**ADDIS ABABA UNIVERSITY**

**SCHOOL OF GRADUATE STUDIES**

# Exchange Rate and Trade Balance in Ethiopia: Structural Break Cointegration Approach

**BY: ZELALEM GETINET**

**JUNE, 2014**

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**BY: ZELALEM GETINET**

**A project submitted to the School of Graduate Studies of Addis Ababa University in Partial fulfillment of the requirement for the Degree in Masters of Art in Applied Economic Modeling and Forecasting**

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**This is to certify that the paper prepared by Zelalem Getinet entitled: Exchange Rate and Trade Balance in Ethiopia: Structural Break Cointegration Approach, and submitted in partial fulfillment of the requirement of the Degree of Masters of Art in Applied Economic Modeling and Forecasting complies with the regulations of the University and meets the accepted standards with respect to originality and quality.**

**BY: ZELALEM GETINET**

**Approved by** **Signature**

Dr. Fantu Guta _____

**JUNE, 2014**

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# Abstract

*The paper analyzed the relationship between exchange rate and trade balance of Ethiopia employing cointegration technique using annual data from 1974/75 to 2011/12. It has conducted Zivot-Andrews and Perron unit root test with structural break and Gregory-Hansen structural break cointegration test besides the convectional unit root and cointegration tests. The coingeration tests revealed that there is long run relationship among variables, however, estimation results indicated that the sign of real effective exchange rate is positive and insignificant which confirms against Marshal-Learner condition, only currency devaluation may not improve trade balance of Ethiopia unless other simultaneous policies taken.*

*Keywords:* Exchange Rate; Trade Balance; ML Condition; Structural Break and Cointegraion

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# List of Acronyms

| | |
|---|---|
| ADF | Augmented Dickey Fuller |
| ADLI | Agricultural Development Lead Industrialization |
| EPDRF | Ethiopian People's Democratic Revolutionary Front |
| FDI | Foreign Direct Investment |
| FM-OLS | Fully Modified Ordinary Least Square |
| GH | Gregory Hansen |
| IMF | International Monetary Fund |
| ML | Marshal Learner |
| ODA | Official Developmental Assistance |
| PP | Phillips Perron |
| REER | Real Effective Exchange Rate |
| TB | Trade Balance |
| UNCTAD | United Nations Conference on Trade and Development |
| US | United States |
| YD | Domestic Income |
| YF | Foreign Income |

# Chapter One

## 1. Introduction

### 1.1. Background

Exchange rate is one of the most important policy variables, which determines the trade flows, capital flows & FDI, inflation, international reserve and remittance of an economy. The advent of floating exchange rates has directed renewed attention to the effects of devaluation on the trade balance of both developed and less developed countries (B.Oskooee & Alse, 1994).

Maintaining internal and external balances are among the main economic objectives that countries want to pursue. Particularly, external balance that is balance of payment equilibrium is could be achieved through expenditure-switching policies, mainly devaluation or revaluation. Hence, exchange rate policy is considered as a main policy instrument to correct balance of trade problems in each country.

However, empirically the dynamics of exchange rate devaluation and balance of trade is still arguable among economists. There is no clear conclusion that exchange rate adjustments will correct current account imbalances. The results of different study come up with mixed findings on the long run movement of exchange rate and trade balance. These fundamentally depend on the type of economy studied, method of analysis and the type of data used.

Both theoretically and empirically, different views have been reflected on the relationship between trade balance and exchange rate; however neither of them has established definite argument. The elasticity approach, Marshall-Learner (ML) and Bickerdike-Robinson-Metzler Condition (B-R-M condition) take the fore front in explaining the relationship between the two variables. The M-L condition which is an extension and more attractive than B-R-M, states that a real devaluation will improve the trade balance if the import and export demand elasticity sum to greater than unity.

Studying the relationship between trade balance and exchange rates is especially important for many developing economies where trade flows are the main determinant of balance of payments accounts due to the low development of capital markets. Ethiopia, as one of developing countries, its economy mainly depends on agriculture sector. It also contributes largest share for export sector, that's why EPDRF adopted Agriculture Development Led Industrialization (ADLI) strategy to transform the entire economy (MoFA, 2007).

During *Derg* regime, the Ethiopian economy was characterized by socialist economy. The government adopted protectionist trade policy and exchange rate was fixed vis a vis US Dollar (Gemchu 2002). Since 1992, the pressure from the World Bank, the IMF, and the world-wide turn against the import substituting development policies, contributed to the consideration of a policy reversal in Ethiopia (Hailegiorgis, 2012).

With the fall of the *Derg* in 1991, the new government faced the difficult tasks of organizing the demobilization as well as starting the transition to a market economy. Exchange-rate reform, which was an essential first step in achieving economic recovery, began in October 1992 with a devaluation of 140 per cent from 2.07 Birr to the dollar to 5 Birr to the dollar (Addison and Geda, 2001).

Sequentially, the current government has been taking a series of reforms including exchange rate devaluation measures, to improve the particular foreign trade sector. In addition, the government has made efforts to diversify and value adds the export items, which are heavily depend on the agricultural sector. Simultaneously, however, imported goods and service form the rest of the world has been increasing due to liberalization policy actions.

On account of this issue, the paper found long run relationship with and without structural cointegration tests. However, FM-OLS estimates revealed that trade balance and real effective exchange rate has a positive and insignificant relationship. The paper found against Marshal-Learner condition, exchange rate devaluation does not improve

trade balance deficit of Ethiopia. These imply, government need to see another policy options in addition to mere devaluation actions.

## 1.2. Statement of the Problem

The relationship between exchange rate and trade balance has been hotly debating among economists. Many empirical analyses, regression models are applied to individual countries, have been conducted into how exchange rate changes affect the trade balance of developing and developed countries. Despite the excess of theoretical and empirical research into how exchange rate changes affect trade balance, there is still considerable disagreement concerning the relationships between these economic variables and the effectiveness of currency devaluation as a tool for increasing a country's balance of trade.

Investigating the relationship between exchange rate changes on trade balance is generally believed desirable as it helps to side whether the relationship exists or not and to set out easy policy actions at reasonable time. In other words, if a stable long-run relationship does not exist, then merely depreciating the exchange rate does not seem to be a reasonable way to improve the country's competitiveness on a long-term basis, or if a significant long-run relationship does exist, then it is necessary to establish whether depreciation is likely to lead to a net improvement of the trade balance in the long-run. Establishing the relationships between exchange rate devaluations or adjustments and balance of trade in Ethiopia, has a paramount importance to solve trade balance problems or to see another policy options to correct the increasing merchandize trade deficit.

## 1.3. Objectives of the Study

The paper has the following broad objectives;

- ✓ To establish whether there is a stable long-run relationship between the exchange rate and the merchandise trade balance.
- ✓ To empirically estimate relationship between exchange rate and balance of trade in Ethiopia that is M-L condition.

- ✓ To give policy recommendation on the relationship between exchange rate and balance of trade.

## 1.4. Significance of the Study

From the end result of the study, the following significances could be achieved;

- ➢ It can be used as an input for policy decision related to exchange rate and trade balance.
- ➢ It helps in quantifying the extent of the trade balance change that would be desirable due to change in exchange rate.
- ➢ It provides knowledge on the relationship between the two variables.
- ➢ It can be a base for further study.

## 1.5. Limitation of the Study

The study has applied various types of tests to examine the relationship between exchange rate and trade balance in Ethiopia. There are few papers done in Ethiopia, while they are wrongly concluded on the relationship between the two variables. They wrongly perceive or miss adopt theoretical relationship between exchange rate and trade balance, which may put some reservation to their findings. In addition, the studies don't consider the issue of structural break in their methodology. However, this study employed alternative 'with structural break' tests that is, both Zivot and Andrews and Perron structural unit root test and Gregory and Hansen structural break cointegration test, which highly not in favors of the null hypothesis as compared to convectional tests.

Even if the paper has employed different alternative tests, it has a limitation of conducting more than one structural break unit root. Moreover, in terms of level of aggregation the paper doesn't employ a disaggregated bilateral real exchange rate index to analyze with each trading partners. Last but not the least lack of time and empirical studies done in Ethiopia was the main challenges.

## 1.6. Organization of the Study

The paper is organized into five chapters. The first chapter focuses on introducing the main finding of the paper and the second chapter presents the data and methodological treatment. The third chapter reviews related theoretical and empirical literature's on the topic and chapter four, data analysis part, presents the main finding and results of the paper. Finally, chapter five summarizes the main results of the study and provides policy implications.

# Chapter Two

## 2. Methodology and Data

### 2.1. Model Specification

Ethiopia is a small country[1] in the sense that its import prices are given in the world market and the prices are independent of the volume of imports. Thus demand for imports would depend mainly on real domestic income. However, the demand for imports can also be determined by real exchange rate. On the other hand, export demand generally depends on the relative prices of competing goods from the competing countries and on trade partners' real income.

### 2.1.1. Imperfect Substitute Trade Model

The study is based on imperfect substitute model[2], which assumes that imports are imperfect substitutes for domestically produced goods, that is developed by Goldstein and Khan (1985), and Rose A. K. (1991).

