

Determinants of Real Exchange Rate in Ethiopia: An Empirical Investigation [1985Q1 – 2000Q2]

By: Equar Desta



A Thesis submitted to the School of Graduate Studies
Addis Ababa University in partial fulfillment of the Master of science degree in
Economic Policy Analysis.



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Acknowledgement

I acknowledge all those who helped me to produce this paper. Few will be mentioned here since it is hardly possible to mention all of them. Especially I would like to thank my advisor Dr. Gebrehiwot Ageba for his guidance and valuable comments.

I would also like to acknowledge National Bank of Ethiopia (NBE) and African Economic Research Consortium for sponsoring my study at the university. Special tanks also go to Dr. Eyob Tesfaye, Yohans Ayalew and other staff of research department of NBE for their valuable comments during preparation of this paper.

Finally, I would like to tank my friends and families whose valuable support helped me to complete this paper. In this regard my wife Fetlework Nuguse and my friends G/egziabher Redda and Tesfamariam Tsegay have to be mentioned first.

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List of abbreviations

REER = Real effective exchange rate.

NEER = Nominal effective exchange rate.

ERER = Equilibrium real exchange rate.

OREER= Official exchange rate based real effective exchange rate.

WREER = Official parallel market rate based real effective exchange rate.

ONEER = Official-exchange rate based nominal effective exchange rate.

WNEER = Official-parallel market rate weighted nominal effective exchange rate.

EXCRED= Excess credit.

NDVA = Nominal devaluation.

TOT = terms of trade

GCGDP = ratio of government consumption to GDP.

NKF = net capital flow

TARF = import tariff

EXCON= Exchange control

Abstract

This paper examines the role of real and nominal disturbance in explaining the movement of real exchange rate in Ethiopia and assess whether the nominal effects are permanent or transitory. The study also tried to see the extent of exchange rate misalignment.

In estimating the model, we first test for the time series properties of the model and indicate the order of integration. The ADF tests, for unit root, showed that all variables except government consumption, nominal devaluation and excess credit are integrated of order one. Johansen's likelihood ratio is employed for co-integration tests and these tests revealed that there is one co-integrating vector.

The test for weak exogeneity also reveal that except real exchange rate and terms of trade all of the variables are found to be weakly exogenous in the official exchange rate based REER specification but all the variables except the dependant variable (weighted real exchange rate) are weakly exogenous in the weighted exchange rate based REER specification. Findings in this paper show that the main long run determinants of real exchange rate in Ethiopia are terms of trade, government consumption, capital flow and import tariffs. However, the estimated error correction model shows that nominal devaluation and domestic credit have significant effect on the real exchange rate in addition to the above stated variables.

These findings indicate that trade and exchange rate liberalization have lead to depreciation in the real exchange rate which in turn boosts exportables and improved the country's BOPs position. Contractionary monetary policy also contributed significantly much in improving exchange rate stability.



1, Introduction

The start of the Smithsonian agreement¹ in March 1971 marked the end of the Bretton Woods system² of fixed exchange rates among the major industrial countries. Initially, developing countries reacted to this event by sustaining their fixed exchange rate parities but latter most of these countries have moved towards exchange rate arrangements involving more frequent adjustments in nominal exchange rates. Since then these countries have followed a form of crawling pegs or managed floating³ in determining their nominal exchange rate and this has led to increase activism in exchange rate management. Consequently, these countries faced a problem of setting an appropriate nominal exchange rate. The question of how to choose the appropriate value of nominal exchange rate has remained a key concern of macro economic policy in developing countries [Hinkle and Ghie (1999)].

A broad consensus has emerged in recent years that the overriding objective of exchange rate policy should be to avoid episodes of prolonged and substantial misalignment- a situation in which the actual real exchange rate (RER) differs significantly from its long run equilibrium value. Recent discussions in macro economic policy in developing and developed countries have stressed the crucial role played by the real exchange rate (RER) in adjustment process [Edwards (1988); Elbadawi and Soto (1995)]. In the recent policy evaluations of the performance of less developed countries, it has been argued that more “successful” developing countries owe much of their success to having been able to maintain the real exchange rate to its” appropriate” level [Edwards (1988)].

¹ Smithsonian agreement is an agreement reached among the group of ten (G-10) in 1971 following the collapse of the Bretton Woods conference agreement. At a meeting at Smithsonian Institution in Washington D.C, the G-10 agreed to implement a floating exchange rate system when US abandon the gold standard [Gipson (1993)].

² The system was based on a par value exchange rate system linked to the value of the US dollar fixed at 1/35 ounce of Gold [Gipson (1993)].

³ Managed float is an exchange rate value influenced by a government entering currency markets to achieve specific policy objective. However, in a pegged currency system when the peg is altered periodically to maintain values against the index basket or currency and when the rates are adjusted frequently the rate is known as a crawling peg [Gipson (1993)].

In a broader sense real exchange rate is a measure of relative price of goods in an economy. Khan and Lizondo (1987) state, “the real exchange rate is a relative price in the economy and policies to change it are centerpiece of adjustment programs designed to improve international competitiveness and shift resources toward production of tradable goods⁴. Consequently, it is critical for policy makers to have some idea of the magnitude and time path of the likely response of the real exchange rate to fundamentals.”

In this paper questions such as what determines the real exchange rate in the short run and long run? Why real exchange rate deviate from its equilibrium value? will be raised. The paper will, therefore, attempt to identify the appropriate model that could explain determinant of real exchange rate in Ethiopia.

1.1 Statement of the problem

Recent discussions on macroeconomics policy in the developing and developed countries have emphasized the crucial role played by the real exchange rate (RER) in the adjustment process (Sebastian Edwards, 1988a). Since the real exchange rate is usually considered in the literature as a good proxy for the measurement of international competitiveness, macro economic policies are formulated in such a way that how they do affect this important price.

Exchange rate is a direct and powerful method of manipulating domestic expenditure and relative prices; hence it is a very important tool in the allocation of scarce resources in the economy.

⁴ goods that are traded internationally. This category includes all those items that are exportable and importable.

As Elbadawi and Soto (1995) and Edwards (1988a) note, “ it is not an overstatement to suggest that issues related to the determinants of the RER, its evaluation overtime and its position relative to equilibrium now occupy a central role in the academic and policy debates on economic adjustment and, increasingly in the discussion on long-term growth and development strategies. However, in spite of its importance, the research on the empirical determination of RER, the calculation of its equilibrium path and assessment of the misalignment of the RER can, at best, be described as inadequate”. And this applies to both developed and developing countries alike, including Ethiopia.

The aim of this study is, therefore, to fill this gap by conducting an empirical investigation of the determinants of the real exchange rate in Ethiopia. This paper is thus hoped to contribute to this discussion by examining the determinants of real exchange rate (RER).

1.2 Objectives of the study

The broad objective of the study is to use an empirical framework to analyze the determinants of the RER in Ethiopia.

Specifically, the objectives of the study are:

- i) To analyze empirically the relative importance of nominal and real variables in explaining RER movements in Ethiopia in the short-run.
- ii) To determine the equilibrium real exchange rate of the “Birr” and identify its fundamental determinants in the long run.

iii) Based on the results, to draw policy recommendations, which may help improve the policy design in implementing, monitoring and evaluating in the area of exchange rate management of the country.

1.3 Significance of the study

To the best of my knowledge, no systematic analysis has been done on the real exchange rate of the “Birr” over the period 1985-2000. However, this is very important price, which is worthy studying. Interest in the exchange rate⁵ arises mainly because of the fact that exchange rate misalignment (sustained deviation of the actual real exchange rate from its long-run equilibrium) affects economic growth negatively. So, policy makers need to know the possible response of the exchange rate to different policy packages and the effects of these policy packages on other macroeconomic variables since a policy action that influences the exchange rate will eventually have repercussions on other variables too.

The theme of this study is relevant for a number of reasons. First, the exchange rate performs a dual role in small economies like Ethiopia. Its movement can achieve and maintain international competitiveness and ensure a viable balance of payments. At the same time a stable exchange rate can anchor domestic price. There are recurring policy objective in Ethiopia; therefore, a study of the factors that determine the RER movement is very crucial.

The result expected from this study would also be useful in improving policy design, implementation, monitoring and evaluation in the area of exchange rate management of the country. Finally, this study may also serve as a springboard for further research in this area.

1.4 Organization of The Study

The presentation of this study will take the following form: The first chapter highlights the issues to be investigated in this study. As is discussed in the chapter, the motivation of the study could be attributed partly to lack of enough empirical evidences on the topic in the country.

Chapter Two briefly reviews the theoretical and empirical literature on the issue. It captures some of the main theoretically and empirically established facts about the determinants of real exchange rate. Chapter Three provides a brief overview of the Ethiopian economy and exchange rate policies in Ethiopia.

Chapter Four is devoted to discussion of data sources, methodology and model specification. Based on the review of the literature, the empirical model for this study is specified in chapter four. As will be is discussed on the data section of this study, RER based on official and on weighted parallel-official exchange are calculated and the two equations are formulated using these two RER as dependent variables and estimated independently.

Chapter five gives the empirical result and interpretation of the coefficient in the long-run analysis. The chapter also gives the empirical result for the vector error correction model, which was reduced further (using the “general to specific approach”) to arrive at the preferred model whose empirical results allow for a clear interpretation of the dynamic process. The last chapter summarizes the paper and provides conclusion and policy implications.

⁵ Exchange rate is defined in this study as the unit of domestic currency per unit of foreign currency.

2. Survey of the literature

2.1 Theoretical literature

The theoretical literature on the determination of exchange rate is rich. Some of these theoretical literatures are briefly and selectively (recent literature) surveyed in this section. Since the break up of the Bretton Woods System, exchange rates have attained great prominence in economic and policy discussion in both developing and developed countries. Most of the economics literature dealing with exchange rate describes it as the most important price with both nominal and real values. Considered as a price, however, the exchange rate has special properties. It affects many other prices, touches the interest of every one, and has the quality of linking the general level of prices in the economy with price in other countries.

Given the importance attached to the exchange rate, it is not surprising that exchange rate economics is one of the most heavily researched areas; hence, the past two decades have seen an enormous growth in the literature on the sub-discipline [Macdonald (1997)]. According to Elbadawi and Soto (1995), as an economy-wide relative price signaling for inter-sectoral resource transfer, the concept of RER has assumed a central position in the past and current debates in the literature on economic development and growth strategies, and the more recent literature on structural adjustment and economic stabilization.

Policy discussions have included increasing reference to RER stability and correct exchange rate misalignment as crucial conditions to improve economic performance in the less developed countries [Elbadawi (1992)]. Evidence from Latin American, Asian and African countries is often quoted to support the view that the link between RER behavior and economic performance is strong [Elbadawi and Soto (1995)]. There is a growing argument that sustained RER misalignment usually generates severe macroeconomic disequilibrium [Edwards 1988].



Therefore, there is a need for stability and proper alignment of exchange rates if proper growth is to resume in stagnant developing countries.

Some analysts have argued that many of the economic misfortunes suffered by the LDCs during the 1980s – including the debt crisis and the dismal performance of Africa's agricultural sector have been the results, in one way or another, of inappropriate exchange rate policies [Edwards, 1989]. Two main issues have attracted the attention of policymakers and academics. First, there has been a growing interest to understand real exchange rate fluctuation. Secondly, there is also a growing concern regarding the effectiveness of devaluation as a policy tool.

A number of definitions of RER still appear in the literature. Fosu (1992) defines the RER as a concept that involves adjusting a specified nominal exchange rate⁶ for relative inflation between a domestic economy and the rest of the world to determine the effect on incentives to produce, purchase and store goods and services.

Edwards (1989) also defines the RER as the domestic relative price of tradable goods to non-tradable goods. According to him this definition summarizes incentives that guides resource allocation across the tradable to the non-tradable sector; an increase in the RER will make the production of tradable relatively more profitable, inducing resources to move out of non-tradable sector into the tradable sector. Generally, the real exchange rate is broadly defined as a relative price that summarizes the degree of competitiveness of the external sector of a country.

Real exchange rates (RERs) have become increasingly volatile in both developed and developing countries (Edwards (1989)). This has been true even for the developing countries

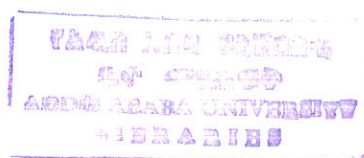
that maintained a fixed nominal exchange rate regime after the collapse of the Bretton Woods System. According to Edwards (1989) changes in the RER are sometimes “justified” by real events in the economy, such as technological progress, movements in external terms of trade, changes in taxation, and so on. These changes are an equilibrium phenomenon and do not require policy intervention. In some circumstances, however, there are “unjustified” departures of the actual RER from its equilibrium. This is a disequilibrium change and is called RER misalignment.

Kignel (1992) raised some issues about the role of exchange rate policies in determining the real exchange rate. Some of these are the following:

1. Exchange rate policy has a limited effect on the real exchange rate. Efforts to achieve a real depreciation, not only depend on the choice of an appropriate exchange rate policy but also on the overall environment in which this policy is used. The real exchange rate understood as the relative price of tradable to non-tradable, is an endogenous variable that depends on the underlying factors affecting supply and demand. Thus, the evolution of external factors such as the terms of trade, external demand, and domestic factors, such as the budget deficit, and the share and overall level of government expenditure on both goods (tradable and non-tradable) are important as exchange rate policy in determining the RER.

2. Exchange rate policy can only affect the real exchange rate in the short-run, because domestic prices and wages are more rigid. The larger the rigidity in domestic price and wages, the more effective will exchange rate policy is.

⁶ The distinction between nominal and real exchange rates is that the nominal exchange rate is a monetary concept that measures the relative price of two moneys, that is, the price of foreign currency in terms of domestic currency.



Edwards S. (1988) also raised very important issue in dealing with the determination of the RER. Some of these are: -

1) All movements in the real exchange rate do not necessarily require policy intervention “ An increase in the real exchange rate or exchange rate depreciation, likewise represents an improvement in the country’s international competitiveness. Sometimes these changes in a country’s degree of international competitiveness are ‘justified’ by real events in the economy such as technological progress, changes in external term of trade, changes in taxation and so on...(these) are equilibrium phenomena and do not require policy intervention.” It is only in the case of departure of the actual RER from its equilibrium where policy intervention is required - that is, when there is misalignment in the RER;

2) The equilibrium real exchange rate (ERER) is a relative price of tradable to non-tradable; that is, for a given long run equilibrium (sustainable) values of other relevant variables such as trade taxes, international prices, capital and aid flow, results in simultaneous attainment of internal and external equilibrium. ”... The fundamental determinants of the ERER are those real variables that, in addition to the real exchange rate, play a large role in the determination of a country’s internal and long-run sustainable external situation”. Internal equilibrium means that the non-tradable goods market clears in the current periods and is expected to be in equilibrium in future periods. Meanwhile, external equilibrium is attained when the current account balances are compatible with long-run sustainable capital flows. By exposing this concept of the equilibrium RER and its fundamental determinants, Edwards has contributed towards understanding of the extent of misalignment of the RER and hence for determining the form of policy intervention. Real exchange rate misalignment is a term commonly used in policy discussions and it is defined as sustained deviations of the actual real exchange rate from its long run level. If the

The real exchange rate on the other hand is the relative price of tradable and non-tradable goods.

actual real exchange rate is below the equilibrium level, it is said that there is a real exchange rate overvaluation.

3) Edwards S. (1988) also identified that there are two basic types of misalignments- macroeconomics induced misalignment and structural misalignment. The former occurs when the actual RER departs from its equilibrium value because of inconsistencies between macroeconomic policies and the official nominal exchange rate system. Structural misalignment takes place when the changes in the sustainable value of the real determinants (fundamentals) of the equilibrium RER are not translated in the short run into changes of the actual RER [p.21].

4, Policy makers deal with the costs of misalignment of the RER in different ways.

“In the case of macroeconomic induced misalignment, a necessary step is to eliminate the source of the macroeconomic disequilibrium – that is, the inconsistency between macroeconomic policy and the nominal exchange rate. The authorities can then supplement this policy by other measures or can simply wait for the economy to adjust on its own- that is, wait for the actual RER to converge on its own to the equilibrium RER. However, this type of policy, which we will call disinflation with automatic adjustment, has limitations that can be particularly severe under predetermined nominal exchange rates” [Edwards (1989), pp.23].

