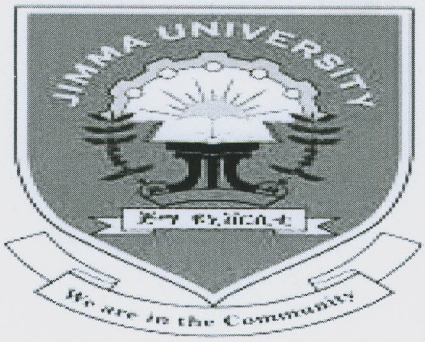


THE EFFECT OF CURRENCY DEVALUATION ON OUTPUT: THE CASE OF ETHIOPIAN ECONOMY

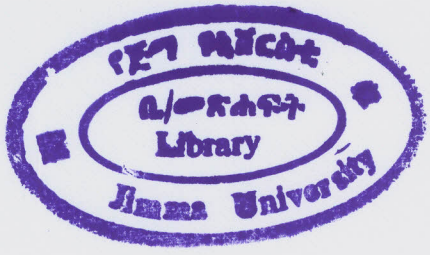
BY: YILKAL WASSIE

JIMMA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

July 2012

JIMMA



THE EFFECT OF CURRENCY DEVALUATION ON OUTPUT: THE CASE OF ETHIOPIAN ECONOMY

BY: YILKAL WASSIE

ADVISOR: WONDAFERAHU MULUGETA (PhD CANDIDATE)

CO- ADVISOR: Mr. TOFIK SIRAJ (MA)

A thesis Submitted to the School of Graduate Studies of Jimma University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Economics
(Economic Policy Analysis)

JIMMA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

July, 2012

DECLARATION

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

Declared by:

Name: _____

Signature: _____

Date: _____

Confirmed by advisor:

Name: _____

Signature: _____

Date: _____

JIMMA UNIVERSIITY

SCHOOL OF GRADUATE STUDIES

THE EFFECT OF CURRENCY DEVALUATION ON OUTPUT: THE CASE OF ETHIOPIAN ECONOMY

By

YILKAL WASSIE AYEN

Approved by the Board of Examiners:

_____	_____
Advisor	Signature
_____	_____
Examiner	Signature
_____	_____
Examiner	Signature

Acknowledgment

This part is perhaps the only section I was able to write with relatively little support from others. Above all, I praise my God for being with me whenever I needed him uncomfortable times of my life. My thanks also go to my advisor Wondaferahu Mulugeta (PhD candidate), and my co-advisor Mr. Tofik Siraj for their whole-hearted advice, supervision and valuable comments throughout this research work.

I am also grateful to Alebel Bayrou (PhD), Firew Woldeyes (PhD), Tsegaye Tekelesadik (PhD candidate) who are Ethiopian Development Research Institution (EDRI) staffs; for their valuable technical assistance and provision of important literatures during the study period. I also thank Mr. Ashagrie Demelie at National Bank of Ethiopia, Mr. Leta Sera Economics Department head, Kelbessa Abdissa (PhD candidate) and Teferi Daba (PhD candidate) for their valuable support in providing me the necessary information and valuable comments. Great thanks also go to Firehiwot Yimer for her support in terms of printing the necessary materials and typing the final paper.

Finally, I would like to express my gratitude to my parents; my father Wassie Ayen, my mother Emenesh Sineshaw, my sister Nigiste Wassie, and my brother Alelign Wassie for their continuous love and support throughout my life.

Table of Content

Contents **page**

Acknowledgment I

Table of Content II

List of Tables IV

List of Figures V

Acronyms/ Abbreviations VI

Abstract VIII

CHAPTER ONE

INTRODUCTION 1

1.1. Background of the Study 1

1.2. Statement of the Problem 4

1.3. Objectives of the Study 6

1.4. Significance of the Study 6

1.5. Scope of the Study 7

1.6. Limitation of the Study 7

1.7. Organization of the Paper 7

CHAPTER TWO

REVIEW OF RELATED LITERATURE 8

2.1. Theoretical Literature 8

3.2. Empirical Literature 13

CHAPTER THREE

OVERVIEW OF THE ETHIOPIAN ECONOMY 19

3.1. Economic Growth and Structure in Ethiopia 19

3.2. Fiscal Policy 25

3.3. Monetary Policy 28

3.4. External Trade and Exchange Rate Policy 31

3.4.1. External Trade 31

3.4.2. Exchange Rate Policy and Development 33

CHAPTER FOUR
MODEL SPECIFICATION AND METHODOLOGY 37
4.1. Choice of Variables 37
4.2. Model Specification 40
4.3. Econometric Tests 43
4.3.1. Stationary Test 43
4.3.2. Co-integration Test 45
4.3.3. Vector Error Correction Model (VECM) 47
4.3.4. Impulse Response and Variance Decomposition 47
4.4. Data Type and Source 49
CHAPTER FIVE
ESTIMATION RESULTS AND INTERPRETATION 50
5.1. Unit Root Test 50
5.2. Determination of Optimal Lag Length 52
5.3. Co-integration Test 53
5.4. Vector Error Correction Model [VECM] 59
5.5. Impulse Response and Variance Decomposition Analysis 62
5.5.1. Impulse Response 62
5.5.2. Variance Decomposition 63
CHAPTER SIX
CONCLUSIONS AND POLICY IMPLICATIONS 65
6.1. Conclusions 65
6.2. Policy Implications 67
References 69
Appendices IX

List of Tables

Table 2.1: Channel of Devaluation 11

Table 2.2: Summary of Contractionary effect of devaluation 17

Table 2.3: Summary of Neutral effect of devaluation 18

Table 2.4: Summary of Expansionary effect of devaluation 18

Table 3.1: Growth Rate of Agriculture Industry GDP and Per Capital Income..... 21

Table 3.2: Structure of the Ethiopian Economy share of Sectors in the GDP..... 22

Table 3.3: Recent Growth Decomposition by Sector 23

Table 3.4: Summary of General Government Finance (in percent of GDP)..... 26

Table 5.1: Unit Root Tests 50

Table 5.2: VAR Lag Order Selection Criteria 53

Table 5.3: Co-integration Rank Test 54

Table 5.4: Standardized β Coefficient 55

Table 5.5: Standardized α Coefficients 55

Table 5.6: Raw of β Coefficient 56

Table 5.7: Colum of α Coefficient 56

Table 5.8: Test of Significance of Long-run Coefficients 56

Table 5.9: Result for Vector Error Correction Term (VECT) 60

Table 5.10: Variance Decomposition of LRGDP 63

List of Figures

Figure 3.1: Contribution of Agriculture, Service and Industry to GDP..... 24

Figure 3.2: The Share of Budget Deficit, Government Expenditure and Revenue to Nominal GDP..... 27

Figure 3.3: Trends of Real GDP and Broad Money Supply (M2) 30

Figure 3.4: Growth Rate of RGDP and Money Supply 31

Figure 3.5: Trends of RGDP, Export and Import 32

Figure 3.6: Growth Rate of Real GDP, Export and Import 33

Figure 3.7: Trends of REER and NEER 35

Figure 3.8: Trends in the Official and Parallel Exchange Rate.....36

Acronyms/ Abbreviations

ACF	Auto Correlation Function
ADF	Augmented Dickey- Fuller
BREER	Bilateral Real Effective Exchange Rate
CPI	Consumer Price Index
DF	Dickey- Fuller
ECM	Error Correction Model
EEA	Ethiopian Economic Association
E-G	Engel Granger
EPRDF	Ethiopian People's Revolutionary Democratic Front
GDP	Gross Domestic Product
IMF	International Monetary Fund
LDCs	Less Developed Countries
MoFED	Ministry of Finance and Economic Development
MPC	Marginal Propensity to Consume
MRER	Multilateral Real Exchange Rate
NBE	National Bank of Ethiopia
OECD	Organization of Economic and Cooperation Development
OLS	Ordinary Least Square
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
REER	Real Effective Exchange Rate

RER	Real Exchange Rate
RGDP	Real Gross Domestic Product
SAP	Structural Adjustment Program
SDPRP	Structural Development and Poverty Reduction Program
SSA	Sub-Saharan Africa
TB	Trade Balance
TOT	Terms of Trade
US	United States
VAR	Vector Auto Regression
VECM	Vector Error Correction Model
WB	World Bank

Abstract

The objective of this paper is to analyze the short and long run effect of currency devaluation on output growth in Ethiopia. The study is conducted by using quarterly time series data over the period ranging from 1997/98 to 2009/10 and employing a Vector Auto regression model. By controlling for monetary and fiscal policy, the study found that currency devaluations are contractionary in the long run and neutral in the short-run. Other results are that monetary policy has the expected positive effect on output growth, while an increase in total government expenditure has negative effect. Moreover, this study clarify that devaluation explains a considerable part of real gross domestic product change in Ethiopia. Since the Ethiopian output is dominated by primary agricultural products and it is insensitive for the change in exchange rate, it is not possible the government allowing market forces to determine the value of Ethiopian birr. Policy intervention is needed to balance the adverse impact of exchange rate movements until the economy well transformed from agricultural sector to industrial sector and becomes less dependent on imported raw materials. Thus, monetary policy suggested a bigger role since it affects the total output positively and significantly.

Key words: Currency Devaluation, Output, VAR

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Devaluation is a deliberate downward adjustment to a countries official exchange rate relative to other currencies. According to Parida (2002), devaluation is exchange rate management and defined as in discrete and continuous senses. Countries use different type of exchange rate management, such as fixed and flexible exchange rate system. Under fixed exchange rate system a country can determine the value of its currency in terms of other countries currency which is termed as discrete devaluation. Under flexible exchange rate system on the other hand countries can determine the external value of its currency in terms of other countries currency which is termed as continuous devaluation. It is believed that, currency devaluation is a deliberate policy action to stabilize the parity value of a countries currency. Countries should have sufficient foreign currency reserve, often in US dollar, in order to sustain fixed exchange rate system.

Up to 1970s, countries have the same consensus on the possible effect of currency devaluation on economic growth. There appears a consensus view on the fact that devaluation or depreciation could boost domestic production through stimulating the net export component. This is evident through the increase in international competitiveness of domestic industries leading to the diversion of spending from foreign goods whose prices become high, to domestic goods. "The leading vision up to 1970s was that

devaluation has expansionary effect. It would improve trade balance, alleviate balance of payments deficits and accordingly expand output and employment." (Acar 2000).

The expansionary effect of devaluation in output has undergone some changes recently. According to Acar (2000), in developing countries devaluation has adverse impact on output. Most of this effect is happened in developing countries because of their economic structures. The effect of currency devaluation can be classified in to demand side and supply side channels. Most empirical studies suggested that the demand side [1]channel works that currency devaluation has expansionary effect on output. The modern view (the supply) side[2] channel suggests the contractionary effect on output.

Less developing countries give due attention for currency devaluation since countries are constrained by foreign exchange reserve. Because currency devaluation changes most macro economic variables like investment and consumption. It is argued that exchange rates in most developing countries have exhibited excessive volatility and have important effects on international trade and specialization. Therefore, there is a need to undertake efforts to co-ordinate economic policy in order to maintain medium term exchange rate misalignment and the use of monetary policy to reduce short-term exchange rate volatility (Tarawalie, 2003).

Krugman and Taylor (1978), examine the negative effect of currency devaluation on output in developing countries that has used as a policy strategy even though many

[1] The traditional view of devaluation that has expansionary effect on output through aggregate demand
[2] The modern approach in which devaluation has contractionary effect on output through supply side channel

researchers give different results for the effect of currency devaluation on output. Ethiopia, which is one of the Sub-Sahara African countries, listed among the less developed countries in the world, uses this strategy. However, there are many factors that could explain the weak economic development of the country for the last two regimes[3]. "Several policies like building up institutions, privatization of the public sector and devaluation of the currency were used in the last twenty years in order to solve the problems and create a sustainable economic development in Ethiopia" (Tirsit, 2011).

Ethiopia has continuously been vulnerable to various economic shocks like acceleration in the rate of inflation, an increase in the balance of trade deficit, continuous depletion of foreign exchange reserves and a rising premium in the black market for foreign exchange. According to Tarawalie (2003), a number of developing countries adopted the International Monetary Fund (IMF) and World Bank (WB) stabilization and adjustment policies. Thus, Ethiopia adopted its Structural Adjustment Program (SAP) since 1992. The policy package includes exchange rate adjustment, price liberalization, trade policy reforms, and privatizing public enterprise and fiscal reforms, including reduced subsidies and rationalization of public spending. At the time currency devaluation was the major component of this program.

Ethiopia's exchange rate policy has also been subject to scrutiny. Ethiopian governments successively resisted the pressure to devalue the currency over years, despite the consensus that the Ethiopian birr had been overvalued since the 1970s. The scrutiny

[3] The two regimes are the Derge and post 1992

gained momentum with the change in Ethiopian government, which finally leads to a devaluation of currency since September 1992 (Taye, 1999).

1.2. Statement of the Problem

Exchange rate change affects balance of payment and external competitiveness in developing countries. It affects economic variables like saving and investment and hence influences the nature and direction of capital flows. As a relative price, the real exchange rate reflects the impact of trade and macroeconomic policies on price of tradable and non-tradable goods. Changes in the exchange rate could affect variables such as demand, supply, price stability, capital flows, government revenue and expenditure, investment, employment, as well as distribution of income and wealth. It affects economy-wide fundamentals such as terms of trade, openness of the economy, government consumption, money supply and growth in output (Tarawalie, 2003).

In recent time reducing the value of domestic currency in terms of foreign currency has become the basic macroeconomic policy issue in most less developed countries. The effect may be contractionary or expansionary depending on the structure of the economy. During the structural adjustment program the IMF and WB suggests for developing countries to devalue their currency for the development of domestic firms. Devaluation increases the demand for domestic product and protects infant firms from outside competition (Tirsit, 2011).

Many researchers examined that, devaluation have mixed results. Even though, the ambiguous result is observed, developing countries actively used devaluation as a policy

instrument. This study examines the long and short run impact of currency devaluation on output growth in Ethiopia for two reasons. First, the country has short history of using exchange rate adjustments as a policy tools to promote external competitiveness. Since 1992, Ethiopia devalued its exchange rate where the 'Birr' exchange rate is adjusted continuously rather than in discrete steps as it was previously the case. Second, Ethiopia is heavily dependent on agricultural products and imported intermediate goods that have the possibility of contractionary effect of devaluation. In addition, research output on the effects of currency devaluations in Ethiopia is very thin. A research done by (Tirsit, 2011), which is the closest recent antecedent to my study, addresses this question of the effect of currency devaluation on output growth in Ethiopia based on time series data from the year 1980-2010. However, results from this study have limited policy implications as she do account for the fixed exchange rate of the Derge regime. My study has contributed to the literatures in such a way that; it covers a period from 1997/98-2009/10, during which Ethiopia is experiencing currency devaluation and the study depend on a quarter data rather than annual data. The other paper Taye (1999), examines the effect of devaluation on the macroeconomic performance of Ethiopia, is not sector specific and has time gap with this study.

Furthermore, Ethiopia's balance of payment has been in deficit for a long period. Devaluation has become a central policy for correcting balance of payment deficit and maintaining macroeconomic stability, even though we do have observed a lot of literatures that indicates the negative (contractionary) effect on trade balance and output

in LDCs. Thus, the study is conducted to examine the likely impact of devaluation on output growth in Ethiopia whether it is expansionary or contractionary?

1.3. Objectives of the Study

Currency devaluation is viewed as one of the main determinants of a macroeconomic variables and economic performance. The main objective of this study is to analyze the effect of devaluation on the output growth in Ethiopia. More specifically this study will:

1) Investigate the long run effect of devaluation on output.
2) Examine the short run effect of devaluation on output.
3) Forward policy implication based on the results.

1.4. Significance of the Study

The result of this study is relevant for: First, devaluation is one of the important factors that determine macroeconomic performance of a country like Ethiopia. So the study is important for policy makers to examine the likely impact of devaluation on economic growth. Second, devaluation can achieve and maintain international competitiveness and ensure a viable trade balance, by doing so the study may have its own contribution to government officials. Thirdly, this study may also be important for foundation of further researches in the area of the Ethiopian economy.

1.5. Scope of the Study

This study explored the possible ways through which devaluation of birr affects economic growth in Ethiopia. To achieve this objective, the period ranging from 1997/98 to 2009/10 is chosen. The period begins in 1997/98 is a date chosen not by the appearance of dark spot on the economy, but it makes the period when Ethiopia experiencing currency devaluation and due to the availability of quarterly data.

1.6. Limitation of the Study

Although this study attempts to shed light on the impact of currency devaluation on economic growth in Ethiopia, it suffers from certain limitations. The first problem arises from inconsistency in data by different institutions. Even the data obtained from the reports of the National bank of Ethiopia shows different figures for the same year and full data not available in the whole period. The other problem is that, quarterly data is not available on many variables for the whole period of post 1991.

