation come from a shock to its own innovation followed by the shock to the innovation in the debt servicing at the beginning of the forecast horizon. But by the end of the forecast horizon the variations in inflation are mainly due to a shock to its own innovation followed by the variations in debt servicing, money supply, foreign asset reserve, output and exchange rate.

According to appendix B4, during the first few quarters of the forecast horizon the variation in interest rate forecast comes from the variability of output and the balance of payment. In the last quarter there an important variation on foreign asset reserves to explain the variations in interest

rates in the forecasting time horizon. However, most variations on interest rate are explained by the variations in itself.

As provided in appendix B4, in the first period of the forecast horizon the great variations in the foreign asset reserve comes from the variation in its own innovations followed by variations in money supply. By the end of the forecast horizon the variations in foreign debt servicing is the major source of the variation in the foreign asset reserve. The variations in money supply, output, interest rate, the balance of payment and exchange rate have an effect on the variation in foreign exchange reserve in the order of the magnitude of their effect.

### **5.3. Vector Error Correction Model Results and Analysis**

Testing for cointegration using Johansen co-integration test indicates the existence of the long run equilibrium relationship between variables in the model. According to Said (2013) SVAR model doesn't Vector Error Correction representation. The reduced form VAR can be used to write the model in the VEC representation form. The VECM adjusts the short run variations and deviation of variables from the long run equilibrium. As presented by Moriyama (2008) the VECM equation is specified as follows;

$$\Delta y = \phi(L)\Delta y_t + \lambda y_{t-1} + \varepsilon$$

Where  $\Delta y$  presents the change in the vector of variables in the system that includes exchange rate (e), balance of payment (bop1), real GDP ( $\ln rGDP$ ), money supply ( $\ln Ms$ ), debt servicing ( $\ln deb$ ), inflation rate (inf), interest rate (i) and foreign asset reserve ( $\ln re$ ). The coefficient matrices for lag operators L are represented by  $\phi(L)$  And the long run equilibrium relationship between variables in the model are captured by the matrix denoted by  $\lambda$ .

Before directly going to the discussion of impulse response and variance decomposition of in the VECM model and compare with SVAR; let's discuss the long run and short run dynamics for more elaboration in addition to the SVAR model.

#### **5.3.1. The long run model**

The Johansen cointegration test result indicates the existence of three cointegrating vectors in our model. If the variables found to have cointegration then we can estimate long-run equilibrium

relationships among the variables. Since, the objective of the study is to address the nexus between currency devaluation, the balance of payment and output; we are limited to consider the three cointegrating vectors as indicated by trace statistics and maximum Eigen value. The table below indicates that the long run estimation the cointegrated vectors in VECM model. From table (5.6) below, the first three by three matrixes shows an identity matrix, That comes due to the misspecification of the effect of temporary effects by assuming all shocks are permanent (Nguyen, 2014). For this reason, we tried to see other methodology which shows the full dynamic relationship of our model; in our case SVAR model. Even if, VECM model has its limitations it is important to show the speed of adjustment through normalised coefficients, to reach the long run equilibrium. Therefore, we start the long run analysis by constructing the long run equation of the cointegrated from of VECM estimation from the table.

The long run error correction models for the three cointegrated equations which are drawn from the table below, VECM estimation result is given as:

$$ECM_{1,t-1} = e_{t-1} + 61.26195 - 4.04787lnMs_{t-1} - 2.16882lndeb_{t-1} - 0.06298inf_{t-1} \\ - 1.85753i_{t-1} + 0.90099lnre_{t-1}$$

$$ECM2_{t-1} = bop1_{t-1} + 68.11549 - 6.46613lnMs_{t-1} + 5.279072lndeb_{t-1} \\ + 0.415204inf_{t-1} - 12.7027i_{t-1} - 10.24802lnre_t$$

$$ECM_{3,t-1} = rGDP_{t-1} - 8.09191 - 0.58273lnMs_{t-1} + 0.072666lndeb_{t-1} + 0.003377inf_{t-1} \\ + 0.094627i_{t-1} - 0.026lnre_{t-1}$$

In the long run the error correction term is assumed to be zero and rewritten as:

$$e_{t-1} = -61.26195 + 4.04787lnMs_{t-1} + 2.16882lndeb_{t-1} + 0.06298inf_{t-1} \\ + 1.85753i_{t-1} - 0.90099lnre_{t-1}$$

$$bop1_{t-1} = -68.11549 + 6.46613lnMs_{t-1} - 5.279072lndeb_{t-1} - 0.415204inf_{t-1} \\ + 12.7027i_{t-1} + 10.24802lnre_t$$

$$rGDP_{t-1} = 8.09191 + 0.58273lnMs_{t-1} - 0.072666lndeb_{t-1} - 0.003377inf_{t-1} \\ - 0.094627i_{t-1} + 0.026lnre_{t-1}$$

Table 5. 6 long run relationship of cointegrated vectors

Vector Error Correction Estimates

Date: 06/09/18 Time: 11:15

Sample (adjusted): 3 68

Included observations: 66 after adjustments

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	CointEq2	CointEq3
E(-1)	1.000000	0.000000	0.000000
BOP1(-1)	0.000000	1.000000	0.000000
LRGDP(-1)	0.000000	0.000000	1.000000
LNMS(-1)	-4.047865 (0.76749) [-5.27416]	-6.466133 (5.21584) [-1.23971]	-0.582734 (0.04077) [-14.2940]
LNDEB(-1)	-2.168815 (0.38087) [-5.69438]	5.279072 (2.58838) [ 2.03953]	0.072666 (0.02023) [ 3.59181]
INF(-1)	-0.062979 (0.01531) [-4.11343]	0.415204 (0.10405) [ 3.99041]	0.003337 (0.00081) [ 4.10289]
I(-1)	-1.857532 (0.46627) [-3.98380]	-12.70270 (3.16877) [-4.00872]	0.094627 (0.02477) [ 3.82061]
LNRE(-1)	0.900990 (0.67478) [ 1.33524]	10.24802 (4.58576) [ 2.23475]	-0.025997 (0.03584) [-0.72530]
C	61.26195	68.11549	-8.091910

*Source, own completion from Eviews 10*

This econometric result indicates that money supply was significant as a factor that explains the exchange rate (nominal) in the long run. This is based on the fact on the negative t-statistic value of -5.27416 which implies that the variable is significant in explaining the dependent variable. A one percent change in money supply in the long run led to increase nominal exchange rate by 4.04787 percent. That is, in the long run an increase in money supply has devolutionary effect on exchange rate. External debt servicing is significantly explaining the long run exchange rate equation. That is, a change in external debt servicing by one percent leads to nominal exchange rate devalue by 2.16882 percent. In the long ran the effect of inflation on nominal exchange rate

is positive and significant. However, in the long run nominal exchange rate is negatively affected by interest rate. Even if, it was insignificant the effect of foreign asset reserve on the long run is negative. This relationship shows an accumulation of foreign asset in the long run leads to appreciate nominal exchange rate.

The balance of payment model can be explained positively by money supply. However, its effect is insignificant. In the long run external debt servicing affects the balance of payment negatively. That means an increase in external debt servicing by one percent led to decrease the balance of payment by 5.279072 billion Birr in the long run. Inflation and foreign asset reserve explains the balance of payment model in the long run and they have a negative relationship. A one percent increase in inflation and foreign asset reserve led to decrease the balance of payment by 0.415204 and 10.24802 respectively billion Birr. However, an increase in the interest rate leads to the balance of payment surplus in the long run; which means a one percent increase in the interest rate led to increase the balance of payment by 12.7027 billion Birr.

All the variables which are expected to explain the percentage change in real GDP [lrgdp] were to be found significant as expected except the foreign asset reserve. The long-run impact of money supply on output is found to positive and significant, which means that a one percent increase in money supply leads to output increase by 0.58273 percent in the long-run. In the long run external debt servicing has a negative impact on output. Inflationary pressure in the long run has negative impact on output. In other words, an increase in inflation by one percent led to decrease output by 0.003377 percent.

In the long run, the impact of interest rate on output is negative. That means a one percent increase in interest rate led to decrease output by 0.094627 percent. Hence, an increase interest rate in the long run led to increase saving; which makes investment to decrease. Thus, the decrease in investment leads to decrease output in the long run. Even though, foreign asset reserve is statistically insignificant, it has a positive relationship with output in the long run.

### 5.3.2. The Short Run Dynamics for Vector Error Correction Model

The short run relationship between the exchange rate, the balance of payment and output can be shown by the Vector error correction model. From the estimation result, it can be inferred that the adjustment coefficients of the error correction term to reach the long run equilibrium. Error correction term which measures the speed of adjustments towards equilibrium should have negative sign for convergence of the three cointegrating equations. From results it can be seen that error correction term is significant and has right sign (negative sign). This indicates convergence towards equilibrium level.