The most outstanding case of macro and exchange rate inconsistency is when expansionary fiscal policy is considered. In developing countries deficits are mainly financed by monetisation of the economy, which will create inflation. Nevertheless, there will be a ‘required’ inflation to finance a fiscal deficit and this inflation level may be high (higher than world inflation). Hence inconsistencies between the fiscal deficit and the maintenance of the nominal exchange rate arise.

Furthermore, prices of non-tradable increase at the rate approximately equal to the rate of domestic inflation. However, the domestic price of tradable grows approximately at the rate of world inflation. If the domestic inflation is high (i.e., higher than the world inflation), the domestic price of non-tradable grows at a rate higher than that of the domestic price of tradable. Hence, this leads to appreciation of the real exchange rate, that is, a misalignment of the exchange rate.

Even though policy makers have tried to control the inconsistent macroeconomic forces generating macroeconomic induced misalignment, the RER will still differ from the ERER due to structural misalignment. The adjustment of RER to its equilibrium level may even be slowing under a fixed exchange rate regime. Edwards (1988) states the following regarding this issue.

“ Consider the most common case, in which the real exchange rate misalignment takes the form of real overvaluation and loss of competitiveness in the international market. In this case, under fixed nominal rates a rapid return to real exchange rate equilibrium will require a decline in the nominal domestic price of non-tradable. A rapid reduction in this nominal price is quite unlikely under most circumstances, and therefore an automatic adjustment could take a long time, prolonging the situation of RER misalignment.”

The concept of equilibrium real exchange rate (ERER) has deepened in recent years. In the literature ERER is broadly defined as the relative price of tradable to non-tradables that will assure full employment of domestic resources and balance of payment equilibrium in the medium and long-run given sustained value of other variables (such as terms of trade, tariff reform, capital flow and the like). According to Edwards (1988,1989), a number of implications follow from the above definition of ERER. First, the ERER is not an immutable number. When

there are changes in any of the other variables that affect the country's internal and external equilibrium, there will also be changes in the ERER. In a sense, then, the ERER itself is a function of a number of variables such as terms of trade and capital flows. These determinants of the ERER usually called in the literature fundamentals. Fundamentals can also be divided into those variables that are directly affected by policy decisions (such as foreign trade taxes, exchange and capital control and composition of government expenditure) and those that are independent of them (such as technological progress).

Second, there is no a single ERER; rather there is a path of ERERs through time.

Third, in analyzing the effect of the fundamentals on the ERER, it is important to distinguish between permanent and temporary changes in these variables. For instance, a temporary worsening of term of trade will affect the ERER very differently from the permanent worsening.

The fundamental factors considered are the major factors identified in the theoretical literature as being amenable to empirical analysis. They are the terms of trade, capital flow or the underlying factors affecting them, trade policy and the like. However, it is more difficult to obtain proxies for some factors that may be important in the analysis, such as technical progress.

The theoretical literature indicates that the effect of terms of trade on the RER depends on the size of the income and substitution effects. The likely result is that. Deterioration in the terms of trade⁸ leads to real depreciation and an improvement leads to appreciation⁹. Krumm (1993) states the following concerning this issues. "...A fall in the price of exports or a rise in the price

⁸ Terms of trade are defined in the data analysis section of this paper.

⁹ It is also possible that a deterioration in the terms of trade could lead to a real appreciation, for example, if the substitution effect dominates the income effect for an import price increase. This could be the case if imports are competitive and have many domestic substitutes or if importables represent a low proportion of the production of tradable [krumm (1993)].

of imports lowers disposable income, generating a higher excess supply of non-tradable, downward pressure on the price of non-tradable, and, hence real depreciation”[pp-225].

Another important factor in RER determination is capital flow. Although capital flow in the literature on small open economies often are treated as endogenous, one of the factors to which they respond is the extent of controls on capital account and policies aimed at controlling the level of foreign borrowing (Krumm 1993). This alternative interpretation of the capital account variable is associated with RER appreciation. This is because capital account controls would be expected to reduce capital out flow or increase net inflow.

Another factor of importance in RER analysis (econometric analysis) is trade policy of the country. Generally accepted view in the literature is that trade liberalization characterized by a reduction of tariffs (in small country) will result in RER depreciation. Import demand is expected to increase as the price of imports declines in line with lower tariffs or the removal of quantitative restrictions generating a trade deficit. This obviously leads to real exchange rate depreciation other things remain constant.

2.1.1 PPP theory of real exchange rate.

One of the earliest theories of how exchange rates are determined is the theory of purchasing power parity (PPP). It states that exchange rates between any two currencies will adjust to reflect changes in the price levels of the two countries.

The purchasing power parity between two countries is defined as either the ratio of the countries' price levels (absolute PPP) or the product of the exchange rate in a base period and the ratio of the countries' price indices (relative PPP) [Lawrence O., 1976].

Hamid Farugee (1995), in his article on the long-run determinant of the real exchange rate, states the following. “As a theory of exchange rate determination, PPP posits an underlying tendency for movements in the nominal exchange rate to offset movements in the ratio of national price levels, assuring constancy of the real exchange rate. Based on this static measure of long-run relative prices, deviations in the real exchange rate from its PPP benchmark can then be viewed as gains or losses in external competitiveness”.

Dornbusch (1988) also states “Purchasing power parity (PPP) is a theory of exchange rate determination. It asserts (in most common form) that the exchange rate change between two currencies over any period of time is determined by the change in the two countries’ relative price levels. Because the theory singles out price level changes as the overriding determinant of exchange rate movements, it has also been called the inflation theory of exchange rates”.

Generally, PPP maintains that changes in nominal effective exchange rates must compensate for the inflation differential between the country and its trading partners, thus implying that the equilibrium exchange rate is constant. Although this view is appealing for its simplicity, several factors may produce long-run deviations between the actual exchange rate and its PPP equilibrium.

Keith Pilbeam (1998) identified two interpretations of the doctrine. He called them the “absolute” and “relative” version of PPP theory. According to him, the absolute version holds that if one takes a bundle of goods in one country and compares the price of that bundle with an identical bundle of goods sold in a foreign country converted by the exchange rate into a common currency of measurement, then the price will be equal. He also expressed it algebraically as follows:

$S = P/P^*$ where S = is nominal exchange rate

P = domestic price of bundle of goods

expressed in the domestic currency

p^* = is the price of an identical bundle of goods in the foreign country

Therefore, according to the absolute PPP, a rise in the home price level relative to the foreign price level will lead to a proportioned depreciation of the home currency against foreign currency. According to Pilbeam (1998) the absolute version of PPP is unlikely to hold precisely because of the existence of transport cost, and imperfect information. Nonetheless, it is argued that a weaker form of PPP (i.e., relative PPP) can be expected to hold even in the presence of such distortions. Put simply, the relative version of PPP theory argues that the exchange rate will adjust by the amount of the inflation differential between two economies. Algebraically this can also be expressed as:

$$\% \Delta S = \% \Delta P - \% \Delta P^*$$



Where:

ΔS is change in the exchange rate, ΔP is the domestic inflation rate, and ΔP^* is foreign inflation rate.

The PPP exchange rate as a measure of such a relative price has got both theoretical and empirical drawbacks (Edwards (1989)]. First, it (PPP) does not take into account that many goods and services (whose prices are included in a measure of a country's price level) are not traded across borders. Second, it rests on a number of assumptions like that of all goods are identical in both countries. However, the assumptions that goods are physically identical may not be realistic. Therefore, due to the above reasons and other (assumptions like the law of one

price), PPP theory does not provide an adequate explanation of some of the observed features of floating exchange rates.

2.1.2 'Modern' theory of real exchange rate.

More recently, however, most authors have defined the real exchange in the context of models of dependent economies, as the relative price of tradable to non-tradable. This approach of exchange rate determination is usually called the 'modern' (relative price of tradable to non-tradable) approach. Owing much to the early work of Australian economists Salter (1959) and Swan (1960), the more modern economic interpretation of the real exchange rate emphasizes the distinction between tradable and non-tradable goods in the context of open economy macroeconomic models [Krumm (1993)].

In this approach real exchange rate is measured as the relative price of tradables to non-tradables. More precisely, it is defined as the product of the ratio of the world price index of tradable goods to the domestic price index of non-tradable and the nominal exchange rate, measured as the number of units of domestic currency paid for one unit of the foreign currency. "Modern definition of the real exchange rate is taken in most empirical literatures as a good proxy for the degree of international competitiveness" [Edwards (1988)]. This approach is sometimes referred as Salter-Swam approach.

This alternative is theoretically more appealing definition of real exchange rate which provides a summary measure of the incentives guiding resources allocation between the two key sectors of the economy. According to this approach, if the domestic price of tradable rises relative to the price of non-tradable resources will be reallocated toward the tradable goods sector and the trade balance will improve accordingly or vice versa. (Wiickham, P. 1985).

As tradable goods are classified into exportables and importables and because the objectives of analysts differ, the definition of the RER as the relative price of tradable to non-tradable has been treated in different ways. In this respect, Edwards (1988) stated four different ways of defining RER.

- i) The dependent economy definition of the relative price of tradable to non-tradable, excluding taxes on trade;
- ii) The domestic relative prices of tradable to non-tradable;
- iii) The domestic relative price of importables to non-tradable; and
- iv) The domestic relative prices of exportables to non-tradable.

The PPP theory has confronted a number of counter arguments. Some of these contend that various economic forces cause large and prolonged deviation of the real exchange rate from its equilibrium. Hence, the previous consensus on the validity of PPP has shifted radically over the past two decades and so. PPP theory does not provide an adequate explanation of observed exchange rate variability after the collapse of the Breton Woods system.

One of the most influential contributions to exchange rate analysis during the 1970s resulted from abandoning the short-run PPP hypothesis in favor of a model in which the exchange rate was free to jump instantaneously in response to new information, while national price levels were constrained to be non-jumping or slowly adjusting [Isard (1995)].

Dornbusch (1976) has developed a model in an attempt to model exchange rate behavior more successfully in contrast to the models developed previously. This model, Sticky-price monetary model, allows short term overshooting of the real exchange rates above their equilibrium levels. In respect to this issue Pilbeam (1998) states the following: -

The basis underlying the model is that prices in the goods market and wages in the labour market are determined in sticky-price market, and they only tend to change slowly over time in response to various shocks such as changes in the money supply, prices and wages are especially resistant to downward pressure. However, the exchange rate is determined in a 'flexi-price' market; it can immediately appreciate or depreciate in response to new development and shocks. In such circumstance, exchange rate changes are not matched by corresponding price movements and there can be persistent and prolonged departure from PPP [pp. 168].

As it is implied from the above, overshooting¹⁰, in Dornbusch model, is a result of the discrepancy of adjustment speed between the two markets (the goods and asset markets), asset market adjust instantly whereas goods markets adjust slowly overtime. According to this model, the main reason why short run exchange rate overshoots its long-run equilibrium value is as follows: -

"...given domestic prices are fixed in the short-run the money supply expansion creates an excess of real money balance which are only willingly held at a lower domestic interest rate. According to UIP¹¹ condition, a fall in the domestic interest rate means that international investor will require an expected appreciation of domestic currency to compensate for the lower domestic interest rate. Such an appreciation is only possible if the exchange rate depreciation in the short run exceeds its long-run depreciation"[Pilbeam (1998)].

The above statement shows that how short run exchange rate overshoots its long run value in the short run.

¹⁰ According to Dornbusch model the effect of increase in money supply is that the exchange rate jumps, beyond its long run value, to the value which is determined by the new money market equilibrium and the original price level because price are sticky but assets market clears immediately. This is a phenomenon usually referred as exchange rate overshooting.

¹¹ Uncovered interest parity condition says that the expected rate of depreciation of a currency is equal to the interest rate differential between the countries.

2.2 Empirical Literature

A lot of the empirical literature on the determinant of real exchange rate has been written since 1980's. In his study on the terms of trade, commercial policy, and the parallel exchange rate for foreign exchange, Elbadawi (1992) tried to see Sudan's real exchange rate and its determinants using time series data for the period 1975 to 1979 in his regression. The result of the estimation was that, commercial policy was consistent with prior expectations in the sense that foreign trade taxes on exports and imports could lead to RER appreciation. He also found that improvement of the terms of trade (TOT) resulted in RER depreciation.

Edwards (1988) used pooled annual data for 1962-1988 in his cross country study for some 12 developing countries and estimated the following equation based on the pooled data:

$$\Delta \log e_t = \gamma_1 \log(\text{TOT})_t + \gamma_2 \log(\text{NGCGDP})_t + \gamma_3 \log(\text{TARIFF})_t + \gamma_4 \log(\text{KAPFLO})_t \\ + \gamma_5 \log(\text{TECHPRO})_t - \theta \log e_{t-1} - \lambda \text{EXCRE}_t + \phi \text{NOMDEV}_t - \psi (\text{PMPR}_t - \text{PMPR}_{t-1}) \\ + u_t$$

Where:

e = bilateral real exchange rate;

TOT = External terms of trade, defined as (P_x^*/P_m^*) ;

NGCGDP = ratio of government consumption on non-tradable to GDP;

TARIFFS = Proxy for the level of import tariffs;

TECHPRO = Measure of technological progress;

KAPFLO = Capital inflows, if negative it denotes capital outflows;

EXCRE = Excess supply of domestic credit, measured as the rate of growth of domestic credit minus lagged rate of growth of real GDP;

NOMDEV = Stands for nominal devaluation;

PMPR= Parallel market Premium;

U= error term.

Generally he identified four forces that determined the real exchange rate and he used the following equation to show the four force that determine the dynamics of RER behavior.

$$\Delta \log e_t = \theta \{ \log e_t^* - \log e_{t-1} \} - \lambda \{ Z_t - Z_{t-1} \} + \phi \{ \log E_t - \log E_{t-1} \} - \psi \{ \text{PMPR}_t - \text{PMPR}_{t-1} \}$$

Where e is the actual real exchange rate; e^* is the equilibrium real exchange rate, in turn a function of the fundamentals; Z_t is an index of macroeconomics policies, Z_t^* is the sustainable level of macroeconomics policy, E_t is nominal exchange rate; PMPR is the spread in the parallel market¹² for foreign exchange; θ, λ, ϕ and ψ are positive parameters that captures the most important dynamic aspects of the adjustment process.

He stated that the results are quite satisfactory and provide support to the view that short-run movements in real exchange rates respond both to real and nominal variables. In his regressions, Edwards (1988), showed that the measure of macroeconomic policy, the excess supply of domestic credit (EXCRE), is significant and negative. This indicates that as policy become increasingly expansive (increased supply of credit), the real exchange rate appreciates. In the regression the coefficient of terms of trade is negative and significant and this give support to the popular view that suggests improvement in the terms of trade (i.e., an increase in TOT) will result in an equilibrium real appreciation. The coefficient for the exchange rate in the parallel market premium was negative as suggested by the theory.

¹² The spread in the parallel market for foreign exchange is defined as the deference between the parallel market exchange rate at time t and the rate in the previous period ($\text{PMPR}_t - \text{PMPR}_{t-1}$).

Grennes and Ghura (1993) did another empirical study on the determinant of RER. They made their study on the real exchange rate and macroeconomic performance in Sub Saharan Africa (SSA) countries and they estimated a model similar to that of Edwards (1988) using a pooled time-series and cross-section data. The results of the estimation were that all coefficients were significant and have the expected theoretical signs. From the estimated equation, they identified several sources of variation in the RER. The RER appreciates with i) an improvement in the terms of trade, ii) a capital inflow, iii) a decrease in openness, iv) an increase in excess domestic credit and v) an improvement in technology. The estimated coefficients, except for nominal devaluation and excess credit, are close to the ranges reported in the empirical literature for LDCs of Edwards (1988).

Favaro and Spiller (1989), who analyzed the dynamics of RER behavior in Uruguay, used time series data for the period 1950-1984 in their estimation. The result showed that an increase in capital inflows in Uruguay during this period resulted in a RER appreciation. They also found that an increase in the level of import tariffs in Uruguay resulted in RER appreciation.

Kignel (1992) also used the simple version of the familiar dependent economy model to analyze the long run determinants of the real exchange rate and the role of exchange rate policy in determining the RER. His main findings are: -

1. Exchange rate policies only have a limited effect on the real exchange rates. Their success ultimately depends on the consistency between exchange rate policy and other macroeconomic policies, and external developments. In the longer term the real exchange rate, as any relative price, is primarily determined by fundamental factors affecting the supply and demand for foreign exchange, and in this respect it is primarily independent of the exchange rate policy.

