



**ADDIS ABABA UNIVERSITY**  
**COLLEGE OF BUSINESS AND ECONOMICS**

**EXCHANGE RATE RISK EFFECT ON INTERNATIONAL TRADE: THE  
CASE OF ETHIOPIA**

**BY MAHLET ANLEY MENGESHA**

**JUNE, 2019**

**ADDIS ABABA, ETHIOPIA**

**ADDIS ABABA UNIVERSITY**  
**COLLEGE OF BUSINESS AND ECONOMICS**

**EXCHANGE RATE RISK EFFECT ON INTERNATIONAL TRADE: THE  
CASE OF ETHIOPIA**

**BY MAHLET ANLEY MENGESHA**

**A Thesis Submitted to the College of Business and Economics Addis Ababa  
University, in Partial Fulfillment of the Requirements for the Degree of  
Masters of Business Administration- Finance.**

**JUNE, 2019**

**ADDIS ABABA, ETHIOPIA**

**Addis Ababa University**  
**College of Business and Economics**

This is to certify that the paper prepared by Mahlet Anley, entitled: Exchange Rate Risk Effect on International Trade: The Case of Ethiopia, and submitted in partial fulfillment of the requirement for the degree of Master of Business Administration- Finance complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

Signed by the examining Committee:

Advisor: Dr. Alem Hagos Signature \_\_\_\_\_ Date \_\_\_\_\_

Examiner: \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

Examiner: \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

## **DECLARATION**

I, Mahlet Anley, declare that this thesis is my own work and it has never been submitted for any award in any form for any other institution. I have duly acknowledged the works of others which have been referenced.

Mahlet Anley

GSR/0838/10

## **ACKNOWLEDGMENT**

Praise be to The Lord.

I would like to express my deepest gratitude towards my advisor Dr. Alem Hagos, for his most valuable support and constructive advice throughout the completion of this study.

My parents, family, and friends thank you for being by my side and extending a helping hand whenever I needed one.

I finally would like to thank Addis Ababa University staff members for their time and valuable comments, and National Bank of Ethiopia staff members for data provision.

## Table of Contents

DECLARATION.....	i
ACKNOWLEDGMENT.....	ii
LIST OF TABLES .....	vi
LIST OF FIGURES .....	vii
ACRONYMS .....	viii
ABSTRACT.....	x
CHAPTER ONE.....	1
1. Introduction.....	1
1.1 Background of the Study.....	1
1.2 Statement of the Problem .....	2
1.3 Objective of the Study.....	4
1.4 Research Question.....	4
1.5 Significance of the Study .....	5
1.6 Scope of the Study.....	5
1.7 Organization of the Paper.....	5
CHAPTER TWO .....	7
2. Theoretical and Empirical Literature Review.....	7
2.1 Introduction .....	7
2.1.1 Exchange Rate Risk/ Volatility .....	8
2.1.2. International Trade .....	9
2.1.3 Exchange Rate Risk and International Trade .....	9
2.1.4 Exchange Rate Regimes in Ethiopia .....	10
2.1.5 Devaluation in Ethiopia.....	11
2.1.6 The Trend of Foreign Trade in Ethiopia and Balance of Payment.....	12
2.2 Theoretical Literature Review.....	12
2.2.1 The Elasticity Approach.....	12
2.2.2 The Absorption Approach .....	15
2.2.3 The Monetary Approach.....	16
2.3 The Four Major Theories in the Forex Market .....	16
2.3.1 Balance of Payments .....	16

2.3.2 Interest Rate Parity: .....	17
2.3.3 International Fisher Effect (IFE): .....	18
2.3.4 Purchasing Power Parity (PPP): .....	19
2.4 Empirical Literature Review .....	20
2.5 Research Gap.....	30
2.6 Conceptual Framework .....	30
CHAPTER THREE .....	32
3 Research Methodology .....	32
3.1 Research Design.....	32
3.2. Data Source and Collection Methods.....	32
3.3. Definition of Basic Variables.....	32
3.3.1 Trade Openness .....	33
3.3.2 Exchange Rate Volatility Measurement.....	34
3.3.3 Gross Domestic Product (GDP) .....	34
3.3.4 Real Effective Exchange Rate (REER) .....	35
3.3.5 Terms of Trade .....	35
3.3.6 Inflation .....	36
3.4 Model Specification .....	36
3.5 Methods of Estimation Procedure and Data Analysis.....	37
3.5.1 Test of Stationarity .....	38
3.5.2 Bound Test and ARDL Procedures .....	38
3.5.3 Long Run and Short Run model Estimation.....	39
3.5.4 Post Diagnostic Tests.....	40
CHAPTER FOUR.....	41
4. Data Analysis and Discussions .....	41
4.1 Descriptive Analysis for the Variables.....	41
4.1.1 Trend Analysis of the Variables .....	42
4.2 Econometric Data Analysis.....	46
4.2.1 Test of Stationarity .....	46
4.2.2 Determination of the Lag Length .....	47
4.2.3 Bound Test for Co-Integration .....	48

4.2.4 Long Run Relationship Analysis .....	49
4.2.5 Short Run Analysis .....	52
4.3 Post Analysis Diagnostics Tests.....	53
4.3.1 Test for Serial Correlation .....	53
4.3.2 Test for Heteroscedasticity .....	54
4.3.3 Test for Normality .....	55
4.3.4 Test for Model Stability.....	55
CHAPTER FIVE .....	57
5 Summary, Conclusion and Recommendations .....	57
5.1 Summary of Findings .....	57
5.2 Conclusion.....	57
5.3 Recommendations .....	58
Reference .....	59
Appendix.....	64

## LIST OF TABLES

Table 4.1: Statistical summary of variables .....	41
Table 4.2: Export of few selected commodities in millions of dollars .....	43
Table 4.3: Import of few selected commodities in millions of dollars .....	44
Table 4.4: ADF and PP at level and at First difference .....	47
Table 4.5: Lag length selection.....	48
Table 4.6: Bound Test Results .....	49
Table 4.7: Long run analysis results .....	49
Table 4.8: Short run analysis results .....	52

## LIST OF FIGURES

Figure 2.1 Conceptual Framework .....	31
Figure 4.1: REER movement.....	42
Figure 4.2: Import and Export of Ethiopia.....	45
Figure 4.3: Gross Domestic Product of Ethiopia.....	46
Figure 4.4: Result of normality test .....	55
Figure 4.5: Result of stability test.....	56

## ACRONYMS

ADF	Augmented Dickey Fuller
AIC	Akaike Information Criterion
ARCH	Autoregressive Conditional Heteroscedasticity
ARDL	Autoregressive Distributed lag
CUSUM	Cumulative Sum
CUSUMSQ	Cumulative Sum of Squares
DF	Dickey Fuller
ECM	Error Correction Method
ECT	Error Correction Term
ETB	Ethiopian Birr
ERCA	Ethiopian Revenues and Customs Authority
FPE	Final Prediction Error
GARCH	Generalized Autoregressive Conditional Heteroscedasticity
GDP	Gross Domestic Product
HQIC	Hannan-Quinn Information Criteria
IFE	International Fisher Effect
IMF	International Monetary Fund
LR	Likelihood Ratio test statistic
NBE	National Bank of Ethiopia
PP	Philips Perron
PPP	Purchasing Power Parity

REER	Real Effective Exchange Rate
TOP	Trade Openness
TOT	Terms of Trade
UK	United Kingdom
USA	United States of America
USD	United States Dollar
VOL	Exchange rate volatility
WB	World Bank

## **ABSTRACT**

*This study investigates the effect of foreign exchange rate risk on international trade performance of Ethiopia. It has used Trade Openness as a measure of international trade performance and Standard Deviation of the Real Effective Exchange Rate as a proxy for exchange rate volatility. The study applied Autoregressive Distributive Lag (ARDL) model to investigate the long run and short run relationship between exchange rate risk and international trade performance. To conduct the regression analysis, Gross Domestic Product (GDP), Real Effective Exchange Rate (REER), Terms of Trade (TOT) were controlled. The research relied on secondary data obtained from the National Bank of Ethiopia. The data series covered a period of sixteen years, 2002/03-2017/18. The analysis result indicates that exchange rate risk negatively and significantly affects the international trade performance of Ethiopia. The findings suggest that in addition to the monetary policy interventions, more emphasis should be put on the quality and diversification of tradable commodities.*

*Key words: Exchange Rate Volatility, ARDL, International Trade*

# CHAPTER ONE

## 1. Introduction

### 1.1 Background of the Study

African countries are waking up from the quagmires of poverty and destitution which have shackled the continent for years. Recent performance of the economies of Sub Saharan African countries is one of progress which reflects the implementation of better economic policies and structural reforms Biruk (2012). Foreign exchange rate is one of the most important means through which a country's relative level of economic growth is determined. The exchange rate is a rate at which one country's currency is converted to another. A country's foreign exchange rate provides a new window to its economic stability.

The period of 1970s marked the shift in economic thinking from import substitution to export promotion strategy, because it was the time when many developing countries which had been following the former strategy, experienced slower growth and rapid inflation Palley, (2002). According to Kebede, (2011), Export- led growth has been given special attention in many countries. This is so because exports generate scarce foreign exchange reserves that are necessary to finance essential imports required for domestic production and capital formation. The increase in export earning can also improve the balance of payment of a country. Moreover, the re-investment of proceeds from export could play a prominent role in creating employment opportunities for those unemployed Jordaan and Eita, (2007). Giles and Williams, (1999) also added that an expansion in exports may promote specialization in the production of export products, which in turn may boost the productivity level of the export sector accompanied with reallocation of resources away from the relatively less productive nontrade sector to the this more productive tradable sector. Then, the improvement in productivity may lead to output growth.

The relationship between a country's exchange rate, export earnings and economic growth is a crucial issue from both descriptive and policy perspectives. As Edwards (1994) puts it "it is not an overstatement to say that exchange rate behavior occupies a central role in policy evaluation

and design”. A country’s exchange rate is an important determinant of the growth of its cross-border trading and export earnings and it serves as a measure of its international competitiveness Bah and Amusa, (2003).

The exchange rate plays a crucial role in guiding the broad allocation of production and spending in the domestic economy between foreign and domestic goods. The exchange rate’s level, relative to an equilibrium exchange rate level, and its stability has been shown to importantly influence export earnings, growth, consumption, resource allocation, employment and private investments Aron et al., (1997). Because of this important role the exchange rate plays in the economy; emerging economies, in particular, are encouraged to conduct their policies so as to get this macroeconomic relative right. The right exchange rate is one that does not stray too far from its equilibrium value Otieno & Mudaki, (2011).

The proceeds from international trade are basically paid in any of the hard currencies and they are usually exchanged to the local currency in order to facilitate and meet local obligations. The hard currencies can either be sold to a banker or foreign exchange dealer. Exchange from a hard currency to a local currency can lead either to exchange loss or gain. Realization of gains or losses depends on the depreciation or the appreciation of the local currency against respective hard currencies relative to the date of the transaction that gave rise to earning of the hard currencies Matsuyama et al., (1993).

## **1.2 Statement of the Problem**

The exchange rate market is an area of critical interest for international business actors. According to Jean and Thepthida, (2004), Exchange rate determination has been the “holy grail” of international finance and macroeconomics ever since the collapse of the Bretton Woods regime in 1971 and the ensuing period of high exchange rate volatility. Exchange rate volatility is mainly a concern for firms that are linked to international trade and therefore exposed to currency risk. Thus, exchange rate volatility is an important factor in explaining the worldwide trade pattern. The exchange rate creates risk in macroeconomic policy formulation, investment decisions and international trade flows.

Ethiopia is basically an agrarian economy with great untapped potentials and multiple challenges. Although the country is endowed with a great potential for rapid agricultural development and transformation with vast fertile land and having the largest cattle population in Africa, the multiple challenges the country has in inefficient international trading and among others have been the major hindrances to exploit the resources Kebede (2011).

Exchange rate volatility is normally considered as a barrier to trade in Ethiopia especially for agricultural commodities like tea, coffee and horticulture because investment decisions are made way before production and consumption decisions. Volatility highly affects exporters of agricultural products because of their limited ability to adjust to changes in exchange rates and export prices. This in turn becomes a barrier in achieving the required success in the export sector. Amezenech, (2018).

The Ethiopian government has been devaluing the currency for about two decades, which was expected to improve the competitiveness of the country and substitute some of the imported commodities by switching expenditure from expensive imported goods to relatively domestic products, which would improve the foreign currency reserve of the country and set up a good ground for domestic investment. Nonetheless, foreign currency has been a serious problem of the country, where investors have been insisted to wait for more than two months to get a foreign currency. Even in some years the government was unable to import some necessity goods like medicaments Abule, (2012).

Although the focus of the economic reform program has been to make export as an engine of growth, it does not seem that the government's attempt has brought the required results. Moreover, even if the government adopts continuous devaluation of currency for the last two decades, the evils of market imperfection such as negative terms of trade, serious foreign currency shortage, and deterioration terms of trade are still persistent figures of the economic report of the country Abule (2012).

The relationship between exchange rate uncertainty and exports performance has been investigated in several researches but no consistent results have been up to now found. The subject on how the exchange rate volatility impacts trade has been investigated and the results have varied widely. Some studies have found a negative interaction between currency risk and exports and others have found that higher risk associated with ups and downs exchange rate'

movements can lead to great opportunity increasing exports performance. Despite the many studies on this subject and the different estimation techniques used, analytical gaps remain, especially methodological ones, Abuka, (2014).

Although numerous researches have been conducted in the area of exchange rate volatility and its impact on international trade, Africa in general and Ethiopia in have not seen much research on the subject. Therefore, this research attempts to investigate the impact of exchange rate risk on international trade performance of Ethiopia

### **1.3 Objective of the Study**

The General objective of the research is to investigate the impact of foreign exchange risk on International Trade performance of Ethiopia.

The specific objectives of the research are:

1. To investigate the relationship between exchange rate volatility and international trade flows of Ethiopia
2. To estimate the magnitude of impact foreign exchange rate volatility has on Trade Openness (TOP) as a measure of international trade performance
3. To empirically estimate the short run and long run relationship between international trade and Real Effective Exchange Rate (REER), Gross Domestic Product (GDP), Terms of Trade (TOT) and Inflation.

### **1.4 Research Question**

What is the impact of exchange rate risk on international trade performance of Ethiopia?

#### **Hypothesis**

- Ethiopian International Trade performance is negatively related with Foreign Exchange Risk.
- There exists long run and short run relationships between international trade flows and exchange rate volatility, real effective exchange rate, gross domestic product, terms of trade and inflation.

## **1.5 Significance of the Study**

The exchange rate plays an important role in a country's trade performance. Whether determined by exogenous shocks or by policy, the relative valuations of currencies and their volatility often have important repercussions on international trade, the balance of payments and overall economic performance.

Recent discussions on persistent trade imbalances and on the resurgence of non-traditional trade restrictive measures have led to a renewed interest in better understanding the effect of exchange rates on international trade. In spite of the increasing number of studies on the topic, the actual effect of exchange rates on international trade is still an open and controversial question. The theoretical literature on the issue provides little guidance as the presumption that exchange rates directly affect trade depends on a number of specific assumptions which do not hold in all cases.

This research has tried to make a customized analysis of the relationship between international trade and exchange rate risk in the case of Ethiopia.

## **1.6 Scope of the Study**

The research covers a period of 16 years from the year 2002/03 to 2017/18, Although the initial intention of the researcher was to cover the managed floating exchange rate regime of Ethiopia, that is 1991/92-2017/18, adequate data could not be obtained to carry out the econometric analysis.

The study relies on secondary data obtained from National Bank of Ethiopia, Ethiopian Revenue and Customs Authority, World Bank reports and International Monetary Fund reports. The data is presented in a quarterly manner so as to obtain 64 observations for every variable. Based on the information gathered, descriptive and empirical analysis has been conducted. The study is limited to the case of Ethiopia, due to this the policies recommended at the end of the paper might not fit other economies.

## **1.7 Organization of the Paper**

This paper has five sections. The first section discusses the statement of the problem, the general and specific objectives, and the significance of this study. Adequate background information on the topic and the scope of the study has also been included. The second section, the literature

review, assesses theoretical and empirical evidences in relation with the impact of foreign exchange rate risk on international trade and provides an overview of the Ethiopian experience. Section three focuses on the data management system and estimation methods applied. Section four provides the data analysis results. Finally, sections five summarizes the study and concludes by providing recommendations based on the research findings.

# CHAPTER TWO

## 2. Theoretical and Empirical Literature Review

### 2.1 Introduction

Economic development is one of the most essential prerequisites for a nation's survival. This prerequisite decides on the fates, positions and capacity of countries to endure manmade and natural hazards. Hence, Countries aim towards achieving the highest level of development. Economic development includes maintaining or achieving full employment, higher productivity level, low level of inflation, income equality, avoidance of Balance of payment deficit and many more. These can be generalized in to Internal and external balance. As both the balances are the paths for economic development, countries engage themselves in different economic measures and policies to attain the preset goal. Economic development mostly is the concerning issue for least developed countries because they are the ones struggling to feed their own people Acar, (2000).

According to Stambuli, (2006), the balance of payment of less developed countries has shown high deterioration due to overvalued currencies along with other economic inefficiencies. After the 1970's and 1980's, many countries, especially the third world countries, have taken the devaluation of their currency, that is, the depreciation of their own currency in terms of foreign currencies as a central growth issue. These currency changes can have an expansionary or contractionary effect on economic growth. Many development organizations like International Monetary Fund (IMF) support the idea of devaluation of currency as one means of economic growth in addition to the financial aid and loans they arrange to their member countries for the development of domestic firms. It is expected to increase competitiveness of firms and increase the production of domestic products and output. However, some researchers focusing on developing countries Krugman and Taylor, (1978) shed light on the negative effects of devaluation on output.

