ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

THE IMPACT OF REAL EFFECTIVE EXCHANGE RATE ON THE ECONOMIC GROWTH OF ETHIOPIA

BY FENTAHUN BAYLIE

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A Thesis Submitted to the School of Graduate Studies of
Addis Ababa University in Partial Fulfillment of the Requirements for the
Degree of Masters of Science in Economics

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Acronyms and Abbreviations

ADF: Augmented Dickey-Fuller

AIC: Akaike Information Criteria

AR: Autoregression

CPI: Consumer Price Index

CSA: Central Statistics Authority

DF: Dickey-Fuller

DSP: Differenced stationary process

ECA: Economic Commission for Africa

ECM: Error Correction Mechanism

EEA: Ethiopian Economic Association

EPRDF: Ethiopian People's Revolutionary Democratic Front

FPE: Final Prediction Error

GDP: Gross Domestic Product

HIC: Hannan-Quinn Information Criteria

IFS: International Financial Statistics

IMF: International Monetary Fund

LR: Likelihood Ratio

MoFED: Ministry of Finance and Economic Development

NBE: National Bank of Ethiopia

PP: Phillips-Perron

REER: Real Effective Exchange Rate

RER: Real Exchange Rate

RGDP: Real Gross Domestic Product

RMSE: Root Mean Squared Errors

RWM: Random Walk Model

SDR: Special Drawing Rights

SIC: Shwarz Information Criteria

TSP: Trend stationary process

USD: United States dollar

VAR: Vector Autoregression

VECM: Vector Error Correction Model

VIF: Variance Inflation Factor

Abstract

This study analyzes the impact of real effective exchange rate on the Ethiopian economy using annual time series data for the period 1970-2009. With the help of cointegration and vector error correction analysis, the impact of real effective exchange rate on real gross domestic product growth was assessed in the long-run as well as in the short-run. The study found that the impact of real effective exchange rate on economic growth works through the aggregate demand channel in the short-run and the aggregate supply channel in the long-run i.e. decrease/depreciation in the value of the domestic currency promotes economic growth only in the short-run. In the long-run, it discourages economic growth. The study also found that the government, through its spending, may play a key role in bringing about economic growth in Ethiopia. Government expenditure is found to be equally statistically significant to real effective exchange rate in explaining economic growth in Ethiopia. Other variables like real interest rate and real exchange rate premium are also found to be statistically significant with the expected sign in explaining economic growth in the long-run. The study confirms that the country is on the right truck to go for a long-term economic growth as the [appreciation of] real effective exchange rate and [increase in] public expenditure are the most important tools of economic growth in the hand of the government. With the use of at least these two tools, the government may play a key role in transforming the agrarian economy.

Key words: Real effective exchange rate, economic growth.

CHAPTER ONE

1. Introduction

1.1. Background of the Study

The world is composed of countries that have different features in terms of economic, political and social matters. Considering the economic matter only, one can see that some countries are very rich, others are very poor and the remaining are found in between. These differences can be attributed to different factors. Whatever are the reasons for the difference, countries are found at different stages of development experiencing different rates of economic growth each year. Some have transformed themselves from a lower to a higher level of development. The 'Asian tigers' are good examples in this regard. They have experienced a dynamic economic growth and transformed themselves within few decades. Different reasons have been mentioned for their success. For example, Lall S. (2002) mentions a number of reasons among which good quality of human resources, different incentive regimes, financing technological investment, export promotion, liberalization [of, for example, exchange rate] and privatization are few examples. To follow the same path, other developing countries, including those in Africa such as Ethiopia, have been trying to introduce the same measures. Some of these measures have been captured as those variables affecting economic growth and used to forecast the fate of a country in different studies.

Ethiopia started to implement a comprehensive program of macroeconomic adjustment and structural reforms since the beginning of 1990s. This helped the country to restore macroeconomic stability and achieve economic growth. "Ethiopia's growth in the last decade, and in particular in the second half the decade, has been appreciated by international observers" (ECA 2007, cited in Alemayehu G. and Kibrom T. 2008 P: 2).

The observed economic growth patterns are assumed to be the results of the comprehensive macroeconomic policy reforms and interventions implemented by the government. The economic reform packages include trade liberalization, privatization of public institution and relative liberalization of interest rates and foreign exchange rates. For example, the 'birr' was devalued by 242% in 1994 and a bi-weekly foreign exchange was introduced as a major tool for bringing about economic growth and stability (Asmerom K., 1999).

Ethiopia is a small country in terms of the size of its GDP and according to Cottani (cited in Moya M., 2009), stabilization of the real exchange rate may help to improve economic performance of such a small and less developed country. This implies that there may be a relationship between Economic growth and exchange rate in some way. Thus, a study on such topic may be helpful in knowing how exchange rate can be used as a policy instrument to affect economic growth. Therefore, this study tries to address whether economic growth in Ethiopia can be explained by exchange rate and if so, may help policy makers to use this variable to influence economic growth accordingly.

1.2. Statement of the Problem

According to Rowan and Mayer, a nation has four major objectives to be achieved (Rowan D.C. and Mayer T. 1972; p356). These are internal balance, external balance, economic growth and equitable distribution of income. Internal balance refers to full employment and stable price whereas external balance refers to equilibrium in the balance of payments. Economic growth is one of the main goals of a nation. This objective partly depends on the second objective which incorporates international trade. The capacity of international trade to affect economic growth, on the other hand, depends on the international competitiveness of a country. The international

competitiveness of a country is partly determined by the relative strength of its currency. This means, the higher the value of its currency in terms of foreign currency, the lower the competitiveness of a country. The World Economic Forum in its Global Competitiveness Report of 2009 shows that Ethiopia's exports are among the least competitive at world (118^{th}) as well as African (21^{st}) standard. The study by McPherson M.F. and Rakovski T. (1998) supports that persistent real overvaluation is believed to seriously erode business and consumer confidence, thereby lowering the rate of savings and investment. The outcome is declared to be a decline in economic growth. Therefore, there arises a need to reduce the value of the domestic currency to improve the competitiveness of a country and promote its growth. This calls for adjustment on the exchange rate system. All these imply that change in exchange rate may affect economic growth.

Many studies including that by Thapa (2002) shows that a monetary policy cannot directly achieve its objective without an intermediate monetary target between the instrument and ultimate goals. For example, a monetary policy that aims at achieving higher rate of economic growth through monetary instruments such as bank rate requires such variables as exchange rate, domestic credit, nominal income, money supply etc as intermediate targets. The importance of each intermediate target differs from country to country. In this study, the focus relies on exchange rate. It assumes that monetary authorities may use exchange rate as an intermediary target to affect its instruments and then achieve their objectives. Given this, the focus is on to what extent exchange rate affects the instruments that impact economic activities in Ethiopia.

Two channels of transmission have been identified for the real exchange rate to affect economic activities by Thapa (2002). These are: the aggregate demand channel and aggregate supply

channel. The first channel is a traditional view that argues the transmission works through the aggregate demand channel i.e. depreciation of real exchange rate enhances the international competitiveness of a country and enlarges its GDP. The second channel asserts that the transmission works through the aggregate supply channel i.e. depreciation of the real exchange rate increases the cost of production and helps redistribute income in favour of the rich but reduces economic growth. The latter view can be supported by a statement from the findings of the World Bank (1993; cited in Moya M. and Watundu S. 2009), that a real depreciation by itself cannot provide incentives and cannot stimulate the supply response unless it is complemented by price and market liberalization. This means change in exchange rate can bring about two opposite results; one, promoting growth and the other, discouraging growth. If exchange rate is found to have a negative relationship with GDP, it is said to work through the aggregate demand channel. If exchange rate is found to have a positive relationship with GDP, it is said to work through the aggregate supply channel.

The purpose of this study is thus to identify which of these two channels functions in Ethiopia. This helps to suggest some measures that may ensure the sustainability of the current economic growth believed to be partly affected by the exchange rate. The performance of this variable to affect GDP also depends on the type of regime the country follows. The type of regime affects the nominal exchange rate and this in turn affects the real effective exchange rate and finally its growth. Thus, the study also considers exchange rate regime as a dummy variable in the analysis.

Most of the studies done so far and referred by the researcher are found to focus on either major determinants of economic growth or exchange rate (Andualem B. (1996), Anteneh B. (2005), Dawit S. (2003), Equare D. (2001), Eshetu A. (2007), Gebrelibanos H. (2005), Sintayehu W.

(1996), Tamiru D. (2005), Tsega H. (2008), Zewdie A. (2009)). Economic growth and exchange rate have been studied together in some of the papers as one being the determinant of the other. But emphasis was not placed on how the latter affect the former or vice versa. The emphasis was put on how the other variables included, such as inflation, money supply, government expenditure etc affect economic growth or exchange rate. The objective of this study is to determine the impact of real effective exchange rate on economic growth.

1.3. Objectives of the Study

The general objective of this study is to find out the channel of transmission through which the real effective exchange rate impacts economic growth in Ethiopia. As it has been mentioned above, there are two channels of transmission, the aggregate demand and aggregate supply, through which the real exchange rate can impact economic growth. Thus, the main objective of the study is to identify which of these two channels is functioning in Ethiopia.

The specific objectives are:

- To identify the major determinants of real gross domestic product growth in the short-run and long-run and their direction of influence on the latter.
- To examine the degree of response of real gross domestic product to innovations in its determinants for consecutive years by analyzing the impulse response functions and variance decompositions.

1.4. Significance of the Study

The researcher believes that such a study on current economic issue/problem is believed to be worth to all stockholders; such as the government, financial institutions and other economic agents. This may help policy makers in particular, to recognize the way the two variables relate and to determine the way to use real effective exchange rate as a policy variable.

1.5. Hypothesis

This study is supposed to verify the following hypothesis:

- ❖ Real effective exchange rate has significant impact on the growth of real gross domestic product in the long-run in Ethiopia.

1.6. Scope and Limitations

The scope of the study is designed to cover the study of the impact of real effective exchange rate on Ethiopia's economic growth for the period 1970 to 2009. It covers two extreme exchange rate regimes. The first regime is characterized by a fixed exchange rate system and ranges between 1970 and 1991. The second regime is assumed to be characterized by a relatively flexible exchange rate system and ranges between 1992 and 2009. This study uses the classification that represents the *de jure* [publicly stated commitment of the central bank] even though the *de facto* [observed behaviour of the exchange rate] may be different[1]. The *de jure* classification used in this study is based on the IMF's (2000) *Annual Report on Exchange Arrangements and Exchange Restrictions.*

[1] The exchange rate regime in Ethiopia is classified under different categories in different studies. It is classified as freely floating in Appleyard D.R., (1998), IMF (2000) and Pilbeam K. (1998). It is classified as Managed floating in Fischer S. (1999). It is classified as a pegged system in Gudmundsson M. (2005)

The authorities of the current Ethiopian regime describe their *de jure* exchange rate regime as a managed float with no predetermined path for the exchange rate. However, in light of the relative stability in the rate as well as the authorities' intervention policy, the exchange rate regime has *de facto* been akin to a conventional peg, although recently exchange rate flexibility has increased somewhat (IMF, 2007).

There were many constraints faced in accomplishing this study. These include Lack/unavailability of data, Shortage of finance and studies done on the same area in Ethiopia. The problem related to the reliability of data on Ethiopian economy was chronic. Different institutions provide significantly different data reports on the same variable. The major difference is between the data provided by governmental and nongovernmental/international organizations. The reason may be the use of different methods and assumptions in the preparation of the macro-variables. The researcher used only governmental sources of data such as the Ministry of Finance and Economic Development and the National Bank of Ethiopia to minimize the variations as the raw data mainly originate from these offices.

The other problem was the difficulty to get a long time series data on real GDP which is prepared with the same base year. There is a long time problem of preparing a time series data with the same base year in MoFED. It frequently report real data for a short period of time, usually 10 years. Three alternative solutions were suggested to solve the problem. The discussion of these solutions and the method used for this study are presented in chapter 5 and Appendix E.

1.7. Organization of the Study

The study is organized in the following manner. The first chapter assesses the issues to be investigated and the driving force behind making a study on the topic concerned. As mentioned in this chapter, the motivation of the study is lack of enough empirical evidences on the topic, particularly on the impact of real effective exchange rate on economic growth after the liberalization of foreign exchange market in the early 1990's.

Theoretical and empirical literatures are discussed in the second chapter. The introductory part discusses the concepts of exchange rate, economic growth and the impact of the former on the latter. Under the theoretical framework; major theories of Economic Growth and the impact of exchange rate on economic activities are discussed. Under the empirical framework; empirical evidences on the impact of exchange rate on economic growth are discussed.

Chapter three deals with the history of exchange rate policy in Ethiopia. It discusses the rational for devaluation and foreign exchange rate determination mechanisms in Ethiopia under different periods; the period before 1992, the period of intensive devaluation [October 1992-May 1993], the auction system [1993- 1998] and inter-bank exchange rate system [since 1998]. It also assesses the development and functioning of the parallel exchange rate market in Ethiopia.

Chapter four is designed to provide some clue about the methodology and model specification used in this study. The data type and sources as well as the methods of analysis are shown**.** Pre-estimation tests and post-estimation diagnosis are also conducted. The cointegration and vector error correction mechanisms (VECM) are used to show the long-run and short-run relationship between real effective exchange rate and economic growth in Ethiopia. The impulse response function and variance decomposition are also discussed.

Chapter five presents the results of the empirical analysis and interpretation of the findings. The data set are analyzed by using descriptive as well as econometric methods. The trend of economic growth with respect to exchange rate, real interest rate, government expenditures and exchange rate premium are discussed with the help of graphs.

Conclusions of the findings from chapter five and the policy recommendations derived from there are provided in chapter six.

CHAPTER TWO

2. REVIEWS OF THEORETICAL AND EMPIRICAL LITERATURES

2.1. Discussion of Basic Concepts

1. Exchange Rate:

Like any other commodity, currencies can be also sold and bought in a market. The only difference is two different currencies are mainly exchanged in direct barter system, one for the other without any intermediary currency in between. In simple terms, the rate at which one currency is exchanged for the other is called ***Exchange rate.*** More formally, Pilbeam K. (1998) defined exchange rate as "the price of one currency in terms of another". In his book of International Finance, he mentions two ways of expressing exchange rate. These are domestic currency units per unit of foreign currency and foreign currency units per unit of domestic currency. One is exactly the reverse of the other. In this study, exchange rate is defined in terms of units of foreign currency per unit of domestic currency. Thus, an increase in the exchange rate refers to the appreciation/revaluation of the domestic currency and reflects an increase in the value of the domestic currency.

Exchange rate can be nominal or real each with its own relevance for economic analysis. "The exchange rate that prevails at a given date is known as *nominal exchange rate*" (Pilbeam K. 1998). It is usually expressed in terms of index from a given period. The nominal exchange rate (NER) has nothing to do with purchasing power of a currency or the competitiveness of countries in the international markets (Pilbeam K. 1998). For these latter uses, the nominal exchange rate has to be adjusted for some changes. The result of this adjustment is to find what is known as real exchange rate (RER). "The real exchange rate is the nominal exchange rate adjusted for relative prices changes between the countries under consideration" (Pilbeam K. 1998).

If E_n represents the nominal exchange rate in index form and P_d and P_f represent the indices of domestic and foreign price levels respectively, the real exchange rate (E_r) can be defined as follows.

$$E_r = E_n.P_d/P_f \quad \text{.....(2.1)}$$

This definition may represent a real exchange rate in external or internal terms.

> *"(a) in external terms, the nominal exchange rate is adjusted for price level differences between countries (that is, as the ratio of the aggregate home price level to the foreign country's aggregate price level or cost level measured in common currency), or (b) in internal terms, the ratio of domestic price of nontradable to tradable goods are considered within a single country. The first of these concepts of the RER is derived originally from the purchasing power parity (PPP) theory. The second is derived from models of dependent economies or Salter-Swan model" (Montiel P.J. and Hinkle L.E, 1999).*

The real exchange rate is defined in external terms in this study. This method is chosen for the reason that it may include the second definition. This is possible when the domestic price level [P_d] is heavily weighted by non-tradables [if it is measured by the index of consumer price] and the foreign price level [P_f] is heavily weighted by tradable goods [if it is measured by the index of wholesale price] (Herberger A.C. 2003).

The above formula shows the relative value of two currencies. That is, it is a bilateral measure. But in reality a country usually trades with more than one country. This means the rate of exchange with all other currencies should be considered to determine the relative position of the home economy. The rate of exchange that accounts for the relative importance of all trading partners is called Multilateral or Effective exchange rate (Pilbeam K. 1998). The relative importance of trading partners can be weighted by size of imports from them or exports to them

or average of the two (Asmerom K. 1994). Using the same procedure as the above one, the nominal effective exchange rate can be converted into Real Effective Exchange Rate (REER). "Real Effective Exchange Rate is a measure of whether or not the currency is appreciating or depreciating against a weighted basket of foreign currencies" (Pilbeam K. 1998). Therefore, the real effective exchange rate can be determined either from the real exchange rate or the nominal effective exchange rate. The real effective exchange rate which is derived from real exchange rate as a weighted average of currencies of all trading partners of a country, is given by following expression in Montiel P.J. and Hinkle L.E, (1999).

$$REER=\prod_{i=1}^{m}[E_n P_{Gd}]^{\omega_{id}}\ {}^{1}/_{P_{Gf}} \quad \text{.....(2.2)}$$

Where m is the number of trading partners or competitors of the home country and $\prod$ denotes the product of bracketed terms over the m countries. P_{Gd} and P_{Gf} represent the price levels of domestic and foreign goods. The geometric averaging method is used where ω_{id} is the appropriate weight for each foreign country i (i=1...m) and the sum of the weights equal to one$\sum_{i=0}^{m}(\omega_{id})$.

In all the above cases, it has been shown that prices have to be expressed in terms of indices. Asmerom (1994) identified five types of price indices that can potentially be used to convert NEER to REER. These are Consumer price index, Index of wholesale price, Cost index, Index of export unit values and GDP deflator index. This study considers the consumer price index as it is used by the National Bank of Ethiopia to calculate the real effective exchange rate.

The REER in the above formula is defined as a function of price indices, exchange rate and trade weight. A small country like Ethiopia may be unable to affect foreign prices and/or trade weight. But it may affect the REER by manipulating the nominal exchange rate as its upper and lower limits are determined by the central bank in the inter-bank exchange rate system in Ethiopia.

2. Economic Growth:

"Economic Growth is defined as a long term rise in the capacity of a country to supply increasing and diverse economic goods to its population; this growing capacity being based on advancing technology and institutional and ideological adjustments that it demands" (Kuznet S., 1963; cited in Taylor, 1991). In simple terms, it can be equivalently expressed as growth in the national income of a given nation. Growth in national income is usually measured by a percentage change in the real gross domestic product which takes change in price levels in to account (Thirlwall A.P. 1995).

2.2. Exchange Rate and Its Impact on Economic Activities

As long as an economy is open to international trade where foreign investment finances domestic production, it may be possible to find certain relationship between exchange rate and economic growth. Change in exchange rate affects the prices of exportable goods, and thus the allocation of resources to production of these goods. The impact of this process may lead to increase total output of the economy which is considered as economic growth. This is possible; however, if the negative impact on the imported essential materials are minimal relatively. According to Eichengreen B. (2007), "… if technology transfer is relatively rapid in sectors producing for export, then there will be additional stimulus to the overall rate of growth". He mentioned countries like Japan, Hong Kong, Singapore, South Korea, Taiwan and China which have succeeded by making real exchange rate a 'development-relevant policy tool'.

The impact of exchange rate on economic growth assumes certain type of exchange rate regime which means the impact may depend on the nature of the exchange rate regime adopted. This section discusses the impact of exchange rate on economic activities with the help of different

types of exchange rate regimes. There are different types of exchange rate regimes each with its own impact in influencing economic growth. Pilbeam K., (1998) identified three basic types of exchange rate regimes; fixed, managed floating or intermediate and freely floating exchange rate regimes. It should, however, be noted that this classification of exchange rate regimes is very broad and accepted only in principle not in practice. Exchange rate regimes under one of these categories are not one and the same. Within each group, there are sub-groups. For example, under the fixed exchange rate regime, countries may form Currency Unions, Currency Boards or Currency with no separate legal tender. The Intermediate exchange rate regime includes regimes near to the hard peg as well as the free float such as Conventional Pegs, Crawling Pegs, Crawling Bands and Basket Pegs. Similarly, the floating exchange rate regime may include a managed one in addition to an independently floating exchange rate regime (IMF, 2000).

A fixed exchange rate regime is "a system where governments determine exchange rates and make necessary adjustments in their economies to maintain these rates" (Pilbeam K., 1998). Proponents of such regime, according to Pilbeam K., claim that this system promotes international trade and investment; provides discipline for macroeconomic performance; and encourages international cooperation. All these are due to the fact that exchange rate uncertainties are eliminated and stability is ensured under this regime. But there is also a fear that such a system may distort trade and result in favouritism. Since the level of the nominal exchange rate is not determined by forces of demand and supply. This will disturb the smooth functioning of the economy by misallocating resources. In the second place, such a system is characterized by rationing of foreign exchange due to shortage of foreign currency. Government officials may provide the limited foreign currency to unauthorized importers in return for a favour done by the latter to the former group.

In a freely floating exchange rate system, “the demand for and the supply of foreign currency determine exchange rate and no government intervention is found” (Pilbeam K., 1998). In other words, if a currency is freely floating, its exchange rate is allowed to vary against other currencies and is determined by the forces of demand and supply. Some of the advantages of a flexible exchange rate include the following. It ensures the balance of payment equilibrium and monetary autonomy and insulates domestic economies from foreign price shocks. The system is generally characterized by automatic adjustment against economic shocks. But the uncertainty and volatility associated with the regime may reduce its application (Pilbeam K. 1998). Due to this dangerous nature of the regime, most countries did not dare to declare freely and independently floating exchange rate though the movement is towards it. In the absence of a perfectly competitive market, it would be risky to allow such a regime and one should not also forget the fact that markets are not free of failures in general.

In a Managed floating exchange rate system, “exchange rates among the major currencies are free to float to their equilibrium market levels, but nations occasionally use currency interventions in the foreign exchange market to stabilize or alter market exchange rates” (Pilbeam K., 1998). While countries with this type of exchange rate regime may be saved from the disadvantages of extreme regimes, they may suffer from losing the advantages associated with a fixed or a freely floating exchange rate regime. An intermediate exchange rate regime helps monetary authorities to set the rate in line with the economic fundamentals which may be different from the one set by the market. Interventions [which characterize the regime] help to reduce the costs of exchange rate overshooting and can be used as an appropriate instrument to smooth necessary economic adjustment (Pilbeam K., 1998). This is because of the fact that the economy is closely watched by the monetary authorities and not allowed to fluctuate beyond a limit. The regime may be

criticized for not being as certain as the fixed exchange rate regime in eliminating uncertainties and providing discipline and not as fast as the floating regime in adjusting economic shocks.

The above discussions show that the impact of exchange rate on economic activities partly depends on the nature of the exchange rate regime adopted. Each regime has merits as well as demerits encouraging or discouraging economic activities. Even with in the same type of exchange rate regime, the change in the level of exchange rate may have positive impact on economic growth in one country and negative impact on the other. This depends on the nature and structure of the economy. This has been discussed in detail in the subsequent sections with the help of theories and empirical evidences.