1.7. Organization of the Paper

This paper is organized in such a way that Chapter one provides introduction in the research while Chapter two discusses the theoretical and empirical literature in the area. Chapter three summarizes the brief overview of Ethiopian economy. Chapter four discusses the methodology and model specification and Chapter five presents' econometric results and interpretations. Finally, Chapter six deals with conclusions and provides possible policy recommendations.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1. Theoretical Literature

Exchange rate is one of the crucial issues for policy makers in less developed countries. "It is widely believed that currency devaluation and their direct and indirect effect play an important role in determining macroeconomic performance in developing countries. This made the IMF to often recommended currency devaluation as the essence of structural adjustment program (SAP) for countries suffers from balance of payment deficits and international reserve shortages" (Elramly and Abdel-haleim, 2008). As a result, the issue of devaluation as a policy instrument attracts many researchers in less developed countries.

The macroeconomic performances like output growth, inflation, current account balance, etc. of developing countries in general has been unsatisfactory since the 1970s. Factors accountable for the weak economic performance of these countries are usually grouped into two broad categories: external economic shocks and inappropriate domestic macroeconomic policies (Taye, 1999). External economic variability includes unfavorable changes in terms of trade (TOT), a decline in economic activity in the industrialized countries, and an increase in the international interest rates and prices. And inappropriate domestic macroeconomic policies include: high fiscal deficits and misalignment of the real exchange rate. Though these factors are interrelated, the relative influence on the performance of each economy is differing.

Devaluation is one instrument to maintain and sustain the economic growth. The trade balance (TB) of countries is significantly affected by foreign exchange rate misalignment. Thus, government in less developed countries in most cases tries to change the exchange rate in a way that is covenant for their political and economic situations (Tarawalie, 2003).

According to Elramly and Abdel-haleim, (2008) devaluation is an "expenditure switching" mechanism. Devaluation increases the competitiveness of domestic firms. Hence, devaluation increases the price of foreign goods in terms of domestic goods, the demand for imported goods decline. The inverse is true the price of domestic goods become cheep in the international market. Finally the demand condition shifts from foreign imported to domestically produced goods is called "expenditure switching"[4]

In the conventional views, devaluation always has expansionary effect on output. Though the demand side channel increase the demand for domestically produced goods the general price level will increases. As cited in Tirsit, (2011), Taye, (1999), argued that when devaluation is undertaken, the price of imported goods will boost while the price of domestically produced goods will reduce which intern increases export.

Devaluation can also brings development through increasing the profit of firms (especially domestic firms), increase innovation through price computation in the

[4] Means devaluation increases the price of imported goods whereas it reduces the price of domestic goods in the international market in relative terms. At the end trade balance increases.

international markets. And devaluation improves the balance of payment and trade balance and stabilizes the economy.

Even though developing countries intensively use currency devaluation as basic policy program to boost the economy, some time it is experienced by contractionary effects. The effect is depends on the economic structure of the countries. When countries are dominantly dependent on imported raw materials, exercising devaluation may have contractionary effect on output.

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

The other possible effect of devaluation is that, it could result in higher profit for firms. This higher profit makes favorable condition for these firms and become idle (Tirsit, 2011). At the end the effect is contractionary on output growth.

Devaluation also increases the interest rate. Devaluation increases the general price level and then reduces the real money supply. When real money supply is reduced the interest rates in the economy will increases and negatively affect the cost of production (Acar, 2000).

Table: 2.1 Channels of Devaluation that makes Contractionary

N^{O}	*Channels*	*Effect of Devaluation*
1.	Real balance Channel	Devaluation increases the general price level, then the real money supply decline. Finally reduce total expenditure and contract output.
2.	Income Distribution Channel	Devaluation has income redistribution effect from low income earners to high income earners. The marginal propensity to consume (MPC) for low income earners are higher than high income earners. As devaluation is undergone the saving propensity for low income earners highly affected while high income earners improved.
3.	External Debt Channel	Devaluation increases external debt. Most of the time external debt is denominated in dollar. When countries haves huge external debt and devalue its currency the debt burden increases in terms of domestic currency. Thus, devaluation has contractionary effect on output for countries having external debt and denominated by foreign currency most of the time in dollar.
4.	Speculative Demand Channel	When speculators expect real devaluation in the future, they purchase higher dollar today. This will have negative effect on foreign exchange reserve and negatively affect the economy. This situation is common when the financial

		system of the countries is not developed.
5.	Trade Liberalization Channel	Trade liberalization may arise if import restriction is removed with devaluation. When countries remove import restriction on spot with devaluation, import become high enough and will reduce net export and discourage aggregate expenditure, through which it has contractionary effect on output.
6.	Tax Channel	Devaluation increases the value of both exportable and importable goods in terms of domestic currency. The amount of tax revenue will be higher following devaluation. Thus, devaluation increase tax and reduce the purchasing power of the people. This negatively affects total expenditure.
7.	Imported Input Cost Cannel	This typical example is true in less developed countries. Countries which are dependent on imported raw materials, making devaluation increases the cost of production. Thus, production decreases and eventually devaluation results in contractionary effect.
8.	Wage Indication Channel	As devaluation takes place the price of traded goods and the general price level will increase, eventually results a decrease in real wages. Workers may ask for nominal wage increase to restore their purchasing power. Then cost of production increase and negatively affect the economy.

9.	Cost of Working Capital Channel	"In an economy where the financial market is developed, firms can easily borrow from these markets in case they need short term funds. However, it is the fact that LDCs financial market is not developed and borrowing facilities are not easily available. Therefore, it is argued that working capital is another variable factor of production in LDCs." (Acar, 2000). If devaluation occurs, then the real volume of credit available in the market declines and interest rate tends to rise. This will increase cost of production.
10.	Import Cost Channel	When a country initially has trade deficit, following devaluation import exceeds export. Price increase in traded goods reduces the home countries real income; hence raise real income of outside world.

Source: Summarized from Acar (2000) discussion.

3.2. Empirical Literature

Empirically many researchers give different result for the effect of currency devaluation on real output growth. In some countries devaluation is contractionary whereas some other countries its effect is expansionary. In some cases devaluation has mixed result i.e. contrationary and expansionary in the short and long run. For some other countries case the effect is zero.

Typically this controversial issue is more sensitive in less developed countries. Ratha (2010) as cited in Tirsit, (2011), supported the traditional view of devaluation for the case of India. The result showed that contractionary in the short run, but overtime the effect is expansionary.

After 1970s the international organizations like IMF and WB suggests for less developing countries to adopt the structural adjustment program (SAP). Researchers like Narayan and Narayan (2007) support this idea, in their study on Fiji. Devaluation is expansionary in the long and short run. Whereas researchers like Agenor (1991), a study on less developing countries, expected devaluation is contractionary whereas unexpected devaluation has expansionary effect.

Many researchers tested the possible effect of devaluation in the long run as well as in short run. Most results suggest that devaluation is contractionary in LDCs, some others expansionary and some researchers' found neutral (zero) result. Edwards (1986), in his study in LDCs devaluation has conractionary effect in the short run, but the effect changed in to expansionary in the long run. Unlike Edwards, Acar, (2000) has found different results on the effect of devaluation in less developed countries. Accordingly devaluation is expansionary in the short run and neutral in the long run. Both Edwards and Acar used lagged variables as explanatory variable in their model.

On the other hand, various researchers obtained different result of devaluation on output growth. Researchers like Gylfason and Schimid (1983), and Connolly (1983), confirmed

the conventional effect of devaluation. On the other hand, Gylfason and Risager (1984), confirmed the modern view of devaluation in less developed countries. However, researchers like Bahmani-Oskooee (1998) found that devaluation has neutral (zero) effect in the long run.

A study by El-Ramly and Abdel- Haleim (2008), the effect of devaluation on output by applying a VAR model the effect is contractionary in the short run, whereas expansionary in the long run. Basically, these different results of currency devaluation in different countries come from the economic structures of the countries, the model adopted and the variable used by researchers.

Some empirical studies on the effect of devaluation on output is not adequately control economic variables. These economic variables are terms of trade, government expenditure, money supply and exchange rate. Kalyocu et.al (2008), by using error correction model found mixed results. In the same token Bahmani- Oskooee and Kutan (2008) by using error correction model found different results in the short and long run.

A study by Galbotswe and Andrias (2010), on the effect of devaluation by using error correction model with appropriate stance for monetary and fiscal policy the effect is contractionary in the long run and expansionary in the short run.

Miteza (2006), tests the effect of devaluation on output in a group of five transition economy. In his study, he use panel unit root and panel co-integration test. Based on his result devaluation has contractionary effect on output in the long run.

Kindi and Mirzaie (2005), in their study investigate the effect of anticipated and unanticipated devaluation in less developed countries. Unanticipated devaluation has expansionary effect on output, whereas anticipated devaluation is contractionary.

Due to unavailability of data there is no significant research output on the effect of devaluation in Ethiopian economy. On the other hand, the empirical study on this topic that focus on Ethiopia has been extremely limited. Taye (1999) as cited in El-Ramly and Abdel-Haliem, (2008), "used a macro simulation approach to a macroeconomic model for Ethiopia. His finding indicated that devaluation has positive impact on the current account balance, because of the reduction in import and an increase in export, while it decreases output and employment."

According to Tirsit (2011), devaluation has contractionary effect in the short run. She uses variables like private investments, openness, education, war beside the exchange rate. Thus the resul t suggests that devaluation has expansionary effect on output in the long run.

Generally empirical studies on the effect of currency devaluation on output revealed mixed results. Some group of authors still support the traditional (demand) side channel of devaluation has expansionary effect on output. The other group of researchers suggests the modern approach (supply side channel) obtained contractionary effect of devaluation. But some other group of researchers did not find any effect.

Though there is mixed results for the effect of devaluation on output among researchers, the current Ethiopian government uses devaluation as instrument for exchange rate policy to improve the balance of trade and the economic performance. Hence, the main objective of this paper is to examine the effect of currency devaluation on output growth in Ethiopia.

Table: 2.2. Summary of Empirical Studies that Suggests the Contractionary effect of Devaluation

No	*Author*	*Year*	*Region*	*Period*
1	Van-Wijinbergen	[1986]	LDCs	
2	Edwards	[1986]	LDCs	
3	Nunnenkamp and schweickert	[1990]	LDCs	Short run
4	Agenor	[1991]	LDCs*	
5	Domac	[1997]	Turkey*	
6	Taye	[1999]	Ethiopia	
7	Upadhyaya, K.et al	[1999]	Latin America	
8	Acar	[2000]	LDCs	Long and short run
9	Miteza	[2006]	5 Emerging economies	Long run
10	Yiheyis	[2006]	20 African Countries	Short run
11	El-Ramly and Abdel-Haleim	[2008]	Egypt	Short run
12	Galebotswe and Andrias	[2010]	Small open import dependent countries	Long run
13	Ratha	[2010]	India	Short run
14	Tirsit	[2010]	Ethiopia	Short run

Source: Researcher's own computation

(*) means expected devaluation

Table: 2.3. Summary of Empirical Studies Suggests Neutral effect of Devaluation

No	*Author*	*Year*	*Region*	*Period*
1	Upadhyaya, K &M. Upadhyaya	[1999]	6 Asian countries	
2	Upadhyaya, K.et al	[2009]	Kenya Tanzania Uganda	Short run

Source: Researcher's own computation

Table: 2.4, Summary of Empirical Studies that Suggests the Expansionary Effect of Devaluation

No	*Author*	*Year*	*Region*	*Period*
1	Nunnenkamp and schweickert	[1990]	LDCs	Long run
2	Agenor	[1991]	LDCs -	
3	Bahmani-Oskooee	[1998]	Fiji	
4	Acar	[2000]	LDCs	Medium
5	Upadhyaya, K.et al	[2004]	Greece & Cyrus	Short run
6	Yiheyis	[2006]	20 African Countries	Long run
7	El-Ramly and Abdel-Haleim	[2008]	Egypt	Long run
8	Kalyoncu, H.et al	[2008]	OECD	
9	Upadhyaya, K.et al	[2009]	Kenya Tanzania Uganda	Long run
10	Galebotswe and Andrias	[2010]	Small open import dependent countries	Short run
11	Ratha	[2010]	India	Long run
12	Tirsit	[2010]	Ethiopia	Long run

Source: Researcher's own computation

(-) means unexpected devaluation

CHAPTER THREE

OVERVIEW OF THE ETHIOPIAN ECONOMY

3.1. Economic Growth and Structure in Ethiopia

After the change in government Ethiopian economy changes away from socialist regime of the Derg in to liberal capital system (Zekarias, 2003). After 1991 the government takes many reforms like, exiting restrictions on the private sector, reducing macroeconomic imbalances, realigning the exchange rate, liberalizing the trade system. The government takes a number of reforms such as reducing tariff, cutting quota restrictions, simplifying licensing procedure and privatization becomes common. In addition to these reform measures, decentralization of political system and reform of the civil service were introduced.

The recent years was a new phenomenal for Ethiopia in its economic growth. The Ethiopian economy is grown by an average rate of two digits. The period was also characterized by a record of high inflation which started to rise as early as 2004/05 the average annual inflation rate for the period measured by the general consumer price index (CPI) was about 19.2 percent in which 64.2 percent like in the general price observes in July 2008 was the highest. The major issue that preoccupied the debate among policy makers, researchers, and other stakeholders was this seemingly paradoxical incidence of high growth and high inflation in Ethiopia (EEA, 2010).

According to national income account figures of the ministry of finance and economic development, real GDP grew at an average rate of 11 percent average growth of the five years prior to 2005/06 with an average population growth rate of 2.8 percent in the country. The high growth in GDP translates in to a comfortably high per capital income growth which had a potential of reducing poverty with a significant margin. However, this heavily depends on the quality of growth and most importantly on the nature of specific sectors which lead the growth.

The service sector dominated the period in terms of growth value added in the sector and grew an average rate more than 14 percent in the last five years. A growth rate of about 8 percent in the value added of the agricultural sector for such relatively longer period was unprecedented. Given the structural constraints of the agricultural sector are tight possibilities of expansion of arable land in major crop-growing areas. The 8 percent growth is ostensibly on the high side with such high growth in the value added in the agricultural sector. The period marks the highest rate of improvement of average rural welfare so far in the country; measured on a basis of five years average value added in the industrial sector grew at 10 percent accelerating only by 2 percentage points over the preceding five years.

Table 3.1: Growth Rates of Agriculture, Industry, Service, GDP and per Capital GDP

Period	Agriculture	Industry	Service	GDP	PC GDP
1960/61-2009/10	1.87	3.83	4.91	2.96	0.04
1960/61-1973/74	2.10	7.04	7.47	3.60	1.33
1974/75-1990/91	0.06	3.60	3.41	1.75	-0.07
1991/92-2009/10	4.14	7.16	8.42	6.09	3.28
1991/92-1999/00	2.11	6.38	7.99	4.56	1.78
2000/01-2004/05	5.55	8.20	6.70	6.22	3.42
2005/06-2009/10	8.37	10.01	14.33	11.01	8.21
2008/09	6.36	9.67	13.97	10.05	7.25
2009/10	7.63	10.58	13.04	10.41	7.61

Source: Adopted from Ethiopian Economic Association data from MoFED, (2010)

From the above table we observed that the period has also marked a shift of dominance in the overall economy from agriculture to the service sector. The seemingly high growth rate of 10 percent in the value added in the industrial sector was not robust enough to enable the sector gain a share in the GDP. This is because the industrial sector has a small based and the smallest share in the GDP. The sector gains only a mere 1 percentage points increase in the share in GDP over two decades from about 12 percent to13 percent in 2010. In contrast, the share of the service sector has been increased from 33 percent to 46 percent within the same period. A significant gain in the share in the GDP for the industrial sector with such small base requires an aggressive growth in the sector. This

phenomenon in the dynamics of the structure of the Ethiopian economy has an important implication on the direction and sustainability of the growth of the Ethiopia economy.

Table 3.2: Structure of the Ethiopian Economy Share of Sectors in the GDP

Year	1991/92-1998/99	1999/00-2004/05	2005/06-2009/10	2008/09	2009/10
Agriculture	49.4	47.5	44.1	42.6	41.6
Industry	11.7	13.2	13.0	12.8	12.9
Service	33.2	39.2	42.9	45.5	45.6

Source: Owns' computation data obtained from MoFED, (2012)

In terms of leading the growth, the share of the service sector was quite significant. Out of the total 11 percent growth, 6.15 percent (about 55.2 percent of the growth in GDP) was the share of the service sector. In this sector like wholesale and retail trades, hotels and restaurants, and real estate and renting have together accounted for 36 percent of the 11 percent growth in GDP. This might be one of the reasons for the fact that the phenomenally high rate of growth was accompanied by record-high inflation. It has also implication on the sustainability of growth such a boast in demand can only be welcomed if it is accompanied by supply responses from the agricultural and industrial sectors.