Despite ambiguous results from empirical studies devaluation of currency has continued to be used as a growth strategy by many developing countries. Ethiopia, which is one of the sub-Saharan countries, is listed as the least developed countries in the world. The Ethiopian Birr (ETB), since the days the country has become open to international trade has been declining

continuously. Among many, the main reasons for these persistent devaluations were to improve performance in international trade and fasten economic development Tamirayehu, (2015).

Although the state of exchange rate market matters, it's degree considerably varies from country to country and from sector to sector. Agricultural products are relatively homogenous, and typically less storable than the exports in other sectors making them far more irresponsive to exchange rate changes than trade of manufactured products. The Ethiopian export is highly dominated by primary commodities, for primary commodities and processed exports with low in-country value added products, which forces the country into bring a price taker in the international market Tamirayehu, (2015).

Empirical studies suggest that the link between exchange rate uncertainty and trade performance varies depending on risk-averse, the absence of hedging instruments, the specialization and the degree of competitiveness. To reconcile the mixed results of prior researches, using meta-regression analysis, Coric and Pugh, (2010) provide evidence that the effect of exchange volatility on trade is likely to be adverse when measured in real rather than nominal term and when less developed rather than developing countries are considered.

### **2.1.1 Exchange Rate Risk/ Volatility**

Exchange rate volatility is defined as the risk associated with unexpected movements in the exchange rate. Higher exchange-rate volatility leads to higher cost for risk-averse traders and to less foreign trade. This is because the exchange rate is agreed on at the time of the trade contract, but payment is not made until the future delivery actually takes place. If changes in exchange rates become unpredictable, this creates uncertainty about the profits to be made and, hence, reduces the benefits of international trade Hook and Boon, (2000).

Estimating equilibrium exchange rates and the degree of exchange rate fluctuations remains one of the most challenging empirical problems in open economy macroeconomics (Williamson, 1994). According to Chang and David, (2005) the fundamental difficulty is that the equilibrium value of the exchange rate is not observable. While exchange rate fluctuations can also be referred to as a situation in which a country's actual exchange rate deviates from such an unobservable equilibrium with respect to another currency, an exchange rate is said to be undervalued when it depreciates more than its equilibrium, and overvalued when it appreciates

more than its equilibrium. The issue is, unless the equilibrium is explicitly specified, the concept of exchange rate fluctuations remains subjective Abuka (2014).

A high exchange rate level lowers the receipts that exporters receive thereby decreasing export earnings. On the other hand, a low exchange rate level raises receipts that exporters receive thereby improving export earnings. A fluctuation in the exchange rate impacts directly either positively or negatively on export earnings. Exchange rate fluctuations might impact negatively on exporters and trend economic growth by discouraging firms from undertaking investment, innovation and trade. It may also deter firms from entering the export market. Large fluctuations in exchange rate impose adjustment costs on the economy as resources keep shifting between the tradable and non-tradable sectors. This could permanently shift resources to non-tradable sectors if firms are put off from export markets due to high exchange rate fluctuations Kiptui, (2007). If exchange rate movements are not fully anticipated, an increase in exchange rate fluctuations may lead risk-averse agents to reduce their international trading activities. The presumption of a negative nexus between exchange rate fluctuations and export earnings is an argument routinely used by proponents of managed or fixed exchange rates. Exchange rate fluctuations lead to exchange rate risk which is a potential gain or loss occasioned by movements in the exchange rate Abuka, (2014)

### **2.1.2. International Trade**

Exports of agricultural products are of vital importance to the economies of third world countries. This is due to the main source of export earnings for countries like Ethiopia is the export of primary agricultural products. As Basu et al., (2000) put it, the importance of export earnings in economic development is widely acknowledged. Ideally, export earnings stimulate growth in a number of ways including; production and demand linkages, economies of scale due to larger international markets, increased efficiency, and adoption of superior technology embodied in foreign produced capital goods, learning effects and improvement of human resources together with increased productivity through specialization.

### **2.1.3 Exchange Rate Risk and International Trade**

There are strong indications in literature which link a country's performance in the international market to fluctuations in exchange rates. For instance, De Rosa et al., (1991) suggest that in

order to boost export earnings, exchange rates should be allowed to adjust to more realistic values. This will lead to significant increases in production and export of items as coffee, tea amongst other products. Export performance is sensitive to exchange rate fluctuations with the effect of the exchange rate fluctuations dominating the financial performance of the export oriented products and crops. Under the floating exchange rate regime, fluctuations in world prices of coffee strongly affect its export earnings. Therefore, a higher demand or a decrease in supply causes appreciation of foreign currency which makes export earnings decline Akila, (2004).

Early theoretical models of analyzing the effect of exchange rate fluctuations and export earnings suggest a negative effect of exchange rate fluctuations on export earnings especially in situations where hedging is not possible or is costly Clark, (1973).

#### **2.1.4 Exchange Rate Regimes in Ethiopia**

The exchange rate regime is the way the country manages its currency in respect to foreign currencies and the foreign exchange market. There are various types of exchange rate regimes practiced by countries the main types are free floating or flexible exchange rate regime, pegged or fixed exchange rate regime and pegged floating or managed floating exchange rate regime Nega(2013).

Free floating or flexible exchange rate regime is an economic system where the value of a nation's currency is allowed to fluctuate based on the demand and supply of the foreign exchange market. The price is determined by market forces of the demand and supply of the foreign currency without any intervention by the government. Therefore, there is a probability of getting different prices for one currency in terms of the other currency with in specific time interval, following fluctuations in the demand and supply of foreign currency. These fluctuations will lead us to say that there is either depreciation or appreciation of domestic currency Klein and Shambaugh, (2009).

Pegged or fixed exchange rate system is where the exchange rate between two currencies is set by government policy. It is a system in which government plays a significant role in deciding the worth of its currency in terms of either a fixed weight of gold, or a fixed amount of another currency. In other words, Conventional fixed peg arrangements are exchange rate regimes where

a country formally pegs its currency at a fixed rate to another currency or a basket of currencies Aklilu, (2018).

Pegged floating or managed floating exchange rate system is a system which combines both fixed and floating exchange rates. On one hand, it allows the market to adjust the exchange rate and arrives at its equilibrium level. On the other hand, it allows the government to intervene in to the exchange market whenever intervention is needed so as to protect the domestic currency, trade balance and nation's economy from external shocks. Hence, a managed float is halfway between a fixed exchange rate and a flexible one Aklilu (2018).

The Ethiopian birr has been pegged to the USD until the early nineties. 1992/93 marks the year that the Ethiopian exchange rate policy was reformed. Prior to this period the then government has been following a purely controlled exchange rate determination. The Ethiopian birr was overvalued causing considerable fall in export prices of the country's export commodities while the price of manufactured imports of the country had increased. Since 1992, the country implemented an exchange rate policy which is more close to managed floating exchange rate system, where there is a government intervention whenever necessary to stabilize the foreign exchange market Nega, (2013). According to Biruk, (2012), the abandonment of the fixed exchange rate systems has caused exchange rate movements to become a major concern for traders, policy makers and researchers. Since the adoption of the recent exchange rate management system the country has experienced continuous devaluation.

### **2.1.5 Devaluation in Ethiopia**

Devaluation of a currency is a deliberate act by the central bank of a country to reduce the value of its currency in relation to other countries currency. In other words, devaluation is an official downward adjustment to the value of a country's currency relative to another currency, group of currencies or standard. It is a monetary policy tool used by countries that have a fixed exchange rate or semi-fixed exchange rate. In theory, currency devaluation is a tool for enhancing the exports sector of the economy. Devaluation increases the price of a country 's imports relative to that of its exports; therefore, exporters obtain higher domestic currency revenues from a particular export quantity while imports contract due to the higher domestic currency price of imports. Thus, devaluation performs similar to a tax on imports and a subsidy to exports. That

causes the trade balance to recover. This tends to improve the foreign sector, which increases output in the economy Kandil, (2008).

The National Bank of Ethiopia is mandated to manage the exchange rate movement in the Ethiopian economy. Since the adoption of the managed floating rate in 1999 the National Bank of Ethiopia has been implementing multiple devaluation schemes.

### **2.1.6 The Trend of Foreign Trade in Ethiopia and Balance of Payment**

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

Ethiopia's trade balance has been negative for the past 30 years and over. The end of the year 1973 is the only exception for the country in which a trade balance was recorded i.e. there were neither trade surplus no trade deficit. Ethiopia was able to achieve every countries objective which is external balance in the end of the year 1973 Sewasew, (2002).

## **2.2 Theoretical Literature Review**

In the current literature dedicated to international economics, there exist three core theoretical frameworks that clarify the liaison between exchange rate volatility and trade, namely; the elasticity approach, the absorption approach and the monetary approach.

### **2.2.1 The Elasticity Approach**

The elasticity approach was developed by Bickerdike, (1920), Robinson, (1947) and Metzler, (1948). This approach originates from the well-known Marshall-Lerner condition which stipulates that the depreciation of a country's currency will lead to an improvement of the trade balance if the sum of the elasticity of both the demand of exports and imports exceed unity. This approach thus reflects the sensitivity of imports and exports to the variation in the value of a

nation's currency. Two essential theories govern the elasticity approach namely the Marshall-Lerner condition and the J-curve. The Marshall-Lerner condition sustains that depreciation (devaluation) of a nation's currency will have a significant influence on the trade balance. Specifically, a depreciation/devaluation of a currency will cause domestic merchandises to be cheaper and foreign merchandises to be costlier in the international market. Pandey (2013) accentuates that it is both the elasticity of imports and exports with regard to the changes in exchange rates that determine the overall impact of the depreciation on the trade balance. Contrary to the Marshall-Lerner condition, the J-curve theory advocates the existence of a lag period before both the total volume of exports and imports could retort to some changes which may arise from movements in exchange rates. Relating to this theory, economists established the hypothesis that in the short-run, following a devaluation of a nation's currency, the balance of trade will deteriorate but as time goes by, the elasticity will improve thereby causing the balance of trade to also improve. This situation usually leads to a shape which bears a resemblance to the letter 'J', henceforth the name 'J-Curve pattern'.

### ***J-Curve Pattern***

The J-curve effect, in economics, is the phenomenon where a country's balance of trade initially worsens following a devaluation or depreciation of its currency, before it recovers to a higher level than where it started.

The J-curve effect is observed in trade balances because the weaker currency initially translates into more costly imports and cheaper exports, leading to a bigger initial trade deficit or a smaller surplus. However, because the affected country's exports are now cheaper in currency terms, they start to rise as foreign demand for the lower-priced option increases. Local consumers also purchase fewer of the now more expensive imports and substitute them with comparable local goods which have now become more affordable. As a result, the trade balance eventually recovers and bounces back to a higher level than it was at before the exchange rate dropped. The lag is caused by the fact that importers and exporters have to honor pre-existing contracts, so the trade volumes initially remain unchanged even though the exchange rate and relative prices have changed.

When a country's currency appreciates, a reverse J-curve may occur. This happens because the country's exports initially become more expensive for importing countries than they were before. If other countries are able to offer the good at a more affordable rate, the stronger currency will reduce its export competitiveness and demand for its exports may fall. Additionally, local consumers may switch to imported versions of goods if they are suddenly cheaper.

The J-Curve is related to the Marshall-Lerner condition, which states:

If  $(PED_x + PED_m > 1)$  (sum of price elasticity of import and price elasticity of export  $> 1$ ) then a devaluation will improve the current account.

An elastic variable (with elasticity value greater than 1) is one which responds more than proportionally to changes in other variables. In contrast, an inelastic variable (with elasticity value less than 1) is one which changes less than proportionally in response to changes in other variables.

The J-Curve is an example of how time lags can affect economic policy. It also shows the link between microeconomic principles (elasticity) and macroeconomic outcomes (current account).

The current account on the balance of payments measures the net value (X-M) of exports and imports of goods, services and investment incomes.

### ***Marshall-Lerner Condition***

The Marshall-Lerner condition verifies whether the foreign exchange market is stable or unstable. Conclusion that can be drawn from the Marshall-Lerner condition are depending on the shape of the curves for the demand for import and exports of a country. The condition indicates that the foreign exchange market is stable if the sum of the price elasticities of the demand for imports and exports are greater than one. It would be better for the country if the two elasticities exceed one by a large amount since the current account then improves more in case of a depreciation. If the price elasticities sum up to less than one in absolute terms, the foreign exchange market is unstable. The current account will be unaffected by a change in the exchange rate, if the elasticities sum up to exactly one, in absolute terms (Salvatore 2004). The reasoning behind the use of the Marshall-Lerner condition is to examine if the foreign exchange market is stable or unstable. The exact shape of the demand and supply curves of the foreign exchange market is

difficult to determine if the foreign exchange market is stable or unstable. If the supply curve should be determined it could be straight forward to correct a deficit in the current account by depreciation the currency Salvatore, (2004).

Policymakers today are taking the responsiveness of trade flows to relative price changes into account when constructing an exchange rate policy or a commercial policy. Historically, the elasticities of the demand for imports and exports had a bigger impact and were used more frequently by policy makers in order to make a decision Bahmani-oskooee and Niroomand, (1998). The sum of the elasticities for the demand for imports and exports would need to be sufficiently larger than one so that the supply and demand curves of the foreign exchange rate are elastic enough and depreciation can therefore make it possible to correct a balance of payment deficit. This is the reason why it is important to calculate the real world value of the price elasticities of the demand for imports and exports Salvatore, (2004).

The Marshall-Lerner Condition simply states that, for a currency devaluation to lead to an improvement (e.g. reduction in deficit) in the current account, the sum of price elasticity of exports and imports (in absolute value) must be greater than 1.

If  $(PED_x + PED_m > 1)$  then a devaluation will improve the current account.

If  $(PED_x + PED_m < 1)$  then an appreciation will worsen the current account.

This is because the effect on the current account depends on the total value and not just the quantity of exports.

### **2.2.2 The Absorption Approach**

Established by Sidney Alexander in the 1950s, this approach describes how variations in domestic income are very significant in understanding a country's balance of trade. Rehman and Rashid (2006) define this approach as payments imbalances that are categorized by ex-ante discrepancies between cumulative income receipts and cumulative domestic expenditures. The study further accentuated that the absorption approach gives considerable attention to the product market while less attention is given on the exchange rate market and the monetary/money market is entirely disregarded. Notwithstanding, Melvin and Norrbin (2013) explained the absorption approach to the total trade balance as a theory that underlines how local expenditure on national

goods varies with respect to domestic output. The authors additionally emphasized that the total balance of trade is regarded as the difference between what the economy produces and what the economy absorbs/consumes for local purposes. Whereas the elasticity approach centers its outcomes on the effects of exchange rate variations on distinct microeconomic performance (Marshallian demand and supply analysis), the absorption approach on the other hand concentrates its analysis predominantly on economic aggregates, typical of Keynesian study. In essence, the fundamental theme of this approach is the notion that any development in the balance of trade necessitates a proliferation of total income over total domestic spending.

### **2.2.3 The Monetary Approach**

Distinct from the elasticity and the absorption approach, the monetary approach integrates both the current account (trade in goods and services) and trade in financial assets. The core notion of the monetary approach is the assertion that the 03 balance of payments is in essence a monetary occurrence. In other words, under this approach, the performance of the balance of payments should be analyzed from the approach of the demand and supply of money. It can therefore be easily asserted that money acts as a disorder and an alteration to the balance of payments. Under this approach, the balance of payments is affected by inconsistencies between the amount of money individuals aspire to hold in hand and the amount supplied by the central bank. In a floating exchange rate system, the demand for money is attuned to the supply for money through some deviations in exchange rate. Holding other variables constant, the extra money supply will lead to an upsurge in the domestic price levels in a way that the national currency will depreciate. In essence, the monetary approach shows that alterations in the balance of payment are partially due to changes in both demand and supply of money.

## **2.3 The Four Major Theories in the Forex Market**

Four major theories are used in explaining movements in exchange rates between countries. These are Balance of Payment, Interest Rate Parity, International Fisher Effect, and Purchasing Power Parity.

### **2.3.1 Balance of Payments**

There are two segments involved with a country's balance of payments (BOP), which is a listing of all transactions between one country and others during a particular period of time. When you

are discussing BOP it is normally discussed from either a standpoint of capital accounts or current accounts. This is a measure of influx and outgo of a nation's capital and goods.

Normally, the BOP Theory looks at a country's current accounts rather than the capital ones. This is used to determine the direction that a currency is heading in based on the trading of tangible goods. When a country runs a large current account with either deficits or surpluses, its monetary exchange rates are said to be out of equilibrium or are unbalanced. Adjustments to the currency rates will need to be made. When a country's imports outweigh their exports, this is considered a deficit and it normally devalues the currency. Conversely, when exports exceed imports, a surplus exists and the currency will normally ascend in value Abuka (2014).

### ***The Mundell-Fleming Model***

This theory was developed in the early 1960's by Fleming and Mundell. They independently extended the open economy Keynesian model of macroeconomic policy to incorporate systematically the role of capital flows. In 1970, Dornbusch published a series of articles on exchange rate policy that codified these contributions into the Mundell Fleming model. This model is an extension of the IS-LM model to the case of an open economy, and thus provides understanding of how the exchange rate is determined Akila, (2004).