Table 5. 7 The Short run relationships of cointegrated variables under VECM model

Error Correction:	D(E)	D(BOP1)	D(LRGDP)	D(LNMS)	D(LNDEB)	D(INF)	D(I)	D(LNRE)
CointEq1	-0.120841 -0.04529 [- 2.66798]	-0.065544 -0.93644 [- 0.06999]	0.000798 -0.00132 [ 0.60291]	0.060244 -0.00907 [ 6.64224]	-0.114542 -0.03802 [-3.01269]	0.672933 -1.23695 [ 0.54403]	0.0907 -0.05621 [ 1.61345]	-0.057531 -0.0283 [- 2.03290]
CointEq2	-0.000204 -0.00331 [- 0.06183]	-0.179866 -0.06833 [- 2.63217]	0.000368 -9.70E-05 [ 3.81552]	0.00127 -0.00066 [ 1.91867]	-0.000792 -0.00277 [-0.28557]	-0.171835 -0.09026 [- 1.90373]	-0.009956 -0.0041 [- 2.42693]	0.000944 -0.00207 [ 0.45699]
CointEq3	0.275809 -0.91158 [ 0.30256]	2.413898 -18.847 [ 0.12808]	-0.011063 -0.02663 [-0.41540]	1.204386 -0.18254 [ 6.59792]	-2.205002 -0.7652 [-2.88162]	-13.02236 -24.8951 [- 0.52309]	1.946296 -1.13139 [ 1.72026]	-0.60458 -0.56957 [- 1.06146]
D(E(-1))	-0.144798 -0.13497 [- 1.07278]	1.077206 -2.79061 [ 0.38601]	0.003622 -0.00394 [ 0.91839]	-0.031818 -0.02703 [- 1.17722]	0.104097 -0.1133 [ 0.91877]	9.915695 -3.68612 [ 2.69001]	-0.114205 -0.16752 [- 0.68173]	-0.007862 -0.08433 [- 0.09322]
D(BOP1(-1))	0.000256 -0.00597 [ 0.04284]	0.14678 -0.12348 [ 1.18865]	-3.33E-05 -0.00017 [-0.19092]	0.00166 -0.0012 [ 1.38796]	-0.003098 -0.00501 [-0.61791]	0.094757 -0.16311 [ 0.58094]	-0.005277 -0.00741 [- 0.71189]	-0.000671 -0.00373 [- 0.17993]
D(LRGDP(-1))	12.14539 -4.05902 [ 2.99220]	131.5583 -83.921 [ 1.56764]	0.345354 -0.11859 [ 2.91214]	-0.103681 -0.81281 [- 0.12756]	-0.359947 -3.40722 [-0.10564]	9.444828 -110.851 [ 0.08520]	23.05388 -5.0378 [ 4.57618]	-1.734214 -2.53616 [- 0.68380]

D(LNMS(-1))	-1.023561	5.473686	-0.000251	0.276733	-0.799025	21.97087	0.528307	-0.492222
	-0.59542	-12.3105	-0.0174	-0.11923	-0.49981	-16.2609	-0.739	-0.37203
	[-1.71905]	[0.44464]	[-0.01444]	[2.32097]	[-1.59866]	[1.35114]	[0.71489]	[-1.32306]
D(LNDEB(-1))	-0.588187	8.295177	0.011532	0.147606	0.198812	-2.607434	0.433268	-0.246021
	-0.2064	-4.26729	-0.00603	-0.04133	-0.17325	-5.63667	-0.25617	-0.12896
	[-2.84979]	[1.94390]	[1.91242]	[3.57138]	[1.14752]	[-0.46258]	[1.69135]	[-1.90772]
D(INF(-1))	0.005539	-0.107869	-0.000137	-0.001262	0.003094	0.494778	-0.013241	3.65E-05
	-0.00418	-0.08639	-0.00012	-0.00084	-0.00351	-0.11411	-0.00519	-0.00261
	[1.32570]	[-1.24866]	[-1.12578]	[-1.50843]	[0.88214]	[4.33600]	[-2.55321]	[0.01398]
D(I(-1))	-0.110912	-1.195952	0.004667	-0.006611	-0.029819	-2.073602	-0.224389	-0.02056
	-0.10812	-2.2353	-0.00316	-0.02165	-0.09075	-2.95261	-0.13419	-0.06755
	[-1.02587]	[-0.53503]	[1.47747]	[-0.30536]	[-0.32857]	[-0.70229]	[-1.67223]	[-0.30436]
D(LNRE(-1))	0.362832	-6.326932	-0.018808	-0.073217	-0.22661	-12.11187	0.553331	0.079668
	-0.2224	-4.59822	-0.0065	-0.04454	-0.18669	-6.0738	-0.27603	-0.13896
	[1.63142]	[-1.37595]	[-2.89449]	[-1.64402]	[-1.21384]	[-1.99412]	[2.00459]	[0.57331]
C	0.039606	-3.145905	0.014116	0.037696	0.064612	-2.498644	-0.532377	0.117065
	-0.09782	-2.0225	-0.00286	-0.01959	-0.08211	-2.67153	-0.12141	-0.06112
	[0.40488]	[-1.55545]	[4.93909]	[1.92439]	[0.78685]	[-0.93529]	[-4.38490]	[1.91528]
R-squared	0.610856	0.310171	0.712557	0.550797	0.401352	0.480965	0.389551	0.19307
Adj. R-squared	0.531586	0.16965	0.654003	0.459293	0.279405	0.375236	0.2652	0.028695

The normalized adjustment coefficient for exchange rate equation is -0.120841, which is significant. In the short run the relation between the balance of payment and exchange rate positive which the same direction in the long run relation but it is insignificant. The impact of output in the short run is positively and significantly on exchange rate. That is, a one percent increase in real GDP led to increase exchange rate by 12.14539 percent. In the short run an increment in output encourages the nation to devalue its currency.

As explained by table (5.7) the estimated result the external debt servicing affects the exchange rate negatively in the short run. The result indicates a one percent change in external debt servicing led to decrease the nominal exchange rate by -0.588187 percent. Variables such as the balance of payment, inflation, interest rate and foreign reserve are insignificant in explaining the short run exchange rate dynamics.

In the short run the balance of payment is independent from explanatory variables. In other words, all variables in the model are insignificant in explaining the balance of payment variation in the short run. However, the adjustment coefficient of the error correction term is negative and statistically significant.

In the short run real GDP significantly affected by foreign exchange rate reserve. The estimated result from the short run model indicates that a one percent change in foreign exchange rate reserve led to a decrease in real GDP by -0.018808 percent. However, in the short run other variables including the exchange rate and balance of payment in our model have insignificant effect.

### **5.3.3. Impulse response function and variance decomposition for VECM**

The impulse response functions and the respective variance decomposition function of the vector error correction model indicated in appendix C1 and C2; to compare with the structural VAR model. The response of exchange rate to the contemporaneous shocks in the balance of payment and foreign asset reserve is negative relationship. That is the response of exchange rate in the positive innovation shocks in the SVAR and VECM models are the same. A positive shock on output has positive impact on exchange rate; which coincides with the findings of the SVAR model in this paper. In general, the response of exchange rate to a positive shock in Money supply, debt servicing, inflation rate and interest rate is positive. That is, the finding in VECM model is the same as the finding in SVAR model.

The contemporaneous effect of positive shocks in exchange rate, foreign asset reserve and inflation led to a negative response by the balance of payment. And the response of balance of payment to the positive shocks in output, money supply, external debt servicing and interest rate is positive. The results in the VECM model support the results of SVAR model.

The response of output to positive shocks of exchange rate is positive in VECM model. However, the response of output in SVAR model is negative (contractionary). VECM model contradicts SVAR model. In VECM model the response of output to the shocks in the balance of payment, foreign debt servicing and inflation is positive. This result supports the outcome in the SVAR model. The findings in VECM model opposes the findings of SVAR model in the shocks of foreign asset reserve which output responds.

When we see the variance decomposition of the VECM model<sup>8</sup>, in the exchange rate equation a great variation is comes from the variation itself, about above 56 percent of variation in the first year (first four quarters). The contributions of foreign debt servicing and real GDP can explain second and third, that is, 15.77903 percent and 10.25369 percent respectively. And in the long period in our case 16<sup>th</sup> quarter the influence of balance of payment variation increases on the exchange rate variation. These shows in the long run the balance of payment have significant impact on exchange rate variation.

In the first four quarter the variation of balance of payment comes by the variations of debt servicing and the general inflation rate. However, the great variation comes from the variations of itself (above 64percent). The smallest contribution for the variation of balance of payment is money supply.