2. Countries can only maintain a stable real exchange rate when they follow stable macro economic policies, and when they are not subject to large external shock. The adoption of 'realistic' exchange rate policy helps in smoothing short-term fluctuations in the real exchange rate.

Asmerom Kidane (1997) did another empirical study on the determinant of the RER. He made his study on exchange rate policy and economic reform in Ethiopia. In order to capture the effect of 1992 economic reforms in general and that of devaluation in particular, Kidane used quarterly data up to the end of 1994 in his study of real exchange rate. The empirical result obtained indicated that most of the explanatory variables showed the expected signs and significant coefficients. The results suggested that devaluation, which is an inverse of the parallel market premium, be expected to lead to the depreciation of the real exchange rate. On the other hand, the effect of foreign terms of trade on the RER was insignificant even though it showed the expected sign. Kidane's study also showed that the decrease in export and import taxes (more liberalization) did cause the depreciation of the real exchange rate.

Kidane's study is different from this paper in defining the real exchange rate (RER). He defined RER as the ratio of the price of tradable commodity (coffee only) to the non-tradable (cereals). However, in this paper a more operational definition is chosen for the real exchange rate. It is defined as the ratio of price of tradable to non-tradable ($RER = E \cdot PT / PN$, where PT is the world price of tradable, PN domestic price of non tradable and E is nominal exchange rate). In measuring the variable, foreign wholesale price index (WPI) and domestic CPI is given as a proxy for PT and PN, respectively. Furthermore, unlike Kidane's paper, this study tries to incorporate the effect of parallel market exchange rate in the calculation of the real effective exchange rate.

Andualem Berhanu (1996), who analyzed the dynamics of the real exchange rates behavior of the 'Birr', used annual time series data for the period 1960-1991. He constructed four different indexes of the RER. These indexes are the real effective exchange rate indexes constructed in line with the PPP approach and in line with the Salter Swan approach; bilateral real exchange rate indexes with the United States dollar constructed in line with both approaches.

The results obtained from this regression showed that the terms of trade deterioration push the equilibrium real exchange rate (ERER) to appreciate. The extent of trade controls had, however, different effects on the various equilibrium real effective exchange rates constructed on the different approaches. According to Andualem an increase in trade controls had an appreciating impact on ERER constructed based on PPP approach. However, it had a depreciating impact on ERER constructed based on the Salter-Swan approach. This difference can be explained in the movements of the wholesale and consumer prices indexes of Ethiopia's trade partners. An increase in the excess supply of credit had also a depreciating impact on the ERERs.

Andualem Berhanu's study is different from this paper both in type of the data and methodology used. This study used quarterly data rather than annual and also covers different period 1985Q1 – 2000Q2. He estimated an error correction model based on the Engle-Granger two-step procedure, which is highly criticized for not being applicable in the presence of multiple co-integration vectors. This study uses Johansen procedure to determine the time series characteristics of the data. Moreover, unlike Berhanu's study, this paper incorporates the effect of the parallel market exchange rate in the construction of the real effective exchange rate

3. Overview of the Ethiopian economy and foreign exchange market.

3.1 Macro economic performance.

Like many other Sub Sahara African (SSA) countries, Ethiopia has faced serious economic crises over the last three decades. The poor economic performance was attributed to both internal and external factors. The economic policy of the Derge regime (1974 –1991) could be considered as the major internal cause. Internal factors include macroeconomic mismanagement such as overvalued real exchange rate and excessive fiscal deficit. On the external side, the oil crises 1970s, deteriorating of terms of trade, and an increase in the interest rate of developed countries relative to the countries interest rate could be identified as factors contributing to the poor performance of the economy.

During the Derge regime Ethiopia's economy was characterized by large budget deficits, overvalued exchange rate and persistent deficit in the balance of payment. Moreover, the fiscal imbalance was largely financed by money creation and through domestic bank borrowing during the Derge period. Apparently, such financing has lead to price rise of non-tradables. However, the domestic price of tradables increased roughly at the lower international rate. Hence, the real exchange rate, at a fixed nominal exchange rate, declined (appreciation of the rate). As these external and internal factors affected the real exchange rate of the country, it is worthwhile to look in to the performance of national economy at large. In particular, there are important linkages between exchange rate misalignment and the macroeconomic condition of a given nation in the sense that a persistent misalignment of exchange rate has a negative impact on investment, productivity and hence, on economic growth.



Given these important linkages between the foreign exchange rate and macro-economic variables of Ethiopia, an attempt is made in this section to review the macroeconomic performance of the country.

3.1.1 GDP and its components.

Ethiopia is reputed for her natural and human resources potential. Nevertheless, the rate of growth of its GDP has been slowing down since the mid 1970s. This slow down in the growth of the economy is significantly attributed to structural problems, natural calamities (such as drought and famine) and man made crises (such as civil war and poor economic policies).

Growth was relatively satisfactory in the late 1960s and early 1970s. The average rate of growth of GDP in real terms for the period 1967/68 – 1971/72 was four percent per annum (Eshetu Chole and Makonnen M. (1992)). However, since 1974 the Ethiopian economy has persistently declined deep into serious crises until the 1992 reform year. Real economic growth had been below zero for the large part of the military regime (1974-1991). The average real GDP growth for the last four years of the Derge period was almost zero (0.02%) per year compared with an average population growth of 3% leading to a net decline in per capita income. Particularly, during the last few years of the military regime, the average growth rate of real industrial GDP was below zero and lowest with an all time lowest growth rate of about -19 percent in 1990/91 fiscal year. However, available data shows that, after the downfall of the military regime, Ethiopia's economy has bounced back from a negative performance to a positive one and in some cases showed remarkable growth.

According to the MEDaC data, the average growth rate of real GDP during the three identified periods 1967/68 - 1973/74, 1974/75 -1990/91, and 1991/92 - 1999/00 were 5.6, 2.9 and 4.6,

respectively, while average per capita GDP has declined from 269.27 Birr in 1982/83 to Birr 249.94 in 1998/99. The major underlying contributor to the decline in per capita income during the above stated period was the poor performance of the agricultural sector and an increase in population growth rate.

As it is evident, Ethiopia's economy is dominated by agriculture (it accounts to 49.6 percent of GDP recently). Agricultural sector is said to provide 90 percent of the country's exports and around 85 percent of employment. This implies that economic growth of Ethiopia is heavily dependent on agricultural growth. Hence, agricultural output is the single most important determinant of Ethiopia's overall economic development and the problem of this sector and the internal and external constraints it usually faces are the most important problem of the country's economy. The average share of agricultural GDP in total GDP for the periods 1967/68 - 1973/74, 1974/75 -1990/91, and 1991/92 - 1999/00 were 53.4, 52, and 49.6 percent. Economic growth is often followed by a decline in the share of agriculture in GDP. In this regard, however, Ethiopia's economy has been stagnant for long without showing a significant change in the relative share of the sector. It is then apparent that the process of development in Ethiopia has failed to exhibit a fundamental structural transformation of the economy.

The Ethiopian government has given due attention to the enhancement of this sector since the introduction of the economic reform in 1992. Nevertheless, in contrast to its size in the economy, agricultural growth is still very low as it is characterized by extremely low productivity. The poor performance of the agricultural sector meant that it failed to raise the transfer of resources between agriculture and other sectors implying that overall productivity was hindered. The contribution of industry to GDP is still low. Industry's average share of GDP has declined from 15% in 1967/68- 1973/74 to 10.7 percent in the period 1991/92 - 1999/00.

However, the second largest sector, service, increased its share during the same period from 28.7% to 39.7%.

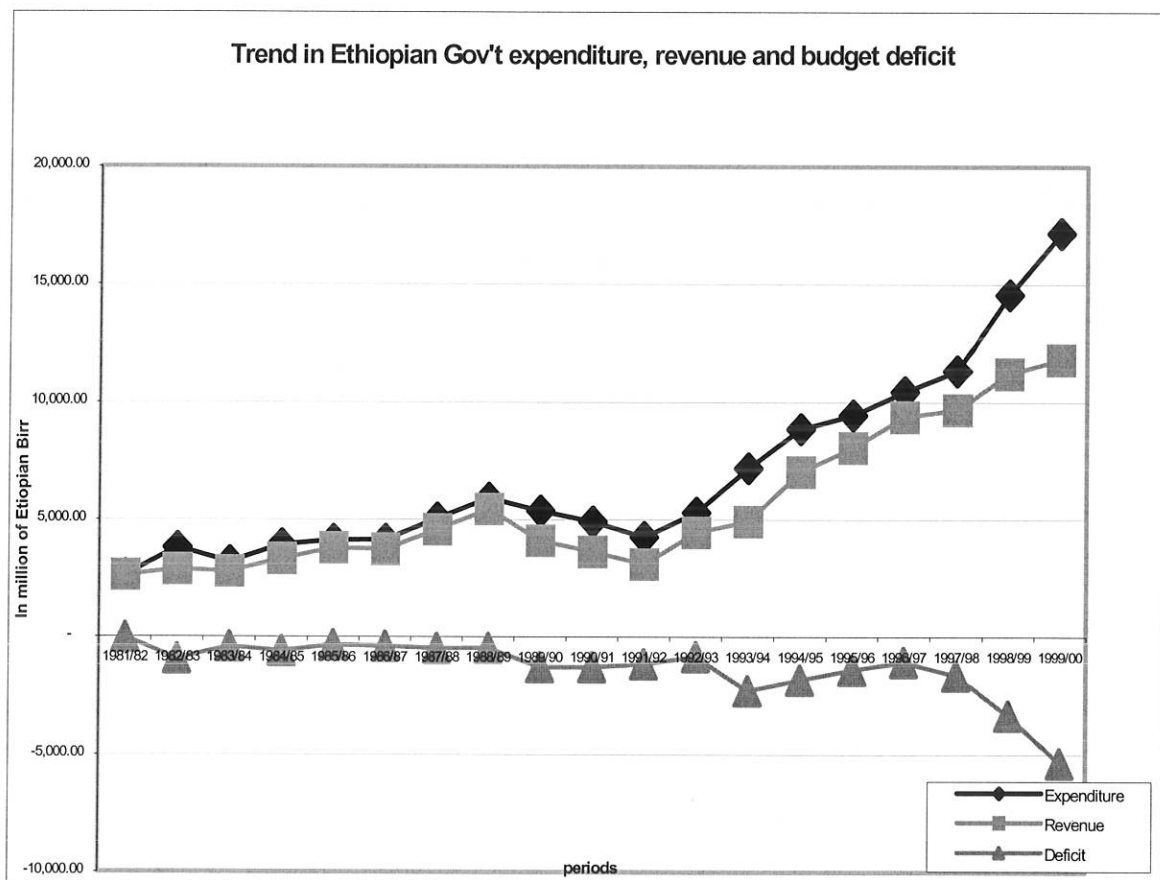
3.1.2 Fiscal Deficit, Money Supply and Prices.

Fiscal deficit has a direct and indirect effect on price, money supply and the trade balance of the country. It is plausible that when fiscal deficits are financed through credit expansion the obvious results are an increased money supply. This situation may lead to a rise in inflation rate and exchange rate appreciation. Furthermore, excessive resort to external borrowing to finance the deficit is also expected to influence external debt and hence deteriorating current account position, which finally leads to exchange rate depreciation.

Fiscal condition in Ethiopia is mainly characterized, like other developing countries, by continuous fiscal deficit. The fiscal policy in the imperial regime (before 1974) was very prudent. Nevertheless, during the military regime, the government pursued expansionary fiscal policy. Birhanu and Befekadu (1999/00) state the following about trends in fiscal deficit in Ethiopia.

" The overall fiscal balance in Ethiopia has moved from a surplus in the early 1950s to a balanced budget up to the mid 1960s and a rather small deficit in the 1965 - 1974 period owing to the fiscal conservatism of the state during the imperial period. Fiscal deficit started to grow rather rapidly following the 1974 revolution. The ever increasing fiscal deficit in the post-revolution period was partly caused by a relatively higher growth of expenditure which was instigated by unplanned expenditure particularly excessive spending on defense"[pp-372].

Fig. 1



Sources: Ministry of Finance

The deficit was almost 5% of GDP in the period 1981/82 - 1990/91. During the 1999/2000 fiscal years, however, it has gradually reached 9.9 % of GDP. Ethiopia's fiscal development over the years 1981/82 - 1999/00 could be viewed with the help of the trend in the fiscal deficit (see chart 1). As it is indicated by the chart both government expenditure and revenue have increased over the entire period.

The worsening of the fiscal deficit in the 17 years of Derge, could also be explained by the rapid increase in the ratio of government expenditure to GDP. This ratio was, on average, 27.5% in the period 1981/82 - 1990/91 and dropped to an average of 21.5% during the nine years after the reform. However, when it is compared with revenue to GDP ratio (about 23% and 22% on

average for the periods, 1981/82 - 1990/1991 and 1991/92 – 1999/00, respectively) the expenditure to GDP ratio is high implying that the budget deficit became worsened in the stated period.

The movement of broad money (M2)¹³ is one of the macroeconomic indicators. According to data from National Bank of Ethiopia broad money increased by 19 fold between 1974/75 and 1999/00 fiscal years, an average annual growth of 12.7. Money supply grew by 10, 15 and 9 percent during the periods 1967/68 – 1973/74, 1974/75 – 1990/91 and 1991/92 – 1999/00 respectively. The growth rate of domestic credit was also high with an average annual growth of 15.9 in the reviewed period. The mounting of the money supply during the last three decades was mainly due to deficit financing from domestic sources (bank) increased by 24 % per annum during 1991/92 - 1999/00 and domestic credit expansion to the private sector, which increased 58% per annum during the period 1991/92 - 1999/00.

Despite the fast increase in money supply and alarming increase in the budget deficit, inflation pressure is low in Ethiopia compared to other developing countries. Inflation rate was low and in most years below 5% in the late 1960s. In the periods 1967/68 – 1973/74 the inflation rate average was 4.5%. However, it went up to two digits between the periods 1973/74 - 1980/81. During this period the average inflation rate was 13.6% but the rate went down to a single digit afterwards. (1981/82 – 1990/91 the average inflation was 6.2%). The period 1974/75 - 1979/80 was characterized by high rate of domestic inflation, caused by excess demand for goods, and raw materials, which were in short supply (Abdulahi, 1999). Inflation rate was relatively higher during the Derge regime inspite of wide range price control through out the country. During the period 1991/92 –1999/00 the rate went down to 4.5 %.

3.1.3 Balance of Payments.

The balance of payments account is a record of the economic transactions of an economy with the rest of the world (IMF, 1993). In this regard, various flows reflected in the balance of payments (BOPs) are the reflection of the overall economic activities. For instance, the rise in the volume of a country's export observed in the BOPs account is an indication of a healthy economic activity, whereas deficits could indicate a precarious international reserve position. In a nutshell, to have an insight into the complex effects (positive and negative) of international economic development on a specific country's economy, the starting point would be assessing the country's record of international transaction namely the BOPs account.

Owing to the weak performance of the Ethiopia economy, the BOPs for the largest part of the period (1967/68 - 1999/00) were unfavorable. Throughout this period, the overall balance showed more often a deficit situation than surplus (see Annex 2). Surplus was recorded only for a few fiscal years during the stated period. Thus achieving favorable balance of payments has become a matter of fortune happening in Ethiopia. The favorable situation was during large influx of capital and public transfer, which offset the deficit in the current account.