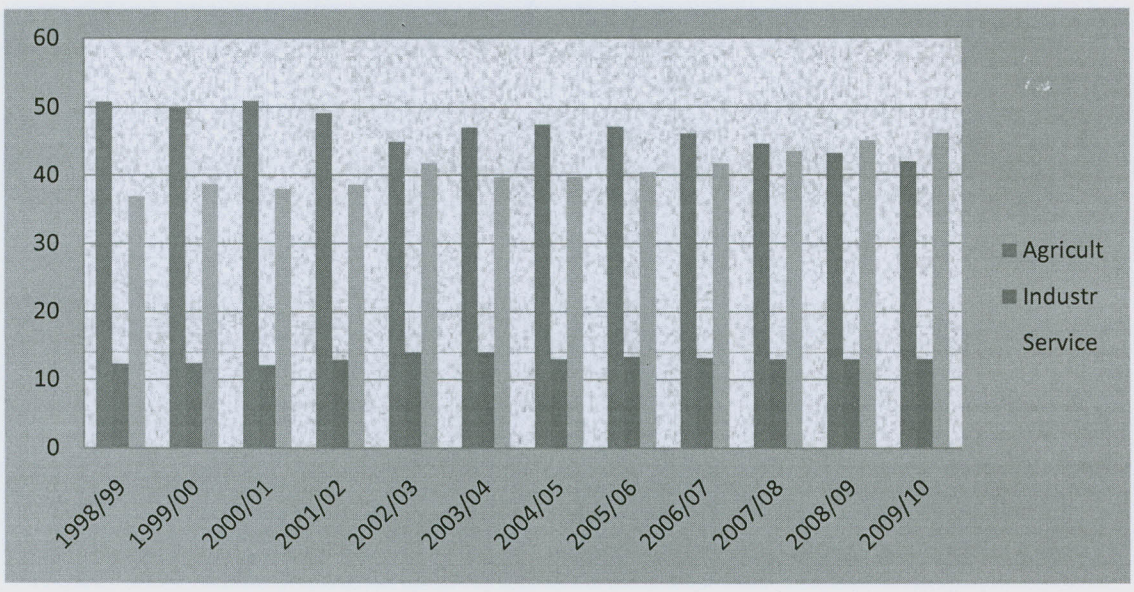
Table 3.3: Recent Growth Decomposition by Sector

	2000/01-2004/05		2005/06-2009/10	
	Weighed growth	Share in total growth	Weighed growth	Share in total growth
Agriculture	**2.64**	**41.5**	**3.7**	**33.2**
Crop	2.23	33.3	2.83	25.1
Industry	**1.08**	**17.1**	**1.3**	**11.7**
Manufacturing	0.26	3.9	0.48	4.2
Construction	0.69	10.3	0.63	5.6
Service	**2.63**	**41.4**	**6.15**	**55.2**
Wholesale and retail trade	0.71	10.6	1.85	16.4
Hotels and restaurants	0.17	2.5	0.73	6.5
Transport and communication	0.65	9.7	0.55	4.9
Financial intermediation	0.14	2	0.49	4.4
Real estate and renting	0.83	12.4	1.44	12.7
Public administration and Defense	-0.11	-1.64	0.43	3.9
Education	0.29	4.3	0.45	4
Health	0.07	1.1	0.14	1.3
GDP	**6.35**	**100**	**11.14**	**100**

Source: Adopted from EEA Computation using data from MoFED, (2010)

The agricultural sector which had a significant contribution to growth with a magnitude equivalent to that of the service sector during the period 2000/01-2004/05 fell short of keeping up to the service sector in term of its share in growth. Its contribution to growth has declined from about 42 percent during 2000/01-2004/05 to 33 percent during the last five years. This was not, however, because value added in the agricultural sector accelerated. In fact value added in the sector has accelerated from 5.6 percent during structural development and poverty reduction programs (SDPRP) to 8.4 percent during plan for accelerate structural development to end poverty (PASDEP). The reason for the decline in its share in the overall GDP growth was due to the extra ordinary high rise of the value added in the service sector. The growth in the service sector has more than doubled from 6.7 percent to 14.3 percent during the last five years compared to the preceding five years (EEA, 2010).

Figure 3.1: Contribution of Agriculture Service and Industry to GDP



Source: Owns' computation data from MoFED, (2012)

From the above chart and the previous tables observed that, there has been very slow change in the structure of Ethiopian economy. The share of agricultural sector is not taken by the industrial sector rather taken by service sector.

3.2. Fiscal Policy

"The fiscal[5] performance of Ethiopia during 1992/93-1994/95 mainly referred the postwar availability of external funds, reforms to the tax system, and efforts to restrain and reorient expenditure. Government revenue showed an important contribution as a percentage of GDP from 1991/92 to 1993/94. However, the increase in revenue counterbalance by the surge in expenditure from about 20 percent of GDP in 1992/93 to 25 percent in 1993/94 before dropping back to 24 percent in 1994/95. The fiscal deficit increased to 11 percent of GDP in 1993/94 before narrowing down to 7.6 percent in 1994/95" (Zekarias, 2003).

During the period 1998/99-1999/00 the government expenditure increased significantly due to war with Eritrea. "On average, during the 1997/98-2006/07 period, 61.7 percent of the total government expenditure has been on current expenditure the rest being on capital expenditure. This large size of current expenditure may have impeded growth by reducing the resources available for capital expenditure. Defense expenditure, poverty targeted expenditure (which includes education, health and agriculture) and expenditure on interest payment constitute the most important components of current expenditure with 27.9 percent, 30.7 percent and 9.1 percent respectively. Over 55 percent of the interest obligation has been on domestic borrowing and the rest on external borrowing.

[5] Fiscal policy in Ethiopia includes government expenditure and tax revenue.

Over the ten years period, current expenditure has grown steadily at a rate of 12 percent per annum. Capital expenditure accounts for 10.6 percent of GDP and 37.1 percent of government expenditure over the 1997/98-2006/07 period" (Kibrom, 2008).

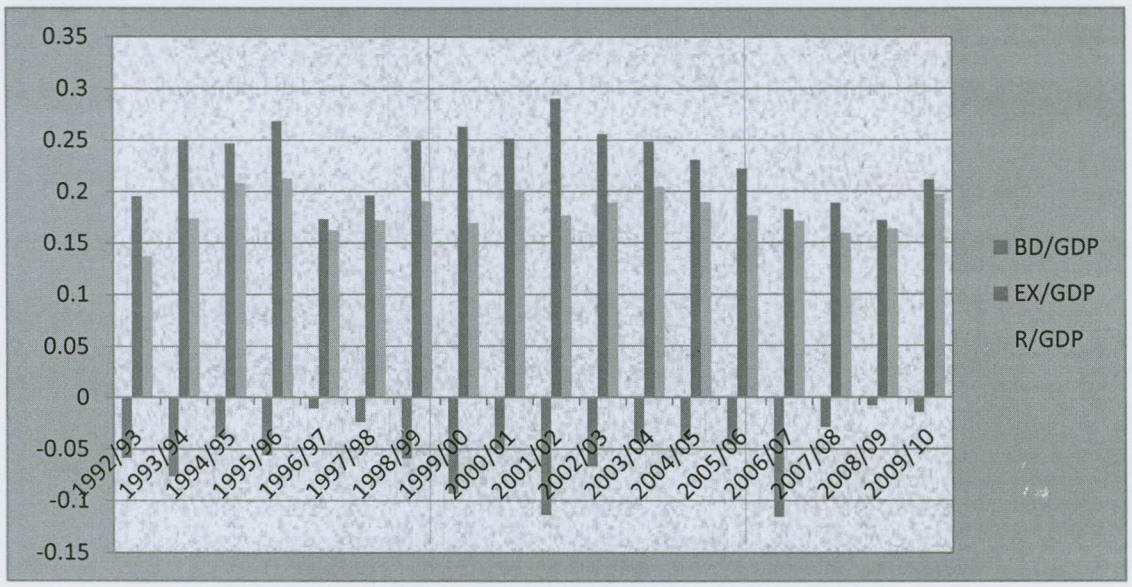
Table 3.4: Summary of General Government Finance (In percent of GDP)

					Period Average		
year	2006/07	2007/08	2008/09	2009/10	1992/93-1995/96	1996/97-1999/00	2000/01-2005/06
Revenue	13	12	12	16	15.425	14.9	15.4166
Tax revenue	10	10	9	13	10.775	9.35	11.4833
Non tax revenue	3	2	3	3	4.65	5.575	3.95
Grant	4	4	4	4	2.85	2.45	3.6
Expenditure	18	19	17	21	24.05	22.05	24.966
Current expenditure	10	9	8	9	14.625	15.325	15.733
Capital expenditure	8	10	9	12	8.725	6.675	9.3833
Overall balance	-6	-7	-5	-5	-8.625	-7.125	-10.133
Financing	1	3	1	2	5.775	4.7	6.6833
External(net)	0	0	1	1	4.05	1.725	4.066
Domestic	1	3	0	1	1.725	3	2.466
Banking sys	2	2	0	0	2.025	2.35	1.7
GDP at current price	171834	248605	336106	336106	31703.725	59686.6	66858.2355

Source; Owns' computation data, from MoFED, (2012)

The capital expenditure in Ethiopia on average was 8.725, 6.675, and 9.3833 percent of GDP for the year 1992/93-1995/96, 1996/97-1999/00 and 2000/01-2005/06. In 2006/07, 2007/08 and 2008/09 are 8, 10, and 9 percent respectively. It shows a decline trend in the recent period. The current government expenditure has shown a decreasing trend as a percentage of GDP over the year 1992/93-1995/96, 1996/97-1999/00, and 2001/01-2005/06 was 14.625, 15.325 and 15.733 percent of GDP respectively. While in 2006/07, 2007/08, and 2008/09 are, 10, 9 and 8 percent respectively.

Figure 3.2: The Share of Budget Deficit, Government Expenditure and Revenue to Nominal GDP



Source: Owns' computation data from (NBE) and MoFED, (2012)

From the above figure, budget deficit as ratio of GDP (BD/GDP) decline the year from 2006/07-2009/10. The total government revenue as a ratio of GDP (R/GDP) shows an increasing trend over the same year.

3.3. Monetary Policy

Monetary policy defined as actions taken by a central bank to manage liquidity in the financial system in an effort to achieve a certain stated goals. To manage the liquidity of money, central banks may use direct or indirect methods. Most central banks around the world have increasingly restated to using indirect methods of liquidity management as opposed to direct one. The transition from using direct methods to indirect one has not been easy in countries where the level of development of the financial system is low as this development highly influences the extent to which indirect methods of liquidity management are employed.

Monetary policy has significant role in affecting the overall performance of economy. The policy effectiveness in achieving the goal is restrained by institutional factors. Thus to achieve the monetary policy, money supply is the major instruments. Money supply can be defined as narrow and broad money. Narrow money means primary intended for transaction purpose, like checkable deposits, traveler checks, demand deposit and currency apprehended by the public. Broad money is a measure of the domestic money supply that includes M1[6] money. M2[7] money can be used for spending plus items that can be quickly converted to narrow money (NBE, 2009).

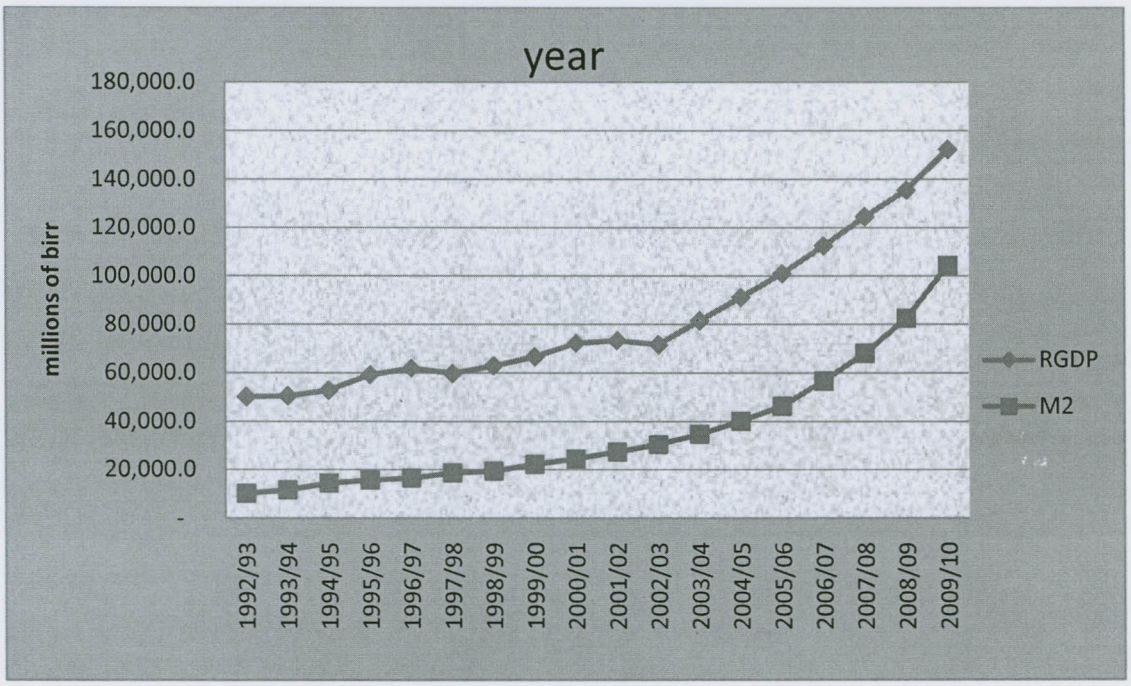
The current objective of the government is to make sure that the money supply growth is consistent with nominal GDP growth. Ethiopia's monetary policy has intended to focus

[6] M1 money is narrow money supply which used as transaction purpose and immediate repurchase
[7] M2 is defined as broad money supply and the national bank of Ethiopia used as a policy instrument to stabilize the economy

on maintaining price stability and achieving international reserve targets during the year 2003/04. Accordingly, broad money supply increased by 15.2%, which was lower than the 21.2% growth in nominal GDP. This has shown as M2/GDP ratio declining from 52.7% in 2002/03 to 50.1% in 2003/04. National Bank of Ethiopia use monetary policy instruments like reserve requirements, sale of T–Bills, setting minimum deposit rate, and rediscount window facility and moral suasion. The bank is considering enhancing the effectiveness of the instruments and /or introducing new one (NBE, 2003/04).

National Bank of Ethiopia tends to follow expansionary monetary policy since recently. Accordingly, narrow and broad money supply surged by 18.1% and 19.5% respectively, over the years 2004-2010. This can be compared with corresponding growth of 9.5% and 12.5% respectively, over the period from 1993-2003. The resent development implies that there is a clear and significant shift from stringent to expansionary monetary policy. Accounting the growth of money supply to its component is also relevant. Of the component of money supply, domestic credit grew by 21% from the 2004 up to 2009 as compared to 1996-2003 (which was 9.6%) showing a significant expansion in the latter years with a possible important role the recent monetary expansion played on output. Similarly net foreign assets with possible impact on money supply grew by 10.6% in the latter period 11.3% in the earlier years.

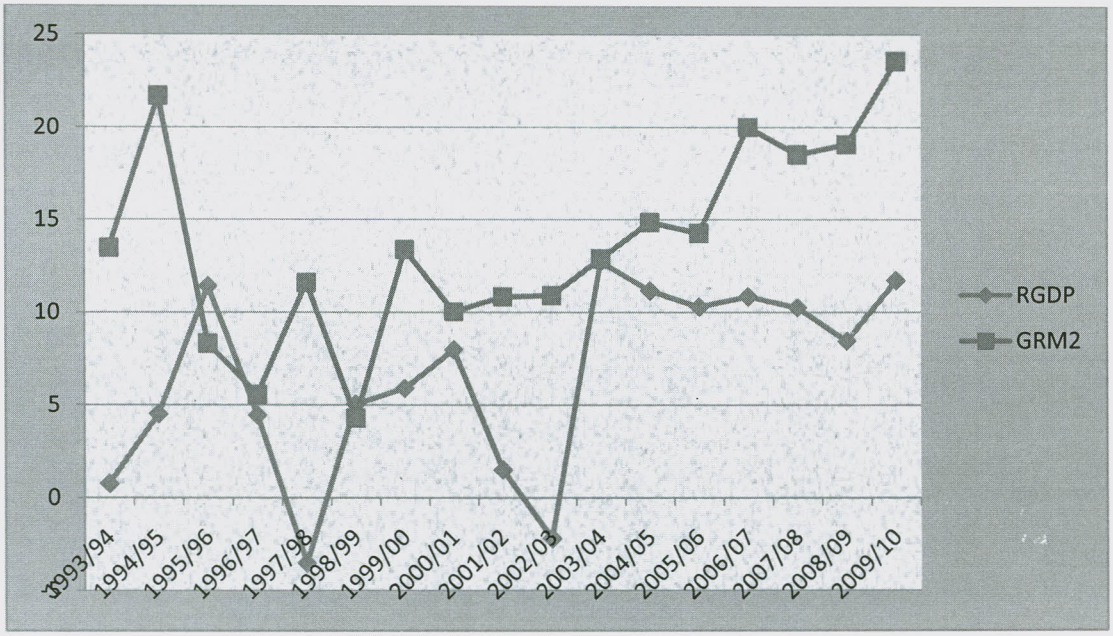
Figure 3.3: Trends of Real GDP and Broad Money Supply (M2)



Source: Owns' computation data from NBE, (2012)

From the above figure, it could observed that, broad money supply and real gross domestic product has shown a slit increment from the year 1992/93 to 2002/03, but there has a significant improvement after 2003/04.

