The Effect of Exchange Rates on Economic Growth in Ethiopia

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Abstract

This study attempts to investigate the effect of exchange rates on economic growth in Ethiopia using annual time series data spanning from 1985/86 to 2014/15. The explanatory variables in this study were real effective exchange rate, government final consumption expenditure, gross fixed capital formation, broad money supply and trade openness. The multilateral real exchange rates are used to measure real exchange rates. Results from Vector Error Correction Model revealed that real effective exchange rates, broad money supply and trade openness have a positive long run effect on economic growth, while government final consumption have a negative long run effect on the economic growth of Ethiopia. From the regression results, it was noted that undervaluation of the currency is contractionary in the long run and neutral in the short- run. As such, the effect of exchange rates on economic growth works through the supply channel. It is the reflection of various economic and policy shocks, mainly a strategy shift of the government. Based on the findings of this study, the researcher recommended that since the Ethiopian output is dominated by primary agricultural products and is insensitive for the change in exchange rate, government intervention is needed to balance the adverse effect of exchange rate movements until the economy is well transformed from agricultural lead economy to industrial lead economy and becomes less dependent on imported raw materials.

Key Words: Exchange Rates, Economic Growth in Ethiopia

1. Introduction

1.1. Background of the Study

Countries have the same consensus on the possible effect of exchange rates on economic growth until the end of 1970s. There appears a consensus view on the fact that exchange rate devaluation or depreciation could boost domestic production through stimulating the net export component. This is possible because devaluation increases international competitiveness of domestic industries which leads to the diversion of spending from foreign goods to domestic goods. Up to this period, devaluation has expansionary effect on output. It would improve trade balance, alleviate balance of payment deficits, and accordingly expand output and employment (Accra, 2000).

Since 1992, Ethiopia, under the support and guidance of the IMF and the World Bank has undergone liberalization and enhanced Structural Adjustment Programs (SAPs) to restrain internal and external imbalances of the economy. One of the basic tasks of the new policy is to increasingly open the economy to foreign competition with a view of benefiting the economy from expanded markets. To this end, the government uses different tools such as: devaluation of the Ethiopian Birr (ETB) and step-by-step liberalization of the foreign exchange market (Haile, 1999).

In the recent period, devaluation has become the basic macroeconomic policy issue in most less developed countries. The effect is contractionary or expansionary; depending on the structure of the economy. During the structural adjustment program, the International Monetary Fund (IMF) and World Bank (WB) suggested for developing countries to devalue their currency for the

development of domestic firms. Devaluation increases the demand for domestic product and protects infant firms from outside competition (Genye, 2010). Krugman T. (1978) examines the negative effect of currency devaluation on output in developing countries which has used devaluation as a policy strategy. However, many researchers like Eichengreen, (2008), Mbaye, (2012), Accra (2000), Schweicker, Thiele and Wiebelt, (2006), Ngandu and Gebreslassie, (2006), Medina-Smith (2001), Schweicker et al., (2006) and Araujo and Soares (2011) found different results on the effects of currency devaluation on output in less developed countries.

1.2 Statement of the Problem

Even though ambiguous results were observed on the possible effect of devaluation, developing countries have actively used devaluation as a policy instrument. This study investigates the long run and short run effects of currency devaluation on real output growth in Ethiopia for two reasons. First, the country has short story of using exchange rate adjustments as a policy tools to promote external competitiveness. Since 1992, Ethiopia devalued its currency where the ETB exchange rate is adjusted continuously rather than discretely, as it was previously the case. Second, Ethiopia is heavily dependent on agricultural products and imported intermediate goods that would have contractionary effect on output. Despite the large number of studies on the effect of exchange rates on economic growth, they generally considered channels of exchange rates while the growth implications of currency adjustments are generally overlooked. The responses of productions and exports of the countries are highly heterogeneous depending on their characteristics such as export orientation, import dependency and liability of dollarization. The empirical evidence on the effects of currency adjustments on output is mixed and consequently government development approaches, where the manufacturing industry and its sub-sectors are being the main engine of economic growth, are the best possible option to guide policy directions of Ethiopia. This study, therefore, attempted to fill this research gap.

1.3 Objective of the Study

The general objective of this study is to analyze the effect of exchange rates on economic growth in Ethiopia spanning from 1985/86 to 2014/15.

The specific objectives of the study will be as follows:

- To provide a review of the trends in exchange rates and economic growth of Ethiopia over the period 1985/86-2014/15.
- To analyze the short run and long run effect of exchange rates on economic growth in Ethiopia during the period 1985/86-2014/15.

1.4 Basic Research Questions

- What look like the trend of exchange rates and economic growth in Ethiopia?
- Does an exchange rate have a long run effect on economic growth in Ethiopia?

1.5 Hypothesis

H0: Exchange rates do have a long run effect on economic growth in Ethiopia.

H1: Exchange rates do not have a long run effect on economic growth in Ethiopia.

1.6 Significance of the Study

The issue of nominal devaluations attracts so much attention in Ethiopia; discussions around this mainly focus on inflation and are generally without any reference to overall economic activity. This generates a lack of attention to the role of exchange rate management for promoting economic growth and maintaining the external competitiveness. It is on this basis that this study adds value to the relevant macro policy discourse more effectively by carrying out an empirical investigation of the effects of exchange rate changes on economic growth based on the government development approaches. Even though the study focuses on Ethiopia, the results from this study can hopefully be used when evaluating the growth effects of exchange rates in other developing countries.

1.7 Scope and Limitation of the Study

The study analyzes the effect of exchange rates on economic growth in Ethiopia. To achieve this objective, the period range from 1985/86 to2014/15 is chosen, based on two reasons: primarily the official exchange rate was first announced in 1992, and the other is Ethiopia's heavily dependency on imported intermediate goods that would have contractionary effect on output. However, the effect of exchange rate changes on production and international trade dynamics vary with technology intensity and product complexity of the country. This study did not take this into consideration because the researcher thought that it is insignificant in the context of Ethiopia. Another limitation of this study concerns data on the Ethiopian economy because it lacks consistency. Different data sources give different information or fact or records for the same variable. To maintain accuracy and consistency, the study used data from the Ministry of Finance and Economic Development, Central Statistics Agency and National Bank of Ethiopia which are more harmonized. The objectivity of the economy which is obsessed by factors like political and rules of law (property right) are not addressed here and might be consider other limitations of this study.

1.8 The Organization of the Study

Chapter I provides the introduction to the study; Chapter II reviews both the theoretical and empirical literature pertaining to the relationship between the exchange rates and economic growth; Chapter III presents a discussion on the research methodology; Chapter IV presents both the descriptive and econometric results and the interpretation of the results; finally Chapter VI provides a summary of main findings, and conclusions based on the findings along with their policy implications.

2. Data and Methodology

2.1 Introduction

This chapter presents the research design, the theoretical framework and the empirical model. It also presents the data type and the data source, definitions, measurements and expected signs of variables, testing techniques for variables and diagnostic test techniques for residuals.

2.2 Research Design

The study made use of the quantitative research design because of the quantifiable and the numerical data that is produced in the process. This research deals with the manipulation of the empirical variables from time series data for the period 1985/86 to 2014/15. This period ranges

from end of socialist Derg regime and coming of EPRDF in Ethiopia with various reforms of government policies. These include trade reforms, exchange rate policies, and other global reforms like the liberalization of the economy and the Structural Adjustment Programs (SAPs).

2.3 Data Type and Sources

Due to the very nature of the study, the only source of data used is secondary data sources based on the country's level macroeconomic data. The annual time series data for the period 1985/86 to 2014/15 on real gross domestic product, real effective exchange rate, government final consumption expenditure, gross fixed capital formation, broad money supply and trade openness were gathered from the Ministry of Finance and Development and National Bank of Ethiopia. The choice of the period is basically based on the availability of data.