The variance decomposition estimated by VECM framework suggests that the real GDP fluctuation in Ethiopia is mostly explained by its own shocks. However, even though its own shock still accounting for more than 52 percent of the variation, unlike in the SVAR model, the balance of payment showed to dominate the second and third with more than 20.46991 and 9.467776 percent respectively. While real money supply appears to have the least contribution on real GDP variations about 0.168592. Even though there are some similarities of the outcome provided by the two estimated models, the accuracy of their outcomes was not expected to be exactly the same.

Generally, the difference of the results produced under VECM from SVAR model could be explained by the unrestricted nature of VECM analysis, whereas the model does not control the economic dynamics of the shocks. Due to that, VECM does not completely trace out the

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<sup>8</sup> See appendix C2

direction of shocks (which shock affects which shock) that may tend to produce misleading results. Hence the paper relies more on results under SVAR model since it controls for dynamic structure of time series data.

## **5.4. Transmission channel**

This section deals with the last research question: ‘What are the implications for monetary policy in Ethiopia?’ A discussion about different channels of monetary transmission mechanism will be presented with some information about the structure of Ethiopian economy and monetary policy.

### **5.4.1. Channels of monetary transmission mechanism:**

The empirical results showed that exchange rate channel played an important role in monetary transmission mechanism. This is not a surprising finding. As discussed in the above, recursively identified restrictions on all macroeconomic variables in the model play a great role.

This exchange rate channel links the economy through the effect of the balance of payment, output, money supply, interest rate, and debt servicing. In the exchange rate channel output and foreign debt servicing have dominant role in determining exchange rate. It is also one of the most important policy variables, which determines the trade flows, capital flows, inflation, international reserve and remittance of an economy. The beginning of floating exchange rates has directed renewed attention to the effects of devaluation on the trade balance of both developed and less developed countries (B.Oskooee & Alse, 1994). Therefore, it is important for the central bank to control the exchange rate variation.

The balance of payment channel only had an insignificant role. Although an immature financial market reduces the effectiveness of the interest rate channel to transmit effects of monetary policy (Camen, 2006), it was likely that the central bank not focus on and use interest rate policy as a primary component of monetary policy from 2000 to 2017. Monetary policy factors like the balance of payment, money supply, inflation and interest rate had a larger impact on output dynamics. Especially, these monetary factors were found to have a significant impact on output level as shown in the impulse response and variance decomposition results. The possibility that

money supply could be the source of inflation after and the presence of price puzzle<sup>9</sup> can suggest the limited ability of central bank to use monetary policy to control inflation.

The external debt channel is largely explained by the balance of payment and exchange rate variations. Devaluation increases external debt burden. Most of the time external debt is denominated in dollar. When countries have huge external debt and devalue its currency the debt burden increases in terms of domestic currency. Thus, devaluation has contractionary effect on output for countries with external debt and denominated in foreign currency such as the USD. Managing external debt burden is important by setting appropriate policy on exchange rate and the balance of payment.

In the foreign asset reserve channel, devaluation reduces foreign asset reserve. Hence, devaluation increases interest rate; an increment in interest rate reduces the money supply and cause stock prices to fall. This situation limits the ability of firms to finance their activities as the cost of capital increases due to rise in interest rate and rise in the cost of equity from issuing stocks. Consequently, a reduction in investment is likely to occur and cause output to fall. This result supports the finding of Thi Nhat, (2017).

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<sup>9</sup> An increase in price should lead to a decrease in inflation, but is found to be followed by an increase (Sims, 1992).

## **Chapter six**

### **Conclusion and Recommendation**

#### **6.1. Conclusion**

This study aimed at examining theoretically and empirically the nexus between currency devaluation, the balance of payment and output dynamics in Ethiopia. The analysis was made using impulse response function by adopting different econometric models. The main model being Structural Vector auto-regression (SVAR) and the other is Vector Error correction model (VECM). The models were estimated using quarterly data for the period ranging between 2000/2001Q1 to 2016/17Q4 on exchange rate (e), the balance of payment (bop), output (rgdp), money supply (Ms), external debt servicing (deb), inflation (inf), interest rate (i) and foreign asset reserve (re) were used and estimated.

The short run and long run relationship between devaluation, the balance of payment and output as well as the direction of causality have been analysed through Johnson co-integration analysis, the vector error correction model and Granger causality. There are three co-integrating equations, which indicate the existence of long run relationship. The Recursive identification scheme based on Cholesky decomposition is employed in the SVAR model to verify the result.

The response of exchange rate to a random positive impulse on the innovations of output, money supply, interest rate, external debt servicing and inflation is positive. This positive shock indicates that any policy change to raise output, money supply, interest rate, external debt servicing or inflationary situation made a pressure a country to devalue their currency. On the other hand, any positive shock on the balance of payment and foreign exchange reserve led to appreciate the nominal currency. Here, negative relationship shows that when a nation has balance of payment surplus and excess foreign exchange reserve; in the short run exchange rate appreciates. However, balances of payment surplus and excess exchange rate reserve do not continue to the long run. In the long run, to continue the surplus conditions of the balance of payment and excess exchange rate reserve the country forced to devalue its currency.

The estimation result indicated in the VECM model; in the long run exchange rate is positively affected by, money supply, external debt servicing, inflation rate and interest rate; which are statistically significant. However, foreign asset reserve is statistically insignificant; it has negative effect on the exchange rate.

Given the findings of this paper exchange rate is more sensitive to shocks of output in the short time period and in the long time period it is sensitive to the change in external debt service. Moreover, the great variation of exchange rate comes from the variations of itself.

A positive innovation on the nominal exchange rate deteriorates the balance of payment in the short time period and in the long run the deterioration decreases, and the response becomes positive. However, the short run estimated result in the VECM for the balance of the payment equation indicates that the effects of exchange rate and output including money supply, inflation, interest rate and foreign asset reserves are insignificant.

In the short run real GDP significantly affected by nominal exchange rate. The estimated result indicates that, in the short run devaluation has contractionary effect on output. However, in the short run other variables including the balance of payment in our model have insignificant effect.

In the long run balance of payment, money supply, interest rate and inflation affects output negatively.

From the variance decomposition representation of output equation, real GDP is highly sensitive to any variation in the balance of payment. From this we conclude that a great variation in real GDP emanates from the balance of payment variation and the variation in exchange rate comes from real GDP. This designates in the long run the balance of payment affects exchange rate through real output. Therefore there is a linkage between exchange rate, the balance of payment and output.

In general, we conclude that devaluation has contractionary effect. This contractionary effect of devaluation comes in different ways. First, devaluation increases money supply, a rise in money supply has inflationary pressure on market prices and this intern forces output to decline. Second, devaluation increases interest rate and an increase in interest rate forces output to decline. Third, devaluation reduces foreign asset reserve, a reduction in foreign asset reserve leads to a fall in

the balance of payment. A reduction in the balance of payment led to a decrease in output. Finally, devaluation increases external debt burden.

## **6.2. Policy implications**

This study has the following useful implication for policy and future researches in the area of dynamic effects of monetary policy shock on macroeconomic variables in Ethiopian economy.

Given the empirical findings, the study stresses the dynamic relationship between exchange rate, the balance of payment and output, and other monetary policies. The policy implication of the study is that before devaluating its currency the government should consider a policy that encourages productivity, diversification of the export sectors and expansion of import substituting industries which are alternative policies for devaluation. Moreover, the country on the process of industrialization, first it needs to encourage import substituting industries; then focused in to export oriented industries. Thus, devaluation will be effective. Even if, devaluation is taken place the National Bank should control the growth of money supply that comes due to devaluation in order to create an appropriate equilibrium that is in line with the price stability and economic growth.

The National Bank should revise policies that aims devaluation of currency is more appropriate for the development of the Ethiopian economy. For instance, the result shows a clear impact of devaluation on the balance of payment, money supply, inflation, external debt and foreign asset reserve. Given this, measures of controlling devolutionary pressure would be a great help in alleviating inflationary pressures in Ethiopia. Unless controlling devolutionary situations, the growths of the country will not long lasting.

Lastly, the outcomes and policy implications of this study are conditional on the included variables in the study, time span of the data and the underlying conditions of the model used for the estimations. This is so, given the exclusion of some relevant determinants and the relative short data sample used in the regression due to lack of quarterly data. Second this paper did not analyse in depth the effectiveness of monetary policy rather specifying the magnitude of the response of the balance of payment, output to devaluation and other macroeconomic variables; and transmission channels. Thus further studies could be taken in that direction by using different methodology like DSGE models.