Even though the size of the deficit in the current account has shown minor ups and downs, the overall trend in the deficit was upwards. This was the effect of a huge deficit in the trade balance of the country. According to NBE data, Ethiopia's trade deficit increased on average per annum by 20 percent during the period 1967/68 – 1973/74. The growth rate in merchandise trade deficit however went up to 24.3 percent on average during the entire period of the Derge regime (1994/95 – 1990/91). The growth rate further increased to about 24.6 percent per annum on average between 1991/92 – 1999/00. Given the limited role that the invisible trade plays to

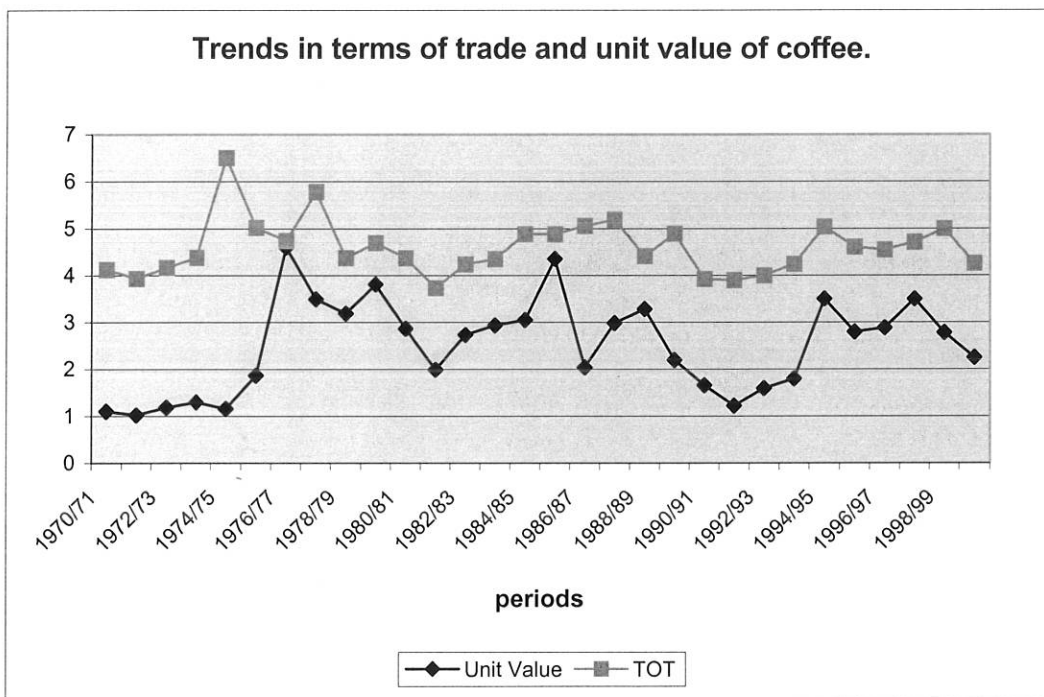
¹³ M2 is defined as the sum of M1 (currency in circulation plus demand deposit), time deposit and saving deposit.

offset the effects of trade deficit, the current account worsened as the trade deficit grows. Accordingly the ratio of the current account deficit to GDP increased from about 5% in 1989/90 to about 9.5% in 1999/00. The major contributors to the widening of trade deficit were stagnating or declining export volumes and values accompanied by rising imports. As this situation forces government to borrow from foreign source to fill the gap, the debt servicing will increase and consequently depreciation of the currency.

3.1.4 Terms of trade.

Since the mid 1970s a significant fall in the export prices (world) of agricultural commodities relative to the world price of manufactured products have been observed. Apparently, the terms of trade for primary product exporting countries has declined over time. As the commodity composition of Ethiopia exports has stayed rigid for a long time, the country is heavily dependent on primary commodity exports for its foreign exchange earnings.

Fig. 2



Like other low-income developing countries, Ethiopia is subjected to large external shocks. Fig. (2) shows the terms of trade (TOT)(define as the ratio of export unit value index to import unit value index) of Ethiopia in logarithm¹⁴ and the average value of TOT over the stated period is 4.6. Therefore, this figure shows that the Ethiopian terms of trade fluctuated roughly within a 50%(taken as the largest number below or above the average as a ratio of the average) wide band around its mean value. The decline in the terms of trade indicates that a given volume of export during a given period of time fetch lower volume of imports than the base year imports. During 1978 - 81, for instance terms of trade losses were particularly large for Ethiopia (27%); this loss reflects the increase in the price of imported oil, price of manufactured imports, and the decline in the price of most commodity export (Woldu, 1994). The fluctuation in the terms of trade in Ethiopia is mainly associated with fluctuation in price of coffee Vis -a-vis (chart 2) gradually rising import price. This in turn finally contributes to the crisis of foreign exchange earnings and depreciation of the real exchange rate.

3.2 Exchange rate policies.

3.2.1 Official Exchange Rate market.

Over the last two decades, the mix of exchange rate arrangements in developing countries has changed significantly. Following the break down of the Bretton Woods par value system and the widespread adoption of floating exchange rate by the major advanced countries in the early 1970s, most developing countries initially continued to peg their currencies either to a single key currency or to a basket of currencies. Starting in the late 1970s, however, a number of developing countries moved away from this arrangement.

¹⁴ Logarithm is taken to smooth the large fluctuations so that to see the trend continently.

Like many other developing countries, Ethiopia followed a pegged exchange rate regime after the collapse of the Bretton Wood system. Before 1973 Ethiopia's exchange rate policy was in consonance with IMF par value system. The country's legal tender currency, then called Ethiopian Dollar, was issued in 1945 with an official rate of 2.48 Eth. dollar per USD and became the official currency of the country, replacing the Maria Theresa which had been circulating as legal tender. Two decades latter, in 1964, the Eth. dollar underwent a minor adjustment the, official rate being set at Eth. dollar 2.50 per USD.

During the late 1960s the relevance of the par value monetary system based on U.S. dollar came under questioning. The U.S. dollar was floated and ceased its convertibility to gold in December 1971. This situation led to the devaluation of the U.S. dollar. Consequently, the Eth. dollar appreciated against USD to the rate of 2.30 per USD. The subsequent devaluation of the U.S. dollar had temporarily brought about under valuation of the Eth. dollar. Hence, the Eth. dollar was again revalued to 2.07 Eth. dollar per U.S dollar in 1973 so as to realign the rate.

Since then Ethiopia followed a fixed per determined nominal exchange rate pegged¹⁶ to the U.S dollar until the massive devaluation of October 1992. On September 21, 1976 the name of the Ethiopian currency was changed to 'Birr', with official rate remaining unaltered. This fixed official exchange rate was left unchanged for two decades despite the floating of the major world currencies including the U.S dollar. As a result the Birr became overvalued against the world major currencies including the U. S. dollar.

Asmerow Kidane (1994) arrived at the conclusion that whether we use the nominal, real or parallel exchange rate index, all the results asserted the continuous appreciation of Ethiopian

¹⁶ Pegging denotes the condition of the 'Birr' being fixed at a given rate to its reserve currency (USD) for any appreciable length of time

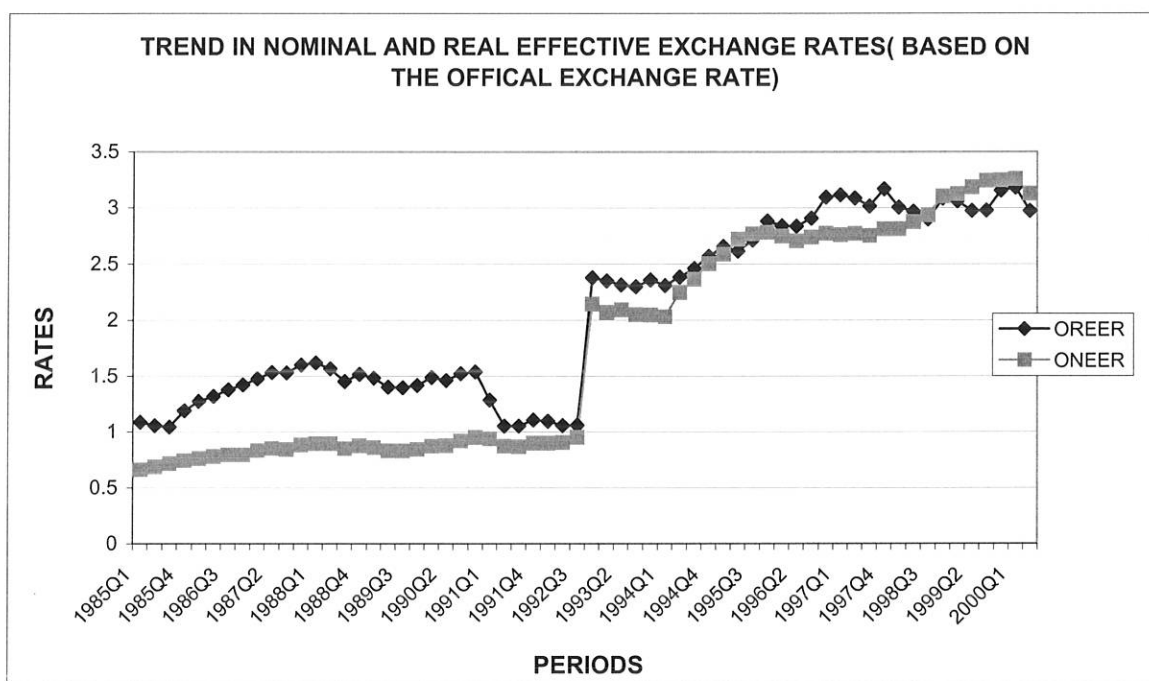
'Birr'. The movement in all the nominal and real effective exchange rates¹⁷ displayed a substantial degree of appreciation from 1988Q1 to 1991Q4. Therefore, an increase in the effective exchange rates indicates appreciation and vice versa. Generally the Birr exhibited two distinct patterns over the sample period. Even though it showed minor fluctuations in its course of movement before 1992 it looks stable. It, however, started to depreciate soon after the devaluation (see Fig. 3).

Haile Kibret (1994) also arrived at the following conclusion concerning the exchange rate of the Birr before 1992. “ All the relevant indicators as a group, but particularly the prevalence of a significant black market premium for foreign exchange, and the fact that real exchange rate is consistently higher than the nominal exchange rate suggest the Birr is overvalued.”

Exchange rate overvaluation causes misallocation of resources in production and promotes investment of resources in rent seeking and socially unproductive but privately profitable activities, hence, reduces the growth rate of output. It also reduced the competitiveness of legal exports and led to significant smuggling activities.

¹⁷ The calculation of the real and nominal effective exchange rate are shown in Annex 3.

Fig. 3



As the trend in the above chart indicates, the Ethiopian Birr was allowed to depreciate against the USD in nominal and real effective terms after the introduction of economic reform in 1992. OREER stands for real effective exchange rate based on the official exchange rate and ONEER also stands for nominal effective exchange rate based on the official exchange rate.

Realizing the negative effect of an overvaluation of the 'Birr' on the country's economy, the Ethiopian government had adopted discretionary devaluation of the currency that was followed by subsequent and gradual depreciation. The trust of the successive devaluation of the currency and the adoption of the auction system was to encourage exports and strengthen official reserves.

3.2.2 Auction system.

Following the devaluation of the Birr the government took major steps that allowed the exchange rate to be market-determined. In line with this, fortnightly auction market for foreign exchange was introduced in May 1, 1993. Following these two rates, namely the official exchange rate and marginal rate emerged. The official rate was applicable to imports classified

as 'essential' commodities (such as petroleum, pharmaceuticals, fertilizers, as well as official debt servicing). The marginal rate was determined only through the auction system and applied to other imports (other than the above stated imports). Since the inception of the auction system no sporadic forex supply has been observed and it is plausible to argue that exchange rate remained relatively stable¹⁸. The National Bank of Ethiopia declares in advance the total supply of foreign exchange for each auction and the marginal rate is announced on the day the auction is held. In order to attend the auction, importers are required to have an import license for the commodity they want to import.

In order to avoid multiplicity of rate the official and marginal rates were unified as of July 25, 1995 because the government bans the privilege or implicit subsidy enjoyed by the so-called essential commodities. Hence the official rate was irrelevant. Since then one auction determined official exchange rate system has been applied for all imports. Furthermore, the frequency of auction was also changed from fortnightly to weekly basis, starting August 1996, to accommodate the growing demand for foreign exchange. Thus, there was significant increase in demand for foreign exchange in the auction market.

Since its inception, several important modifications have been made to the operation of the auction; the retail auction (whereby the National Bank of Ethiopia sells foreign exchange to final users) was replaced by wholesale auction in September 1998. Like the retail auction, the wholesale forex auction has been conducted openly in the presence of prospective bidders every Saturday. The wholesale auction is different from that of the previous one in that the participants are not the final users of the foreign exchange but authorized commercial banks and investors who want to bid for at least half a million U.S dollar. All foreign exchange won from the auction, other than by commercial banks, for which L/C is not established or transfer is not

¹⁸ stability here refers to minor fluctuations of Birr at the auction market

made, will be cancelled within 60 days from the date the bid is won. The marginal rate serves as an official rate for all transactions and it applies until the next auction date.

3.2.3 Foreign exchange bureaus

In an attempt to further liberalize the exchange rate and to move towards a fully realistic exchange rate, the National Bank of Ethiopia (NBE) allowed the establishment of foreign exchange bureaus in 1996. Only authorized commercial banks¹⁹ are allowed to establish forex bureaus. These banks are authorized to allow importers and exporters, excluding coffee, and provide associated services importers and exporters against submission of the required documents. They can approve imports for any values; but values of USD 1 million and above are subjected to open international competitive bidding backed by relevant documents.

Foreign exchange bureaus are authorized to engage in the purchase and sale of foreign exchange at freely negotiated rates and each foreign exchange bureau being free to quote buying and selling rates. The first licensed bureau went into operation in April 1998; but at end-December 2000, more than 26 bureaus are operating. From practical observation it is plausible to say that the exchange rate quoted by the bureaus, particularly selling rate mostly remained very close to the parallel market rate.

The foreign exchange bureau scheme made the structure of Ethiopia's exchange arrangement more complex, with the spread between the auction rate and the average selling rate in the bureaus averaging about 1 percent during the October 2000 – December 2000 period. However,

¹⁹ Authorized commercial banks shall mean a commercial bank established in accordance with the law and authorized by the NBE to engage in foreign exchanger transactions (directive No. FXD/07/1998).

the deference between the auction rate and the average bureau's selling rate was averaging some 5 percent during the same period.

Liberalization of external sector of the Ethiopian economy has been taking place in progression since the start of Structural Adjustment Program in October 1992. Before the introduction of the reform, there were relatively substantial restrictions on current account transactions; all international transactions were virtually under the control of the National Bank of Ethiopia (NBE). All transfers and payments abroad for exports, imports and invisible transactions required licenses issued by the NBE. There were quantitative restrictions on foreign exchange for personal travel abroad, business and medical purposes. Furthermore, exporters were required surrendering all foreign exchange earned to the NBE.

With the introduction of the reform, however, most of the restrictions that existed for long on current account transaction have been considerably liberalized. Currently, there are improvements in the policy environment with respect to the current account transactions. The limit previously set in the amount of business and personal travel is waived. The payment (foreign currency) for the personal and business travel will be made in acceptable instrument such as, travelers check, draft and cash notes. But the cash note payment shall not exceed USD 400 and the rest can be made in traveler's check, draft, etc. There is no export surrender now but exporters must sell their foreign exchange receipt within 28 days to any commercial banks at the attractive rate they get at the market.

3.2.4 The Parallel foreign Exchange market.

Even though there is no consensus among researchers about the inception of the Ethiopian parallel market exchange rate, some are of the opinion that it was non-existent or at its minimal

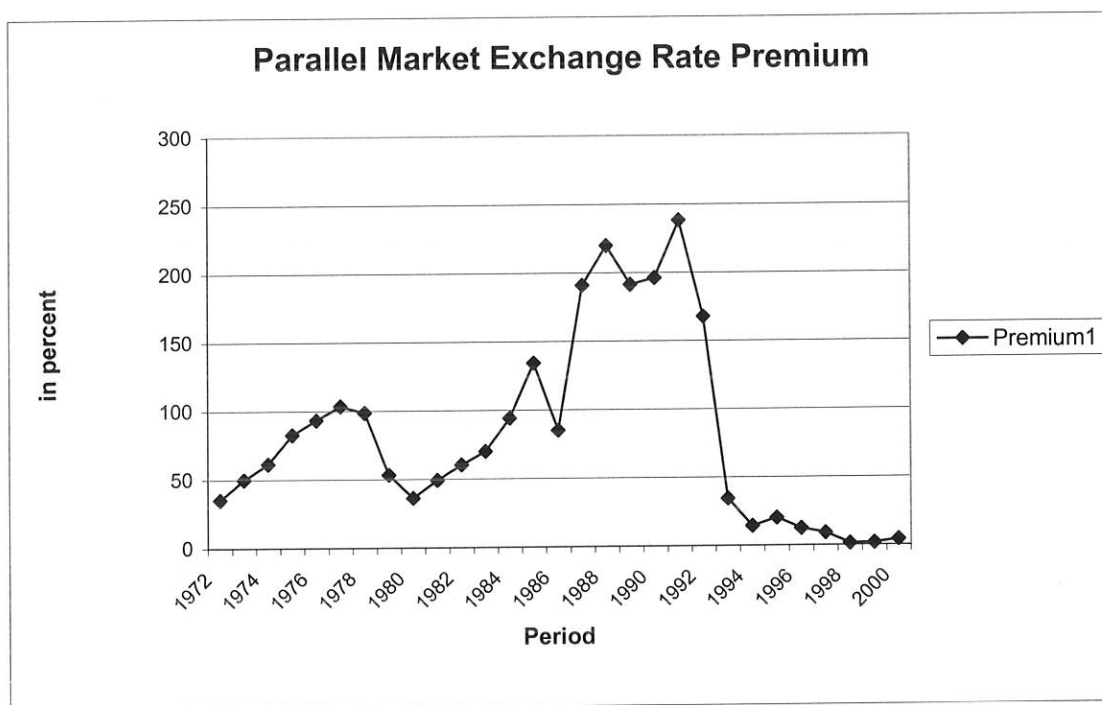
before the Derge assumed power. Befkadu Degefe (1994) stated that the significance of the illegal parallel market for foreign exchange has grown to the extent that impairing the operation of the official foreign exchange market during the post-1974 and particularly since 1980/81 fiscal years. Willem Naude and Abu Girma (1994) noted that illegal parallel exchange rate system in Ethiopia developed in the 1970s, and expanded considerably during the 1980s.