2.4 Method of Data Analysis

Descriptive as well as Econometric methods are employed to discuss and analyze different issues. In the descriptive technique, statistical and time series properties such as means, standard deviations, maximums, minimums and correlation matrices are used. These measurements are used to show the trending behavior of economic growth with respect to real effective exchange rate and other variables. In the Econometric method part, emphasis is placed on investigating the effects of Real Effective Exchange Rate on the growth of Real Gross Domestic Product. The data is analyzed using EViews 8 software. The nature of the model is given in natural logarithmic form to make the analysis and interpretation of the results easier in terms of percentage and growth rate.

2.5 Model Specification

This study modifies (Accra, 2000) model. The reduced form equation for output in this model is formally specified below. Here, broad money supply is used instead of money supply term.

$$y_t = \alpha + \gamma T + \beta_1 G_t + \beta_2 \Delta M_t^s + \beta_3 TT_t + \beta_4 E_t + e_t \quad \ldots\ldots 1$$

Where
y_t: Real output
α: Constant term
γ : Parameter that captures the trend rate of growth
T: Time period
G: Relative size of government (the ratio of government expenditures to nominal output)
M^s: Money supply term (the difference between actual and expected rate of growth of nominal money supply)
TT: Terms of trade
E: Real exchange rate
ε: Error term with mean zero and constant variance.
The main objective of this study is to investigate the effect of the exchange rates on real economic growth (GDP). An output growth model specified as follows:

$$Y = \beta_0 + \beta_1 REER + \beta_2 GFCE + \beta_3 GCF + \beta_4 M2 + \beta_5 TO + \varepsilon \quad \ldots\ldots 2$$

Where:

β_0: The intercept

$\beta_1, \beta_2, \beta_3, \beta_4$ and β_5: Coefficients of the explanatory variables, ε: Error term which represents omitted variables and other errors in the specification of the model, RGDP: real gross domestic product, REER: real effective exchange rates, GFCE: government final consumption expenditure, GCF: gross fixed capital formation, M2: broad money supply, TO: trade openness.

To obtain elasticity coefficients and remove the effect of outliers, the variables have to be transformed to natural logarithms.

This can econometrically be stated as:

$$lnRGDP_t = \beta_0 + \beta_1 lnREER_t + \beta_2 lnGFCE_t + \beta_3 lnGCF_t + \beta_4 lnM2_t + \beta_5 lnTO_t + e_t \ldots\ldots 3$$

Where;

$lnRGDP_t$= Log of real gross domestic product
lnREER = Log of real effective exchange rate index
lnGFCE= Log of government final consumption expenditure
lnGFCF= Log of gross fixed capital formation
lnM2= Log of liquid liability or broad money supply
lnTO= Log of trade openness index

I. Definition and Measurement of Variables

All of the variables included in the above model are stated in terms of natural logarithm. The reason behind taking the natural logarithm of the variables is that, it enables to correct skewed data into normal distribution which is a critical assumption in econometric estimation (Verbeek, 2004).

Natural Log of real gross domestic product: - represents real income or real gross domestic product. Real gross domestic product refers to the value of all final goods, and services produced within the territory of a given country in a given period, usually a year. It is calculated at constant price. Since most economists argue that economic growth can be measured as growth in real GDP, it includes in the model as main dependent variable in order to measure economic growth. In order to avoid the inconsistency associated with different base year price while computing real GDP, this study was used the real GDP (constant value), which is deflated by Ministry of Finance and Economic Development (MoFED) based on the constant price of 2010/11 G.C. or 2003 E.C.

Natural Log of real effective exchange rate:- As the measure of real exchange rate, the researcher preferred to use multilateral real effective exchange rates instead of bilateral real exchange rates since they can move in different, and even opposite directions after the collapse of Bretton Woods's system. The use of bilateral indexes can result in misleading and incorrect inferences regarding the evolution of a country's degree of competitiveness. Therefore, it is necessary to use a multilateral index of real exchange rate especially when evaluating policy related situations. Real effective exchange rate of 15 major trade partners (Djibouti, Kenya, Sudan, U.A.R, France, Germany, Italy, Netherlands, U.K., Russia, Yugoslavia, U.S.A., Peoples Republic of China, Japan, and Saudi Arabia) instead of frequently used bilateral (usually against USD) real exchange rate was chosen because it is richer measure of competitiveness. Also Ethiopia's trade is not only against the United States of America but against more countries; hence, an average for these trading partners is a more realistic measure.

Natural Log of government final consumption expenditure: - is the government expenditure on goods and services that are used for the direct satisfaction of individual needs or collective needs

of members of the community. It includes all government current expenditures for purchases of goods and services.

Natural Log of trade openness index: - is the measure of openness to trade. In this study, trade intensity or trade ratio import plus export divided by GDP is used as proxy for trade openness. The reason behind applying trade ratio as a measure of trade openness is that of its popular measure of trade openness, and it is widely used by various researchers. All variables are expressed in current prices. The researcher used GDP deflator to make it real.

Natural Log of gross fixed capital formation: - is the net increase in physical assets (investment minus disposals) within the measurement period. It is proxy used to measure net investment.

Natural Log of broad money supply: - money supply is the amount of money within a specific economy available for purchasing goods or services. For the purposes of this study, the broad definition money supply (M2) is adopted which includes all bank notes and coins in circulation plus all deposits of the domestic private sector with banking institutions. The rationale behind choosing M2 as proxy for money supply is that it has a stable relationship with the domestic demand compared to M1.

M1 money is narrow money supply which used as transaction purpose and immediate repurchase. Narrow money means primary intended for transaction purpose, like checkable deposits, traveler checks, demand deposit and currency apprehended by the public. M2 is defined as broad money supply and the national bank of Ethiopia used as a policy instrument to stabilize the economy. Broad money is a measure of the domestic money supply that includes M1 money. M2 money can be used for spending.

III. **Expected Signs**

The parameter β_1 captures the effect of real effective exchange rate on output growth. For the purpose of this study, the sign of this parameter is critical. As long as the parameter is statistically significant, a positive sign will indicate an expansionary, while a negative sign will indicate a contractionary effect. An increase in government final consumption expenditure reduces the resources available for investment and can be contractionary and hence β_2 is expected to be negative. β_3 is expected to be positive, as a rise in gross fixed capital formation expansionary to economic growth. β_4, and β_5 are also expected to be positives, because an increase in money supply and trade openness are expected to affect output positively.

Table 2.1: Expected Sign of the Independent Variables

Variables	**Expected signs**
Real effective exchange rate	+/-
Government final consumption expenditure	-
Gross fixed capital formation	+
Broad money supply	+
Trade openness	+

2.6 Unit Root Tests

Stationarity is defined as a quality of a process in which the statistical parameters (mean and standard deviation) of a process do not change with time (Challis and Kitney, 1991). The assumption of the classical regression model necessitate that both the dependent and independent variables be stationary and the errors have a zero mean and finite variance. According to Newbold and Granger (1974), the effect of non stationarity includes spurious regression, high R^2 and low Durbin-Watson (DW) statistic. Below are basic reasons why data must be tested for non stationarity.

First, the stationarity or otherwise of a series can strongly influence its behavior and properties, for instance, persistence of shocks will be infinite for non-stationary series. Secondly, if two variables are trending over time, a regression of one, on the other hand could have a high R^2 even if the two are totally unrelated; and this is known as spurious regressions. Thirdly, if the variables in the regression model are not stationary, then it can be proved that the standard assumptions for asymptotic analysis will be invalid. In other words, the usual "t-ratios" will not follow a t-distribution, so it is impossible to validly undertake hypothesis tests about the regression parameters (Bowerman and O'Connell, 1979).