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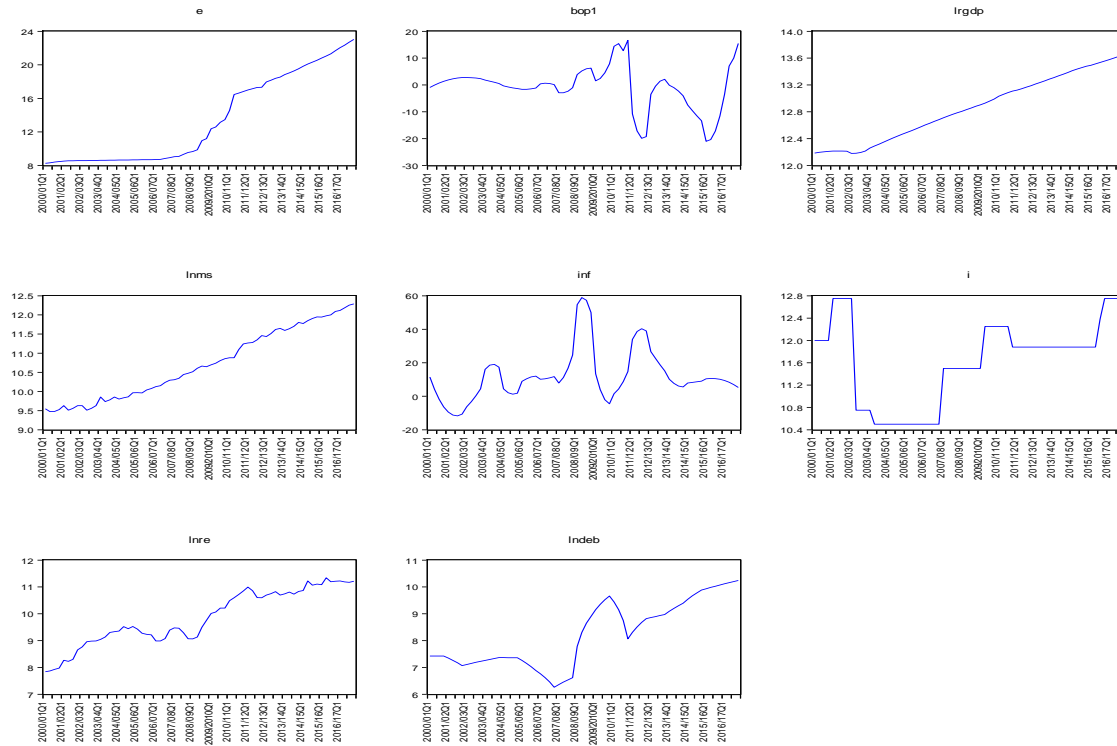
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# Appendices

## Appendix. A

### A1. Testing of unit root test by Plotting at level



### A2. Lag exclusion Wald test

VAR Lag Exclusion Wald Tests

Date: 05/24/18 Time: 15:46

Sample: 1 68

Included observations: 66

Chi-squared test statistics for lag exclusion:

Numbers in [ ] are p-values

	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE	Joint
Lag 1	47.3531 [ 0.0000]	73.6229 [ 0.0000]	133.3271 [ 0.0000]	26.78937 [ 0.0008]	101.8623 [ 0.0000]	117.9949 [ 0.0000]	67.36762 [ 0.0000]	44.8173 [ 0.0000]	669.1578 [ 0.0000]
Lag 2	16.81138 [ 0.0321]	13.36756 [ 0.0998]	22.00188 [ 0.0049]	16.51583 [ 0.0356]	12.28355 [ 0.1390]	30.74074 [ 0.0002]	25.91387 [ 0.0011]	5.212992 [ 0.7346]	173.6503 [ 0.0000]
df	8	8	8	8	8	8	8	8	64

### A3. VAR Residual Serial correlation LM test

VAR Residual Serial Correlation LM Tests

Date: 05/25/18 Time: 00:07

Sample: 1 68

Included observations: 66

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	81.00049	64	0.0743	1.312029	(64, 202.6)	0.0805
2	74.12509	64	0.1814	1.182161	(64, 202.6)	0.1921
3	75.44393	64	0.1551	1.206777	(64, 202.6)	0.1648

### A4. Residual test by plotting after first difference



## Appendix B.

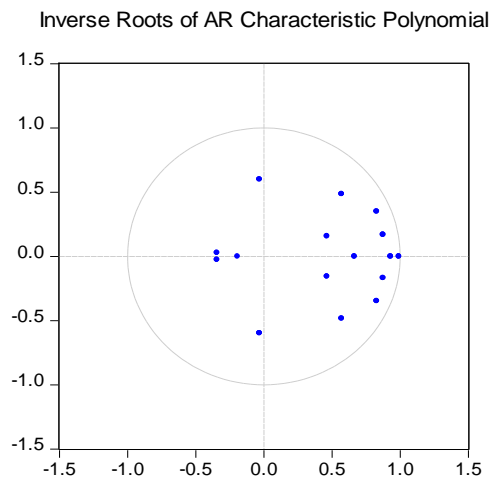
### B1. VAR Stability test

AR table for stability condition

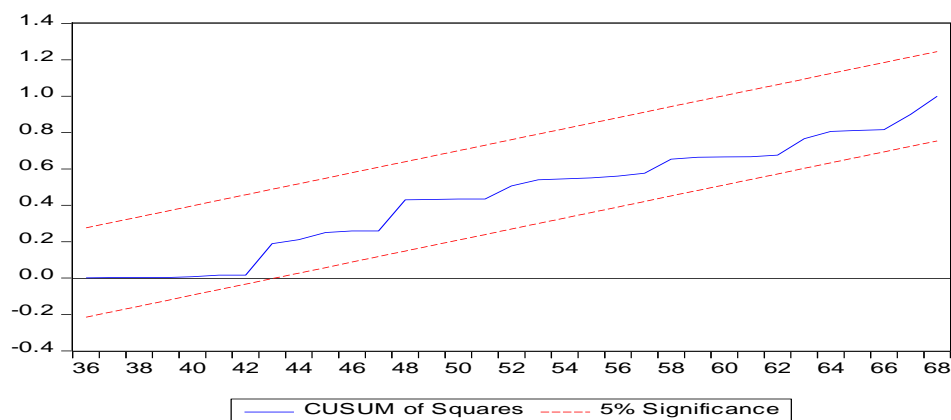
Roots of Characteristic Polynomial  
Endogenous variables: LNRE E LNDEB I  
LNMS INF BOP1 LRGDP  
Exogenous variables: C  
Lag specification: 1 2  
Date: 06/03/18 Time: 11:34

Root	Modulus
0.992238	0.992238
0.930758	0.930758
0.827511 - 0.348721i	0.897987
0.827511 + 0.348721i	0.897987
0.875259 - 0.168435i	0.891319
0.875259 + 0.168435i	0.891319
0.570430 - 0.484589i	0.748476
0.570430 + 0.484589i	0.748476
0.665525	0.665525
-0.032135 - 0.598214i	0.599076
-0.032135 + 0.598214i	0.599076
0.463723 - 0.157022i	0.489587
0.463723 + 0.157022i	0.489587
-0.342650 - 0.027633i	0.343763
-0.342650 + 0.027633i	0.343763
-0.192318	0.192318

No root lies outside the unit circle.  
VAR satisfies the stability condition.



## Cusum square test



## B2: Alpha and beta coefficients of Johansen cointegration test

Unrestricted Cointegrating Coefficients (normalized by  $b'S_{11}b=I$ ):

LNRE	E	LNDEB	I	LNMS	INF	BOP1	LRGDP
0.931602	1.578262	-1.57711	-0.80215	-20.6887	-0.01222	0.014005	24.38427
0.749516	-0.38364	-0.19052	-1.79545	11.90859	-0.01241	0.060094	-18.4377
-1.02309	-0.33834	-0.79215	0.680558	9.870453	-0.06676	-0.10416	-13.4322
-3.07319	0.886313	-0.19627	-1.01222	-3.88088	0.052079	-0.01673	4.544644
1.797845	0.052974	-1.68981	1.261045	-0.27034	0.03062	-0.05209	-0.63519
-0.37401	-0.38095	1.434838	-1.32014	-1.05195	-0.01288	-0.1147	5.260637
1.578216	0.180267	0.506949	0.826983	0.794657	0.031429	-0.06513	-9.68075
0.871398	-0.41324	0.277196	0.466184	-4.10389	0.024937	-0.06257	7.507453

Unrestricted Adjustment Coefficients (alpha):

D(LNRE)	-0.04309	-0.00942	-0.02029	0.023187	-0.04766	-0.01451	-0.00572	0.004396
D(E)	-0.12272	-0.11735	-0.08224	-0.06188	-0.02058	0.022131	-0.0056	-0.00028
D(LNDEB)	-0.06335	0.025678	0.013903	0.011286	0.057627	-0.0162	-0.03293	0.002304
D(I)	0.049956	-0.08028	0.055981	0.087869	0.005459	0.030046	-0.04923	-0.00453
D(LNMS)	0.032037	-0.01212	-0.01487	0.005351	-0.00027	-0.00242	-0.00451	0.001874
D(INF)	0.995583	0.50948	2.077498	-1.72878	0.246436	-0.70484	-1.11709	0.107995
D(BOP1)	-0.0458	-1.0174	1.133672	-0.21519	-0.18203	0.708024	0.635652	0.238801
D(LRGDP)	0.000867	0.002984	-0.0017	-0.0015	-0.00065	0.001261	-0.00027	0.000182