The demand equation for aggregate trade can be written as;

(2.1) $X_{tp} = f\left(\mathrm{Y}_{tp}, \mathrm{REER}_{tp}\right)$

(2.2) $\mathrm{M}_{\mathrm{tp}} = f\left(\mathrm{Y}_{\mathrm{Ethiopia}}, \mathrm{REER}_{\mathrm{tp}}\right)$

[1] to say that nation is small; the country is sufficiently small to affect the relative commodity Price at which it trades so that the nations term of trade relatively constant or un changed

[2]The perfect substitute's model assumes that domestic goods and imports from foreign countries are perfect substitutes for each other. Therefore, the model predicts that a country will entirely export or import a particular good, with no domestic production if the good is imported. Accordingly, you should not see the simultaneous importation and domestic production of any particular good.

The left hand side represents Ethiopia's imports and exports to or from the trading partners. $Y_{Ethiopia}$ is real income (GDP) for Ethiopia and $Y_{tp}$ is real income (GDP) of trading partners. Whereas $REER_{tp}$, is the real exchange rate between Ethiopia and rest of the world or her trading partners'.

We can specify export and import demand function using standard trade model as follows;

(2.3) $$X_t = \left(\frac{p}{p^*.E}\right)_t^{\phi}.(Y^*)^{\sigma}$$

(2.4) $$M_t = \left(\frac{p^*.E}{p}\right)_t^{\rho}.(Y)^{\omega}$$

Taking logarithm on both sides on equation (1.3) and (1.4) we will have the following logarithmic export and import demand function;

(2.5) $$\ln X_t = \phi\left(\ln p_t - \ln p_t^* - \ln E_t\right) + \sigma \ln Y_t^*$$

(2.6) $$\ln M_t = \rho\left(\ln p_t^* + \ln E_t - \ln p_t\right) + \omega \ln Y_t$$

Where the letter $X$ and $M$ are the volume of exports and imports, $E$ *is* the nominal exchange rate and $P$, $P^*$*and* $Y$, $Y^*$ denote the domestic and foreign price levels and incomes respectively; $\phi$ and $\rho$ are the real exchange rate elasticities for exports and imports and $\sigma$ and $\omega$ are the income elasticities for export and import.

Practically, trade balance (TB) is the difference between the value of export and import. Using that definition we can derive trade balance equation from equation (1.5) and (1.6).However, if the balance of trade is negative it can be expressed in ratio of export over import or vice versa in order to transform to logarithm without changing the basic specification of the model.

(2.7) $$\ln TB = -(\phi + \rho)\left(\ln E_t + \ln p_t^* - \ln p_t\right) + \sigma \ln Y_t^* - \omega \ln Y_t$$

Here, $\ln E_t + \ln p_t^* - \ln p_t$ is logarithm of real effective exchange rate (REER) which is an index whose value takes account of movements in the country's nominal effective exchange rate and also of relative movements of prices vis-à-vis the rest of the world by giving trade weight, used in the same manner like $REER_{tp.}$

The paper uses a multilateral REER or $REER_{tp,}$ which is calculated as follows;

(2.8) $$REER = \sum_{i=1}^{n} w_j e_{ji} (p_j / p_i)$$

Where REER denotes real effective exchange rate, $e_{ji}$ is nominal exchange rate between home country (j) and trading partner (i), n is total number of trading partners[3] and $W_i$ means Trade-weight corresponding to country i. It is defined as $W_i$[4] (Value of trade of country i/total value of trade of all the trading partners of a country) * 100 while $P_j$ and $P_i$ refers to price index of home country and trading partners, respectively.

In this case, a decline in REER represents a real depreciation and thus enhanced competitiveness of the country's good vis-à-vis foreign goods. On the other hand, an increase in REER represents a real appreciation implying declining competitiveness of the home economy.

[3] as per the NBE old compilation methodology of REER, On the basis of 1996/97 assessment, Ethiopia's has 14 trading partners having trade shares of more than 1 % of cut-off points are: Belgium, Kenya, France, Germany, Netherlands, Sweden, Italy, UK, USA, India, Japan, Korea, S. Arabia, and Switzerland

[4] Over all trade weight of trading partners' can be derived in such way i.e

$$W_i = \frac{X_a}{(X_a + M_a)} W_i^x + \frac{Ma}{(Xa + Ma)} W_i^m,\ i = 1,\ 2\ \&\ ..N,\ X^a = \sum_{j=1}^{n} x_j^a\ ,\ M^a = \sum_{j=1}^{n} m_j^a$$

Since trade balance is the difference between Exports and imports, factors that affect both import and export also affect trade balance in the same way. Considering equations from (1.1) to (1.7), trade balance is a function of real effective exchange rate, real domestic income and trading partners' real income, which can be put as;

$$(2.9)\ TB = f\left(REER, YD, YF\right)$$

Having this, the study attempts to develop Similar model applied by Bahmani-Oskooee and Brooks (1998), Brooks (1999) and Onafowora (2003) where trade balance is the function of real exchange rate, real domestic and real income and structural dummy variable ($D_s$) that takes the value of zero or one to capture structural changes. By applying logarithm on variables, log linear specification of the model can be stated as follows;

$$(2.10)\ \ln TB = \alpha + \beta \ln REER + \delta \ln YD + \theta \ln YF + \gamma D_s + \varepsilon_t$$

In this study, TB is expressed in terms of ratio of export over import to make ready for logarithmic transformation. The ratio is used since trade balance is negative so that it will give relatively the same representation as differencing. The term lnREERt, lnYDt, lnYF*t,* $D_s$ are logarithm of real effective exchange rate, real gross national product of Ethiopia and trading partner real Gross Domestic product and dummy variable that indicate a change in structure of the economy. Whereas $\varepsilon$ or a stochastic term added to capture short term departures from long run equilibrium. Given our definition of *REER* the sign of β is expected to be negative, the trade balance will improve when the coefficient of the real exchange rate becomes negative and significant.

The M-L condition is assumed to be met if this long-run coefficient is negative and significant.[5] Theory suggests that the volume of exports (imports) to a foreign country

[5] M-L condition concerned about export and import elasticity, by assuming supply elasticity's are infinite, if the sum of absolute value of import price and export price elasticity is greater than one, depreciation will lead to an

(domestic country) ought to increase as the real income and purchasing power of the trading partner (domestic economy) rises, and vice versa. So we expect $\delta < 0$ and $\theta > 0$. However, if the rise in real income is due to an increase in the production of import-substitute goods, imports may decline as income increases in which case $\delta > 0$. While the sign of $\gamma$ is ambiguous, which is determined empirically.

### 2.2. Unit Root and Structural Break

Many economic and financial time series shows trending behavior or non stationary from its mean. Unit root tests can be used to determine if trending data should be first differenced or regressed on deterministic functions of time to make the data stationary. The tests for unit roots was developed by Dickey and Fuller (1976), and Dickey and Fuller (1979). Then after, unit root test has been used widely in order to understand the behavior of the series and to conduct further analysis. Hence, the paper will conduct the usual Augmented Dickey Fuller (ADF) test to check whether the variables are integrated of order zero or one.

However, Maddala & Kim (1998) stated that one major drawback of unit root tests is that, in all of them, the implicit assumption is that the deterministic trend is correctly specified. However, events like the great depression, oil price shocks, abrupt policy changes, and so on; models with constant coefficients have been found to perform poorly, either for forecasting purposes or for the purpose of analyzing the effect of policy changes.

Hence, the paper employs structural break test that is Chow test to check statistically the presence of a break. On the other side, from prior information we presume the presence of structural changes in Ethiopia. For instance, Ethiopia has experienced a lot of major economic events like drought, frequent wars and regime changes. Here, the main focus is

improvement in the trade balance. However, the study checks M-L condition indirectly without estimating import and export price elasticity separately through sign and significance of REER Coefficient i.e. if $\beta$ is negative and significant.

the 1991/92 regime and economic system changes, from socialist economy to market oriented type.

Considering the above issues, the paper will conduct unit root test under structural break to overcome the usual unit root tests. Maddala & Kim (1998) point out that the exact definition of structural changes has not been given in the literature. Usually it is interpreted as changes of regression parameters. Thus the focus of unit roots tests is on finding the effect of changes in regression parameters particularly the effect of changes in the coefficients of the deterministic trends.

The paper proposed to use single unknown structural break unit root test developed by Zivot and Andrews (1992) and Perron (1997). Both tests determine the break point 'endogenously' from the data. But Perron's (1989) work was based on exogenous known break time by modifying Dickey-Fuller (DF) unit root tests. Zivot and Andrews (1992) test allows a structural break only in the alternative hypothesis, however, Perron's (1997) unit root tests allows for a break under both the null and alternative hypothesis.