I. Augmented Dickey-Fuller (ADF) test

The augmented dickey fuller test modifies the work done by Dickey and Fuller (1979 and 1976 respectively).The aim of the Dickey Fuller theory was to test the hypothesis that $\emptyset = 1$ in:

$y_t = \emptyset y_{t-1} + \mu_t$ 4

Thus, the hypotheses are formulated. H_0 Series contains a unit rootH_1: series which is stationary.

The rejection of the null hypothesis under these tests means that the series does not have a unit root problem.

The standard Dickey Fuller test estimates following equation:

$\Delta y_t = \beta_1 + \beta_{2t}\varphi y\varepsilon_{t-1} + \mu_t$ 5

Where y_t is the relevant time series, Δ is a first difference operator, t is a linear trend and μ_t is the error term. The error term should satisfy the assumptions of normality, constant error variance and independent error terms. According to Gujarati (2004), if the error terms are not independent in equation (4), results based on the Dickey-Fuller (DF) tests will be biased.
The weakness of the DF test is that it does not take account of possible autocorrelation in the error process or term(μ_t). Clemente, et al (1998), noted that a well–known weakness of the Dickey–Fuller style unit root test with 1 as a null hypothesis is its potential confusion of structural breaks in the series as evidence of non-stationarity.

Blungmart, (2000) stated that the weakness of the Dickey-Fuller test is that it does not take account of possible autocorrelation in error processε_t. If ε_t is auto-correlated, then the OLS estimates of coefficients will not be efficient and t-ratios will be biased. In view of the above mentioned weaknesses the Augmented Dickey-Fuller test was postulated and is preferred to the Dickey-Fuller test.

The presence of serial correlation in the residuals of the Dickey-Fuller test biases the results (Mahadeva and Robinson, 2004). When using the Dickey-Fuller test the assumption is that the error terms ε_t are uncorrelated. But, Dickey and Fuller developed a test, known as the Augmented Dickey-Fuller test to cater in case ε_t is correlated for the above mentioned problem.

The Dickey-Fuller test is only valid where there is no correlation of the error terms. If the time series is correlated at higher lags, the augmented Dickey-Fuller test constructs a parameter correction for higher order correlation, by adding lag differences of the time series. The Augmented Dickey-Fuller test estimates the following equation:

$$\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta y_{t-1} + \varepsilon_t \quad \ldots\ldots 6$$

Where ε_t is a pure white noise error term and where $\Delta y_{t-1} = (y_{t-1} - y_{t-2})$, $\Delta y_{t-2} = (y_{t-2} - y_{t-3})$, etc. According to Gujarati (2004), the number of lagged difference terms to include is often determined empirically, the idea being to include enough terms so that the error term in (4.5) is serially uncorrelated. In ADF as in DF the test is whether $\delta = 0$ and the ADF test follows the same asymptotic distribution as the DF statistic, so the same critical values can be used.

The calculated value of ADF is then compared with the critical value. If the calculated value is greater that the critical value, we reject the null hypothesis, that the series have unit root, thus confirming that the series are stationary.
In a nutshell Gujarati (2004), states that an important assumption of the DF test is that the error terms μ_t are independently and identically distributed. The ADF test adjusts the DF test to take care of possible serial correlation in the error terms by adding the lagged difference terms of the regression.

II. Phillips-Perron (PP) Tests

The Phillips-Perron tests are a more comprehensive theory of unit root non-stationarity. Gujarati (2004), states that the Phillips-Perron use non-parametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference terms. According to Brooks (2008), the tests are similar to ADF tests, but they incorporate an automatic correction to the DF procedure to allow for auto correlated residuals. The PP test and the ADF test have the same asymptotic distribution. Brooks (2008) explains that the PP tests often give the same conclusions, and suffer from most of the same important limitations as, the ADF tests.

2.7. Johansen Co-integration Test and Vecm

When dealing with time series data, there is need to check if the individual time series are either stationary or that they are co-integrated. If that is not the case, there is great chance of engaging in spurious (or nonsense) regression analysis (Gujarati, 2010). If two series appear to move together over time, it suggests that there exist an equilibrium relationship. This therefore, shows that even though the variables are non-stationary in the short run and if they are co-integrated, they will move closely together over time and their difference will be stationary.

The vector autoregressive (VAR) model is a general framework used to describe the dynamic interrelationship among stationary variables. Dolado *et al*. (1999) states that if the time series are not stationary then the VAR framework needs to be modified to allow consistent estimation of the

relationships among the series. The vector error correction (VEC) model is just a special case of the VAR for variables that are stationary in their differences (for instance, I (1)). The VEC can also take into account any co-integration relationships among the variables.

In order to justify the use of vector error correction model (VECM), there is need to test for co-integration. A VECM is intended to be used with non-stationary series that are known to be co-integrated. Brooks (2008) contends that the VECM has co-integration relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge to their co-integrating relationships while allowing for short-run adjustment dynamics. Brooks (2008) also states that the co-integration term is known as the correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments estimated. Thus, the presence of a co-integration relation(s) forms the basis of the vector error correction model (VECM) specification.

There are several methods of testing for co-integration; but two often stand above the rest namely the Engle-Granger approach which is residual based and the Johansen and Julius (1990) technique which are based on maximum likelihood estimation on a VAR system. Brooks (2008) argues that the problems of the Engle-Granger approach include lack of power in unit root tests, simultaneous equation bias and the impossibility of performing hypothesis tests about the actual co-integration relationships.

In light of the above mentioned shortfalls of the Engle-Granger approach this study applies the vector error correction modeling (VECM) by Johansen (1991; 1995). The rationale behind being that this approach applies maximum likelihood estimation to a vector error correction (VEC) model to simultaneously determine the long run and short run determinants of the dependent variable in a model. This approach also provides the speed of adjustment coefficient, which measures the speed at which Gross Domestic Product reverts to its equilibrium following a short term shock to the system (Greene, 2000).

I. Johansen Technique Based on VAR s

According to Greene (2000) the following steps are used when implementing the Johansen procedure:

Step 1: Testing for the order of integration of the variables under examination. All the variables should be integrated of the same order before proceeding with the co-integration test.

Step 2: This step involves setting the appropriate lag length of the model. Also in the step are the estimation of the model and the determination of the rank of Π.

Step 3: With regards to the deterministic components in the multivariate system, the choice of the appropriate model is made. An analysis of the normalized co-integrating vector(s) and speed of adjustment coefficients is made.

Step 4: Step 4 includes the determination of the number of co-integrating vectors. Causality tests on the error correction model to identify a structural model and determine whether the estimated model is reasonable are done in this last step.

After ascertaining the existence of co-integrating relationships, the vector error correction model (VECM) is estimated to test for the short-run dynamics. We consider the following VAR of order P:

$y_t = A_1 y_{t-1} + \cdots A_p y_{t-p} + Bx_t + \varepsilon_t$ ……..……7

Where,
y_t is a k-vector of non-stationary I (1) variables, x_t is a d-vector of deterministic variables, and ε_t is a vector of innovations. In order to use the Johansen test, the VAR needs to be turned into a VECM specification (Brooks, 2008). We may rewrite this VAR as:

$\Delta y_t = \Pi y_{t-1} + \sum_{i-1}^{p-1} \Gamma_i \Delta y_{t-1} + Bx_t + \varepsilon_t$……8

Where:
$\Pi = \sum_{i-1}^{p} A_i - I, \quad \Gamma_i = -\sum_{j=i+1}^{p} A_j$……....9

Granger's representation theorem asserts that if the coefficient matrix has reduced rank $r < k$, then there exist $k \times r$ matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is I (0). R is the number of co-integration relations (the co-integration rank) and each column of β is the co-integrating vector. The elements of α are adjustment parameters in the VEC model. Johansen's method is to estimate the Π matrix from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of Π (Green, 2007).