Figure 3.4: Growth Rate of RGDP and Money Supply (M2)



Source: Owns' computation data from NBE, (2012)

3.4. External Trade and Exchange Rate Policy

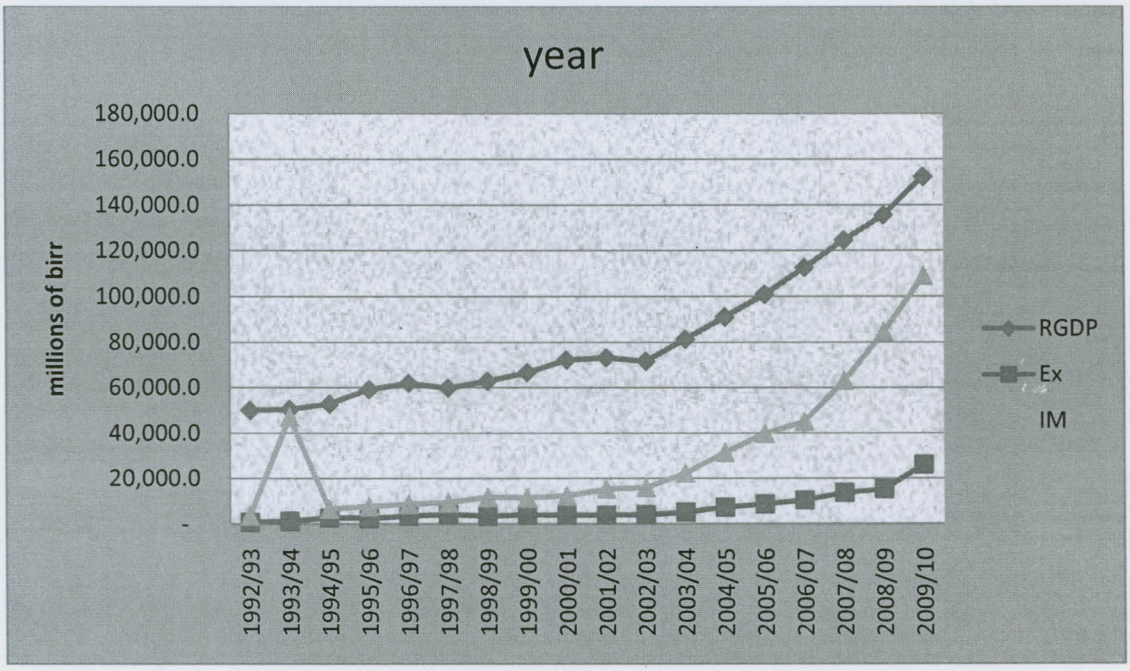
3.4.1. External Trade

One of the characteristics of external trade in Ethiopia is experiencing perpetuated trade deficit. Ethiopian export sector is predominantly dependent up on agricultural products. The amount of export sector earnings of the economy has been declining due to decline in the price of agricultural products in the international markets (Zekarias, 2003).

Ethiopia's trade policy during the Derg regime characterized by controlled foreign exchange allocation, tariffs, export rehabilitations (Derress, 2001). During 1991/92-

2001/02, on average of about Birr 2.8 billion values of goods were Birr 8.6 billion. At the time import was very high due to measure taken by current government that is trade liberalization part of the reform program (Zekarias, 2003).

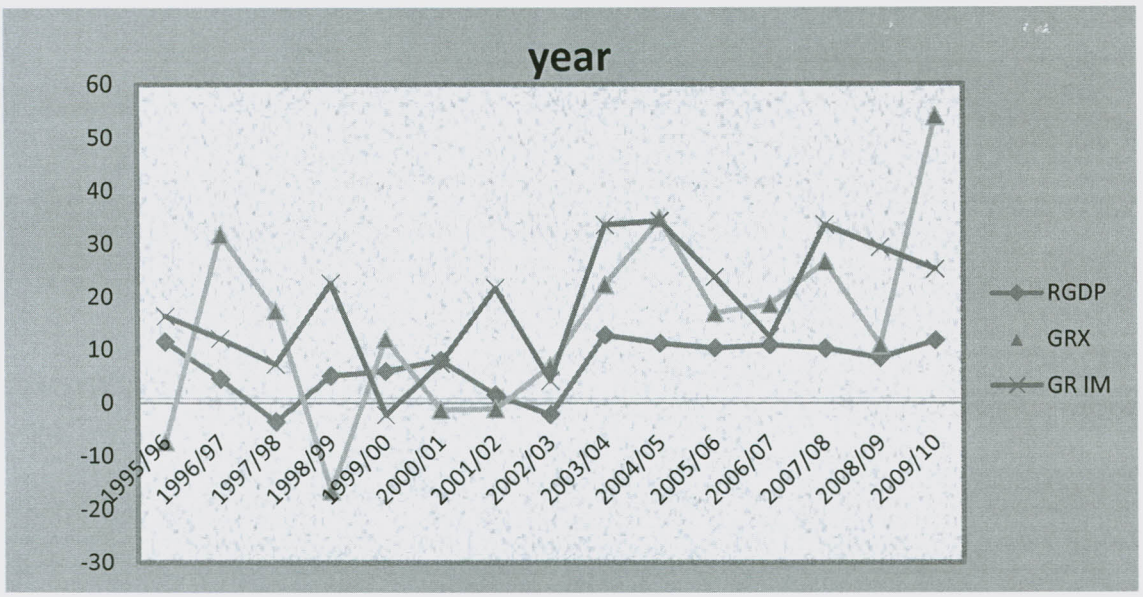
Figure 3.5: Trends of real GDP, Export and Import



Source: Owns' computation based on data from National Bank of Ethiopia, (2012)

From the above figure it can be seen that, the amount of export was increased by almost a constant trend over the year from 1992/93-2001/02, and shows an increasing trend from 2004/05-2009/10. The amount of import has significantly increased from 2003/04-2009/10, the trade deficits become more and more widen.

Figure 3.6: Growth rate of real GDP, Export and Import



Source: Owns' computation based on data from National Bank of Ethiopia, (2012)

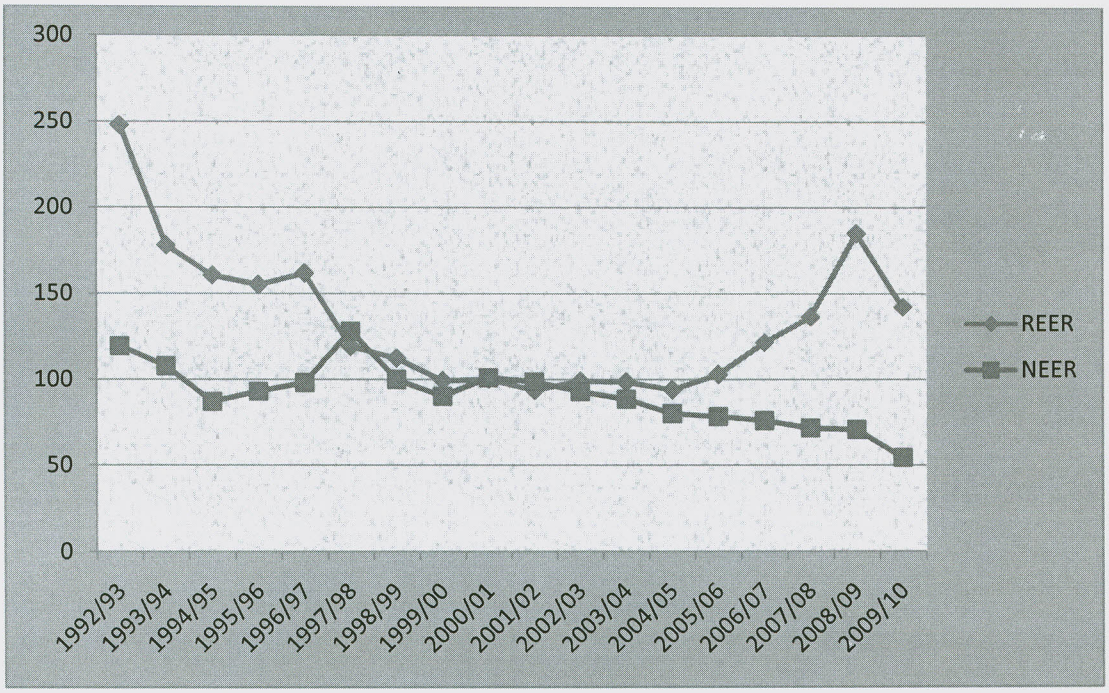
3.4.2. Exchange Rate Policy and Development

The Ethiopian legal affectionate currency was issued and the official exchange rate of this currency with US dollar was created on July 23, 1945. The name was initially Ethiopian dollar with the gold content 0.357690 gram corresponding to US$ of 0.4025 or an official rate of 2.48 Birr/US$. The gold content was almost constant up to the collapse of Britton woods system and devaluation of US dollar. After 1976 the name of the Ethiopian currency changed in to Ethiopian birr and the exchange rate of birr with dollar was remained fixed during Derg regimes (Fentahun, 2011).

Therefore, the Ethiopian currency has been pegged to the US dollar at the rate of 2.07 birr per US dollar until the huge devaluation of October 1992. This fixed official exchange rate was left unaltered for two decades despite the floating of the major world currencies including US dollar. As a result the birr became overvalued in terms of US dollar as well as many other foreign currencies. "From May 1993 up to the unification of the official and the public sale exchange rates on July 25, 1995, the exchange rate was partly determined by the government decree (applicable to the official rate) and partly by quasi-market forces (applicable to the auction rate) as represented by fortnightly auctions"(Derress, 2001).

The primary task of exchange rate policy in Ethiopia is promoting export and minimizing the adverse effect of exchange rate instability. The objective is limiting the gap between effective exchange rate indicating that the overvaluation of the birr has substantially been reduced and the parallel market exchange rate premium has declined significantly (Zerayehu, 2006).

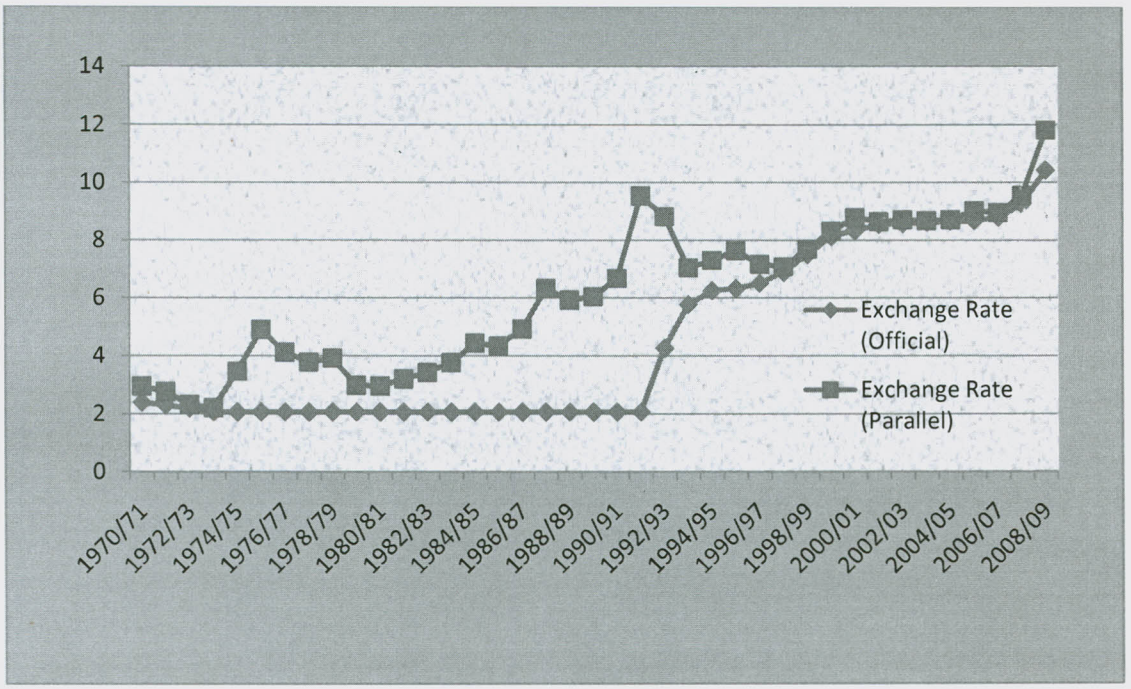
Figure 3.7: Trends of REER and NEER



Source: Owns' computation data from National Bank of Ethiopia, (2012)

From the above line chart the real effective exchange rate starts to decline from the beginning of the recent government. It confirms that decline in REER is real devaluation as per the National Bank of Ethiopia's computation. As cited by Derress (2001) from Haile Kibret, (1994), the real exchange rate is every time higher than the nominal exchange rate, suggested that the Ethiopian birr has been overvalued since the mid-1970s. The export weighted index, import weighted index, and trade weighted index shows the Ethiopian birr was appreciated during the 1980s.

Figure 3.8: Trends in the Official and Parallel Exchange Rate



Source: Owns' computation data from National Bank of Ethiopia, (2012)

As shown in figure above before the Derg period the official and the parallel exchange rate was moving very close to each other. From 1972/73-1992/93 the parallel market for foreign exchange expended, especially the late 1980s. During this period the parallel rate is significantly higher than the official rate. Clearly the birr was overvalued.

CHAPTER FOUR

MODEL SPECIFICATION AND METHODOLOGY

4.1. Choice of Variables

Edwards (1986) cited in El-Ramly and Abdel-Haleim, (2008), to investigate whether devaluation is contractionary or expansionary, he considered the important effect of policy variables like monetary fiscal and trade policy on economic activities in developing countries. In his model variables included the ratio of government expenditure to nominal income, money supply, terms of trade, the real effective exchange rate and real output are incorporated.

Nominal devaluation leads to real devaluation when the real effective exchange rate is accompanied by policy variables. In this study the real effective exchange rate (REER) is incorporated as variable of interest. This variable is accompanied by macroeconomic variables, in particular fiscal and monetary policy. Appropriate stance for monetary and fiscal policies is included in this model because of their crucial role in sustain a real devaluation.

A. Exchange rate

Exchange rate is a rate at which one country's currency is exchanged for the other currency. As cited by Fentahun (2011) from Pilbeam (1998), exchange rate can be expressed in two ways. These are domestic currency per unit of foreign currency and

foreign currency units in terms of domestic currency. In may study data's taken from NBE, exchange rate is defined in terms of foreign currency per unit of domestic currency.

Exchange rates can defined as nominal and real terms. Nominal exchange rate can be defined as the amount of domestic currency required to purchase a unit of foreign currency (Tarawalie, 2003). As he further defined real exchange rate is the adjustment of specified nominal exchange rate for relative inflation between a domestic economy and the rest of the world to determine the effects on incentive to produce, purchase and store goods and services.

RER= E.P/P*---------- (4.1)

Where; E, nominal exchange rate

P, domestic price level is measured by CPI

P*, foreign price level is weighted by tradable goods

The above formula is a bilateral measure. In reality countries traded with many countries. Real exchange rate is the rate of exchange that accounts for the relative importance of all trading partners. The real effective exchange rate can be formulated as;

$$MRER_{jt} = \sum_{i=1}^{k} aitE_{it} \frac{P*_{it}}{P_{jt}}$$ ---------- (4.2)

Where: $MRER_{jt}$ =is index of the multilateral real exchange rate in period t for country j

E_{it}=nominal exchange rate between country j and country i in period t

k =number of trading partner countries.

ait = weight corresponding to trading partner country i

P^*_{it}=price index of partner i in period t

P_{jt}=price index in the home country j in period t

B. Devaluation

Devaluation can be defined as a policy undertaken by a nation to reduce the value of its national currency either in relation to gold or in relation to currency of other nations (http/culture.yourdictionary.com).

In Ethiopia devaluation of Birr officially began during the EPRDF regime. After 1992 the exchange rate is changed from fixed to flexible rate in order to control overvaluation through a gradual depreciation of domestic currency every year. During 2007/08 the rate of depreciation against other foreign currencies increased as compared to the previous years. In recent years the Ethiopian Birr depreciated more and more (Tirsit, 2011).

C. Money Supply

Monetary policy rendered important in its use for stabilization purposes. In open market operation system monetary authorities to reduce inflation would leave domestic residents holding less money than they desire at the prevailing foreign rate of interest. Even though monetary policy is said to be important under fixed exchange rate system, it does have influence on the real exchange rate in the process of adjustment (Tarawalie, 2003).

D. Government Expenditure

Fiscal policy includes government expenditure and tax revenue. Government expenditure can possibly affect aggregate expenditure and real output. Change in government expenditure can affect real exchange rate by altering the gap between domestic expenditure and domestic income. An expansionary fiscal policy that might from higher government expenditure would induce inflation and hence appreciate the real exchange rate.

4.2. Model Specification

This study employs the vector Auto-regression (VAR) technique to test the effect of devaluation on output in the Ethiopian economy. Sims (1980) cited in El-Ramly and Abdel-Haleim (2008), the VAR model is a means of overcoming the limitations of traditional approach in estimating economic variables.