### B3: Variance decomposition in the Structural VAR model.

#### Variance Decomposition of E:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	0.218445	100	0	0	0	0	0	0	0
2	0.283366	88.75284	0.523178	4.429799	0.069377	0.013587	3.854112	0.85654	1.500569
3	0.350345	73.63778	0.414986	6.909403	3.924434	5.582131	4.781604	3.767516	0.982151
4	0.42519	56.82134	0.570197	9.287138	5.584532	17.66922	3.910334	5.490048	0.667196
5	0.509449	42.37959	1.206878	9.907767	6.628134	29.31675	2.855255	7.212536	0.493087
6	0.60134	31.22858	1.987714	9.98611	8.430018	37.66172	2.062733	8.268747	0.374384
7	0.697317	23.40523	2.55662	9.692921	10.0963	43.65728	1.533995	8.720676	0.336974
8	0.790547	18.24853	2.809769	9.463761	11.21659	47.89614	1.193625	8.801605	0.369975
9	0.876638	14.84997	2.834637	9.447411	11.9931	50.66237	0.978806	8.776003	0.457712
10	0.953137	12.56856	2.719706	9.692541	12.57391	52.27459	0.859626	8.744483	0.566583
11	1.018292	11.02549	2.53711	10.19568	12.96199	53.05167	0.812787	8.749225	0.66606
12	1.071471	9.990979	2.341901	10.9359	13.18084	53.21038	0.814944	8.793172	0.731876
13	1.113477	9.312667	2.172593	11.86702	13.27756	52.92161	0.844319	8.847909	0.756326
14	1.146071	8.882206	2.05922	12.91989	13.28937	52.34826	0.8829	8.870733	0.74741
15	1.171378	8.616846	2.030378	14.01143	13.24461	51.62844	0.918659	8.827797	0.721832
16	1.191482	8.449429	2.113481	15.05716	13.16988	50.85761	0.945509	8.708776	0.698156

#### Variance Decomposition of BOP1:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	4.408468	1.449135	98.55087	0	0	0	0	0	0
2	6.422774	1.591341	92.50156	0.735489	0.031568	3.251954	1.00874	0.359753	0.519598
3	7.478586	1.374178	83.07853	1.598145	0.067275	8.042674	3.381639	1.643261	0.814303
4	8.007218	1.208519	74.88122	2.281095	0.064194	11.07524	6.117821	3.567351	0.804566
5	8.336335	1.417551	69.11552	2.627627	0.281174	12.609	8.092495	5.097332	0.759299
6	8.546027	1.812474	65.89767	2.736177	0.527254	13.53713	8.927162	5.787907	0.774225
7	8.655209	2.098671	64.40176	2.781337	0.639409	14.1672	8.990896	5.975841	0.944882
8	8.711066	2.21	63.62917	2.830713	0.680872	14.48173	8.87679	5.992362	1.298363
9	8.745838	2.211607	63.12478	2.902558	0.684468	14.50975	8.887183	5.972155	1.707497
10	8.772846	2.20539	62.7536	2.998528	0.686741	14.42074	8.984664	5.950661	1.999674
11	8.807164	2.25704	62.31277	3.099649	0.756784	14.50962	9.036243	5.919377	2.108519
12	8.865106	2.362244	61.56753	3.17171	0.945639	15.02945	8.972354	5.853537	2.097534
13	8.950041	2.476022	60.48326	3.189529	1.256538	15.97587	8.812755	5.744761	2.061271
14	9.048737	2.555895	59.26088	3.15596	1.63991	17.09362	8.621722	5.624719	2.047294
15	9.141412	2.584821	58.16516	3.098311	2.01049	18.07643	8.456209	5.551895	2.056684
16	9.214332	2.573149	57.35226	3.051156	2.292453	18.73863	8.342527	5.574322	2.075503

#### Variance Decomposition of

#### LRGDP:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	0.006372	3.55882	9.614787	86.82639	0	0	0	0	0
2	0.010638	3.602177	12.40594	78.38979	0.13668	2.89039	0.142946	0.532388	1.899689
3	0.014584	2.780458	16.61914	69.2718	0.075243	5.89756	0.238503	3.579468	1.537826
4	0.018206	1.889092	20.99459	59.00238	0.521328	8.526593	0.244598	7.787297	1.034125
5	0.022002	1.30247	24.73864	47.94867	2.131794	10.54121	0.203914	12.32308	0.810218
6	0.026065	1.017314	27.63036	37.98298	4.219418	11.86024	0.147937	16.074	1.067752
7	0.03033	0.882959	29.72814	30.1021	6.339054	12.41389	0.121616	18.64704	1.7652
8	0.034692	0.802242	31.21108	24.22622	8.323256	12.4101	0.161092	20.10705	2.758956
9	0.039058	0.729681	32.28498	19.93244	10.03572	12.08993	0.267366	20.73748	3.922394
10	0.043348	0.654818	33.10448	16.80198	11.41717	11.61615	0.418951	20.81682	5.169634
11	0.047515	0.582089	33.74273	14.497	12.5039	11.08626	0.58844	20.55326	6.446319
12	0.051542	0.517101	34.23293	12.7703	13.35794	10.56865	0.751341	20.09436	7.707382
13	0.055427	0.462536	34.59602	11.44911	14.03522	10.1107	0.891581	19.54209	8.912749
14	0.059175	0.418986	34.84642	10.41386	14.58679	9.741016	1.002708	18.96115	10.02907
15	0.062797	0.386339	34.99436	9.581891	15.05785	9.47447	1.085276	18.38832	11.0315
16	0.066307	0.364492	35.04964	8.89658	15.48269	9.316109	1.143629	17.8417	11.90516

Variance Decomposition of

LNMS:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	0.04538	0.663915	0.150914	2.854875	96.3303	0	0	0	0
2	0.052619	1.90612	6.092599	4.816283	76.58398	8.587349	0.100069	1.205984	0.707617
3	0.059294	8.299463	10.70171	7.524248	61.11474	9.521994	0.6372	1.360516	0.840134
4	0.064722	11.16654	12.30147	12.18364	51.84892	8.201697	2.406788	1.147044	0.743896
5	0.069968	11.94637	13.06514	16.03986	46.44432	7.584298	3.087823	0.985713	0.846471
6	0.074533	12.40759	14.10503	18.59073	41.76881	7.943266	3.047548	0.931999	1.205025
7	0.078663	12.29045	15.04866	20.15722	38.22637	8.531901	2.867779	0.956649	1.92098
8	0.082911	11.48173	15.70491	20.80926	35.92911	9.526936	2.637143	1.077545	2.833364
9	0.087743	10.34139	16.14208	20.50734	34.25435	11.41271	2.375094	1.353567	3.613469
10	0.09328	9.154004	16.40653	19.52523	32.79872	14.09089	2.118567	1.753205	4.152854
11	0.099508	8.055181	16.48071	18.19969	31.68913	17.03161	1.894504	2.162927	4.486254
12	0.10627	7.106314	16.42433	16.80374	30.97228	19.78795	1.720889	2.501605	4.682895
13	0.113215	6.319306	16.36888	15.54503	30.52026	22.06802	1.606939	2.74453	4.82704
14	0.119993	5.675503	16.41514	14.53313	30.22675	23.7036	1.553435	2.899876	4.992574
15	0.126395	5.147139	16.60714	13.78491	30.02039	24.67557	1.551612	2.992348	5.220898
16	0.132353	4.709592	16.95759	13.26671	29.82407	25.0795	1.585911	3.051478	5.525152