2.8 Impulse Response and Variance Decomposition Analysis

I. Impulse Response Analysis

The impulse response analysis traces out the responsiveness of the dependent variable in the VAR to shocks to each of the other variables. In this study therefore, it shows the sign, magnitude and persistence of real and nominal shocks to the real growth. Brooks (2008) further states that impulse response analysis is applied on the VECM and, provided that the system is stable, the shock should gradually die away. This study applies the generalized impulse response analysis. Lutkepohl (1993) cited in Rusike (2007) explains that this approach fully takes into account historical patterns of correlations amongst the different shocks.

II. Variance Decomposition Analysis

After performing the impulse response analysis, further information on the link between economic growth and exchange rates is found using the variance decomposition analysis. Brooks (2008) explains that variance decomposition analysis provides the proportion of movements in the dependent variables that are due to its own shocks and against shocks to other variables.

2.9. Diagnostic Checks

The diagnostic tests are very important in the analysis of the effect of exchange rate adjustments on economic growth in Ethiopia because, it validates the parameter estimation outcomes achieved by the estimated model. Diagnostic Checks test the stochastic properties of the model such as residual autocorrelation, heteroscedasticity and normality, and many more. These mentioned tests are applied in this study and, hence, they are briefly discussed below.

I. Heteroscedasticity

The OLS makes the assumption that $V(\varepsilon_j) = \sigma^2$ for all j. That is, the variance of the error term is a constant condition termed homoscedasticity. If the error terms do not have constant variance, they are said to be heteroscedastic. The study employs the White heteroscedasticity test. According to Greene (2000) white test computes the White (1980) general test for

heteroscedasticity in the error distribution to regress the squared residuals on all distinct repressors, cross-products, and squares of repressors. The test statistic, a Lagrange multiplier measure, is distributed Chi-squared (p) under the null hypothesis of homoscedasticity. The null hypothesis for the White test is homoscedasticity and if we fail to reject the null hypothesis then we have homoscedasticity. If we reject the null hypothesis, then we have heteroscedasticity.

II. Residual Normality Test

The assumption of normality is $\varepsilon_t \sim N(0, \sigma^2)$. The null is that the skewness (α_3) and kurtosis (α_4) coefficients of the conditional distribution of y_t (or, equivalently, of the distribution of ε_t) are 0 and 3, respectively:

H_0 : α_3 =0(if $\alpha_3 < 0$ then f (y_t/x_t) is skewed to the left)

$\alpha_4 = 3$ (If $\alpha_4 > 0$ then f (y_t/x_t) is leptokurtic)

The above assumptions can be tested using the Jarque-Bera test (JB). The JB test follows the null hypothesis that the distribution of the series is symmetric. The null hypothesis of normality would be rejected if the residuals from the model are either significantly skewed or leptokurtic (or both).

III. Autocorrelation lm Tests

Serial correlation happens when the error terms from different time periods (or cross-section observations) are correlated. In time series studies it occurs when the errors associated with observations in a given time period carry over into future time periods. Serial correlation (also called autocorrelation) in the residuals means that they contain information, which should itself be modeled. The Durbin-Watson statistic is used in the study to test for the presence of first order serial correlation in the residuals. The null hypothesis is no serial correlation ($H_0 := 0$). The DW statistic lies in the 0 to 4 range, with a value near 2 indicating no first order serial correlation. The Lagrangian Multiplier was used to test for serial correlation.

3. Empirical Analysis and Discussions

3.1 Introduction

Results from this chapter explain the effect of exchange rates on economic growth in Ethiopia using annual data for the period between 1985/86 and 2014/15. This chapter is divided into two sections. The first section of the chapter dealt with the descriptive nature of variables and trend of real exchange rate and economic growth in the period under consideration. The second section of the chapter presents the econometric analysis results with discussions and the impulse response and variance decomposition analysis. Finally the diagnostic checks on the residuals of VECM are presented.

3.2. Descriptive Data Analysis

Table 3.1: Summary Statistics

	LNRGDP	LNREER	LNGFCE	LNGCF	LNM2	LNTO
Mean	26.19546	4.937026	24.01997	24.80121	20.43848	-1.462662
Std. Dev.	0.559782	0.319283	0.512883	0.803108	0.533865	0.390637
Maximum	27.34070	5.651643	25.02938	26.72523	21.53243	-0.987332
Minimum	25.49257	4.538796	23.08347	23.54193	19.55608	-2.513022
Observations	30	30	30	30	30	30

Table 3.1 presents the summary statistics of the variables used to define real GDP growth in this study. It shows the number of observations, means, standard deviations, minimum and maximum values of each variable. All the variables have 30 observations. The average values of all variables are positive. Almost all variables have minimal standard deviations. The maximum and the minimum values show that the range is small and almost similar over all variables.

Table 3.2: Correlation Matrix between the Independent Variables

Correlation	LNREER	LNGFCE	LNGCF	LNM2	LNTO
LNREER	1.000000				
LNGFCE	-0.341123	1.000000			
LNGCF	-0.266019	0.888039	1.000000		
LNM2	-0.375362	**0.897445**	**0.947570**	1.000000	
LNTO	-0.666766	0.784638	0.781967	0.786584	1.000000

The correlation matrix, given by table 3.2, may give a clue to identify which variables to consider in the main analysis. It shows whether the degree of correlation between any two explanatory variables is high or low. If two explanatory variables are highly [perfectly] correlated, it would be difficult to identify the independent impact of each explanatory variable on the dependent variable. In this case a formal test of multi-co-linearity has to be conducted to determine which variable to retain and which one to exclude from the final analysis. The informal test of correlation matrix suggests the exclusion of one or more of the variables with the highest value in the matrix. I can start with natural logarithm of broad money supply (M2) which has the highest score with at least two variables.

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

Table 3.3: Variance Inflation factors of a full model

Variable	VIF	1/VIF
LNREER	3.022626	0.3308
LNGFCE	6.035149	0.1574
LNGCF	9.014081	0.11093
LNM2	9.260110	0.10799
LNTO	6.777121	0.14755
Mean	6.82181	

A formal test of multi-co-linearity is conducted with the help of variance inflation factor [VIF]. VIF shows how much the variance of a coefficient is "inflated" because of linear dependence with other predictors. A variable that has a VIF value of greater than 10 require further investigation. The level of tolerance defined as 1/VIF is also used to check the degree of co linearity among the independent variables. A variable with a tolerance value lower than 0.1, is considered as a linear combination of other independent variable (Eviews 3.1 User's Guide; 1999).

Table 3.3 shows VIF values of all variables are less than 10 and the level of tolerance 1/VIF values are also greater than 0.1. Thus variables are not a linear combination of other independent variables.