According to Ramly and Abdel-Haleim (2008), when variables have simultaneity biases the feedback relationship between the dependants and independent variables results in biased coefficients and standard errors if estimated by ordinary least square (OLS) method. "Charmeza and Deadman (1997), confirmed that, the traditional multi equation modeling has been criticized on the bases of two main assumptions namely (i) the zero restriction assumption imposed on some variables as a resolution for the identification problem, and (ii) initial division of variables in to exogenous and endogenous variables".

In the VAR model there is no particular relationships imposed on the variables. Before estimation the VAR model the optimal lag length should determined and all variables deals with endogenous[8] in the system. This avoids the simultaneity problem in the system.

The relationships between macroeconomic variables are affected by reverse causation like real exchange rate and output. "Considering the reveres causation between real exchange rate and output, the real devaluation often found to accompany macroeconomic contractions while real revaluation often accompany macroeconomic expansions" Ramly and Abdel-Haleim (2008).

In assessing the impact of devaluation on output, most of the earlier researchers have also included in their model as a stance of fiscal policy as well as a stance of monetary policy in addition to the interest variable i.e. real exchange rate. Therefore, this study follows researchers like Edwards (1986), Bahmani-Oskooee (1998), Bahmani-Oskooee and Kutan (2008) and Galeboswe and Andrias (2010) to adopt the following model specification:

$$\boldsymbol{LRGDP_t = \beta_0 + \beta_1 LREER_t + \beta_2 LM2_t + \beta_3 LG_t + \varepsilon_t} \quad \text{---------- (4.3)}$$

(?) (+) (+)

Where the variables;

RGDP- Real Gross domestic product is a function of money supply, government expenditure and real effective exchange rate.

[8] Endogenous variables are variables that are determined within the system

REER - Real effective exchange rate has no predetermined sign on output growth.

M2 - Broad money supply as a stance of monetary policy has expected positive sign.

G - The amount of total government expenditure as a stance of fiscal policy has expected positive sign.

ε_t Error term

Equation (4.3) is a long run equation model in which RGDP is a measure of real output; M2 is broad money supply as a stance of monetary policy; G is real government expenditure as a measure of fiscal policy; and the real effective exchange rate (REER) is the policy variable, and ε is an error term. Following macroeconomic theories if expansionary monetary and fiscal policies are to have expansionary effects on output in the long run, we would expect estimates of β_2 and β_3 to be positive. When the real effective exchange rare (REER) is decline, it reflects real depreciation of domestic currency against trading partners. Therefore, real depreciation is expansionary, if an estimate of β_1 is negative. Thus, for real depreciation to be contractionary, an estimate of β_1 must be positive.

In summary all variables are in real terms. The coefficients of the fiscal and monetary variables are expected to be positive, but the coefficient of REER, can be positive or negative, depending on the likely impact of devaluation is contractionary or expansionary.

4.3. Econometric Tests

4.3.1. Stationary Test

A data series is said to be stationary if its error term has zero mean, constant variance and the covariance between any two time periods and it depends only on the lag between the two periods and not on the actual time which it is computed (Wondwesen, 2011). To avoid the pitfall of wrong inferences from the non-stationary regressions, the time series data should be stationary. Ordinary Least Squares (OLS) may lead to inconsistent and less efficient parameters as they may show that there is a strong relationship whilst in actual fact there is no relationship at all and hence the results obtained from such regressions will not have a meaningful economic interpretation. Hence, prior to estimation of the long run model(s) the time series properties of the variables, unit root test, should be conducted.

The first step in time series variables are testing whether the variables are stationary or non-stationary. Several tests are usually employed to test whether time series variables are stationary or non-stationary by Dickey-Fuller (DF), the Augmented Dickey-Fuller (ADF) test, Auto-Correlation Function (ACF) and Phillips-Peron (PP) test. This study employed the ADF and Phillips-Peron test to determine a unit root.

The general form of the ADF equation with intercept;

$$\Delta Y_t = A_o + \gamma Y_{t-1} + \sum_{i=2}^{p} \beta_i \Delta Y_{t-i+1} + \varepsilon_t \quad \text{---------- (4.4)}$$

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

$$\Delta Y_t = A_o + \gamma_1 t + \gamma Y_{t-1} + \sum_{i=2}^{p} \beta_i \Delta Y_{t-i+1} + \varepsilon_t \text{ ---------- (4.5)}$$

Where, Y_t is any variable in the model to be tested for stationary, ε_t is an error term and Δ is the first difference operator.

The null hypothesis of ADF is $\delta=0$ against alternative hypothesis that $\delta<0$. Where $\delta=$ γ -1.

Rejection of the null hypothesis means that the time series is stationary or it does not contains a unit root.

If a time series to be integrated of order zero, it should be stationary at level. Some series needs to be differenced several times before becoming stationary. Order of integration is the number of times a series needs to be differenced before stationary. So if a time series is said to be integrated of order *d*, it means that it has to be differenced *d* times before the series become stationary. If the series are stationary, running a regression avoids spurious regressions.

4.3.2. Co-integration Test

Most macroeconomic variables are non stationary over time. One can difference or de trend variables to make stationary. And if variables become stationary through differencing, variables are difference stationary and if they are de trended variables are trend stationary (Wondwesen,2011).

In the case where variables are difference stationary, it is possible to estimate the model by first difference. However, this gives only the short run dynamics in which case valuable information concerning the long run equilibrium properties of the data could be lost. In order to obtain both the short run and long run relationship one can appeal to what is known as co-integration.

Variables have long run relationship if they are co-integrated. We need to test for co-integration because differencing the variables to attain stationary generates a model that does not show the long run behavior of the variables. Hence, testing for co-integration is the same as testing for long-run relationship. In general, if variables that are integrated of order 'b' produce a linear combination which is integrated of order less than 'b' then the variables are co-integrated and hence have constant long run equilibrium relationship (Gujarati, 1995).

There are two approaches to test for Co-integration, these are, the Engle-Granger (EG) and the Johansen Approach. Although, the Engle-Granger procedure is easily implemented, it is subject to the some important limitations. Tests three or more variables

by using E-G methodology, there may be more than one co-integrating vector. The Engle Granger method has no systematic procedure for separate estimation of the multiple co-integrating vectors. The E-G approach relies on a two-step estimator. The first step is to generate the error series and the second step uses these generated errors for estimation, thereby carrying over errors obtained from regression using the residuals. Any fault introduced in the first step is extended in to the second step. Co-integration test may depend on the variable put in the left hand side of the co-integration and tests are not invariant to the variable. the E-G method does not allow the variables in the right hand side to be potentially endogenous (Wondwesen, 2011).Since, the Johansen (1988) procedure enables estimating and testing for the presence of multiple co-integration relationships, in a single step procedure this paper chooses to use the Johansen maximum Likelihood Procedure (1988) since it addresses the above stated weakness of the E-G method.

The starting point in this procedure is formulation of vector auto regression (VAR) model in the following form.

$$X_t = A_O + A_1X_{t-1} + A_2X_{t-2} + \cdots + A_pX_{t-p} + et \text{ ---------- (4.6)}$$

Where;

$$X_t = [RGDP_t, REER_t, M2_t, G_t] \text{---------- (4.7)}$$

Equation (1) is a (n×1) vector containing each of the n variables including in the VAR

A_O = (n×1) vector of intercept terms

A_i = (n×n) matrices of coefficients

e_t = (n×1) vector of error terms.

4.3.3. Vector Error Correction Model (VECM)

In the previous co-integration discussion, if two variables that are non-stationary at levels have a stationary liner combination, then the two variables are co-integrated. Variables may have short run behavior that can be captured through dynamic modeling. Co-integration means the presence of error correction representation. Any deviation from the long run equilibrium will come back to its long run path. Thus error correction model depicts both the short and long run relationship between economic variables (Wondwesen 2011).

4.3.4. Impulse Response and Variance Decomposition

Impulse response is a method of assessing interrelations among variables in the VAR. It can be used either to assess the dynamic behavior of the VAR or to investigate the policy impact of the variables that constitute the VAR (Alemayehu et al, 2009).Impulse response shows how one variable, responds over time to a shock in another variable and compares this response to shocks from other variables. Impulse response just traces out time path of the effects of shocks of other variables contained in the VAR model on a particular variable. In other words, this approach is designed to determine how each variable responds over time to an earlier shock in that variable and to shocks in other variables. (Lutkepohl and Kratzig, 2004)

Impulse response functions represent the time profile of the effect of a shock to one variable on the contemporaneous and future values of all endogenous variables. They capture both direct and indirect feedback effects caused by endogeneity over time.

However, given the interrelationships that characterize economic system, it is often more informative to undertake an impulse response analysis when the short and long run impacts are of key interest. In cases where variables are interrelated, a shock to one variable may set off a chain reaction of knock on and feedback effects as it permeates through the system, impulse response analysis estimates the net effect of the direct and indirect effects of a shock not only in the long run but at all periods following the shock. The accumulated effects of unit impulses can be obtained by an appropriate summation of the coefficients of impulse response functions.

The variance decomposition helps in identifying the degree of one variable influences the other variable in the system. This study is going to use variance decomposition to break down and ascertain the degree to which devaluation influence other variables in the system and vice versa. Variables in a system will have a forecast error and the error in forecasting can be attributed to the present and past values of the variable in question and the past and present values of all other variables in the system. So by breaking down this forecast error it is possible to determine the degree to which the variable in question is being influenced by its past and present values and to the other variables.

The forecast error variance decomposition permits inferences to be drained concerning the proportion of the movements in a particular time-series due to its own earlier shocks visa-a-versa shocks arising from other variables in a VAR model. The technique breaks down the variance of the forecast error for each variance following a shock to a particular

variable , through which it is possible to identify which variables are strongly affected and those that are not (Ibid).

4.4. Data Type and Source

The success of every research is ultimately depends on the availability and relevance of data. For the purpose of analyzing the effect of devaluation on output growth in Ethiopia, quarterly time series secondary data source, from 1997/98 to 2009/10, are used. The major data sources for this study are National Bank of Ethiopia (NBE), Ministry of Finance and Economic Development (MoFED) and Ethiopian Economic Association (EEA) 2010 data base.

CHAPTER FIVE

ESTIMATION RESULTS AND INTERPRETATION

5.1. Unit Root Test

Testing variables for stationary is the first step in time series data analysis. Variables should be stationary in the same level unless it leads to spurious regression results. The co-integration analysis and the associated error correction modeling are among the next step and are recent solution to the problem of estimating relationship to the variables that have unit roots.

Table 5.1: Unit Root Test

Variables	Specifications	ADF statistics	PP statistics	Order of integration
LRGDP	With C	0.378815	2.5478	
	With C and T	-1.445699	-1.2746	
DLRGDP	With C	-4.2648**	-3.3464*	I(1)
	With C and T	-5.1310**	-3.428847*	
LREER	With C	-1.147379	-1.258273	
	With C and T	-1.623180	-1.734994	
DLREER	With C	-6.1602**	-6.1453**	I(1)
	With C and T	-6.1530**	-6.1339**	
LM2	With C	3.059563	3.50759	

	With C and T	-1.20101	-1.07552	
DLM2	With C	-6.8621**	-6.86377**	I(1)
	With C and T	-7.3285**	-8.79454**	
LG	With C	-1.0496	-1.343112	
	With C and T	3.0793	-1.28045	
DLG	With C	-9.7101**	-9.7829**	I(1)
	With C and T	-9.6100 **	-9.6805**	

Note;

C is estimated value of test statistics when intercept is included in the auxiliary regression for unit root test. **T** is estimated value of test statistics when trend is included in the auxiliary regression for unit root test.

As the test is conducted, the conventional Augmented Dickey – Fuller (ADF) and PP test were used with trend, and trend and intercept. The ADF[9] and PP test statistics in the above table show that all variables are non-stationary at level. That is, the null hypothesis of unit root, both with trend and trend and intercept are not rejected. But, both the ADF test statistics and the PP tests become stationary at 1% and 5% level of significance with the same variables. As a result the variables are stationary at first difference and integrated of the same order, I (1).

[9] If the estimated Augmented Dickey-Fuller statistic is greater than the critical value we reject the null hypothesis that the series is non-stationary in favour of stationary.

It is also possible to verify the non-stationary of these series at levels just by observing at the line graphs of the series which is shown in the appendix part A[10]. In the graph natural logarithm of real gross domestic product (LRGDP), shows an increasing trend in the whole analysis of the period from 1998 to 2010. We can also observe an increasing trend in the natural logarithm of broad money supply (LM2) over the whole period of analysis. And also the natural logarithm of real effective exchange rate (LREER) has a decreasing pattern for the years from around 1997/98QI to 2004/05QIII and has an increasing trend for the period from around 2004/05QIII to 2010QIV except for the years 2005 and 2007 showing a decreasing trend. The natural logarithm of government expenditure (LG) has an increasing trend during the period except for some minimal ups and downs. Therefore, when we look at the plot of each time series variables, we can observe an increasing trend, decreasing trend or a fluctuating pattern, suggesting that the mean of the series have been changing. This suggests that these series are not stationary at level.

5.2. Determination of Optimal Lag Length

The first step in estimating a VAR model and undertaking Co-integration test is determining the optimal lag length. Length selection criteria, which are the sequential modified Likelihood Ratio test statistic (LR), Final Prediction Error (FPE), Akaike Information Criteria (AIC) and the Hannan-Quinn Information Criterion (HQ), are used in this study. All this information criteria in this study shown in Table 5.2 below gives four optimal lag lengths at 5% level of significance.

[10] See the plot of variables at level in the appendix part, which shown as the mean , the variance and standard errors are not constant over time

Table 5.2: VAR Lag Order Selection Criteria[11]

VAR Lag Order Selection Criteria
Endogenous variables: LRGDP LREER LM2 LG
Exogenous variables: C
Date: 07/02/12 Time: 14:00
Sample: 1998Q1 2010Q4
Included observations: 47

Lag	Log L	LR	FPE	AIC	SC	HQ
0	81.72578	NA	4.30e-07	-3.307480	-3.150021	-3.248227
1	317.9179	422.1305	3.68e-11	-12.67736	-11.89006	-12.38109
2	354.8314	59.68991	1.54e-11	-13.56729	-12.15016	-13.03401
3	385.2341	43.98694	8.66e-12	-14.18017	-12.13320	-13.40988
4	**424.8030**	**50.51355***	**3.43e-12***	**-15.18311***	**-12.50630***	**-14.17581***
5	438.9455	15.64698	4.25e-12	-15.10406	-11.79742	-13.85975

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

5.3. Co-integration Test

Table 5.1 shows that all the variables are contained in the equation and are I (1). This permits to conduct test for co-integration among variables. The trace statistics adjusted for degrees of freedom confirms that the null hypothesis of one co-integrating vector is not rejected at 5% significance level. This points the presence of one co-integrating vector. The test is reported in the following table.

[11] LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC Akaike information criterion; SC Schwarz information criterion; HQ: Hannan-Quinn information criterion.

Table 5.3: Co-integration Rank Test

Null	Alternative	Trace Statistics	Eigen Value	5% critical Value	P - value	Hypothesized No. of CE(s)
Trace[12]						
$r = 0$	$r \geq 0$	57.45124	0.445957	47.85613	0.0049	None *
$r \leq 1$	$r \geq 1$	29.69709	0.335736	29.79707	0.0513	At most 1
$r \leq 2$	$r \geq 2$	10.47057	0.145294	15.49471	0.2463	At most 2
$r \leq 3$	$r \geq 3$	3.091654	0.063663	3.841466	0.0787	At most 3
Maximum Eigen value[13]						
$r = 0$	$r = 1$	27.75415	0.445957	27.58434	0.0476	None *
$r = 1$	$r = 2$	19.22652	0.335736	21.13162	0.0905	At most 1
$r = 2$	$r = 3$	7.378914	0.145294	14.26460	0.4453	At most 2
$r = 3$	$r = 4$	3.091654	0.063663	3.841466	0.0787	At most 3
Max- Eigen test indicates 1 co integrating Eigen(s) at the 0.05 level						
****denotes rejection of the hypothesis at the 0.05 level***						
****Mackinnon- Haug- Michelis (1999) p-value***						

The result depicted in table 5.3 reports the existence of one co-integrating vector in the system. The null of no co-integration vector is rejected at 5 % significance level. On the other hand, the null that there exists at most one co-integrating vector is accepted.

[12] Trace statistics accepted at least one co-integrating vector
[13] Maximum Eigen value accepted there is exactly one co-integrated vector in the system

Table 5.4: Standardized Beta (β') Coefficients

LRGDP	LREER	LM2	LG
1.0000	-0.2906	-0.7451	0.2758
0.6395	1.0000	-6.4671	3.7738
-1.8074	0.2260	1.0000	-0.0076
-2.8746	-1.0134	0.1967	1.0000

Table 5.5: Standardized α Coefficients

DLRGDP	-0.001577	0.000584	-0.001248	-0.000195
DLREER	0.000550	0.031045	0.007073	0.004649
DLM2	0.004191	0.001972	-0.003299	0.003086
DLG	-0.092406	-0.018824	0.008075	0.011990

In the Johansson's co-integration test, one co-integration vector suggests the existence of one equation in the VAR. Therefore, in the above tables (5.4 and 5.5) the first raw of β coefficient and the first column of α coefficients are the relevant entry for interpretation. For instance, the long run feedback effect on government expenditure seen in the above result is the speed of adjustment as high as 9 percent in each quarter. The co-integration rank test in the previous section suggests one co-integrating equations that define real GDP, as dependent variables. This study relates real GDP to other variables as the focus to examine the impact of these variables.