They argue that in the presence of structural break test the standard ADF tests are biased towards the non-rejection of the null hypothesis. The test is conducted by allowing a one-time change in the intercept, time and both in the trend function. This can be captured through dummy variable. Perron (1989) employed an adjusted Dickey-Fuller (ADF) type unit-root testing strategy. His test for a unit root in Models (1.11), (1.12), and (1.13) involve the following augmented regression;

$$(2.11)\ y_t = \alpha_0 + \alpha_1 DU_t + d(DTB)_t + \beta t + \rho y_{t-1} + \sum_{i=1}^{p} \theta_i \Delta y_{t-1} + e_t$$

$$(2.12)\ y_t = \alpha_0 + \phi DT^*_t + \beta t + \rho y_{t-1} + \sum_{i=1}^{p} \theta_i \Delta y_{t-1} + e_t$$

$$(2.13)\ y_t = \alpha_0 + \alpha_1 DU_t + d(DTB)_t + \phi DT^*_t + \beta t + \rho y_{t-1} + \sum_{i=1}^{p} \theta_i \Delta y_{t-1} + e_t$$

Where the intercept dummy DU represents a change in the level; $DU_t$ =1 if ($t > TB$) and zero otherwise; the slope dummy $DT_t$ (also $DT_t$*) represents a change in the slope of the trend function; $DT^* = t\text{-}TB$ (or $DT^* = t$ if $t > TB$) and zero otherwise; the crash dummy ($DTB$) = 1 if $t = TB + 1$, and zero otherwise; and TB is the break date. Each of the three models has a unit root with a break under the null hypothesis, as the dummy variables are incorporated in the regression under the null. The alternative hypothesis is a broken trend stationary process.

Zivot and Andrews (1992) transformed Perron's unit root test that is conditional on structural change at a known point in time into an unconditional unit root test. The null hypothesis that they specify is a unit-root process without any exogenous structural breaks, and alternative hypothesis is a trend-stationary process with structural change occurring with possible at an unknown point in time.

Here, we will not show Zivot and Andrews (1992) unit root specification since almost similar with Perron's(1989) specification with little assumption difference on allowing break on null and alternative hypothesis. This has clear implication on subsequent cointegration tests.

### 2.3. Cointegration and Structural Break

The work of Engle and Granger (1987) showed that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be co integrated. Usually, in economics knowing stable long run relationship among variables is a foremost interest. Many studies conduct a cointegration test to check the presence of long run relationship between included variables.

Hence, the study will conduct residual based cointegration test which is developed by Engle and Granger (1987). Moreover, the paper will also conduct Phillips-Ouliaris (1990) residual based Cointegration test. Though, both tests are residual based cointegration tests, they differ in the method of accounting for serial correlation in the residual series;

the Engle-Granger test uses a parametric, Augmented Dickey-Fuller (ADF) approach, while the Phillips-Ouliaris test uses the nonparametric Phillips-Perron (PP) Methodology.

The main issue that the paper wants to emphasize is structural break. However, the above cointegraton tests doesn't consider structural break in their specification. In the same manner, inference on cointegration test also affected by in the presence of structural break like unit root test. Hence the paper will employ a structural break cointegraion test that is developed by Gregory and Hansen (1996) together without structural break cointegraion test.

Gregory and Hansen (1996), building upon Zivot and Andrews (1992), generalized the standard residual co-integration tests by allowing alternative hypothesis a regime shift at an unknown timing. They analyzed models through different forms of structural change namely a level shift model (C), a model with a level shift plus trend (C/T), a "regime shift" model (C/S) where both the constant and slope parameters change, as well as a regime shift model where a trend shift is added (C/S/T). They modeled the four forms having two variables $y_t = (y_{1t}, y_{2t})$ as follows;

(2.14) Model (C): $$y_{1t} = \mu_1 + \mu_2 \varphi_{2t} + \alpha^{T} y_{2t} + e_t$$

(2.15) Model (C/T): $$y_{1t} = \mu_1 + \mu_2 \varphi_{t\tau} + \beta t + \alpha^{T} y_{2t} + e_t$$

(2.16) Model (C/S): $$y_{1t} = \mu_1 + \mu_2 \varphi_{t\tau} + \alpha_1^{T} y_{2t} + \alpha_2^{T} y_{2t} \varphi_{t\tau} + e_t$$

(2.17) Model (C/S/T): $$y_{1t} = \mu_1 + \mu_2 \varphi_{t\tau} + \beta_1 t + \beta_2 t \varphi_{t\tau} + \alpha_1^{T} y_{2t} + \alpha_2^{T} y_{2t} \varphi_{t\tau} + e_t$$

$$\varphi_t = \begin{cases} 0, & if \quad t \le [n\tau] \\ 1, & if \quad t > [n\tau] \end{cases} \quad \text{and t = 1,.....,n}$$

Where the unknown parameter $\tau \in (0,1)$ denotes the (relative) timing of the change point, and the closed bracket denotes integer part. They propose extensions of the $ADF$, $Z_\alpha$ and $Z_t$ tests for co integration equations which allows for a regime shift in either the intercept alone or the entire coefficient vector and are non informative with respect to the timing of the regime shift. Their study sets the alternative hypothesis to be co integration while allowing for a one time regime shift of unknown timing. Thus rejection of the null hypothesis provides evidence in favor of co integration equation with structural break.

Finally, to estimate the cointegration equation, Fully Modified Ordinary Least Square (FM-OLS) method is employed. P.C. B. Phillips (1995) point out that Fully Modified Least Squares (FM-OLS) regression was originally designed in work by Phillips and Hansen (1990) to provide optimal estimates of cointegrating regressions. The method modifies least squares to account for serial correlation effects and the endogeneity in the regressors which results from the existence of a cointegrating relationship. In addition, the FM estimates of the non stationary components retain their optimality property that is they are asymptotically equivalent to the maximum likelihood estimates of the cointegrating matrix.

### 2.4. Data Sources

To conduct this study, 38 years annual data is employed from 1974/75 to 2011/12. The data is mainly obtained from National Bank of Ethiopia and United Nations Conference on Trade and Development (UNCTAD) data base to derive trading partners' income.

# Chapter Three

## 3. Literature Review

### 3.1. An Overview of Alternative Approaches to Balance of Payment

It is usual hearing phrases; elasticity approach, absorption approach, and monetary approach on adjusting countries balance of payment status. However, each theoretical approaches or models are different on the adjustment process. Hans Genberg (1978) pointed out that, the difference is thought to stem from the concentration on export and import functions in the elasticity approach, on income and expenditure (absorption) functions in the absorption approach, and on hoarding and money supply functions in the monetary approach.

According to the elasticity approach (EA), devaluation improves the trade balance if the absolute values of the sum of the demand elasticity for exports and imports exceed unity. If this (Marshall-Lerner) condition holds, there is excess supply of foreign exchange when the exchange rate is above the equilibrium level and excess demand when it is below. A different approach to the balance of payments emerged at the beginning of 1950s, absorption approach, focuses its analysis mainly on economic aggregates, typical of Keynesian analysis. The core of this approach is the proposition that any improvement in the trade balance requires an increase of income over total domestic expenditure (Rincón C, 1998).

The monetary approach focuses on the overall balance of payments. It has its roots in 18th and 19th century classical theory, which originated with Hume's (1752) price-specie-flow mechanism. Any excess demand for goods, services and assets, resulting in a deficit of the balance of payments, reflects an excess supply of or demand for the stock of money. Accordingly, the balance of payments behavior should be analyzed from the point of view of money supply and demand.

## 3.2. Elasticity Theory

Prior to the 1930s, economics possessed no comprehensive theories of the balance of payments, of devaluation, or of balance of payments policy. Instead there was a well worked out theory of the mechanism of international adjustment under the gold standard, and a theory of exchange rate determination under floating exchange rates, Gustav Cassel's widely misunderstood and criticized theory of purchasing power parity(H.G.Johnson, 1977). The elasticities approach to the balance of payments can trace its origins to the work of Bickerdike (1906, 1920). He used such analysis to derive the general condition under which devaluation improves the trade balance. The following sub topic presents the main elasticity approaches and its derivation.

### 3.2.1. The Bickerdike-Robinson-Metzler (BRM) Condition

The idea of the relationship between the trade balance and exchange rates, appeared first with the seminal paper of Bickerdike (1920), and then continued with Robinson (1947) and Metzler (1948). The core of this view is the substitution effects in consumption (explicitly) and production (implicitly) induced by the relative price (domestic versus foreign) changes caused by a devaluation (Rincón C, 1998; Brooks, 1999).

The BRM model is a partial equilibrium version of a standard two-country (domestic and foreign), two-goods (export and imports) model which discusses the effects of exchange rate changes in terms of separate markets for imports and exports. In each market, demand and supply depend only on the nominal price in terms of the importing or exporting country's currency, and cross-price effects between markets do not exist (R.Dornbusch, 1975).

Here the study presents Bickerdike condition how exchange rate devaluation improves trade balance based on R.M.Sterns (1973) derivation. The mathematical derivation is similarly adopted by Brooks (1999) in his paper.