The IS-LM model considers three markets: goods, money and asset markets, and is mainly used to analyze the impacts of monetary policy and fiscal policy. Under this model, the balance of international payments is considered another equilibrium condition in addition to the money market and goods market. One of the most important issues addressed by the model is the trilemma, which states that perfect capital mobility, monetary policy independence and a fixed exchange rate regime cannot be achieved simultaneously. Specifically, it argues that a country cannot sustain monetary policy independence in a fixed exchange rate regime with perfect capital mobility. However, this argument is made in a small country setting, and it is not necessarily true in bigger economies Akila, (2004).

### **2.3.2 Interest Rate Parity:**

This exists when the difference between two country's interest rates are equal to the difference between forward exchange value versus the spot exchange value. Due to the connection between

interest rates and the two aforementioned values, interest rate parity plays an extremely significant role in the Forex market.

The mindset is that if there is no difference in the rates of interest between to comparative countries, then there most likely won't be any opportunities for financial gain. This is due to the fact that risk ceases to exist, therefore thwarting much hope for any monetary gain via investing Jean and Thepthida (2004).

### **2.3.3 International Fisher Effect (IFE):**

The International Fisher Effect is an exchange rate model developed by Fisher in 1930. The theory is based on the present and future risk free nominal interest rates rather than pure inflation. It states that differences in interest rates in different markets can cause a flow of funds from markets with low interest rates to markets with high interest rates. This theory is to the effect that interest rate differential will only exist if the exchange rate is expected to change in such a way that the advantage of the higher interest rate is offset by the loss of the exchange rate transactions. In an efficient market with no transaction costs, the interest rate differential should be approximately equal to the forward differential. When this holds, the forward rate is said to be at interest rate parity and equilibrium prevails in the money market. Interest parity ensures that the return on a hedged foreign investment will just equal the domestic interest rate on investments of identical risk which means the covered interest differential Madura, (2007).

The international Fisher effect (IFE) suggests that currencies with high interest rates will have high expected inflation and therefore will be expected to depreciate. Therefore, investors based in the home country may not necessarily attempt to invest in interest bearing securities in foreign countries because the exchange rate effect could offset the interest rate advantage. The exchange rate effect is not expected to perfectly offset the interest rate advantage in every period. It could be less pronounced in some periods and more pronounced in other periods. But advocates of the IFE suggest that on average, investors that attempt to invest in interest bearing securities with high interest rates would not benefit because the best guess of the return after accounting for the exchange rate effect in any period would be equal to what they could earn domestically Madura (2007).

This theory basically states that any expected changes in currency rates between two countries is roughly equal to the differential of nominal interest rates between the two subject countries. The theory suggests that exchange rates between two nations should fluctuate based on amounts that are most like these nominal interest rates. If the rate is lower in one of the countries compared to the other, than its exchange rate should appreciate against the higher exchange rate or so the theory would predict Madura (2007).

#### **2.3.4 Purchasing Power Parity (PPP):**

This theory was developed by Cassel in 1918. The theory is founded on the law of one price which posits that in the absence of transaction costs, identical goods should have the same price in different markets. The PPP theory, measures the purchasing power of one currency against another after taking into account their exchange rate. Under this theory, parity between the purchasing powers of different currencies establishes the rate of exchange between the two currencies. When the inflation rate differential between two currencies change, the exchange rate adjusts to correspond to the relative Purchasing Power of the currencies. The relationship under this theory is derived from the basic idea that in the absence of trade restrictions, changes in the exchange rate mirror changes in the relative price levels in the two countries Engel, (1996).

At the same time under conditions of free trade, prices of similar commodities cannot differ between the two countries because arbitrageurs will take advantage of such conditions until price differences are eliminated. This leads to the law of one price which is to the effect that what is true of one commodity should be true of the economy as a whole. The price level in the two countries should be linked through the exchange rate and hence the notion that exchange rate changes are tied to inflation rate differences. If the theory doesn't hold, a conclusion is made that purchase parity doesn't exist between the two currencies Madura, (2007). The purchasing power parity theorem as Expressed by the author states that the percentage change is the difference in the inflation rate in home market less the inflation rate in the foreign market multiplied by the direct quote.

Estimating the amount of adjustments needed between two country's exchange rates so that these rates equal the purchasing power of the countries is how PPP functions. The theory mandates that the price levels of the two countries in question should be equal once the adjustments to the

exchange rates are completed. The theory also is also suggestive of the "law of one price" wherein the pricing of identical goods be the same on a global basis Engel (1996).

### ***Balassa-Samuelson Model***

This theory was developed by Balassa and Samuelson in 1964. They independently provided what has come to be regarded as definitive explanation of why the absolute PPP theory is flawed as a theory of exchange rates. The Balassa-Samuelson model is one of the cornerstones of the traditional theory of the real equilibrium exchange rate Akila, (2004) The key empirical observation underlying the Balassa-Samuelson model is that countries with higher productivity in tradable compared with non-tradable tend to have high price levels. The B-S model hypothesis states that productivity gains in the tradable sector allow real wages to increase commensurately and, since wages are assumed to link the tradable to the non-tradable sector, wages and prices also increase in the non-tradable sector. This leads to an increase in the overall price level in the economy, which in turn results in an appreciation of the real exchange rate Akila, (2004).

## **2.4 Empirical Literature Review**

The first aspect of the relationship between exchange rates and trade relates to exchange rate volatility. The basic argument for which an increase in exchange rate volatility would result in lower international trade is that there are risks and transaction costs associated with variability in the exchange rate, and these reduce the incentives to trade.

The findings of the economic literature on this issue have evolved in the last few decades. While early studies found adverse effects of exchange rate volatility on trade Ethier, (1973), Clark (1973), Baron, (1976), Cushman, (1983), Peree and Steinherr, (1989) subsequent studies report very small impacts Franke, (1991), Sercu and Vanhulle, (1992). More recently, the use of refined quantitative methods resulted in more skepticism about causality of short-term exchange rate volatility on international trade Clark, Tamirisa and Wei, (2004), Teneyro, (2006). A number of models have been advanced which find support for the negative hypothesis that volatility acts to the detriment of international trade. While other models supported the positive hypothesis that exchange rate volatility may lead to greater levels of trade McKenzie, (1999). Then, inevitably, many empirical studies have failed to establish any significant link between measured exchange rate variability and the volume of trade.

Possible reasons for such mixed results could be the different time horizon and economic conditions that were based for the analysis. One common argument is that exporters can easily ensure against short-run exchange rate fluctuations through financial markets, while it is much more difficult and expensive to hedge against long-term risk. Pereg and Steinherr (1989), Obstfeld (1995), and Cho et al. (2002), presented evidences that long-run changes in exchange rate seem to have more significant impacts on trade than do short-run exchange rate fluctuations that can be hedged at low cost. On the other hand, Vianne and de Vries (1992) show that even if hedging instruments are available, short-run exchange rate volatility still affects trade because it increases the risk of premium in the forward market. Furthermore, Krugman (1989), Wei (1999), and Mundell (2000) argue that hedging is both imperfect and costly as a basis to avoid exchange rate risk, particularly in developing countries and for smaller firms more likely to face liquidity constraints. Pick (1990) analyzes the effects of exchange rate risk on U.S agricultural trade flows and he find that exchange rate risk is not a significant factor affecting bilateral agricultural trade from the United States to seven out of eight developed markets, but indicates that exchange rate risk adversely affects U.S. agricultural exports to some developing countries. DeGrauwe (1988) illustrates how the relationship between exchange rate volatility, whether long run or short run, and trade flows is analytically indeterminate when one allows for sufficient flexibility in assumptions.

Another possible reason for such controversial results could be the aggregation problem. The effects of exchange rate volatility on export may vary across sectors McKenzie, (1999). This may occur because the level of competition, the price setting mechanism, the currency contracting, the use of hedging instruments, the economic scale of production units, openness to international trade, and the degree of homogeneity and storability of goods vary among sectors. The differences among sectors in exporters' access to financial instruments, currency contracting, production scale, storability, etc., may be partly pronounced in developing countries. This contrast is only accentuated by the fact that agriculture is typically a notably competitive sector with flexible pricing on relatively short-term contracts Fogarasi, (2014).

Any relation between volatility and international trade could be driven by reverse causality, in which trade flows help stabilize real exchange rate fluctuations, thus reducing exchange rate volatility Broda and Romalis, (2010). In any case, there are several reasons why volatility is

often not a critical issue for international trade. One particularly compelling argument is that the risks associated with volatile exchange rates are softened by the increasing number of financial instruments available (e.g. forward contract and currency options) that allow firms to hedge against these risks Ethier, (1973). Another critique is related to the presence of sunk cost in exporting Krugman, (1989) Franke, (1991). The higher the fixed costs of exports are, the less responsive firms (and therefore international trade) are to exchange rate volatility. All this makes exchange rate volatility less of a critical issue for international trade. In modern cross-border transactions firms often decide to hedge against the risk in the exchange rate or to bear the cost associated with possible exchange rate fluctuations as part of their export strategy. The second aspect of the relationship between exchange rates and international trade pertains to currency misalignments. The influence of currency misalignment on international trade is largely driven by its impact on relative import prices Mussa, (1984) Dornbusch, (1996).

Frieden and Broz, (2006), argue that an undervalued currency, whether determined by exogenous shocks or by policy, increases the competitiveness of the export- and import-competing sectors at the expense of consumers and the non-tradable sector. In this regard, the effects of misaligned currency on prices are similar to those of an export subsidy and import tax. The literature on the topic provides a great amount of evidence on how responsive trade flows are to changes in relative prices consequent to movements in exchange rates Hooper and Marquez, (1995); Bernard and Jensen, (2004).

As of this day, as in the case of volatility, there are a number of issues that greatly complicate the relationship between exchange rate misalignment and international trade Staiger and Skyes, (2010). Of particular importance is the issue that part of the undervaluation or overvaluation of the exchange rate is often absorbed by firms which do not fully adjust their price in the destination country Goldberg and Knetter, (1997). Related to this is the presence of irreversible sunken costs of entry which act as powerful incentives for firms to stay in the market even when there is substantial undervaluation of the importer currency Baldwin, (1988); Froot and Kemperer, (1989).

Another issue on the relationship between exchange rates and trade explored here regards the effect of exchange rate misalignments on trade policy. The rationale is that the stance of the exchange rate may indirectly affect governments' decisions regarding other policies, especially

those affecting international trade. The recent literature on this topic is more limited and largely focused on contingency measures. Most of the studies find that long periods of overvalued exchange rates are often associated with an increase in the use of protectionist trade policies, especially anti-dumping Frieden, (1997); Knetter and Prusa, (2003); Irwin, (2005); Oatley, (2010).

Trade policy may be used to compensate for some of the effects of an overvalued currency. Domestic firms that lose competitiveness as a result of a real exchange rate appreciation may lobby for restrictive trade policies. In practice, disputes over exchange rate policies among trading partners could foster an increase in domestic political pressures and unilateral action on trade (Copelovitch and Pevehouse, 2010). In more general terms, countries may also be using trade policy as a substitute for exchange rate overvaluation, so as to deal with persistent disequilibria in the trade balance.

The Ethiopian Birr has been depreciating continuously since the floating exchange rate was adapted in the early 90's. We can take the recent phenomenon of the 2017 devaluation as an instance. By 2015, the IMF estimated that the birr was 30 % overvalued. This overvaluation was all the more visible because the country was suffering from a structural trade deficit that should have mechanically depreciated its currency. The consequences of this overvaluation were a competitiveness deficit for exports, which were more expensive than they should be and therefore less attractive. On the other hand, the overvalued birr lowers the price of imports. For a country with a large trade deficit, this choice is understandable.

In 2017 the government took action to depreciate the currency rate of birr by 15 percent. The measure has been seen by economic players as helping to boost the growth of the country's export sector which has experienced a sluggish outlook. It was also expected to reduce forex shortages and to ease debt burden. Although the high return on investment was expected to prevent inflation in relation with the devaluation, it hardly held.

For devaluation to be successful, domestic supply of output must be responsive to meet the existing and surging demand, which is caused by the depreciation of the birr. If demand surges for Ethiopian exportable products, an excess or spare capacity must have existed ready to meet the demand for domestic products. As indicated above, devaluation adversely affects

intermediate and capital goods that are imported from overseas thereby affecting domestic production in a negative way. For state-owned, private and even party owned enterprises, which heavily depend on imported intermediate/capital goods (inputs), the devaluation measure will raise their cost of production thereby adversely affecting their capacity utilization capabilities. In the unlikely event other trading partners might follow suit (that is, devalue their currency so that Ethiopia would not take advantage of them), or take other retaliatory measures. The measure may also trigger a potentially damaging mini trade war involving Ethiopia, its neighbors and major trading partners Bienen et.al, (2010).

Moreover, there is a doubt about enough available domestically (Ethiopian) produced goods which both domestic and foreign consumers wish to buy. As It was argued elsewhere, one of the major causes of the 2008 (and thereafter) rampant inflation is shortages of goods, particularly food items. Given that the country's imports are three to four times than the value of its exports, thereby indicating already-existing shortages, the measure will largely be ineffective at best. In fact, the measure will exacerbate the shortages as there are no sufficiently locally produced goods ready to meet foreign demand for domestic products, since shortages exist within the Ethiopian economy, supply is inelastic. The times, how long will it take for both domestic and foreign consumers to adjust their preferences and switch towards Ethiopian-made goods matters as well. If they take relatively larger time to change their preference from imported goods to domestically produced goods, the devaluation measure will be largely ineffective. Devaluing the birr could also have a negative effect on trade. In particular, weakening the birr means that products in countries with stronger currencies become more expensive. If Ethiopia, now with a weakened birr, fails to curb imports, it will need more money to pay for the same amount of foreign goods. In this case, the measure will fail to improve Ethiopia's serious trade imbalance Seid, (2010) Others bring, however, the traditional theory of the J-curve in play, suggesting that, even though the depreciation of the birr may worsen the country's current balance of payments position in the short-run, the devaluation measure could lead to improved trade balances in the long run. Other economists disagree with this contention, arguing that given the awful past and current balance of payments of the country (both the current and capital), it is not clear for them if the J-curve theory is applicable to Ethiopia.

Devaluation of currency has ambiguous result towards growth. Many countries, specially developing ones, use currency devaluation as a strategy to achieve short and long run growth. A study by Ratha, (2010) of India confirmed the Keynesian positive view of devaluations and the multiplier effect on the increase in export, one component of GDP and growth. The result showed a contractionary effect in the short run but changed to expansionary effect in the long run.

P. K. Narayan and S. Narayan, (2007) supported the IMF strategy that encourages the devaluation of domestic currency to increase economic growth. Their study on Fiji indicated that devaluation of currency increased output with “2.3% and 3.3% in the short and long run” respectively.

However, Agénor, (1991) envisaged about the negative side of devaluation in his study of sample 23 developing countries. The main emphasis was the effect of expected and sudden depreciation in the exchange rate. The result showed that expected devaluation has contractionary effect. The one year lagged expected devaluation has also the same result whereas the unexpected devaluation has an expansionary effect.

Furthermore, various empirical studies have tested the effect of devaluation in the short and long run growth. Most of the results confirmed that devaluation has contractionary effect in the short run and zero or no effect in the long run growth. Edwards, (1986) studied 12 developing countries based on a hypothesis about a negative effect of devaluation. He used the lagged variable to differentiate the effect of exchange rate in the short and long run. The result showed devaluation of the exchange rate in the same year has a negative effect in the short run. But after one year the effect was reversed and resulted in a positive relation. In the long run according to the author this conflicting effects will cancel each other and result in zero effect in the long run. Acar, (2000) also used the lagged variable as additional variable to test the relation between growth and devaluation. He took sample of 18 LDC's with different export performance. His result however showed a negative relation between devaluation of currency and output only during the first year, a positive effect the next year and zero growth in the long run as the two effects cancel out in the future. Even though Edwards, (1986) and Acar, (2000) got the same result the countries used in the sample as well as the functional form of the dependent and independent variables used in their study is different.

Acharya, (2010) provided evidence that devaluation will increase the price of import leading to high production export products by the agricultural and industrial sector by studying Nepalese currency. According to Acharya's study the expansion of the industrial sector will decrease the service sector and so does the agricultural sector. But the overall GDP will grow due to the increase in the production of the industrial sector as well as the consistent increase in the export of agricultural products.

Nunnenkamp and Schweickert, (1990) tested the hypothesis of contractionary effect of devaluation on growth by using data for 48 developing countries. They made a pooled time series cross country analysis of different income groups of developing countries to test the relation between GDP growth per capita and exchange rate. 3 They included other explanatory variables such as government expenditure, terms of trade etc. Their result rejected the hypothesis that countries that exported manufactured goods mainly faced contractionary effect in the short run but these effects were offset by the positive effects. And for exporters of agricultural product devaluation has an expansionary effect on the short run and in the long run. At the end they added low economic growth and the effect of devaluation shouldn't always be related because the low economic growth of some countries might be related to problem in poor economic policies.

The ambiguity of the result for the studies using econometric approach of various countries might be due to the difference in the country's economic growth. Having this in mind Domac, (1997) tried to study the hypothesis of contractionary effect of devaluation (both anticipated and unanticipated) on growth by taking the case of Turkey The empirical result showed that unexpected devaluation has expansionary effects where as expected devaluation has a contractionary but statistically insignificant effect. This contractionary effect according to the author might be due to the multiplier effect of the negative trade balance that arises from the decrease in export by foreigner's future expectations of an appreciation of the currency.