Be it as it may, one can intuitively say that the parallel market for foreign exchange started to expand and flourish during the 17 years of the Derg regime. Like many developing countries, the main factors that were behind the emergency of the parallel exchange market in Ethiopia, among others, were persistent external imbalance and fixed exchange rate policy which led to overvaluation of the Birr since 1970s

Undoubtedly, export performance of this country was virtually poor and export earnings remained meager. Therefore, the National Bank of Ethiopia allocated foreign exchange to importers through rationing. These measures worsened the forex problem and aggravated it extremely. Most of the private importers who could not get access to the official foreign exchange market resorted to the alternate parallel market. On the other hand, those who acquire foreign exchange through private transfer from abroad continuously showed their preference for the parallel market, as official exchange rate was artificially low.

To this end, parallel foreign exchange market activities in Ethiopia have been important at various times in attracting traders and dealers, especially in the late 1980s, particularly when franco-valuta imports were allowed. The premium of the parallel market exchange rate has also depicted a substantial increase over the years. The premium, which was about 97 percent in 1975/76, moved up to 223.6 percent in 1990/91. Hence, parallel exchange rate premium over the last two decades had made a continuous expansion before the 1992 reform (See chart 4)

Fig. 4



So

Source:- National Bank of Ethiopia

However, after the introduction of the reform in Ethiopia and various exchange liberalization measures (devaluation, adoption of foreign exchange auction system and opening of forex bureax to engage in retail transaction) the margin of the premium began to narrow. Most importantly, the banning of franco-valuta imports in late 1996 contributed much to the small premium in the exchange rate market.

The Ethiopian parallel foreign exchange market is a very volatile market (see annex 4), which at times has showed a drastic fluctuation even after the economic reform program of 1992. This high degree of volatility was due to both economic and non-economic factors.

As the activities of the parallel market are often illegal measuring of its size is almost impossible. However, it is believed that the market accommodates significant transaction

because contraband and most of franco-valuta imports are financed from the black market. Nowadays, the source of supply to the parallel market has showed fluctuation even in some cases have a seasonal behavior. As a matter of fact during holidays the amount of transfer sent from abroad by Ethiopians to their family shows an increase and this to some extent pushes up the supply of foreign exchange in the parallel market. As a result the Birr/USD rate in this market usually goes down. Accordingly, the Birr/USD rate declined by 20 Ethiopian cents from Birr 8.50/USD at the beginning of April, 2000 to Birr 8.30/USD at the end of the same month (at the eve of the Ethiopian Easter).

This shows sensitivity of this market to seasonal factors. Recently, the premium for foreign exchange declined and the sources of supply of foreign exchange to this market also decreased. Nevertheless, due to different factors, the demand for foreign exchange in this market is still strong. This is due to, first, the amount of foreign currency which is allowed for personal travel abroad is 1200 USD, travelers who wanted an additional foreign currency in excess of the allowed amount try to fill the gap from this market. Secondly, there is a need to finance illegal imports (contraband). Thirdly, according to some reliable sources, there are some agencies owned by foreigners, which are engaged in receiving or sending money from or to abroad illegally.

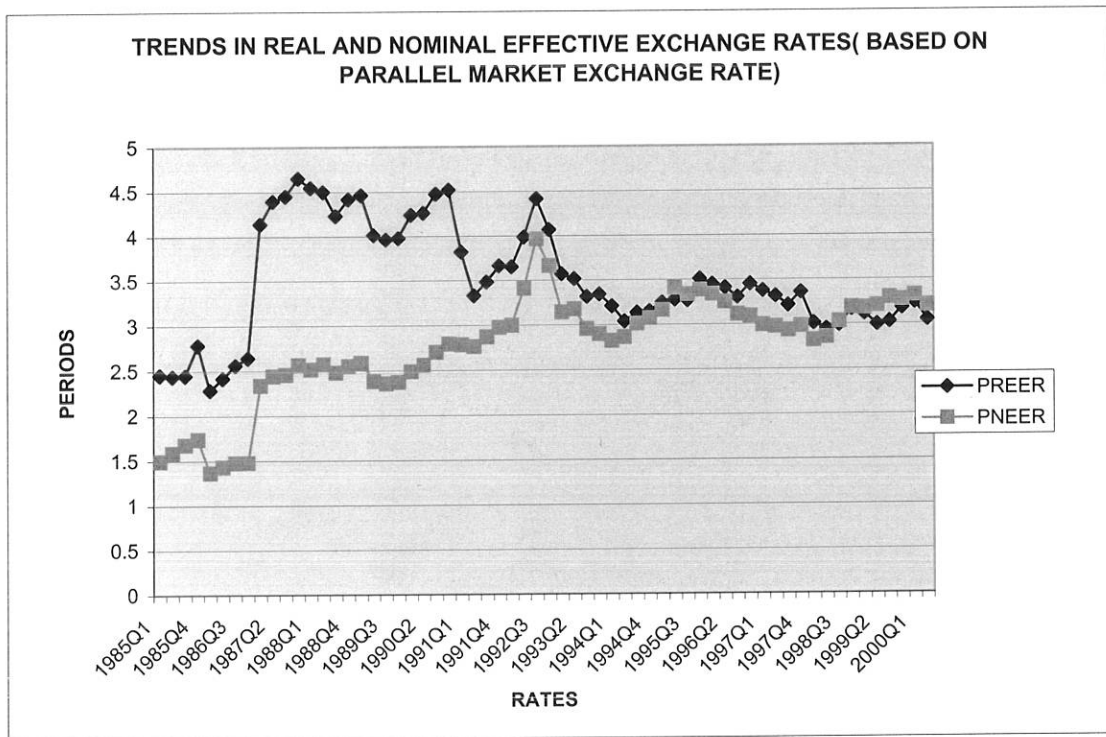
These groups (agencies) are legally established as Import-Export agencies and are equipped with computer, telephone and other facilities. These are located mainly around the Bole-Rwanda road in Addis Ababa. Furthermore, these agencies also operate in domestic currency. However, when sending money abroad, they settle the payment in foreign currency (in Dollar or Pound or in the country's currency in which the receiver is residing) these agencies would obviously convert the collected domestic currency into foreign currency in the parallel market. This creates pressure on the demand side of the market. These are some of the factors that contribute for the

seasonal demand in the parallel market for foreign exchange. As it is evidenced from practical observation, the parallel market is driven by and large by speculative motives, which in fact has a direct impact on the movements of the exchange rate at this market. Moreover, economic agents of this market closely follow developments associated with exchange liberalization, supply of forex in the official market, negotiations with international financial institutions, particularly with IMF. For instance, recently following the agreement of new program, poverty reduction and growth, between the government and IMF, developments at the parallel market indicate that both the buying and selling rate significant down ward movement.

To put it succinctly, the stated supply and demand side problems of the market mostly explain the observed volatile nature of the exchange rate in the parallel market.

The parallel market exchange rate is more or less a floating one (as it is governed by supply and demand of the currency) when compared with the official exchange rate. Hence, there is a preference to use the parallel market exchange rate in construction of effective exchange rate indices. Asmerom Kidane (1994) stated the following" most nominal and real effective exchange rates are estimated using the official exchange rates. In economies with large parallel markets the official nominal and real effective exchange rates may not show the true picture. One may also have to estimate effective exchange rates based on the parallel market".

Fig. 5



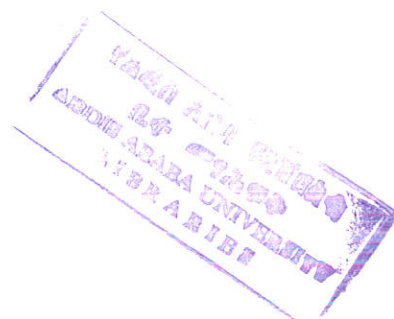
Based on the parallel market the author of this paper also tried to construct the nominal and real effective exchange rate for Ethiopia for the period 1985 - 2000. Chart 3 and 5 indicate that there are large differences between the indices based on the official and those based on the parallel market rates. The gap between the real and the nominal rates is high in the parallel market effective exchange rate (Fig.5) compared to the official based effective exchange rate (Fig. 3). This shows that the parallel market effective exchange rates may give a better feature of the depreciation or appreciation of the Birr.

4. Data source, Methodology and model specification.

4.1 Methodology

In principle it is important to test the order of integration of each variable in a model to establish whether it is stationary or non-stationary, and how many times the variable needs to be differenced to result in a stationary series (Harris, 1995). A given variable (a stochastic process) is said to be stationary if it has a zero or at least constant mean, constant variance overtime, and if the covariance between observations in two time periods depends only on the distance of the lag between the time period rather than on the actual time the covariance is computed [see Gujarati (1995), Harris (1995)]. Testing for stationarity of time series economic variables has become mandatory before going in to a meaningful regression analysis. Macroeconomic data often appear to possess a stochastic trend that can be removed by differencing once (Baffes, et. Al., 1997). Such variables are integrated of order one, or I(1); they are non-stationary in levels and stationary after differencing. This pattern can readily be revealed using standard tests for the presence of a unit root.

The assumptions of the classical regression model necessitate that the variables be stationary and the errors have a zero mean and constant variance. In the case of non-stationary variables, however, there might be what the literature called spurious regression. A spurious regression has a high R^2 , t-statistics that appears to be significant, but the results are without any economic meaning. However, if the non-stationary series are co-integrated, i.e., if there exists a stable long run linear combination of the variables, which is stationary, then we can estimate economically sensible relationship among the variables Solomon (1999). So far, there are two major procedures to test the existence of co-integration; the Engle and Granger (1987) two-step procedure and the Johansen maximum likelihood method [Baharumshah (2000)].



In the Engle-Granger procedure, variables entering the co-integrating vector are tested for integration of the same order, in fact order one – $I(1)$. In the first step the long run static model, consisting of $I(1)$ variables; is estimated and obtain the residual. If this residual, the linear combination of the non-stationary variables, is stationary then the variables are said to be co-integrated i.e., they do have long-run relationship. Secondly, the error correction model is estimated and the first difference of the dependent variable regressed on the first difference of the explanatory variables (with their appropriate lags) and the first lag of the residual obtained from the static model. Although popular, this procedure is plagued with several problems hampering its reliability. The test is extremely weak under mild cases of auto-correlated and/or non-normally distributed errors [see Harris, 1995]. The residual that is used as error-correcting term in the second procedure is obtained from the static regression in the first step, which is already suspected to be spurious. Furthermore, it categorizes variables as endogenous and exogenous with implication of simultaneity problem (Said, 2000). It also assumes that there is unique co-integrating vector (the variables in the model may have only one equilibrium relationship governing the joint evaluation of the variables), which may not always be the case. As it is stated in Solomon (1999) generally the Engle-Granger two-step method is said to be weak in testing co-integration among variables (see Charemzo and Deadman, 1993: 201).

Co-integration tests in this paper are conducted by Johansen Maximum Likelihood estimation procedure since this particular method is claimed to be superior to the above procedure. This method does not require a priori endogenous-exogenous distinction among variables and it can also identify multiple co-integration vectors.

The Johansen procedure sets out a maximum likelihood procedure for the estimation and determining the presence of co-integrating vectors in VAR system. Vector auto regression (VAR) is one form of multivariate modeling where no variable in the system is assumed to be

exogenous a priori. Suppose the vector of P-variables, $Z_t = (Z_{1t}, \dots, Z_{pt})$, is generated by the P-order Autoregressive process with Gaussian errors. This can be formulated as follow.

$$Z_t = A_1 Z_{t-1} + \dots + A_k Z_{t-k} + U_t + \varepsilon_t \dots \dots \dots (1)$$

Where: $t = 1, \dots, T$

A_i is an (nxn) matrix of parameters

Z_t is a vector of non-stationary variables.

U is vector of deterministic components such as deterministic time trends and constants.

ε_t is vector of error terms

Equation (1) can also be reformulated in to a vector error correction (VECM) form as,

$$\begin{aligned} \Delta Z_t &= \Gamma \Delta Z_{t-1} + \dots + \Gamma_{k-1} \Delta Z_{t-k+1} + \Pi Z_{t-k} + \mu + \varepsilon_t \\ &= \Pi Z_{t-k} + \sum_{i=1}^{k-1} \Gamma_i \Delta Z_{t-i} + \varepsilon_t \dots \dots \dots (2) \end{aligned}$$

Where: $t = 1, \dots, T$

$$\Gamma_i = -[I - A_1 \dots A_i], \quad i = 1, \dots, k-1$$

Δ = First difference operator

$$\Pi = -[I - A_1 \dots A_k]$$

I = a unit matrix

This way of specifying the vector auto regression (VAR) is taken from Harris (1995). The matrix Π contains information about the long run relationship between the variables in the vector. Information about the number of co-integrating vectors is also found in the rank of Π . In other word, the rank of Π determines how many linear combination of Z_t are stationary. If the $p \times p$ matrix Π has rank zero, $r=0$, then all the elements of Z_t are non-stationary. Thus, there is no co-integrating relationship between the variables. If, however, Π is full rank²⁰, that is $r=p$, then

²⁰ The rank of a matrix gives the maximum number of independent rows and columns [Lipschutz(1977)].

all elements of Z_t are stationary (the variables are stationary at levels and no error-correction formulation is required)

In the intermediate case $r < p$, there is r nonzero co-integrating vectors among the elements of Z_t and $p-r$ common stochastic trends. If non-zero relationship is indicated by the test, a stationary long-run relationship is implied. In the case where $0 < r < p$, Π can be factored as $\alpha \beta'$ ($\Pi = \alpha \beta'$) where, α and β' are both $p \times r$ matrices. The matrix α contains the adjustment parameters while the matrix β is called the co-integrating matrix and has the property that $\beta' Z_t \sim I(0)$, where $I(0)$ indicates integrated of order zero. Thus we can interpret the relations of $\beta' Z_t$ as stationary relations among potentially non-stationary variables, that is, as co-integrating relations. Hence, in a VAR model consisting of p variables there can be $r = p - 1$ co-integrating vectors.

Johansen (1988) and Johansen and Juselius (1990) developed a maximum likelihood estimation procedure to determine the rank of Π and thus the number of co-integrating vectors and the Johansen method suggests two statistics to check for co-integrating vectors trace and maximum eigenvalue tests²¹. If the case where rank of $\Pi = r < p$ is true and we have $\Pi = \alpha \beta'$, the column of β after normalization represents long run parameters relating the variables in their equilibrium situation. The matrix α represents the error correction parameters, which measures the 'speed of adjustment' from temporary disturbances in the equilibrium relation.

2²¹ Trace test statistics tests for the null hypothesis that there are at most r distinct co-integrating vector. This restriction can be imposed for different values r and then the log of the maximized likelihood function for the restricted model is compared to the log of the maximized likelihood function unrestricted model and a standard likelihood ratio test computed (Harris, 1995).

$$(\lambda_{\text{trace}} = -2(Q) = T \sum_{i=r+1}^n \log(1 - \hat{\lambda}_i)) \quad r=0,1,2,\dots,n-2,n-1$$

Where $Q =$ Ratio of restricted to unrestricted maximized likelihood. $\hat{\lambda}_i$ is eigenvalue.