Variance Decomposition of

LNDEB:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	0.177997	2.499771	11.06296	0.040697	1.435175	84.9614	0	0	0
2	0.291245	3.587191	12.9507	0.080492	3.982052	79.01977	0.001272	0.015216	0.363308
3	0.39673	5.374336	12.13118	0.1045	10.49311	71.16758	0.006552	0.200386	0.52236
4	0.483588	5.848089	10.77226	0.091017	14.14283	68.01755	0.004862	0.428303	0.695086
5	0.542502	5.651844	9.897705	0.075207	15.34727	67.29639	0.02078	0.827591	0.88322
6	0.579757	5.272319	9.432916	0.174604	16.01688	66.42245	0.116911	1.519743	1.044172
7	0.602968	4.912449	9.150184	0.528123	16.35323	65.11494	0.303712	2.461011	1.176352
8	0.617274	4.708159	8.933965	1.187105	16.24524	63.60837	0.526486	3.51381	1.276857
9	0.627044	4.731221	8.729176	2.1047	15.87674	61.98167	0.72703	4.51971	1.329755
10	0.635173	4.934404	8.519262	3.144534	15.47364	60.41028	0.859707	5.321101	1.337069
11	0.642526	5.208784	8.326141	4.134298	15.1668	59.11126	0.912998	5.821199	1.318514
12	0.648828	5.454671	8.186407	4.943211	15.00257	58.17265	0.913957	6.032426	1.294108
13	0.653594	5.614891	8.126555	5.519963	14.95007	57.55987	0.900878	6.051932	1.275845
14	0.656695	5.682829	8.152291	5.878474	14.94166	57.17558	0.899001	6.002648	1.267516
15	0.658555	5.686905	8.249226	6.065908	14.92239	56.90858	0.914241	5.9853	1.267447
16	0.659939	5.664733	8.39096	6.13698	14.87144	56.67181	0.938244	6.053624	1.272208

Variance Decomposition of INF:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	5.827632	2.95127	2.435068	1.987122	4.664353	24.07048	63.89171	0	0
2	8.993391	1.320701	1.797438	2.760598	7.657025	20.92625	63.35733	0.092351	2.088313
3	10.61453	1.201054	1.297837	3.843491	8.349072	18.40828	64.70494	0.108358	2.086966
4	11.27795	2.007273	1.333351	5.022591	8.15602	16.34471	64.48089	0.772096	1.883069
5	11.8287	3.029674	1.47168	6.008935	7.415406	16.85548	60.1645	2.008122	3.046202
6	12.58994	3.658726	1.525699	6.272213	6.839547	20.38851	53.18118	2.913695	5.220429
7	13.36575	3.799288	1.608615	6.07323	6.827086	24.32429	47.24139	3.018694	7.107406
8	13.9197	3.691715	1.820353	5.766484	7.206929	26.81161	43.72889	2.80397	8.170045
9	14.21737	3.547693	2.16932	5.540344	7.544704	27.66433	42.10809	2.79923	8.62629
10	14.36786	3.529809	2.575647	5.449769	7.615086	27.47818	41.39407	3.21263	8.744811
11	14.4989	3.725209	2.923324	5.493797	7.488064	26.98716	40.77708	3.92704	8.678335
12	14.67007	4.105988	3.139801	5.638961	7.37276	26.64275	39.92008	4.674143	8.505524
13	14.86897	4.554403	3.233766	5.83002	7.416415	26.51193	38.90677	5.251937	8.294755
14	15.05309	4.943679	3.259394	6.012531	7.618012	26.47464	37.97418	5.608205	8.109353
15	15.18909	5.202549	3.266303	6.151477	7.881893	26.42428	37.29717	5.78871	7.987609
16	15.26946	5.327942	3.28	6.235718	8.108822	26.33228	36.91748	5.86223	7.935531

Variance Decomposition of I:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
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1	0.260246	0.407666	2.557503	1.422509	5.949624	3.309581	0.639537	85.71358	0
2	0.354181	1.603318	4.939354	7.166949	3.248908	2.037051	4.719539	74.83565	1.449236
3	0.433034	1.576949	7.551112	8.716319	4.612743	1.456286	5.487573	69.30489	1.294125
4	0.483647	1.457531	9.632187	11.00286	4.754822	1.267805	5.429361	64.52067	1.93477
5	0.518349	1.278222	10.60446	12.1793	4.82258	1.752343	5.172612	60.12675	4.063729
6	0.544176	1.16019	10.76418	12.67066	4.887114	2.842938	4.904333	56.01574	6.754848
7	0.563299	1.093699	10.62785	12.78511	4.856818	3.896225	4.680361	52.83409	9.225857
8	0.575918	1.064456	10.47115	12.81473	4.766079	4.529263	4.543875	50.7618	11.04865
9	0.58321	1.04715	10.35254	12.85837	4.723426	4.72709	4.481666	49.57878	12.23098
10	0.587	1.033682	10.26496	12.92946	4.756241	4.690442	4.456252	48.95938	12.90957
11	0.589367	1.03583	10.18569	12.99073	4.85256	4.707048	4.433675	48.56689	13.22758
12	0.59185	1.065201	10.11027	12.99966	4.994414	4.957109	4.399096	48.17336	13.30088
13	0.595075	1.120856	10.05802	12.93905	5.164135	5.438564	4.351563	47.7075	13.22031
14	0.598918	1.186706	10.05182	12.82085	5.332292	6.035296	4.296106	47.2144	13.06253
15	0.602889	1.241245	10.10089	12.67364	5.464449	6.606907	4.239764	46.78191	12.8912
16	0.606525	1.271263	10.19812	12.52674	5.539668	7.048773	4.189298	46.47688	12.74925

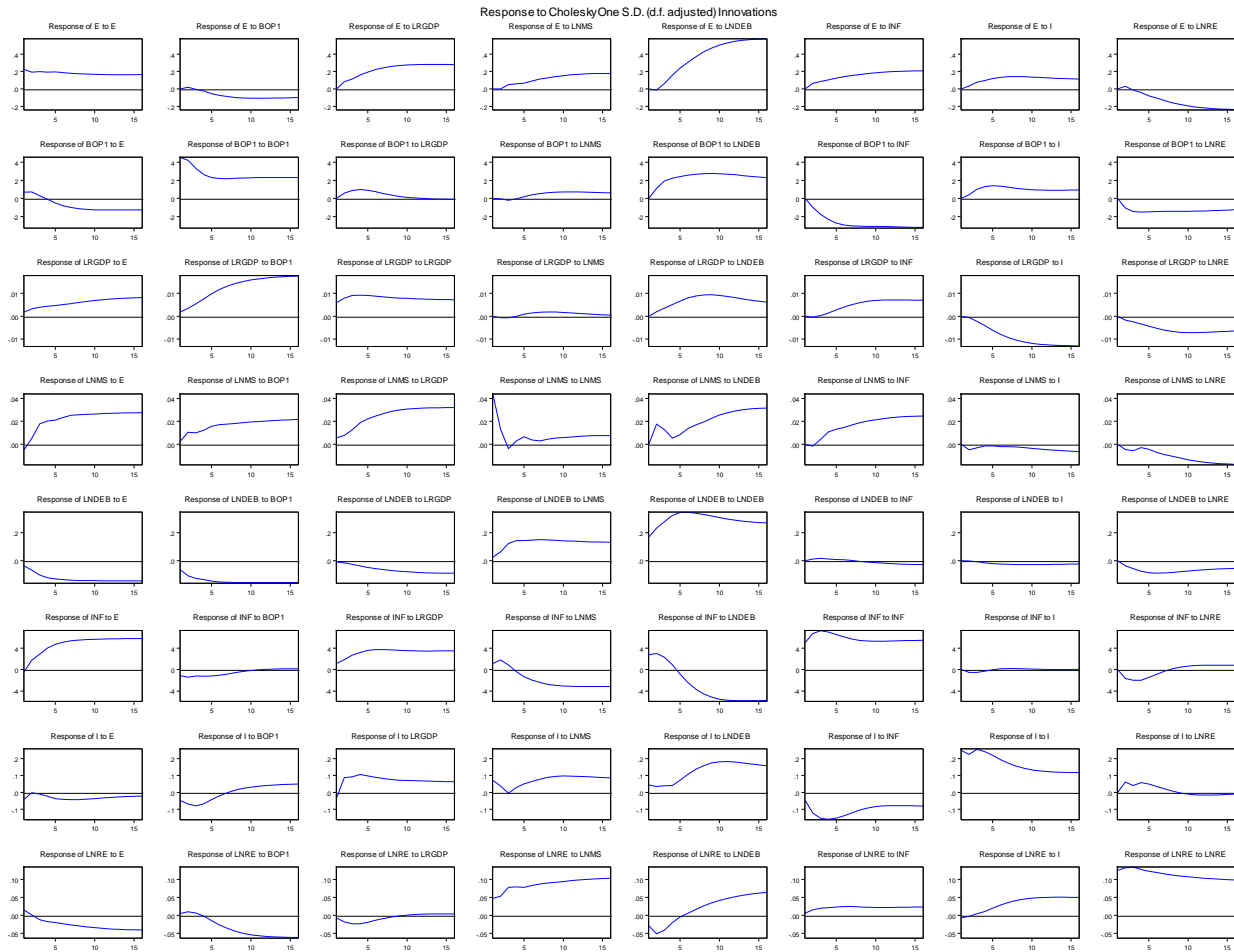
Variance Decomposition of  
LNRE:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	0.130399	2.636129	0.054221	0.009965	11.12266	1.564669	0.357011	1.39998	82.85537
2	0.175343	1.702924	0.082561	0.433302	12.26304	2.851565	1.752751	1.660352	79.2535
3	0.205628	1.249276	0.863878	0.59178	16.39917	2.079715	3.283197	2.288896	73.24409
4	0.227763	1.01826	2.321491	0.621515	18.45736	4.366109	4.302897	2.72408	66.18828
5	0.248745	0.869995	3.279928	0.545087	19.79603	9.82698	4.643879	2.554891	58.48321
6	0.270539	0.845162	3.380402	0.463617	21.50333	16.14328	4.398723	2.162095	51.10339
7	0.292224	0.932273	3.067393	0.439263	23.06897	21.78753	3.91551	1.951579	44.83747
8	0.311742	1.040317	2.719737	0.491388	24.09332	26.09775	3.483302	2.009495	40.0647
9	0.328071	1.113408	2.456022	0.636758	24.72545	29.05557	3.173833	2.260437	36.57852
10	0.34114	1.134788	2.271865	0.892331	25.09793	30.984	2.978901	2.598186	34.042
11	0.351206	1.112726	2.143696	1.265375	25.24495	32.19168	2.882199	2.946124	32.21325
12	0.358715	1.073191	2.061987	1.748844	25.21774	32.85592	2.859465	3.26526	30.91759
13	0.364198	1.041877	2.027665	2.317453	25.08633	33.10231	2.877304	3.534005	30.01306
14	0.368152	1.031561	2.044671	2.928299	24.90503	33.06347	2.903992	3.73502	29.38795
15	0.371014	1.041408	2.117321	3.529659	24.70845	32.86751	2.92073	3.85711	28.95781
16	0.373155	1.061852	2.249851	4.073393	24.51722	32.61241	2.922785	3.902708	28.65978