The result in price competition can help the growth rate at the expense of other country and become misleading. Taking these in mind Blecker & Razmi, (2007) tested a hypothesis on devaluation of currency with respect to competing developing country as well as developed country. They focused on price competition as a result of devaluation in developing countries involved in the export of manufactured goods to the developed countries. Their result suggested

that devaluation of currency with respect to market competing developing country will result in short run growth and decrease the growth of the competing country. On the other hand, devaluation of currency with respect to the developed country where the final goods are exported will lead to a contractionary growth especially in those developing countries with high debt rate and high import dependent countries.

Wong Hock Tsen (2014) made a brief analysis of researches conducted on exchange rate volatility and international trade around world. As per the article the empirical evidence shows that, the rationale of examining the impact of exchange rate volatility on international trade is that exchange rate volatility induces uncertainty into international transactions. This uncertainty decreases international trade and economic welfare. Theoretically, exchange rate volatility can have a negative impact or a positive impact on international trade. Empirically however, there is no general consensus about the impact of exchange rate volatility on international trade. It could be considered as a case-by-case basis. Thus, many studies have been carried-out to examine the impact of exchange rate volatility on international trade for developing, emerging and developed countries. Different data analysis methods with different economic structures have produced various insights, most importantly, it has been stated that adverse impact of exchange rate volatility on international trade has been significantly identified on developing countries where forward and future options markets are less developed compared with those in developed countries.

There are two popular measures of exchange rate volatility that are used to examine the impact of exchange rate volatility on international trade. One measure is exchange rate volatility that is expressed by the standard deviation or the moving average of standard deviation. The other measure is exchange rate volatility that is expressed by an Autoregressive Conditional Heteroscedasticity type model. Exchange rate volatility is usually generated from the real exchange rate or the real effective exchange rate.

The impact of exchange rate volatility on international trade is found to be negative particularly in the short run but the magnitude is relatively small compared with other explanatory variable such as income. The majority of the affected industries are also found to be small industries as measured by their international trade shares.

Empirical evidence in support of the hypothesis of a negative link between exchange rate fluctuations and export earnings is mixed. The pertinent survey of McKenzie (1999) concludes that exchange rate fluctuations may impact differently on different markets and calls for further tests using export market specific data. A study by Hooper and Kohlhagen (1978) used time series data to examine the impact of exchange rate volatility on exports of industrialized countries and found essentially no evidence of any negative relationship.

De Grauwe (1988) found that an increase in exchange risk has both a substitution and an income effect. The substitution effect decreases export activities as an increase in exchange rate risk induces agents to shift from risky export activities to less risky ones. The income effect, on the other hand, induces a shift of resources into the export sector when expected utility of export revenues declines as a result of the increase in exchange rate risk. If the income effect dominates the substitution effect, exchange rate fluctuation will have a positive impact on export activity and vice versa. In addition, an increase in exchange fluctuations can create profit opportunities for exports if firms in this sector can protect themselves against negative effects of exchange rate fluctuations by hedging or if they have the ability to adjust trade volumes to movements in the exchange rate.

From a political economy point of view, Brada and Mendez (1988) note that exchange rate movements facilitate the adjustment of balance of payments in an event of external shocks, and thus, reduce the use of trade restrictions and capital controls to achieve equilibrium, and this in turn encourages international trade. Economic theory suggests that when markets are free of distortions, an exchange rate misalignment has no long run effects on export earnings as it does not change relative prices. But long run effects are predicted in models that assume market distortions such as information problems or product market failures. In the short run some prices in the economy can be sticky; movements in nominal exchange rates can alter relative prices and affect international trade flows Marc & Mitchell, (2011).

Coric and Pugh (2010) found that on average, exchange rate fluctuations exert negative effects on international trade. Exporting firms may be more sensitive to exchange rate fluctuations than domestic firms but this sensitivity is likely to be reduced by factors such as the existence of hedging instruments, the presence of imported inputs, and the presence of firms on the global market where upward and downward movements of various exchange rates cancel out. More

recent studies using panel data tend to find evidence of a negative effect of exchange rate fluctuations on export earnings. The choice of the data to use in these studies has both advantages and disadvantages for example, Dell'Arricia (1999) notes that unobservable cross sectional specific effects which may have an impact on export trade flows such as cross country structural and policy differences, can be accounted for either via fixed effects or random specification effects. The effect of exchange rate fluctuations on export earnings is a delicate but critical issue that needs to be understood since there are varied findings by studies done elsewhere regarding the effects of foreign exchange rate fluctuations on export earnings.

In support of the theory that devaluation may have a positive impact on an economy and its performance in the international market we can refer to the experience of few countries.

South Korea undertook successive devaluations in the 1970s, as part of its export-led strategy to boost growth and shared prosperity. The devaluations were generally supported by restrictive monetary and fiscal policies to keep inflation in check. Furthermore, the success of devaluation in boosting exports was tied to the strong external demand and continued high investment in the export sector Kebede (2011)

Brazil devalued the Real Exchange Rate by 64 percent in 1999 without causing a major surge in inflation, thanks to a massive tightening of monetary and fiscal policies. Economic growth, underpinned by the agriculture and services sectors, turned positive in 1999 and further expanded by 4.4 percent in 2000. FDI increased by 37 percent between 1998 and 2000. Industry then became the lead growth sector in 2000, reflecting a lagged response to the changing policy environment. The Brazilian experience suggests that the resurgence in growth was a result of the devaluation combined with structural and institutional reforms including fiscal adjustment, structural reforms of the financial sector and the adoption of credible inflation-targeting Tamiayehu (2015).

Egypt depreciated the Egyptian pound by about 200 percent between November 2016 and May 2017 and adopted a floating exchange regime. The devaluation coupled with the introduction of a VAT, and partial removal of energy and petroleum subsidies fueled inflation. Inflation peaked at 30 percent, but the devaluation achieved the desired depreciation of the REER. The central bank increased interest rates by 400 basis points and tighten liquidity in the banking sector. The

gap between the parallel and the official exchange rate eventually closed and official foreign exchange reserves began to grow again Aklilu (2018).

## **2.5 Research Gap**

Several researches have been conducted on the exchange rate volatility and its impact on international trade performances of different countries worldwide. As the empirical evidences indicate, researchers have found widely varying results. However, much attention has not been given for third world countries like Ethiopia.

The government of Ethiopia has been working on improving the international trade performance of the country in the international market. Among the measures taken, change of exchange rate regime and continuous devaluations are to be mentioned. This research intended to address the gap that exists between exchange rate volatility and international trade performance of Ethiopia.

## **2.6 Conceptual Framework**

Exchange rate volatility is not directly observable. Different theories exist in literature regarding the impact of exchange rate volatility. Traditionally it has been argued that exchange rate volatility will have negative influence on foreign trade. However, recent researches suggest that such conclusions were made under restrictive assumptions. Empirical evidences support that the impact of exchange rate volatility varies depending on economic and political stance of a country. Its fist is also usually felt sometime after its occurrence and the magnitude and direction of impact might vary due to plausible alternative assumptions, modeling strategies, differences on economic structures, or time periods covered.

In the case of Ethiopia, since the adaptation of the managed floating exchange rate, the country has experienced continuous devaluation. According to Alemayehu et al. (2008), there are three main reasons why governments sometimes resort to devalue their currencies. The first reason for devaluing is the resulting improvement in the current account, a development the government may believe to be desirable. Second, devaluation allows the government to fight domestic unemployment despite the lack of effective monetary policy. If government spending and budget deficits are politically unpopular, for example, or if the legislative process is slow, a government may opt for devaluation as the most convenient way of boosting aggregate demand. The third motive behind devaluations is their effect on the central bank's foreign reserves. If the central

bank is running low on reserves, in Ethiopia, a one-time devaluation can be used to draw in more foreign currency.

According to Marshall-Lerner condition, a depreciation/devaluation of a currency will cause domestic merchandises to be cheaper and foreign merchandises to be costlier in the international market. Contrary to this the J curve theory advocates the existence of a lag period before both the total volume of exports and imports could retort to some changes which may arise from movements in exchange rates. The conceptual framework to that would help to capture the impact of foreign exchange rate volatility on foreign trade has been developed as below:

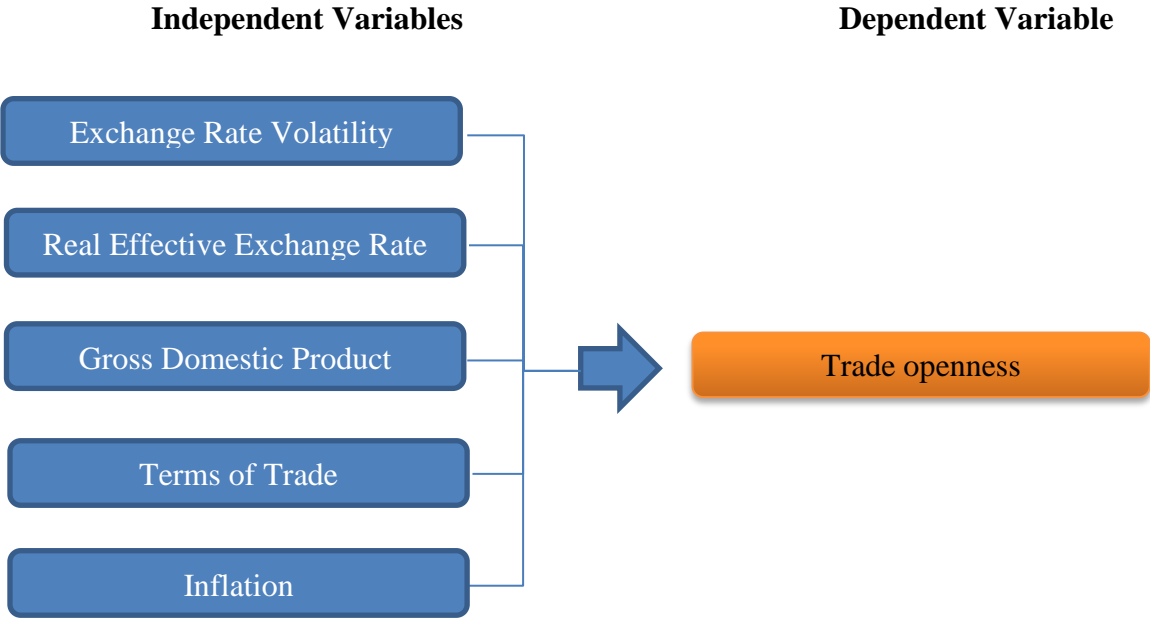


Figure 2.1 Conceptual Framework

# CHAPTER THREE

## 3 Research Methodology

### 3.1 Research Design

The research has been conducted using a quantitative data analysis approach. The data for the variables included in the model has been collected from a secondary source. The data validity has been verified by making cross check references with multiple data sources. Different tables and graphs were used to show the trend of the variables. The data has been analyzed using an econometric model suitable for the data and study type.

### 3.2. Data Source and Collection Methods

The research has relied on secondary data to investigate the impact of foreign exchange rate risk on international trade performance of Ethiopia. The data type is time series and it was arranged in a quarterly average manner for the period under discussion. The main sources of data were National Bank of Ethiopia (NBE), Ethiopian Customs and Revenues Authority (ERCA), The World Bank (WB), and The International Monetary Fund (IMF). The study was conducted based on a country wide macro data covering the period of 16 years, 2002-2018. The study limits the analysis to the mentioned period due to unavailability of necessary data.

### 3.3. Definition of Basic Variables

The model to capture the impact of foreign exchange rate volatility on International Trade Performance could be developed by taking the below variables into consideration:

$$TOP = f(VOL, GDP, REER, TOT, INF) + \mu \dots\dots\dots(1)$$

Where:

TOP= Trade Openness

VOL= Exchange rate volatility

GDP= Gross Domestic Product

TOT= Terms of Trade

INF= Inflation

$\mu$  = The Error Term

The definition of the variables employed in this study is defined as below:

### 3.3.1 Trade Openness

Aa Hau (2002) sited, trade openness explains a large part of the cross-country variation in the long-run volatility of the effective real exchange rate. A robust theoretical prediction emphasized by Hau (2000) and Obstfeld is that more-open economies should exhibit less volatile real exchange rates. The intuition for this effect is straightforward. More imported goods provide a channel for a quick adjustment of the domestic aggregate price level. This in turn reduces any short-run effect of a money supply or real shock on the real household balances and therefore reduces the scope of such a shock to develop real effects on either domestic consumption or the real exchange rate. Relatively closed economies with little aggregate price flexibility due to a lower import share are deprived of this aggregate price level flexibility trans mitted through the exchange rate and therefore produce (ceteris paribus) more pronounced effects on consumption and the real exchange rate. Incomplete exchange rate pass-through in the short run does not change the nature of the argument, but may just imply that the structural link between real exchange rate volatility and openness is more difficult to detect over short measurement periods. Measuring real exchange rate volatility at a sufficiently low frequency allows us to find clear evidence that more-open economies have indeed substantially lower real exchange rate volatility.

Openness to trade as it is calculated as a percentile of sum of import and export as a percentile of GDP, has been selected as a proxy for the dependent variable due to its ability to filter out the degree of change specifically on international trade performance from an overall GDP outlook of an economy. The higher the rate the more liberal the trade is in the given economy.

$$TOP = \frac{Import + Export}{GDP}$$

Empirical evidence suggests that the openness-volatility linkage does not simply result from a closer co-movement of domestic and foreign monetary shocks for more open economies since effective relative price level volatility measured at the same low frequencies is uncorrelated with

openness. The researcher considers this evidence as a main contribution to study the impact exchange rate volatility has on foreign trade.

### 3.3.2 Exchange Rate Volatility Measurement

As Thuy 2019 stated, exchange rate volatility denotes the amount of uncertainty or risk about the size of changes in the exchange rate. If the exchange rate can potentially be spread out over a larger range of values in a short time span, it is termed to have high volatility. If the exchange rate does not fluctuate dramatically, and tends to be steadier, it is termed to have low volatility. Additionally, real and nominal exchange rate volatilities are different for practical purposes. The properties of the method used to estimate volatility have also received lots of attention. Bahmani-Oskooee and Hegerty (2007) emphasizes the fact that a clearly dominant approximation for uncertainty has not yet emerged up to now.

Finding a standard exchange rate volatility proxy has been one major challenge in conducting researches in this area. While a variety of exchange rate volatility measures have been used, there is still no consensus on which measure is most appropriate Clark, Tamirisa, and Wei (2004). In this paper, the exchange rate volatility is measured by the standard deviation of real effective exchange rate. Which is typically used by a number of scholars such as Nicita (2013), Fountas and Aristotelous (2005), Akhtar and Spence-Hilton (1984) Arize and Malindretos (1998); and Thuy (2019).

$$VOL = \text{Log} \left[ \sqrt{\frac{1}{n-1} \sum_{k=1}^n (REERiq - \overline{REERi})^2} \right]$$

REERiq= The quarterly real effective exchange rate

REERi= The quarterly average of the real effective exchange rate

### 3.3.3 Gross Domestic Product (GDP)

GDP is the value of goods and services produces in a country in a given fiscal year. A higher GDP implies a higher production and hence larger volume of exports.

Researchers conducted by (Abule 2012), (Kebede 2011),(Thuy 2019) and many others have included GDP in their econometric model in an effort to investigate the impact of volatility on export performance and International trade.

### **3.3.4 Real Effective Exchange Rate (REER)**

It is a trade –weighted geometric average of the level of consumer prices in home country relative to that in its trading partners. The real effective exchange rate is used to capture appropriate incentives for exports, which may trigger supply response. The indicator is obtained by deflating the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) by a suitable effective deflator (Henok, 2011).

Bagellaetal (2006) show advantages of effective exchange rate volatility comparing with bilateral exchange rate volatility and find that this variable performs much better than the bilateral exchange rate volatility measure. An important advantage is that the effective exchange rate reflects more sufficiently the stability of a country which might have low bilateral exchange rate volatility with a leading currency but absorb instability via variability of economic policies of its trade partners.

Prior studies conducted by Muteba and Dube (2014), Thuy (2019), Bouoiyour and Selmi (2013) on impacts of volatility on trade also have taken REER into consideration. It is constructed by dividing the trade-weighted foreign price level index by the corresponding domestic price level index, after converting the values to a common scale using nominal exchange rate Bouoiyour and Selmi (2013).

$$REER_t = NEER_t (P^*_t/P_t)$$

It is a measure of the competitiveness of one country's export sector in relation to the rest of the world. When the value of REER falls either because of a decrease in exchange rate or a decline in the inflation differential or both, it shows real depreciation of the exchange rate and thus enhanced competitiveness of the country's goods in relation to foreign goods. On the other hand, an increase in REER represents a real appreciation implying declining competitiveness of the home economy.

### **3.3.5 Terms of Trade**

Terms of trade is one of the determinants of international trade performance in developed and developing countries. TOT represents the ratio between a country's export prices and its import prices, it can be interpreted as the amount of import goods an economy can purchase per unit of export goods. An improvement of a nation's terms of trade benefits that country in a sense that it

can buy more imports for any given level of exports. The terms of trade maybe influenced by the exchange rate because a rise in the value of a currency lowers the domestic prices of its imports but may not directly affect the prices of the commodities it exports. Researches follow different procedure to find this value, for this study the terms of trade ratio is calculated as below:

$$\text{TOT} = \frac{\sum p_i * x_i}{\sum p_i * m_i}$$

Where numerator and denominator represent export and import respectively.