Table 5.6: Row of β Coefficients

LRGDP	LREER	LM2	LG
1.0000	-0.2906	-0.7451	0.2758

Table 5.7: Colum of α Coefficients

DLRGDP	DLREER	DLM2	DLG
-0.001577	0.000550	0.004191	-0.092406

Once the long run relationship is defined, the next task is to formulate test of significance on the long run parameters. This test can be obtained by imposing restriction on β coefficients or simply by taking the t-statistics from the co-integrating result, which is termed as exclusion test. It helps to determine which are relevant or statistically significant in the co-integrating vector. The results of the test along with their respective t- values are reported in table 5.8 below.

Table 5.8: Significance of long-run Coefficients

Variable	Beta coefficients	Std. Err.	t-statistic
LREER	-0.290618	0.06503	-4.4689**
LM2	-0.746115	0.13680	-5.4540**
LG	0.275874	0.09713	2.8402*

*** denotes significance at 5%*

As it is explained from table above, the long – run results depict that all explanatory variables LREER, LM2 and LG, for LRGDP were found to be statistically significant.

Thus, the result rejects the null hypothesis that the β coefficients are jointly insignificant at 5% level. Moreover, the variables are with the hypothesized sign. Hence, the long run growth equation with the corresponding signs is presented as follows:

$$LRGDP = 0.29061\ LREER + 0.7451154\ LM2 - 0.27587\ LG \quad \text{---------- (5.1)}$$

(t-value) (-4.4689) (-5.4540) (2.8402)

Diagnostic tests;

Normality test; Jegue-Bera 5.567[0.0618]

Autocorrelation; Godfrey serial correlation prob. F(4,27) [0.6513]

Heterosckedasticity test; Breusch-Pagan-Godfrey 2.472390 Prob. F(4,38)[0.0608]

In line with the definition of real effective exchange rate, the regression result shows that, currency devaluation has contractionary effect in the long run and broad money (M2) as stance of monetary policy produced a significant and positive effect on output. But, total government expenditure as a stance of fiscal policy shows a negative effect on output growth.

From the forgoing discussion the variable real effective exchange rate has positive sign and statistically significant in affecting output growth. Thus, increase in real effective exchange rate by one percent increases output by 0.29061%. The inverse is true devaluation (decrease in real effective exchange rate) by one percent promoted economic growth 0.29061% in the above long run model. This may be devaluation works through

the modern approach in the long run. This result is consistent with the most researchers discussed in the literature[14] part.

The modern view suggests that devaluation of the domestic currency has a negative effect on real GDP. "For the modern viewers, the impact of exchange rate on economic growth works through the aggregate supply side channel i.e. developing countries are dependent on foreign capital for investment and the demand for their export elasticity is low" (Fentahun, 2011),. Thus, the impact of devaluation in this study is consistence with the above explanation. This is due to the increased cost of materials much greater effect than its positive effect of devaluation.

This result is consistent with, Wijinbergen (1986) in LDCs, Taye (1999) in Ethiopia, Upadhyaya, K.et al (2000) in Kenya, Tanzania and Uganda, Acar (2000) in LDCs, Miteza (2006) in 5 emerging countries and Galebotswe and Andrias (2010) in small import dependant countries. But, it is inconsistent with researchers like Nunnenkemp and Scheickert (1990) in LDCs, Yiheyis (2006) in 20 African Countries, El-Ramly and Abdel –Haleim (2008) in Egypt, Rathta, (2010) in India and Tirsit (2010) in Ethiopia.

Referring from the above equation it is proved that, money supply has a positive contribution for the economic growth of Ethiopia and it is also supported by the descriptive analysis part. In fact, the coefficient 0.7451154 indicates that a one percent

[14] Channels through which devaluation has contractionary effect presented in under the contractionary effect of devaluation part

increases in the broad money accounted for 0.7451154 percent increase in the real gross domestic product in Ethiopia.

Total government expenditure has a negative effect on economic growth implying that, large size of government expenditure goes to recurrent expenditure. Thus, recurrent expenditure may have impeded growth by reducing the resources available for capital expenditure. Data used for this study is after 1997/98, during this period the government expenditure were high due to war with Eretria. Defense expenditure, poverty targeted expenditure (which includes education, health and agriculture) and expenditure on interest payment constitute the most important components of current expenditure. As a result, long run responsiveness of real GDP to the change in total government expenditure is -0.27587. It means that a one percent increase in total government expenditure will decrease real GDP by 0.27587 percent over time.

5.4. Vector Error Correction Model [VECM]

Having obtained the long run model and estimated coefficients, the next step is to determine Vector Error Correction Model [VECM], which captures both the long run and short run relationship. The change in the variables represent variation in the short run, while the coefficients obtained for the error correction term represents the speed of adjustment towards the long run relationship.

Table 5.9: Result for the Vector Error Correction Term [VECT]

Variables	Coefficient	Std. Error	t- Value	Prob.
ECM_1	-0.051403	0.02377	-2.16265*	0.0390
D(LRGDP(-1))	1.813536	0.16280	11.1399	0.0000
D(LRGDP(-2))	-1.664093	0.31940	-5.21009	0.0000
D(LRGDP(-3))	0.944422	0.30747	3.07162	0.0046
D(LRGDP(-4))	-0.235922	0.16917	-1.39459	0.1737
D(LREER(-1))	-0.003606	0.01579	-0.22845	0.8209
D(LREER(-2))	-0.007052	0.01461	-0.48281	0.6329
D(LREER(-3))	-0.022531	0.01512	-1.48996	0.1470
D(LREER(-4))	0.016301	0.01575	1.03513	0.3092
D(LM2(-1))	0.037495	0.03685	1.01757	0.3173
D(LM2(-2))	0.018880	0.03269	0.57748	0.5681
D(LM2(-3))	0.049870	0.03221	1.54822	0.1324
D(LM2(-4))	0.033360	0.03211	1.03881	0.3075
D(LG(-1))	0.009482	0.00739	1.28347	0.2095
D(LG(-2))	0.005317	0.00535	0.99362	0.3286
D(LG(-3))	0.007487	0.00460	1.62874	0.1142
D(LG(-4))	0.006558	0.00572	1.14678	0.2608
CONSTANT	-0.003171	0.00340	-0.93387	0.3581
R-squared	0.916319			
Adjusted R-squared	0.867265			
Durbin-Watson stat	2.031268			
F-statistic	18.67972			
Prob(F-statistic)	0.000000			

In modeling short-run dynamics, all weakly exogenous variables which are considered in the long run are entered in to the right hand side of the model by differencing. The main reason to difference this variable is due to the fact that there will be high level of correlation between current and lagged values of a variable, which will therefore result in problems of multi co-linearity.

Results from error correction model pass all diagnostic tests; serial correlation, normality and Heterosckedasticity tests .These results are also confirmed in the appendix D[15].

The coefficient of vector error correction terms interpreted as speed of adjustment to the long run model. The result suggested that, the coefficient is less than one, negative and statistically significant. The result confirms the model converges to its long run and the speed of adjustment is too slow. Only each quarter over 5% of the disequilibrium is adjusted. This is due to the slow adjustments of agricultural products to devaluation and low elasticity of export products in Ethiopia.

In general the study gives mixed results on the relationship between devaluation and output growth in the short-run and long-run. The results of short run econometric analysis confirms devaluation has no significant effect on Ethiopian output, whereas the aggregate supply channel holds in the long-run.

[15]Diagnostic test for error correction model; Normality test , hetrosckdastisity, and autocorrelation presented in the appendix part D

5.5. Impulse Response and Variance Decomposition Analysis

5.5.1. Impulse Response

The Impulse Response analysis for the above model is undertaken. All of the response is examined for 10 periods and the relevant variable comes to its long-run equilibrium back in this time period. Impulse Responses for VECM are shown in the appendix part. This study uses generalized impulse response functions and in each case the shock to each variable is one standard error shock. The impulse response function shows the increment to each variable due to one standard error shock of the other variable taking in to account all interactions between the variables. The impulse responses are eventually expected to converge to a level that is consistent with the estimated long run co-integrating relationship. The graphical relationship of impulse responses to a one period shock on the variables are represented at appendix E[16].

As shown in the appendix part, the response of real gross domestic product to shocks emanating from the real effective exchange rate stock is zero in the early periods but it becomes positive in the long run, that is devaluation has no effect in the short run, but it becomes contractionary in the long run. This is consistent with the results obtained from both the long run co-integrating analysis and the short run error correction model. In line with the regression results obtained the response of real gross domestic product to real effective exchange rate is positive in the long run.

[16] See appendix E regarding the graphical presentation of impulse response functions

5.5.2. Variance Decomposition

Variance decomposition depicts the proportion of movements in one variable that are due to errors in own shocks and to each other variables in the system. Basically these give information on how important is each variable in explaining variations in the variable in question in the system.

Table 5.10: Variance Decomposition of LRGDP

Period	S.E.	LRGDP	LREER	LM2	LG
1	0.004999	100.0000	0.000000	0.000000	0.000000
2	0.015028	97.94958	0.799370	1.028940	0.222113
3	0.027411	92.35518	3.036780	3.508719	1.099319
4	0.039498	86.07608	4.640251	7.023408	2.260261
5	0.050290	80.29998	5.481315	11.26024	2.958460
6	0.060064	75.16592	5.872865	15.48506	3.476158
7	0.069255	71.39618	6.168256	18.31896	4.116606
8	0.078036	69.33847	6.267577	19.69869	4.695263
9	0.086263	68.68589	5.901117	20.55101	4.861987
10	0.093773	68.57045	5.287759	21.43784	4.703952

The variance decomposition of real gross domestic product, which is represented in the above table, shows that in the very early periods the forecast error of this variable in question is attributed to the variable itself. The deviation explained by the real gross domestic product decreases to 68 percent in the tenth period from 100 percent in the first

period. The deviation in economic growth explained by the variations in real effective exchange rate is insignificant explaining zero in the first period and only rises to around 5.2 percent in the 10^{th} period. The variations of real gross domestic product due to variation in broad money supply it explains about 21.4 percent of the deviations in real GDP. The contribution of the government expenditure to the variation in the forecast error of real gross domestic product is of very less.

CHAPTER SIX

CONCLUSIONS AND POLICY IMPLICATIONS

6.1. Conclusions

Currency devaluation is said to stimulate aggregate demand by increasing its net export component. On the other hand, it is said to discourage aggregate supply by increasing cost of imported inputs. Thus, the ultimate impact is ambiguous on theoretical ground. A recent review article reveals that in developing countries, devaluation or real depreciation is indeed expansionary in the short run. In the long run, however, devaluation is neutral in most countries and as well contractionary for some others. Ethiopia has received no attention and the researcher try to fill this gap in this paper.

The objective of this work is to add to the existing empirical literature on the effect of devaluation on output. The study is based on quarterly time series data for the period from 1997/98 to 2009/10. The long and short run results of this study are confirmed by the help of co-integration and vector error correction models. In the long run devaluation has negative effect of output; it works through the modern approach, whereas the effect is zero in the short run. Thus, in the long run devaluation negatively affects output growth in Ethiopia.

Different authors give different argument for the negative effect of devaluation in the long run. As mentioned by Cooper (1971), Krugman and Taylor (1978) and Edwards (1986), devaluation may create contractionary effects through imported cost, real

balance, income distribution, external debt, speculative demand, trade liberalization, tax, wage indication and cost of working capital channels. Developing countries like Ethiopia depends on foreign capital and the export elasticity of their product is insensitive. Devaluation increases the cost of foreign capital and increase the cost of imported items and raw materials. Since the major imported item in Ethiopia is petroleum which significantly affect the whole economy and domestic price as well. As a result, devaluation harms real gross domestic product in the long run.

Monetary policy has a positive and significant role in affecting overall performance of Ethiopian economy. The objectives of monetary policy are price stability, promoting growth, achieve full employment, smoothing the business cycle, and prevent financial crisis and stability of interest rate and exchange rate. National Bank of Ethiopia tends to follow expansionary monetary policy since recently. Based on data from national bank of Ethiopia, narrow and broad money supply surged by 18.1% and 19.5% respectively, over the years 2004-2010. This can be compared with corresponding growth of 9.5% and 12.5% present respectively, over the period from 1993-2003. The resent development implies that there is a clear and significant shift from stringent to expansionary monetary policy in Ethiopia.

Based on the result, total government expenditure (including recurrent and capital expenditure) has a negative effect on output growth. From the forgoing disquisition, recurrent expenditure accounts large proportion of total government expenditure implying that large proportion of government expenditure goes to consumption expenditure like salaries, pension payment, defense and war expenditure especially

during war with Eretria. According to Zekarias (2003) cited from World Bank report (2001), "Ethiopia's defense expenditure increased from 3.0 percent of GDP during 1995/96-1997/98 to 13.1 percent of GDP in 1999/00. Total government expenditure increased from 24 percent of GDP in 1996/97 to 33.1 percent in 1999/00". Thus, it impeded output growth in Ethiopia.

6.2. Policy Implications

Since, there is a negative and significant long-run effects of devaluation on output, the researcher conclude that exchange rate change (or exchange rate policy, in general) may hurt the catching-up efforts of the Ethiopian economy. Thus, based on the above conclusion, the researcher forwards the following policy recommendations.

- Even though devaluation helps the growth of some sectors in the economy, the foreign exchange earnings may not be sufficient enough to cover imported materials. This is true when the supply side channel is greater than the demand side channel of devaluation. Thus, the final result is reducing the economic growth unless the government reduces imported materials and reverts to other options. So, government should use other options such as import restriction like import quota, and tariff on selected import items to improve the external sector rather than devaluation.

- The study clarify that real exchange rate variation explain a considerable part of real gross domestic product change in Ethiopia. Since the Ethiopian GDP is dominated by primary agricultural products, it is insensitive to the change in exchange rate. Thus, it

is not possible for the government to allow market forces to determine the value of Ethiopian birr. Policy intervention is needed to balance the adverse impact of exchange rate movements until the economy become well transformed from agricultural sector to industrial sector and becomes less dependent on imported raw materials. To this end, monetary policy should assume bigger role since it affects the total output positively and significantly.

- This study uses total government expenditure as a stance for fiscal policy and the discussion founds that, on average large proportion of government expenditure is goes to recurrent expenditure. It has the possibility to reduce output in the long run. Therefore, the government should reduce recurrent expenditure. And thus, to identify the likely impact of government expenditure clearly, further studies should be conducted on the effect of recurrent and capital expenditure on output separately.

References

Acar, M.(2000). Devaluation in Developing Countries: Expansionary or Contractionary?. *Journal of Economic and Social Research*, 2(1), 59-83

Agenor, P.-R. (1991). Output, devaluation and the real exchange rate in developing countries. *Weltwirtschaftliches Archiv*, 127(1), 18-41

Alemayehu Geda, Daniel Zerfu and Ndung'u, N. (2009). *Applied Time Series Econometrics*. A Practical Guide for Macroeconomic Researchers with a focus on Africa.

Bahmani-Oskooee, M. and Kutan, A.M. (2008). Are Devaluation Contractionary in the Emerging Economies of Eastern Europe. The Center for Research on International Economics and Department of Economics, The University of Wisconsin-Milwaukee Milwaukee, WI 53201

Bahmani-Oskooee, M. (1998). Are devaluations contractionary in LDCs? *Journal of Economic Development*. 23(1), 131-145

Charemza, W. & Deadman, D. (1997*). New directions in Econometric practice: General to specific modeling, Cointegration and Vector Auto regression* (2nd ed.). Cheltenham: Edward Elgar.

Connolly, M. (1983). Exchange Rates, Real Economic Activity and the Balance of Payments: Evidence from 1960s, In: E. Classen and P. Salin, (ed.) *Recent Issues in the Theory of the Flexible Exchange Rates*, North- Holland.

Cooper, R. (1971). *Currency devaluation in developing countries*. Essays in International Finance No.86, Princeton, New Jersey: Princeton University Press.

Derrese .D. (2001). The parallel foreign exchange market and macroeconomic performance in ethiopia. *African economic research*

Dickey, D. A., and Fuller, W. A. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with Unit Root, *Econometrica*, 49(4), 1057-1072

Domac, I. (1997). Are devaluations contractionary? Evidence from Turkey. *Journal of Economic Development*, *22*(2), 145-163

Edwards, S. (1986). Are devaluations contractionary?. *The Review of Economics and Statistics*, *68* (3), 501-508

El-Ramly, H. and Abdel-Haleim S.M. (2008). The Effect of Devaluation on Output in the Egyptian Economy: A vector Autoregression Analysis. *International Research Journal of Finance and Economics,* 14, 82-94

Ethiopian Economic Association, (2010). Annual report on the Ethiopian economy, Addis Ababa, Ethiopia

Fentahun B. (2011). *The impact of real effective exchange rate on economic growth of Ethiopia*. M.Sc thesis, Addis Ababa Universiy

Galebotswe.O. and Andrias.T. (2010). *Are devaluation contractionary in small import dependent economy? Evidence from Botswana*. Unpublished paper.