3.3. Effective Exchange Rate and Economic Growth

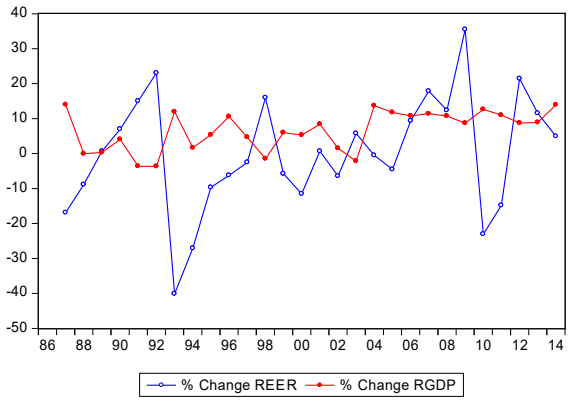

Figure 3.1: Trend of Real Effective Exchange Rates and Real GDP in Percentage Changes

The graphs of real effective exchange rate and real GDP are plotted against time on fig. 3.1. They seem to follow inverse trend for most of the study period. A decrease/increase in real effective exchange rate represents depreciation/appreciation of the domestic currency in this study. Except for years after the 2004, a decrease/depreciation of the real effective exchange rate is accompanied by a fairly stable movement in the real gross domestic product. Before the reform period the real effective exchange rate declines/depreciates sharply and rises/appreciates suddenly after the reform period 1992 until 1999.

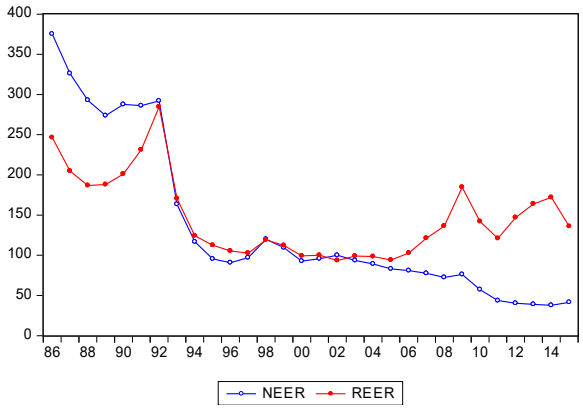

Figure 3.2: Trends in Real Effective Exchange Rates and nominal effective exchange rates: Average for the period - 16 trading partners

From the above line chart, the real effective exchange rate less than nominal effective exchange rate shows the undervaluation of birr, while the reverse implies the overvaluation of birr. The real effective exchange rate starts to decline and move closely with nominal effective exchange rate from the beginning of the current government. It confirms that decline in REER is real devaluation as per the National Bank of Ethiopia's computation. Real effective exchange rate is defined as a composite of nominal exchange rate, price indices [foreign and domestic] and trade weights. Any change in either price indices and/or trade weights of trading partners has the power to affect/change the real effective exchange rate. Changes in one of these factors could be the reason for the variation of real effective exchange rate and nominal effective exchange rate for the period prior to 1992[reform period] though the nominal exchange rate was fixed. After the reform period, the nominal exchange rate is partly determined by the demand for and supply of foreign exchange among the commercial banks. Therefore, in addition to the above factors, any change in demand for and supply of foreign exchange of the inter-banks market, also affects the real effective exchange rate during this period.

Ethiopia’s inflation is currently higher than all its trading partners included in the researcher’s analysis. As a result, despite depreciation pressure, NBE’s real effective exchange rate calculation shows rapid ETB appreciation in recent years. An overvalued exchange rate is hampering the competitiveness of Ethiopia. The authorities have continued to favor gradual ETB depreciation but, real effective exchange rate appreciation reveals increasing pressure for more significant devaluation. The ETB has depreciated gradually so far this year. However, ongoing deterioration of Ethiopia’s current account position for the coming years will likely increase pressure on the authorities to devalue the currency on a larger scale. The authorities remain focused on improving export performance. Infrastructure development and reforms to improve the investment environment are important to increasing investment and enabling export-led sectors such as manufacturing to develop further. Increasing power-sector capacity and infrastructure projects including rail and road remain important in GTP II. The authorities are targeting huge investment spending on industrial parks over the next 10 years. This should help drive manufacturing performance over the medium term, but concerns remain about the affordability of such plans. Since export performance has been sluggish, hampered by softer commodity price trends and weak commodity exports; all of which has contributed to a wider trade deficit.

3.4 Tests of the Time Series Data

3.4.1 Stationarity Tests

The opening stage of the Johansen procedure is to test for stationarity in time series. There are two main methods to test whether time series are stationary or not, namely; the graphical method which is informal and then the formal test. This study first presents the visual plot of graphs before the formal tests. The formal tests conducted are the Augmented Dickey-Fuller and the Phillips-Peron tests. These tests are very important as they give insight into the structural breaks, trends and stationarity of the data set (Brooks, 2008).The graphical results from the test for stationarity are presented in Appendix A and B. The informal method, however, is not enough to conclude that data is stationary as it is informal, hence the need for a more formal method to complement it. Consequently, other formal tests were conducted to support findings from the graphical findings. In this regard, the Augmented Dickey-Fuller and the Phillips-Peron tests were adopted and the results are presented in Table 3.4(a) and 3.4 (b) below.

Table 3.4 (a) Stationarity results of the Augmented Dickey-Fuller test

Augmented Dickey-Fuller

Order of integration	Variable	Intercept	Trend and	Intercept None
Level	LRGDP	2.932315	-0.331735	6.598178
1st difference	DRGDP	-3.918600***	-6.205928***	-0.20437
Level	LREER	-2.084972	-1.784539	-0.757074
1st difference	DREER	-4.201641***	-4.111850**	-4.254503***
Level	LGFCE	-0.202638	-1.804557	1.676351
1st difference	DGCFE	-4.098026***	-4.138530**	-3.911547***
Level	LGCF	1.526031	3.927666	2.693409
1st difference	DGCF	-5.081032***	-3.894111**	-1.221451
Level	LM2	0.701184	-1.555282	4.975718
1st difference	DM2	-2.05602	-2.190841	-2.973099***
Level	LTO	-0.985783	-2.060605	-0.946412
1st difference	DTO	-4.485758***	-3.450428*	-4.489703***
1%	Critical values	-3.689194	-4.323979	-2.650145
5%		-2.971853	-3.580623	-1.953381
10%		-2.625121	-3.225334	-1.609798

Values marked with a *** represent stationary variables at 1% significance level, and ** represent stationary at 5% and * represent stationary variables at 10%.

Table 3.4 shows that the test in intercepts, intercepts and trends and none revealed that all the variables in levels were not stationary as reflected by the non-rejection of the null hypothesis at both 1% and 5 % significance levels. The entire differenced variables test in intercepts was stationary at 1% significance level; hence the null hypothesis of unit root is rejected. For the test under trend and intercept and no trend and no intercept data series were all stationary at 1% and 5% significance level respectively.

Table 3.4 (b) Stationarity results of the Phillips-Perron test

Phillips-Perron

Order of integration	Variable	Intercept	Trend Intercept	None
Level	LRGDP	2.932315	-0.331735	4.864413
1st difference	DRGDP	-4.168828***	-6.769424***	-2.386941**
Level	LREER	-2.103499	-1.747646	-0.835676
1st difference	DREER	-4.065072***	-3.967384**	-4.132922***
Level	LGFCE	-0.335725	-1.999084	1.643656
1st difference	DGCFE	-3.963587***	-4.126317**	-3.825801***
Level	LGCF	2.310291	-0.893955	2.708496
1st difference	DGCF	-5.081270***	-6.187912***	-4.357662***
Level	LM2	1.016686	-1.723237	5.579397
1st difference	DM2	-4.563617***	-5.849393***	-2.968891***
Level	LTO	-1.151022	-2.21516	-0.838591
1st difference	DTO	-4.467832***	-4.380167***	-4.431264***
1%	Critical values	-3.689194	-4.323979	-2.650145
5%		-2.971853	-3.580623	-1.953381
10%		-2.625121	-3.225334	-1.609798

Values marked with a *** represent stationary variables at 1% significance level, and ** represent stationary at 5% and * represent stationary variables at 10%.