Trade balance in terms of foreign currency specified as follows;

$$(3.1)\ TB_f \equiv p_{fx} X - p_{fm} M$$

Where $TB_f, P_{fx}, X, P_{fm}$ and $M$ refers to trade balance in foreign currency , price of export in foreign currency, export volume, price of import in foreign currency and volume of imported goods respectively. So after devaluation the change in trade balance is written in the following way;

$$(3.2)\ \Delta TB_f \cong (p_{fx}\Delta X + X\Delta p_{fx}) - (p_{fm}\Delta M + M\Delta p_{fm})$$

Let's denote the initial values $V_{fx}$ and $V_{fm}$ in the following manner;

$$(3.3)\ V_{fx} \equiv p_{fx} X$$

$$(3.4)\ V_{fm} \equiv p_{fm} M$$

Where $V_{fx}$ and $V_{fm}$ are foreign values of export and import respectively. Then rearranging terms and substituting (3.3) and (3.4) into (3.2) yields:

$$(3.5)\ \Delta TB_f \equiv V_{fx}\left(\frac{\Delta X}{X} + \frac{\Delta p_{fx}}{p_{fx}}\right) + V_{fm}\left(-\frac{\Delta M}{M} - \frac{\Delta p_{fm}}{p_{fm}}\right)$$

Let's define demand and supply elasticietes of export and import in order to simplify equation (3.5) so as to closer the final result of elasticity approach.

$$(3.6)\ \varepsilon_x \equiv \frac{\Delta X}{X} \Big/ \frac{\Delta p_{hx}}{p_{hx}}$$

$$(3.7)\ \mu_x \equiv -\frac{\Delta X}{X} \Big/ \frac{\Delta p_{fx}}{p_{fx}}$$

$$(3.8)\ \varepsilon_m \equiv \frac{\Delta M}{M} \Big/ \frac{\Delta p_{fm}}{p_{fm}}$$

$$(3.9)\ \mu_m \equiv -\frac{\Delta M}{M} \Big/ \frac{\Delta p_{hm}}{p_{hm}}$$

The notation $\varepsilon_x \& \mu_x$ refers home supply export and foreign demand export elasticity, respectively. However, $\varepsilon_m$ & $\mu_m$ denotes foreign import supply and home import demand elasticity, respectively.

The fact that both foreign and home currency prices are linked by exchange rate (e), so we can derive the relationships as follows;

$$(3.10)\ p_{fm} \equiv p_{hm} e$$

After little algebra we can write foreign currency value of change of trade balance owing to a change in exchange rate in terms of export and import elasticity.

$$(3.11)\ \Delta TB_f = V_{fx} \frac{\mu_x - 1}{1 + (\mu_x / \varepsilon_x)} + V_{fm} \frac{\mu_m \left[1 + (1/\varepsilon_m)\right]}{(\mu_m / \varepsilon_m) + 1}$$

Now derived what we generally referred to as Bickerdike-Robinson-Metzler (BRM) condition which the elasticity approach framework to balance of payment adjustment is originated. Later Robinson (1944) and Metzler (1947) simplified and extended in detail Bickerdike's original idea. Equation (3.11) implies that the change in the foreign currency value of the trade balance depends upon the import and export supply and demand elasticities and the initial volume of trade ($V_{fx} \& V_{fm}$) and given certain devaluation or depreciation of domestic currency there are many elasticity combinations that would correct the balance of trade. BRM Condition can be later further simplified by Marshal and Learner is called M-L condition.

### 3.2.2 Marshall-Lerner (M-L) Condition

M-L has extended BRM condition by assuming prices are fixed in seller's currency, so that the supply elasticites are infinite. Hence, the home export supply and foreign import supply are perfectly elastic that is $\varepsilon_x$ and $\varepsilon_m$, is assumed equal to infinity then equation 2.11 is reduced to;

(3.12) $\Delta TB_f = V_{fx}\left(\mu_x - 1\right) + V_{fm}\left(\mu_m\right)$

If we add another assumption, trade was initially balanced so that the foreign currency value of exports equals the foreign currency value of imports. In another words trade balance become zero which gives the next equation (3.13)

(3.13) $V_{fx} \big/ V_{fm} = 1$

Then if the sum of export and import demand elasticities greater than unity, change of trade balance in foreign currency value will improve.

(3.14) $\mu_x + \mu_m \succ 1$

This is known generally as the Marshall-Lerner condition. In other words, this condition states that if domestic and foreign supply elasticities are strictly elastic and if income remains constant, then a devaluation causes an improvement of the trade balance when the domestic plus the foreign import demand elasticities for imports, in absolute value, exceeds one. The total revenue from exports minus imports must be larger after depreciation. Accordingly, the effect of a country's currency devaluation on the trade balance using foreign currency value of export and import would be the following;

*Case I*

If trade balance initially zero or equilibrium($TB_f$=0) that means the ratio of volume of export and import equal to one then the sum of the import and export demand price

elasticities would be greater than unity (equation 3.14 $\mu_x + \mu_m \succ 1$) is called Marshal Learner(M-L) condition. The M-L condition states that a real devaluation will improve the trade balance if the import and export demand elasticities sum to greater than unity.

*Case II*

It can be here the assumption relaxed where trade balance is initially surplus ($TB_f > 0$) alternative to case one, hence the result may be additional insight on necessity and sufficiency of M-L condition in improving countries trade balance comes from currency devaluation. In this case equation (2.14) is no longer a sufficient condition; devaluation necessarily insures improvement of trade balance. The foreign currency value of the trade balance will improve if the sum of the export demand elasticity and the "weighted" import demand elasticity are greater than unity, where the weight is the foreign currency value of imports divided by the foreign currency value of exports.

$$(3.15)\ \mu_x + \frac{V_{fm}}{V_{fx}} \mu_m \succ 1$$

*Case III*

Let's further assume, when countries trade balance deficit initially, the M-L condition is more tough than necessary to insure depreciation improves the trade balance, when the country initially has a trade deficit. Now the M-L condition becomes a sufficient and not a necessary condition. The M-L condition becomes a sufficient and not a necessary condition, as the weighted import demand elasticity ($V_{fm}/V_{fx}{}^{*}{}_{m}$) can be much smallerbut changing trade balance is greater than zero ($\Delta TB_f > 0$) then previously and still insure an improvement in the trade balance.

## 3.3. Empirical Evidence

Many researches' have been done globally on the empirical link between exchange rate and trade balance. They have studied using relatively different situations to trace out long run relationship and to prove the empirical validity of Marshal-Learner condition to their

area of interest. However, they ended up with a mixed result since the result depend on type of economy investigated, econometric techniques, data set and method of aggregation.

There are several studies done on the globe particular to these area, this paper presents only some of them which are relevant to study objective. There is no firm stance also in the rest of the world on the role of exchange rate devaluation to balance trade account. The paper begins pioneer empirical works which used as a base for current study.

Marshal-Learner condition is examined by Rose (1991) to prove the empirical relationship between the real effective exchange rate and the aggregate real trade balance for five major OECD countries in the post-Bretton Woods era. A variety of parametric and nonparametric techniques are used. However, it concludes exchange rate is insignificant to affects the trade balances. Similarly, Rose (1990) examined the impact of the exchange rate on the trade balance for some number of developing countries. Non-structural techniques indicate that a depreciation of the real exchange rate is not strongly associated with a significant improvement in the trade balance.

Rose and Yellen (1989) investigate whether a J-curve can be detected in the last twenty-five years of American data. The model is checked extensively however no statistically reliable evidence of a stable J-curve is detected and Bahmani-Oskooee and Ratha (2007) analyzed the short run and the long run effects of Swedish kroner on her seventeen bilateral trade balances. They used bound testing method and it revealed that the J- curve effect is present only in the five cases out of seventeen; however, the short run effects don't last into the long run.

Onafowora (2003) examined the short run and long run effects of real exchange rate changes on the real trade balance of three Asian countries in their trade with the US and Japan using Vector Error Correction Model (VECM). The study concluded that generally Marshal-Learner condition holds based on generalized impulse functions and with

varying degree of short run effects. Rincón (1998) also studied the role of exchange rates in the short run and long run trade balance behavior for Colombia. The model includes both absorption and monetary approaches to balance of payment and multivariate cointegration econometric method is employed. Based on Johansen-Juselius cointegration approach and VECM results, the paper concluded that exchange rate do play a role in determining the short run and long run behavior of Colombian trade balance.

Likewise, Brooks (1999) investigated the validity of Marshal-Learner condition for bilateral trade between US and the G-7 using elasticity approach to balance of payment. The paper employed OLS, FM-OLS and VECM regression technique to estimate the long run bilateralexport and import demand elasticity. The results indicate that the US satisfies the M-L condition on a bilateral basis with all of the countries except Canada.

However, Bahmani-Oskooee and Alse (1994) found mixed result. They studied the short-run versus long-run effects of devaluation for nineteen developed countries and twenty two least developed countries through error correction modeling and cointegration. They used quarterly data and indicated only for six countries trade balance and real effective exchange rate are cointegrated. For most countries, the two variables were found to be not cointegrated indicating that devaluations cannot have any long-run effects on the trade balance.

Olivia (2012) imperfect substitute model is employed to test the Marshall-Lerner-Robinson condition 1960 to 1983. OLS and panel regressions conclude that the Marshall-Lerner-Robinson condition does not hold in Ghana, implying devaluation would lead to worsening the trade account. Similarly, Caporale, Gil-Alana & Mudida (2012) examined the Marshall-Lerner (ML) condition for the Kenyan economy. They used fractional integration and cointegration methods, which are more general than standard approaches based exclusively on integer degrees of differentiation. The results indicate that there exists a well-defined cointegrating relationship between the balance of payments to the

real exchange rate and relative income, and that the ML condition is satisfied in the long run although the convergence process is relatively slow.

Dama, Shen and Ahmed (2010) investigated the effect of real exchange rate on the balance of trade of Cote d'Ivoire using multivariate cointegration tests and vector error correction models with time series data covering the periods of 1975-2007. Estimated results also showed that the real effective exchange rate has a significant positive influence on Cote d'Ivoire's trade balance in both short and long-run under fixed real exchange rate management policies for the period under consideration.