Gujarati ,D. (1995). *Basic Econometrics* (3rd ed.). Mc Graw-Hill: Inc.

Gylfason, T. and Risager, O. (1984). Does devaluation improve the current account? *European Economic Review*, 25(1-3), 37-64

Gylfason, T. and Schmid, M. (1983). Does devaluation cause stagflation? *The Canadian Journal of Economics*, 16(4), pp.641-654

Haile,K.(1994). *The Monetary Approach to the Balance of Payment and the Implication to Monetary Policy*. M.Sc thesis. Addis Ababa University.

http://www.ethiopiainvestor.com/index.php?view=article&catid=1%3Alatest

Johansen, S. (1988). Statistical Analysis of Cointegration Vectos. *Journal of Economic Dynamics and Contro,*. 12(2/3), 231-254

National Bank of Ethiopia, (2009). Monetary policy framework of Ethiopia

National Bank of Ethiopia (NBE), Annual Report (2010). Various Issues

National Bank of Ethiopia, (NBE) Annual Bulletin (2003/04). Various Issues

Kalyoncu, H. (2008). Currency Devaluation and Output Growth : An Empirical Evidence from OECD Countries. *Finance and Economics*, 14(14)

Kamin, S. (1988). Devaluation, external balance and macroeconomic performance: A look at the numbers. Princeton Studies in International Finance, No.62, Princeton University Press, Princeton, New Jersey

Kandil .M and Mirzaie.I. (2005). the effects of exchange rate fluctuations on output and prices: evidence from developing countries. *The Journal of Developing Areas,* 38(2), 189-219

Kibrom, T. (2008). *The source of the recent inflationary experience in Ethiopia.* M.Sc, thesis. Addis Ababa University, Ethiopia

Krugman, P. and Taylor, L. (1978). Contractionary effects of devaluation. *Journal of International Economics*, *8,* 445-456

Lutkepohl.H and Kratzig.M. (2004). *Applied Time Series Econometrics*. Cambridge University press.

Metiza, I. (2006). Devaluation and Output in Five transition Economies: A panel cointegration Approach of Poland, Hungary, Czech Republic, Slovakia and Romania, 1993-2000. *Applied Econometrics and international Development*, 6 (1), 77-86

Narayan, P.K. & Narayan, S. (2007). Is devaluation expansionary or contractionary? Empirical evidence from Fiji. *Applied Economics*, 39(20), 2589-2598

Nunnenkamp, P. & Schweickert, R. (1990). Adjustment policies and economic growth in developing countries; is devaluation contractionary? *Weltwirtschaftliches Archiv*, 126(3), 474-493

Parida, P. C. (2002). Currency devaluation, trade balance and the balance of payment in India. RBI endowment unit the numbers. Princeton Studies in International Finance, No.62

Pilbeam K. (1998), *International Finance*, Macmillan Publishing Enterprise, London

Tarawalie.A (2003). *Real exchange rate trade balance in Sierra Leone*. M.Cs thesis, Addis Ababa University

Taye, H. (1999). The Impact of Devaluation on Macroeconomic Performance: The Case of Ethiopia. *Journal of Policy Modeling*, 21(4), 481-496

Tirsit, G. (2010). *Currency devaluation and economic growth the case of Ethiopia;* M.Cs thesis, Stockholm University

Upadhyay, M. P. (1999). Output Effects of Devaluation: Evidence from Asia. *Journal of Development Studies*, 35, 89-103

Upadhyaya K. P. (1999). Currency Devaluation, Aggregate Output, and the Long Run: An Empirical Study. *Economics Letters*, 64, 197-202

_____, Mixon, D. and Bhandari, R. (2004). "Exchange Rate Adjustment and Output in Greece and Cyprus: Evidence from Panel Data", *Applied Financial Economics*, Vol. 14, pp. 1181-1185.

_____, Rainish, R. and Phelan, J. (2009). "Currency Devaluation and Aggregate Output in East Africa". *Indian Journal of Economics and Business*, Vol.

Van-Wijnbergen, S. (1986). Exchange rate management and stabilization policies in developing countries. *Journal of Development Economics*, 23, 227-247

World Bank, (2001). Ethiopian Focusing on Public Expenditure on Poverty Reduction,Vol.1, World Bank Country Office, Addis Ababa

Wondwsen. W (2011). *The impact of foreign capital inflows on economic growth, saving and investment in ethiopia.* M.Sc thesis, Addis Ababa Universiy

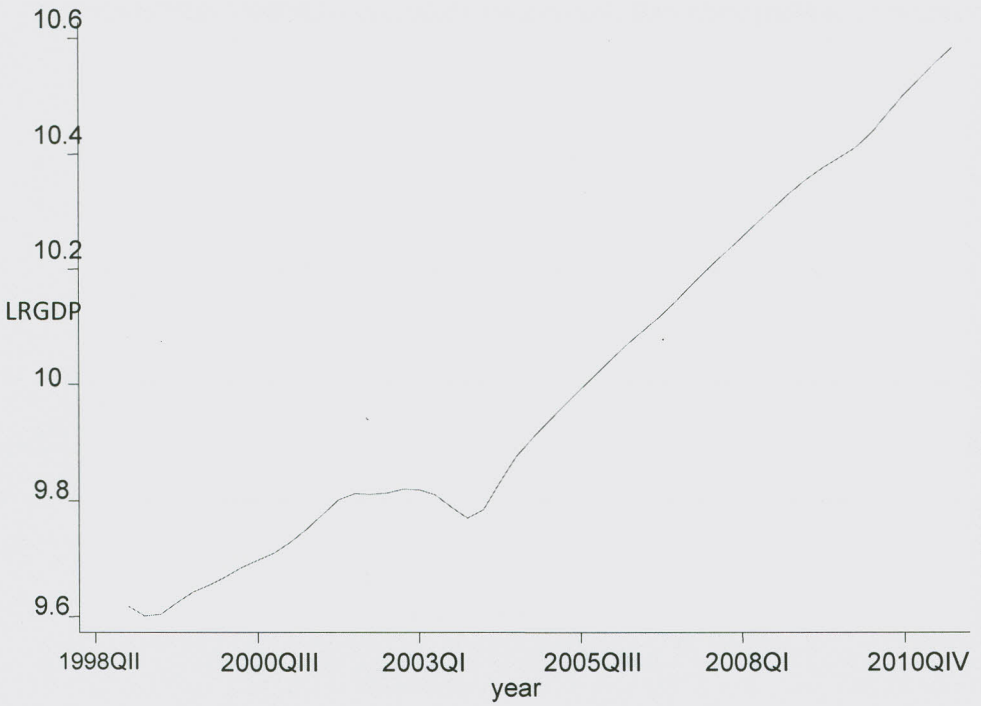
Yiheyis, Z. (2006). The Effects of Devaluation on Aggregate Output: Empirical Evidence from Africa. *International Review of Applied Economics*, 20(1), 21-45

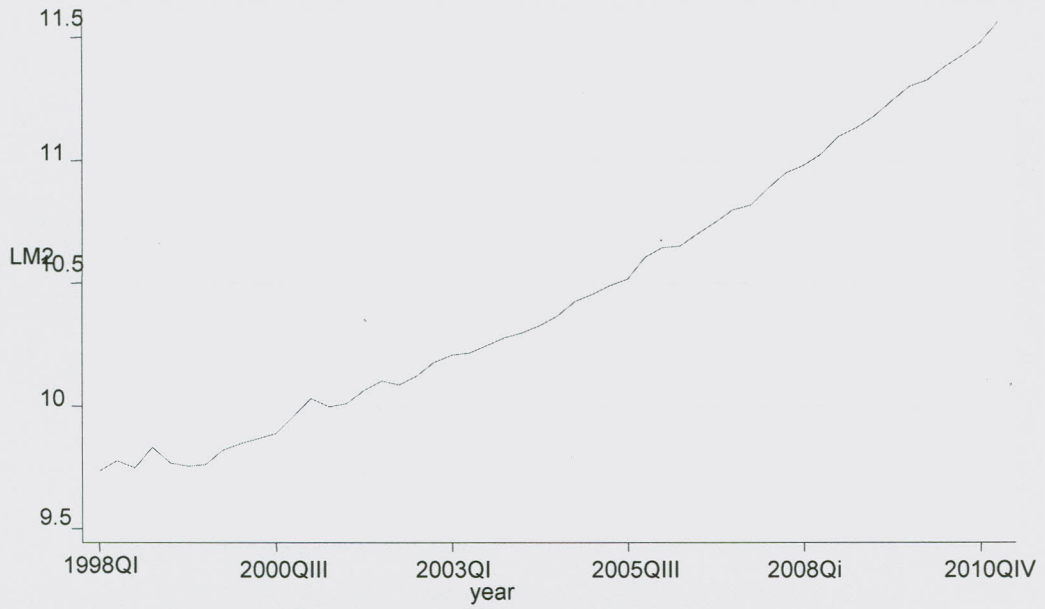
Zekarias ,M. (2003). *A dynamic monetary model of Ethiopia.* M.Sc thesis, Addis Ababa Universiy

Zerayehu. S. (2006). *How Central Bank responds to macroeconomic shocks?.* M.Sc thesis, Addis Ababa Universiy

Appendices

Appendix A: Plot of Variables at Level



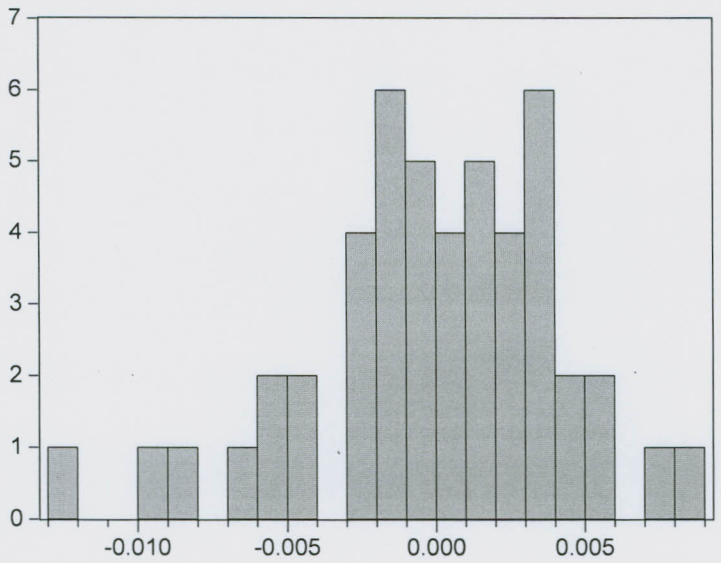



5.4
5.2
5
4.8
4.6
4.4
LREER
1998QII
2000QIII
2003QI
2005QIII
2008QI
2010QIV
year


11
10
9
8
7
LG
1998QI
2000QIII
2003QII
2005QIII
2008QI
2010QIV
year

Appendix B: Diagnostic Test of the Long-run Model

B.1) Normality Test



Series: Residuals
Sample 1999Q1 2010Q4
Observations 48

Mean	-2.48e-15
Median	0.000768
Maximum	0.008409
Minimum	-0.012550
Std. Dev.	0.004137
Skewness	-0.728996
Kurtosis	3.811024
Jarque-Bera	5.567001
Probability	0.061822

B.2) Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.621147	Prob. F(4,27)	0.6513
Obs*R-squared	4.044830	Prob. Chi-Square(4)	0.4000

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 07/22/12 Time: 08:38
Sample: 1999Q1 2010Q4
Included observations: 48
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.095396	0.246125	-0.387593	0.7014
C(2)	0.278650	0.551217	0.505518	0.6173
C(3)	-0.251128	0.488510	-0.514070	0.6114
C(4)	0.077841	0.184607	0.421661	0.6766
C(5)	-0.001481	0.015612	-0.094854	0.9251
C(6)	0.004362	0.018346	0.237760	0.8139
C(7)	0.000334	0.017838	0.018730	0.9852
C(8)	-0.004036	0.014159	-0.285021	0.7778
C(9)	-0.001888	0.039028	-0.048380	0.9618
C(10)	0.001649	0.041731	0.039513	0.9688

C(11)	-0.012329	0.038150	-0.323166	0.7491
C(12)	0.008558	0.035501	0.241060	0.8113
C(13)	-0.001218	0.003832	-0.317818	0.7531
C(14)	2.74E-05	0.003713	0.007390	0.9942
C(15)	-0.000990	0.003766	-0.263007	0.7945
C(16)	0.001352	0.004715	0.286705	0.7765
C(17)	-0.046368	0.167132	-0.277435	0.7836
RESID(-1)	0.264670	0.296033	0.894053	0.3792
RESID(-2)	-0.251654	0.278304	-0.904242	0.3739
RESID(-3)	0.032104	0.291501	0.110132	0.9131
RESID(-4)	-0.248751	0.281813	-0.882683	0.3852

R-squared	0.084267	Mean dependent var	-2.48E-15
Adjusted R-squared	-0.594053	S.D. dependent var	0.004137
S.E. of regression	0.005223	Akaike info criterion	-7.371876
Sum squared resid	0.000737	Schwarz criterion	-6.553225
Log likelihood	197.9250	Hannan-Quinn criter.	-7.062507
F-statistic	0.124229	Durbin-Watson stat	2.018789
Prob(F-statistic)	0.999994		

B.3) Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.799541	Prob. F(16,31)	0.6755
Obs*R-squared	14.02170	Prob. Chi-Square(16)	0.5971
Scaled explained SS	8.220084	Prob. Chi-Square(16)	0.9420

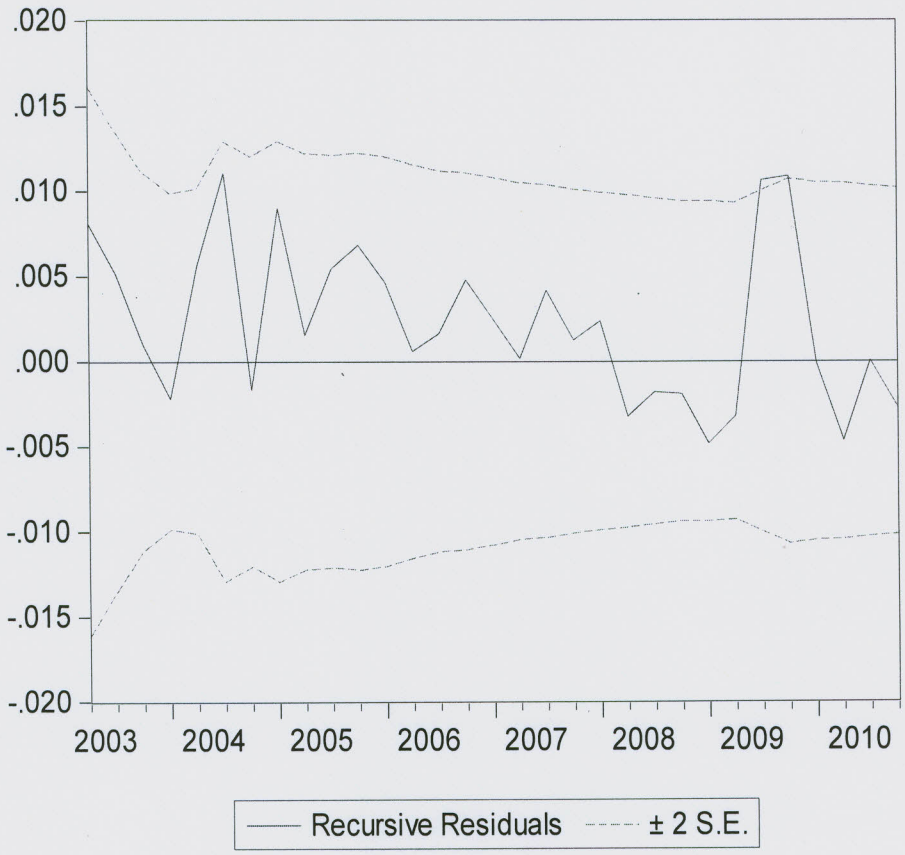
Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/22/12 Time: 08:42
Sample: 1999Q1 2010Q4
Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000839	0.000819	1.024362	0.3136
LRGDP(-1)	-0.000952	0.000794	-1.198388	0.2398
LRGDP(-2)	0.001065	0.001848	0.576188	0.5686
LRGDP(-3)	-0.000407	0.001829	-0.222274	0.8256
LRGDP(-4)	0.000150	0.000794	0.189036	0.8513
LREER(-1)	-5.47E-05	8.46E-05	-0.646089	0.5230
LREER(-2)	6.29E-05	9.35E-05	0.672001	0.5066
LREER(-3)	-3.48E-05	9.95E-05	-0.350256	0.7285
LREER(-4)	4.57E-06	7.69E-05	0.059410	0.9530
LM2(-1)	0.000109	0.000215	0.507525	0.6154
LM2(-2)	0.000100	0.000228	0.439280	0.6635
LM2(-3)	-0.000184	0.000209	-0.878904	0.3862
LM2(-4)	2.72E-05	0.000192	0.141456	0.8884
LG(-1)	2.99E-05	2.11E-05	1.414825	0.1671
LG(-2)	-2.05E-05	1.90E-05	-1.075700	0.2904
LG(-3)	3.85E-06	1.95E-05	0.197867	0.8444
LG(-4)	6.05E-06	2.52E-05	0.240392	0.8116