Table 3.4 shows the Phillips-Perron test results are similar to ADF tests, but they incorporate an automatic correction to the DF procedure to allow for auto correlated residuals. For variables in levels, the test in intercepts revealed that all of the variables were not stationary. All differenced variables on intercepts were stationary at 1% significance level. On trend and intercept all variables were non-stationary in levels but, all variables on trend and intercept were stationary at 1% and 5% significance level when first differenced. For the test under no trend and no intercept, all variables in levels were non-stationary. When first differenced, all the variables were stationary at 1% and 5% significance level.

Both methods used to test for stationarity significantly revealed that the data series were none stationary in levels and stationary when first differenced. Therefore, the series are integrated of the same order I (1).

3.5. Tests for Co-integration

If the variables are integrated of the same order, it is very important to determine whether there exists a long-run equilibrium relationship amongst them. Co-integration describes the existence of equilibrium or stationarity relationship between two or more times series; each of which is individually non stationary. For the purposes of this study co-integration examines the long run relationship between the real gross domestic product and its determinants. It is very important to assess whether there exists long run relationships between real gross domestic product and the chosen determinants, in order for a viable economic conclusion to be reached from the results obtained. The co-integration approach allows researchers to integrate the long run and short run relationship between variables within a unified framework (André, 2007). The Johansen co-integration approach is preferred over the Engle and Granger residual-based methodology to test for co-integration because of the obvious reasons mentioned in this chapter.

Since all variables are non-stationary in level, the next procedure is to test for the existence of long run relationships among the variables in the model. The co-integration test using Johansen test requires the estimation of a VAR equation. The variables i.e. LNREER, LNRIR, LNGFCE,

LNGCF, LNM2 and LNTO are entered as endogenous variables. Table 3.6 below presents the co-integration test results.

Table 3.6 Testing for co-integration in Johansen-Juselius procedure

Null hypothesis	*Alternative hypothesis*	*Computed statistics: Order of VAR = 1*	*5% Critical values*	*Hypothesized No. of CE(s)*
The Co-integration Rank Test (Maximum Eigen value)				
$r = 0$	$r = 1$	40.92424	40.07757	None *
$r = 1$	$r = 2$	26.58033	33.87687	At most 1
$r = 2$	$r = 3$	17.46233	27.58434	At most 2
$r = 3$	$r = 4$	16.14304	21.13162	At most 3
$r = 4$	$r = 5$	8.552719	14.26460	At most 4
$r = 5$	$r = 6$	2.81E-05	3.841466	At most 5
The Co-integration Rank Test (Trace)				
$r = 0$	$r \geq 0$	109.6627	95.75366	None*
$r \leq 1$	$r \geq 1$	68.73845	69.81889	At most 1
$r \leq 2$	$r \geq 2$	42.15811	47.85613	At most 2
$r \leq 3$	$r \geq 3$	24.69578	29.79707	At most 3
$r \leq 4$	$r \geq 4$	8.552747	15.49471	At most 4
$r \leq 5$	$r \geq 5$	2.81E-05	3.841466	At most 5

* denotes rejection of the hypothesis at the 0.05 level.
Max-Eigen value test indicates 1 co-integrating eqn(s) at the 0.05 level.

Trace test indicates 1 co-integrating eqn(s) at the 0.05 level. The trace test results based on the Johansen co-integration are shown in Table 3.6. The null hypothesis of the trace test is that the number of co-integrating equations is greater than the number of variables involved. If the test statistic is smaller than critical values of the trace tests we do not reject the null hypothesis. The results of the Johansen co-integration test were based on the maximum Eigen value. The maximum Eigen value test was conducted on a null hypothesis of the number of co-integration equations (*r)* against the alternative hypothesis of number of co-integration equations plus one (*r +1)*. We do not reject the null hypothesis if the test statistic is smaller than the maximum Eigen value test's critical values. The Johansen method is used for the test of co-integration as it is superior over the Engle-Granger method in allowing for the test of more than one co-integrating vectors.

Table 3.6 reports the results of the JJ co-integration tests using both the Maximal Eigen value and Trace tests. Considering the Maximal Eigen value results for VAR order 1, it is found that the null hypothesis of no co-integrating vector (CV), i.e. no long-run relationship, is strongly rejected against the alternative of exactly 1 co-integrating relationship as the computed statistics, 40.92424, turns out to be greater than the 5% critical value of 40.07757. However, the null hypothesis that there is at most 1 co-integrating vector cannot be rejected since the test statistic of approximately 26.58033 is less than the 5% critical value of about 33.87687. For that reason, the Maximal Eigen value statistics specified 1 co-integrating relationship at 5% significance level. The maximum Eigen value test in Table 3.6 put forward that there is only 1 co-integrating relationship in the real gross domestic product model.

Table 3.6 shows the results of the trace test (with order of VAR = 1) which reflect that, at least one co-integrating equation exists at 5% significance level. The null hypothesis of no co-

integrating vectors is rejected since the trace (test) statistic of 109.6627 is greater than the 5% critical value of approximately 95.75366. However, the null hypothesis of (CV≤1) at most one co-integrating vector cannot be rejected against the alternative of at least 2 CVs. The computed test statistics in this case 68.73845 is less than the 5% critical value of 69.81889.Therefore, it can be concluded that there is one significant long run relationship between the given variables (using the trace test). These indicate the existence of strong evidence for co-integration amongst the variables in my model. The co-integration vector represents the deviations of the endogenous variable from its long run equilibrium level. Since variables can either have short or long run effects, a vector error correction model (VECM) is used to disaggregate these effects.

3.6 Determination of Optimal Lag Length

Co-integration test is usually preceded by a test of optimal lag length as the result of the test is affected by the number of lags included in the VAR model. The information criteria are used to determine the optimal lag length of the VAR model for co-integration test.

Table 3.7 VAR Lag Order Selection Criteria

Endogenous variables: LNRGDP, LNREER, LNTO, LNM2, LNGCF, LNGFCE.
Exogenous variables: C Sample: 1986 2015
Included observations: 28

Lag	LogL	LR	FPE	AIC	SC	HQ
0	38.02766	NA	4.09e-09	-2.287690	-2.002218	-2.200419
1	191.7787	230.6266*	9.71e-13*	-10.69848*	-8.700175*	-10.08758*
2	224.7771	35.35534	1.79e-12	-10.48408	-6.772934	-9.349542

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

Table 3.7 confirms that almost all criteria LR, FPE, AIC, SC and HQ are selected a lag length of 1 at 5% level of significance. Consequently, using the information criteria approach, the Johansen co-integration test was conducted using 1 lag for the VAR.

3.7. Estimation Results and Interpretation

3.7.1. Vector Error Correction Model (vecm)

The detection of a co-integration equation in the previous section means that a VECM can be used. This has led to a distinction between the long and short run impacts of variables so as to establish the extent of influence that real exchange rates has on economic growth. Using the results from the co-integration test the VECM was specified.

I. Long Run Relationships

Table 3.8 Results of the Long Run Co-integration Equation

Variable	Coefficient	Standard error	t-statistic
Constant	-10.18669	-	-
LN-RGDP	1.000000	-	-
LN-REER	-0.665405	0.16308	-4.08027***
LN-GFCE	0.683307	0.11316	6.03858***
LN-GCF	0.149109	0.17518	0.85117
LN-M2	-1.672230	0.22009	-7.59791***
LN-TO	-0.920669	0.22472	-4.09702***

*** denotes significance at 1%.

The long run impact of real exchange rates on economic growth as presented in Table 3.8 is illustrated using Equation 11:

LNRGDP - 0.665LNREER + 0.683LNGFCE + 0.149LNGCF – 1.672LNM2 – 0.921LNTO – 10.1867 = 0…....10

This can be rewritten as,

LNRGDP = 0.665LNREER – 0.683LNGFCE – 0.149LNGCF + 1.672LNM2 + 0.921LNTO + 10.186……...….11

Equation 11 shows that REER (LNREER), M2 (LNM2), and TO (LNTO) have positive long run relationship with GDP (LNRGDP). On the other hand, GFCE (LNGFCE) and GCF (LNGCF) show negative long run relationship with GDP (LNRGDP). All the variables are statistically significant in explaining economic growth except GCF since, they have absolute values greater than two.