2.3. Review of Theoretical Literature

2.3.1. Major Theories of Economic Growth

1. Classical Theory of Economic Growth

Economic growth has been discussed as early as the 12th century before the classical period when an Arabian economic thinker called Ibn Khaldun[2] wrote about the issue in his famous book entitled Muquddimah (Khalid H., 2006). According to Abdol Soofi (1995), Ibn Khaldun was able to identify the basic factors of production; namely labour, capital and nature at this early period. Labour was considered as the most determining factor of output. Increase in the quantity of labour was assumed to raise output. This he described as economic growth. In the later period, another group of economists known as Mercantilists emphasized the importance of trade in growth.

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[2] Ibn Khaldun was born in Tunisia in 1332 and died in Egypt in 1406. He was a famous philosopher and sometimes considered as the first sociologist. He is known for his history of the world (Kitab al-Ibar) written in 1377-1380, and most particularly for his long book al-Muqaddimah. It has become more famous where Ibn Khaldun appears as a sociologist and economist (Seifudein Adem 2005).

Classical economists centred their attention on the economic growth of nations which is explained by the theory based on the class structure of the capitalist economy. They identify three classes: workers, capitalists and land owners. They have their own specific role in the economic process. Workers own labour and sell it on the labour market for a subsistence wage. Land owners rent their land to capitalists to obtain rent. Capitalists own the produced means of production and organize production by employing labour and land. They earn profits. The behaviour of all these agents is governed by their attempt to get as much as possible from the resources they own. The classical economics assumes that among these groups only capitalists save from what they earn (Salvadori N. 2003).

According to Salvadori N. (2003), the allocation of income is not determined by preferences or by the type of income earned but mainly by the social group to which those who receive the income belong. The mechanism by which savings are transformed into investment can be direct, if the savers are entrepreneurs, or indirect, through the capital market, if the savers are not entrepreneurs. This means classical economists accept the view that all savings are transformed into investment. However, while they accept this idea, it is difficult to say that they share the neoclassical view that the means of equalization between savings and investment is interest rate. For classical economists, adjustment on the capital market between savings and investments occurs mainly through adjustments in the labour market. Moreover, unlike neoclassical growth theory, the rate of growth of the economy is determined by the interplay between savings and population growth rate, the former being completely employed in investment and the latter being endogenously given as an increasing function of the real wage rate.

Among the models developed by classical economists, the Smithian model is discussed below.

Adam Smith showed that the level of output basically depends on inputs of three factors of production namely; labour, capital and land. Adam Smith implicitly discussed the importance of their productivity or technology as supporting element of growth in addition to the above basic factors. He also explained the importance of non-economic factors such as political stability, the security of private property, and the role of laws and institutions in facilitating economic growth. According to Rostow W.W. (1990), the Smithian growth model can be defined as a function of three components; factor inputs, technology and non-economic factors. An economy will transfer to a higher level if some or all these factors are increased. By this, the economy will move from one static equilibrium position to another. However, it is shown that this process has a limit where increase in input use may not necessarily bring increase in out put.

The formal derivation of the Smithian growth model is given as follows in Rostow W.W. (1990). It started with the assumption that there are only two inputs, labour and capital, without technological progress. The two-factor production function is defined as:

$$Y_t = F(K_t, L_t) \quad \ldots\ldots (2.3)$$

Where Y_t is out put, K_t is capital and L_t is labour input. F is assumed to exhibit constant return to scale. Factor rewards are assumed to be related to factor inputs through the marginal productivity relationship given by:

$$W_t = F_L(K_t, L_t) \quad \ldots\ldots (2.4)$$

$$r_t = F_K(K_t, L_t) \quad \ldots\ldots (2.5)$$

Where W_t and r_t represent wage rate and interest rate respectively. F_L and F_K are partial derivatives showing the marginal productivities of labour and capital respectively.

The capital accumulation relationships are given by:

$K_{t+1} = (1-\delta)K_t + I$ .....(2.6)

$I_t = sF_K(K_t, L_t)K_t = sr_tK_t$ .....(2.7)

In the above equations, δ refers to annual depreciation, s refers to the rate of saving of owners of capital, r_t is the rate of return and I_t refers to gross investment. I_t is part of saving made by owners of capital as defined by equation (2.7). Added to what is left after depreciation of previously invested, capital forms new level of capital as defined by equation (2.6).

Substituting equation (2.7) in to equation (2.6) yields the following relation.

$\frac{(K_{t+1}-K_t)}{K_t} = (sr_t-\delta)$ .....(2.8)

This expression represents the growth rate of capital stock and states that it depends on the rate of return to capital (r_t) given the rates of saving and depreciation. This implies that if the rate of return to capital exceeds the ratio of depreciation to saving rates ($r_t > \delta/s$), then the capital stock increases and vice versa.

Similarly, the growth rate of labour can be defined as follows.

$g(W_t/\dot{W}) = \frac{(L_{t+1}-L_t)}{L_t}$ .....(2.9)

It depends on the wage rate. If the wage rate is above the substance level ($W_t > \dot{W}$), then the labour force grows and vice versa.

Equations (2.8) and (2.9) are equivalent. They show growth rates of capital and labour respectively. There are no growths of capital and labour if $r_t=\delta/s$ and $W_t=\dot{W}$ respectively. If the no-capital growth level ($r_t=\delta/s$) is above the no-labour growth level ($W_t=\dot{W}$), then the economy will grow without bound. At later developments, land was introduced as a third factor of production in the Smithian model.

In general, the Classical economists suggested a number of factors that promote economic growth in explaining the theories of economic growth. They started from the basic factors of production such as labour, capital, land and technology and continued to the non-economic factors such as political stability, the security of private property, the role of laws and institutions, the expansion of towns and growth of population; and non-market variables such as education and customs. Most of these variables are also considered as the factors of production and are used to explain growth in the modern theories of economic growth.

2. The Keynesian Theory of Economic Growth

The Keynesian theory of economic growth assumes households save constant proportion of their income and producers convert these savings into investment. However, unlike other theories of economic growth, the Keynesian theory of economic growth noted that not all savings are transferred into investment. Thus, it is not the level of saving rather level of investment that determines growth. In a special case where all savings are converted into investment, the economy is said to be in the steady state (Salvadori N. 2003).

According to Salvadori N. (2003), Harrod and Domar were among the first economists to develop macroeconomic model to formally analyze the problem of growth in the Keynesian framework. They emphasized the relationship between consumption and saving by households and investment decision by entrepreneurs although these behaviours were not theoretically developed. The consumption-saving decision is defined by an exogenously given propensity to consume while the investment decision is defined by the accelerator principle. In their model, production is obtained only by means of physical capital and labour. Given the Keynesian assumption of fixed prices, firms choose the best technique at the given prices. Thus, there is only one cost minimizing technique which implies that the capital-labour ratio and the capital-output

ratio are uniquely determined. They focus only on the equilibrium of the goods market because of the assumption that the market mechanism is not able to attain full employment of labour.

The goods market is said to be in equilibrium when savings are equal to the desired investment. An economy growing along a path with equilibrium on the goods market is said to be on its warranted growth path. Along this path one obtains $G_w = s/v$ where G_w is called the warranted rate of growth of income, s is the rate of saving and v is the capital-output ratio. The behavioural hypothesis on producers and the Keynesian multiplier yield that if the warranted growth path also ensures full employment of labour (a rare case), then the economy is said to be on the golden age growth path.

At a later development, Kaldor held that it is not saving, investment, technical progress and population growth that are the causes of growth-these being the features of growth-but the attitude of investing by the society and in particular entrepreneurs. In this, he follows the Keynesian approach in conceiving the expansion of the economy as driven by psychological and social factors like human attitude to risk taking and money making (Kaldor 1954; cited in Salvadori N. 2003).

3. Neoclassical Growth Theories

The neoclassical theory of economic growth is different from the classical theory of economic growth in the sense that the former produces rising wage and constant long run returns to land and other natural resources while the latter assumes constant real wages and growing land and other natural resources rents. According to Agenor and Montiel (1996), Robert Solow was the first economist to develop a model that represents the neoclassical theory of economic growth incorporating this idea. Later on, his model was further developed by Trever Swan. The latest

model was then called by the name of the two economists as the Solow-Swan model. The neoclassical growth theory is best represented by this model.

The Solow-Swan model is built up on aggregate constant return to scale production function that combines labour and capital (with diminishing marginal returns) in the production of a composite good. Production is distributed between savings and consumption on the basis of the Keynesian saving rule. Savings are assumed to be a fixed fraction of output, and technology improves at an exogenous rate. If savings are equal to the level of investment, then the economy is said to be in the steady state. The convergence process towards the steady state is ensured by the assumption of decreasing productivity of capital. The model had attempted to solve the stability problem of full-employment steady state by assuming a neoclassical production function that allows for flexible coefficients of production (Salvadori N. 2003).

Without technological progress, the production function of the Solow-Swan model is given as follows in Heijdra B.J. and Ploeg F. (2006).

$$Y(t)=F[K(t), L(t)] \quad \text{.....(2.10)}$$

The fundamental differential equation [FDE] is derived as follows. Writing in per capital form $y(t)=Y(t)/L(t)$ and $k(t)=K(t)/L(t)$. At equilibrium, it is assumed that savings equal investment.

$$S(t)=I(t)$$

$$sY(t) = \delta K(t) + \acute{K}(t)$$

$$sF[K(t), L(t)] = \delta K(t) + \acute{K}(t)$$

$$sF[K(t), L(t)]/L(t)= \delta K(t)/L(t) + \acute{K}(t)/L(t) \quad \text{.....(2.11)}$$

The last expression $[\acute{K}(t)/L(t)]$ is the same as $\acute{\kappa}(t)$ because $k(t)$ is defined to be equal $K(t)/L(t)$. Using the quotient rule, the last expression is defined as:

$$\acute{k}(t) = \acute{K}(t)/L(t) - [K(t)/L(t)][\acute{L}(t)/L(t)]$$

Which means $\acute{K}(t)/L(t) = \acute{k}(t) + [K(t)/L(t)][\acute{L}(t)/L(t)]$

$$\acute{K}(t)/L(t) = \acute{k}(t) + k(t)[\acute{L}(t)/L(t)]$$

$$\acute{K}(t)/L(t) = \acute{k}(t) + k(t)n_L \quad \text{.....(2.12)}$$

Note that F(K(t), L(t)) is characterized by constant return to scale which means:

$$Y(t)=F[K(t), L(t)]=L(t)F[K(t)/L(t), 1]$$

$$y(t)=f(k(t)) \quad \text{.....(2.13)}$$

Therefore, substituting (2.12) and (2.13) in to (2.11) yields:

$$sf(k(t)) = \delta k(t) + \acute{k}(t) + k(t)n_L$$

$$sf(k(t)) = \acute{k}(t) + (\delta + n_L)k(t)$$

$$\acute{k}(t) = sf(k(t)) - (\delta + n_L)k(t) \quad \text{.....(2.14)}$$

Where the first expression in the right hand side of equation (2.14) represents per capita saving, the second expression is called replacement capital.

The model implies that countries with similar production technologies as well as comparable saving and population growth rates should converge to similar steady state levels of output. This convergence property-known as Absolute Convergence Hypothesis- means that poor countries starting with a relatively low standard of living and a lower capital-labour ratio should grow faster during the transition as they catch up with the rich countries, but ultimately both groups arrive at the same level of per capita income (Agenor and Montiel, 1996). Later on, other economists developed an alternative hypothesis that states rich countries grow faster than poor countries]. This hypothesis is known as Conditional Convergence Hypothesis

Ramsey had also developed a model that further explains the neoclassical theory of economic growth by making the saving rate of households endogenous. He replaced the ad hoc saving/consumption function by forward looking theory based on utility maximization. The Ramsy model yields very similar growth predictions as the Solow-Swan does. However, unlike the Solow-Swan model, it features the Ricardian equivalence [i.e. the argument that the particular method used to finance government spending does not matter in affecting consumption, investment and output or in short government debt and tax have equivalent impact on macroeconomic variables] and rules out over-saving (Heijdra B.J. and Ploeg F. 2006).

4. Endogenous Growth Theories

Unlike the traditional growth theories which view economic growth as a result of exogenous factors, Paul Romer, Robert E. Lucas and Robert J. Barro came up with a new type of growth theory which endogenizes technology in the eve of 1990s. This theory is known as Endogenous Growth Theory. The recent literature highlights the existence of a variety of channels through which steady state growth may emerge endogenously. The new growth theory stressed the importance of innovation, human capital accumulation, the development of new technologies and financial intermediation as important determinants of economic growth. The experience of East Asian countries also provides several lessons on the impact of policies on economic growth. It is agreed that government intervention aimed at removing obstacles to market mechanisms or other sources of market failures is not harmful to growth (Agenor and Montiel, 1996).

According to Salvadori N. (2003), the aim of the endogenous growth theory is twofold. First, to overcome the short comings of the neoclassical growth theory which does not explain sustained growth, and second, to provide a rigorous model in which all variables crucial for growth such as savings, investment and technology are the outcome of rational decisions. Since the main

objective of the endogenous growth theory is to develop economically meaningful accumulated factors, then the rate of interest should never be driven too low. This is considered as a necessary condition for perpetual growth. The accumulation of factors can be facilitated either by removing the scarcity of natural resources or by introducing technical progress. As far as the former is concerned, for example, labour has been straight forwardly transformed into a fully reproducible resource, human capital. As for technical progress, one of the main features of the endogenous growth theory is the capacity to endogenize the investment decision yielding technological progress which consists mainly in the introduction of new intermediate and/or final goods.

Heijdra B.J. and Ploeg F. (2006) showed that the models developed by economists to explain the endogenous growth theory follow three approaches. These are Capital Fundamentalist approach, Human Capital Formation approach and Endogenous Technology approach. The first approach generates perpetual growth by abandoning the neoclassical assumption that the average product of capital goes to zero as the capital stock get very large. The second approach emphasizes the purposeful accumulation of human capital as an engine of growth. The third approach consists of group of studies based on the notion that research and development (R&D) activities by firms constitute the engine of growth in the economy.

The approaches are discussed with the help of the well known AK model. The first approach was proposed by Rebelo (1991; cited in Agenor and Montiel 1996). It eliminates labour from the production function altogether and assumes constant return to scale on a broad measure of capital. It considers all production inputs as some form of reproducible capital to relax the assumption of diminishing returns to capital imposed in the basic neoclassical growth model.

Within this model, it is possible to obtain a constant positive rate of growth of the per capita consumption along the optimal path. This path can be rationalized as the outcome of a decentralized perfectly competitive economy. The AK growth model is given by the following expression in Salvadori N. (2003).

$$Y_t = AK_t \quad \text{.....(2.15)}$$

Where K_t is composite measure of physical and human capital stock. It is a constant return to scale production function. The steady state growth per capita is defined as:

$$g = sA - \delta \quad \text{.....(2.16)}$$

This implies that the growth rate is positive for $sA > \delta$ and that the level of income per capita rises without bound. Unlike the neoclassical model, an increase in the saving rate raises the growth rate per capita. This model also shows that poor countries with the same degree of technological sophistication as other nations always grow at the same rate (not at faster rate as stated in the neoclassical model) as rich countries, regardless of the initial level of income. The only problem with the AK model is that it does not predict convergence even if countries share the same technology and are characterized by the same pattern of saving rate. Rebelo added that (1991; cited in Agenor and Montiel 1996) to obtain a positive growth requires only that there exists a subset of capital whose production takes place under constant returns to scale and does not require the use of non-reproducible inputs.

Barro (1990; Cited in Heijdra B.J. and Ploeg F. 2006) further developed the AK model by incorporating productive government spending to see its impact on economic growth. He found a significant impact on economic growth by government spending.

Lucas incorporated a variable that represent human capital in the AK model in the second approach [Human capital approach] which was pioneered by Uzawa in the mid 1960s (Heijdra B.J. and Ploeg F. 2006). He introduced positive externality to relax the assumption of diminishing returns to scale of capital imposed in the basic neoclassical growth model. The existence of externalities is associated with increasing returns to scale. Because the equilibrium growth rate depends on the rate of investment in human capital, the externality implies that growth would be higher with more investment in human capital. This leads to the conclusion that government policies are necessary to increase the equilibrium growth rate up to the level of the optimal growth rate (Agenor and Montiel, 1996).

Similar to the Harrod-Domar model, along the optimal path the rate of saving is constant in the Lucas model. However, unlike the Harrod-Domar model, it is determined endogenously by the maximizing behaviour of the planner. On the other hand, the AK model, unlike the Keynesian models follow the classical and neoclassical tradition in conceiving investment as induced by savings, rather than the other way round (Salvadori N. 2003).

The third approach [Endogenous technology approach] introduced technology in to the above basic AK-model. It assumes that technology can be created or improved through Research and Development (R&D) activities and thus used as a source of growth. Research and Development (R&D) activities provide some new and cheap type of technique of production which is exclusive for the inventor. In this case, even in the absence of physical and human capital, there can be growth (Heijdra B.J. and Ploeg F. 2006). The model considers three types of productive sectors each with its own technology and pricing decision. These are final goods sector, Intermediate goods sector and Research and Development sector.

In general, it has been shown that there is continuity from classical to endogenous growth theories, partly through Keynesian theory concerning the fact that the steady state is conceived as endogenously determined by the model. By contrast, neoclassical economists see it as exogenously determined by factors considered outside the realm of economic explanation. There is also continuity between classical, neoclassical and endogenous growth theory as opposed to Keynesian theory, in terms of saving-investment relationship. While the former theories conceive saving as wholly transformed into investment, and therefore, growth being determined by saving itself, Keynesian theory conceived investment as the source of growth and no relationship between the former and the latter variable necessarily exists (Salvadori N. 2003).

2.3.2. The Relationship between Exchange Rate and Economic Growth

In almost all theories discussed under different schools, exchange rate was not explicitly proposed as a factor that directly determines output or growth. They illustrated many factors that determine economic growth. However, exchange rate is not among the list of these factors. In the words of Eichengreen B. (2007),

> *"When asked about the fundamental determinants of growth, economists tend to focus on, inter alia, education and training, savings and investment… technological knowledge etc… However, a stable and competitive real exchange rate can be thought of as a facilitating condition for economic growth… Keeping it at appropriate levels and avoiding excessive volatility enable a country to exploit its capacity for growth and capitalize on the afore-mentioned fundamentals".*

According to him, the ignorance of exchange rate as a determinant of economic growth may be associated with different reasons. For the classical and neoclassical growth theories in particular, a good reason is that they were formulated for closed economies where foreign trade and

exchange rate had no roles to play. Even for the latter theories of economic growth, exchange rate was not a choice variable that can be altered. It was considered as a given variable until the breakdown of the Bretton Woods system (i.e. the gold standard).

But this does not mean that the relevance of exchange rate was not recognized at all. While advocating the importance of favourable trade, economists had implicitly talked about the relevance of exchange rate since the pre-classical [Mercantilist] period. For a home economy, the balance between what is taken and given basically depends on, among others, the rate of exchange of goods and services between the home economy and the rest of the world. This means, exports can be defined, among others, as a function of exchange rate. Exchange rate determines the gain from foreign trade which are used to finance domestic investment that contributes for growth. Therefore, through the net export component, exchange rate may affect economic growth.

There are also some ideas relevant for this study in the endogenous growth theory. The theory suggested government policy as one factor that influences economic growth. In line with this proposition, exchange rate may be considered as one policy variable that determines economic growth. Though it is not under direct control of the monetary authorities, it can be influenced by government policies. The government can use fiscal and monetary policies to influence the level of exchange rate. Based on all these facts, this study incorporates real effective exchange rate in to a growth model to determine its impact on the growth of output or real GDP in Ethiopia.

Trade theories also states that there may be some type of relationship between exchange rate and economic growth. From the trade theory of absolute advantage by Adam Smith to the modern

theories of international trade, an economy with trade has been advocated to be better off than an economy without trade (autarky). Trade increases the total output of the world. Trade also helps a country to exploit increasing return to scale, technology and know-how from a foreign country. If trade has the power to impact a country's economy, any factor that affect international trade such as exchange rate, also affects the well being of a country. According to MacDonald R. (2000), exchange rate affects an economy through two channels. These are: trade and investment channels. Through the trade channel, exchange rate has two types of effects on growth through its level and volatility.

Traditional open economy macroeconomic models suggest that there is positive relationship between the level of exchange rate and economic growth in general. But this is possible only if the impact of change in exchange rate on the export sector is stronger than the impact it has on the import sector. Decrease in the exchange rate (depreciation of the domestic currency) reduces the foreign price and increases the demand. This encourages domestic producers. However, depreciation of the domestic currency has also cost in terms of increasing prices of imported raw materials and decreasing real income of consumers (MacDonald R. 2000).

Volatility of exchange rate, on the other hand, depends on the nature of exchange rate regime a country follows. In general, according to MacDonald R. (2000), a flexible exchange rate is said to be more volatile than a fixed one. Volatility increases risk and reduce probability of earning profit. This may lead to a conclusion that a relatively fixed exchange rate regime promotes growth. However, empirical evidences on the impact of exchange rate regime on economic growth provide mixed results. Some suggested fixed, others flexible exchange rate and the remaining indifferent. Moreover, MacDonald (2000) concluded that the removal of a number of separate currencies and their replacement with a single currency stimulates trade and growth.

The second important impact of exchange rate on economic growth is through the investment channel. Investment here refers to foreign direct investment (FDI) which is influenced by exchange rate. Appropriate policies may be important to attract foreign direct investment. However, investment decision is not merely dependent on domestic policies. As long as foreign investors invest in the home country for export, the same issue of exchange rate can be raised (MacDonald 2000).

2.3.3. Contractionary Effects of Exchange rate on Economic Growth

Agenor and Montiel (`1996) showed that according to Krugman and Taylor (1978), exchange rate is said to have contractionary effect on output through the following demand and supply channels.

In a small open economy producing traded and non-traded goods, Agenor and Montiel (1996) found from the work of Krugman and Taylor (1978) that the aggregate real demand for non–traded goods ($d_N(t)$) consists of domestic consumption ($C_N(t)$), investment ($I_N(t)$) and government demand (g_N) for such goods.

$$d_N(t) = C_N(t) + I_N(t) + g_N \quad \text{.....(2.17)}$$

This means the impact of exchange rate on the demand for non-traded goods depends on the relationship between exchange rate and these variables [consumption, investment and government expenditure]. In the next paragraphs, the effects of change in exchange rate on these variables are discussed.

According to Agenor and Montiel (1996), the consumption of non-tradable goods depends on relative prices or exchange rate (Z_t), net real factor income (Y_t-tax), real interest rate (i_t-$\acute{\pi}_a$) and real financial wealth (a_t) i.e.

$C_N(t) = C_N[Z_t, Y_t–tax, i_t-\acute{\pi}_a, a_t]$ .....(2.18)

In this equation exchange rate directly affects the consumption of nontradable goods. Agenor and Montiel (1996) show that, exchange rate also affect the other variables that affects consumption of nontradable goods [net real factor income (Y_t–tax), real interest rate ($i_t-\acute{\pi}_a$) and real financial wealth (a_t)]. This means through the variables determining consumption, exchange rate also affects the demand for non-traded goods again. These are discussed below.