When we come to area of interest, Ethiopia, there are few papers done on the topic, most of papers, however, don't relate to this study and has not employed econometric methods. Associated to this topic there are five papers, four published and one unpublished, they found a mixed result. Moreover, they differ in terms of econometric methodology and time period.

But there is common problem interpreting the sign of Real Effective Exchange Rate Index (REER). In Ethiopia, time series REER data is officially compiled by two institutions National Bank of Ethiopia (NBE) and recently by Ethiopian Development Research Institute (EDRI). According to NBE's compilation deprecation and appreciation of REER is defined as a decrease REER is a real deprecation and an increase REER is a real appreciation. Hence, unless they used other than NBE's data the interpretation of the index should be consistent with compilation methodology.

However, in other countries the index is compiled mostly in other way round that is an increase of the index is a real deprecation. They used foreign consumer price in the numerator rather than their domestic consumer price. While NBE's methodology, applies domestic consumer price index on the numerator in the REER formula. Hence, the definition of REER could vary across different methodologies. This show there is no fixed way of constructing REER index in each study but the interpretation should follow

based on compilation methodology because it's very important to validate famous exchange rate theory known as Marshal-Learner condition.

Commonly, most of papers done on Ethiopia misinterpreted the expected sign of REER with trade balance. The reason is that they simply *adopt or misunderstood* what is written in the literature. They claim a positive and significant relationship to improve trade balance though they have mentioned NBE as data source. But as per NBE compilation methodology, the expected sign of the two variables should be negative and significant to hold the Marshal-Learner condition. This may lead them wrong conclusion and shield on their result.

Dessalegn (2013) studied the movement of exchange rate and trade balance for 38 years using annual data. The paper conducted OLS regression to estimate trade balance up on real effective exchange rate, domestic and foreign income, money supply, terms of trade, real government expenditure and policy and drought dummy variable. He incorporated many variables including monetary and fiscal variables. The result showed that significant and positive sign of real effective exchange rate and concluded that real depreciation succeeds in improving trade balance of Ethiopia in the long run.

Likewise, Hailemariam (2011) studied using VAR model, the estimated long run and short run equations have showed that currency devaluation, which is proxied by real exchange rate, has a positive and significant impact on the trade balance of Ethiopia. Therefore, the paper confirmed that Marshal-Learner condition holds in Ethiopia. Based on their citation, the data source is from NBE's however both papers found significant and a positive sign between exchange rate and trade balance that support their prior expectation. This may raise some question on their conclusions.

However, Fikreyesus and Menasbo (2012) analyzed the effect of Birr devaluation on trade balance of Ethiopian economy using 30 years of time serious data. Descriptive statistics and regression analysis were employed as analytical tools. Based on OLS estimates they found accordingly, real GDP and Real Effective Exchange Rate Index

were positively correlated with the nation's trade balance while currency devaluation (dummy) was negatively correlated with trade balance. Their finding is currency devaluation may not improve trade balance so they recommended there is a need to introduce import substitutions and export oriented strategy of industrialization scheme so as to improve the country's competitiveness on the external world and to correct trade balance deficit.

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

Samuel and Tarekegn (2011) worked on how to narrow the widening trade deficit of Ethiopia. The study doesn't applied econometric technique rather desk and field research methods is used to analyze the data. They point out options to narrow the trade deficit, such as transformation of the export of primary commodities into export of high value-added manufactured products through the development of proper upgrading strategies and introduction of new import substituting commodities and increasing the production volume and the competitiveness of existing domestic manufacturing industries.

So far the studies done on Ethiopia have been reviewed however there is no anonymity on the conclusion. They found a mixed result on empirical soundness of Marshal-Learner condition by which whether currency devaluation is the best solution to alleviate trade balance deficit. However, some of the findings should be reconsidered with their interpretation of the sign of the change of real effective exchange rate with trade balance.

# Chapter Four

## 4. Data Analysis and Results

### 4.1. Development of Trade, Exchange Rate and Income

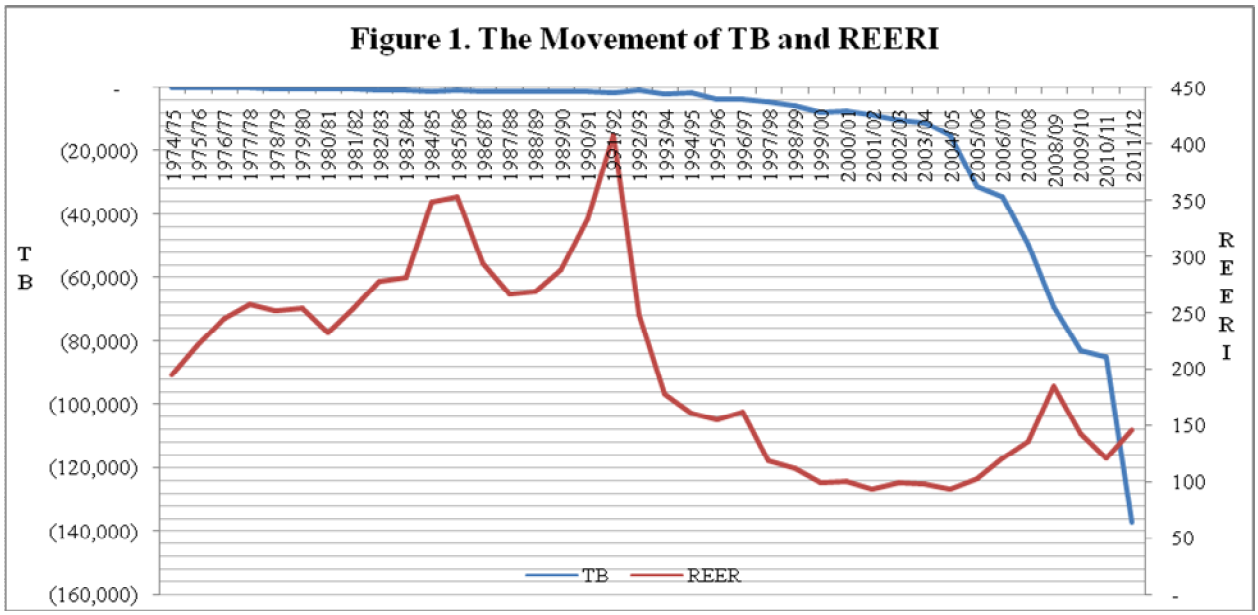
Ethiopia's trade policy, which became increasingly inconsistent with some of the macroeconomic policies especially during the *Derg* regime, has long been characterized by controlled foreign exchange allocation, import quotas, high tariffs, state owned marketing exports, export prohibitions, export subsidies and export taxes (Naude and Abu Girma, 1994).

During the *Derg* regime the exchange rate of Ethiopian currency against its reference currency, the US dollar, was determined by government decree. However, the current government undertook vast reforms including foreign exchange market, *Birr* was devalued initially from 2.07 per a US Dollar to *Birr* 5 per a US Dollar on October 1,1993 and in the same year introduced a biweekly foreign exchange retail auction.

Unlike to EPDRF, the *Derg* regime were adopted import substituting strategy by which prohibiting the importing goods and services through tariffs and quotas. However, the new government in August 1993 embarked on a comprehensive trade reform program aimed at dismantling quantitative restrictions and gradually reducing the level and dispersion of tariff rates. Together with exchange rate policies, such measures significantly improve the foreign trade sector.

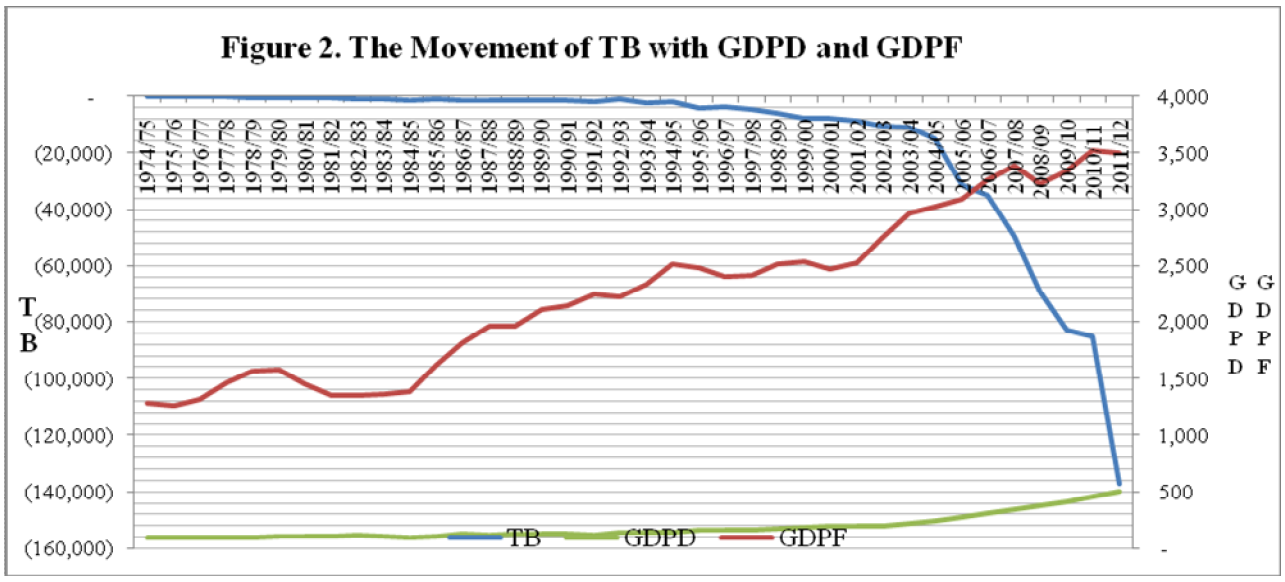
The Real Effective Exchange Rate (REER) during *Derg* regime was clearly appreciated due to rigid exchange rate policy and other restrictive policies. This index indicates that the export sector during that regime was less competitive due to overvalued exchange rate. On the other side, the regime experienced balance of trade deficit due to overvalued exchange rate though the regime has had adopted too restrictive trade policies (Figure 1).