Cholesky Ordering: E BOP1 LRGDP LNMS LNDEB INF I LNRE

## Appendix C.

### C1: Impulse response for vector error correction model.



### C2: Variance decomposition of VECM model

Variance Decomposition of E:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	0.221786	100	0	0	0	0	0	0	0
2	0.315932	86.51954	0.382409	6.643203	0.000845	0.191167	4.190182	1.129429	0.943223
3	0.414429	72.99573	0.233401	11.29344	1.494172	2.527729	6.779861	4.035553	0.640112
4	0.534511	56.9951	0.371296	15.77903	2.029284	10.25369	7.94548	5.669824	0.956291
5	0.678603	43.55127	0.861771	17.83791	2.177614	18.80503	8.247178	6.58691	1.932325
6	0.837644	33.59534	1.356029	18.80021	2.575756	25.73045	8.269689	6.809735	2.862792
7	1.00611	26.49295	1.713553	18.89481	3.021615	31.3812	8.105668	6.632104	3.758103

8	1.178585	21.50406	1.940027	18.57676	3.373042	35.90491	7.897533	6.256019	4.547649
9	1.350447	17.97474	2.0716	18.09956	3.655232	39.42271	7.724077	5.829034	5.223048
10	1.51857	15.42688	2.134535	17.59135	3.902667	42.14642	7.597473	5.411814	5.788863
11	1.681058	13.54991	2.15155	17.10188	4.113262	44.28189	7.507878	5.028822	6.264807
12	1.83669	12.14413	2.141082	16.65697	4.285535	45.96915	7.447803	4.689539	6.665791
13	1.984799	11.07499	2.115425	16.2671	4.426052	47.30642	7.411189	4.395449	7.003379
14	2.125211	10.24982	2.082014	15.93258	4.541395	48.37156	7.391779	4.143296	7.287552
15	2.258097	9.604354	2.045438	15.64888	4.635745	49.22608	7.384271	3.9281	7.527133
16	2.383841	9.09321	2.008521	15.41004	4.712642	49.9165	7.38491	3.744691	7.729489

Variance Decomposition of BOP1:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	4.585479	2.399999	97.6	0	0	0	0	0	0
2	6.575324	2.403323	88.83405	0.786703	0.004861	2.920248	2.154288	0.395894	2.500634
3	8.07098	1.723491	75.94401	1.735099	0.070759	7.683829	6.165824	1.817274	4.859715
4	9.36103	1.29307	64.40946	2.423244	0.055954	11.48304	10.80296	3.342709	6.189569
5	10.55707	1.246375	55.44917	2.669821	0.08224	14.25066	15.0882	4.423963	6.789575
6	11.69859	1.489317	48.7043	2.579037	0.187249	16.43233	18.60509	4.95726	7.045409
7	12.7816	1.867647	43.7494	2.344228	0.329741	18.17889	21.26686	5.109398	7.15383
8	13.80143	2.278833	40.12364	2.083414	0.493527	19.54257	23.21366	5.059951	7.204408
9	14.76067	2.668938	37.43516	1.846142	0.660442	20.58451	24.65319	4.920872	7.23074
10	15.66205	3.011366	35.4026	1.646257	0.808138	21.35699	25.77237	4.756758	7.245519
11	16.50749	3.301069	33.83674	1.482924	0.92685	21.89529	26.70662	4.601634	7.248875
12	17.30087	3.54443	32.60611	1.350036	1.017618	22.23427	27.54016	4.4696	7.237773
13	18.04796	3.750305	31.61786	1.240927	1.08453	22.41355	28.31844	4.363604	7.210788
14	18.75496	3.926609	30.80689	1.150061	1.132159	22.47212	29.06143	4.28173	7.169003
15	19.42766	4.079855	30.12766	1.073221	1.165253	22.44428	29.77431	4.220318	7.115107
16	20.07123	4.215102	29.54792	1.007277	1.188055	22.35865	30.45512	4.175323	7.052553

Variance Decomposition of LRGDP:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	0.00648	8.060012	8.188163	83.75182	0	0	0	0	0
2	0.011596	10.09487	11.24308	72.97821	0.285425	2.810644	0.075473	0.211781	2.300517
3	0.016938	10.11221	15.68198	63.08678	0.29793	5.706413	0.065994	1.828411	3.220283
4	0.022516	9.467776	20.46991	52.58095	0.168592	8.322883	0.457671	4.36661	4.165604
5	0.028583	8.551965	24.55928	42.7183	0.198266	10.53997	1.239706	7.274986	4.917534
6	0.035059	7.78815	27.47404	34.59378	0.293378	12.21457	2.164744	9.894969	5.576373
7	0.041694	7.283482	29.43819	28.53159	0.375103	13.2034	3.059247	12.01772	6.091269
8	0.048245	7.001226	30.82429	24.16631	0.427148	13.60902	3.830176	13.67365	6.468175
9	0.054551	6.884395	31.89531	21.02773	0.44707	13.6045	4.445595	14.97153	6.72387

10	0.060522	6.884793	32.80038	18.74013	0.440402	13.33123	4.914868	16.0088	6.879395
11	0.066127	6.962014	33.61667	17.03819	0.41772	12.89152	5.263857	16.85671	6.953323
12	0.071376	7.084455	34.37873	15.74017	0.387853	12.36213	5.51925	17.56334	6.964074
13	0.076299	7.229975	35.09759	14.7242	0.356204	11.79816	5.704178	18.16072	6.92899
14	0.080933	7.384028	35.7738	13.90947	0.325759	11.2358	5.837669	18.67046	6.863014
15	0.085316	7.537352	36.40479	13.24224	0.29798	10.69701	5.934555	19.10792	6.778144
16	0.089479	7.684401	36.98813	12.6862	0.273354	10.19389	6.005806	19.48468	6.683548

Variance Decomposition of  
LNMS:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	0.044412	1.226994	0.352973	1.526852	96.89318	0	0	0	0
2	0.051913	1.91423	4.235428	3.3594	77.32746	11.35473	0.119973	0.879822	0.808953
3	0.059236	10.45898	6.144902	7.019406	59.79713	13.39857	0.642964	0.994219	1.543827
4	0.067762	16.90364	8.040966	13.08971	45.86341	10.84281	3.056676	0.819027	1.383761
5	0.077979	20.16451	10.06135	17.96376	35.29504	9.334594	5.124739	0.663633	1.392383
6	0.089469	22.22	11.28094	21.21031	26.97794	9.478854	6.565492	0.563567	1.702885
7	0.10166	23.37091	11.70396	23.41511	20.96844	10.1069	7.836587	0.485937	2.112153
8	0.11412	23.65108	11.81308	24.91237	16.78272	10.9317	8.950436	0.433641	2.524964
9	0.126736	23.4109	11.79346	25.76426	13.79286	12.05367	9.808371	0.409789	2.966688
10	0.139363	22.96934	11.69335	26.15645	11.58216	13.31114	10.46202	0.409196	3.416347
11	0.151818	22.46895	11.56347	26.28138	9.930959	14.50514	10.98776	0.424376	3.837966
12	0.163982	21.96722	11.44341	26.24977	8.685455	15.56995	11.41593	0.450947	4.217309
13	0.175788	21.50267	11.34763	26.12436	7.725094	16.49904	11.7617	0.485825	4.553679
14	0.187185	21.09734	11.27845	25.95195	6.967701	17.28738	12.04398	0.525847	4.847357
15	0.198146	20.7555	11.23543	25.7641	6.36018	17.93773	12.27905	0.568338	5.099667
16	0.208662	20.47269	11.21637	25.57775	5.865059	18.46513	12.47726	0.611464	5.31428