According to Agenor and Montiel (1996), change in exchange rate brings about changes in relative prices of non-tradables that affect the demand for domestically produced goods. The total (foreign + domestic) demand for domestically produced traded goods is assumed to be perfectly elastic and therefore is not affected by relative price changes. This means change in exchange rate of the home economy affects only the price of nontradables. Therefore, changes in the relative prices that affect the domestic demand for non-traded goods affects the total domestic demand for these goods. Therefore, a real depreciation (for example) of the domestic currency, with real income held constant, increases the demand for non-traded goods and vice versa assuming that the impact works through the aggregate demand channel.

Change in exchange rate also produces changes in real income that affect the demand for domestically produced goods. For an economy producing both traded and non-traded goods, real income is derived from the production of both sectors. As such change in exchange rate affects the production of non-traded and traded goods in different ways. Change in exchange rate, changes the relative importance of the goods for the domestic producers depending on the direction of the change [increase or decrease]. For example, depreciation of the domestic currency makes tradables cheaper to foreigners and may increase demand for these goods. However, following this output may not increase if the tradable sector uses imported inputs

because the depreciation of the domestic currency increases the price of imported inputs and makes production costly.

If the assumption that the production of traded goods requires imported inputs holds true and production of traded goods decreases, then the production of nontraded goods increases. If the decrease in production of traded goods is greater than the increase in production of non-traded goods, exchange rate is said to have contractionary effect on income and thereby on demand and output. Therefore, the net effect of change in exchange rate on output [income] may be positive [increase] or negative [decrease]. If the net impact of change in exchange rate on output [income] is positive/negative, this in turn increases/decreases the demand for nontradable goods in the above equation.

According to Krugman and Taylor (1978; cited in Agenor and Montiel 1996), the effect of change in exchange rate on interest rate depends fundamentally on the characteristics of the economy's financial structure. The following analysis assumes that domestic residents hold financial assets in the form of domestic currency, domestic and foreign interest-bearing assets. It also assumes that expected inflation is exogenous and thus makes analysis of the impact of change in exchange rate on nominal interest rate. If domestic and foreign assets are imperfect substitutes, the effect of unanticipated exchange rate change on domestic interest rate depends on the composition of household financial wealth.

Change in exchange rate has opposite effect on the stock of real money and on the value of real foreign assets. If, for example, a large share of household financial wealth is devoted to the holding of cash balances, and if traded goods have a large weight in private consumption, depreciation of the domestic currency reduces real private financial wealth and increases the

demand for loans thereby raising the domestic interest rate. Because depreciation reduces the relative value of the domestic currency and increases prices of tradables for the domestic consumers. If one holds more domestic currency and makes large expenditure on traded goods during depreciation, then the value of his/her wealth decreases. This decrease in wealth finally reduces the consumption of nontraded goods also. If this is so, exchange rate is said to have contractionary effect on demand through the interest rate effect.

Change in exchange rate can also affect the demand for domestically produced goods through its effects on real wealth because increase in wealth can be expected to increase household consumption. Change in exchange rate affects the price level and thus changes the real value of wealth. This change in the real value of wealth has two types of effects, both tending to affect absorption: a direct effect, when individuals change their expenditure in order to maintain their real money holdings to the desired level; and an indirect effect, when individuals try to shift their portfolios from other assets into money or vice versa. If change in exchange rate reduces the real value of wealth thereby reducing the consumption of non-traded goods, it is said to have contractionary effect on demand (Agenor and Montiel 1996).

The effect of exchange rate on private demand for non-traded goods also depends on investment demand for this category of goods emanating from both the traded and non-traded goods sectors. Branson and Buffie (1986; cited in Agenor and Montiel 1996) emphasized that since a substantial portion of any new investment in developing countries is likely to consist of imported capital goods, change in exchange rate affects the price of capital in terms of home goods. If change in exchange rate discourages new investment, it is said to have contractionary effect on aggregate demand.

Exchange rate also affects the foreign earnings from exports to the government. Government expenditure partly depends on foreign earnings as the latter is used to finance domestic expenditure. If change in exchange rate reduces foreign earnings, then it reduces government expenditure and said to have contractionary effects on output.

On the supply side, Agenor and Montiel (1996) also showed that exchange rate affects the supply of domestically produced goods in addition to their demand. The production cost of those goods in domestic currency is likely to change as the prices of the factors of production change in response to change in exchange rate. It is well known that the supply curve is inversely related to a cost function. Decrease in the cost function means an upward shift in the supply curve for those goods. Exchange rate affects the supply of goods through three separate channels; nominal wages, imported inputs and working capital. If change in exchange rate increases the nominal wage, the price of imported inputs and the cost of working capital, it is said to have contractionary effect on the supply of these goods.

2.4. Review of Empirical Literature

2.4.1. The Impact of Exchange Rate on Economic Growth: Empirical Evidences

Thapa N.B. (2002) studied the Nepal economy by using annual data for the period 1978/79-1999/00. He used the basic Keynesian macroeconomic model. Due to the non-availability of quarterly data on GDP and wages in Nepal, he used annual data. Such a short period of time [22 years] is not appropriate for a time series analysis. The objective of his study was to analyze the impact of real effective exchange rate on the Nepali economy. Nepal adapted a dual exchange rate arrangement during the study period; one pegged with the Indian currency and the other floating with all remaining currencies.

The study summarized two channels of transmission through which the real effective exchange rate can affect economic growth. One is through the aggregate demand channel and the other is through the aggregate supply. If depreciation of the real effective exchange rate promotes exports and economic growth, the aggregate demand channel works [a traditional view]. If depreciation increases the cost of imported materials and discourages supply, aggregate supply channel works [a modern view]. If the impact works through the aggregate demand channel, the relationship between real effective exchange rate and economic growth would be negative. If the impact works through the aggregate supply channel, the relationship between real effective exchange rate and economic growth would be positive. But through which channel the impact works depends on the nature of the economy, whether it is major exporting or importing among its trading partners. If the value of imports exceeds the value of exports by many folds, it is likely that the aggregate supply channel works. If the value of exports exceeds the value of imports by many folds, it is likely that the aggregate demand channel works.

Thapa N.B. (2002) developed a model from the demand as well as the supply side of Keynesian macroeconomic framework. From the demand side of the model, he considered consumption, investment, government expenditure and net exports as major determinants of GDP. He substituted consumption and investment by the factor that affects them, interest rate and later on money supply. He also substituted net export by real exchange rate while maintaining government expenditure. Therefore, from the demand side three factors namely; money supply, real effective exchange rate and government expenditure were identified as major determinants of GDP for the Nepali Economy.

From the supply side, production or GDP was defined as a function of labour, capital and total factor productivity. Due to the difficulty of calculating total factor productivity and unique nature

of capital (local plus imported), this side was represented by wage of masons and real effective exchange rate. Finally, he estimated the following aggregate model constructed from both the demand and supply sides.

$$\text{Log(RGDP)} = C + b_1\log(AM_1) + b_2\log(W) + b_3\log(REER) + b_4\log(RGEXP) + U_t \ldots\ldots\ldots\ldots \quad (2.19)$$

Where M_1 represents narrow money supply, W refers to wage, REER refers to real effective exchange rate and RGEXP refers to real government expenditure. The regression result shows that all the coefficients have the appropriate signs. However, except REER and W, coefficients of other variables are not statistically significant even at 10 percent level of significance. The statistical insignificance of M_1 coefficient suggests that interest rate channel is not important to boost the economic activities in Nepal. Similarly, the coefficient on real government expenditure has also remained statistically insignificant. Therefore, international competitiveness represented by REER and the labour costs are more significant variables in influencing economic activities in Nepal. Real GDP growth rate regressed on REER growth rate along with M_2 [broad money supply] instead of M_1, provides more or less the same results except in this case the new model has no long-run relationship. The result implies that the aggregate demand channel works for the Nepali economy. Real effective exchange rate has negative sign implying that decrease in the real effective exchange rate [or depreciation in his model], increases economic growth.

The model used to explain the Nepali economy can be criticized for the reason that it did not incorporate sufficient amount of explanatory variables. The economic activities in Nepal are not well represented. The variables included explain only 37% of the variation in the real GDP. Again, the wage rate used was that of the masons who were regarded as 'best representative' but not weighted or well justified.

Moya M. and Watundu S. (2009), on the other hand, analyzed the impact of real effective exchange rate on the GDP of Uganda using a time series data for the period 1975-2007. They adapted the model developed by Thapa N.B. (2002). They added two more variables namely real exchange rate and Price. The only difference is they estimated the demand and supply side impacts of exchange rate on real GDP separately and finally estimated them together to see the net effects. In estimating the impact of real effective exchange rate on RGDP, they used the following model on the demand side. They considered a regression of RGDP on money supply (narrow) and real effective exchange rate.

$$LRGDP = C + LM_1 + LREER + \varepsilon_t \quad \text{(2.20)}$$

Where M_1 represents narrow money supply and REER refers to real effective exchange rate. They found positive and statistically significant coefficients for both variables and concluded that depreciation increases the international competitiveness of a country and promotes growth. These variables together explain about 69% of the variation in real GDP. They excluded government expenditure from this side for the reason that it was highly correlated with money supply. They did not provide a reason why they prefer to exclude government expenditure instead of money supply.

In estimating the impact of real effective exchange rate on RGDP, they used the following model on the supply side. They considered a regression of RGDP on population growth rate, real effective exchange rate and real exchange rate.

$$LRGDP = C + LPOPNGR + LREER + LRER + \varepsilon_t \quad \text{(2.21)}$$

Where POPNGR represents population growth rate, REER refers to real effective exchange rate and RER is real exchange rate. They did not include any variable that represent expenditure on

factors of production and instead included population growth rate which became statistically insignificant. Real exchange rate was found to be positively and statistically significant in determining real GDP. However, REER and RGDP were negatively related in the supply side i.e. increase in real effective exchange rate [depreciation in their model] decreases RGDP. This is because it increases the cost of imported raw materials. All the variables together explain about 45% of the variation in real GDP.

To determine the net effect, they defined log of real GDP as a function of log of Money supply [M_1], log of population growth rate [POPNGR], log of real effective exchange rate [REER] and log of real exchange rate [RER].

$$LRGDP = C + LM_1 + LPOPNGR + LREER + LRER + \varepsilon_t \quad (2.22)$$

Their results show that change in narrow money, population growth rate, real effective exchange rate and real exchange rate explain about 73% of the variation in real GDP. Narrow money and population growth rate were statistically significant and positively related to real GDP. Real effective exchange rate was statistically significant and positively related to real GDP. Real exchange rate was not statistically significant in determining real GDP.

The same question regarding the absence of a variable representing cost of production can be raised against this model. Unlike Thapa, they found that permanent changes in narrow money significantly and positively affect the value of Gross Domestic Product. Thus, an increase in the amount of money in circulation plus private demand deposits leads to an improvement in GDP. This could be because an increase in the amount of money in circulation leads to a reduction in interest rates which improves private consumption and subsequent investments thereby increasing output. Population growth rate has a significant positive effect on Uganda's GDP

possibly because an increase in the population growth rate leads to an increase in potential private consumption and increased demand which stimulates production. The results on the net effect of Real Effective Exchange Rate on Gross domestic product of Uganda show that depreciation of the domestic currency does not improve the country's export competitiveness among its trading and investing partners. This brings about unfavourable terms of trade since most of Uganda's industries rely on imported raw and semi finished goods for production. The depreciation of the domestic currency, therefore, leads to higher costs of importation which eventually affects production costs and private consumption, hence a reduction in aggregate supply.

The real exchange rate has a negative but insignificant effect on Gross domestic product of Uganda. This could be, according to the authors, because the Ugandan market is import based and because of the reliance on importation, even if the Uganda domestic currency depreciates with respect to the individual trading patterns, more is imported compared to exports. This effect may also not be significant given the fact that Uganda exports more of raw materials and it does not play a significant role in determining the prices of its own exports on the international market such that a depreciation of the domestic currency does not enhance production. This means, the REER impacts economic growth through the aggregate supply channel for Ugandan economy i.e. depreciation of the domestic currency does not promote growth in Uganda. This is in contrast with the findings of Thapa on Nepal's economy.

Asmerom K. (1999) analyzed the impact of devaluation on the price and supply of coffee in Ethiopia by using panel data. He described the Ethiopian currency (Birr) as overvalued and cause of budget deficit. He found that the effect of devaluation on the supply of coffee is positive and significant. Some economists argue that the risk aversive nature of farmers in developing countries make them not responsive to changes in prices in the long run. But the study by

Asmerom found that farmers in Ethiopia respond positively to devaluation. The study uses two sources of data, primary and secondary. The secondary source provides data for coffee production, acreage, domestic consumption and export mainly obtained from the Ministry of Coffee and Tea Development of Ethiopia. The secondary data are used to provide some indication on the past and current situation of the coffee sector and its importance on the Ethiopian economy.

To empirically implement a reduced form model, Asmerom K. collected farm level data by administering a questionnaire designed for this purpose. The questionnaire is used to measure the variables that are necessary for estimating supply response equations. The survey sample size was 300 households, from which 276 responses were found to be fit for analysis. The method of sampling was both purposive and scientific. First, he identified regions that are fair representatives of the coffee farming areas of the country. Thus, the first stage is purposive. Once the regions were identified, he chose households that represented various demographic and socio-economic categories such as small, medium and large size households. A proportional sampling method was adopted in the second stage. He used descriptive as well as econometric methods of data analysis. He used a model developed by French and King which has five components. He considered only the first four components relevant to his study; namely equations that explain desired production and acreage, new plantings equation that shifts average towards the desired level, an equation that explains acreage removed each year and an equation that explains variation in the values of average yields.

From the descriptive statistics as well as the econometric findings, Asmerom K., (1999) noted that farmers do indeed respond positively to devaluation. Both the short-run and long-run supply responses were significant. At the end of his study, he suggested that the real exchange rate

should be considered as one of the major policy variables for restructuring the economy. According to him, issues such as monetary, fiscal and commercial policies must be made consistent with the process of real exchange rate realignment. In an earlier study, Asmerom K., (1994) associated the poor export performance of the Ethiopian economy with the over valuation of its currency. In general, the results showed that depreciation has expansionary effect while appreciation had contractionary effect for the period under study in Ethiopia.

Unlike other studies reviewed by the researcher, the study by McPherson M.F. and Rakovski T. (1998) did not identify any significant direct relationship between exchange rate and economic growth. They used time series data for the period 1970-1996 to analyze the relationship between exchange rate and economic growth on the Kenyan economy. They showed that they were interested on quarterly data but did not find enough observations. But this could not be a good argument to use such a short period for a time series analysis.

They employed three types of approaches in the study; single equation regression, system of simultaneous equations and vector autoregressive models. The first approach was used to investigate the effects of money supply, inflation and exchange rate including their lags on real GDP. Only inflation was found to be statistically significant in explaining real GDP. Using the second approach, the authors defined the functions of all variables in their study. From these estimations, the direct and indirect relationships between exchange rate and economic growth were found to be insignificant. In the third approach, the Johnson method was used to test for the long run relationship between exchange rate and economic growth and found no relationship. Thus, they concluded that there is no direct relationship between exchange rate and economic growth. But there could be indirect relationship between them through money supply, import and aid.

CHAPTER THREE

3. The History of Exchange Rate Policy in Ethiopia

3.1. Introduction

In this chapter the natures of exchange rate policy adopted over different political regimes in Ethiopia are discussed. It also gives an overview of historical developments related to the national currency of the country. The following is a discussion of the history of the national currency since its introduction in the mid of the 1940s.

According to Befekadu Degefa (1993; cited in Eyob Tesfaye 2001), prior to 1945, attempts to issue a national currency was not successful in Ethiopia for various reasons among which the British effort to include Ethiopia in its currency zone was the main factor. The legal tender currency of Ethiopia was issued on 23 July, 1945 by defining the monetary unit as the Ethiopian dollar (E$) with a gold content of 5.52 grains [or 0.357690 grams] of fine gold corresponding to US$ of 0.4025 or an official rate of 2.48 birr/USD. In 1964 a slight change in the gold content was made to 0.355468 grams of gold to adjust the exchange rate to a more convenient value of US$ 0.40 or an official rate of 2.50 birr/USD. The linkage with fine gold was in accord with the monetary system established by the Bretton Woods Agreement of 1944 (i.e. the gold standard).

The gold content of the Ethiopian currency was never changed then after. However, following the collapse of the Bretton Woods System and devaluation of the US dollar, the birr revalued by 7 percent to 2.30 birr/USD in 1971 and by 11 percent to 2.07/USD in 1973. In 1976, the name of the national currency was changed from the Ethiopian dollar to the Ethiopian birr. The rate has remained fixed at 2.07 Birr/USD for two decades until the EPRDF came to power and changed the rate to 5.00 Birr/USD in 1992 since it was believed that the birr was overvalued.

The history of exchange rate policy in Ethiopia can be classified in to four major periods; namely the period before the year 1992, the period of intensive devaluation [October 1992-May 1993], the auction system [1993- 1998] and the inter-bank exchange rate system [since 1998].

3.2. The Period Before 1992

This period covers the years before the first heavy devaluation of the domestic currency in 1992. Ethiopia passed through two political regimes during this period; namely the Imperial regime up to 1974 and the Derg regime up to 1991. Nevertheless, both political regimes adopted the same type of exchange rate regime; namely a fixed exchange rate system with relatively strict controls on the activities related to the system.

For nearly half a century up until October 1992, the exchange rate of Ethiopian currency was fixed to its reference or reserve currency, the US dollar except minor changes in 1964, 1971 and 1973. Gezahegn Tsegaye (1993) pointed out the following reasons for Ethiopian authorities to maintain fixed exchange rate for such a long period.

- The authorities were genuinely committed to the Bretton Woods agreements which had advocated fixed exchange rate up to the collapse of the system in 1973.
- The maintenance of a fixed rate was believed to inspire confidence in the national currency and an official devaluation was seen as a failure despite external and internal pressures to do so.
- There was a constant fear that devaluation would entail inflation.

For Eyob Tesfaye (2001), however, the reasons for the maintenance of a fixed exchange rate for such a long period were different. He found two basic reasons. These are:

- ❖ Structural characteristics of the economy such as the less diversified production structure, less capital mobility and lower level of financial market development.
- ❖ A single currency pegging was believed to ensure the stability of the domestic currency and flexible exchange rate regimes were believed to create unpredictable exchange fluctuations.

The reasons to maintain a fixed exchange rate for almost half a century may be associated with the system advocated at that time around the world and its advantages. These reasons are provided in the above studies. The only exception to these, the researcher believed, may be the structural characteristics of the economy which might not be in the mind of the authorities at that time to set up a regime i.e. it may not be the case that the monetary authorities of the time considered such characteristics of the Ethiopian economy to set up the system.

The maintenance of a fixed exchange rate regime was accompanied by strict exchange control measures and an array of exchange restrictions during the Derg regime in particular. These measures include quantitative restrictions on imports, surrender of foreign exchange earnings to the central bank, advance import deposits and restrictions on capital flows (Exchange Control Act 1974; cited in Eyob Tesfaye 2001).

According to Gezahegn Tsegaye (1993), the period before the year 1992 was generally characterized by a breakdown of financial discipline in Ethiopia, particularly, under the military rule. The Derg military rule was characterized by over expansionary domestic policies especially through its military public expenditures. Moreover, appreciation in the real exchange rate of Birr, increase in the current account deficit, depletion of foreign exchange reserves and increase in foreign debt during the same period are considered as indicators of the over valuation of the national currency.

3.3. Period of Intensive Devaluation [October 1992-May 1993]

As part of the Structural Adjustment Program of the IMF, the government of Ethiopia introduced economic reforms in the early 1990s. One of these measures was regarding the exchange rate policy. The government recognized the importance of liberalizing its policy on exchange rate. Thus, a smooth transition from a fixed exchange rate system to a more flexible one was performed. As it has been done in other developing countries, Ethiopia initially practiced consequent devaluation of the exchange rate to reduce the gap between the official and parallel market rates. Then, it introduced a Dutch type of exchange rate auction market for the determination of the exchange rate. Finally, it practices an inter-bank exchange rate determination system. By doing so it has slowly moved away from a fixed exchange rate system. These developments are discussed in the subsequent sections.

The domestic currency was devalued from 2.07 Birr/USD to 5.00Birr/USD in October 1992 to improve mainly the deficit in the balance of payment by discouraging the demand for imports and encouraging the demand for exports. Tamiru D. (2005) also showed that the following were the specific objectives of the devaluation during the reform period.

- To stabilize the economy and attain economic growth.
- To narrow the gap in the current account deficit by increasing the profitability of exports and at the same time, to increase the local cost of imports.
- To enable exporters to offer a competitive price to the coffee producers.
- To reduce external imbalance and promote the use of under-utilized labour or excess capacity.
- To improve the government budget by increasing the taxes revenue from imports and exports.
- To reduce the parallel market premium and improve efficiency in resource allocation.

3.4. Auction System [1993- 1998]

The Auction system in Ethiopia was a type of Dutch auction system. The name is derived from an auction system used for centuries in the Netherlands flower industry. Hundreds of years ago, growers of flower decided to be less dependent on the buyers and found an auction where they brought all their flowers together to determine their prices. Unlike typical auctions, it runs on a clock system where the maximum price is set by the auctioneer [such as the Flora Holland] and keeps falling till the price is interesting for the buyer (thus showing the equilibrium between supply and demand). The clock auction does not permit counter bidding and the auction is conducted in reverse with prices falling. The movement of a price indicating running light on the clock represents a fall in price. The auction stops when a buyer presses a button indicating a purchase of flowers (Ticker Management Talk 2009).

In general, there are two ways in which the exchange rate can be determined through an auction system, i.e., discriminatory or Dutch auction and a competitive or marginal pricing auction system. The Ethiopian exchange rate auction system was a type of discriminatory or Dutch auction system. In this system, the foreign exchange was allocated to winners of bids at their respective bid prices until the total foreign exchange made available was exhausted (Derrese Degefa, 2001).

The National Bank of Ethiopia (NBE) introduced the Dutch auction system of exchange rate determination on May 1, 1993, to achieve the following objectives (NBE 2000; cited in Dereje G. 2004).

- To allow the exchange rate to respond to changes in the demand for and supply of foreign exchange markets.

- To ensure prompt and timely provision of foreign exchange to effect essential transactions.
- To minimize the use of administrative mechanism in the allocation of foreign exchange, and
- To prompt trade liberalization through easing and finally, eliminate controls on exports and foreign payments and thereby enhance the volume of external trade.

The auction process was administered by the Foreign Exchange Auction committee which initially composed of members drawn from both private and public sectors to ensure transparency. With the termination of the retail auction and introduction of the wholesales auction in September 1998, however, the auction committee members were exclusively from the National Bank of Ethiopia. In both cases, the governor was the chairperson of the committee. The Foreign Exchange Auction Secretariat provided the committee with the necessary technical and administrative support for the successful conduct of an auction (NBE 2000; cited in Dereje G. 2004).

The auction procedures were as follows. A public announcement was made by the national bank regarding the amount of foreign exchange to be auctioned and the procedure of applying and bidding period to an auction. Bid applicants were required to fill a foreign exchange bidding application form in which they would specify the amount of foreign exchange required, the exact amount of birr they would be willing to pay for a USD and the purpose for which the foreign exchange was required. An applicant might submit as many sealed bids (multiple bids) as she/he required for the purchase of foreign exchange to import different goods. But it was forbidden to offer different bid rates for similar items from the same supplier. Then, the bids were ordered by decreasing price, until the pre-announced supply target was reached. Below this marginal price, bids were deemed unsuccessful. This marginal bid determined the exchange rate for exports until the next auction (NBE directive 19/96; cited in Dereje G. 2004).