### 3.3.6 Inflation

Inflation is the rate at which the general level of prices for goods and services is rising and, consequently, the purchasing power of currency is falling. It is a sustained increase in the general price level of a national economy measured either at the retail or wholesale level. The annual rate of change in this price level, commonly expressed in index numbers, is the inflation rate.

General price inflation reflects changes in the level and distribution of real income within countries and across national boundaries. Inflation also tends to change currency exchange rates and international balance of payments accounts.

A difficulty in determining the impact of exchange rates movements on export earnings is that most of the important macroeconomic effects are indirect. The interactions between the exchange rate, inflation and export earnings are especially important. A typical problem is created by high and rising inflation within the context of a sluggishly adjusting nominal exchange rate, which is managed by the central bank in order to maintain price stability. The resulting real over-valuation of the exchange rate impedes export growth and creates uncertainty about potential future movements in the exchange rate Malcolm et al., (2000).

### 3.4 Model Specification

The choice of a particular approach or methodology and expected outcomes depend on a particular economy and nature and availability of data. This study adopts the recent developed autoregressive distribution lag (ARDL) frame work by Pesaran and shin (1999), Peseran et al.(1996) and Pesaran (1997) to establish the direction of causation between variables.

The ARDL method does not involve pre testing variables, which means that the test on the existence of relation between variables in levels is applicable irrespective of whether the underlying repressors are purely I(0) , purely I(1) or mixture of both. This feature alone, given the characteristics of the cyclical components of the data, makes the standard of co-integration techniques unstable and the existing unit root test to identify the order of integration and still highly questionable. Farther more, the ARDL method avoid the larger number of specification to be made in the standard co-integration test. These include decision regarding the number of endogenous and exogenous variables if there is any to be included, the treatment of deterministic elements as well as the optimal number of lags to be specified.

The empirical results are generally very sensitive to the method and various alternative choices available in the estimation procedure Pesaran and smith, (1998). With ARDL, it is possible that different variables have different optimal lag, which is impossible with the standard co-integration test. The ARDL regression model is specified as below:

$$TOP_t = \beta_0 + \beta_1 VOL_t + \beta_2 GDP_t + \beta_3 REER_t + \beta_4 TOT_t + \beta_5 Inflation_t + \mu \dots\dots\dots(2)$$

$\beta_0$  = The intercept

$\beta$  = The parameters

$\mu$  = The error term

$VOL_t, GDP_t, REER_t, TOT_t, Inflation_t$  = The explanatory variables

For econometric analysis purpose some of the variables in equation 2 has been changed to logarithmic format to generate equation 3:

$$\ln TOP_t = \beta_0 + \beta_1 \ln VOL_t + \beta_2 \ln GDP_t + \beta_3 REER_t + \beta_4 TOT_t + \beta_5 Inflation_t + \mu \dots\dots\dots(3)$$

### 3.5 Methods of Estimation Procedure and Data Analysis

This study employed both descriptive and empirical analysis. In the first section of the data analysis section graphs and tables were applied to descriptively support the empirical analysis. The statistical property of the variables has also been included in this section as part of the descriptive analysis.

In the econometric analysis section, the unit root test has been conducted on the variables to understand their stationarity variable. The bound test has been conducted to check for long run co-integration. The study has adopted The Autoregressive Distributed Lag (ARDL) econometric model to estimate the parameters of the variables in the short run and in the long run.

The empirical analysis generally includes three sub sections, pre analysis tests: Unit root test and Bound test, Model estimation: Long run and Short run relationships and the final section post diagnostics tests: tests for serial correlation, tests for heteroskedasticity, test for normality and tests of stability to ensure the robustness of the model adopted.

### **3.5.1 Test of Stationarity**

Although ARDL doesn't require the pre testing of the variables for stationarity, it is vital to understand the properties of the variables. According to various literatures, most times series data are not stationary, therefore it's important to establish stationarity before using them in a model to avoid a bogus regression analysis. A non-stationary variable can be made stationary with appropriate differentiation. The suitable number of differencing is called the order of integration. To identify the level of integration of the data Augmented Dickey- Fuller (ADF) and Philips Perron (PP) tests were used.

### **3.5.2 Bound Test and ARDL Procedures**

According to Pesaran and Smith (1999), the ARDL approach requires two steps, the first step is to determine the existence of any long run relationship among the variables of interest using an F-test, the second one is to estimate the coefficients of the long run relationship and determine their values followed by the estimation of the short run parameters of the variables with the error correction representation of the ARDL model. The ECM version of ARDL also helps in determining the speed of adjustment to equilibrium.

The General conditional ARDL modeling specifications for equation (3) is stated as below:

$$\begin{aligned}
\Delta \ln TOP = & \Psi_0 + \sum_{i=1}^m \beta_1 \ln TOP_{t-1} + \sum_{i=1}^{m1} \beta_2 \ln VOL_{t-1} + \sum_{i=1}^{m2} \beta_3 \ln GDP_{t-1} + \sum_{i=1}^{m3} \beta_4 REER_{t-1} \\
& + \sum_{i=1}^{m4} \beta_5 TOT_{t-1} + \sum_{i=1}^{m5} \beta_6 INFLATION_{t-1} + \alpha_1 \sum_{i=1}^m \ln TOP_{t-1} + \alpha_2 \sum_{i=1}^{m2} \ln VOL_{t-1} \\
& + \alpha_3 \sum_{i=1}^{m3} \ln GDP_{t-1} + \alpha_4 \sum_{i=1}^{m4} REER_{t-1} + \alpha_5 \sum_{i=1}^{m5} TOT_{t-1} \\
& + \alpha_6 \sum_{i=1}^{m6} INFLATION_{t-1} + \lambda ECT_{t-1} + \mu t
\end{aligned}$$

.....(4)

$\Delta$ = The First difference operator

$\beta$ 's= Parameters of the long run estimator

$\alpha$ 's= Parameters of the short run estimator

$\Psi_0$ = The intercept

$\mu$ = The error term

### 3.5.3 Long Run and Short Run model Estimation

To obtain the long run coefficients the model is specified as below:

$$\begin{aligned}
\ln TOP = & \Psi_0 + \sum_{i=1}^m \beta_1 \ln TOP_{t-1} + \sum_{i=1}^{m1} \beta_2 \ln VOL_{t-1} + \sum_{i=1}^{m2} \beta_3 \ln GDP_{t-1} + \sum_{i=1}^{m3} \beta_4 REER_{t-1} \\
& + \sum_{i=1}^{m4} \beta_5 TOT_{t-1} + \sum_{i=1}^{m5} \beta_6 INFLATION_{t-1} + \mu t
\end{aligned}$$

.....(5)

The short run variable estimation model to obtain the coefficients of the parameters and the unrestricted error correction representation is specified as below:

$$\begin{aligned}
\ln TOP = & \Psi_0 + \alpha_1 \sum_{i=1}^m \ln TOP_{t-1} + \alpha_2 \sum_{i=1}^{m2} \ln VOL_{t-1} + \alpha_3 \sum_{i=1}^{m3} \ln GDP_{t-1} + \alpha_4 \sum_{i=1}^{m4} REER_{t-1} \\
& + \alpha_5 \sum_{i=1}^{m5} TOT_{t-1} + \alpha_6 \sum_{i=1}^{m6} INFLATION_{t-1} + \lambda ECT_{t-1} + \mu t
\end{aligned}$$

.....(6)

In the short run analysis:

$\lambda$ = The speed of adjustment to long run equilibrium following changes to the system

$ECT_{t-1}$ = Error correction term

According to Engel and Granger 1987, when variables are co-integrated, their dynamic relationship could be specified by an error correction representation in which an error correction term (ECT) computed from the long run equation must be incorporated in order to capture both the long run and the short run relationships. ECT indicates the amount of time required for the short run shocks to adjust to the long run equilibrium. Thus, the residuals of the long run model can be treated as the equilibrium residual and it can be used to connect the short run behavior of the models dependent variables to its long run value. It is vital since it articulates information for the speed of adjustment from short run disturbance to long run equilibrium. It is expected to be statistically significant with a negative sign which implies that any disturbance that occurs in the short run model will be corrected in the long run. The larger the coefficients of the error correction term in absolute terms the faster the convergence to the equilibrium.

#### **3.5.4 Post Diagnostic Tests**

To test the robustness of the ARDL model adopted in estimating the variables and the long run and short run analysis it is important to conduct post diagnostic tests. For the model adopted in this paper tests of Serial correlation, testes for hetroskasticity, tests for normality and tests for stability has been conducted.

# CHAPTER FOUR

## 4. Data Analysis and Discussions

This section covers the descriptive and econometric data analysis. In the first section the variable's statistic properties and trend analysis would be discussed. In the following section the research findings would be discussed with the support of theoretical and empirical evidences.

### 4.1 Descriptive Analysis for the Variables

It is undisputable that thorough understanding of the data is very important before embarking on econometric analysis. Therefore, different tools of descriptive statistics such as measures of central tendency, graphs and charts were employed in an effort to check the properties of the variables. All these tools help to identify the characteristics of the variables over the research period. Moreover, a comprehensive observation of the data helps to make meaningful interpretation of econometric results. Bearing this in mind, the following section elaborates the preliminary analysis of the data and associated variables.

Table 4.1: Statistical summary of variables

	LTOP	LVOL	LGDP	REER	TOT	INFLATION
Mean	-0.910355	0.328826	4.283591	130.2312	0.230742	14.66444
Median	-0.913256	0.400271	4.335904	130.8000	0.221080	10.61171
Max	-0.852562	0.700230	4.641732	172.1000	0.404229	61.81738
Min	-0.943390	-0.819915	3.586700	93.30000	0.139227	-3.873358
Std. Dev.	0.021365	0.317368	0.296401	23.89818	0.061422	11.86173

*Source: Researcher's own construct using E-view 10*

The table above shows the statistical summary of the variables over the research period covering sixteen years.

#### 4.1.1 Trend Analysis of the Variables

This study attempts to investigate the impact of foreign exchange rate risk on international trade performance using trade openness as a proxy. Below are the trend analysis of the components of trade openness and exchange rate volatility.

##### *Exchange rate volatility*

Ever since the adoption of the managed floating exchange rate system, the Ethiopian Birr has experienced continuous depreciation. The Ethiopian government has significantly devalued the currency over the period in an effort to encourage the export sector and improve performance in international trade and due to pressure exerted by other internal and external factors. The below graph shows the movement of the real effective exchange rate over the research period.

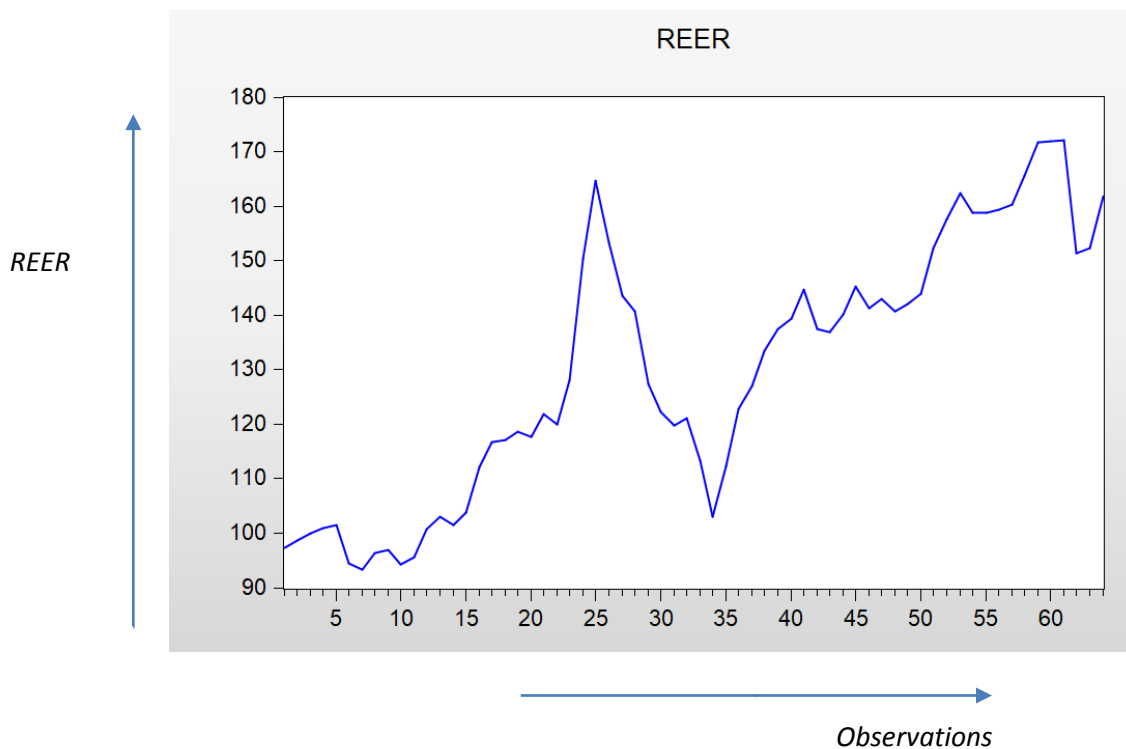


Figure 4.1: REER movement

Source: Researcher's own construct using E-view 10

### *Foreign Trade of Ethiopia*

According to the report of the National Bank of Ethiopia, the history of the balance of payment of Ethiopia shows continuous deficit. In the fiscal year 2015/16 for instance, the merchandise import bills were five times higher than that of merchandise export. Ethiopia basically being an agrarian economy, its export commodities are highly dominated by primary products and the imports are mostly processed and semi processed products. The tables below show the main exports and imports of Ethiopia.

Table 4.2: Export of few selected commodities in millions of dollars

<i>Commodities/ Year</i>	<i>Coffee</i>	<i>Oil Seeds</i>	<i>Leather and Leather products</i>	<i>Pulses</i>	<i>Meat &amp; Meat Prod.</i>	<i>Fruits &amp; Veg</i>	<i>Live Animals</i>	<i>Chat</i>
2002/03	\$ 41.31	\$ 11.52	\$ 13.05	\$ 5.00	\$ 0.61	\$ 2.39	\$ 1.54	\$ 14.51
2003/04	\$ 55.89	\$ 20.90	\$ 11.09	\$ 6.68	\$ 1.92	\$ 1.79	\$ 0.52	\$ 22.01
2004/05	\$ 83.80	\$ 31.26	\$ 16.91	\$ 8.86	\$ 3.64	\$ 4.02	\$ 3.20	\$ 25.05
2005/06	\$ 88.56	\$ 52.85	\$ 18.76	\$ 9.24	\$ 4.63	\$ 3.30	\$ 6.89	\$ 22.27
2006/07	\$ 106.05	\$ 46.86	\$ 22.40	\$ 17.57	\$ 3.87	\$ 4.04	\$ 9.19	\$ 23.20
2007/08	\$ 131.12	\$ 54.69	\$ 24.80	\$ 35.91	\$ 5.22	\$ 3.21	\$ 10.21	\$ 27.08
2008/09	\$ 93.97	\$ 89.02	\$ 18.81	\$ 22.68	\$ 6.65	\$ 3.03	\$ 13.17	\$ 34.68
2009/10	\$ 132.08	\$ 89.63	\$ 14.09	\$ 32.53	\$ 8.50	\$ 7.87	\$ 22.68	\$ 52.38
2010/11	\$ 210.44	\$ 81.66	\$ 25.95	\$ 34.46	\$ 15.82	\$ 7.87	\$ 36.97	\$ 59.58
2011/12	\$ 208.26	\$ 118.08	\$ 27.48	\$ 39.92	\$ 19.70	\$ 11.23	\$ 51.77	\$ 60.09
2012/13	\$ 186.66	\$ 110.86	\$ 30.27	\$ 58.34	\$ 18.56	\$ 10.97	\$ 41.60	\$ 67.82
2013/14	\$ 178.60	\$ 162.97	\$ 32.45	\$ 62.67	\$ 18.65	\$ 11.49	\$ 46.67	\$ 74.34
2014/15	\$ 195.12	\$ 127.52	\$ 32.89	\$ 54.96	\$ 23.20	\$ 11.89	\$ 37.13	\$ 68.10
2015/16	\$ 180.68	\$ 119.30	\$ 28.82	\$ 58.10	\$ 24.10	\$ 13.42	\$ 36.95	\$ 65.61
2016/17	\$ 220.80	\$ 87.76	\$ 28.50	\$ 69.98	\$ 24.67	\$ 14.03	\$ 16.91	\$ 68.25
2017/18	\$ 179.90	\$ 88.26	\$ 27.33	\$ 55.78	\$ 21.94	\$ 12.81	\$ 15.28	\$ 65.79

*Source: National bank of Ethiopia*

Almost all of the export commodities are primary goods. Coffee, the leading export commodity of Ethiopia shows a strong increasing pattern except for the fluctuation caused by the sudden

decrease in 2008/09 and 2017/18. Oilseeds follow the pattern of coffee with a rapid growth specially starting from the year 2008/09. Other export commodities like pulses, meat, fruits and vegetables, live animals and chat are also increasing in total amount although their share is relatively smaller. The export of Leather and leather products however has shown comparatively slower growth rate.