The other test is the so called maximal eigenvalue or λ_{max} statistics. This tests there are r co-integrating vectors against the alternative $r+1$ exist.

$$\lambda_{\text{max}} = -T \log(1 - \lambda_{r+1}).$$

The use of stationary analysis is imperative for the validation of results accruing from econometric modeling. This is because the use of non-stationary time series may result in extremely good test statistics when the relationship in the variables is in fact spurious. In order to avoid the problem of spurious regression, which normally results from estimating non-stationary series, unit root tests are used. The aim of this is to identify the order of integration of a variable with the intention of differencing the data if it is necessary to make it stationary. According to Engel and Granger (1987), a series, X_t , is integrated of order d if it can achieve stationarity after differencing d times and is usually denoted $X_t \sim I(d)$.

The Dickey Fuller Test for the existence of unit root assumes X_t to be a random walk process²² given as,

$$X_t = \rho X_{t-1} + \varepsilon_t$$

Where, ε_t is a white noise disturbance term. The test is for $\rho = 1$ or by subtracting X_{t-1} from each side of the equation in order to write the equivalent form of $(\Delta X_t = \alpha X_{t-1} + \varepsilon_t)$. Where $\alpha = \rho - 1$ or $\rho = \alpha + 1$

In the DF test the null and the alternative hypotheses are:

$$H_0: \alpha = 0$$

$H_1: \alpha < 0$. Rejection of $\alpha = 0$ in favor of the alternative ($\alpha < 0$) implies that X_t is integrated of order zero. A constant and/or a trend can be included in the random walk equation. Dickey and Fuller (1979) actually consider three different regression equations that can be used to test for the presence of a unit root [Enders (1995)]. These equations can be formulated as follows;

²² Suppose that ε_t is a purely random series with mean μ and variance σ^2 . Then a process X_t is said to be random walk if $X_t = X_{t-1} + \varepsilon_t$. Let us assume that X_0 is equal to zero. Then the process evolves as follows: $X_1 = \varepsilon_1$ and $X_2 = X_1 + \varepsilon_2 = \varepsilon_1 + \varepsilon_2$ and so on. We have by successive substitutions $X_t = \sum_{i=1}^t \varepsilon_i$. Hence $E(X_t) = t\mu$ and $\text{Var}(X_t) = t\sigma^2$. Since the mean and the variance change with time t , the process is non-stationary [Maddala G. S. (1995)].

$$\Delta X_t = \alpha X_{t-1} + \varepsilon_t \dots \dots \dots (1)$$

$$\Delta X_t = a_0 \alpha X_{t-1} + \varepsilon_t \dots \dots \dots (2)$$

$$\Delta X_t = a_0 \alpha X_{t-1} + a_1 t + \varepsilon_t \dots \dots \dots (3)$$

The difference between the above equations is the inclusion of the constant and intercept in the last two equations. However, both are the DF type equation for testing unit root. On the other hand, the Augmented Dickey-Fuller test is regarded to be the most efficient amongst the tests for the order of integration and is widely used in practice. This is because the DF test generally fails to take into account the possible autocorrelation in the error process. If the error term is auto correlated, then the OLS estimate of the DF test will be inefficient. However, the ADF solves this problem by including the lagged dependent variable as an explanatory variable to approximate autocorrelation. Hence, it is augmented by lags of the dependent variable to take care of autocorrelation problem. The test normally takes the following formulation.

$$\Delta X_t = \alpha X_{t-1} + \sum_{i=1}^{k-1} \alpha_i \Delta X_{t-1} + \varepsilon_t$$

The testing procedure is the same as DF tests and adding a linear deterministic trend and drift can also modify it.

4.2 DATA.

The data sources of this analysis are National Bank of Ethiopia (NBE), Ministry of Economic Development and Co-operation (MEDaC), Customs Authority, Ministry of industry and Trade, Central Statistics Authority (CSA), Development Bank of Ethiopia (DBE), International Publications such as International Financial Statistics, IMF Publication and World Currency Year Books. The author computes real exchange rates and terms of trade.

The model specified in this study require data on the following variables, real effective exchange rate, terms of trade, government consumption of non-tradables, capital inflows, import tariff, exchange control, excess credit and nominal devaluation. Due to data problems encountered in most developing countries including Ethiopia, some of these variables are proxied by other "close cousin" variables. For example government consumption of non-tradable has been proxied by the ratio of total government consumption to GDP. This is an admittedly limited proxy, since it is possible for ratio of government consumptions for non tradable to GDP (GCGDP) to increase with the share of non-tradable on government expenditure actually going down [Edwards (1988)]. This means that the actual sign of GCGDP can be either positive or negative. With respect to import tariff (TARIF) we computed implicit tariffs as the ratio of tariff revenue to imports. The net capital flow (NKF) is taken from the capital account of the BOPs and it includes long-term and short-term net capital. Exchange control (EXCON) is also proxied by the spread of the parallel exchange rate from the official exchange rate. Excess supply of domestic credit (EXCRE) is measured as the rate of growth of domestic credit minus the lagged rate of growth of real GDP. The extent of nominal devaluation is measured by changes in the nominal effective exchange rate constructed using the methodology for constructing the REER discussed below.

Terms of trade.

Terms of trade is defined here as the ratio of export unit value index and import unit value index. However, data is not available on export and import unit value indices for Ethiopia over the study period. Hence, an attempt has been made to construct these indices using the Laspeyre's method (LP); Paasche method and Fisher's formula. These are given as follows (Gupta 1973:400):

$$LP = \frac{\sum P_n Q_o}{\sum P_o Q_o} \times 100$$

$$PP = \frac{\sum P_n Q_n}{\sum P_o Q_n} \times 100$$

Where: P_n = the current unit value

P_o = base year unit value

Q_n = current quantity

Q_o = base year quantity

Fisher's formula = $\sqrt{LP \times PP} \times 100$ (i.e, it is simply the geometric mean of the above two methods).

These indices are constructed based on the value and volume of exports and imports by major commodity group reported by the National Bank of Ethiopia (NBE) quarterly bulletin. Since Laspeyre's method assumes constant quantity and quality of basket of goods, indices for different periods are easily comparable. This formula, however, is frequently criticized for the indices obtained are biased downward compared with other indices. The Paasche takes current period weights. Since the quantities used as weights changed with each given period the index number for different period are not comparable. It also overstates the index when price is increasing as it takes the current year as a base. The Fisher formula corrects the deficiencies of the above two indices as it takes the geometric mean of the indices. Hence, this formula is employed in this study.

Real effective exchange rate.

Edwards (1989) defines the RER as relative price of tradable goods to non-tradable goods. This paper uses this definition in constructing the real exchange rate. The following formula²² is used to construct of the real effective exchange rate (based on official exchange rate).

$$\triangleright \text{OREER} = \sum_1^n W_j E_{jt} \frac{P_{jt}}{P_t}$$

Where P_t = a measure of consumer price index of the home country at time t.

P_{jt} = wholesale price index of country j at time t.

N = Number of trading partners countries.

W_j = relevant weight (trade share) of country j.

E_{jt} = nominal exchange rate defined as domestic currency per unit of foreign in period t.

So as to see the effect of parallel market exchange rate on the REER, real effective exchange rate is also constructed based on the parallel market exchange rate.

$$\triangleright \text{PREER} = \sum_1^n W_j PM_{jt} \frac{P_{jt}}{P_t}$$

PM_{jt} = parallel market Exchange rate defined as domestic currency per unit of foreign currency in period t.

I also attached weights to both the official and parallel exchange rate based on REER to construct the weighted REER. The ratio of Private franco-valuta imports plus actual controband (Average of total Franco- Valuta imports plus contrabands from 1991 - 2000) seized by Customs

²² for the detailed see annex 3

Authority to total imports taken as a weight to the parallel market exchange rate. Hence, the weights are as follows:

$$\triangleright 0.078\text{PREER} + 0.922\text{OREER} = \text{WREER}$$

I have taken the private franco-valuta imports as a weight for the parallel market exchange rate since these transactions are not financed from the bank system but from the black market. As it is, also, well-known controband activities are financed from black market foreign exchange. Hence, taking this weight as a proxy to capture transactions that are made in the black market is somewhat a good proxy.

GDP²³

Since quarterly GDP is not available for the country, quarterly figures are generated using the annual GDP. According to Bahmani-Oskooee (1986: 123), the generated quarterly data for GDP should be adjusted in such a way that. $Q1 + Q2 + Q3 + Q4 = \text{Annual GDP}$

Yohannes Ayalew also did similar work on disaggregation of annual GDP into quarterly GDP and we discussed with him about this approach and definitely this discussion helped us in developing this approach.

Data on labour requirements for each agricultural activity (like ploughing, planting, sowing etc.) for major cereal crops, per hectare, were obtained from DBE. Hence, based on this input coefficients for each quarter are derived and the activities are carefully identified in which quarter they are performed.

Data on the production of some 28 industrial public enterprises are (from 1993/94 – 1999/2000) available on quarterly basis (MEDaC). These data is used to obtain average coefficients that are

²³ This exercise is done in collaboration with my colleges Tura and Haile.

used to disaggregate the annual data for industrial GDP. For the disaggregation of distributive service (it includes trade, hotel and restaurants, transport and communication) component of GDP, loan disbursement from the bank system to the sector is used as a coefficient on which the annual data is disaggregated. However, for the other service component of GDP (it includes items such as banking, insurance, real state and others), the same ratio is taken for the four quarters, as it is not relatively seasonality sensitive.

Details of the disaggregation are shown in Annex 1.

This exercise has some limitations. First we used a constant ratio to disaggregate the annual series into quarterly series for the whole sample period. Secondly, in the case of industrial GDP we have taken the production of major industrial public enterprises and ignore the private sector, as there is no available data. Thirdly, for the other service component of GDP we took the same ratio for the all the quarters as it is assumed less seasonally sensitive.

4.3, Model Specification

In analyzing the determinants of the real exchange rate (RERs), Edwards (1988,1989) developed a general equilibrium model, which is consistent with simultaneous attainment of internal and external equilibrium. The determination of the equilibrium real exchange rate (RER) has been elaborated in Edwards (1988,1989), Elbadawi (1993), and Elbadawi and Soto (1995).

This paper will basically use the RER model adapted from Edwards (1988,1989), Elbadawi (1993) and Elbadawi and Soto (1195). As Edwards (1988) notes, “ the advantage of this model is that it allows for both real and nominal variables to play a role in the short run determination of RER.”

Edwards (1988,1989) starts from the portfolio decision and divides the economy into the demand side, supply side, government sector and external sector. Furthermore, the model considers a small open economy with three goods - importable (M), Exportable (X) and non-tradable (N). The international price of tradable is assumed to be exogenous while that of non-tradable, on the other hand, is endogenously determined by the forces of demand and supply in the domestic market (Elbadawi (1993), Elbadawi and Soto (1995)).

Edwards (1989) defines the real exchange rate (RER) as the domestic relative price of tradable goods (P_T) to non-tradable goods (P_N).

$$e = EP_T^* / P_N \dots\dots\dots(1)$$

This definition summarizes incentives that guide resource allocation across the tradable and non-tradable sectors. An increase in RER is referred to as real depreciation and will make the production of tradable goods relatively more profitable, induce resource movement out of the non-tradable and into the tradable goods sector.

Another and earliest definition of the RER has been called by some writers the purchasing power parity real exchange rate (e_{ppp}) Elbadawi (1989) and Holden (1986). According to this definition, the e_{ppp} is equal to the nominal exchange rate (E) multiplied by the ratio of foreign price level (P^*) to the domestic price (P).

$$e_{ppp} = EP^* / P \dots\dots\dots(2).$$

The paper will use real exchange rate defined as the relative price of tradable to non-tradable goods. According to this definition, a decline in RER represents a real appreciation.

The domestic price of tradable is then proxied by the level of tariffs on importable and exportable and the nominal exchange rate then determines the domestic price of tradable. The domestic price index of tradable goods is thus defined as.

$$P_T = E[(1-t_x)P_x^*]^\alpha \cdot [(1+t_m)P_m^*]^{1-\alpha} \dots\dots\dots(3).$$

Where P_x^* and P_m^* be the dollar denominated international price of exportable and importable and t_x and t_m the export tax and import tax rates respectively. E is nominal exchange rate.

Therefore, using the definition of the RER as the relative price of tradable to non-tradable goods, we have.

$$RER = e = E[(1-t_x)P_x^*]^\alpha \cdot [(1+t_m)P_m^*]^{1-\alpha} / P_N \dots\dots\dots(4).$$

The price of non-tradable (P_N) is endogenously determined as a result of the interaction of supply and demand [Elbadawi and Soto, 1994,1995}.

$$S_n(P_x, P_m, P_N) = d_n((P_x, P_m, P_N) \cdot [A/Y - g] + g_n \cdot g \dots\dots\dots(5).$$

Where A/Y is the ratio of domestic absorption to income, g is the ratio of government expenditures to income and g_n is the government expenditures allocated to non-traded goods [Elbadawi and Soto (1994,1995)].

Equation (4) and (5) can be solved for the level of RER that ensures instantaneous equilibrium in the non-traded goods market, for given level of the exogenous and policy “fundamentals” [Elbadawi and Soto (1994)].

$$e = e(A/y, TOT, t_x, t_m, g_n, g) \dots\dots\dots(6).$$

Where TOT represents the terms of trade (P_x^*/P_m^*). Equation (6) implies that higher levels of absorption, trade taxes, and public expenditures on non-tradable are consistent with a more appreciated RER. However, theoretically, the effects of TOT and government expenditures cannot be determined a priori (Elbadawi and Soto (1994)). In the case of government consumption what is more important is the composition of the expenditure. If the consumption composed more of non-traded goods the increase will lead to appreciation of the exchange rate. On the other hand, if the consumption comprises more of traded goods an increase will lead to exchange rate depreciation. The empirical evidence (Edwards (1989)), however, shows an improvement in TOT tend to RER appreciation. The effect of TOT shock on the RER depends on whether or not the income effect exceeds the substitution effect. If, for example, TOT deteriorates which leads to a fall in real income and the demand for non-tradable will also fall. Hence, to ensure equilibrium, the price of these goods will fall and the real exchange rate tends to depreciate. This argument lays emphasis upon the income effect. On the other hand, consumers may shift to relatively cheap commodities as a result of a fall in real income. Perhaps, this may increase consumption of non-tradable commodities which in turn lead to higher price of these commodities and hence an appreciation of the exchange rate. This is the substitution effect.

By endogenizing private absorption as a function of net capital inflows and the expected real exchange rate depreciation Elbadawi and Soto (1994) extended the basic model (equation 6) as shown below.

$$A/Y = (NKI/Y, [{}_t e_{t+1} - e_t]) \dots \dots \dots (7).$$

Where NKI are net capital inflow and ${}_t e_{t+1}$ is the expected real exchange rate.

According to the theoretical model presented above, the most important fundamental determinants of the equilibrium real exchange rate (ERER) are: capital inflows, external terms of

trade, government consumption of non tradable, exchange and trade controls, technical progress (Edwards (1989)).

The model for the ERER can, therefore, be written as:

$$\begin{aligned} \log e_t^* = & \beta_0 + \beta_1 \log(\text{TOT})_t + \beta_2 \log(\text{GCGDP})_t \\ & + \beta_3 \log(\text{TARIFFS})_t + \beta_4 \log(\text{TECHPRO})_t \\ & + \beta_5 \log(\text{KAPFLO})_t + \beta_6 \log(\text{OTHER})_t + U_t \dots\dots\dots(8) \end{aligned}$$

Where:

- e^* = Equilibrium real exchange as defined earlier;
- TOT = External terms of trade, defined as (P_x^*/P_m^*) ;
- GCGDP = ratio of government consumption of non- tradable to GDP;
- TARIFFS = Proxy for the level of import tariffs;
- TECHPRO = Measure of technological progress;
- KAPFLO = Capital inflows, (if negative it denotes capital outflows);
- OTHER = other fundamentals²⁴, such as the investment to GDP ratio.
- U = error term.