Despite the purchase requirement of the bidder for various currencies, the birr cost of bids (bid rates) must be expressed in terms of the USD. The birr value of the bids for currencies other than the USD was calculated by the foreign exchange auction secretariat using the bid rates in terms of the USD and the cross rate between the USD and the appropriate currencies prevailing on the business day preceding the date of the auction. Any difference between the birr amount deposited by the bidder and the amount obtained by applying the appropriate cross rate was adjusted to the account of the bidder i.e. the bidder was required to pay the difference at the time of allocation of the foreign exchange by the National Bank of Ethiopia. The bank made available the foreign exchange won at the auction within two business days after the auction up on the fulfilment of the import procedures outlined in the exchange control procedure. Apart from this, it made available to the successful bidders the major convertible currencies such as the Canadian dollar, Pound sterling, Japanese yen, Dutch mark etc (17 major world currencies including the euro and SDR) (NBE directive 19/96; cited in Dereje G. 2004).

However, bidders with bids at the marginal price did not receive a pro-rated fraction of their demand. Instead, the committee had to decide whether it was feasible to expand supply to provide fully for all bidders' demands at this marginal price or to decrease supply from the pre-announced level and make the next higher price the marginal price. The reason for this inflexibility according to Jenine Aron (1998) was to simplify the monitoring of foreign exchange usage which was required by donor countries and organizations, since sufficient foreign exchange was required to purchase particular or dedicated imports for which pro-forma invoices were provided. Providing partial amounts of foreign exchange for these 'lumpy' imports would have meant bidders returning at another auction, considerably increasing monitoring bureaucracy.

The auction was initially held every two weeks and later on weekly basis. It was conducted on a retail base but finally changed to a wholesale base. During this time, two types of exchange rates were used, one was the official rate determined by the National Bank and the other was the marginal rate determined by the auction system among the commercial banks. The official exchange rate was determined as the simple average of the buying and selling rates of the auction system. It was used for the import of 'essential' commodities such as the imports of petroleum, pharmaceuticals, fertilizers and debt service and government contributions to international organizations and its foreign offices. All transactions other than these were conducted with the marginal rate determined in the auction market. The major imports that were financed at the marginal auction exchange rate are spare parts, chemicals, various raw materials, machinery and equipment, and non-durable goods. Prior to February 1995, foreign exchange was not made available through official markets for negative list imports, which include wild animals, meat, butter, fish, oilseeds, sugar and honey, coffee, tea, spices, alcoholic beverages, leather, chat, beeswax, cotton based fabrics, TV sets, radios, private autos, shoes, watches and jewellery (Derrese Degefa, 2001).

The National Bank of Ethiopia announced the unification of the official and marginal rates on July 25, 1995 (Derrese Degefa, 2001). This single exchange rate was determined through auction market. The reason for the introduction of this measure, according to Derrese D., was that the government lifts the privilege or implicit subsidy given to the so called 'essential' items listed above. Thus, the marginal rate became official rate. Since then, based on the auction result, this exchange rate had been applied for all imports.

As the demand for foreign exchange increased, after a year stay (in 1996), the bank declared that the auction would be held weekly to satisfy the demand for foreign exchange. This action stayed up to September, 1998 only and replaced by wholesale auction. This was the same as the retail auction system except the participants in the wholesale auction are pre-determined. In the wholesale auction, the participants are banks and investors who want foreign exchange above half a million. For those who are in need of less than half a million dollar can obtain from the foreign exchange bureaus established in the same year. The bureaus are allowed to issue foreign exchanges to importers and exporters against the required documents as specified by national bank, with the exception of coffee, and collect commission for the bank and for their own through the foreign exchange permit desk. The purchase of foreign exchange is without any limit while the sale of foreign exchange is undertaken as per the limit set by the bank (Tamiru D. 2005). The requirements to participate in the wholesale auction markets include a permanent import license, supplementary documents such as a copy of registered trade balance, the birr equivalent of the foreign exchange, and pro-forma invoices indicating the price as well as transport expenses from at least two suppliers. The minimum bid allowed for participation in the auction was US$5,000 for the first three years after the adoption of the auction system. It was then raised to US$10,000 on 1 December, 1995 (Derrese Degefa, 2001).

With the establishment of wholesale foreign exchange auction, the National Bank of Ethiopia took the following measures in 1998 in order to further liberalize current external transactions and decentralize import and export licensing procedures (Derrese Degefa, 2001).

- The commercial banks were empowered to handle the licensing of foreign exchange for merchandise imports and the issuance of export permits with the exception of that for coffee, which remains with the NBE.

- There was automatic provision of foreign exchange for merchandise imports by commercial banks for an amount not exceeding $500,000 US dollars.
- The surrender of foreign exchange proceeds from exports to commercial banks was subject to the following procedures: 10% of export proceeds may be indefinitely retained in the exporter's own foreign currency account in a domestic bank while the remaining 90% may be converted into local currency at any legal exchange deemed favourable by the exporter within a period of 28 days.
- With the exception of a US$1,200 limit on the purchase of foreign exchange for holiday travel abroad, clients might purchase any amount of foreign exchange at the foreign exchange bureaus for educational, medical, business travel and other similar expenses abroad.
- Foreign employees working in Ethiopia might transfer abroad any amount of foreign exchange up to an individual's net salary earnings.
- The weekly retail foreign exchange auction was replaced by the weekly wholesale foreign exchange auction for participants bidding not less than US$500,000.

The average foreign exchange supply per auction was 17.2 million dollar for the fortnight auctions and 17.6 million dollar for the weekly auctions. During the auction period, 143 auctions were conducted of which the first 85 auctions were conducted fortnightly and the remaining weekly. The supply of foreign exchange to the auction market was mainly derived from foreign aid and coffee export receipts (Jenine Aron, 1998).

The auctions were classified into three groups by Jenine Aron (1998) on the basis of their distinct features. The first group consists of auctions 1-29, the second group consists of auctions 30-104 and the third group consists of auctions 105-143. The first group of auctions were characterized

by a period of learning for the central bank and bidders. The exchange rate was fairly volatile and the emphasis was on reducing the parallel premium. Fiscal demand was particularly high in this period. The second group of auctions included both weekly and fortnightly auctions, and a fairly stable crawl for the exchange rate was evident. The third group of auctions were weekly auctions that occur shortly after the banning of the *franco valuta*[3] market and extension of the auction to include second hand goods. Demand was considerably increased as new bidders came in from the *franco valuta* market, yet supply was constrained.

3.5. Inter-Bank Exchange Rate Determination [since 1998]

The most recent development in the liberalization of exchange rate system in Ethiopia is the establishment of an inter-bank exchange rate determination system. According to Tamiru D. (2005), the auction system did not satisfy the commercial banks' demand for foreign currency as the request by their customers for foreign currency became beyond the amount of foreign currency they bought from NBE and the latter was unable to satisfy banks' request due to shortage of foreign currency. On the other hand, some commercial banks could accumulate excess foreign currency beyond their utilization capacity and the limit they are allowed to hold in their safe account. In order to alleviate this problem, the NBE through Directive No.IBD/01/98 allowed authorized commercial banks to buy and sell foreign exchange among each other between weekly wholesale auctions.

The foreign exchange bureaus were established and allowed to engage in all approved spot/cash external current account transactions. There is exchange tax on exchange sale. Authorized dealers must observe a prescribed commission of 1.5% on selling, which accrues to the National Bank of Ethiopia, and they may levy service charges of up to 0.25% on buying and 1% on selling for their

[3] Franco valuta refers to the process of importing goods by a person permitted to do so by using foreign currency from his own source.

own accounts. The National Bank of Ethiopia transferred the responsibility for determining compliance of buyers and sellers of foreign exchange with import and export licensing requirements and foreign exchange regulation to commercial banks (IMF 2000).

The transition from the wholesale foreign auction market to inter-bank market represents a significant step forward to create a flexible exchange rate and complex market structure. Under the inter-bank system, the exchange rate is determined in negotiations between banks and their clients and in transactions between the banks. The exchange rate is free to vary from hour to hour and day to day. However, to ensure the competitive operation of the market, the NBE imposed maximum and minimum limits on foreign exchange holdings of commercial banks. According to Eyob Tesfaye (2001), the main objectives of such regulations are twofold.

First, it helps to prevent banks from excessive exchange risk and to restrain dealers from some kind of speculative operation. The size of the limits for instance, could be established by taking the previous working balances of banks in to consideration.

Second, a regulation on the upper limit of the volume of foreign exchange surrendered to each commercial bank helps to prevent any bank from collusive practices. Such limit could be necessary in countries where the foreign exchange receipts of the economy accrue to one or a few major transactions which could then direct all of their foreign exchange earnings to one exchange dealer with regard to the difference between the two markets (i.e. between an auction arrangement and inter-bank system) (Quirck 1987; cited in Eyob Tesfaye 2001).

In an inter-bank arrangement the surrender requirement of foreign exchange is not as strict as the auction system and it may largely remain in the hands of the private sector. Under an inter-bank

arrangement, the national bank may put some portion aside for certain purposes like payments of external debt obligations (Eyob Tesfaye 2001).

The nature of the inter-bank market system is also different from the auction market in terms of the supply side of the market, namely the exchange rate applying to sales. Under the inter-bank market system, the exchange rate may be determined directly and may vary continuously during business hour by negotiation between buyers and sellers but under the auction system, which functions discretely, surrender occurs in practice at the exchange rate determined in the preceding auction. This may create uncertainty for market participants engaged in both purchases and sales in the market. The more frequently the auctions are conducted, the less inefficiency in the market occurs (Eyob Tesfaye, 2001).

3.6. The Parallel Exchange rate market in Ethiopia

The parallel foreign exchange market is usually created in response to foreign exchange scarcity in the formal economy. It is common in most developing countries. If the supply of foreign exchange in the official market is insufficient to satisfy the demand for it at the official exchange rate, excess demand for foreign currency is created in this market. If the concerned body of the government does not react to this excess demand, it will result in the emergence of a parallel foreign exchange market (Derrese Degefa, 2001).

According to Derrese Degefa (2001), Naude and Abu Girma (1994) showed that the illegal parallel market for foreign exchange in Ethiopia developed in the 1970s and expanded considerably during the 1980s in response to import controls and foreign exchange rationing implemented by the Derge regime. Befekadu Degefe (1994; cited in Derrese Degefa, 2001) added that the significance of the illegal parallel market for foreign exchange grew to the extent of

impairing the operations of the official foreign exchange market during the post-1974 years, and particularly since 1981.

The sources of supply and demand for foreign exchange in a parallel market differ from country to country and depend on the nature and effectiveness of exchange restrictions imposed. According to Derrese Degefa (2001), the supply of foreign currency in a parallel foreign exchange market generally has five principal sources: smuggling of exports, under-invoicing of exports, over-invoicing of imports, foreign tourists and the diversion of remittances from abroad into unofficial channels. Besides, government officials may also divert foreign currency from official to a parallel market through corruption. The dominant sources of supply of foreign exchange for the parallel market in Ethiopia are largely contraband exports (smuggled exports) of goods and services and unofficial private transfers.

Contraband importers and invisible payments such as payments for medical, educational and travel services abroad are the dominant sources of demand for foreign exchange in the parallel foreign exchange market of Ethiopia. Also, a large portion of *franco valuta* imports was financed with the foreign exchange obtained on the parallel foreign exchange market. Jenine Aron (1998) shows that the *franco volute* imports were paid by importers' own funds, source undeclared and attracted an additional tariff. The *franco voluta* market was established in 1983 and operated until August 1996, when it was abolished.

Dordunoo (1994; cited in Derrese Degefa, 2001) argued that a large parallel market for foreign exchange with a high premium indicates a basic disequilibrium in the foreign exchange market and trade regimes and, hence, involves substantial social and economic costs. The expansion of a parallel market for foreign exchange leads to the loss of government control over the economy as

more and more of the official transactions are diverted to the parallel market. Kiguel and O'Connel (1995; cited in Derrese Degefa, 2001) similarly asserted the negative impact of a parallel market. They argued that as the illegal markets develop, the premium with the official market widens. This has detrimental effects on official exports and growth. According to them, a 10% premium is likely to reduce GDP growth by 0.4 percentage points per year.

The study by Derrese Degefa (2001) shows that Ethiopia is among those countries that had high parallel premium for foreign exchange for 20 years (1973–1993). Despite the maxi-devaluation of October 1992, which was followed by mini-devaluations, adoption of an auction system for foreign exchange in May 1993 and gradual trade liberalization reforms, the parallel premium remained high in 1992 and 1993 before dropping to the range of moderate premium in 1994, 1995 and 1996 and then to the low level afterwards. Accordingly, he showed that the parallel premium rose from 21.74% in 1972 to 238% in 1991 and then dramatically fell to 45% in 1992 due to the maxi-devaluation in that year. The premium further fell to about 15.59% in 1996, largely in response to the operation of the auction system. The rapid expansion of the parallel market for foreign exchange particularly after 1974 and before 1992 may be mainly attributed to the serious economic crisis that partly emanated from acute foreign exchange constraints during the Derge regime.

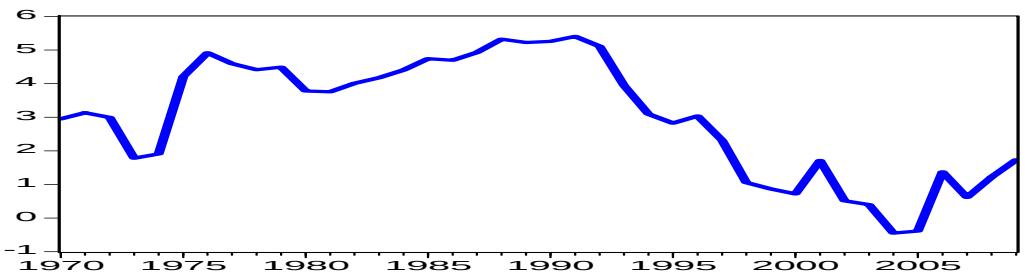

Fig. 3.1 Exchange Rate Premium

CHAPTER FOUR

4. METHODOLOGY AND MODEL SPECIFICATION

4.1. Methodology of the Study

4.1.1. Data type and Sources

This study fully relies on secondary data. Data were collected from annual reports and publications of National Bank of Ethiopia (NBE), Ethiopia Central Statistics Authority (CSA), Ministry of Finance and Economic Development (MoFED), and Ethiopian Economic Association (EEA) as well as various issues and data bases of International Monetary Fund (IMF), International Financial Statistics (IFS) and World Bank (WB). The annual time series data covers the period 1970-2009 and includes real GDP, real effective exchange rate, Real interest rate, government expenditure, active labour force growth, exchange rate premium, broad money supply and exchange rate regime [dummy variable] variables in the analysis.

4.1.2. Method of Data Analysis

Descriptive as well as Econometric methods are employed to discuss and analyze different issues in this study. In the descriptive technique, statistical and time series properties such as means, standard deviations, maximums, minimums and correlation matrices are used. These measurements are used to show the trending behaviour of economic growth with respect to real effective exchange rate and other variables. In the Econometric method part, emphasis is placed on investigating the effects of Real Effective Exchange Rate on the growth of Real Gross Domestic Product. The data are analysed using PcGive, STATA and EVIEWS softwares. The nature of the model is given in logarithmic form to make the analysis and interpretation of the explanatory variables easier in terms of percentage and growth rate.

4.2. Model Specification

The model used in this study was initially derived by Thapa N.B. (2002). Thapa N.B. derived an econometric model from the Keynesian open economy macroeconomic framework for his study of the impact of real effective exchange rate on economic activities in Nepal.

There are two major economic agents for a simple economy; namely consumers and producers representing the demand and supply side of the economy. Neoclassical economists initially, assumed that consumers spent their income on consumption and save what are left thereafter and producers sell part of their produce for consumption and reinvest the remaining. The identities for these are given as follows respectively in Dornbusch R. and Fischer S. (1994).

$$Y=C+S \quad \text{.....(4.1)}$$

$$Y=C+I \quad \text{.....(4.2)}$$

Where Y represents output or income, C is consumption, S is saving and I is investment. From these two equations, they derived the relationship between saving and investment and show that at equilibrium:

$$S=I \quad \text{.....(4.3)}$$

The neoclassical economists assumed that it is the level of saving that determines output. But for the Keynesian economists, it is the level of investment that determines output because all what are saved may not be invested. Thus, by considering equation (4.2) and recognizing the importance of a third economic agent [government represented by G], they defined the demand side of the economy as follows.

$$Y=C+I+G \quad \text{.....(4.4)}$$

Moreover, countries also make trade among themselves to consume what they cannot produce. The net exchange between what they supply and receive is measured by net export (NX). It is equal to exports minus imports. Thus, the new identity would be:

$$Y=C+I+G+NX \quad (4.5)$$

In the supply side, producers need resources such as labour and capital to produce output. According to neoclassical economists, output is also determined by total factor productivity. Thus, it can be defined as follows (Dornbusch R. and Fischer S. 1994).

$$Y= f(A, L, K) \quad (4.6)$$

Where *A* represents total factor productivity, *L* is labour input and *K* is capital input. Using a Cobb-Douglas production function, it can take the following form.

$$Y= AL^{\alpha}K^{\beta} \quad (4.7)$$

Log-linearzing both sides, the growth of output can be defined as:

$$y=a + \alpha \mathbf{l} + \beta k \quad (4.8)$$

Thapa N.B. compiled the variables of his model from the aggregate demand as well as aggregate supply part of the macroeconomic framework discussed above. The researcher in this study believed that such compilation of factors from the demand as well as supply sides may help policy makers to identify factors from both sides and take measures that can affect either side without affecting the overall performance. For example, if they want to influence the demand side, they may use the most statistically significant variable derived from this side. If they want to influence the supply side, they may use the most statistically significant variable derived from this side. It is not necessarily true that the most statistically significant variable in the demand side will be equally statistically significant in the supply side. The researcher defined the demand

as well as the supply side separately and finally put all factors together to determine the factors that have net effect on real GDP and identify whether real effective exchange rate is among the statistically significant variables.

The following is a summary of the procedures that show the model derived by Thapa and modified by Moya M. and Watundu S. (2009). The model is used in this study with further modifications appropriate for the Ethiopian economy.

The standard framework for demand side of a GDP in an open economy is given as follows in Thapa (2002).

$$GDP = C + I + G + (X-M) \quad \text{.....(4.9)}$$

Where C refers to private sector consumption expenditure, I is private sector investment expenditure, G is government expenditure, and X and M are exports and imports of goods and services respectively.

The term (X-M) is the difference between exports and imports and can be expressed as (NX). Therefore, the above equation can be equivalently expressed as:

$$AD \text{ or } GDP = C + I + G + NX \quad \text{.....(4.10)}$$

The term C represents the private sector consumption expenditure. It is a positive function of income and a negative function of real interest rate. The term investment (I) can be considered as a negative function of real interest rate. Government expenditure is exogenous factor, which depends on government policy. The term NX, i.e. the external demand for domestic goods and services is postulated as a positive function of real exchange rate. On the basis of these determinants of real GDP, the above relationship was converted in to the following equation.

$$GDP = a - b_1(\gamma) - b_2(q) + b_3(g) + U_t \quad \text{.....(4.11)}$$

Where γ refers to real interest rate =r-p^e [r = nominal interest rate and p^e = expected inflation rate], q is real exchange rate, g is government expenditure and U_t is an error term.

The equation can be elaborated as follows. Thapa (2002) assumes that the decision whether to consume or invest a saving depends on the real interest rate. Therefore, instead of the two variables [C and I], he considered real interest rate [γ] as a variable that determine output. Both consumption expenditure and Investment expenditure are negative functions of real interest rate. Net exports are represented by exchange rate. Exchange rate policy that promotes exports encourages production. The negative sign is because Thapa defined increase in exchange rate as appreciation of the domestic currency. Thus, increase in exchange rate or appreciation of the domestic currency decreases the demand for exports in his model. Increase in government expenditure has positive impacts on GDP.

According to Thapa (2002), nominal interest rate depends on, among others, total money supply in the economy. Nominal interest rate is said to be negative function of money supply. Thus, GDP will be positive function of money supply. Thapa redefined GDP as a positive function of money supply instead of a negative function of real interest rate and substituted the real interest rate term in the above model by money supply term. By introducing lagged real GDP, the following equation is used to define RGDP in the demand side of the Ethiopian economy.

$$LogRGDP_t = a + b_1Log(RGDP_{t-1}) - b_2Log(REER)_t + b_3Log(BMON)_t + b_4Log\,(GOVEX)_t + U_t \quad .....(4.12)$$

Where $RGDP_{t-1}$ represents lagged RGDP, *REER* is real effective exchange rate, *BMON* is broad money supply and *GOVEX* is government expenditure. The sign of *REER* shows that decrease in

exchange rate [depreciation of the domestic currency] is expected to encourage the foreign demand for domestic goods and services thereby raising gross domestic product.

On the supply side, Thapa (2002) considered three determinants of real GDP growth; namely labour (L), capital (K) and total factor productivity (TFP) as follows.

$$AS \text{ or } GDP = f(L, K, TFP) \quad \text{.....(4.13)}$$

The equation shows that real GDP goes up with the increased use of labour force, capital and increased total factor productivity (TFP). The employment of labour and capital depends on their factor prices, wage and interest rate respectively. Thus, the employment of labour and capital are negatively affected by wage and real interest rate respectively. Thapa has left out total factor productivity from his analysis for the reason that it is exogenous from the producers' viewpoint. Therefore, the equation in the supply sides takes the following form in his analysis.

$$GDP = a - b_1(w) - b_2(\gamma) + U_t \quad \text{.....(4.14)}$$

In the model modified by Moya M. and Watundu S. (2009) for the Ugandan economy, they considered the importance of exchange rate in the supply side as well. This variable is considered for the Ethiopian economy as well since there are industries importing semi-finished products for the production of final goods like the Ugandan economy. Decrease in exchange rate [depreciation] increases the cost of importing these materials and thereby reduces their employment. This finally reduces the aggregate supply. This means exchange rate may be positively related to real GDP in the supply side.

Another important fact in Ethiopia is about the nature of wage rates. It is a well known fact that Ethiopia's economy is an agrarian economy where almost 50% of the total annual output is derived from this sector. Most of the population [more than 80%] is employed in this sector. This

implies that cost of employment for labour or the wage rate [if available] should be mainly determined in a factor market for the agricultural sector. But a related fact shows that farmers in Ethiopia use mainly family labour the employment of which hardly depend on the level of wage rate or its opportunity cost. It may have opportunity cost in the form of wage income earned if it was to be employed in another sector or sub-sector. This shows that output in the agricultural sector in particular and the Ethiopian economy in general may not be directly related to the level of wage rate rather to the level of employment or quantity of labour employed. Therefore, it is better to consider the level of employment for labour rather than the wage rate in this analysis. Again data on real wage rate is not available in Ethiopia. By adding real effective exchange rate and labour variables [labour force growth rate is a proxy of labour in the model below] and removing wage rate and maintaining real interest rate, the following equation is used to define RGDP in the supply side of the Ethiopian economy.

$$LogRGDP_t = a + b_1 Log(RGDP_{t-1}) + b_2 Log(REER)_t - b_3(RINT)_t + b_4(LABG)_t + U_t \quad \text{.....(4.15)}$$

Where $RGDP_{t-1}$ represents lagged RGDP, *REER* is real effective exchange rate, *RINT* is real interest rate and *LABG* is growth rate of active labour force.