The real effective exchange rate (LNREER) has positive sign and is statistically significant in explaining the economic growth in the long run. This result confirms that the null hypothesis (exchange rates have a long run effect on economic growth of Ethiopia) is accepted. Increase/appreciation of real effective exchange rate by 1% increases economic growth by 0.665%. The finding of this study shows that decrease in real effective exchange rate [depreciation] does not promote economic growth in the long run. Depreciation may encourage exports and increase the foreign earnings of the country for the time being, but it hurts the economy in the long-run as the cost of imported raw materials increase continuously. The positive sign of real effective exchange rate shows that the impact works through the aggregate supply channel in the long-run. This is in line with the modern view.

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

The government final consumption expenditure (LNGCE) has a negative and significant effect on economic growth of Ethiopia implying that, large size of government expenditure goes to recurrent expenditure. Thus, recurrent expenditure may have impeded growth by reducing the resources available for capital expenditure. Defense expenditure, poverty targeted expenditure, inflation targeted expenditure, and voting campaign expenditure and expenditure on interest payment constitute the most important components of current expenditure. As a result, long run responsiveness of real GDP to the change in government final consumption expenditure is -0.683. It means that a one percent increase in government final consumption expenditure will decrease real GDP by 0.683 percent over time. This is explained by the fact that government spending of money for the purchase of consumption goods and services leads to the increase of the aggregate demand for goods and services.

The gross capital formation (LNGCF) had a negative effect on economic growth of Ethiopia but it is found statistically insignificant effect in the long run.

The broad money supply (LNM2) had a positive and significant long run effect on economic growth. A 1% increase in broad money supply leads to an increases economic growth by 1.6722% which was contrary to the expected sign. The result was highly significant at 5 percent level of significance. Therefore, the results show that increase in money supply improves economic growth. The National Bank of Ethiopia manages the supply of money through channels like the management of the reserve requirements and the management of the interest rate with the commercial banks. Thus, the expansionary policy may be implemented in Ethiopia since it is significant in the long run.

Lastly, Trade Openness (LNTO) was also found to be positively related to economic growth of Ethiopia. Trade openness could increase the economic growth of Ethiopia by encouraging domestic productivity growth due to the increased competition and productivity spillovers between industries in different countries. It means that a one percent increase in trade openness will increase real GDP by 0.9206 percent over time.

II. Short Run Dynamics

Table 3.9 Short Run Error Correction Model Results

Variable	Coefficient	Standard error	t-statistic
D(LN-RGDP)	-0.181171	0.05388	-3.36267
D(LN-REER)	-0.068808	0.23310	-0.29518
D(LN-GFCE)	-0.415510	0.23602	-1.76045
D(LN-GCF)	-0.539062	0.22512	-2.39454
D(LN-M2)	0.156627	0.09286	1.68668
D(LN-TO)	-0.184289	0.19340	-0.95288

The change in the variables represent variation in the short run, while the coefficients obtained for the error correction term represents the speed of adjustment towards the long run relationship. From the results, the economic growth adjusts to equilibrium by -0.1811 and the speed of

adjustment is approximately 18.1 percent. This means that if there is a deviation from equilibrium, 18.1 percent is corrected in one year as the variable moves towards restoring equilibrium. There is strong pressure on economic growth to restore long run equilibrium whenever there is a disturbance. This speed of adjustment is statistically significant with an absolute t-value of approximately 3.36267. The low speed of adjustment by economic growth in the short run may be insensitive as a result of the undeveloped structural strategies like low productivity growth. Therefore, there may be need for the vibrant strategies to enhance productivity level so that economic growth can be stimulated.

Also, from the results, the gross capital formation has a negative sign and hence improves economic growth towards equilibrium by -0.539062. This adjustment in the short run is significant with absolute t-value of approximately 2.39454, even though the magnitude of the coefficient is small.

On the other hand, real effective exchange rate, government final consumption expenditure, money supply and trade openness adjustment to equilibrium is not statistically significant as there t-values are 0.29518, 1.76045, 1.68668 and 0.95288 respectively are below 2; even though broad money supply has the positive adjustment effect (0.156627) in the short run. This implies in the short run, increased money supply adjusts to improve economic growth but the adjustment is not significant.

Turning to our variable of interest, REER, it is observed that in contrast to its long-run counterpart, the estimated short-run adjustment effect is negative. That is, the results suggest a contractionary impact of Birr depreciation in the short-run. The effect is small - a 10 per cent real devaluation is associated with just above half a percent (-0.0688) decline in GDP – and insignificant. The ECM technique permits the possibility of finding differing short and long-run effects and in this case the negative coefficient on the real exchange rate is plausible. It could be that currency depreciations led to certain adjustments in terms of resource allocation and inflationary pressure (including expectation about price changes), resulting in declining economic activity in the short-run. However, with the improvement in the incentive structure for resource allocation in favor of the more productive tradable sector, and given its enhanced competitiveness, the expansionary effect sets in the long-run.

3.8 Diagnostic Tests on the Residual of Vecm

Tests of serial correlation, normality and heteroscedasticity on the residuals of the vector error correction models are conducted with the help of Lagrange-multiplier test, Jarque-Beta test, White-heteroscedasticity test respectively. From the tests, it was found that the nulls of no serial correlation, normality and constant variance could not be rejected.

3.9. Impulse Response and Variance Decomposition Analysis

I. Impulse Response Analysis

The Impulse Response analysis for the above model is undertaken. All of the response is examined for 10 periods and the relevant variable comes to its long-run equilibrium back at this time period. This study uses generalized impulse response functions and in each case the shock to each variable is one standard error shock. The impulse response function shows the increment to each variable due to one standard error shock of the other variable taking in to account all interactions between the variables. The impulse responses are eventually expected to converge to

a level that is consistent with the estimated long run co-integrating relationship. The graphical relationships of impulse responses to ten periods shock on the variables are represented.

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

II. Variance Decomposition Analysis

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

Table 3.10 Variance Decomposition of RGDP

Period	S.E	LNRGDP	LNREER	LNGFCE	LNGCF	LNM2	LNTO
1	0.042557	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.059109	91.21321	5.766996	0.523836	0.002003	2.109648	0.384306
3	0.081581	71.73833	14.63601	2.448253	0.071860	3.477187	7.628360
4	0.108597	55.93669	19.33149	5.997448	0.516497	3.540059	14.67781
5	0.137395	45.83169	21.28149	10.32402	0.938173	3.405152	18.21947
6	0.165745	39.80404	22.10329	13.77313	1.219889	3.204982	19.89467
7	0.191833	36.22886	22.51449	16.22453	1.378733	3.026119	20.62727
8	0.215285	34.01173	22.77528	17.90710	1.459938	2.893338	20.95261
9	0.236398	32.55788	22.96631	19.05029	1.502446	2.797437	21.12564
10	0.255626	31.54613	23.11343	19.84807	1.527018	2.728160	21.23719

The variance decomposition of real gross domestic product, which is represented in the above table, shows that in the very early periods the forecast error of this variable in question is attributed to the variable itself. The deviation explained by the real gross domestic product decreases to 31.5 percent in the tenth period from 100 percent in the first period. The deviation in economic growth explained by the variations in real effective exchange rate is insignificant explaining zero in the first period and significant explaining 23.1 percent in the 10^{th} period. The variations of real gross domestic product due to variations in trade openness and government final

consumption expenditure explains about 21.2 and 19.8 percent of the deviations in real GDP respectively in the 10th period. The contribution of gross fixed capital formation and broad money supply to the variations in the forecast error of real gross domestic product are very less.