R-squared	0.292119	Mean dependent var	1.68E-05
Adjusted R-squared	-0.073239	S.D. dependent var	2.84E-05

S.E. of regression	2.94E-05	Akaike info criterion	-17.75916
Sum squared resid	2.68E-08	Schwarz criterion	-17.09645
Log likelihood	443.2199	Hannan-Quinn criter.	-17.50872
F-statistic	0.799541		
Prob(F-statistic)	0.675514		

Appendix C: Model Stability Test



Appendix D: Diagnostic Test of the Short run Model

D.1: Normality Test

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 07/22/12 Time: 11:45
Sample: 1998Q1 2010Q4
Included observations: 47

Component	Skewness	Chi-sq	df	Prob.
1	-0.456850	1.634907	1	0.2010
2	0.015392	0.001856	1	0.9656
3	-0.025744	0.005192	1	0.9426
4	0.103393	0.083739	1	0.7723
Joint		1.725693	4	0.7860

D.2: Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.099761	Prob. F(4,25)	0.9815
Obs*R-squared	0.738416	Prob. Chi-Square(4)	0.9465

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 07/22/12 Time: 08:48
Sample: 1999Q2 2010Q4
Included observations: 47
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.001090	0.027687	-0.039365	0.9689
C(2)	0.045066	0.351906	0.128062	0.8991
C(3)	-0.074632	0.603769	-0.123611	0.9026
C(4)	0.090566	0.486630	0.186109	0.8539
C(5)	-0.038347	0.238052	-0.161086	0.8733
C(6)	-0.000645	0.017946	-0.035948	0.9716
C(7)	0.000524	0.015648	0.033484	0.9736
C(8)	-0.000475	0.016453	-0.028895	0.9772
C(9)	0.001294	0.018593	0.069575	0.9451
C(10)	0.002870	0.040081	0.071614	0.9435
C(11)	0.001429	0.035629	0.040110	0.9683
C(12)	-0.001680	0.035824	-0.046885	0.9630
C(13)	-0.000386	0.037767	-0.010219	0.9919
C(14)	-0.000291	0.009017	-0.032305	0.9745
C(15)	-0.000169	0.006495	-0.025960	0.9795
C(16)	-0.000338	0.005397	-0.062648	0.9505
C(17)	-0.000296	0.006610	-0.044801	0.9646
C(18)	-0.000529	0.003995	-0.132445	0.8957

RESID(-1)	-0.069091	0.415572	-0.166255	0.8693
RESID(-2)	-0.036938	0.350904	-0.105267	0.9170
RESID(-3)	0.018924	0.362586	0.052191	0.9588
RESID(-4)	-0.142878	0.334503	-0.427135	0.6729

R-squared	0.015711	Mean dependent var	-1.49E-17
Adjusted R-squared	-0.811092	S.D. dependent var	0.003969
S.E. of regression	0.005341	Akaike info criterion	-7.321860
Sum squared resid	0.000713	Schwarz criterion	-6.455834
Log likelihood	194.0637	Hannan-Quinn criter.	-6.995968
F-statistic	0.019002	Durbin-Watson stat	1.983825
Prob(F-statistic)	1.000000		

D.3: Heteroskedasticity Test

Heteroskedasticity Test: ARCH

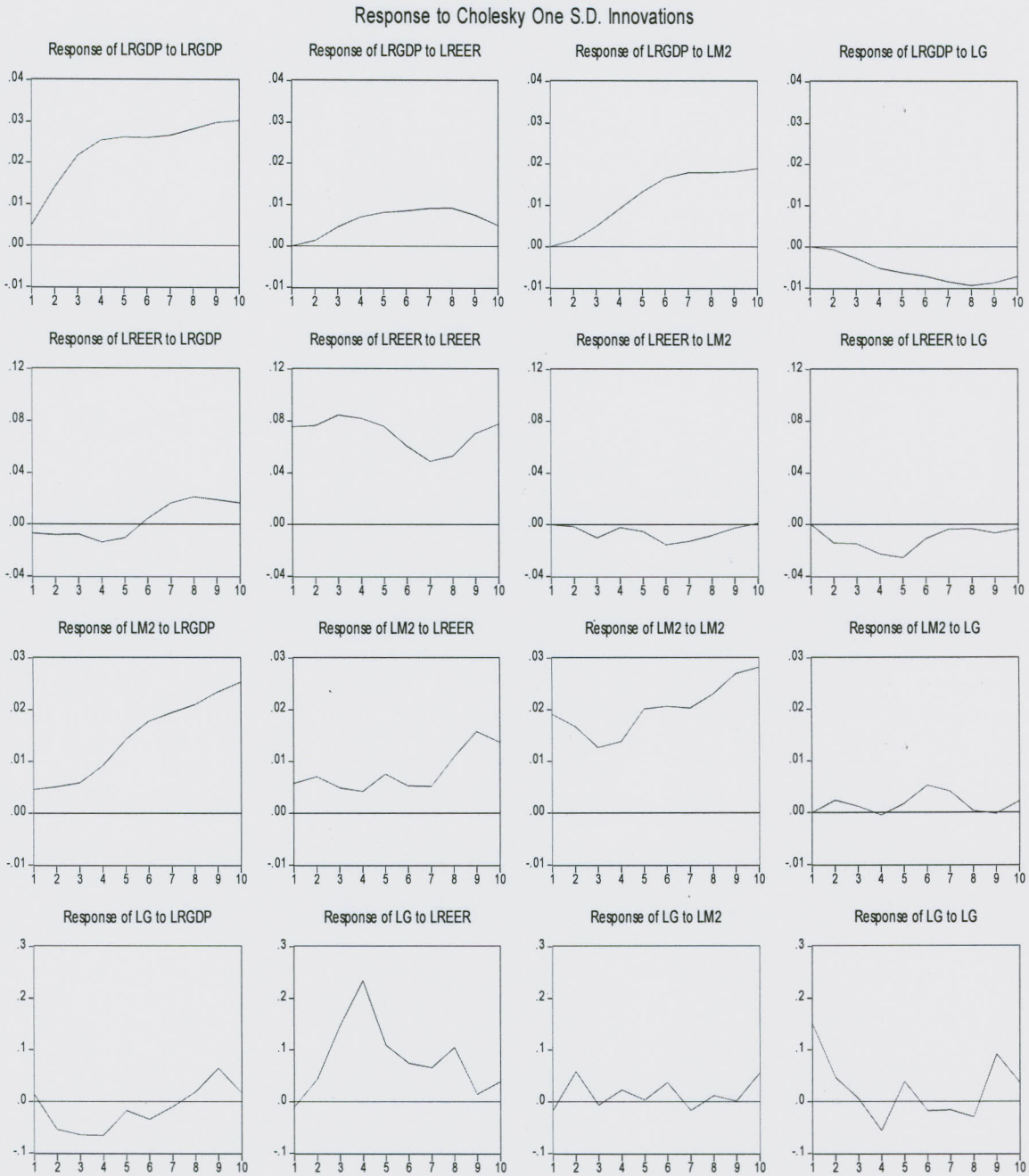
F-statistic	2.472390	Prob. F(4,38)	0.0608
Obs*R-squared	8.879829	Prob. Chi-Square(4)	0.0642

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/22/12 Time: 08:50
Sample (adjusted): 2000Q2 2010Q4
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.37E-05	5.80E-06	2.355781	0.0237
RESID^2(-1)	-0.018610	0.160985	-0.115604	0.9086
RESID^2(-2)	0.444178	0.159103	2.791764	0.0082
RESID^2(-3)	-0.145681	0.158556	-0.918802	0.3640
RESID^2(-4)	-0.099350	0.160136	-0.620411	0.5387

R-squared	0.206508	Mean dependent var	1.67E-05
Adjusted R-squared	0.122982	S.D. dependent var	2.74E-05
S.E. of regression	2.57E-05	Akaike info criterion	-18.19123
Sum squared resid	2.51E-08	Schwarz criterion	-17.98644
Log likelihood	396.1115	Hannan-Quinn criter.	-18.11571
F-statistic	2.472390	Durbin-Watson stat	1.933470
Prob(F-statistic)	0.060757		

Appendix E: Impulse Responses Function



Appendix F: Variance Decomposition

Avarice Decomposition of LRGDP: Period	S.E.	LRGDP	LREER	LM2	LG
1	0.004999	100.0000	0.000000	0.000000	0.000000
2	0.015028	97.94958	0.799370	1.028940	0.222113
3	0.027411	92.35518	3.036780	3.508719	1.099319
4	0.039498	86.07608	4.640251	7.023408	2.260261
5	0.050290	80.29998	5.481315	11.26024	2.958460
6	0.060064	75.16592	5.872865	15.48506	3.476158
7	0.069255	71.39618	6.168256	18.31896	4.116606
8	0.078036	69.33847	6.267577	19.69869	4.695263
9	0.086263	68.68589	5.901117	20.55101	4.861987
10	0.093773	68.57045	5.287759	21.43784	4.703952

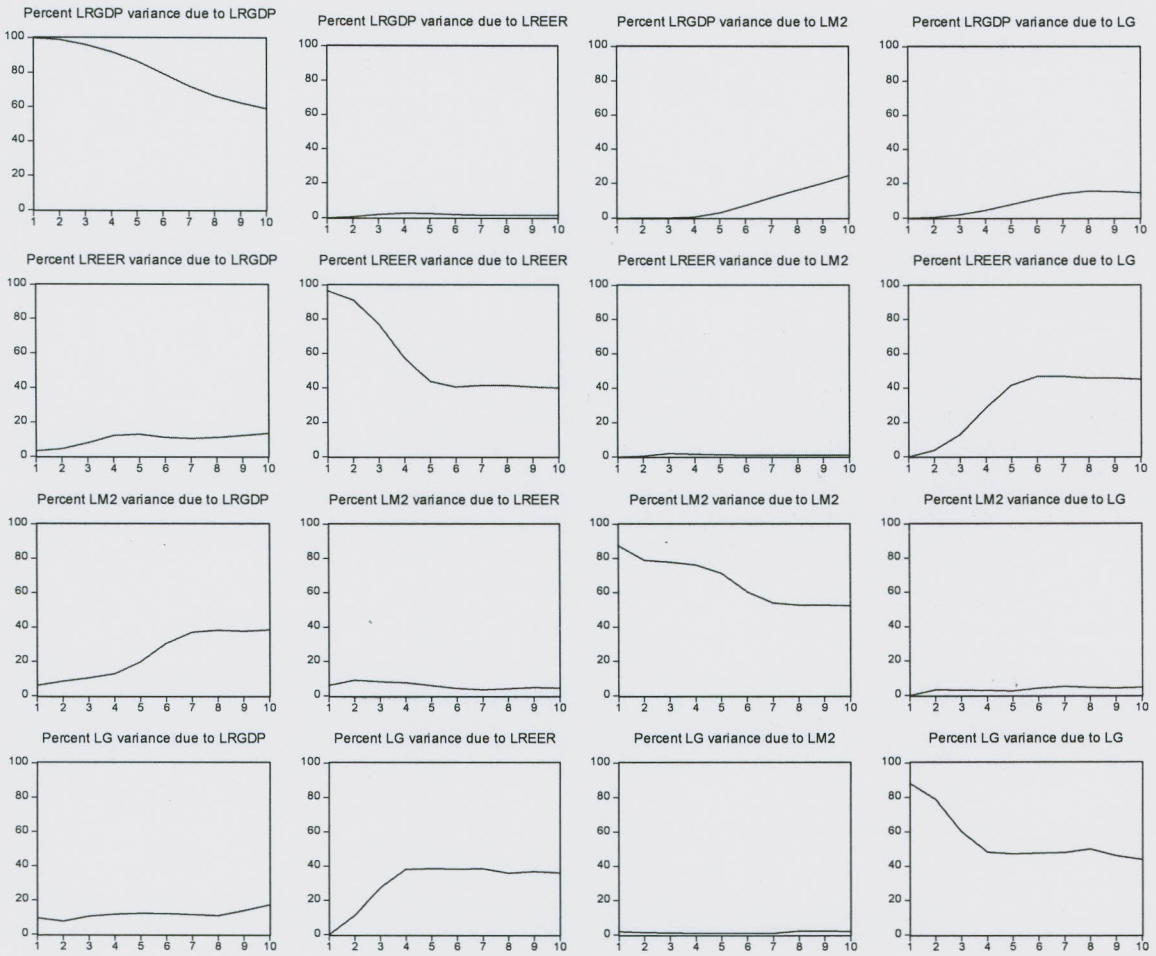
Variance Decomposition of LREER: Period	S.E.	LRGDP	LREER	LM2	LG
1	0.075904	0.885336	99.11466	0.000000	0.000000
2	0.109077	0.969901	97.22645	0.026536	1.777108
3	0.139506	0.899453	96.27303	0.573334	2.254183
4	0.164118	1.372735	94.60115	0.436075	3.590036
5	0.183027	1.435641	93.24513	0.436545	4.882681
6	0.193874	1.332599	92.94287	1.052996	4.671536
7	0.201166	1.928110	92.29858	1.402452	4.370862
8	0.209374	2.825123	91.65331	1.461410	4.060153
9	0.221791	3.255235	91.72132	1.317536	3.705912
10	0.235629	3.387699	92.13886	1.169192	3.304249

Variance Decomposition of LM2: Period	S.E.	LRGDP	LREER	LM2	LG
1	0.020444	4.996838	8.030476	86.97269	0.000000
2	0.027913	6.034094	10.68516	82.55268	0.728066
3	0.031615	8.170068	10.73275	80.39040	0.706778
4	0.035974	12.88951	9.644944	76.89766	0.567876
5	0.044294	18.86961	9.258822	71.35435	0.517216
6	0.052523	24.87827	7.580900	66.16476	1.376066
7	0.059937	29.64717	6.560522	62.27182	1.520487
8	0.068415	32.17110	7.531481	59.12837	1.169054
9	0.078782	33.10399	9.692119	56.32168	0.882215
10	0.088542	34.43484	10.07336	54.73540	0.756396

Variance Decomposition of LG: Period	S.E.	LRGDP	LREER	LM2	LG
1	0.152614	0.802803	0.444968	1.191934	97.56029
2	0.183083	9.218963	5.910900	10.71561	74.15452

3	0.243520	12.10697	39.81030	6.120005	41.96272
4	0.349574	9.350872	64.41592	3.380250	22.85295
5	0.368812	8.620794	66.71636	3.045644	21.61720
6	0.379879	8.905177	66.67384	3.832063	20.58892
7	0.386240	8.676279	67.34400	3.888596	20.09113
8	0.401842	8.238429	68.97950	3.674234	19.10783
9	0.417355	10.02367	64.06604	3.407311	22.50297
10	0.424637	9.832212	62.70592	4.982697	22.47917

Variance Decomposition



Appendix J: Estimation results of Error Correction Model

Dependent Variable: D(LRGDP)
Method: Least Squares
Date: 07/15/12 Time: 14:14
Sample (adjusted): 1999Q2 2010Q4
Included observations: 47 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.051403	0.023769	-2.162655	0.0390
C(2)	1.813536	0.162797	11.13986	0.0000
C(3)	-1.664093	0.319398	-5.210092	0.0000
C(4)	0.944422	0.307467	3.071624	0.0046
C(5)	-0.235922	0.169169	-1.394595	0.1737
C(6)	-0.003606	0.015785	-0.228454	0.8209
C(7)	-0.007052	0.014605	-0.482814	0.6329
C(8)	-0.022531	0.015122	-1.489958	0.1470
C(9)	0.016301	0.015747	1.035134	0.3092
C(10)	0.037495	0.036848	1.017573	0.3173
C(11)	0.018880	0.032693	0.577481	0.5681
C(12)	0.049870	0.032211	1.548216	0.1324
C(13)	0.033360	0.032114	1.038806	0.3075
C(14)	0.009482	0.007388	1.283466	0.2095
C(15)	0.005317	0.005351	0.993621	0.3286
C(16)	0.007487	0.004597	1.628739	0.1142
C(17)	0.006558	0.005718	1.146779	0.2608
C(18)	-0.003171	0.003395	-0.933874	0.3581

R-squared	0.916319	Mean dependent var	0.020130
Adjusted R-squared	0.867265	S.D. dependent var	0.013720
S.E. of regression	0.004999	Akaike info criterion	-7.476237
Sum squared resid	0.000725	Schwarz criterion	-6.767670
Log likelihood	193.6916	Hannan-Quinn criter.	-7.209599
F-statistic	18.67972	Durbin-Watson stat	2.031268
Prob(F-statistic)	0.000000		