Change in exchange rate has opposite effects on the demand and supply sides. These effects are related to two different views of the impact of real exchange rate on RGDP as discussed in the literature review part; the Traditional and the Modern views respectively. The traditional view shows that the impact works through the aggregate demand channel while the Modern view states that the impact works through the aggregate supply channel.

Thapa tested these two conflicting theoretical views empirically by combining equation (4.12) and equation (4.15). He excluded real interest rate (γ) from his final analysis. The reason may be that it is highly correlated with money supply. By combining these two equations and adding

exchange rate premium and exchange rate regime [dummy] variables, the following model is used to determine the net effect of REER on the RGDP growth in Ethiopia.

$$LogRGDP_t = \alpha + \beta_1 Log(RGDP)_{t-1} + \beta_2 Log(REER)_t + \beta_3 Log(BMON)_t + \beta_4 Log(GOVEX)_t + \beta_5 (RINT)_t + \beta_6 (LABG)_t + \beta_7 Log(EXPR)_t + \beta_8 (REG)_t + U_t \quad \text{.....(4.16)}$$

$RGDP_t$ represents real income or real gross domestic product. Real gross domestic product refers to the value of all final goods and services produced within the territory of a given country in a given period, usually a year. It is calculated at constant price.

$RGDP_{t-1}$ represents lagged real GDP. The real GDP of the current year may depend on the real GDP a year before. Thus, it is considered as one variable that determine current real GDP in Ethiopia.

REER represents real effective exchange rate and is expected to have significant and positive/negative coefficient. Increase/decrease in exchange rate is defined as appreciation/depreciation of the domestic currency in this study. The national bank of Ethiopia defines real effective exchange rate as $REER_t = \sum_{i=1}^{n} \left(\frac{C_i}{C_h}\frac{CPI_h}{CPI_i}\right) W_i$ Where C_i and C_h represent the currency of the i^{th} country and the home economy respectively. CPI_h and CPI_i are the consumer price indices of the home country and the i^{th} country. W_i is the trade weight of the i^{th} country.

If REER has negative sign and statistically significant magnitude, the impact is said to work through the aggregate demand channel. That is, depreciation of the domestic currency improves the economic growth of a country. If it has positive sign and statistically significant magnitude, the impact is said to work through the aggregate supply channel. That is, depreciation of the domestic currency increases the costs of importing raw materials and thus reduces economic

growth of a country. If it has insignificant magnitude, it is said to have no effect on the economic growth of Ethiopia.

BMON represents broad money (M_2) that refers to "the sum of all currency in the hand of non-bank, public, all deposits subject to check, and all outstanding travellers check" (Pilbeam K., 1998). It is assumed to have positive effect on real GDP.

GOVEX represents total [current + capital] government expenditure. It is assumed to have positive and significant effect on real gross domestic product since it is expenditure by the government that may increase aggregate demand initially and boost aggregate supply finally.

RINT represents real interest rate. Increase in interest rate reduces the availability of money and discourages investment and production. Hence, it reduces growth. This means, it is expected to have a negative sign and statistically significant magnitude.

$LABG_t$ represents the growth rate of the active labour force in the economy. Labour force is one of the factors of production that determines output. It is expected to have positive and significant coefficient for the Ethiopian economy.

EXPR represents exchange rate premium. It refers to the deviation between the parallel and the official exchange rate markets. It is calculated as the difference between the parallel and official exchange rates as percentage of the official exchange rate [(parallel rate-official rate)/official rate]. The larger the deviation, the smaller the growth rate of the real GDP.

REG_t refers to a dummy variable representing exchange rate regime. It takes a value of one for fixed exchange rate regime during the period 1970-1991 and a value of zero for flexible exchange rate regime during the period 1992-2009.

4.2.1. Unit Root Tests

1. Introduction

A stochastic process is said to be stationary if its mean and variance are constant over time and the value of the covariance between the two time periods depends only on the distance or gap or lag between the two time periods and not the actual time at which the covariance is computed. Such a time series tends to return to its mean (called mean reversion) and fluctuations around this mean (measured by its variance) will have broadly constant amplitude. If a time series is not stationary in the sense just defined, it is called a nonstationary time series. In other words, a nonstationary time series will have a time varying mean or a time varying variance or both (Gujarati 2004).

A study on the stationarity of variables is relevant for the reason that it incorporates important behaviour for these variables and making analysis with nonstationary variables may result in spurious correlation. A stationary time series is superior or more important than a nonstationary in economic analysis as it makes easier the study of the behaviour of variables in the long run. If a time series is nonstationary, the behaviour of the series can be studied only for the time period under consideration. Each set of time series data will therefore be for a particular episode. As a consequence, it is not possible to generalize it to other time periods. Therefore, for the purpose of forecasting, such (nonstationary) time series may be of little practical value (Gujarati 2004). Rather it has to be transformed first.

There are two ways of transforming a nonstationary variable in to a stationary one. If a nonstationary variable turns in to a stationary one by differencing [once or more], it is called *Differenced stationary process (DSP)*. If a nonstationary variable turns in to a stationary one by detrending or by removing its trend, it is called *Trend stationary process (TSP)*.

Different varieties of differenced and trend stationary processes may be derived from the following general model (Gujarati 2004).

$$Y_t = \beta_1 + \beta_2 t + \beta_3 Y_{t-1} + u_t \quad \text{.....(4.17)}$$

where:- u_t is a white noise error term and where t is time measured chronologically.

a) If $\beta_1 = 0$, $\beta_2 = 0$, $\beta_3 = 1$, it will be a random walk model [RWM] without drift/Pure random walk nonstationary process.
b) If $\beta_1 \neq 0$, $\beta_2 = 0$, $\beta_3 = 1$, it will be a random walk model [RWM] with drift nonstationary process.
c) If $\beta_1 \neq 0$, $\beta_2 \neq 0$, $\beta_3 = 0$, it will be a Deterministic nonstationary trend.
d) If $\beta_1 \neq 0$, $\beta_2 \neq 0$, $\beta_3 = 1$, it will be a Random walk with drift and deterministic trend.
e) If $\beta_1 \neq 0$, $\beta_2 \neq 0$, $\beta_3 < 1$, it will be a Deterministic trend with stationary AR(1) component.

In general, if a (nonstationary) time series has to be differenced *d* times to make it stationary, that time series is said to be integrated of order *d*. A time series Y_t integrated of order *d* is denoted as Y_t ~ I(d). If a time series Y_t is stationary to begin with (i.e. it does not require any differencing), it is said to be integrated of order zero, denoted by Y_t ~ I(0). Most economic time series are generally I(1); that is, they generally become stationary after taking their first differences (Gujarati 2004).

2. Tests of stationarity

Gujarati (2004) shows that it is possible to use informal [graphical analysis and correlograms] as well as formal methods for a test of stationarity. A graphical method is an informal method used to suspect whether a time series exhibit stationarity or not. This can be done by plotting all the variables against a time period. Such a plot gives an initial clue about the likely nature of the time

series. If the trend varies very much with time [steadily increases or decreases], then one can suspect the possibility of nonstationarity. This shows that the mean increases or decreases over time. But it cannot be a proof of nonstationarity. One has to go for a formal test of stationarity.

In the following sub-sections, three formal tests are discussed for stationarity; namely the Augmented Dickey-Fuller test, the Phillips-Perron test and the Clemente-Montanes-Rayes test.

a) **Augmented Dickey Fuller (ADF) Test**

The Augmented Dickey Fuller test is used to prove whether the suspected problem of nonstationarity in the graphical analysis exactly happens. To allow for various possibilities, Dickey and Fuller show that the test can be estimated in at least three different forms (Gujarati 2004).

Y_t is a random walk without drift: $\Delta Y_t = \delta Y_{t-1} + u_t$ .....(4.18)

Y_t is a random walk with drift: $\Delta Y_t = \beta_1 + \delta Y_{t-1} + u_t$ .....(4.19)

Y_t is a random walk with drift around a stochastic trend: $\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + u_t$ .....(4.20)

Where *t* is the time or trend variable. In each case, the null and alternative hypothesis are:

Ho: $\delta = 0$; [or $\rho=1$ that is, there is unit root or the time series is nonstationary]

Ha: $\delta < 0$; [or $\rho<1$ that is, there is no unit root or the time series is stationary]

If it is assumed that the error term u_t is uncorrelated, the DF test may be used. But in case the u_{ts} are correlated, Dickey and Fuller have developed a test, known as the Augmented Dickey–Fuller (ADF) test. This test is conducted by "augmenting" the preceding three equations [(4.18), (4.19),

and (4.20)] by adding the lagged values of the dependent variable ΔY_t. The ADF test is used in this study as most tests of the DF type have low power; that is, they tend to accept the null of unit root more frequently than is warranted.

The ADF test consists of estimating the following regression (Gujarati 2004).

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{m} (\alpha_i \Delta Y_{t-1}) + \varepsilon_t \quad \text{.....(4.21)}$$

Where ε_t is a pure white noise error term and $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$, $\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$, etc are consecutive lagged differences augmented. The procedure is to test whether $\delta=0$. The ADF test follows the same asymptotic distribution as the DF statistic, so the same critical values can be used. Dickey and Fuller have developed their own critical values for the test.

b) The Phillips-Perron Unit Root Test

In the DF test above, the error terms u_t are assumed to be independently and identically distributed. The ADF test later on adjusts the DF test to take care of possible serial correlation in the error terms by adding the lagged difference terms of the regressand (Gujurati 2004). Phillips and Perron, on the other hand, proposed a nonparametric method of controlling for serial correlation when testing for a unit root. The PP method estimates the non-augmented DF test equation and modifies the t-ratio of the α coefficient so that serial correlation does not affect the asymptotic distribution of the test statistic. A test of unit root using the Phillips-Perron approach does not require a lag length determination (Waheed, Muhammad, Alam, Tasneem and Ghauri, Saghir Pervaiz 2006).

The test regression for the PP tests is given by the following equation in Zhijie Xiao and Peter C.B. Phillips (1998).

$$\Delta y_t = c + \alpha y_{t-1} + u_t \quad \text{.....(4.22)}$$

Where u_t is I(0) and may be heteroskedastic. The PP tests correct for any serial correlation and hetroskedasticity in the errors u_t of the test regression by directly modifying the test statistics. These tests are known as Phillips Z_α and Z_t tests. The Z -tests allow for a wide class of time series with heterogeneously and serially correlated errors.

c) Unit root test that accounts for structural breaks

According to Christopher F. Baum (2001), a well–known weakness of the "Dickey–Fuller" style unit root test with I(1) as a null hypothesis is its potential confusion of structural breaks in the series as evidence of nonstationarity. Many econometricians have attempted to deal with this confusion by devising unit root tests that allow for some sort of structural instability in an otherwise deterministic model.

In his study Christopher F. Baum showed that this problem is fully addressed by Clemente, Montanes and Reyes in 1998. They proposed tests that would allow for two events within the observed history of a time series, either additive outliers (the AO model, which captures a sudden change in a series) or innovational outliers (the IO model, allowing for a gradual shift in the mean of the series). The AO model is given as follows in Baum (2001).

$$y_t = \mu + \delta_1 DU_{1t} + \delta_2 DU_{2t} + \hat{y}_t \quad \text{.....(4.23)}$$

Where $DU_{mt} = 1$ for $t > T_{bm}$ and 0 otherwise, for m = 1, 2. T_{b1} and T_{b2} are the breakpoints, to be located by grid search. The residuals from this regression, $\hat{y}_t$, are then the dependent variable in the equation to be estimated. They are regressed on their lagged values, a number of lagged differences and a set of dummy variables needed to make the distribution of the test statistic tractable:

$$\hat{y}_t = \sum_{i=1}^{k}(\omega_{1i} DT_{b1,t-i}) + \sum_{i=1}^{k}(\omega_{2i} DT_{b2,t-i}) + \alpha\tilde{y}_{t-i} + \sum_{i=1}^{k}(\theta_i \Delta\hat{y}_{t-i}) + e_t \quad \text{.....(4.24)}$$

Where $DT_{bm,t} = 1$ for $t = T_{bm+1}$ and 0 otherwise, for m = 1, 2. No intercept is necessary as $\hat{y}_t$ is mean zero. This regression is then estimated over feasible pairs of T_{b1} and T_{b2}, searching for the minimal t–ratio for the hypothesis $\alpha = 1$; that is, the strongest rejection of the unit root null hypothesis. The value of this minimal t–ratio is compared with critical values provided by Perron and Vogelsang (1992; cited in Baum, 2001), as they do not follow the standard "Dickey–Fuller" distribution.

Similarly, the equivalent model for the innovational outliers is given as follows in the same study.

$$\hat{y}_t = \mu + \delta_1 DU_{1t} + \delta_2 DU_{2t} + \emptyset_1 DT_{b1,t} + \emptyset_2 DT_{b2,t} + \alpha\tilde{y}_{t-i} + \sum_{i=1}^{k}(\theta_i \Delta\hat{y}_{t-i}) + e_t \quad \text{..... (4.25)}$$

Where again an estimate of α significantly less than unity will provide evidence against the I(1) null hypothesis.

Baum showed that in each of the above models, the breakpoints T_{b1}, T_{b2} and the appropriate lag order k are unknown. The breakpoints are located by a two–dimensional grid search for the maximal (most negative) t–statistic for the unit root hypothesis (α=1), while k is determined by a set of sequential F–tests.

According to Feridun M., Sawhney B. and Jalil A. (2009), if the estimates of the Clemente-Montanes-Reyes unit root tests provide evidence of significant additive or innovational outliers in the time series, the results derived from ADF and PP tests are doubtful, as this is evidence that the model excluding structural breaks is misspecified. Therefore, in applying unit root tests in time series that exhibit structural breaks, only the results from the Clemente-Montanes-Reyes unit root tests shall be considered if the two structural breaks indicated by the respective tests are statistically significant at 5% level of significance.

4.2.2. The Granger Causality Test

Although regression analysis deals with the dependence of one variable on other variables, it does not necessarily imply causation. In other words, the existence of a relationship between variables does not prove causality or the direction of influence. The Granger causality test assumes that the information relevant to the prediction of the respective variables, let it be Y_t and X_t, is contained solely in the time series data on these variables. The test involves estimating the following pair of regressions (Gujarati 2004):

$$Y_t = \sum_{i=1}^{n}(\alpha_i X_{t-i}) + \sum_{j=1}^{n}(\beta_j Y_{t-j}) + \mu_{1t} \quad (4.26)$$

$$X_t = \sum_{i=1}^{n}(\gamma_i X_{t-i}) + \sum_{j=1}^{n}(\delta_j Y_{t-j}) + \mu_{2t} \quad (4.27)$$

Where, it is assumed that the disturbances u_{1t} and u_{2t} are uncorrelated. The nature of causality for two variables is known as bilateral causality. It can be extended to multivariable causality through the technique of vector autoregression (VAR). The first equation postulates that Y_t is related to past values of itself as well as that of X_t, and the second equation postulates a similar behaviour for X_t.

Four cases of causality can be identified; unidirectional causality from X_t to Y_t exists if $\sum\alpha_i \neq 0$ in (4.26) and $\sum\delta_j = 0$ in (4.27), unidirectional causality from Y_t to X_t exists if $\sum\alpha_i = 0$ in (4.26) and $\sum\delta_j \neq 0$ in (4.27), feedback, or bilateral causality, is suggested when the sets of Y_t and X_t coefficients are statistically significantly different from zero in both regressions, and independence is suggested when the sets of X_t and Y_t coefficients are not statistically significant in both the regressions.

4.2.3. Cointegration and Testing for Cointegration

1. Introduction

There are two possibilities to deal with nonstationary variables in a given model after the stationarity test. One is, to difference the series so as to obtain stationary variables and if so, then continue with the analysis. This is used only for the analysis of a short run relationship. If not, the second is, to test if the linear combination of the nonstationary variables is stationary by using cointegration test. If they are cointegrated, then proceed the analysis with nonstationary variables. According to Engle and Granger (1987), for x_t and y_t both $I(1)$ to be cointegrated there should exist $a = 0$ such that $y_t - ax_t$ is $I(0)$ (i.e. $y_t - ax_t$ is stationary). (x_t, y_t) is denoted as $CI\ (1,\ 1)$.

Granger noted (cited in Gujarati 2004) that "A test for cointegration can be thought as a pre-test to avoid 'spurious regression' situations". A regression of one nonstationary variable over another nonstationary variable may yield a stationary series and if so, it is known as cointegrating regression and the slope parameter in such a regression is known as cointegrating parameter. The concept of cointegration can be extended to a regression model containing k regressors. In this case, one will have *k-1* cointegrating parameters.

2. Testing for Cointegration

Among a number of tests two commonly used tests are discussed in this section.

a) Engle–Granger (EG) Approach:

This is a DF or ADF unit root test on the residuals estimated from the cointegrating regression. The procedure here is to estimate a regression like the following:

$$Y_t = \beta_1 + \beta_2 X_t + u_t \quad \text{.....(4.28)}$$

and save the residuals, and use the DF/ADF tests with appropriate critical values developed by Engle and Granger to test whether the residuals are stationary. If it is stationary, the two variables

are cointegrated (Gujarati 2004). Engle and Granger (1987; cited in Gujarati 2004), however, show that such a test should be preceded by a check whether the two cointegrated series are integrated of the same order before estimating the model. If they are integrated of different order, it is a proof that they are not cointegrated.

Finally, one can estimate the error correction model from the stationary series of the residuals in step two. However, this method has some limitations. These include its inability to capture the problem of endogeneity and small sample bias. It does not also help to test more than one cointegrating vectors. Moreover, if there is a mistake in the estimation of the residuals in the first step, the estimation of the error correction model may face a problem in the second step (Eshete A. 2007).

b) Johansen Maximum Likelihood Method:

This method overcomes all the shortcomings associated with the Engle-Granger Approach. It applies the maximum likelihood procedure to determine the presence of cointegrating vectors in a vector autoregressive system. Johansen's methodology is given by the following vector autoregressive (VAR) of order *p* form in Erik Hjalmarsson and Par Osterholm (2007).

$$y_t = \mu + A_1 y_{t-1} + \ldots + A_p y_{t-p} + \varepsilon_t \quad \text{.....(4.29)}$$

Where y_t is an nx1 vector of variables that are integrated of order one [I(1)], μ is a vector of constant, ε_t is an nx1 vector and $A_1, A_2 \ldots A_p$ are PxP matrices of estimable parameters.

In the original work of Johansen S. and Juselius (1990), the model incorporates a vector of nonstochastic variables (D_t) orthogonal to the constant term such as seasonal dummies, 'dummy type' variables and/or stochastic 'weekly exogenous' variables. Thus, the model can also be given as:

$y_t = \mu + A_1 y_{t-1} + \ldots + A_p y_{t-p} + \Phi D_t + \varepsilon_t$ .....(4.30)

In general, economic time series are non-stationary processes and the above VAR model is expressed in its first differenced form in Erik Hjalmarsson and Par Osterholm (2007) as follows.

$\Delta y_t = \Pi y_{t-1} + \sum_{i=0}^{p-1} \Gamma \Delta y_{t-1} + \mu + \Phi D_t + \varepsilon_t$…….....……..……(4.31)

Where: $\Pi = \sum_{i=1}^{p} [A_t - I]$ and $\Gamma_i = -\sum_{j=i+1}^{p} [A_j]$

Γ and Π represent short run adjustment and long run relationship among the y_t variables respectively. The rank of Π shows the number of linear combinations of the y_t variables that are stationary. According to Johansen S. and Juselius (1990), there are three possibilities regarding the rank of the coefficient matrix Π. These are:

- If Rank (Π) ≈ n, i.e. the matrix Π has full rank, then it indicates that the vector process X_t is stationary. It means that there is cointegration.
- If Rank (Π) ≈ 0, i.e. the matrix Π has no rank, then the model in equation (4.31) corresponds to a traditional differenced vector time series model. It means that there is no cointegration among the variables.
- If 0 < rank (Π) ≈ r < n, then it implies that there are *nxr* matrices α and β such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is stationary.

r is the number of cointegrating relationships, the elements of α are known as the adjustment parameters in the vector error correction model and each column of β is a cointegrating vector. It can be shown that for a given *r*, the maximum likelihood estimator of β defines the combination of y_{t-1} that yields the *r* largest canonical correlations of Δy_t with y_{t-1} after correcting for lagged differences and deterministic variables when present. Johansen proposes two different likelihood ratio tests of the significance of these canonical correlations and thereby the reduced rank of the

Π matrix: the trace test and maximum eigen value test, shown below (Erik Hjalmarsson and Par Osterholm 2007).

$$J_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \lambda_t) \quad \text{.....(4.32)}$$

$$J_{max} = -T \ln(1-\lambda_{r+1}) \quad \text{.....(4.33)}$$

Where T is the sample size and λ_t is the i^{th} largest canonical correlation. The trace test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors where n is the number of endogenous variables, for r=0,1,2…,n-1. The maximum eigen-value test, on the other hand, tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of $r + 1$ cointegrating vectors. Neither of these test statistics follows a chi square distribution in general; asymptotic critical values are given by Johansen and Juselius (1990) and by most econometric software packages.

Given the drawbacks of the Engle-Granger approach and superiority of the Johansen Maximum Likelihood Method, this study uses the latter method.

4.3. Error Correction Mechanism (ECM)

If two variables are not cointegrated or proved to have no long run relationship, the testing procedure will stop there and one will not go for the construction of an error correction model. But if they are cointegrated or proved to have a long run relationship one needs to go for an error correction mechanism. The error correction mechanism (ECM) is a mechanism used to correct any short run deviation of the variables from their long run equilibrium.

The error correction mechanism (ECM) first used by Sargan and later popularized by Engle and Granger corrects for disequilibrium. An important theorem, known as the Granger representation

theorem, states that if two variables Y and X are cointegrated, then the long term or equilibrium relationship that exists between the two can be expressed as ECM (Gujarati 2004). This means one shall go for the construction of an error correction model if and only if the two variables are cointegrated. The ECM can be given by:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 u_{t-1} + \varepsilon_t \quad \text{.....(4.34)}$$

Where Δ denotes the first difference operator, ε_t is a random error term, and $u_{t-1}=(Y_{t-1}-\beta_1-\beta_2 X_{t-1})$, that is, the one-period lagged value of the error term from the cointegrating regression.

This ECM equation states that ΔY_t depends on ΔX_t and also on the equilibrium error term. If the latter [error term] is nonzero, the model is out of equilibrium. Suppose ΔX_t is zero and u_{t-1} is positive. This means Y_{t-1} is too high [above] to be in equilibrium. Since α_2 is expected to be negative, the term $\alpha_2 u_{t-1}$ is negative and, therefore, ΔY_t will be negative to restore the equilibrium. That is, if Y_t is above its equilibrium value, it will start falling in the next period to correct the equilibrium error; hence the name ECM. By the same token, if u_{t-1} is negative (i.e., Y_t is below its equilibrium value), $\alpha_2 u_{t-1}$ will be positive, which will cause ΔY_t to be positive, leading Y_t to rise in period t. The absolute value of α_2 determines how quickly the equilibrium is restored (Gujarati 2004).