4. Summary, Conclusions and Policy Implications

4.1 Summary of the Findings and Conclusions

How movements in the exchange rate affect overall economic activity has been a subject of longstanding controversy in macroeconomics and empirical scrutiny in applied policy analysis. In Ethiopia the news of Birr depreciation is mostly greeted with skepticism about macroeconomic soundness of the economy, triggering public and policy debates. The issue is certainly controversial as exporters often demand for downward adjustments of the domestic currency in order to become more competitive in international markets in sharp contrast to protests by consumers and others who rely on imported processed and semi-processed goods for their production and the increased Birr value of dollar (or other foreign currencies for that matter) get translated into their higher prices. In recent times when the country has witnessed a general rise in prices, currency depreciation is widely regarded as a wrong policy choice contributing to the inflationary pressure. The government use devaluation as a policy strategy to increase export and overvaluation of Ethiopian Birr. However, exports lack the required quality, and hence unable to become competitive in the world market for agricultural produces. As a result, Ethiopia remains net importer. The net effects of these combined interactions could currency depreciation and it is a reflection of various economic and policy shocks. A strategy shift towards accelerated and sustainable development programs that entail huge demand for foreign currency from the aggregate demand intensifies the problem. Ethiopia has received no attention and the researcher try to fill this gap in this paper.

The objective of this study is to add to the existing empirical literature on the effect of exchange rate on economic growth in Ethiopia. The study is based on annual time series data spanning from 1985/86 to 2014/15. This paper has made use of the vector error correction model to see disaggregated long and short run relationships between the real GDP and a vector of variables including real effective exchange rate, gross fixed capital formation, government final consumption expenditure, broad money supply and trade openness. For empirical investigation, this study has preferred to use multilateral real exchange rates instead of bilateral real exchange rates which considered the real exchange rate of Ethiopia and exchange rates of Ethiopia's most important trade partners.

The estimation strategy has duly examined the time series properties of the variables in regression analyses to avoid the problem of finding out spurious relationships and invalid inferences. In light of the non-stationarity of the model variables, the long and short run results of this study are confirmed by the help of co-integration and vector error correction models. The empirical analyses provide several major findings:

(i) The long-run effects of real devaluations are found to be negative, i.e. downward adjustments of Birr leading to the depreciation of the real exchange rate has an overall contractionary effect. That is, a 10 percent real depreciation of Birr would lead to 6.7% decrease in RGDP. However, in the short run, the effect of devaluations is neutral. Thus, in the long run devaluation negatively affects output growth in Ethiopia.

(ii) Based on the result, government final consumption expenditure has a negative and significant effect on economic growth of Ethiopia.

(iii) Finally, both broad money supply and trade openness are found to have positive and significant effects on the aggregate output of Ethiopia.

Several important policy implications are to be derived from these findings. First of all, there are important growth implications of exchange rate management. Real appreciation turns out to be expansionary, which can operate through two possible channels. Firstly, by enhancing frugality, the import competing sectors can help expand cheap output for the aggregate demand of the economy and the country's import dependence on imported raw materials and capital goods has been raised through gross transformation plans, overtime national saving increases considerably thereby generating larger expansionary effects. Ethiopia depends on foreign capital and the export elasticity of their product is insensitive. Devaluation increases the cost of foreign capital and increase the cost of imported items and raw materials. Since the major imported item in Ethiopia is petroleum which significantly affect the whole economy and domestic price as well. As a result, real appreciation improves real gross domestic product in the long run. Secondly, real exchange rate appreciations can also improve the competitiveness of the import-competing sectors through accessibility of new technology, supporting its growth and aggregate output.

Similarly, the depreciation of the real exchange rate will have adverse consequences for overall economic output. From that perspective Birr depreciations have triggered some of the adverse consequences. The analysis presented in this paper shows Ethiopia's domestic prices relative to those of tradable sector of its major trading partners have risen substantially. Real devaluations have not helped maintain Ethiopia's international competitiveness at more or less the same level since early 1990s.

The finding of the contractionary effect of real depreciations points towards a major policy issue concerning the role of the exchange rate as a development strategy. This has been a subject matter of recent debates and discussions in the literature showing that the undervaluation of the currency cannot stimulate economic growth. It has been argued that since bad institutions and market failures are more prevalent in the tradable sector, devaluations worse the consequences of these distortions. Given that one relevant question is what policy lesson can be drawn for Ethiopia?

4.2 Policy Implications

It needs to be pointed out that to maintain a depreciated real exchange rate regime is going to be far more challenging than staging nominal devaluations. As there is the evidence of strong and significant effect of nominal devaluations on domestic prices, downward adjustments of the currency will result in mounting inflationary pressure decrease economic growth in the long run.

On the other hand, while one episode of nominal devaluations can help promote export competitiveness but decrease output over the long-run, rising import demand will also erode at least some significant portion of these gains. It has therefore been argued that countries seeking to use a competitive exchange rate to aid growth need to develop an exit strategy to avoid getting locked into a strategy that has outlived its usefulness.

Furthermore, it has also been pointed out that nominal devaluations may not always translate into real exchange rate depreciations. Fiscal and monetary policies, in particular, must be consistent with the exchange rate regime to tackle the problem of rising prices. That is why using the real exchange rate as a policy variable may be a very difficult option. In the long-run the movements

in the real exchange rate is to be determined by fundamentals that influence the resource allocations between tradable and non-tradable sectors. Policies that can help more spending on tradable and/or avoid generating undue pressure on the prices of non-traded goods may prove to be more effective to promote international competitiveness.

This paper has highlighted the changing composition of Ethiopia's trade partners. Since the late 1990s, a set of fast-growing and emerging developing countries have gained more prominence, pushing down the relative significance of advanced and developed economies. Prices in developing countries are generally higher and faster growing countries are likely to have appreciated real exchange rates, as pointed out earlier. Therefore, the shifts in the significance of trading partners might provide opportunities for Ethiopia maintaining a competitive real exchange rate regime, provided that domestic inflationary pressure is contained. In this context, it is important to better understand the allocation of resources in non-traded and import- competing sectors and their implications for productivity and output growth, and prices.

In the face of a sustained improvement in terms of trade, the estimated positive effect on output could imply resources being allocated to import-competing sectors or high value added services sector. There has been a lot of discussion on whether developing countries can enhance their reliance on their domestic sectors to promote economic growth. Ethiopia has a relatively large domestic economy, compared to many other African countries with small population, and as such domestic demand management will always have an important influence on overall economic growth. While the need for maintaining competitiveness cannot be overemphasized a better understanding of inter-sectoral resource allocation and productivity growth will make informed exchange rate management that would promote competitiveness of exports as well as expansion of import-competing sectors.

In fine, the management of the exchange rate would remain a delicate task for policymakers. While the effects of nominal devaluations are likely to have negative effects on output growth, tackling inflation would be critically important. In the long-run Ethiopia needs to maintain its international competiveness for which nominal exchange rate adjustment will be an important instrument. Its effectiveness will however be depend on the nature of accompanying monetary and fiscal policies and other factors influencing the relative prices of traded goods designed to prevent the real effects from being dissipated by inflation.

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