The real effective exchange rate has reached its peak in the year 1991/92 mainly attributed to arise in domestic price level in time of regime change. After the regime change i.e. the current government, relatively REERI has been depreciating due to a competitive exchange rate policy measures. Since October 1992 real effective exchange rate index has decreased due to a series of devaluation policies to boost the external economy (Figure 1).




Source: National Bank of Ethiopian and authors Computation

Similar to the *Derg* regime, balance of trade during EPDRF has showed an increasing deficit trend. The deficit has widening through time, however, after 2000s it become more widened because of stimulated economy. Merchandize import has increased due to trade liberalization measures and waking economy. Though, reforms simultaneously affect import and exports, the growth rate of import value surpass export value leads to the trade balance deficit in the economy (Figure 1).




Source: National Bank of Ethiopian and authors Computation

As the main determinant of flow of merchandize trade, Ethiopia's and trading partners' real gross domestic product is the part of the discussion. Economic growth during *Derg* regime was slow or as IMF (2004) stated growth was volatile due to rainfall variability. In addition, repressive socialist policies also shed light on the performance of the economy. The deposition of the military government followed by a shift in economy system to market oriented from socialist type. The economy become relaxed and the structure of the economy changed from agriculture to service sector (Figure 2).

Hence, as compared to the previous government the economy is well performed. The figure showed that GDP has grown slowly at early times relative to the recent periods. However, in the recent periods, since 2003/04 the economy has registered fast economic growth for consecutive years even in world standard. In the same fashion, merchandize export has significantly increased which is component of GDP. Similarly, the fast economic growth demands huge foreign import (capital goods) to sustain stimulated economic growth. This causes the trade balance consistently to deteriorate (Figure 2).

Foreign income, in the international trade model, considered as one of determinant variable which affects the demand for export of a particular country, other things remain

constant. The graph depicts that foreign income has continuously increased except for some periods. Here, foreign income is proxied by taking the average of real gross domestic product of trading partners' multiplied by their trade weight. The increased trading partners' income has positive effect to export more goods given supply constraints and elasticity of exporting items (Figure 2).

## 4.2. Estimation Results

### 4.2.1. Structural Break Test with Known Break Point

Before doing any regression it's better to check the presence of structural break. Hence, the paper conducted a preliminary structural break test using chows' break point test with known break point. The break year is selected based on prior information, that is, regime change is takes place. The Chow breakpoint test tests whether there is a structural change in all of the equation parameters. Hence, it allows to test whether there has been a structural change in a subset of the parameters. The year 1991/92 has been selected as break time where major economic and political changes have been made.

**Table 4.1: Chow Break Point Test: 1991/92**

| | | | |
|---|---|---|---|
| F-statistic | 5.710739 | Prob. F(4,29) | 0.0016 |
| Log likelihood ratio | 22.07508 | Prob. Chi-Square(4) | 0.0002 |
| Wald Statistic | 22.84296 | Prob. Chi-Square(4) | 0.0001 |

The test statistic shows that we can reject the null hypothesis that there is no break at specified break point. It indicates that the coefficients are not stable across regimes. Hence, the result indicate to be cautious in the following unit root and co integration tests

### 4.2.2. Unit Root Test

In order to determine the order of integration of the individual variables, the study performs both unit root test with and without structural break. For the former, the paper conducted Augmented Dickey Fuller (ADF) unit root test, while for the later, it is

employed Zivot and Andrews (1992) and Perron's (1997) unit root with structural break test. Since the conventional (ADF) unit root tests doesn't consider structural break in their specification.

**Table 4.2: ADF Test at Level and First Difference with Constant**

| | Level | | First Difference | |
|---|---|---|---|---|
| Variable* | *t-Statistic*** | *Prob.* | *t-Statistic*** | *Prob.* |
| TB | -1.79 | 0.38 | -10.81 | 0.00 |
| REER | -1.04 | 0.73 | -4.75 | 0.00 |
| YD | -1.54 | 0.50 | -4.28 | 0.00 |
| YF | -0.57 | 0.87 | -4.03 | 0.00 |

*(*) refers all variables are in natural logarithm*

*(**) the test statistics value is taken at 5% significance level*

An ADF test indicates presence of unit root at level but all the series are stationary at first difference. Hence, we can significantly reject the null hypothesis that the first difference of individual variables' have unit root. This implies differencing variables one times could make the variables stationary. From the result we can understand all variables are integrated order one (Table 2).

**Table 4.3: Structural Break Unit Root Test with Intercept**

| | *Zivotandrew* | | | *Perron* | | |
|---|---|---|---|---|---|---|
| Variable* | *t-Statistic* | *5% CV* | *Break Year* | *t-Statistic* | *5% CV* | *Break Year* |
| TB | -4.06 | -4.93 | 1992 | -8.09 | -5.23 | 1991 |
| REER | -4.24 | -4.93 | 1992 | -4.85 | -5.23 | 1991 |
| YD | -7.21 | -4.93 | 1993 | -8.18 | -5.23 | 1992 |
| YF | -4.23 | -4.93 | 1989 | -4.15 | -5.23 | 1989 |

*(*) refers all variables are in terms of natural logarithm*

Unlike the conventional ADF test Zivot and Andrews and Perron unit root test found relatively a mixed result. Except Domestic Gross Domestic Product (YD), Zivot and Andrews (1992) test statistic doesn't reject the null hypothesis there is unit root, however, it is non-stationary with trend specification. Similarly, Perrons (1997) result showed that both REER and YF variables has unit root problem with structural break in the intercept.

But the test statistics for TB and YD indicate that both variables are trend stationary with structural break. However, YD has unit root with structural break with trend specification. Simultaneously, both tests endogenously determined the possible structural break year. Zivot and Andrews test indicated 1992/93 and Perron1991/92 break year. This break years are closely linked to our prior expectation associated with regime and economic system change (Table 3).

### 4.2.3. Cointegration Test

It is frequently of interest to test whether a set of variables are cointegrated. This may be desired because of the economic implications such as whether some system is in equilibrium in the long run, or it may be sensible to test such hypotheses before estimating a multivariate dynamic model (Engle and Granger, 1987).

There are different types of checking for the presence of stable long run relationship in the model. The study conducted a single equation cointegration test. The tests are residual based cointegration test which is primarily developed by Engle and Granger (1987) and Phillips and Ouliaris (1990). In another saying, they are unit root tests applied to the residuals obtained from a static OLS cointegrating regression to test the null hypothesis of no cointegration against the alternative of cointegration.

**Table 4.4: Cointegration Test without Structural Break**

| Test Type | *tau-statistic* | *Prob.* | *z-statistic* | *Prob.* |
|---|---|---|---|---|
| Engel and Granger | -5.567 | 0.004 | -34.515 | 0.003 |
| Phillips-Quliaris | -5.635 | 0.003 | -38.375 | 0.001 |

In Both tests the equation trend specification is specified in constant or level form. The test computes both the Engle-Granger tau-statistic (*t*-statistic) and normalized autocorrelation coefficient (which we term the *z*-statistic) for residuals obtained using each series in the group as the dependent variable in a cointegrating regression. The test statistics are derived when trade balance is dependent variable.

The *tau* statistic for both type of cointegration tests indicate presence of cointegration. Since the probability value for the statistics is significant that we can reject the null hypothesis there is no cointegration. The alternative Z test statistic also found similar result as *tau* statistic for the two types of tests. It rejects the null hypothesis having a significant probability value. This clearly shows there is no unit root in the residual with its given significance level. From Engle and Granger and Phillips-Ouliaris test the null hypothesis of no cointegration is rejected. Therefore, TB, REER, YD and YF are cointegrated.

Based on our information and statistical break point test, we have to conduct structural break cointegration test. The conventional residual based cointegration tests doesn't consider structural break while they calculate the test statistic. Hence, inference based on such tests may often lead to the non-rejection of the null hypothesis of no cointegration. To overcome this problem Gregory and Hansen (1996) developed residual based test by modifying Engle and Granger (1987) and Phillips-Ouliaris (1990) tests by allowing structural break in the specification.

Gregory and Hansen (1996) stated that the basic type of structural change is the one time regime shift model, in which the parameters are permitted to change at one time in the sample. However, practically two or more time regime shifts may occur in the model which the model doesn't deal with. The test prepared the testing procedure in the null of no cointegration against the alternative of cointegration with possible one time structural break which is determined endogenously in the model.