4.4. Impulse Response Function and Variance Decomposition

The Impulse Response Function is defined as the effect of a shock of size δ hitting a system at time t on the state of the system at time $t+n$, given that no other shocks hit the system. More formally, the path followed by the variable $y_{m,t}$ in response to a one time change in $y_{j,t}$, holding the other variables constant at all times t, is called Impulse Response Function. The Impulse Response Function analysis is used in dynamic models such as a VAR to describe the impact of

an exogenous shock (innovation) in one variable on the other variables of the system (Panagiotidis T., Pelloni G. and Polasek W. 2003).

If the innovations to ε_t are contemporaneously uncorrelated, interpretation of the impulse response is straightforward. The i^{th} innovation $\varepsilon_{i,t}$ is simply a shock to the i^{th} endogenous variable $y_{i,t}$. Innovations, however, are usually correlated, and may be viewed as having a common component which cannot be associated with a specific variable (Eviews6.1 User′s Guide II 2007).

While impulse response functions trace the effects of a shock to one endogenous variable on to the other variables in the VAR, variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR (Eviews 6.1 User's Guide II 2007);

Consider a VAR of order P

$$y_t=\beta x_t+A_1 y_{t-1}+ \dots +A_p y_{t-p}+\varepsilon_t \quad (4.35)$$

Where y_t is a k vector of endogenous variables, x_t is a d vector of exogenous variables, and ε_t is a vector of innovations with variance matrix in Ω. Assuming the VAR is invertible, the moving average representation is given as follows in Eviews 3.1 User′s Guide (1998).

$$\begin{aligned}\tilde{y}_t&=A_1\tilde{y}_{t-1}+\dots+A_p\tilde{y}_{t-p}+\varepsilon_t\\ &=(I-A_1L-\dots-A_pL^P)^{-1}\varepsilon_t\\ &=(I+\psi_1L+\psi_2L^2+\dots)\varepsilon_t \quad (4.36)\end{aligned}$$

Where $\tilde{y}$ is the residual from regressing y on the exogenous variables x.

The coefficients ψ of the moving average representation are obtained as follows. The VAR coefficients A and the moving average coefficients ψ must satisfy the relation:

$(I-A_1L-\ldots-A_pL^P)(I+\psi_1L+\psi_2L^2+\ldots) = I$

$(I+C_1L+C_2L^2+\ldots) = I$

Where $C_1=C_2=\ldots=0$. These conditions on Cs recursively define the moving average coefficients:

$\psi_1 = A_1$

$\psi_2 = A_1\psi_1+A_2$

$\psi_s = A_1\psi_{s-1}+A_2\psi_{s-2}+\ldots+A_p\psi_{s-p}$

The orthogonalized impulse response at lag *s* is given by $\psi_s P$ where *P* is a *kxk* lower triangular matrix with the standard deviation of ε along the main diagonal such that PP'= Ω. The row i and column j element of $\psi_s P$ is the effect of a one standard deviation orthogonalized shock to y_{ij} on $y_{i(t+s)}$, holding all other shocks at all dates constant.

The variance is decomposed with the *s-period* ahead forecast error from a VAR as follows.

$\varepsilon_{t+s}\psi_1\varepsilon_{t+s-1}\psi_2\varepsilon_{t+s-2}+\ldots+\psi_{s-1}\varepsilon_{t+1}$ .....(4.37)

With mean squared errors:

$=(\Omega + \psi_1\Omega{\psi_1}' + \cdots + \psi_{s-1}\Omega{\psi_{s-1}}')$

$= (PP' + \psi_1 PP'{\psi_1}' + \cdots + \psi_{s-1}PP'{\psi_{s-1}}')$

$= \sum_{k=0}^{n} \left(P_jP_j' + \psi_1 P_jP_j'{\psi_1}' + \cdots + \psi_{s-1}P_jP_j'{\psi_{s-1}}'\right)$ ..... (4.38)

Where p_j is the j^{th} column of *P*. The expression in parentheses is the contribution of the j^{th} orthogonalized innovation to the mean squared error of the *s-period* ahead forecast.

CHAPTER FIVE

5. Empirical Analysis and Interpretation

5.1. Descriptive Data Analysis

5.1.1. Introduction

In the literature review part of this study, it has been shown that there is a possibility that economic growth may be affected by a number of factors among which some of them are to be verified in this chapter. The econometric analysis in this study identifies the major factors that influence economic growth in Ethiopia and verifies whether real effective exchange rate is among these factors. The extent to which economic growth depends on these factors [the magnitude] and the direction of the pressure they can put on economic growth [the sign] are determined. Three types of softwares, namely PcGive, STATA and EVIEWS are employed in the analysis of this study to benefit from the merits associated with each type of software. A time series data of 40 years [1970-2009] is used for the analysis of the relationship between real effective exchange rate and economic growth.

The analysis begins by describing the nature and trend behaviour of some variables and economic growth in the period under consideration by using descriptive analysis.

5.1.2. Exploration of the Data Set

a) Description of the Data Set

The main constraint with empirical studies done on Ethiopia is regarding the consistency and reliability of time series data provided by different institutions. For the same variable significantly different data are provided by different organizations. Let alone among international organizations/institutions, there is significant disparity between the data set provided by governmental organizations themselves. Different governmental organizations such as the

National Bank of Ethiopia (NBE), Central Statistics Authority (CSA) and Ministry of Finance and Economic Development (MoFED) sometimes provide different data for the same macro variable. However, compared to the data provided by a group of international organizations/institutions such as the International Financial Statistics (IFS) or World Bank/International Monetary Fund (IMF), the disparity among the data provided by the group of governmental organizations is less significant. The problem may arise due to the use of different methods or the inclusion of different components by different organizations/institutions for the collection or calculation of the same macro variables. To reduce the extent of the problem and maintain the consistency of the data set, the researcher prefers to use data provided by governmental organizations namely; the National Bank of Ethiopia (NBE), Ministry of Finance and Economic Development (MoFED) and Central Statistics Authority (CSA).

Among the major problems faced by the researcher was the difficulty to get real GDP data from its main source [Ministry of Finance and Economic Development (MoFED)]. There is a long time problem of preparing a time series data with the same base year in this ministry office. They frequently report real data for a short period of time, usually 10 years. For this study which extends for a long time [40 years], it is required to have long time series data with the same base period. Given this short coming in mind, the researcher tried to find alternative solutions by consulting different organizations such as the Ethiopian Economic Association and Ministry of Finance and Economic Development.

Three different alternatives were suggested to relieve the problem. The first is to pull back the most recent 10 years time series data to the extent required by using the growth rate of real GDP. The growth rate of real GDP data for whole period was calculated on the basis of the 10 years

period [2000-2009] report of real GDP. On the basis of this argument the real GDP for the back period is calculated as follows:

$$RGDP_{t-1} = {RGDP_t}/{[G_t + 1]} \quad \text{..... (5.1)}$$

Where $RGDP_t$ and $RGDP_{t-1}$ are real GDP at time *t* and *t-1* respectively and G_t is the growth rate of real GDP at time *t*. The base year is the year 2000.

The second and the third alternative suggest the calculation of real GDP on the basis of nominal GDP and the use of CPI or GDP deflator. The GDP deflator is calculated as a ratio of nominal GDP to real GDP. Using this index to calculate the real GDP may lead to erroneous results as GDP deflator itself is dependent on real GDP. Both series provide results with exaggerated differences with the real GDP series supplied by the MoFED for the current 10 years. For this reason, data calculated by the first method is used for this study [see appendix E].

Real GDP growth is defined as a function of log of lagged real GDP [LaGDP], log of real effective exchange rate [LREER], log of broad money supply [LBMON], log of government expenditure [LGOVEX], real interest rate [RINT], active labour force growth [LABG], log of exchange rate premium [LEXPR] and exchange rate regime [REG][dummy variable].

$$\text{LogRGDP}_t = \alpha + \beta_1\text{Log(RGDP)}_{t-1} + \beta_2\text{Log(REER)}_t + \beta_3\text{Log(BMON)}_t + \beta_4\text{Log(GOVEX)} + \beta_5(\text{RINT})_t + \beta_6(\text{LABG})_t + \beta_7\text{Log(EXPR)}_t + \beta_8(\text{REG})_t + U_t \quad \text{.....(5.2)}$$

b) Exchange Rate and Economic Growth

The graphs of real effective exchange rate and real GDP are plotted against time on fig. 5.1. They seem to follow inverse trend for most of the study period. A decrease/increase in real effective exchange rate represents depreciation/appreciation of the domestic currency in this study. Except for few years after the 2000s, a decrease/depreciation of the real effective exchange rate is

accompanied by an increase in the real gross domestic product. For the first few years [up to mid 1970s], the graph for the real effective exchange rate declines while the graph for the real gross domestic product rises. For the next 10 years [almost up to the mid of 1980s], the real effective exchange rate increases/appreciates slowly with minor fluctuations in between and reaches its peak in 1985 while the real gross domestic product declines sharply and reaches its minimum point in the same year. Then, the real effective exchange rate declines/depreciates sharply and rises/appreciates suddenly for some years until the reform period [1992].

After the reform period, the real effective exchange rate declines/depreciates rapidly and keeps a downward trend [with only minor peak in the mid 1990s] until the early years of 2000s. The real gross domestic product increases/decreases in the period the real effective exchange rate shows depreciation/appreciation until the early 2000s. For the post reform period, the real gross domestic product grows steadily and the real effective exchange rate depreciates continuously up to the mid 2000s. However, the graphs for the two series show similar behaviour of trending upward since the year 2005.

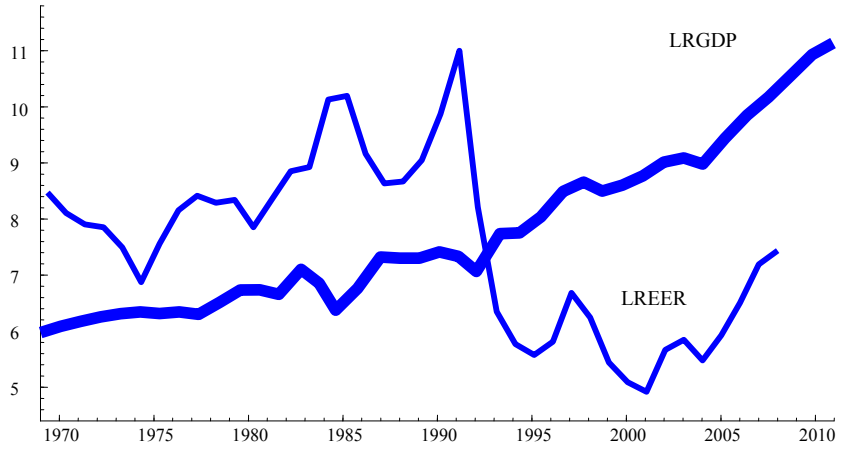

Fig. 5.1 Real effective exchange rate and economic growth

Real effective exchange rate is defined as a composite of nominal exchange rate, price indices [foreign and domestic] and trade weights. Any change in either price indices and/or trade weights of trading partners has the power to affect/change the real effective exchange rate. Changes in one of these factors could be the reason for the variation of real effective exchange rate for the period prior to 1992[reform period] though the nominal exchange rate was fixed. After the reform period, the nominal exchange rate is partly determined by the demand for and supply of foreign exchange among the commercial banks. Therefore, in addition to the above factors, any change in demand for and supply of foreign exchange of the inter-banks market, also affects the real effective exchange rate during this period.

c) Real Interest Rate and Economic Growth

Real interest rate is among the factors that ambiguously affect the growth of real gross domestic product i.e. the net impact of change in real interest rate on GDP can be positive or negative. Decrease in real interest rate encourages investment and increases output. However, it may discourage saving and result in short of supply of funds for the investors. Therefore, decrease in real interest rate encourages investment and increases output only if it is not lowered to the extent that discourage suppliers of this fund for the borrowers. If it is lowered below the level that interests the lenders, the investors cannot get sufficient funds for investment. In this case, decrease in real interest rate may reduce economic growth. The figure below shows that the two variables almost follow the same trend. Economic growth is negative in those periods when the real interest rate was negative. The only exception is when the economic growth was negative in 1998 and 2004 even though the real interest rate was positive. These may be associated with the war with Eritrea and the drought that happened during those years respectively. In the remaining period, it seems true that the two series follow similar trend.

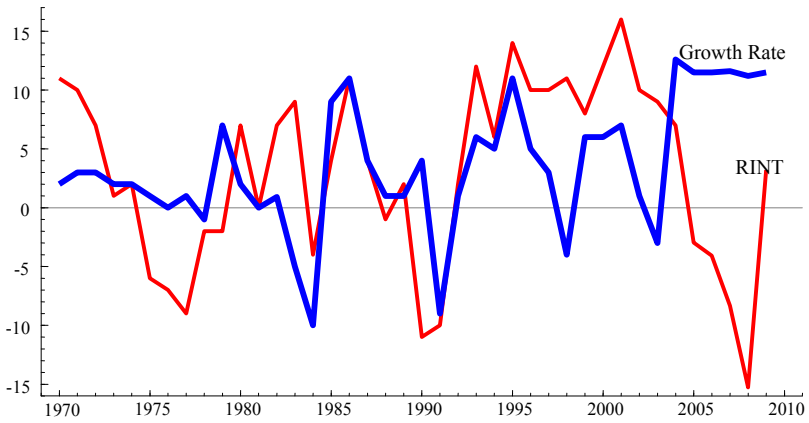

Fig. 5.2 Real Interest rate and economic growth

d) Government Expenditures and Economic growth

Both real gross domestic product and government expenditure increases steadily though the former is flatter while the latter is stepper. This shows that public spending increases at a faster rate than the growth rate of real GDP in the period under consideration. This is shown by figure 5.3. Higher growth rate of public expenditure may be associated with the key role the government play in the economy. In a developing country like Ethiopia, governments do have significant share in the employment and investment sector.

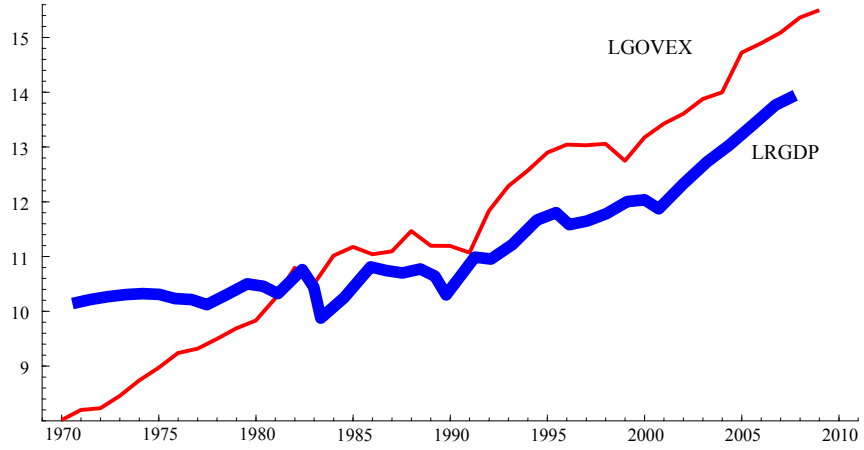

Fig. 5.3 Government Expenditures and economic growth

e) Exchange Rate Premium and Economic growth

As it has been shown by literatures, there is negative relationship between economic growth and exchange rate premium. As the gap between the official and parallel market rates increases, the significance of the parallel market in both the demand and supply sides of foreign exchange increases. According to Dordunoo (1994; cited in Derrese Degefa,2001), the expansion of a parallel market for foreign exchange leads to the loss of government control over the economy as a whole as more and more of the official transactions are diverted to this market. This reduces the size of exports and imports passing through the legal system and adversely affects economic growth.

In the figure below, the exchange rate premium does not show clear trend. However, the graph can be divided into two parts; the period before and after the reform of the 1992 when major change was made on the exchange rate system. Before the reform period, the exchange rate premium was growing for a long period. After the reform period, it continuously declines up to almost the introduction of the inter-bank exchange rate system in the early 2000s. In recent period, it has shown a tendency to increase.

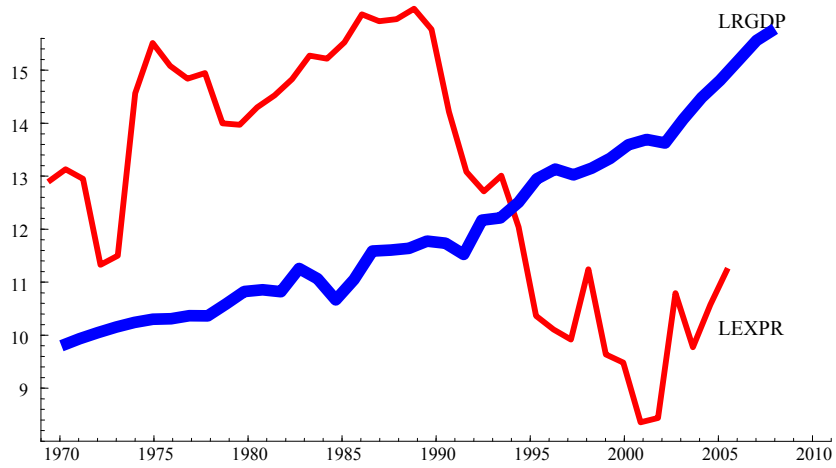

Fig. 5.4 Exchange Rate Premium and economic growth

Table 5.1 presents the summary statistics of the variables used to define real GDP growth in this study. It shows the number of observations, means, standard deviations, minimum and maximum values of each variable. All the variables have 40 observations except lagged real GDP and active labour force growth. The average values of all variables are positive. Almost all variables have minimal standard deviations. The maximum and the minimum values show that the range is small and almost similar over all variables.

Table 5.1: Summary statistics

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
LRGDP	40	10.74192	0.4777488	10.10782	11.79716
LaGDP	39	10.71487	0.4518803	10.10782	11.73468
LREER	40	4.981631	0.2749836	4.512068	5.594711
RINT	40	3.063	7.814792	- 15.29	16
LGOVEX	40	11.59989	2.159894	8.011687	15.49755
LABG	39	0.030285	0.0072139	-0.002457	0.0373228
LEXPR	40	3.020938	1.764421	-0.4462871	5.403668
LBMON	40	9.300555	0.9677289	7.649693	11.20761
REG	40	0.525	0.5057363	0	1

The correlation matrix, given by table 5.2, may give a clue to identify which variables to consider in the main analysis. It shows whether the degree of correlation between any two explanatory variables is high or low. If two explanatory variables are highly [perfectly] correlated, it would be difficult to identify the independent impact of each explanatory variable on the dependent variable. In this case a formal test of multicollinearity has to be conducted to determine which variable to retain and which one to exclude from the final analysis. The informal test of correlation matrix suggests the exclusion of one or more of the variables with the highest value in the matrix. One can start with log of lagged real GDP [LaGDP] or log of broad money supply [LBMON] which has the highest score with at least two variables.

However, the correlation matrix provides only a clue and thus a formal test of multicollinearity has to be conducted to determine the variables entering the analysis.

Table 5.2: Correlation matrix between the independent variables

Variable	LaGDP	LREER	RINT	LGOVEX	LABG	LEXPR	LBMON
LaGDP	1.0000						
LREER	-0.5783	1.0000					
RINT	-0.0005	-0.2977	1.0000				
LGOVEX	**0.9717**	-0.5309	0.0846	1.0000			
LABG	-0.2928	-0.0150	0.1549	-0.2556	1.0000		
LEXPR	-0.6944	0.8064	-0.2509	-0.6174	0.1114	1.0000	
LBMON	**0.9820**	-0.5165	0.0053	**0.9869**	-0.2571	-0.6153	1.0000

A formal test of multicollinearity is conducted with the help of variance inflation factor [VIF]. A variable that has a VIF value of greater than 10 require further investigation. The level of tolerance defined as 1/VIF is also used to check the degree of collinearity among the independent variables. A variable with a tolerance value lower than 0.1 is considered as a linear combination of other independent variables (Eviews 3.1 User′s Guide; 1999).

On the basis of this test, two variables are excluded from the analysis. To maintain the validity of the model with representative variables, the exclusion of one variable is made by taking in to account the presence of another variable representing its behaviour in the model. This means the exclusion of money supply variable [LBMON] in the first step does not affect the validity of the model as long as real interest rate is maintained in the model because one can explain the behaviour of the other. With the help of the VIF criteria, two variables namely money supply [LBMON] and log of lagged real GDP [LaGDP] are excluded from the model. This improves the over all performance of the model from a VIF value of 21.78 in the presence of the above variables to a VIF value 3.04 in their absence. The exclusion of one variable changes the order of importance of each variable in the exclusion process. Finally, the variables which remain in the system are found to have an average tolerance value of greater than 0.2 [VIF value less than 5].

Table 5.3: Variance Inflation factors of a full and reduced model

Full Model			Reduced Model		
Variables	VIF	1/VIF	Variable	VIF	1/VIF
LBMON	80.09	0.012486	LGOVEX	4.26	0.234947
LGOVEX	70.22	0.014241	LREER	4.13	0.242193
LaGDP	6.40	0.156249	REG	3.94	0.253538
LREER	5.25	0.190340	LEXPR	3.36	0.297371
LEXPR	4.75	0.210372	RINT	1.38	0.723046
REG	4.04	0.247402	LABG	1.19	0.843341
RINT	2.06	0.485203			
LABG	1.40	0.714697			
Mean	21.78		Mean	3.04	

5.2. Tests of the Time series data

5.2.1. Stationarity Tests

Unit root tests are used to test whether a series is stationary or not. If a series is not stationary, it is said to have a unit root. For a series to be stationary, its mean and variance have to be constant over time. According to Gujarati (2004), a study on the stationarity of variables is relevant for the reason that it incorporates important behaviour for these variables. A time series is required to be stationarity to make easier the study of the behaviour of variables in the long run. If a time series is nonstationary, the behaviour of the series can be studied only for the time period under consideration. Each set of time series data will therefore be for a particular episode. As a consequence, it is not possible to generalize it to other time periods. Therefore, for the purpose of forecasting, nonstationary time series are of little practical value. These call for the need to test for stationarity of the series prior to detail analysis of the variables.

Visual inspection of the time series plots of the variables against time helps to assess the nature of the variables before a formal test of stationarity. From this, it was found that all variables do not show any clear trend in their series except real GDP [LRGDP] and government expenditure [LGOVEX]. The formal test supports the same fact except for real GDP. The tests show that there is no clear trend in the series of real GDP.

Three types of formal tests are conducted to examine the behaviour of the series. These tests are the Augmented Dickey-Fuller test [ADF], the Phillips-Perron test [PP] and the Clemente-Montanes-Rayes test. The first two tests allow for three options in the conduct of the tests; without intercept and trend, with only intercept and with both intercept and trend. The Clemente-Montanes-Rayes does not allow for such options and conducts the test only at 5% level of significance.