Following Edwards (1988,1989), the dynamics of the RER can be captured by the following equation.

$$\Delta \log e_t = \phi \{ \log e_t^* - \log e_{t-1} \} - \lambda \{ Z_t - Z_t^* \} + \theta \{ \log E_t - \log E_{t-1} \} - \psi \{ \text{PMPR}_t - \text{PMPR}_{t-1} \} \dots\dots(9).$$

Where ϕ, λ, θ and ψ are positive parameters capturing the most important aspect of the adjustment process, e_t is the actual real exchange rate; e_t^* is the ERER which is a function of real

²⁴ According to Edwards (1988) fundamentals are real (long-run) determinants of real exchange rate such as external terms of trade, government consumption, import tariff, capital flow, investment GDP ratio and the like;

variables (fundamentals) only; Z_t is an index of macroeconomic policies (i.e., the rate of growth of domestic credit); Z_{t-1}^* is the sustainable level of macroeconomic policies (i.e., rate of increase of demand for domestic money); E_t is nominal exchange rate; PMPR is the spread in parallel market for foreign exchange.

This means the actual dynamics of real exchange rate responds to the four forces. “In the real dynamics (equation 9) the term $-\lambda\{Z_t-Z_{t-1}\}$ measures the role of macroeconomic policies in real exchange rate behavior. According to our model, with other things given, if macro policies are ‘inconsistent’ the RER will become overvalued”(Edwards (1988)). In the estimation of the model the variables like excess supply for domestic credit (component of $\{Z_t-Z_{t-1}\}$) will be used to see the effect of macro policies on the behavior of RER.

Excess Supply for domestic credit (EXCRE) measured as the rate of growth of domestic credit minus the lagged rate of growth of real GDP (Edwards (1988)).

$$EXCRE = \{d\log(\text{Domestic credit}) - d\log GDP_{t-1}\}$$

Substituting the equation for $\log e_t^*$ and the expression for $\{Z_t-Z_{t-1}\}$ into equation 9 we obtain the following empirical model.

$$\begin{aligned} \log e_t = & \gamma_1 \log(\text{TOT})_t + \gamma_2 \log(\text{GCDGDP})_t + \gamma_3 \log(\text{TARIFF})_t + \gamma_4 \log(\text{KAPFLO})_t \\ & + \gamma_5 \log(\text{TECHPRO})_t - \theta \log e_{t-1} - \lambda EXCRE_t + \phi \text{NOMDEV}_t - \psi (\text{PMPR}_t - \text{PMPR}_{t-1}) \\ & + u_t \dots \dots \dots (10). \end{aligned}$$

The model specified in equation (10) above is the one that will be estimated in this paper. However, a problem that we may face in the regression is unavailability of time series data for some of the real exchange rate fundamentals. Therefore, in estimating the RER equation in this

paper some of the fundamentals either will be excluded or proxied by other variables. The following proxies will be used in the paper for some of the fundamentals: Import tariffs will be computed as the ratio of tariff revenue to total imports. This proxy was used in Edwards (1988). The ratio of government consumption on non-tradable to GDP will be replaced by the ratio of government consumption to GDP (GCGDP) this proxy was used in a number of empirical investigations (for example, see Edwards (1988,1989); Elbadawi (1993)). Excess credit (EXCRED) is also measured as a rate of growth of domestic credit minus the lagged rate of growth of real GDP. Nominal devaluation is proxied by the growth rate of nominal effective exchange rate computed in this paper (Annex 3). The proxy for exchange control variable (EXCON) is parallel market premium. This proxy was used in Edwards (1989). Other variables (like technological progress) are also omitted for unavailability of time series data.

5. Empirical Analysis; The equilibrium real exchange rate.

5.1 Empirical Analysis

5.1.1 Stationarity Test

I begin the empirical analysis by examining the time series properties of each series in the model. The use of non-stationary variables in a given model leads to the spurious regression phenomenon discussed by Granger (1974), and Phillips (1986)[(Charon (2000))]. Moreover, Stock and Watson (1989) have also shown that the usual test statistics (t, F, DW, and R^2) will not possess standard distribution if some of the variables in the model have unit root and are non-stationary [Baharumshah (2000)]. Granger (1986) showed that any non-stationary time series could achieve stationarity if differenced appropriately until it becomes stationary.

As already discussed above, there is a need to indicate the order of integration in each of the time series variables before estimation. To this end, the Augmented Dickey-Fuller (ADF) test statistic is employed to test for the existence of unit roots. ADF needs to tests for the null hypothesis that the variable is non-stationary against the alternative hypothesis of stationary. Hence, the rejection of the null in favor of the alternative implies that the variable is stationary and vice versa. The results in the table below show that the variables are (except GCGDP, EXCRED and NDVA) are non-stationary at levels since we cannot reject the null hypothesis. The critical value is grater than the computed value for these variables implying we cannot reject the null hypothesis that the variables are not stationary.

**Table 1. ADF tests for unit roots and stationarity
(Sample period 1985Q1 – 2000Q2)**

Variables		Without drift and trend with lags of		With drift with lags of		With drift and trend with lags of	
		1	2	1	2	1	2
LOREER		0.85949	0.96815	-1.3310	-1.2292	-2.3276	-2.1730
LWREER		0.91937	1.0042	-1.5088	-1.4361	-2.4320	-2.3255
LTOT		-0.53135	-0.4375	-3.6021	-2.4553	-4.0416	-2.8853
LGCGDP		-2.3015	-1.6284	-5.0275	-3.2060	-8.0132	-6.4634
LNKF		-0.19996	-0.1370	-5.5338	-4.0164	-5.5311	-6.3659
LTARF		-0.89255	-0.8954	-4.8041	-3.7174	-5.1585	-3.9884
LEXCON		-1.3240	-1.3919	-0.3125	-0.0720	-1.9588	-1.8034
NDAV		-4.7239	-3.2585	-5.1546	-3.5164	-5.1062	-3.4839
EXCED		-5.5941	-4.4769	-5.6442	-4.5467	-5.8954	-4.8481
ΔLOREER		-5.6367	-4.3098	-5.9708	-4.5586	-6.0606	-4.6122
ΔLWREER		-5.5683	-4.2364	-5.9324	-4.4983	-6.0719	-4.5893
ΔLTOT		-8.9714	-7.4802	-8.8830	-7.4060	-8.8005	-7.3335
ΔLGCGDP		-10.056	-26.487	-10.010	-27.349	-8.0132	-6.4634
ΔLNKF		-9.0717	-8.3279	-8.9820	-8.2481	-8.8859	-8.1786
ΔLTARF		-8.9210	-6.7040	-8.8774	-6.6862	-8.8213	-6.6586
ΔLEXCON		-6.4934	-4.0198	-6.7372	-4.2244	-6.7816	-6.7816
Critical Value	1%	-2.603	-2.603	-3.546	-3.546	-4.122	-4.122
	5%	-1.946	-1.946	-2.912	-2.912	-3.488	-3.488

This test suggested that real effective exchange rates (OREER, WREER), terms of trade (TOT) and exchange control (EXCON), import tariff (TARF) and net capital inflow (NKF) are all characterized by I(1) process and government consumption (GCGDP) becomes I(0) variable. Based on the theoretical a priory, it is assumed that nominal devaluation (NDAV) and excess credit (EXCED) are I(0) variables and these exogenous variables are found to be I(0) in this study (see Table.1). Since the unit root test above shows that some of the variables are I(1) and some of them I(0), it becomes necessary in this study to undertake co-integration test. “..it is possible that co-integration is present when there is a mix of I(0) and I(1) variables in the model. Stationary I(0) variables might play a key role in establishing a sensible long-run relationship between non-stationary variables, especially if theory a priory suggests that such variables should be included”[Harris (1995)].

5.1.2 Co-integration test.

Once it is confirmed that the variables behave as integrated process, tests for co-integration can be undertaken to establish a long-run relationship between the real exchange rate and its fundamentals. The Johansen (1988) method is selected in this study to estimate the long run relationship between the real exchange rate and its hypothesized determinants. This method produces consistent estimators of the long-run parameters about which various restrictions can be tested using likelihood ratio (LR) statistics²⁵. Johansen demonstrates that estimation and inference on the single equation system will be equivalent to that of the full system only if all the co-integrating variables are weakly exogenous with respect to the first variable in consideration (in this case real exchange rate) and if there is only one co-integrating vector. Johansen's procedure allows us to perform a weak exogeneity test on the full system using LR test. This is simply a test of whether the α coefficient is significantly different from zero in the equation for the variable tested and this is the usual way in which exogeneity and endogeneity are established.

The results of the Johansen co-integration test and the estimated long-run coefficients for both specifications²⁶ are reported in Tables 2 and 3 respectively. Tests for the number of co-integrating relationship in the data indicate that there is one co-integrating vector for both the specifications. However, there is a possibility of rejecting the null hypothesis when in fact it is true, specially, for small samples. "... The problem of small samples has also been mentioned, and Reimers (1992) suggests that in such a situation the Johansen procedure over-rejects when

²⁵ The LR- test statistics used for the restriction is given by $-2 \log(Q) = T \sum \log\left(\frac{(1 - \hat{\lambda}_i^*)}{(1 - \hat{\lambda}_i)}\right)$ where $Q = \frac{\text{restricted maximized likelihood}}{\text{unrestricted maximized likelihood}}$, $T =$ number of observations, $r =$ rank and $\hat{\lambda}_i^*$ and $\hat{\lambda}_i$ are eigenvalues for unrestricted and restricted model respectively [Harris, 1995].

the null is true. Thus he suggests taking account of the number of parameters to be estimated in the model and making adjustment for degree of freedoms”[Harris, (1995)]. Since the sample size is small (60) in this study the adjusted test²⁷ (for degree of freedoms) is conducted.

Table 2. A. Co-integration Analysis for the (first specification which is based on the official exchange rate developed REER)

EigenValue	λ_{\max}	95% critical	Trace	95% critical	H ₀ : p=
0.9371	74.67**	42.5	146.20**	104.90	0
0.6164	25.87	36.4	71.50	77.70	1
0.4805	17.68	30.3	45.62	54.60	2
0.4256	14.97	23.8	27.94	34.6	3
0.3294	10.79	16.9	12.97	18.2	4
0.0776	2.181	3.7	2.181	3.7	5

*The asterisks * and ** indicate that the null hypothesis of p co-integration relationship is rejected at 5 and 1 percent level of significance respectively. When the computed value of the test is greater than the critical value the null hypothesis is rejected.*

B) Standardized β' Eigen vector

LOREER	LTOT	LGCGDP	LNKF	LTARF	LEXCO N	EXCRED	NDVA
1.000	-0.5354	0.1050	0.2875	0.4057	0.01229	-0.00175	-2.630
-0.9313	1.000	-0.0647	1.673	0.2770	0.08604	-0.0314	-0.4151
-0.5471	-0.6712	1.000	-0.2501	0.7027	-0.2646	--0.0385	-0.1505
17.80	-3.082	-5.237	1.000	6.168	0.5433	0.06048	8.840
-1.147	0.7549	2.198	-1.156	1.000	0.01351	-0.0375	0.08463
-3.830	0.3975	1.732	0.7066	0.9666	1.000	-0.3330	-3.138

²⁶ The first specification uses REER constructed based on the official exchange rate as dependent variable and the second specification uses REER constructed on the weighted average of the official and the parallel market rate.

²⁷ In the adjusted case T is replaced by T- kn in both the formulas for λ_{trace} and λ_{\max}

$$\lambda_{\text{trace}} = -T \sum_{i=r+1}^n \log(1 - \lambda_i)$$

$$\lambda_{\max} = -T \log(1 - \hat{\lambda}_{r+1})$$

C) Standardized α - coefficients

LOREER	-0.2004	0.0002041	0.04961	0.002018	0.008453	-0.0006191
LTOT	0.2590	-0.2721	0.7291	0.02819	-0.2606	0.01632
LGCGDP	-0.07413	0.2036	0.04072	0.009596	-0.2537	-0.01831
LNKF	-0.07631	-0.7384	-0.02732	0.07215	-0.1084	-0.05597
LTARF	0.1981	-0.1021	-0.4110	-0.1055	-0.05753	-0.007057
LEXCON	0.2012	0.2198	0.6115	-0.1316	0.2190	-0.05220

Diagnostic Tests

Vector AR 1-4F(144,31) = 1.4673[0.1060]

Vector normality χ^2 (12) = 41.02[0.0872]

Number of lags used: 3

Variable entering unrestricted: constant, policy dummy and centered seasonal, variables entering restricted are nominal devaluation and excess credit.

As it is seen from the diagnostic tests above, the tests do not detect serial correlation and normality problem at 5 percent level. However, due to small sample size PCFIML do not give the other diagnostic tests.

Table3.A Co-integration Analysis (for the second specification, which is based on the weighted parallel and official exchange rate developed REER))

EigenValue	λ_{Max}	95% critical	Trace	95% critical	H ₀ : p=
0.892806	60.29**	42.5	131.30**	104.90	0
0.621319	26.22	36.4	71.00	77.70	1
0.495512	18.47	30.3	44.79	54.60	2
0.415819	14.51	23.8	26.31	34.6	3
0.313795	10.17	16.9	11.80	18.2	4
0.0586219	1.1631	3.7	1.631	3.7	5

The asterisks * and ** indicate that the null hypothesis of p co-integration relationship is rejected at 5 and 1 percent level of significance respectively. When the computed value of the test is greater than the critical value the null hypothesis is rejected.

Where n is the number of variables in the model and k is the lag length.



B) Standardized β' Eigen vector

LWREER	LTOT	LGC GDP	LNKF	LTARF	LEXCN	EXCRED	NDVA
1.000	-0.4340	0.1520	0.3611	0.1742	0.005149	-0.00885	-1.326
-1.621	1.000	-0.0292	1.888	0.2473	0.09677	-0.5315	-0.0641
1.194	-1.288	1.000	-0.6806	1.961	-0.4235	0.6379	-0.06981
4.635	-0.188	-2.247	1.000	0.05288	0.2851	1.585	0.06005
-0.7783	1.124	2.396	-1.139	1.000	0.2551	0.3267	-0.07794
-14.53	1.078	-0.6484	-1.084	7.537	1.000	-11.99	0.03992

C) Standardized α - coefficients

LWREER	-0.2627	0.01455	0.02996	-0.0136	0.003322	-0.0006897
LTOT	0.4155	-0.2068	0.3800	-0.05451	-0.2256	0.008701
LGC GDP	-0.09065	0.1826	0.01682	0.08058	-0.1719	-0.00652
LNKF	-0.1361	-0.6870	0.2059	0.2182	-0.1080	-0.01850
LTARF	0.2973	-0.09679	-0.4862	-0.2561	-0.06562	-0.003506
LEXCON	0.3245	0.2233	0.02470	-0.5747	0.02931	-0.02303

Diagnostic Tests

Vector AR 1-4F(144,31) = 1.5471[0.0778]

Vector normality χ^2 (12) = 43.52[0.0651]

Number of lags used: 3

Variable entering unrestricted: constant, policy dummy and centered seasonal, variables entering restricted are nominal devaluation and excess credit.

As it is seen from the diagnostic tests above, the tests do not detect serial correlation and normality problem at 5 percent level. However, due to small sample size PCFIML does not give the other diagnostic tests. The null hypothesis of no co-integration ($r=0$) among the variables (Table 2, 3) is rejected by both the Trace and λ_{\max} statistics at 1 percent of significance for both specifications. The two tests developed by Johansen (1988) identified one co-integrating vector. Now a single co-integration vector is already identified. Hence, there is only one relevant linear combination of the variables, represented by the first row of β' matrix (and hence the first column of α - matrix), that is stationary. Nevertheless, the combinations represented by the rest

variable (weighted real exchange rate) for the weighted exchange rate based REER specification (Table 5).

Table 4: Test for Zero Restriction on α - coefficients (for the official exchange rate based REER specification)

	LOREER	LTOT	LGCGDP	LNKF	LTARF	LEXCON
α - Coefficients	-0.2004	0.2590	-0.07413	-0.07631	0.1981	0.2012
LR-test: $\chi^2(\approx 1)$	103.02	9.3471	2.2442	0.32972	1.234	2.5155
P-value	0.0000**	0.0022**	0.1341	0.5658	0.0520	0.1127

**Rejection at 1% level of significance

Table 5: Test for Zero Restriction on α - coefficients (for the official - parallel market exchange rate weighted REER specification)

	LWREER	LTOT	LGCGDP	LNKF	LTARF	LEXCON
α - Coefficients	-0.2627	0.4155	-0.09065	-0.1361	0.2973	0.3245
LR-test: $\chi^2(\approx 1)$	69.854	2.3241	1.1326	0.35071	1.514	2.2014
P-value	0.0000**	0.1002	0.2872	0.5537	0.3520	0.1379

**Rejection at 1% level of significance

Hence, in the first case, the equations for the real exchange rate and the terms of trade can be estimated simultaneously conditional upon the rest of the variables in the system. However, the test allows us to estimate the model in a single equation approach, as all the variables except the dependent variable, real exchange rate, are weakly exogenous for the official-parallel exchange rate weighted REER specification.