The test also have a family of test statistic namely $ADF^*$, $Z^*_a$ and $Z^*_t$ with their corresponding critical value. Particularly, $Z_a$ and $Z_t$ test statistics are originally Phillips (1989) statistic value in which regime shift is allowed. The three statistics are derived by introducing a onetime regime shift in the model. The smallest value of test statistics is selected across all possible break year which give evidence against the null hypothesis of no cointegration. Critical values are calculated by adopting Mackinnon (1991) procedure using Monte Carlo experiment.

**Table 4.5: Structural Break Cointegration Test (Gregory-Hansen)**

| *Model ( C)* | *Test Statistic* | *Break Date* | *Asymptotic Critical Values* | | |
|---|---|---|---|---|---|
| | | | *1%* | *5%* | *10%* |
| ADF* | -7.43 | 1980 | -5.77 | -5.28 | -5.02 |
| Zt | -7.53 | 1980 | -5.77 | -5.28 | -5.02 |
| Za | -45.82 | 1980 | -63.64 | -53.58 | -48.65 |
| *Model (C/T)* | *Test Statistic* | *Break Date* | *Asymptotic Critical Values* | | |
| | | | *1%* | *5%* | *10%* |
| ADF* | -8.1 | 2005 | -6.05 | -5.57 | -5.33 |
| Zt | -8.22 | 1989 | -6.05 | -5.57 | -5.33 |
| Za | -49.44 | 1989 | -70.27 | -59.76 | -54.94 |
| *Model (C/S)* | *Test Statistic* | *Break Date* | *Asymptotic Critical Values* | | |
| | | | *1%* | *5%* | *10%* |
| ADF* | -8.19 | 1989 | -6.51 | -6 | -5.75 |
| Zt | -8.3 | 1989 | -6.51 | -6 | -5.75 |
| Za | -48.94 | 1989 | -80.15 | -68.94 | -63.42 |
| *Model (C/T/S)* | *Test Statistic* | *Break Date* | *Asymptotic Critical Values* | | |
| | | | *1%* | *5%* | *10%* |
| ADF* | -10.4 | 2000 | -6.89 | -6.32 | -6.16 |
| Zt | -10.6 | 2001 | -6.89 | -6.32 | -6.16 |
| Za | -54.66 | 2001 | -90.84 | -78.87 | -72.75 |

The modified ADF and Zt test statistics rejected the null of no cointegration in favor of the alternative of cointegration with one time regime shift. They are statistically significant for all model type at 1%, 5% & 10% significance level. The modified ADF estimated break date for four models. The break dates are 1980, 2005, 1989 and 2000 for model (C), Model(C/T), Model(C/S) and Model(C/T/S), respectively.

However, Za doesn't reject the null hypothesis for all cases as Gregory and Hansen (1996) showed the statistic is biased towards the null in case of no serial correlation. Information Criterion (AIC) is used to determine the lag length in the ADF test for all models. The study specified Gregory-Hansen test allowing break in the constant, constant and trend, constant and slope and constant, slope and trend. The test accepts the alternative hypothesis there is cointegration with one time regime shift. Hence, TB, REER, YD and YF are cointegrated.

### 4.2.4. Parameter Stability Test in Cointegration Relationship

To test whether there is structural break in the cointegration relationship, the study employed Hansen (1992) parameters stability and/or instability test. Gregory and Hansen (1996) cointegration test does not provide much evidence about the nature and significance of the regime shift, because the alternative hypothesis is without regime shift cointegration. Hence, it is also complementary test with Hansens parameter instability test.

Hansen (1992) developed a series of tests of the hypothesis of time invariance of the coefficients of a cointegrating relation. He specifies the null hypothesis of cointegration against the alternative hypothesis of no cointegration for a cointegrated regression model. In other words, the null indicate parameter stability and the alternative, however, parameter instability. Hansen(1992) prepared three test statistics (Lc, MeanF&SupF) to test parameter stability in the cointegrated regression model based on Fully-Modified Ordinary Least Square(FM-OLS) method.

The paper used Lc test statistic, which arises from the theory of Lagrange Multiplier tests for parameter instability, to evaluate the stability of the parameters. The statistic examines time-variation in the scores from the estimated equation. In contrast to the residual based cointegration tests, Hansen's test does rely on estimates from the original equation.

**Table 4.6: Hansens Parameter Stability Cointegration Test**

| Lc statistic | Stochastic Trends (m) | Deterministic Trends(K) | Excluded Trends (p2) | Prob.* |
|---|---|---|---|---|
| 0.320656 | 3 | 0 | 0 | > 0.2 |

*Hansen (1992b) Lc(m2=3, k=0) p-values, where m2=m-p2 is the number of stochastic trends in the asymptotic distribution

Based on test result, unable to reject the null hypothesis that there is cointegration with stable parameter. It showed the cointegrating relationship is without a regime shift. This is imperative to estimate the long run cointegrating regression.

### 4.2.5. Cointegration Regression

Once we have checked the variables are non-stationary and cointegrated, estimating the long run parameters could be reasonable in answering spurious result. Estimating the long run parameters is the priority of the study to reach conclusion on the empirical relationship between exchange rate and trade balance. To estimate consistently the parameters the study used Fully Modified Ordinary Least Square (FM-OLS). The estimator is asymptotically unbiased and has fully efficient mixture normal asymptotes allowing for standard Wald tests using asymptotic Chi-square statistical inference. Based on Hansen's parameter stability test, the paper estimated the original model without structural break dummy variable.

**Table 4.7: Long Run Cointegration FM-OLS Estimation Result**

| *Variable* | *Coefficients* | *Prob. Value* | *Test Statistic* |
|---|---|---|---|
| REER | 0.065 | 0.803 | Adj. $R^2$=0.6 |
| YD | -0.536 | 0.071 | DW=1.84 |
| YF | -1.403 | 0.000 | S.E of Regression =0.27 |
| C | 11.501 | 0.000 | Long-run Variance =0.083 |

The long-run covariances are estimated none parametrically using a Bartlett kernel and a bandwidth determined by the Andrews automatic selection method. In addition, Akaike information criterion automatic is used to determine the lag length. The estimates of long run covariance prewhitening with two lags and 0.648 bartlett kernel, Andrews's bandwidth.

The regression result showed that the estimated coefficients are found in accordance with prior expectations except REER and YF. Solely, REER is both insignificant and

inconsistent with a prior expectation of a negative sign when the regressand is trade balance. In addition, Probablity values revealed that all the remaining variables are found to be statistically significant. The measure of goodness fit, Adjusted R squared, indicated that the model explains 60% of the variation in the dependent variable.

The Durbin Watson statistics of 1.83 approached to two which implies absence of serial correlation in the residuals. By construction FM-OLS estimators are free from serial correlation and endogeneity problem. Since the estimator accounts such problem we conducted only two diagnostic tests to check the reliability of the estimates. Eviews only gives three diagnostic test options to ensure the robustness of the estimation. The first diagnostic test is Wald test which is a coefficient restriction test to make inference about parameters. It uses t, F and Chi-square type statistic to make inference about cointegrating regressors.

**Table 4.8: Wald Test**

| Test Statistic | Value | Df | Probability |
|---|---|---|---|
| t-statistic | 0.251405 | 33 | 0.8031 |
| F-statistic | 0.063205 | (1, 33) | 0.8031 |
| Chi-square | 0.063205 | 1 | 0.8015 |

The study in the null specified the coefficient of REER or β restricted to be zero, to make inference on the main interest of the paper. The t-statistic and Chi-square p-values are both around 0.80, indicating that we cannot reject the null hypothesis that the cointegrating regressor coefficient value *(β)* is equal to zero.The linear restriction type of Wald test, both t and LM type Chi-square test statistics clearly confirmed that, REER variable is insignificant to affect trade balance.

The second one is normality test using Jarque-Bera test statistic. It is a test statistic for testing whether the series is normally distributed. The test statistic measures the difference of the skewness and kurtosis of the series with those from the normal

distribution. Under the null hypothesis of a normal distribution, the Jarque-Bera statistic follows a Chi-square distribution. The reported Probability is the probability that a Jarque-Bera statistic exceeds in absolute value the observed value under the null hypothesis. A small probability value leads to the rejection of the null hypothesis of a normal distribution.

**Table 4.9: Histogram Normality Test**

| Statistics | Skewness | Kurtosis | Jarque-Bera |
|---|---|---|---|
| Value | -0.577524 | 4.047185 | 3.747376 |
| Prob.Value | - | - | 0.153556 |

The Probability value is not a bit small to reject the null hypothesis of normal distribution. Thus, the residual is normally distributed.

The main interest of the paper is examining the long run relationship between exchange rate devaluation and balance of trade in Ethiopia, intern validating Marshal-Learner condition by applying standard econometric method. According to the condition, devaluation will improve trade balance if the sum of export and import demand elasicities greater than one or in our case if the sign of Real Effective Exchange Rate (REER) coefficient is negative and significant. Based on regression estimates the sign of REER coefficient is positive and insignificant. This result is inconsistent with Marshal-Learner condition; currency devaluation hence will not improve balance of trade of Ethiopia.