Table 5.4: Augmented Dickey-Fuller and Phillips-Perron unit root tests

Variables	Specifications	ADF statistics	PP statistics	Order of integration
LRGDP	**Without C and T***	**1.681**	**1.801**	**I(1)**
	With C	1.658	1.512	
	With C and T	0.055	-0.077	
DRGDP	Without C and T	**-3.437*****	**-6.113*****	
	With C	-3.664***	-6.461***	
	With C and T*	-5.134***	-7.574***	
REER	**Without C and T***	**-0.895**	**-0.875**	**I(1)**
	With C	-1.568	-1.426	
	With C and T	-2.223	-2.033	
DREER	Without C and T*	**-4.874 *****	**-5.258 *****	
	With C	-4.836***	-5.210***	
	With C and T	-4.788***	-5.144***	
EXPR	**Without C and T***	**-1.522**	**-1.272**	**I(1)**
	With C	-2.059	-1.666	
	With C and T	-2.366	-1.942	
DEXPR	Without C and T*	**-4.574 *****	**-4.529*****	
	With C	-4.509***	-4.471***	
	With C and T	-4.561***	-4.466***	
RINT	**Without C and T***	**-2.601****	**-2.939*****	**I(0)**
	With C	-2.713*	-3.100**	
	With C and T	-2.758	-3.090	
LABG	**Without C and T***	**-0.951**	**-1.059**	**I(1)**
	With C	-2.687*	-4.073	
	With C and T	-2.697	-4.118	
D.LABG	Without C and T*	**-4.670 *****	**-8.200*****	
	With C	-4.670***	-8.152***	
	With C and T	-4.732***	-8.240***	
LGOVEX	Without C and T	4.019	5.136	**I(1)**
	With C	0.101	0.068	
	With C and T*	**-2.494**	**-2.653**	
D.LGOVEX	Without C and T	-2.452 ***	-4.256***	
	With C*	-4.465***	-6.629***	
	With C and T	**-4.404*****	**-6.563**	

*, ** and *** indicates the rejection of the null hypothesis (unit root) at 10%, 5% and 1% respectively.

The Augmented Dickey-Fuller and the Phillips-Perron tests provide identical results for all variables. According to these tests, all variables are integrated of order one [I(1)] except interest rate which is I(0). They show that all variables are nonstationary at levels except real interest rate. This variable is stationary at level. The result of the test for real interest rate is the expected one as some differencing is involved in the process of deriving the variable. The results of the tests are presented on table 5.4.

According to Geda, Ndungu and Zerfu (2009) and Feridun, Sawhney and Jalil (2009), the above tests of unit roots should be supplemented by other tests as they did not account for structural breaks. The tests confuse structural breaks with nonstationarity. This means a truly stationary variable with some structural breaks may be labelled as nonstationary. Among the test of unit root that account for structural breaks the Clemente-Montanes-Rayes test is used in this study.

In the Clemente-Montanes-Rayes test of unit root the null hypothesis is [unit root] the same as the above tests. The null hypothesis is rejected if the calculated t-statistics is greater than [in absolute value] the 5% critical value given by the test. The test allows for two types of causes of structural breaks known as additive outliers [which capture sudden changes in the mean of a series] and innovative outliers [which capture gradual shift in the mean of a series].

According to Feridun, Sawhney and Jalil (2009), the results derived from ADF and PP tests are doubtful if the estimates of Clemente-Montanes-Rayes test provide evidence of significant additive and/or innovative outliers in the series. However, the results of the Clemente-Montanes-Rayes test are valid only if both structural breaks are significant under at least one of the alternatives.

The results of the Clemente-Montanes-Rayes test are provided on table 5.5. It shows that the test is not applicable for three variables namely; real effective exchange rate [LREER], exchange rate premium [LEXPR] and active labour force growth [LABG] as one or more of the structural breaks are not significant. For the remaining three variables the test provides the same result as the ADF and PP tests except for real interest rate. According to the above two tests, real interest rate is stationary at level while in the Clemente-Montanes-Rayes test, it is nonstationary at level. The Clemente-Montanes-Rayes test shows that the three variables [LRGDP, RINT and LGOVEX] for which the test is applicable are nonstationary. The ADF and PP tests showed that the other variables for which Clemente-Montanes-Rayes test is not applicable [LREER, LABG and LEXPR] are also nonstationary. Therefore, combining the results of the three tests, all the variables are [nonstationary] integrated of order one [I(1)].

Table 5.5: Clemente-Montanes-Rayes unit root test

Variables	Additive Outliers		t-statistics	Innovative Outliers		t-statistics	Order of integration
	TB_1	TB_2		TB_1	TB_2		
LRGDP	1997**	2003**	-3.111	1994 **	2003**	-1.603	**I(1)**
D.LRGDP			-8.438**			-8.118**	
REER	1983	1995**	-6.070**	1980	1991**	-6.239**	
EXPR	1986	1994**	-2.434	1986	1990**	-5.811**	
RINT	1993**	2004**	-4.577	1990**	2003**	-5.065	**I(1)**
DRINT			-7.540**			-7.049**	
LABG	***1999***	***2002*****	***-1.189***	***1999*****	***2003***	***-2.637***	
DLABG			***-1.112***			***-0.692***	
LGOVEX	1983**	1997**	-3.118	1990**	2003**	-3.546	**I(1)**
DLGOVEX			-5.994**			-7.880**	

** indicates significance at 5% for both structural breaks and t-statistics. A critical value at 5% is -5.490. TB_1 and TB_2 are the breakpoints.

As it has been shown above, an econometric analysis with nonstationary variables is not plausible. There are two possibilities to deal with nonstationary variables in a given model after the stationarity test. One is, to continue the analysis with first differenced or I(1) stationary variables. This is used only for the analysis of a short run relationship. Second is, to continue

with the nonstationary variables if their linear combination is stationary. This helps for the analysis of a long run (equilibrium) relationship if it exists. The first alternative is considered only if the second fails. But to proceed with the second, it is necessary to establish that the variables are cointegrated. Running a regression of nonstationary variable over another nonstationary variable may lead to meaningless results [i.e. spurious regression]. However, if the two series are cointegrated, the problem of spurious regression is no use to worry about.

The next step would thus be to do a cointegration test. The cointegration concept can be analyzed with the help of a vector autoregressive model. A vector autoregressive model is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables (Eviews3.1 User′s Guide, 1999). But first, we need to do tests of granger causality and optimal lag length determination.

5.2.2. Granger Causality Test

Granger causality test is used to examine the relationship between the variables included in and the relevance of using a VAR model. If the variables are endogenously related to each other in the system, the use of a VAR model is valid. The test shows whether any variable granger causes the other variable in the system and/or vice versa.

Table 5.6 shows that each variable except Government expenditure [LGOVEX] granger causes all variables in the VAR system. There is bidirectional causation among real GDP [LRGDP] and real interest rate [RINT], real GDP [LRGDP] and Government expenditure [LGOVEX], real effective exchange rate [LREER] and exchange rate premium [LEXPR], and Government expenditure [LGOVEX] and real interest rate [RINT].

Change in real effective exchange rate [LREER] and exchange rate premium [LEXPR] may be caused by [same variable] change in real GDP [LRGDP]. Active labour force growth [LABG] and government expenditure [LGOVE] also granger causes the first two variables respectively. Real effective exchange rate [LREER] and exchange rate premium [LEXPR] each granger causes change in real interest rate [RINT] while the latter in particular granger causes active labour force growth [LABG].

The Granger-causality test shows that real GDP is not exogenous. Change in real GDP can be caused by at least two variables in the system; namely real interest rate [RINT] and government expenditure [GOVEX].

Table 5.6: Chi-square statistics and respective p-value for Granger Causality Test

Variables	LRGDP	LREER	LEXPR	RINT	LABG	LGOVEX	ALL
LRGDP	------	9.7358 (0.008)***	8.9402 (0.011)**	30.669 (0.000)***	0.21317 (0.899)	12.651 (0.002)***	79.184 (0.000)***
LREER	2.2938 (0.318)	-------	4.95 (0.084)*	15.9 (0.000)***	0.0118 (0.994)	0.70132 (0.704)	40.332 (0.000)***
LEXPR	2.3473 (0.309)	6.8745 (0.032)**	-------	5.5731 (0.062)*	7.38383 (0.025)**	0.51433 (0.773)	29.3 (0.001)***
RINT	6.4678 (0.039)**	0.4373 (0.804)	1.6046 (0.448)	--------	1.4565 (0.483)	12.073 (0.002)***	16.81 (0.079)*
LABG	4.1123 (0.128)	7.5454 (0.023)**	1.0958 (0.578)	1.035 (0.596)	--------	1.9635 (0.375)	28.749 (0.001)***
LGOVEX	6.8093 (0.033)**	1.1768 (0.555)	9.6335 (0.008)***	8.0021 (0.018)**	4.4658 (0.107)	--------	15.014 (0.132)

*, ** and *** indicates the rejection of the null hypothesis (x does not granger cause y) at 10%, 5% and 1% respectively.

5.2.3. Determination of Optimal Lag Length

Cointegration test is usually preceded by a test of optimal lag length as the result of the test is affected by the number of lags included in the VAR model. The Likelihood Ratio test [LR], the Final Prediction Error test [FPE], the Akaike information criteria [AIC], the Shwarz information criteria [SIC] and the Hannan-Quinn information criteria [HIC] are used to determine the optimal lag length of the VAR model for cointegration test. Table 5.7 shows that all criteria suggest a lag length of one at 5% level of significance and this lag length is used in this study.

Table 5.7 Lag-order Selection criteria

Endogenous: LRGDP LREER RINT LGOVEX LABG LEXPR

Exogenous: _cons REG Sample: 1970 - 2009 Number of obs.=36

Lag	LogL	LR	FPE	AIC	SIC	HQIC
0	-52.50977	NA	1.32e-06	3.487014	4.009474	3.671206
1	95.64265	**232.2389****	**3.20e-09****	**-2.575278****	**-0.485439****	**-1.838512****
2	127.3418	39.40972	4.91e-09	-2.342798	1.314421	-1.053457

To further confirm the relevance of the chosen optimal lag length for all variables, a test of lag exclusion [Wald lag exclusion test] is conducted. It shows that the inclusion of a single lag length for each variable individually and for all the system jointly is significant for all variables at 1% and for active labour force growth at 5% level of significance.

Table 5.8 Wald Lag-Exclusion statistics

Variables	**Lag**	**df**	**Chi2**	**Prob.>Chi2**
LRGDP	1	6	26.43857	[0.000184]***
LREER	1	6	59.99945	[4.50e-11]***
LGOVEX	1	6	17.72878	[0.006947]***
RINT	1	6	18.78001	[0.004552]***
LEXPR	1	6	32.12963	[1.54e-05]***
LABG	1	6	6.210153	[0.040065]**
ALL	1	36	174.0681	[0.000000]***

*/**/*** indicates lag order failed to be excluded at 10%[5%]1% respectively.

5.2.4. Tests for Cointegration

In section 5.2.1, the unit root tests show that all the variables are nonstationary. Theories state that econometric analysis with nonstationary variables makes no sense. The only exception is if their linear combination results in a stationary series. The test of cointegration in this section tests for existence of such a relationship among the nonstationary variables considered in this study.

Engle and Granger (1987; cited in Eviews3.1 User′s Guide, 1999) showed that the finding that many macro time series may contain a unit root has spurred the development of the theory of nonstationary time series analysis. They pointed out that a linear combination of two or more nonstationary series may be stationary. If such a stationary linear combination exists, the nonstationary time series is said to be cointegrated. The stationary linear combination is called

cointegrating equation and may be interpreted as a long-run equilibrium relationship between the variables.

The result of the test of cointegration is affected by the assumption made regarding a trend. The decision to include/exclude a trend is made on the basis of the nature of the series included in the VAR model. In this study, almost all variables do not show any clear trend as checked through the ADF and PP unit root tests. Thus, the cointegration test is made with the assumption of no trend. The results of cointegrating test under different assumptions are provided in appendix A.

For k-endogenous variables each with a single unit root, there is a possibility to find from zero to k-1 linearly independent cointegrating relations. Two types of test statistics are used to determine the rank of the model in this study; namely the trace test and the maximum eigen/likelihood ratio test. The trace test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of k cointegrating vectors, where k is the number of endogenous variables, for r=0,1,2…,k-1. The maximum eigen-value test, on the other hand, tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of $r+1$ cointegrating vectors.

Both the trace statistics and the maximum eigen/likelihood ratio test results in 3 cointegrating equations at 10% level of significance for this study under the no trend assumptions. The trace test shows that the null hypothesis of r≤ 2 cointegrating relation is rejected and the alternative r≥2 cointegrating equations is accepted. This means that there are 3 cointegrating equations because the null hypothesis of r≤ 3 could not be rejected in the next step. The maximum eigen/likelihood ratio test confirms the same result. It shows that the null hypothesis of r=2 cointegrating relation is rejected in favour of the alternative r=3. The results of the trace statistics and the maximum eigen values are given in table 5.9. The Johansen method is used for the test of cointegration as it

is superior over the Engle-Granger method in allowing for the test of more than one cointegrating vectors.

Table 5.9: Cointegration Rank test

Series: LRGDP LREER LGOVEX RINT LEXPR LABG

Included Observations: 36

Exogenous series: REG

Null	Alternative	Eigen value	Statistic	5% Critical value	Prob.	Hypothesized No. of CE(s)
Trace test						
$r = 0$	$r \geq 0$	0.800726	155.3378	103.8473	0.0000	None **
$r \leq 1$	$r \geq 1$	0.613946	97.26712	76.97277	0.0007	At most 1**
$r \leq 2$	$r \geq 2$	0.579352	63.00306	54.07904	0.0065	At most 2**
$r \leq 3$	$r \geq 3$	0.376772	31.82855	35.19275	0.1104	At most 3
Max eigen test						
$r = 0$	$r = 1$	0.800726	58.07069	40.95680	0.0003	None **
$r = 1$	$r = 2$	0.613946	34.26405	34.80587	0.0579	At most 1**
$r = 2$	$r = 3$	0.579352	31.17451	28.58808	0.0228	At most 2**
r=3	*r=4*	0.376772	17.02235	22.29962	0.2317	At most 3

** denotes rejection of the null hypothesis at 5% significance level.

5.2.5. Diagnostic tests on the residual of the vector error correction model

Tests of autocorrelation, normality, hetroskedasticity and exogeneity on the residuals of the vector error correction models are conducted with the help of Lagrange-multiplier test, Jarque-Beta test, Breusch-Pagan test and RMSE tests respectively. These tests are used to confirm the basic assumptions regarding the residual and the validity of the results in this study. From the tests, it was found that the nulls of no autocorrelation, normality, constant variance and weak exogeneity in the residuals could not be rejected in all cases at 10% level of significance.

Table 5.10: Diagnostic test on the on the residual

Diagnosis	Test	Null hypothesis	χ^2-stat	Prob.
Autocorrelation	Lagrange-multiplier	No autocorrelation	39.61787	0.3117
Normality	Jarque-Bera test	Normal	5.580458	0.0614
Hetroskedasticity	Breusch-Pagan	Constant variance	525	0.2244
Exogeneity	RMSE	Weakly exogeneity	2.731529	0.2552

The stability of the VAR model is tested by an inverse root of autoregressive characteristic polynomial. The result of the test is shown by a graphical representation on figure 5.5. It shows that the VAR model is stable as the entire modulus lie inside the circle showing that all the values are less than unity. The tabular presentation of the test is provided in appendix B.

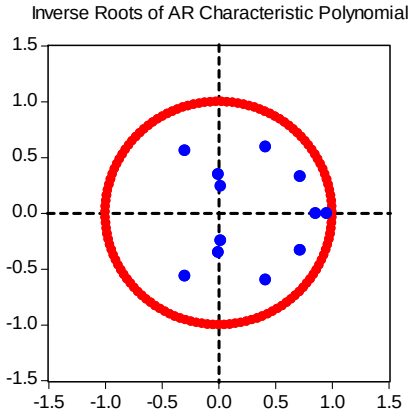

Fig. 5.5 Inverse Roots of AR Characteristic Polynomial

5.3. Estimation Results and Interpretation

5.3.1. The Vector Error Correction Model

A vector error correction model is a restricted VAR model that has cointegration restrictions built in to the specification. It is designed for use with nonstationary series that are known to be cointegrated. The vector error correction specification restricts the long-run behaviour of the endogenous variables to converge to their cointegrating relationships while allowing a wide range of short-run dynamics. The cointegrating term [the error correction term] corrects the deviation from long-run equilibrium gradually through a series of partial short run adjustments (Eviews 3.1 User′s Guide, 1999).

a) Long-Run Relationships

The cointegration rank test in the previous section suggests three cointegrating equations that define real GDP, real effective exchange rate and government expenditure as dependent variables. This study considers only the first cointegrating equation that relate real GDP to other variables as the focus is to examine the impact of other variables [and real effective exchange rate in particular] on real GDP growth. The other cointegrating equations are not considered in this study. After imposing this normalization restriction by the Johansen method, the cointegrating equation for real GDP growth is estimated. The result of the estimation is given by table 5.11 and equation 5.3.

Table 5.11: Cointegrating Coefficients
Identification: beta is exactly identified
Johansen normalization restriction imposed

Beta	Coef.	Std. Err.	t-stats.
LRGDP	1	.	.
LREER	-0.214062	0.08778	-2.43875***
LGOVEX	-0.214463	0.01076	-19.9337***
RINT	0.019231	0.00215	8.94693***
LEXPR	0.124664	0.01471	8.47683***
LABG	-0.718944	3.79470	-0.18946
_cons	-7.578959	.	.

*** denotes significance at 1%.

LRGDP-0.2141LREER-0.2145LGOVEX+0.0192RINT+0.1247LEXPR-0.7189LABG-7.5789=0 ..... (5.3)

All the variables which are expected to explain real GDP [LRGDP] growth are significant except active labour force growth [LABG].

The real effective exchange rate has positive sign and is statistically significant in explaining the economic growth in the long run. Increase/appreciation of real effective exchange rate by 1% increases economic growth by 0.2141%. The finding of this study shows that decrease in real

effective exchange rate [depreciation] does not promote economic growth in the long run. Depreciation may encourage exports and increase the foreign earnings of the country for the time being, but it hurt the economy in the long-run as the cost of imported raw materials increase continuously. The positive sign of real effective exchange rate shows that the impact works through the aggregate supply channel in the long-run. This is in line with modern view discussed in the literature review.

The Modern view states that depreciation of the domestic currency has a net effect of decreasing the real GDP. For the modern viewers, the impact of exchange rate on economic growth works through the aggregate supply channel i.e. developing countries are dependent on foreign capital for investment and the demand for their export elasticity is low. Thus, its impact on increasing the costs of imported raw materials is much stronger than the positive effect it has on competitiveness.

Government expenditure [LGOVEX] is equally statistically significant to real effective exchange rate. It is positively related to and statistically significant in explaining economic growth in the long run. Governments play major roles in the investment sector of LDCs. Public spending may be helpful in complementing private investment if it is productive. The government of Ethiopia may increase economic growth by 2.145% if it can increase its expenditure by 10%.

The relationship between Real interest rate [RINT] and real GDP growth is found to be negative but significant. Reducing interest rate by 1% may increase economic growth by 0.0192% in Ethiopia. The relationship between the two is similar to what investment theories state. They state that for governments to encourage private investment, the real interest rate has to be reduced.

The other significant factor is exchange rate premium [LEXPR] which negatively affects economic growth. If the premium between the official and the parallel exchange rate grows by 10%, economic growth may fall by more than a percentage point in Ethiopia. This is more devastating compared to the empirical findings of Kiguel and O′connel (1995; cited in Derrese Degefa, 2001). They found that a 10% premium is likely to reduce GDP growth only by 0.4 percentage points a year while the finding of this study shows a reduction to real GDP growth by 1.247%. This shows that the parallel market for the exchange rate is badly affecting the performance of the Ethiopian economy. The economy is losing significant amount of benefit due to the existence the parallel market. Studies show that such a significant loss may be associated with the diversion of import and export transactions to this market.

Among the variables that were derived from the demand side, government expenditure is found to be the most significant variable in the long-run. This shows that public spending can be used as a main engine of growth in Ethiopia. Nowadays, the construction of roads [seasonal and all weathered] has made the supply of commodities easy and quick. This has improved the marketability of the commodities and the income of the farmers. This has, the researcher believed, contributed to the current five-to-six years of sustained growth in Ethiopia. Among the factors in the supply side, on the other hand, real interest rate is found to highly determine the supply of capital for investment.

b) Short-Run Relationships

The adjusted R-square shows that 62.26% of the variation in real GDP growth is explained by the combined effects of all the determinants of real GDP in the short-run. Changes in real GDP growth can be motivated by activating two period lagged real effective exchange rate and real interest rate. A one period lagged real interest rate is also significant in generating change in

economic growth in the short-run [table 5.12]. The growth rate of current real GDP is affected by changes in real effective exchange rate and real interest rate made before two years and also a year before for the latter. The two variables, however, have opposite signs compared to their long-run-relationship with real GDP growth.

The real effective exchange rate is negatively related to real GDP in the short-run. This implies that depreciation of the domestic currency in the short-run promotes economic growth as it encourages exports. However, this contradicts the finding for the long-run relationship between the two variables. A two period lagged relationship between real effective exchange rate and real GDP growth shows that a change in the former variable has some impact on the production of some exportable items up to a period of two years. Most of the exports are primary commodities produced by the agricultural sector in Ethiopia. It is true that the production/supply of agriculture sector is not elastic in responding to changes in exchange rate as it takes some time to produce the commodities. Production does not respond immediately to changes in real effective exchange rate. Thus, it may be logical to find a two period lagged relationship between real effective exchange rate and real GDP growth in Ethiopia.

Real interest rate is positively related to economic growth in the short-run. This does not confirm what economic theories on investment state. However, the Mackinnon-Shaw hypothesis states that there is a possibility for real interest rate to positively affect economic growth (Adedoyin Soyibo, 1994). In this case, increase in real interest rate [lending rate] does not discourage investment/production as long as the nominal interest rate remains below expected price/inflation. The real interest rate is partly explained by inflation. It may be the case for this study that the two variables are positively related due to inflation. For not less than half of the

years under the study period, real interest rate is negative which means that the general price level [inflation] is higher than nominal interest rate. If this so, increase in real interest rate a year or two years before may increase economic growth in the current period. In the long-run, monetary authorities will get time to take measures that curve inflation and the negative relationship between real interest rate and economic growth may be maintained.

The error correction term has important implication in linking the short-run periods to the long-run period. It represents the adjustment of the short-run disequilibrium to achieve a long-run equilibrium. Its coefficient is negative and statistically less than one in absolute value. This is the expected sign for the stability of a long-run relationship. A stable cointegrating relationship adjusts the short-run deviations by the extent of the error correcting term. The finding in table 5.12 shows that the actual real GDP growth adjusts itself by 41.4% each year to its equilibrium value and is expected to achieve equilibrium after [almost] 2.5 years.

Table 5.12: Short-Run coefficients

Sample (adjusted):1974-2009

Included observations: 36 after adjusting end points

Variables	Coefficients	Standard Error	t-value
CintEq1	**-0.414013**	**0.08920**	**-4.64152*** **
D(LRGDP(-1))	0.366073	0.15729	2.32730
D(LRGDP(-2))	-0.436311	0.17234	-2.53169
D(LREER(-1))	0.094647	0.08358	1.13235
D(LREER(-2))	-0.357968	0.07905	-4.52859***
D(LGOVEX(-1))	0.009732	0.04513	-0.21566
D(LGOVEX(-2))	-0.070808	0.03852	-1.83829
D(RINT(-1))	0.008648	0.00219	3.95062***
D(RINT(-2))	0.004347	0.00175	2.48316***
D(LEXPR(-1))	0.018079	0.01186	1.52462
D(LEXPR(-2))	-0.001511	0.01258	-0.12017
D(LABG(-1))	0.207423	1.30624	0.15879
D(LABG(-2))	-0.271547	1.37279	-0.19781
REG	0.010983	0.01709	0.64265
C	0.062450	0.02001	3.12055
R-squared	0.773565		
Adj. R-squared	0.622609		
Sum sq. resides.	0.032651	F-statistic	5.124422

In general, the study found mixed results on the relationship between real effective exchange rate and economic growth in the short-run and long-run. The results of the econometric analysis show that the traditional view [the aggregate demand channel] holds in the short-run and the modern view [the aggregate supply channel] holds in the long-run. Depreciation of the domestic currency promotes exports and increases economic growth in the short-run. But it may not be used as a long-lasting strategy in Ethiopia. In the long run, it may not be a good strategy as it hurts the long-run growth by increasing the cost of imported materials.