Table 4.3: Import of few selected commodities in millions of dollars

<i>Commodities/ Year</i>	<i>Raw Materials</i>	<i>Semi- finished Goods</i>	<i>Fuel</i>	<i>Capital Goods</i>	<i>Transport</i>	<i>Industrial</i>	<i>Consumer Goods</i>	<i>Durables</i>	<i>Non- Durables</i>
2002/03	\$ 5	\$ 69	\$ 72	\$ 137	\$ 44	\$ 92	\$ 164	\$ 46	\$ 118
2003/04	\$ 6	\$ 109	\$ 78	\$ 219	\$ 75	\$ 142	\$ 224	\$ 74	\$ 150
2004/05	\$ 12	\$ 166	\$ 167	\$ 300	\$ 93	\$ 201	\$ 247	\$ 84	\$ 162
2005/06	\$ 19	\$ 205	\$ 163	\$ 363	\$ 107	\$ 246	\$ 320	\$ 104	\$ 217
2006/07	\$ 37	\$ 200	\$ 219	\$ 467	\$ 158	\$ 300	\$ 329	\$ 130	\$ 199
2007/08	\$ 64	\$ 315	\$ 405	\$ 444	\$ 95	\$ 339	\$ 379	\$ 115	\$ 264
2008/09	\$ 89	\$ 285	\$ 314	\$ 619	\$ 96	\$ 515	\$ 596	\$ 169	\$ 427
2009/10	\$ 53	\$ 307	\$ 328	\$ 722	\$ 127	\$ 579	\$ 629	\$ 216	\$ 413
2010/11	\$ 46	\$ 307	\$ 415	\$ 689	\$ 172	\$ 501	\$ 574	\$ 217	\$ 357
2011/12	\$ 50	\$ 489	\$ 531	\$ 740	\$ 202	\$ 508	\$ 883	\$ 276	\$ 607
2012/13	\$ 36	\$ 474	\$ 544	\$ 956	\$ 229	\$ 694	\$ 801	\$ 201	\$ 600
2013/14	\$ 42	\$ 558	\$ 643	\$ 1,211	\$ 272	\$ 897	\$ 924	\$ 294	\$ 630
2014/15	\$ 43	\$ 645	\$ 510	\$ 1,721	\$ 425	\$ 1,278	\$ 1,128	\$ 402	\$ 726
2015/16	\$ 37	\$ 724	\$ 335	\$ 1,707	\$ 384	\$ 1,303	\$ 1,316	\$ 392	\$ 924
2016/17	\$ 31	\$ 655	\$ 446	\$ 1,508	\$ 357	\$ 1,132	\$ 1,225	\$ 427	\$ 798
2017/18	\$ 34	\$ 632	\$ 579	\$ 1,317	\$ 283	\$ 1,022	\$ 1,177	\$ 338	\$ 839

*Source: National Bank of Ethiopia*

The import of Ethiopia has an overall increasing pattern. The total amount only decreased in the year 2016/17 from a continues ride up the road since 2002/03. After the year 2016/17 only the import of fuel has increased.

Although the tables above are not inclusive of the overall exports and imports of the country the information could shed light on the consistent current account balance deficit. Form what we can

understand from the above figures the amount of imports outweighs the amount of export, even though both are on an increasing trend the import is increasing at a higher rate than the export causing the balance of payment to show deficit. The below group analysis for overall import and export was computed using E-view and it graphically demonstrates the trend for the sixteen years' period.

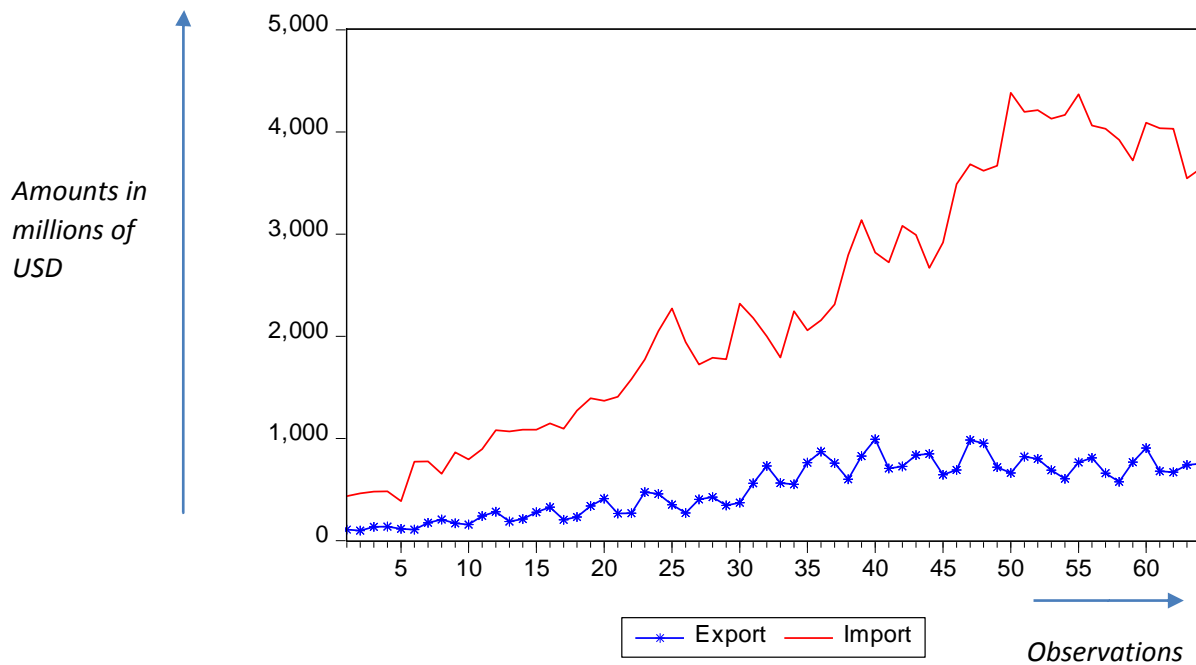


Figure 4.2: Import and Export of Ethiopia

Source: Researcher’s own construct using E-view 10

**Gross Domestic Product**

The growth of gross domestic product values in the exporting country implies increased capacity for export. For instance, Kumar (1998) in his study on the determinants of export growth in developing countries confirmed that GDP has a significant positive impact on export volume. He also underlined that higher level of production is the main cause of export expansion. Therefore, a higher GDP implies a higher production and hence larger volume of exports. According to world bank reports, the Ethiopian economy has been rapidly growing in the last few years and the rate of gross domestic product has recorded a double digit increase. The below figure shows the trend of the growth rate of gross domestic products between the years 2002/03 and 2017/18.

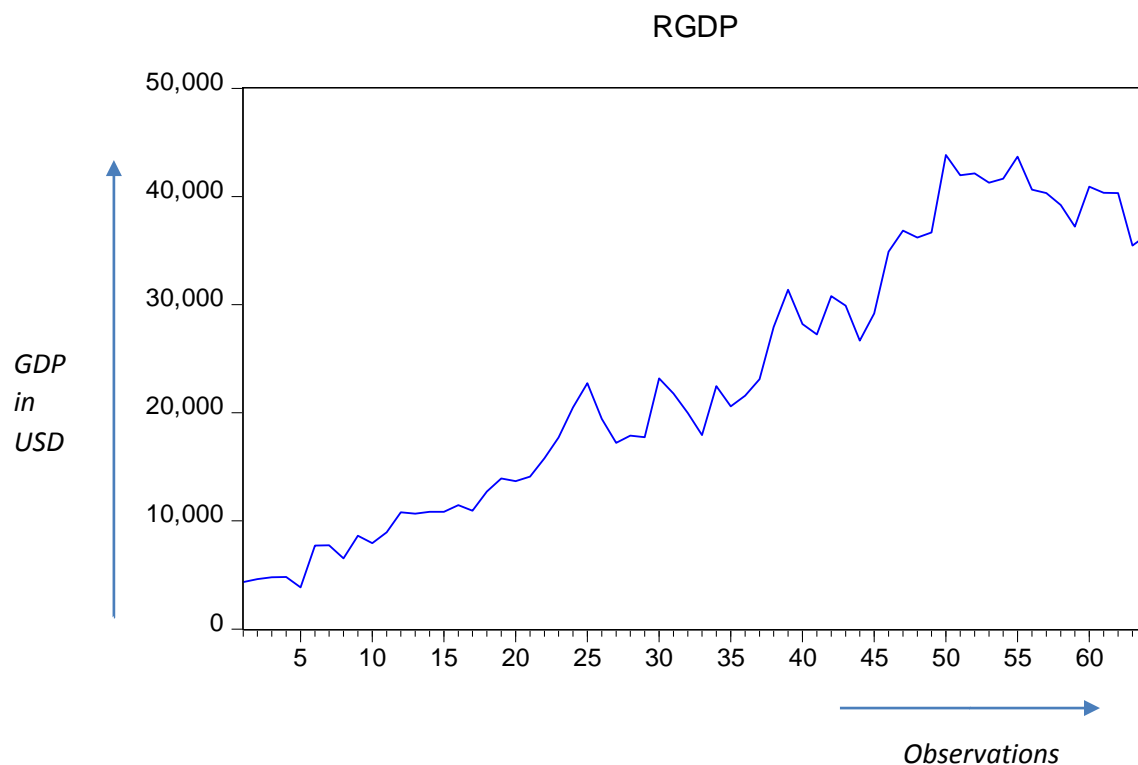


Figure 4.3: Gross Domestic Product of Ethiopia

Source: Researcher's own construct using E-view 10

## 4.2 Econometric Data Analysis

### 4.2.1 Test of Stationarity

The ARDL model does not require pre testing the stationarity of variables, however, it is important to run the unit root test before applying the Autoregressive Distributed Lag Model so as to check the properties of the data. It is vital to conduct this test to verify that the variables are not integrated in an order higher than one and that the dependent variable is stationary at first difference. Therefore, each series was tested for stationarity in levels and first differences using the standard Augmented Dicky- Fuller (ADF) and Phillips- Peron Test to establish their order of integration. The study took the P-values to make the unit root decisions to the rejection or acceptance of the null hypothesis that the series contains unit root which arrived at similar conclusion with the critical values. The rejection of the null hypothesis for the test is based on the MacKinnon (1991) critical values as well as the probability values.

The null hypothesis of non-stationarity or unit root was accepted with the precondition that the absolute values of the computed ADF statistics exceed the absolute critical value at 5% level of significance.

Table 4.4: ADF and PP at level and at First difference

Variable	Variable in Level		Variable in 1 <sup>st</sup> difference		Order of Integration
	ADF	PP	ADF	PP	
<b>LTOP</b>	0.3861	0.0004	0.0004	0.0000	I(1)
<b>LVOL</b>	0.0665	0.0852	0.0000	0.0000	I(0)
<b>LGDP</b>	0.2482	0.0432	0.0000	0.0000	I(1)
<b>REER</b>	0.5445	0.6334	0.0000	0.0001	I(1)
<b>LTOT</b>	0.3669	0.0001	0.0004	0.0000	I(1)
<b>INF</b>	0.0003	0.2055	0.0000	0.0037	I(0)

Source: Researcher's own construct using E-view 10

The results confirm that all the series are I(1), with the exception of the exchange rate volatility (LVOL) and gross domestic product (LGDP), which are I(0). In other words, unit root tests show that the dependent variable is I(1) and the independent variables are a mixture of I(0) and I(1). Thus, the ARDL approach is more suitable than other approaches for examining relationships in levels of variables. The test result of each variable is included in the appendix.

#### 4.2.2 Determination of the Lag Length

After confirming stationarity of the data, it is important to identify the optimal lag length to estimate the ARDL model. The lag length selection criteria, which are the sequential modified Likelihood Ratio test statistic (LR), Final Prediction Error (FPE), Akaike Information Criteria (AIC) and Hannan-Quinn Information Criteria (HQIC) have been employed in this study. According to the information criteria of these four methods the selected optimal lag length is 4.

Table 4.5: Lag length selection

VAR Lag Order Selection Criteria  
 Endogenous variables: LTOP LVOL LGDP REER TOT  
 INFLATION  
 Exogenous variables: C

Sample: 1 64  
 Included observations: 60

Lag	LogL	LR	FPE	AIC	HQ
0	-29.89729	NA	1.33e-07	1.196576	1.278498
1	204.1203	413.4310	1.82e-10	-5.404009	-4.830559
2	260.0376	87.60381	9.73e-11	-6.067919	-5.002942
3	304.3711	60.58916	8.09e-11	-6.345704	-4.789198
4	374.8365	82.20964*	3.10e-11*	-7.494551*	-5.446517*

Source: Researcher's own construct using E-view 10

#### 4.2.3 Bound Test for Co-Integration

The critical step in conducting an econometric analysis using the ARDL model should be checking the existence of long run relationship between dependent and independent variables. The bound test procedure is based on the assumption that the variables are I(1) or I(0), in the presence of I (2) variables the computed F-statistics developed by Pesaran et.al (2001) are not valid Fosu (2006). For various situations, those authors give lower and upper bounds on the critical values. In each case, the lower bound is based on the assumption that all the variables are I(0), and the upper bound is based on the assumption that all the variables are I(1). If the estimated F-statistic falls below the lower bound we cannot reject the null hypothesis, so no co-integration is possible. If the F-statistic exceeds the upper bound, we conclude that we have co-integration. Finally, if the F-statistic falls between the bounds, the test is inconclusive. If the long-run relationship is established between the variables, the long-run and short-run coefficients can be obtained by using the ARDL approach. From the lag selection criteria, we have learned that 4 is the optimal lag length for the given data set, therefore we apply this information to execute the bound test.

**Table 4.6: Bound Test Results**

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	3.395169	10%	2.08	3
K	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
			Finite Sample: n=60	
Actual Sample Size	60	10%	2.204	3.21
		5%	2.589	3.683
		1%	3.451	4.764

*Source: Researcher's own construct using E-view 10*

The result indicates that the F-statistic (3.395169) is significant at 2.5%, 5% and 10% level. Based on this information we can conclude that long run co-integration exists between the dependent and independent variables.

#### 4.2.4 Long Run Relationship Analysis

The below table shows the long run regression analysis results of the model:

Table 4.7: Long run analysis results

Levels Equation Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LVOL	-0.001085	0.000411	-2.638915	0.0123
LGDP	-0.001612	0.000917	-1.758513	0.0874
REER	7.10E-06	1.20E-05	0.591729	0.5578
TOT	0.347202	0.003010	115.3647	0.0000
INFLATION	-2.39E-05	1.13E-05	-2.120700	0.0411
C	-0.983702	0.002593	-379.4299	0.0000

$$EC = LTOP - (-0.0011*S2VOL -0.0016*LGDP + 0.0000*REER + 0.3472*TOT -0.0000*INFLATION -0.9837)$$

*Source: Researcher's own construct using E-view 10*

The impact of exchange rate volatility could vary from country to country or from time to time. The data management and modeling system also play critical roles. This analysis follows the measurement systems and model specification discussed in the methodology section. Holding other things constant, the long run analysis result shows that foreign exchange rate volatility with  $-0.001085$  coefficient negatively affects the international trade performance of Ethiopia. The coefficient with its negative sign shows the direction of impact, a one percent increase on exchange rate volatility would result in dropping the international trade performance of Ethiopia.

In developed countries the risk associated with exchange rate volatility could be resisted with different hedging techniques, diversification possibilities and many other factors. However, in developing and least developed countries like Ethiopia, where forward exchange markets are just in infancy, transaction hedging is relatively expensive and other risk diversification methods are limited, it makes its impacts more Sevier. In addition to this Ethiopian firms taking part in the international trade are not multinational companies with wide range of trade and financial transactions, had that been the case, the diverse opportunities might have offset the cost of the risk associated with exchange rate volatility. However, most of our international trade part takers are not diversified in nature. Scholars around the world have conducted researches to investigate the impact of exchange rate risk on international trade and reached into varying conclusions. In line with this study, Droodian (1999) have found out that exchange rate volatility negatively and significantly affects the international trade performance of India, Malaysia and South Korea. Arize and Malindretos (1998) Thuy (2019), Abuka (2014), Akhtar and Spence-Hilton (1984), and Abule (2012) have also concluded that exchange rate volatility negatively affects exports and international trade performances of New Zealand, Vietnam, Kenya, Germany, USA and Ethiopia respectively.

Inflation is negatively and significantly related with international trade performance while terms of trade has a positive and significant relationship. Based on the analysis results an increase in terms of trade ratio enhances trade whereas an increase in the rate of inflation would hamper the international trade performance of Ethiopia. A possible justification for this could be that, inflation causes prices to shoot exceeding the actual value of the good. In the international market consumers are assumed to be rational decision makers, therefore, goods with lower prices would attract more demand. On the other-hand, goods with inflated prices would lose market.

According to Bleaney and Fielding (1999), the median developing country has an inflation rate of about 10%, that is more than twice as high as the median industrial country. Siting Ghosh et al., (1995), the authors have stated that researches have suggested that developing countries which peg their exchange rates achieve lower inflation than those whose exchange rate floats. The Ethiopian Birr has been pegged to the USD until the early 1990s, a research with a period coverage that goes as far back as the early nineties could shed more light no this area.

Terms of trade is positively and significantly related with the performance of international trade. The result implies that a one-unit increase in the ratio of terms of trade would improve the trade performance of Ethiopia. A rise in the value of a currency lowers the domestic prices of its imports but may not directly affect the prices of the commodities it exports; in the case of Ethiopia the value of the currency has been consistently falling which affects the prices of exports. This result is in line with the findings of Abule (2012).

An increase in GDP is expected to enhance the performance of a country in the international market. It implies that the overall economic development is moving on an upward scale, this includes the growth of export. However, although insignificant, GDP and REER have unexpected direction of relationship with the dependent variable in the long run. This unexpected result is in line with the findings of Abule (2012) and Amezenech (2018).