Variance Decomposition of  
LNDEB:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	0.186172	3.913902	12.1687	0.203432	1.857571	81.8564	0	0	0
2	0.330701	5.256852	14.30328	0.275203	4.198472	74.69327	0.137325	0.003466	1.132125
3	0.481618	6.983583	13.47563	0.396795	8.543703	68.53842	0.197957	0.016526	1.847391
4	0.629628	7.772518	12.47734	0.58787	10.1252	66.32858	0.157569	0.064125	2.4868
5	0.762677	8.131656	12.07794	0.797761	10.39273	65.40596	0.121718	0.115191	2.957036
6	0.87911	8.43857	12.01678	1.002883	10.60886	64.45513	0.0967	0.15688	3.22421
7	0.981625	8.753789	12.06422	1.212254	10.85707	63.48394	0.077819	0.193052	3.357856
8	1.072239	9.05286	12.17192	1.430938	11.02505	62.61219	0.066693	0.225509	3.414843
9	1.152538	9.335693	12.3322	1.654335	11.12867	61.81147	0.064175	0.253139	3.420319
10	1.224378	9.609944	12.52335	1.876737	11.21119	61.04403	0.069258	0.275568	3.389925
11	1.289542	9.874753	12.72582	2.094171	11.28157	60.31194	0.080723	0.293382	3.337639

12	1.349431	10.1261	12.93097	2.303212	11.3372	59.62451	0.097084	0.307137	3.27379
13	1.405135	10.36213	13.13482	2.500684	11.38071	58.98304	0.116642	0.317252	3.204722
14	1.457524	10.58246	13.33394	2.68432	11.41622	58.38653	0.137935	0.324211	3.13439
15	1.507287	10.78688	13.52575	2.852966	11.44562	57.83495	0.159879	0.328554	3.065398
16	1.55494	10.97543	13.70884	3.006333	11.46982	57.32775	0.18167	0.330799	2.999349

Variance Decomposition of INF:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	6.056964	0.407001	3.63889	3.409381	3.387394	21.04336	68.11398	0	0
2	10.26642	3.072201	3.110232	4.451071	4.197417	15.8313	66.60789	0.236511	2.493382
3	13.59033	6.207225	2.524735	6.466524	2.810474	11.8246	66.26641	0.286662	3.613368
4	16.31034	10.37189	2.326035	8.286443	2.004036	8.524211	64.22465	0.228816	4.033922
5	18.70221	14.22859	2.179482	9.959157	2.027251	6.692584	61.05266	0.174477	3.685806
6	20.9334	17.32897	1.99081	11.11626	2.480029	6.700225	57.1254	0.14366	3.114643
7	23.08939	19.6176	1.761271	11.76361	3.131184	8.017038	53.00599	0.125221	2.578093
8	25.19965	21.23892	1.530257	12.00659	3.82566	9.972586	49.14837	0.11073	2.16688
9	27.25754	22.36248	1.324195	12.00749	4.443137	12.07742	45.80901	0.097607	1.878656
10	29.24493	23.15437	1.153367	11.88965	4.949273	14.03254	43.05377	0.085961	1.681062
11	31.15202	23.73859	1.016532	11.73035	5.357443	15.71044	40.8293	0.076108	1.541242
12	32.97743	24.19182	0.907495	11.57109	5.687106	17.09549	39.04266	0.068011	1.436338
13	34.72376	24.55838	0.819598	11.43151	5.954128	18.22054	37.6015	0.061381	1.352958
14	36.39541	24.86464	0.747456	11.31807	6.172679	19.13056	36.42706	0.055911	1.283624
15	37.99796	25.12656	0.687144	11.23024	6.354389	19.86912	35.45698	0.051358	1.2242
16	39.5372	25.35395	0.635913	11.16448	6.50757	20.47373	34.64449	0.047542	1.172331

Variance Decomposition of I:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	0.275268	2.29085	3.151411	1.508404	6.577666	2.537822	2.851951	81.0819	0
2	0.399824	1.088915	4.503472	5.486559	4.004466	1.961097	10.79997	69.86626	2.289261
3	0.516501	0.692711	5.137533	6.428922	2.410466	1.727127	15.3035	66.30745	1.992298
4	0.610024	0.63631	4.925439	7.626302	1.956198	1.671543	17.75111	63.09656	2.336541
5	0.683165	0.801316	4.331076	8.120484	2.11471	2.43049	19.17804	60.6597	2.364181
6	0.74213	0.999956	3.746412	8.311846	2.554818	4.152993	19.75547	58.24715	2.231351
7	0.792774	1.176913	3.283572	8.326263	3.184092	6.592483	19.63354	55.77982	2.023312
8	0.839092	1.312016	2.954623	8.244045	3.95967	9.425417	19.07848	53.21145	1.814298
9	0.88274	1.395923	2.741663	8.112191	4.735741	12.36103	18.3404	50.67233	1.640717
10	0.923858	1.433609	2.616103	7.973283	5.419741	15.12098	17.58814	48.33637	1.511769
11	0.962245	1.440227	2.552781	7.851097	5.998199	17.52858	16.91102	46.30029	1.417803
12	0.99785	1.429124	2.534342	7.751748	6.481025	19.53586	16.34462	44.57786	1.345418
13	1.030793	1.408772	2.549011	7.673134	6.879417	21.16993	15.8934	43.14147	1.284861
14	1.061322	1.384228	2.588336	7.610897	7.208127	22.48423	15.5454	41.94815	1.230628

15	1.089771	1.358434	2.645967	7.560476	7.482952	23.53823	15.2821	40.95159	1.180254
16	1.11649	1.332899	2.716777	7.518074	7.716541	24.38844	15.0846	40.10971	1.132955

Variance Decomposition of  
LNRE:

Period	S.E.	E	BOP1	LRGDP	LNMS	LNDEB	INF	I	LNRE
1	0.138577	1.15056	0.139341	0.292191	11.64957	4.476779	0.164111	0.246409	81.88104
2	0.206829	0.518918	0.286669	0.908911	11.80196	8.200574	0.619911	0.131717	77.53134
3	0.264073	0.534995	0.234546	1.368468	15.98551	7.529698	0.966838	0.107977	73.27196
4	0.307237	0.729924	0.178257	1.586156	18.48467	5.984764	1.206875	0.199616	71.62974
5	0.342856	0.922359	0.335416	1.596774	20.04632	4.823708	1.442287	0.496408	70.33673
6	0.376322	1.149879	0.786802	1.456057	21.52255	4.028029	1.634565	0.999032	68.42309
7	0.408613	1.411119	1.458358	1.278985	22.86322	3.580023	1.740239	1.627287	66.04077
8	0.439829	1.67602	2.262614	1.114593	23.90769	3.452597	1.778663	2.2945	63.51332
9	0.470311	1.933335	3.114107	0.975742	24.72291	3.557121	1.781703	2.940751	60.97433
10	0.500261	2.182761	3.935412	0.862659	25.41237	3.819257	1.76815	3.522299	58.49709
11	0.529601	2.420314	4.682237	0.771515	26.01341	4.195639	1.748632	4.018142	56.15011
12	0.558209	2.64052	5.340592	0.697581	26.53896	4.64732	1.730086	4.427289	53.97765
13	0.586028	2.840767	5.911072	0.636765	27.00496	5.136688	1.715963	4.758918	51.99487
14	0.613034	3.020728	6.400709	0.585967	27.42359	5.635056	1.706876	5.025394	50.20168
15	0.639208	3.180979	6.81995	0.542936	27.80023	6.122609	1.70209	5.239413	48.59179
16	0.664546	3.322757	7.179952	0.506039	28.13819	6.585377	1.700516	5.412473	47.1547

Cholesky Ordering: E BOP1 LRGDP LNMS LNDEB INF I LNRE

### **Declaration**

I, the undersigned, declare that this thesis is my original work and it has never been presented for a degree or masters in any other university, and that all source of materials used for the thesis have been duly acknowledged.

The examiners' comments have been duly incorporated.

Declared by:

Name: Yigermal Maru Ayinewa

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Confirmed by Advisor:

Name: Fantu Guta (PhD)

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Place and Date of Submission: Addis Ababa University, June 2018