Depreciation of the domestic currency may increase the foreign exchange earnings the country receives in the short-run. This may help the growth of some sectors in the economy. As the depreciation process continues, the foreign earnings from the export sector would not be large enough to cover the cost of imported materials for the country. The final result of the process would be to reduce economic growth unless a limit is put up on the period to depreciate the currency and revert to the other option. By the time of reversion, the dependency of the economy on imported raw materials should decrease so that the impact can be resisted.

5.4. Impulse Response Functions and Variance Decomposition

a) Impulse Response Functions

The results in section 5.3 show how the explanatory variables affect real GDP in the short-run and long-run for a given period under consideration. They present the final results of the interaction between the dependent and independent variables. However, both the short-run and long-run analyses do not present how the adjustments are made each time and the final results are reached. The impulse response functions and the variance decomposition show the situation

before the final result or the process to reach the final result. They show how the importance of each independent variable changes during each year in affecting the real GDP.

An impulse response function traces the effect of a one standard deviation shock to one of the exogenous variables on the current and future values of the endogenous variable. A shock to the i^{th} variable directly affects the i^{th} variable and is also transmitted to all of the endogenous variables through a dynamic structure of the VAR (Eviews 3.1 User′s Guide, 1999).

On table 5.13, real GDP responds only to itself in the first period. After the first period, it directly and significantly responds to government expenditure and negatively and significantly to exchange rate premium. In the long-run, real GDP responds more significantly to change in government expenditure than changes in the other variables. The results in parenthesis show standard errors. The graphical representation of the impulse response function is given by appendix C.

Table 5.13: Response of LRGDP to one standard deviation

Period	LRGDP	LREER	LGOVEX	RINT	LEXPR	LABG
1	0.052774	0.000000	0.000000	0.000000	0.000000	0.000000
	(0.00613)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	0.046408	0.008278	0.021604	0.011171	-0.011146	0.005394
	(0.01203)	(0.00997)	(0.01151)	(0.01385)	(0.01077)	(0.01546)
3	0.023801	0.011032	0.037010	-0.019436	-0.029474	0.017450
	(0.01350)	(0.01245)	(0.01269)	(0.01607)	(0.01331)	(0.01910)
4	0.024251	0.013021	0.030570	-0.022757	-0.035847	0.022998
	(0.01748)	(0.01545)	(0.01532)	(0.01975)	(0.01611)	(0.01911)
5	0.021462	0.011574	0.028892	-0.006352	-0.032745	0.016960
	(0.01912)	(0.01727)	(0.01701)	(0.02177)	(0.01704)	(0.02061)
6	0.016430	0.006082	0.030673	0.001395	-0.029425	0.012931
	(0.02061)	(0.01653)	(0.01705)	(0.02322)	(0.01656)	(0.01725)
7	0.015364	0.002629	0.030216	0.007472	-0.027468	0.014475
	(0.02236)	(0.01551)	(0.01626)	(0.02351)	(0.01551)	(0.01465)
8	0.012975	0.002473	0.029337	0.013323	-0.025989	0.014534
	(0.02306)	(0.01403)	(0.01563)	(0.02435)	(0.01520)	(0.01361)
9	0.010783	0.003864	0.027315	0.015065	-0.024522	0.013175
	(0.02374)	(0.01336)	(0.01526)	(0.02499)	(0.01604)	(0.01315)
10	0.010729	0.005658	0.024022	0.015457	-0.022075	0.011880
	(0.02386)	(0.01307)	(0.01504)	(0.02411)	(0.01692)	(0.01248)

b) Variance decomposition of LRGDP

Variance decomposition provides a different method of depicting the system dynamics. It decomposes variation in an endogenous variable in to the component shocks to the endogenous variables in the VAR. It gives information about the relative importance of each random change in the explanatory variables in the VAR (Eviews 3.1 User′s Guide, 1999).

Table 5.14 shows that the variation in the growth of real GDP is explained only by its lagged value in the first period. After the first period, the variation in real GDP growth can be explained by a group of other endogenous variables in the system. After the third period more than 50% of the variation in real GDP growth is explained by other variables. In the long-run the most significant variation in real GDP growth is explained by government expenditure followed by exchange rate premium, active labour force growth, real interest rate and real effective exchange rate in their order of importance. Any action of the government that affects its expenditure may easily impact economic growth. In general, the government may play active role in promoting economic growth in Ethiopia. The graphical presentation of the variance decomposition is given by appendix D.

Table 5.14: Variance Decomposition of LRGDP

Period	S.E.	LRGDP	LREER	LGOVEX	RINT	LEXPR	LABG
1	0.052774	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.071270	83.52080	0.417882	10.61556	2.759656	2.177511	0.508585
3	0.090230	54.66127	1.281105	23.80243	5.768631	10.84837	3.638187
4	0.107940	40.56945	2.145339	25.24702	8.080510	17.38456	6.573122
5	0.118873	34.85925	2.318327	27.71158	6.796760	21.08707	7.227017
6	0.127637	30.93192	2.060766	30.81946	5.983982	23.02398	7.179888
7	0.135804	27.94222	1.820763	33.18659	5.721001	23.97844	7.350985
8	0.143436	25.36349	1.634900	34.94533	6.139999	24.41515	7.501131
9	0.150003	23.32146	1.495428	36.15050	6.786456	24.70242	7.543745
10	0.155258	21.86760	1.413835	36.83661	7.463231	24.85720	7.561531

CHAPTER SIX

6. Conclusions and Recommendations

6.1. Conclusions

This study analyzes the impact of real effective exchange rate on the Ethiopian economy using annual time series data for the period 1970-2009. With the help of cointegration and vector error correction analysis, the impact of real effective exchange rate on real gross domestic product growth was assessed in the long-run as well as in the short-run. The results suggest that the impact of real effective exchange rate on economic growth works through the aggregate demand channel [traditional view] in the short-run and the aggregate supply channel [modern view] in the long-run i.e. decrease/depreciation in the value of the domestic currency promotes economic growth only in the short-run. In the long-run, it discourages economic growth in Ethiopia. The study also found that the government is the key factor that promotes economic growth in Ethiopia and may stay to play its major role in the future.

The study found negative relationship between real effective exchange rate and economic growth in the short run but positive relationship in the long run. It may be the case that in the short run the economy's primary exports can be promoted through depreciation of the economy and this does not much affect the economy through the import sector as the economy does not much depend on foreign capital for investment. However, as it continues to grow foreign investors may be attracted by the domestic economy and in that case depreciation may make the transfer of capital easier and cheaper to the domestic economy.

Different reasons are given for the negative impact of depreciation on economic growth in the long-run. The modern view states that developing economies depend on foreign capital for

investment and the demand for their export elasticity is low. Depreciation increases the cost of importing this capital thereby reduces economic growth. The other argument is in terms of increase in the cost of imported raw materials due to depreciation. The major imported items in Ethiopia are petroleum products which absorbs more than half of its foreign earnings. As the country depreciates its currency, it means that the price of oil increases. In this case, the government cannot allocate more of its foreign earnings to development investments. It also increases the cost of production in the domestic economy. This may cause inflation and reduce aggregate demand. In both cases, the results would be decline in economic growth.

The findings on real interest rate also show mixed results in the short run and in the long run. In the short run, increase in real interest rate [lending rate] promotes economic growth and the reverse is true in the long run. Though the rate is determined by a competition among the commercial banks, the NBE may influence the rate by changing the discount rate, reserve requirement ratio or/and inter-bank rate; it may increase these rates/ratio for increase in the lending rate and decrease these rates for decrease in the lending rate.

The significant determinants of long run economic growth in Ethiopia are government expenditure and real effective exchange rate from the demand side and real interest rate and exchange rate premium from the supply side; the second and the third in the short run as well. Active labour force is found to be insignificant. The choice of exchange rate regime does not matter for economic growth in Ethiopia in the short-run.

On the basis of the above conclusions, the researcher recommends the following measures for policy makers, the National Bank of Ethiopia and the government of Ethiopia.

6.2. Recommendations

This sub-section provides recommendations on the basis of the findings by time horizon; in the short-run and long-run.

In the short-run, the study shows that real effective exchange rate and real interest rate significantly affect economic growth. Therefore, the National Bank of Ethiopia may use these variables in the following manner to affect economic growth.

- ❖ Real effective exchange rate and real GDP growth are negatively related in the short-run i.e. decrease/depreciation in real effective exchange rate increases real GDP growth. Therefore, a smooth and periodical depreciation of the 'birr' may be helpful to promote economic growth in the short run. Depreciation of the domestic currency encourages foreign demand for exports as the price of the exportable items become cheaper in foreign currency for foreigners. Increase in foreign demand for exports encourages domestic producers of the same items. The results of these would be increase in foreign earnings of the economy and economic growth.
- ❖ Real interest rate is positively related to economic growth in the short-run. Though this does not confirm any economic theory on investment, the Mackinnon-Shaw hypothesis states that there is a possibility for real interest rate [lending rate] to positively affect economic growth (Adedoyin Soyibo, 1994). The real interest rate may affect economic growth positively, as long as the inflation rate remains high. In this case, it is recommended that the NBE may help the rate to move upward by increasing the discount rate, reserve requirement ratio or/and inter-bank rate. The short-run result shows that the Ethiopian economy will not be worse off with a higher real interest rate. It shows that increase in real interest rate today may increase economic growth a year or two years later.

In the long-run, the study shows that real effective exchange rate, real interest rate, government expenditure and exchange rate premium significantly affect economic growth. Therefore, the following measures are suggested with regard to these variables.

- ❖ Unlike the short-run result, the long-run result shows that there is a positive relationship between real effective exchange rate and real GDP growth. It has been recommended above that the real effective exchange rate should be kept low [depreciate] in the short run. However, it does not mean that it shall remain low all the time. The long-run result shows that after a periodical depreciation of the 'birr' for some time, it may be helpful to change the policy as the direction of the relationship changes. If the exchange rate variable is to be used as a policy variable in the long-run, it is appreciation of the domestic currency that promotes economic growth. This is, however, recommended on the basis of the assumption that the country's current account deficit problem would be resolved by the foreign earning derived through the depreciation of the domestic currency in the short run.
- ❖ The relationship between real interest rate and economic growth is negative in the long-run. As such, decrease in real interest rate [lending rate] is accompanied by increase in economic growth. The result of this study shows that if the NBE decreases the discount rate, reserve requirement ratio or/and inter-bank rate, the lending rate may fall significantly economic growth may increase. It should, however, be noticed that release of excessive amount of money to the economy may exacerbate the current inflation.
- ❖ Exchange rate premium also negatively affects economic growth in the long-run. If the National Bank of Ethiopia takes measures that reduce the premium between the official and the parallel exchange rate markets, it may help the economy to grow faster. Therefore, it may

be necessary to take measures such as legalizing the parallel markets or unification of the official markets with the parallel markets.

- Government expenditure positively and significantly affects economic growth in Ethiopia. The finding shows that the government of Ethiopia may increase economic growth significantly by increasing its expenditure. The government is found to be the main factor that may generate economic growth in Ethiopia. The government may play its major role in investing in infrastructure that complements private investments. In the absence of significant private investment in a developing country like Ethiopia, public investments may be used as engine of growth. This is to say that fiscal policy in general is more helpful than monetary policy for long run growth in Ethiopia.
- The following areas are suggested for further studies. The first is, to use a wage rate variable instead of active labour force growth variable if data can be available in the future. This may be helpful as the active labour force variable is found to be insignificant in this study. Active labour force variable is used instead of wage rate for the reasons discussed in chapter 4. The second area of further study may be to test the Balassa Hypothesis in Ethiopia. The Balassa Hypothesis states that as the economy continues to grow, it results in the appreciation of the real effective exchange rate (Herberger A.C. 2003). If such a study verifies the existence of the Balassa Hypothesis in Ethiopia, it may be an input for this study. This study shows that appreciation of the real effective exchange rate increases the rate of growth for the Ethiopian economy in the long-run. If a study in the suggested area shows that increase in economic growth results in the appreciation of the domestic currency, it means that monetary authorities need not allow the appreciation of the domestic currency [as suggested by this study] to promote economic growth as the increase in economic growth by itself may appreciate the real effective exchange rate in the long-run.

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Appendices

Appendix A

Summary of Cointegrating Equations under different Assumptions

Sample: 1970 2009
Included observations: 36
Series: LRGDP LREER LGOVEX RINT LEXPR LABG
Exogenous series: REG
Lags interval: 1 to 2

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	4	3	3	3	2
Max-Eig	3	3	1	3	2

5% Critical values based on MacKinnon-Haug-Michelis (1999)

Appendix B

Roots of Characteristic Polynomial

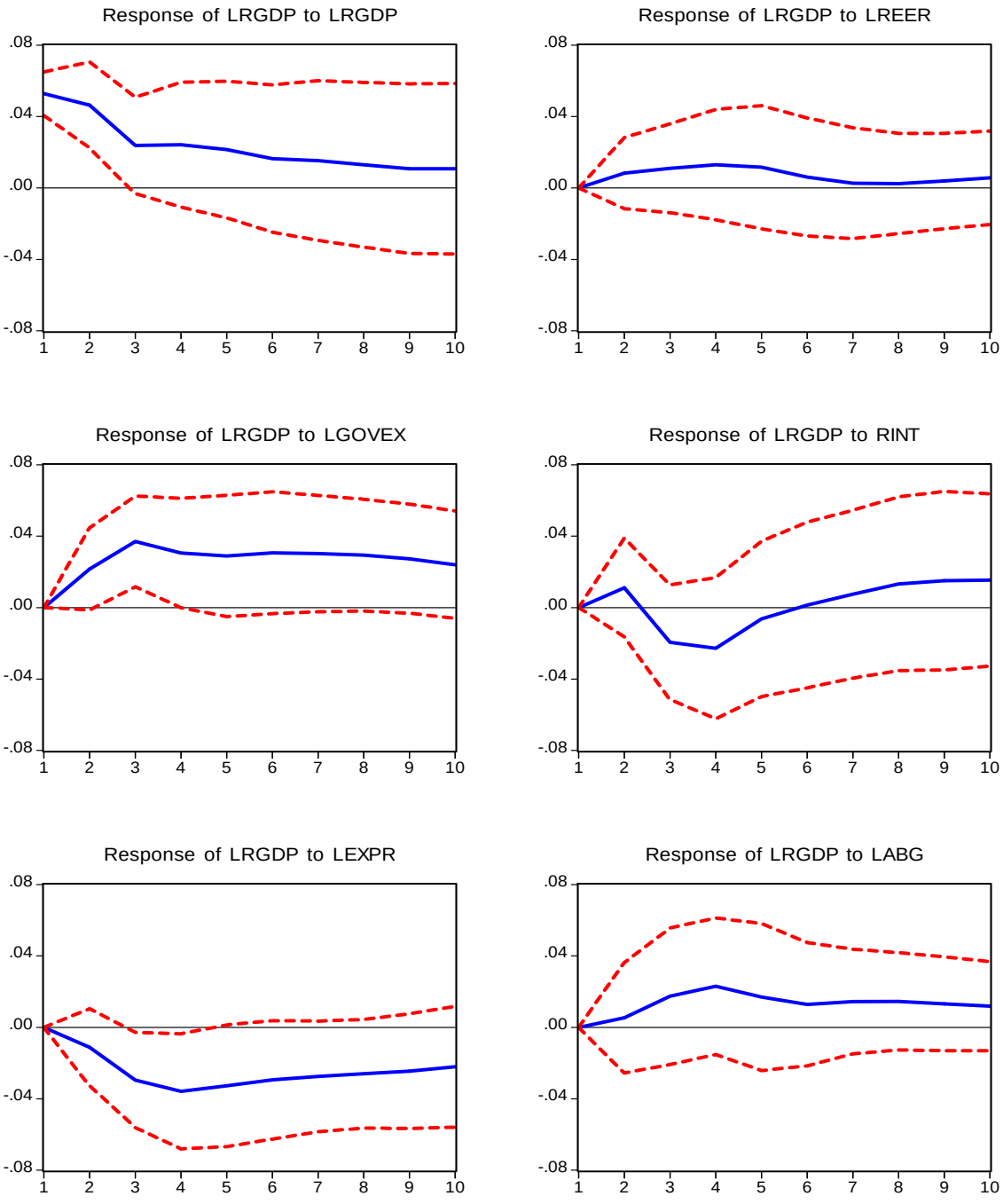
Endogenous variables: LRGDP LREER LGOVEX RINT LEXPR LABG
Exogenous variables: C REG
Lag specification: 1-2
Date: 11/14/10 Time: 07:12

Root	Modulus
0.951366	0.951366
0.853669	0.853669
0.716385 - 0.330250i	0.788843
0.716385 + 0.330250i	0.788843
0.411559 - 0.595856i	0.724172
0.411559 + 0.595856i	0.724172
-0.299231 - 0.561480i	0.636238
-0.299231 + 0.561480i	0.636238
-0.004660 - 0.349292i	0.349323
-0.004660 + 0.349292i	0.349323
0.015693 - 0.244070i	0.244574
0.015693 + 0.244070i	0.244574

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

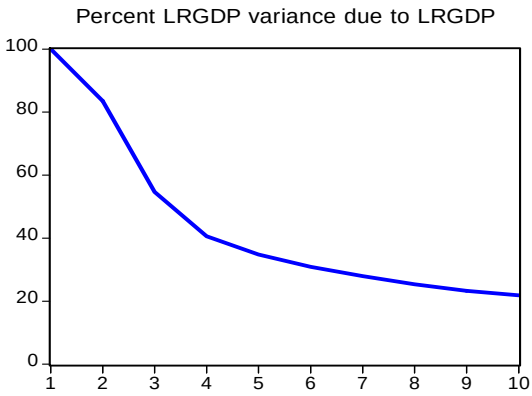
Appendix C

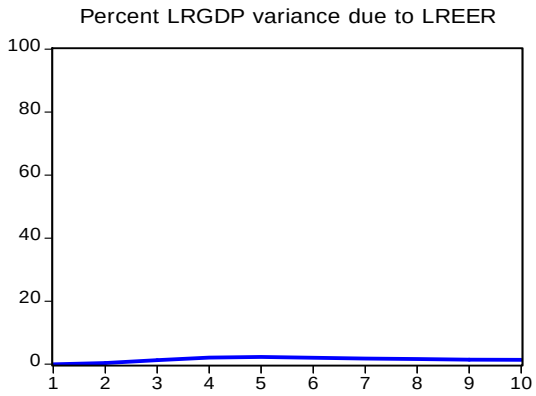
Figure 1: Response of LRGDP to one standard deviation Innovations ± 2 S.E.

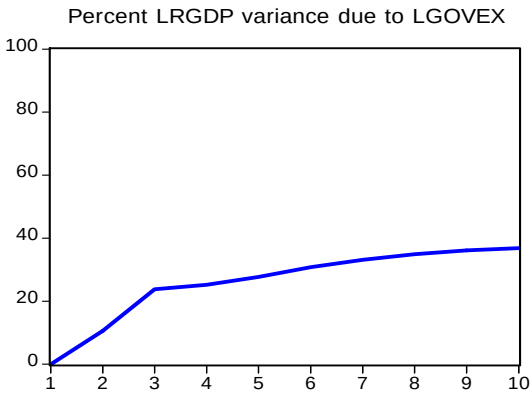


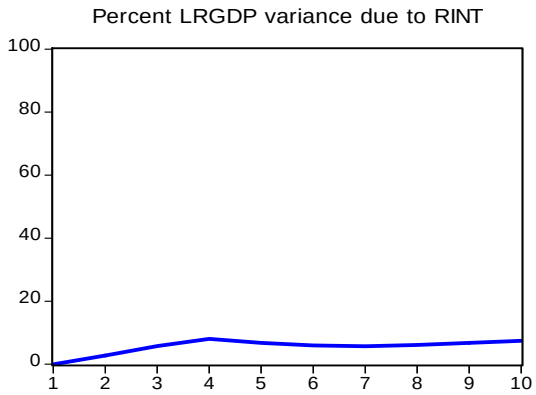
Appendix D

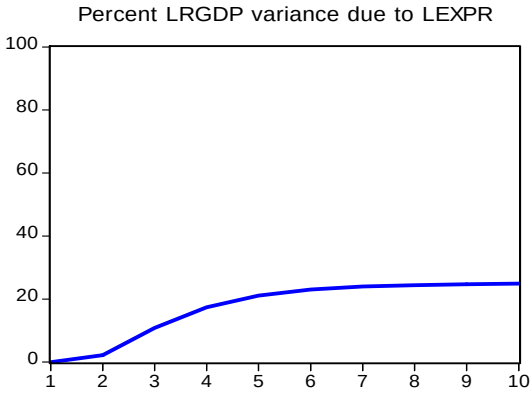
Variance Decomposition of LRGDP

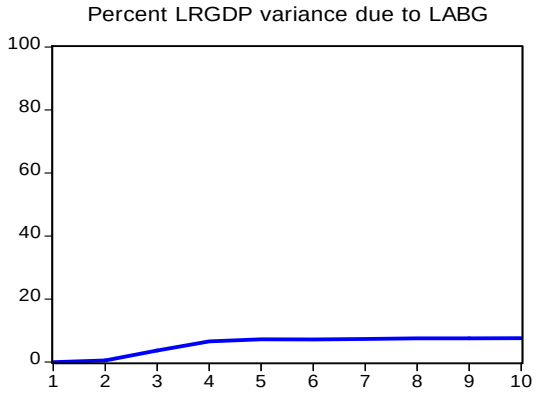












Appendix E

Method of Data Generating Process

The analysis in this study contains eight variables, seven of which directly involve in the analysis and the remaining one [GR: growth rate] is used to generate real gross domestic product. For the reason discussed in chapter 5, the real gross domestic product is generated by using the following formula.

$$RGDP_{t-1} = {RGDP_t}/{[G_t + 1]}$$

Where $RGDP_t$ and $RGDP_{t-1}$ are real GDP at time *t* and *t-1* respectively and G_t is the growth rate of real GDP at time *t*. The base year is the year 2000.

A 10 year report on real gross domestic product is gained from the Ministry of Finance and Economic Development for the period 2000-2009. A real gross domestic product one period lagged is calculated by using the growth rate of the economy and real gross domestic product at current period. By doing so the real gross domestic product series was constructed for the remaining back period (i.e. 1999-1970). From this, a real gross domestic product series with the same base year (2000) was developed.

In the consequent analysis, the logarithms of real gross domestic product [LRGDP], real effective exchange rate [LREER], government expenditure [LGOVEX], exchange rate premium [LEXPR] are derived. For real interest rate [RINT] and active labour force growth [LABG], their logarithmic form is not considered as they consist of negative values. REG is a dummy variable that takes a value of '1' for a fixed exchange rate regime and a value of '0' for a flexible exchange rate regime.

Declaration

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

The examiners' comments have been duly incorporated.

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Confirmed by Advisor:

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Date: _____

Place and date of submission: Addis Ababa, February/2011