The Ethiopian Birr has barely experienced an appreciation, it rather has continuously depreciated. Although devaluation is expected to improve the trade performance of a country by enhancing export and discouraging import, the trend analysis shows that both import and export have been increasing despite the measures taken. The increase in exports is dominated by the around four times heavier and increasing import. For primary commodities and manufactured exports with low in-country value added, the exchange rate matters much less than for highly price sensitive exports with more significant local content including labor. According to economic theories in the long run as interest rate and price of domestic goods decrease due to devaluation, imports were expected to decrease. However, in the Ethiopian case import persists to increase in a higher rate than export.

#### 4.2.5 Short Run Analysis

Table 4.8: Short run analysis results

ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LTOP(-1))	0.063666	0.161624	0.393916	0.6960
D(LTOP(-2))	-0.341111	0.126928	-2.687436	0.0109
D(LTOP(-3))	-0.357082	0.105302	-3.391037	0.0017
LVOL	0.000148	0.000355	0.415890	0.6800
D(LGDP)	-0.005527	0.001515	-3.647314	0.0009
D(LGDP(-1))	-0.000353	0.001405	-0.251268	0.8031
D(LGDP(-2))	-0.003545	0.001403	-2.526252	0.0162
D(REER)	-2.76E-05	1.48E-05	-1.867782	0.0702
D(REER(-1))	-3.53E-06	1.29E-05	-0.273180	0.7863
D(REER(-2))	1.87E-05	1.22E-05	1.529786	0.1351
D(REER(-3))	2.48E-05	1.37E-05	1.807541	0.0793
D(TOT)	0.342480	0.002416	141.7839	0.0000
D(TOT(-1))	-0.026523	0.056639	-0.468289	0.6425
D(TOT(-2))	0.113297	0.044494	2.546354	0.0154
D(TOT(-3))	0.117880	0.036688	3.213022	0.0028
D(INFLATION)	1.15E-05	1.35E-05	0.852041	0.4000
D(INFLATION(-1))	2.60E-05	1.53E-05	1.701939	0.0976
D(INFLATION(-2))	4.52E-05	1.85E-05	2.443663	0.0197
CointEq(-1)*	-0.973302	0.184463	-5.276399	0.0000
R-squared	0.999722	Mean dependent var	-0.000439	
Adjusted R-squared	0.999600	S.D. dependent var	0.022798	
S.E. of regression	0.000456	Akaike info criterion	-12.29520	
Sum squared resid	8.53E-06	Schwarz criterion	-11.63200	
Log likelihood	387.8561	Hannan-Quinn criter.	-12.03579	
Durbin-Watson stat	1.741432			

Source: Researcher's own construct using E-view 10

After accepting the long run analysis results, the short run error correction model was estimated. The ECM indicates the speed of adjustment to restore equilibrium in the dynamic model. It is a five periods lagged residuals obtained from regressing the long run dynamic model. The automatically selected time is as below:

ARDL Error Correction Regression  
 Dependent Variable: D(LTOP)  
 Selected Model: ARDL(4, 1, 3, 4, 4, 3)  
 Case 2: Restricted Constant and No Trend  
 Sample: 1 64  
 Included observations: 60

The error correction estimate results for the short run situation in the analysis estimated at 0.973302 is highly significant and has the expected sign, negative. The error correction model helps to correct for disequilibrium in the short run and therefore the negative coefficient in the results above is a confirmation that the disequilibrium caused by the impact of the explanatory variables would adjust. The coefficient 0.973302 is rather over stated that it implies an adjustment of almost 100%. This overstatement could be explained by the National Bank intervention to prevent the exchange rate fluctuation from deteriorating the federal reserve.

In consistency with Thuy (2019), in the short run, exchange rate volatility is positively related with the international trade performance of Ethiopia. However, the result is insignificant. Surprisingly in the short run, GDP is negatively and significantly related with the dependent variable, this result is consistent with Amezenech (2018).

Real Effective Exchange Rate is negatively and insignificantly related with international trade performance of Ethiopia. REER is inversely related with trade competitiveness. When the value of REER falls either because of a decrease in exchange rate or a decline in the inflation differential or both, it shows real depreciation of the exchange rate and thus enhanced competitiveness of the country's goods in relation to foreign goods. However, the result is insignificant at 5%.

TOT shows consistency with its positive and significant relationship with the dependent variables both in the short run and long run. Inflation shows insignificant relationship in the short run.

### **4.3 Post Analysis Diagnostics Tests**

#### **4.3.1 Test for Serial Correlation**

One of the criteria to apply the ARDL model is that the assumption of no correlation between the variables. Therefore, correlation test was performed to check whether serial correlation existed in the model or not. The Null hypothesis of no serial correlation ( $H_0 =$  No serial Correlation) was tested against the alternative hypothesis of serial correlation existence. The null hypothesis is rejected in favor of the alternative hypothesis if the probability of F- Statistics is significant at five percent.

Breusch- Godfrey Serial correlation LM test has been conducted and the result is presented in the appendix.

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.867540	Prob. F(4,31)	0.4944
Obs*R-squared	6.040283	Prob. Chi-Square(4)	0.1962

*Source: Researcher's own construct using E-view 10*

The probability F-Statistic of the test (0.4944) is statistically insignificant at 5%. The result indicates failure to reject the null hypothesis and conclude that there is no serial correlation.

#### 4.3.2 Test for Heteroscedasticity

The Breusch-Pagan-Godfrey, Harvey and ARCH tests of heteroscedasticity was conducted to check the existence of heteroscedasticity problem. The null hypothesis (H0= No Heteroscedasticity) has been tested against the alternative (H1= Heteroscedasticity exists).

The null hypothesis would be rejected in favor of the alternative hypothesis in cases where the probability of the F- Statistics is significant at 5%.

Heteroskedasticity Test: ARCH

F-statistic	1.767770	Prob. F(4,51)	0.4635
Obs*R-squared	6.818893	Prob. Chi-Square(4)	0.4385

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.863028	Prob. F(33,25)	0.6583
Obs*R-squared	31.41956	Prob. Chi-Square(33)	0.5459
Scaled explained SS	4.113445	Prob. Chi-Square(33)	1.0000

Heteroskedasticity Test: Harvey

F-statistic	0.834319	Prob. F(33,25)	0.6907
Obs*R-squared	30.92216	Prob. Chi-Square(33)	0.5709
Scaled explained SS	21.22780	Prob. Chi-Square(33)	0.9435

*Source: Researcher's own construct using E-view 10*

The complete Heteroscedasticity test results for the three testing methods is presented on the appendix. The result of the F-statistics is statistically insignificant with levels for The Breusch-Pagan-Godfrey (0.6583), Harvey (0.6907) and ARCH (0.4635). Based on the result we can conclude that heteroscedasticity problem doesn't exist in our model since we have failed to reject the null hypothesis.

#### 4.3.3 Test for Normality

The Jarque- Bera test confirms that the residuals in the model are normally distributed with significance level of 0.791938.

The test result is presented below:

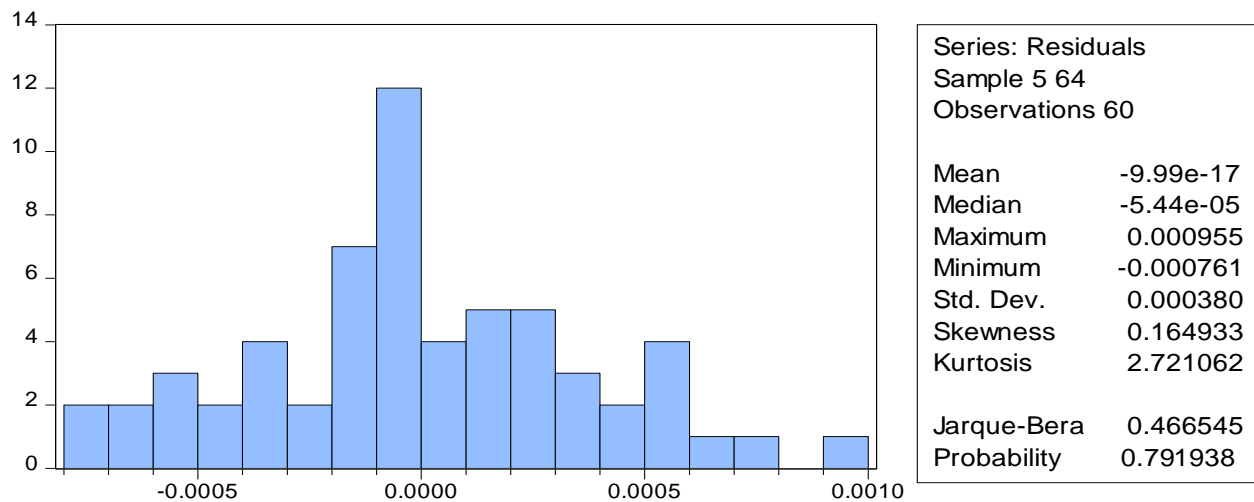


Figure 4.4: Result of normality test

Source: Researcher's own construct using E-view 10

#### 4.3.4 Test for Model Stability

In order to analyze the stability of the long run coefficients together with the short run dynamics we applied the Cumulative Sum (CUSUM) and Cumulative Sum Square (CUSUMSQ) approaches. Conducting a stability test is vital in dealing with time series data specially when the time where structural change took place is uncertain.

According to Bahamani –Oskooee 2004, the stability of the regression coefficients is evaluated by stability tests and they can show whether or not the parameter estimates are stable over time.

Below presented are the results of the CUSUM and CUSUMSQ tests. The null hypothesis states that the coefficient vector is the same in every period as the alternative hypothesis stands against it. The tests are plotted against the critical bond of five percent significance level and the plots of both the CUSUM and CUSUMSQ remain within the boundaries of the 5 percent significance level. Below presented is the plot of the test results:

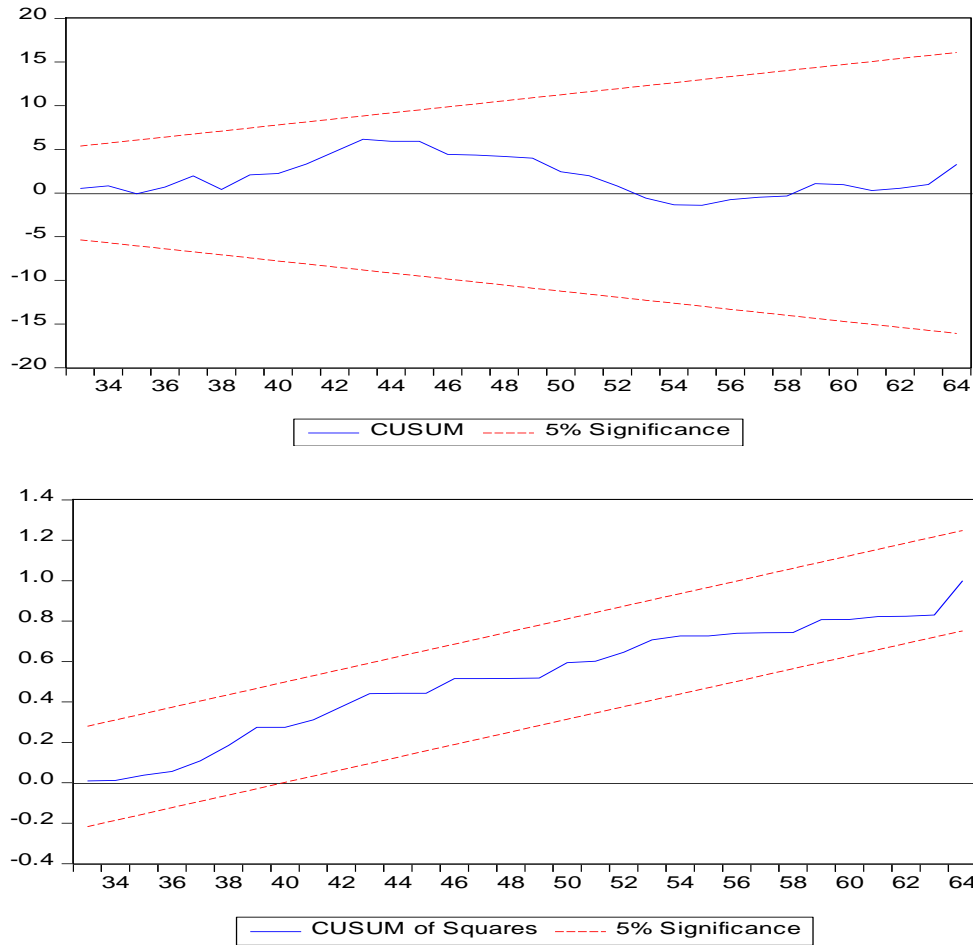


Figure 4.5: Result of stability test

Source: Researcher's own construct using E-view 10

With this result we have failed to reject the null hypothesis and confirmed the stability of the long run coefficients over the sample period.

## **CHAPTER FIVE**

### **5 Summary, Conclusion and Recommendations**

#### **5.1 Summary of Findings**

The study discovered that long run co-integration exists between international trade performance and real exchange rate volatility, real gross domestic products, real effective exchange rate, terms of trade and inflation. Based on the long run and short run analysis conducted, it is possible to conclude that exchange rate volatility negatively affects the trade performance of Ethiopia. The result implies that as the exchange rate becomes more volatile the trade performance of Ethiopia deteriorates. Similarly, inflation has negative relationship with foreign trade. On the other hand, terms of trade is positively related with trade openness, the proxy used for international trade performance of Ethiopia. The overall trend analysis indicates that both import and exports of Ethiopia are increasing, import more rapidly than export.

#### **5.2 Conclusion**

This study attempted to examine the foreign exchange rate risk impact on international trade performance of Ethiopia during 2002 and 2018. Standard deviation of the real effective exchange rate was used as a measure of exchange rate volatility. This study applied the Autoregressive Distributed Lag (ARDL) model to investigate the existence of long run relationship and co-integration among variables in the model and implements it using EVIEWS software offered by IHS Markit (London, UK). The advantage of this approach is that it is suitable for small sample size and regressors which are a mixture of  $I(0)$  and  $I(1)$ .

The General objective of the research is to investigate the impact of foreign exchange risk on International Trade performance of Ethiopia and the specific objectives, investigating the relationship between exchange rate volatility and international trade flows of Ethiopia, estimating the magnitude of impact foreign exchange rate volatility has on Trade Openness (TOP) as a measure of international trade performance, and empirically estimating the short run and long run relationship between international trade and Real Effective Exchange Rate (REER), Gross Domestic Product (GDP) Terms of trade and Inflation have been addressed. This study has successfully answered the research questions.

### 5.3 Recommendations

Ethiopia is becoming more open to the international market, in order to be more competent, in addition to the monetary policy interventions that highly encourage devaluation, it might be better to put more emphasis on incentivizing the discovery of our export potential, for instance by improving the value addition and diversification of our export commodities. At the same time measures should be taken to substitute our imports with domestic products.

From a monetary policy view, given our financial stance, leaving the exchange rate to float with market forces would do more harm than good. Therefore, it is important that the National Bank interferes to mediate the movement. The Ethiopian Birr has been depreciating consistently and if left to float, it might experience a sharp depreciation resulting in speculative moves that would disrupt the market in the short run. In the long run it would deprive the government of cheap and targeted access to forex forcing it to participate in the market.

In Ethiopia the trend of the exchange rate fluctuation is one sided, devaluation, in order to mitigate impacts accompanying measure to reduce the effect of speculative purchases, contractionary monetary and fiscal policies may be needed. For so long the government has been raising low import and export elasticity to exchange rate as a reason not to float, supported by the government export is increasing, however, its constantly being offset by import that's been increasing in even a higher rate. Therefore, taking more actions in improving the ease of doing business, improving product competitiveness, for instance by improving domestic product quality, modernizing the trading system, and adding value to export items could the international trade performance of Ethiopia. Value addition and quality improvement would boost the value of Ethiopian products in the international market. This could help domestic firms to become more competitive and through time become more diverse in production and business engagements.

Finally, since not many studies were conducted in the area of exchange rate volatility and its impacts in developing countries, particularly in Ethiopia, more studies should investigate the impact of foreign exchange rate risk on major imports and exports to analyze its impact separately.

## Reference

- Abule and Abdi (2012). Evaluation of Effect of Exchange rate Variability on Export of Ethiopia's Agricultural Product: Case of Oilseeds, Vol 13, No. 11, 2012.
- Abule Mehare (2012). Evaluation of Effect of Exchange Rate Variability on Export of Ethiopia's Agricultural Products: Case of Coffee, Flower and Oilseeds, University of Malawi.
- Akhtar, M. & Hilton, R.S. (1984). Effects of exchange rate uncertainty on German and U.S. trade. Federal Reserve Bank of New York, Quarterly Review, (Spring).
- Akila, W. (2004). Exchange Rate Systems in South Africa. Journal of Economic developments and change in South Africa, 54 (4).
- Aklilu Abebe (2108). The Economy Wide Impact of the Devaluation of Ethiopian Currency: A Recursive Dynamic Computable General Equilibrium Approach.
- Alemayehu, G., Abebe, S., and Kibrom Tafere (2008). Inflation in Ethiopia: What Caused it and Who is Paying for it. Memo, Department of Economics, Addis Ababa University, Ethiopia.
- Alessandro nicita (2013). United Nations Conference on Trade and Development, Policy Issues in International Trade and Commodities, Exchange Rates, International Trade and Trade Policies Study series no. 56.
- Amezenech Muluneh (2108). Exchange Rate Volatility and Impact on Coffee Export, Addis Ababa University.
- Andre C Jordaan Joel Hinaunye Eita, (2007). Export and Economic Growth in Namibia: A Granger Causality Analysis.
- Aristotelous, K. (2001). Exchange-rate volatility, exchange-rate regime, and trade volume: evidence from the UK-US export function (1889-1999). Economics Letters, July 2001, vol. 72(1). (8). Elsevier Science.
- Arize, A.C. (1996). The impact of exchange rate uncertainty on export growth: evidence from Korean data. International Economic Journal 10.