The fact that, most developing countries commodity exports has low price elasticity of demand since they are primarily agricultural goods unlike developed countries manufactured goods export. Primary commodities have sluggish demand and volatile price in world market as compared to manufactured goods. Likewise, Ethiopia's major exports are agricultural commodities which are relatively inelastic as compared to industrial exports.

On the other side, import is another variable which determine the flow of trade balance, according to Shea (1979) study, in case of imports is used as inputs for domestic production; devaluation increases the cost of production and hence may not be a good policy to improve the trade balance of a country. This is somewhat true for Ethiopia which is highly dependent on imported goods. The share of imports that could be used as inputs other than consumer goods are higher, that is the import of capital, raw materials, semi-finished goods and fuel together takes highest share among imported goods. This has a secondary effect surging the price of goods which uses imported goods as input and has an adverse effect competitiveness of exported commodities.

In addition, Ethiopia's demand for imports is highly inelastic, and then relatively more expensive imports due to devaluation will only minimally affect Ethiopia's demand for imported goods. In this case expenditures on imports could actually rise as they become more expensive. Under these conditions, a depreciation of Birr against US Dollar will actually worsen the trade deficit unless other mechanisms are sought to decrease import, that is, through import substitution strategy at least for some consumer and light capital imported goods. This is consistent with Table 1&2 explanation in which the balance of trade of Ethiopia has been widening continuously even if a series of devaluation measures has been taken.

The other main variable is domestic income (YD), which determine trade balance in standard model of international trade. The sign of the coefficient is negative as expected before the regression. Hence, increasing Ethiopia's income demanded more imported goods and this negatively affected trade balance. However, the sign of foreign income (YF) coefficient is found inconsistence with prior expectation, a positive sign with trade balance. This could be most of exported items of Ethiopia are income inelastic.

As we can see the regression result, the elasticity estimate of REER is too low and insignificant with positive sign. This clearly confirms that Marshal-Learner condition doesn't hold in Ethiopia, those devaluation measures fail to improve trade balance. Even

though, merchandise export has markedly increased due to devaluation measures, simultaneously, merchandize import has grown rapidly which lets trade balance to worsen continuously.

# Chapter Five

## 5. Conclusion and Policy Implication

### 5.1. Conclusion

The study has examined the long run relationship between currency devaluation and balance of trade in case of Ethiopia using elasticity approach by employing a cointegration technique. The paper used trade balance, real effective exchange rate, and domestic and trading partners' income as determinant variable to check the validity of Marshal-Learner condition, whether real devaluation would improve the trade balance, that is the sum of export and import demand elastcities greater than unity.

The major finding of the paper confirmed that exchange rates do not play a role in determining the long equilibrium behavior of the Ethiopians' trade balance; also it doesn't support the empirical validity of the *Marshall-Lerner (ML) condition*, indicating that devaluation will not improve the long run trade balance worsening. Elasticity estimates are too low and inconsistent to support ML condition. To come up with such conclusion the study has conducted various types of tests which are widely used in applied econometrics.

Primarily, the study carried out unit root test 'without' and 'with' structural break next to Chow structural break test. For the former one, it employed the conventional ADF test however for the latter one, both Zivot and Andrews and Perron's test are applied. So both type of test revealed that all variables are stationary at first difference or they are integrated of order one. Consequently, the presence of stable long run equilibrium relationship is proved using cointegration test, employing the popular residual based Engle-Granger and Phillips-Quallaris and Gregory-Hansen (GH) cointegraton test. The GH test allows structural break but the first two do not consider possible regime shift in their specification.

Both type of cointegration tests indicated that there is stable and long run equilibrium relationship among cointegrating regressors and the regressand. Finally, the cointegration equation elasticity parameters are estimated via Fully-Modified Ordinary Least Square (FM-OLS) technique from the class of cointegrating estimators. The Estimates of price and income elascticties are relatively small and mixed result in terms of expected sign and significance. Of which, the coefficient of real effective exchange rate is found statistically insignificant and inconsistent sign against prior assumption. The result clearly infer against popular international trade theory, Marshal-Learner condition, which prescribes exchange rate devaluation as remedy for current account deficit. It will no longer works in Ethiopia to cure the deteriorated trade balance account unless followed by other policy measures.

There is persistent and growing gap between the value of exports and imports of Ethiopia since the domestic economy is growing and the productive capacity of the country is expanding at an increasing rate especially after *Derg* regime. Through time the growth of imported goods has increased significantly as compared to the growth of exported goods which implies Ethiopia still remains an import dependent economy. Even if there are higher growth rates of exports after a depreciation of the *Birr* against US Dollar, the growth rate of imports is larger and prevents any improvement in the trade balance account.

It case of significantly low price elasticities, it's believed a large devaluation would be necessary to boost export growth which is needed to improve the trade balance. However, with such large devaluations, inflationary pressures are inevitable. In other words, inflation would also affect relative prices of exported goods negatively which makes them less demanded in world market. In general for African countries and Ethiopia in particular, exported commodities have low price elasticties as these commodities are primary agricultural products. Diversification and shifting to high value added manufacturing and service sector export could help to relatively improve trade balance deficit.

## 5.2. Policy Implication

The themes of the study tell us a merely advocacy of Marshal-Learner condition to correct trade balance doesn't work anymore. Thus, the extent of the widening trade balance deficit cannot be only attributed to specific *Birr* depreciation. Alternative policies to improve the trade balance would have to involve increasing the competitiveness of domestically produced goods other than currency depreciation. This could mean promoting for domestic producers which may also reduce the reliance on imports which is linked with industry favored strategy. At least we have to adopt import substitution industrialization strategy on some imported items based on our comparative advantage.

Though the following recommendations or ideas are not supported by findings, the researcher believe, it will be future area of study or potential policy implication to correct the worsening trade balance of Ethiopia. In addition to easing infrastructural delivery such as transportation facilities and institutional bureaucracies, exporting high value added export items also should be given emphasis. It has two way benefits to correct trade balance deficit through simultaneously increasing export value and reducing import of processed and semi processed items. Beside undervalued exchange rate policy which has a lower degree of pass through from exchange rate to inflation, could play a great role in increasing the competitiveness of Ethiopian export sector in the world market alongside exporting high valued agricultural products and other export measures.

Focusing on more elastic goods out of primary agricultural products, which should be investigated, could help to increase export and import dependency as well. Overall, a hybrid of policies like exchange rate and institutional policies may improve the worsening trade deficit of Ethiopia.

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# Appendices

## APPENDEX A: Gregory-Hansen Cointegration Test with Structural Break

```
. ghansen TB REER YF YD, break(level) lagmethod(aic) maxlags(3)

Gregory-Hansen Test for Cointegration with Regime Shifts
Model: Change in Level                              Number of obs   =        38
Lags  =  0  chosen by Akaike criterion              Maximum Lags    =         3

              Test       Breakpoint   Date        Asymptotic Critical Values
            Statistic                            1%           5%          10%
-------------------------------------------------------------------------------
   ADF       -7.43          7        1980      -5.77        -5.28       -5.02
   Zt        -7.53          7        1980      -5.77        -5.28       -5.02
   Za       -45.82          7        1980     -63.64       -53.58      -48.65
-------------------------------------------------------------------------------

. ghansen TB REER YF YD, break(trend) lagmethod(aic) maxlags(3)

Gregory-Hansen Test for Cointegration with Regime Shifts
Model: Change in Level and Trend                    Number of obs   =        38
Lags  =  0  chosen by Akaike criterion              Maximum Lags    =         3

              Test       Breakpoint   Date        Asymptotic Critical Values
            Statistic                            1%           5%          10%
-------------------------------------------------------------------------------
   ADF       -8.10          32       2005      -6.05        -5.57       -5.33
   Zt        -8.22          16       1989      -6.05        -5.57       -5.33
   Za       -49.44          16       1989     -70.27       -59.76      -54.94
-------------------------------------------------------------------------------

. ghansen TB REER YF YD, break(regime) lagmethod(aic) maxlags(3)

Gregory-Hansen Test for Cointegration with Regime Shifts
Model: Change in Regime                             Number of obs   =        38
Lags  =  0  chosen by Akaike criterion              Maximum Lags    =         3

              Test       Breakpoint   Date        Asymptotic Critical Values
            Statistic                            1%           5%          10%
-------------------------------------------------------------------------------
   ADF       -8.19          16       1989      -6.51        -6.00       -5.75
   Zt        -8.30          16       1989      -6.51        -6.00       -5.75
   Za       -48.94          16       1989     -80.15       -68.94      -63.42
-------------------------------------------------------------------------------
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```
. ghansen TB REER YD YF, break(regimetrend) lagmethod(aic) maxlags(3)

Gregory-Hansen Test for Cointegration with Regime Shifts
Model: Change in Regime and Trend                  Number of obs    =        38
Lags  =  0  chosen by Akaike criterion             Maximum Lags     =         3

             Test       Breakpoint   Date        Asymptotic Critical Values
            Statistic                           1%           5%          10%
------------------------------------------------------------------------------
   ADF      -10.40          27        2000      -6.89        -6.32       -6.16
   Zt       -10.60          28        2001      -6.89        -6.32       -6.16
   Za       -54.66          28        2001     -90.84       -78.87      -72.75
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**DECLARATION**

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

**Declared by**

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