- Arize, Augustine Chuck, and John Malindretos. (1998). The long-run and short-run effects of exchange-rate volatility on exports: The case of Australia and New Zealand. *Journal of Economics and Finance* 22.
- Aron, J. Elbadawi., I. & Kahn. (2002). Determinants of the real exchange rate in South Africa.
- Bagella, Michele, Leonardo Becchetti, and Iftekhar Hasan. (2006). Real effective exchange rate volatility and growth: A framework to measure advantages of flexibility vs. costs of volatility. *Journal of Banking* 30.
- Bah, I., & Amusa, H.A. (2003). Real exchange rate volatility and foreign trade: evidence from South Africa's exports to the United States. *The African Finance Journal*, 5 (2).
- Bahmani-Oskooee, M. (1991). Exchange rate uncertainty and the trade flows of the developing countries. *Journal of Developing Areas* 25.
- Bahmani-Oskooee, Mohsen, and Scott. W. Hegerty. (2007). Exchange rate volatility and trade flows: A review article. *Journal of Economic Studies* 34.
- Baldwin, R., Skudelny, F., & Taglioni, D. (2005). Trade Effect of the Euro: Evidence from Sectoral Data, European Central Bank Working Paper Series, No. 446
- Basu et al., (2000). Promoting growth in sub-saharan Africa: learning what works. *Economic Issues* No.23, Washington, DC: IMF.
- Biruk Tekle (2012). *The Impact of Exchange Rate Volatility on the Agricultural Exports of Sub Saharan African Countries*, Addis Ababa University, Ethiopia.
- Chang, F. & David, O. (2005). Exchange Misalignment and its Effects on Agricultural Producer Support Estimate: Empirical Evidence from India and China. *International Food Policy Research Institute (IFPRI), MTID Discussion Paper, No. 81, Washington DC.*
- Clark, P. (1973). Uncertainty, Exchange Risk, and the Level of International Trade. *Western Economic Journal*, 11 (3).
- Coric. Bruni., & Geoffrey, P. (2010). The Effects of Exchange Rate Variability on International Trade: A Meta-Regression Analysis. *Journal of Applied Economics*, 42.

- De Rosa, D., & Greene J. (1991). Will Contemporaneous Devaluations Hurt Exports from Sub-Saharan Africa? *Finance and Development journal*, 28 (2), 45-67.
- Doroodian, Khosrow. (1999). Does exchange rate volatility deter international trade in developing countries? *Journal of Asian Economics* 10
- Edwards, S. (1994). Real and monetary determinants of real exchange rate behavior: theory and evidence from developing countries. *Estimating equilibrium exchange rates*. Washington: Institute for International Economics
- Engle, Robert Fry, and Clive William John Granger. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica* 55.
- Ethier, Wilfred. 1973. International trade and the forward exchange market. *The American Economic Review* 63: 494–503.
- Hooper, Peter, and Steven W. Kohlhagen. (1978). The effect of exchange rate uncertainty on the prices and volume of international trade. *Journal of international Economics* 8.
- Jamal Bouoiyour and Refk Selmi (2013). *Exchange Volatility and Export Performance in Egypt: New Insights from Wavelet Decomposition and Optimal GARCH Model*, University of Pau.
- Jean Olivier Hairault and Thepthida Sopraseuth, (2004). *Exchange Rate Dynamics, A New Open Economy Macroeconomics Perspective*.
- Judith A. Giles and Cara L. Williams, (1999). *Export-led growth: A Survey of the Empirical Literature and Some Non-Causality Results*.
- Kandil, M. and Dincer Nergiz, N. (2008). “A comparative analysis of exchange rate fluctuations and economic activity: The cases of Egypt and Turkey”. *International Journal of Development Issues*, Emerald Group Publishing 7.
- Kebede B. (2011). *Does Real Exchange Rate Matter for Ethiopia’s Exports? A Gravity Model Analysis*, Addis Ababa University, Ethiopia.
- Kenen, P.B. & Rodrik, D. (1986). Measuring and analyzing the effects of short-term volatility in real exchange rates. *Review of Economics and Statistics* 68.

- Kiptui, C. (2007). Does exchange rate Volatility Harm exports? Empirical evidence from Kenya's Tea and horticulture exports, CSAE Conference Oxford, 2008
- Krugman, P. & Taylor L. (1978). "Contractionary effects of Devaluation". Journal of international economics.
- Krugman, P. R. (2003). "International Economics: Theory and Policy". Addison Wesley series in economics.
- M Melvin and SC Norrbinn (2013). International Money and Finance, Foreign Exchange Risk and Forecasting.
- Madura, J. (2007). International Financial Management. 7Th Edition, South Western Publishing Co.2007.
- Matsuyama, K., Kiyotaki, N., Matsui, A. (1993). Toward a theory of International Currency, RES 60, 283-307.
- McKenzie, M. D. (1999). The Impact of Exchange Rate Volatility in International Trade Flows. Journal of Economic Surveys, 13(1).
- McKenzie, M. D. and R. Brooks (1997): The Impact of Exchange Rate Volatility on German – U.S. Trade Flows. Journal of International Financial Markets, Institutions, and Money, 7.
- Nega Muhabaw (2013). What Determines the Export Performance of Ethiopia? A Time Series Analysis, Addis Ababa University.
- Nelson Mandela Abuka, (2014). The Effects of Exchange Rate Fluctuations on Export Earnings of Coffee Industry in Kenya, University of Nairobi.
- Nunnenkamp, Peter; Schweickert, Rainer (1990). Real exchange rates and economic growth in developing countries: Is devaluation contractionary? Kiel Institute for the World Economy, Kiel Working Paper, No. 405.
- Otieno, B., & Mudaki, K. (2011). Factors influencing real exchange rate and export sector performance in Kenya, School of business and economics, department of economics, Moi University.

- Pesaran, Mohammad Hashem, Yongcheol Shin, and Richard J. Smith. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics* 16.
- Pinelopi Koujianou Goldberg, Michael M. Knetter (1997). *The Effects of U.S. Trade Protection and Promotion Policies, Causes and Consequences of the Export Enhancement Program for Wheat*, University of Chicago Press.
- Salvator. D. (2004). *International Economics, Eighth Edition*, John Wiley & Sons USA.
- Sewasew Pawlos (2002). *The Relationship Between Import and GDP Growth in Ethiopia*.
- Siong Hook Law and Hui Boon Tan (2009). *The Role of Financial Development on Income Inequality in Malaysia*.
- Stambuli, P. K. (2006). "Revisiting a Policy of Currency Devaluation in African Countries". Surrey Institute of Global Economics Research.
- T. Palley (2002). *Domestic Demand- Led Growth: A New Paradigm for Development*
- Vinh Nguyen Thi Thuy and Duong Trinh Thi Thuy (2019). *The Impact of Exchange Rate Volatility on Exports in Vietnam: A Bounds Testing Approach*, Foreign Trade University.
- Williamson, J., (1994). "Estimates of FEERs," in *Estimating Equilibrium Exchange Rates*, Washington: Institute for International Economics.

## Appendix

### Appendix A

Null Hypothesis: D(LTOP) has a unit root

Exogenous: Constant

Lag Length: 3 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.641177	0.0004
Test critical values:		
1% level	-3.546099	
5% level	-2.911730	
10% level	-2.593551	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LTOP,2)

Method: Least Squares

Sample (adjusted): 6 64

Included observations: 59 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LTOP(-1))	-1.986305	0.427974	-4.641177	0.0000
D(LTOP(-1),2)	0.633077	0.334493	1.892646	0.0638
D(LTOP(-2),2)	-0.000830	0.222293	-0.003734	0.9970
D(LTOP(-3),2)	-0.242302	0.128717	-1.882444	0.0652
C	-0.001133	0.001789	-0.633330	0.5292
R-squared	0.849896	Mean dependent var		-8.07E-05
Adjusted R-squared	0.838777	S.D. dependent var		0.034074
S.E. of regression	0.013681	Akaike info criterion		-5.664623
Sum squared resid	0.010108	Schwarz criterion		-5.488560
Log likelihood	172.1064	Hannan-Quinn criter.		-5.595895
F-statistic	76.43772	Durbin-Watson stat		1.781262
Prob(F-statistic)	0.000000			

## Appendix B

Null Hypothesis: D(LVOL) has a unit root  
 Exogenous: Constant  
 Lag Length: 0 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-8.221791	0.0000
Test critical values:		
1% level	-3.540198	
5% level	-2.909206	
10% level	-2.592215	

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

Augmented Dickey-Fuller Test Equation  
 Dependent Variable: D(S2VOL,2)  
 Method: Least Squares

Sample (adjusted): 3 64  
 Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(S2VOL(-1))	-1.064867	0.129518	-8.221791	0.0000
C	-0.001165	0.027123	-0.042956	0.9659
R-squared	0.529773	Mean dependent var		0.003008
Adjusted R-squared	0.521936	S.D. dependent var		0.308823
S.E. of regression	0.213527	Akaike info criterion		-0.218379
Sum squared resid	2.735631	Schwarz criterion		-0.149762
Log likelihood	8.769748	Hannan-Quinn criter.		-0.191438
F-statistic	67.59785	Durbin-Watson stat		2.004062
Prob(F-statistic)	0.000000			

## Appendix C

Null Hypothesis: D(LGDP) has a unit root  
 Exogenous: Constant  
 Lag Length: 0 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-9.818420	0.0000
Test critical values:		
1% level	-3.540198	
5% level	-2.909206	
10% level	-2.592215	

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

Augmented Dickey-Fuller Test Equation  
 Dependent Variable: D(LGDP,2)  
 Method: Least Squares

Sample (adjusted): 3 64  
 Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	-1.232497	0.125529	-9.818420	0.0000
C	0.017899	0.007570	2.364331	0.0213
R-squared	0.616372	Mean dependent var		-0.000219
Adjusted R-squared	0.609978	S.D. dependent var		0.092568
S.E. of regression	0.057810	Akaike info criterion		-2.831575
Sum squared resid	0.200521	Schwarz criterion		-2.762958
Log likelihood	89.77884	Hannan-Quinn criter.		-2.804634
F-statistic	96.40137	Durbin-Watson stat		2.126568
Prob(F-statistic)	0.000000			

## Appendix D

Null Hypothesis: D(REER) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.542267	0.0000
Test critical values:		
1% level	-3.540198	
5% level	-2.909206	
10% level	-2.592215	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(REER,2)

Method: Least Squares

Sample (adjusted): 3 64

Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(REER(-1))	-0.690886	0.124658	-5.542267	0.0000
C	0.743528	0.816223	0.910937	0.3660
R-squared	0.338600	Mean dependent var		0.130645
Adjusted R-squared	0.327577	S.D. dependent var		7.765341
S.E. of regression	6.367688	Akaike info criterion		6.572076
Sum squared resid	2432.847	Schwarz criterion		6.640694
Log likelihood	-201.7344	Hannan-Quinn criter.		6.599017
F-statistic	30.71672	Durbin-Watson stat		1.811493
Prob(F-statistic)	0.000001			

## Appendix E

Null Hypothesis: D(TOT) has a unit root

Exogenous: Constant

Lag Length: 3 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.650625	0.0003
Test critical values:		
1% level	-3.546099	
5% level	-2.911730	
10% level	-2.593551	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(TOT,2)

Method: Least Squares

Sample (adjusted): 6 64

Included observations: 59 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TOT(-1))	-1.982027	0.426185	-4.650625	0.0000
D(TOT(-1),2)	0.635886	0.333468	1.906887	0.0619
D(TOT(-2),2)	-0.002033	0.221485	-0.009178	0.9927
D(TOT(-3),2)	-0.234746	0.128855	-1.821786	0.0740
C	-0.003220	0.005159	-0.624123	0.5352
R-squared	0.847804	Mean dependent var		-0.000237
Adjusted R-squared	0.836531	S.D. dependent var		0.097581
S.E. of regression	0.039453	Akaike info criterion		-3.546467
Sum squared resid	0.084054	Schwarz criterion		-3.370405
Log likelihood	109.6208	Hannan-Quinn criter.		-3.477740
F-statistic	75.20159	Durbin-Watson stat		1.793758
Prob(F-statistic)	0.000000			

## Appendix F

Null Hypothesis: INFLATION has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.633950	0.0003
Test critical values:		
1% level	-3.540198	
5% level	-2.909206	
10% level	-2.592215	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(INFLATION)

Method: Least Squares

Sample (adjusted): 3 64

Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFLATION(-1)	-0.247337	0.053375	-4.633950	0.0000
D(INFLATION(-1))	0.660723	0.097665	6.765208	0.0000
C	3.536347	0.997679	3.544575	0.0008
R-squared	0.478572	Mean dependent var		-0.111846
Adjusted R-squared	0.460896	S.D. dependent var		6.577143
S.E. of regression	4.829181	Akaike info criterion		6.034408
Sum squared resid	1375.938	Schwarz criterion		6.137334
Log likelihood	-184.0666	Hannan-Quinn criter.		6.074819
F-statistic	27.07538	Durbin-Watson stat		1.805426
Prob(F-statistic)	0.000000			

## Appendix G

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.867540	Prob. F(4,31)	0.4944
Obs*R-squared	6.040283	Prob. Chi-Square(4)	0.1962

Test Equation:  
 Dependent Variable: RESID  
 Method: ARDL

Sample: 5 64  
 Included observations: 60  
 Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LTOP(-1)	-0.118886	0.194338	-0.611752	0.5452
LTOP(-2)	-0.170322	0.201659	-0.844601	0.4048
LTOP(-3)	0.026460	0.172321	0.153552	0.8790
LTOP(-4)	-0.090697	0.149857	-0.605219	0.5494
S2VOL	0.000246	0.000472	0.521473	0.6057
S2VOL(-1)	-0.000231	0.000445	-0.519040	0.6074
LGDP	0.000170	0.002461	0.069248	0.9452
LGDP(-1)	0.000445	0.002154	0.206656	0.8376
LGDP(-2)	-0.000567	0.002214	-0.256035	0.7996
LGDP(-3)	-0.000260	0.002284	-0.113736	0.9102
REER	-4.39E-06	2.08E-05	-0.211518	0.8339
REER(-1)	1.31E-05	2.80E-05	0.467515	0.6434
REER(-2)	-8.39E-06	2.41E-05	-0.347706	0.7304
REER(-3)	-1.52E-06	2.54E-05	-0.059768	0.9527
REER(-4)	3.25E-06	1.87E-05	0.173828	0.8631
TOT	-0.000403	0.003280	-0.122868	0.9030
TOT(-1)	0.042076	0.067307	0.625142	0.5365
TOT(-2)	0.058260	0.069311	0.840559	0.4070
TOT(-3)	-0.008581	0.059327	-0.144645	0.8859
TOT(-4)	0.031210	0.051861	0.601797	0.5517
INFLATION	5.00E-06	1.69E-05	0.295693	0.7694
INFLATION(-1)	1.52E-07	2.96E-05	0.005127	0.9959
INFLATION(-2)	-1.11E-05	3.28E-05	-0.338409	0.7373
INFLATION(-3)	5.88E-06	2.35E-05	0.250049	0.8042
C	-0.349414	0.337978	-1.033836	0.3092
RESID(-1)	0.207541	0.279826	0.741680	0.4639
RESID(-2)	0.374681	0.298378	1.255723	0.2186
RESID(-3)	-0.098878	0.274306	-0.360467	0.7209
RESID(-4)	0.208733	0.257591	0.810327	0.4239
R-squared	0.100671	Mean dependent var	-9.99E-17	
Adjusted R-squared	-0.711625	S.D. dependent var	0.000380	
S.E. of regression	0.000497	Akaike info criterion	-12.06798	
Sum squared resid	7.67E-06	Schwarz criterion	-11.05571	
Log likelihood	391.0393	Hannan-Quinn criter.	-11.67202	
F-statistic	0.123934	Durbin-Watson stat	2.016771	
Prob(F-statistic)	1.000000			

## Appendix H

Heteroskedasticity Test: ARCH

---

---

F-statistic	0.940494	Prob. F(4,51)	0.4635
Obs*R-squared	4.818244	Prob. Chi-Square(4)	0.4385

---

---

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Sample (adjusted): 11 64

Included observations: 54 after adjustments

---

---

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.41E-07	4.44E-08	3.175186	0.0026
RESID^2(-1)	0.196271	0.157746	1.244222	0.2195
RESID^2(-2)	-0.163271	0.157543	-1.036354	0.3052
RESID^2(-3)	0.095406	0.158323	0.602602	0.5496
RESID^2(-4)	-0.261533	0.156928	-1.666582	0.1021

---

---

R-squared	0.089227	Mean dependent var	1.25E-07
Adjusted R-squared	-0.005645	S.D. dependent var	1.87E-07
S.E. of regression	1.88E-07	Akaike info criterion	-28.03486
Sum squared resid	1.69E-12	Schwarz criterion	-27.81386
Log likelihood	762.9413	Hannan-Quinn criter.	-27.94963
F-statistic	0.940494	Durbin-Watson stat	1.815924
Prob(F-statistic)	0.463520		

---

---