The significance and sign of α_{11} , for this co-integration vector, are worth discussing. The coefficient (-0.2004) for the official exchange rate based specification and (-0.2627) for the weighted exchange rate based specification are both significant and have a negative sign as expected and both have low value in terms of magnitude, which suggests a slow adjustment of the real exchange rate towards the long run equilibrium. The next procedure is to test the significance of the long run coefficients to determine which variables uniquely constitute the co-integration vector. In this case also a zero-restriction is imposed on each coefficient and results for the LR-statistics are given in Tables 6 and 7.

Table 6: Test for zero-restriction on the long-run parameters (for official exchange rate based REER specification)

	LOREER	LTOT	LGCGDP	LNKF	LTARF	LEXCON	EXCRD	NDVA
β - Coefficients	1.0000	-0.5354	0.1050	0.2875	0.4057	0.01229	-0.00175	2.630
LR-test: $\chi^2(\approx 1)$	9.0126	13.07	4.2367	2.8463	5.6399	0.08889	0.013804	0.0023
P-value	0.0027**	0.0003**	0.0272*	0.0916	0.0176*	0.7656	0.9065	0.5231

** And * indicate rejection at 1% and 5% level of significance, respectively.

Table 7: Test for zero-restriction on the long-run parameters (for the official and parallel exchange rate weighted REER specification)

	LWREER	LTOT	LGCGDP	LNKF	LTARF	LEXCON	EXCRE	NDVA
β - Coefficients	1.000	-0.4340	0.1520	0.3611	0.1742	0.005149	-0.00885	1.326
LR-test: $\chi^2(\approx 1)$	12.669	13.133	0.69214	6.2327	1.5173	0.02350	0.49111	0.4470
P-value	0.0000**	0.0003**	0.4054	0.0125*	0.2180	0.8782	0.4834	0.4321

** And * indicate rejection at 1% and 5% level of significance, respectively

To test the overall significance of the variables, the joint restriction of the elasticities is checked using the likelihood ratio test-statistic. Hence, the joint restriction that all the elasticities are equal to zero is also rejected at 1% level of significance²⁸e.

5.1.3 Estimation of the model.

a. Long run relationships.

According to the above results (Tables 6 and 7), terms of trade, government consumption and import tariff are found to be statistically significant in the official exchange rate based specification. In the weighted exchange rate based specification, however, terms of trade and capital flow become significant (see table 7). All coefficients have the expected sign.

As stated in the theoretical section of this study the effect of terms of trade is ambiguous. Nevertheless, some empirical literatures (Edwards (1989)) found that the terms of trade has a negative effect for Chile indicating that worsening terms of trade will lead to RER depreciation. Elbadawi (1992), however, noted that the impact of TOT deterioration on RER depends on what causes the deterioration. If it were caused by a decline in export price then the effect would be real exchange rate depreciation. But if it were caused by a rise in import prices the effect would be to the contrary. He found a positive effect of TOT on the RER of the Sudan, thus TOT deterioration will bring exchange rate appreciation. Another study by Andualem Berhanu (1996)

²⁸ LR-test, rank=1: $\chi^2(\approx 7) = 162.23[0.0000]**$

on Ethiopia found a negative impact of TOT on real exchange rate. However, there is inconsistency between the sign he got and the interpretation he gave to this sign. He explain for the negative elasticity as follows"... the terms of trade deteriorating trend pushed the equilibrium real exchange rate to appreciate". He defined the real exchange rate in the same manner Edwards (1989) defined it (as a ratio of tradables price to non-tradable price).

In this study, however, the coefficient of TOT is positive, suggesting that the substitution effect dominates the spending effect. The deterioration in the terms of trade (when it is caused by import price rise) leads to an increase in non-tradable goods price hence appreciation of the RER.

Government consumption has negative and significant elasticity for equation 5.1 (Table 6) but not for equation 5.2 (Table7). The implication of this result, for the significant elasticity, is that government in this country devoted more of their expenditure to non-traded goods which in turn increases the non-tradable goods price and hence appreciation of the real exchange rate. Excessive government expenditure, therefore, leads to RER appreciation and overvaluation. Elbadawi and Soto (1995) found a mixed result for a number of developing countries. For most of these countries (Chile, Cote d'ivoire, Ghana, Kenya and Mali) the elasticity obtained were positive, implying that fiscal spending tends to appreciate the real exchange rate. But for the other countries (Mexico and India) negative parameter were obtained which implies the dominance of non-traded goods on the composition of government expenditure in these countries. However, Elbadawi and Soto (1995) defined the real exchange rate in different manner, from this study, as the ratio of non-tradable goods price to tradable goods price.

With respect to net capital flow, the coefficient is negative in both equations but significant only in equation 5.2. The negative sign of the coefficients indicate that an increase in foreign

exchange supply appreciates the real exchange rate. Edwards (1989) finds a negative and significant sign for Chile, which supports the view that an increase in net capital flow is associated with a real appreciation.

The estimated coefficient of the tariff variable is negative as suggested by the theory. It is statically significant for equation 5.1 but not for equation 5.2. The significance and the sign of the coefficient in equation 5.1 suggest that a reduction in impediments to international trade (like tariff) results in real exchange rate depreciation. This result supports the view that liberalization allows more goods and services into a country, with the impact of bringing in more competition for domestic goods. This competition could have exerted some downward pressure on the prices of non-tradable causing the RER to depreciate. Elbadawi and Soto (1994) found a negative and significant sign for Chile, which supports the notion that reform aimed at reducing tariff and eliminating trade restriction is consistent with a depreciation of the RER.

The coefficient for the exchange control variable is negative as expected but statically insignificant in both regressions. The coefficient of nominal devaluation is also positive and insignificant in both equations (5.1 and 5.2). Obviously, devaluation lead to increase price of tradables relative to non-tradables and depreciation in RER but this do not last long as consumers shift their consumption towards non-tradable. This in turn pushes the price of non-tradables upward and perhaps offset the previous price increase in tradables. This shows that nominal devaluation tends to have transitory effect but not permanent effect on the RER in the long run. Excess credit also showed a positive sign and insignificant.

b. The Error Correction Model.

Having established the existence of a stable long-run relationship between the real exchange rate and its determinants, an attempt has been made to estimate the error correction term to see the short run dynamic of the relationship. In this process (in estimating the short run analysis) we begin with a large model including many explanatory variables as much as possible and dropping the insignificant ones until we arrive at the parsimonious model with few explanatory variables but more acceptable in terms of significance, interpretation and diagnostic tests. This procedure is Hendry's general to specific modeling approach (Charron, 2000).

In estimating the vector error correction model, weak exogeneity of the explanatory variables has important implication. If there are some variables among the explanatory variables that are not weakly exogenous, a problem of simultaneity²⁹ arises when we estimate the model using a single equation analysis. In our case, weak exogeneity was rejected for one of the explanatory variables specified for real exchange rate, i.e., terms of trade, in equation 5.1. This indicates that the identified long-run linear combination may contain some important information that may also explain the behavior of terms of trade. For the second one (equation 5.2) all the explanatory variables are weakly exogenous and hence we can leave the multivariate setting and go to single equation analysis. However, in the first situation the real exchange rate equation have to be simultaneously estimated along with terms of trade equation. The analysis here begins with simultaneous estimation of the terms of trade and real exchange rate equations using two stages least squares (2SLS) method.

²⁹ This problem arise when there is one ore more endogenous variables on the right hand side of the model, these variables may be correlated with the error term. The fact that the variable/s is/are correlated with the disturbance term the OLS yield biased and inconsistent estimator of the parameters.

The result from the 2SLS estimation of the general unrestricted error correction specification (when the real exchange rate and terms of trade are made endogenous) is presented as equation (5.3) below. Only the results for real exchange rate are presented, as the main focus is not in the behavior of terms of trade.

$$\begin{aligned} \Delta(\text{LOREER})_t = & -0.11 + 1.7271\Delta(\text{LOREER})_t - 0.30\Delta(\text{TOT})_{t-1} - 0.0003\Delta(\text{LGCGDP})_t - 0.084\Delta(\text{LNKFL})_t \\ & (-2.905) \quad (-0.345) \quad (-0.314) \quad (-0.699) \quad (-2.160) \\ & - 0.049\Delta(\text{LTRAF})_t - 0.048\Delta(\text{LEXCON})_t + 0.022\text{EXCRE}_t + 0.17\text{NDVA}_t - 0.59\text{VECM}_{t-1} \dots \dots \dots 5.3 \\ & (-1.472) \quad (0.285) \quad (-1.042) \quad (4.832) \quad (-2.968) \end{aligned}$$

Diagnostic tests

<i>AR 1-2</i> $F(2, 44) = 0.27112[0.7638]$	<i>Vector AR 1 -4</i> $F(16, 74) = 0.81075[0.6693]$
<i>Normality</i> $\chi^2(2) = 0.48226[0.7857]$	<i>Vector normality</i> $\chi^2(2) = 3.6545[0.4548]$
<i>ARCH</i> $F(2, 42) = 0.597[0.5549]$	<i>Vector</i> $\chi^2 F(54, 75) = 1.3396 [0.1200]$

Values in parentheses corresponding to each coefficient are t-ratios while those in square brackets are probabilities. VECM_{t-1} stands for the first lag of the co-integrating vector error correction. As can be seen from the diagnostic test above, the hypothesis of auto-correlation, non-normality and heteroscedasticity are rejected for the error correction specification. The signs of the coefficients are consistent with the theoretical a priori. However, there are a number of variables that are not significantly different from zero. The coefficient of the error correction term is significant at 5 percent level of significance and negative, as suggested by the theory but larger than the corresponding adjustment coefficient in the long run analysis. Nevertheless, equation (5.3) cannot be taken as a final model for the real exchange rate because they contain statically insignificant variables. Hence, we use the Henry's general to specific modeling approach, to arrive at a more parsimonious one through elimination of insignificant variables.

Before going to determine the final parsimonious vector error correction model, we checked the parameter stability test for both the real exchange rate and terms of trade equations using PCFIML recursive graph analysis. Figure 1 shows the one-step-ahead chow test and one step ahead residual for terms of trade equation.

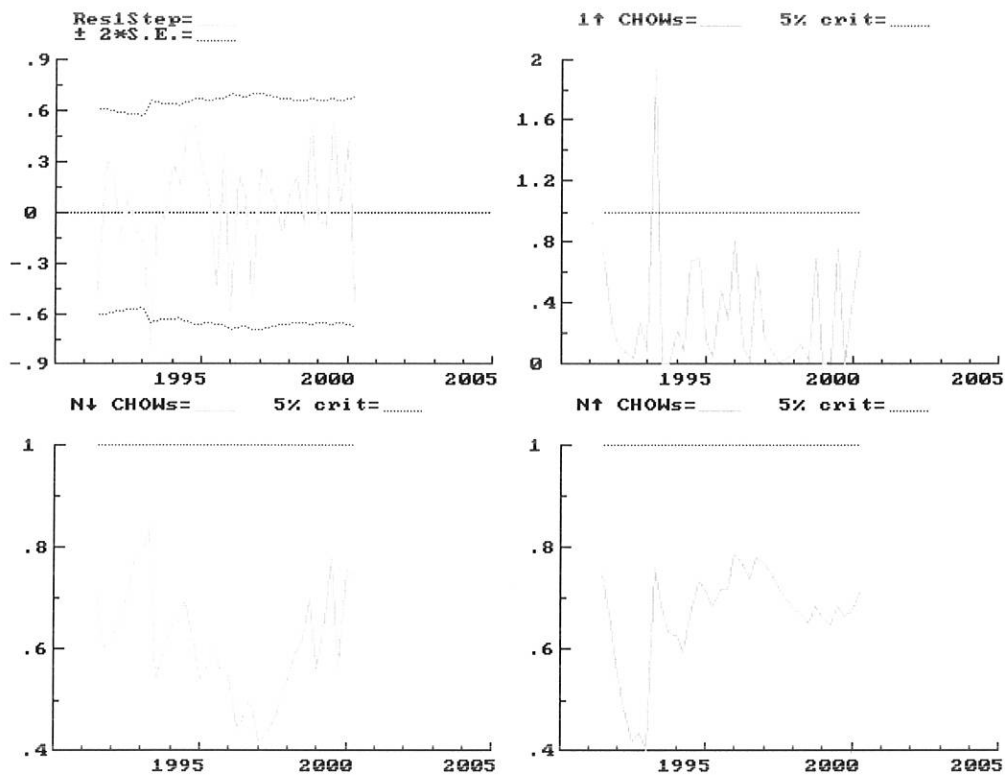


Figure 1 parameter Stability Test for Estimated terms of trade equation.

The result of recursive graphing of the error correction model shows that the parameters are not stable (figure 1). The estimated terms of trade equation could not pass parameter stability test, in addition to other diagnostics tests. As it is stated in Solomon (1999) failure to pass the parameter constancy test in such a simultaneous estimation can be taken as indicative of the weak exogeneity of the variable in the system [Hendry (1988)]. Then we can safely assume that terms of trade (TOT) are also a weakly exogenous variable. Therefore, we can specify the RER equation conditional on all the explanatory variables including terms of trade and estimate this equation as single equation analysis using OLS. For the model selection process, we follow the general to specific approach of Hendry and start the process by estimating the single equations (similar to equations 5.1, 5.2) using OLS. The results from OLS estimation of error correction representation for both specifications are given below in equations 5.4 and 5.5.

$$\Delta(\text{LOREER})_t = -0.079 + 0.0177\Delta(\text{LTOT})_{t-4} - 0.0145\Delta(\text{LNKF})_t - 0.0217\Delta(\text{LTARF})_t - 0.006\Delta(\text{EXCRED})_{t-5} \\
\begin{matrix} (2.000) & & (-2.738) & & (-2.432) & & (2.273) & & (-2.705) \end{matrix} \\
+ 0.49\text{NDVA}_t - 0.018\text{CSE}_t - 0.25\text{VECM}_{t-1} \dots\dots\dots(5.4) \\
\begin{matrix} (4.032) & & (-2.248) & & (2.861) \end{matrix}$$

$$R^2=0.64, \quad F(7, 47) = 12.453[0.000], \quad \sigma = 0.02223, \quad DW=1.94, \\
RSS = 0.02322, \quad n = 55$$

Diagnostic tests

- AR 1 - 4F(4, 43) = 0.33928 [0.8499]
- ARCH 4F(4, 39) = 0.28469 [0.8861]
- Normality $\chi^2(2) = 2.6091 [0.2713]$
- $\chi^2 = F(13, 33) = 0.5259 [0.8916]$
- $X_i^* X_j F(34, 12) = 1.9524 [0.1079]$
- RESET F(1, 46) = 0.97724[0.3281]

$$\Delta(\text{LWREER})_t = -0.071 + 0.018\Delta(\text{TOT})_{t-4} - 0.014\Delta(\text{LNKF})_t - 0.0179\Delta(\text{LTARF})_t - 0.006\text{EXCRED}_{t-5} \\
\begin{matrix} (-2.411) & & ((1.963) & & (-2.499) & & (-1.976) & & (2.048) \end{matrix} \\
+ 0.54\text{NDVA}_t - 0.0175\text{CSE}_t - 0.23\text{VECM}_{t-1} \dots\dots\dots(5.5). \\
\begin{matrix} (4.344) & & (-2.128) & & (-2.563) \end{matrix}$$

$$R^2=0.63, \quad F(7, 47) = 11.832[0.000], \quad \sigma = 0.02259, \quad DW=1.89, \\
RSS = 0.02399, \quad n = 55$$

Diagnostic tests

- AR 1 - 4F(4, 43) = 0.18999 [0.9423]
- ARCH 4F(4, 39) = 0.29914 [0.8767]
- Normality $\chi^2(2) = 2.3802 [0.3042]$
- $\chi^2 = F(13, 33) = 0.48028 [0.9204]$
- $X_i^* X_j F(34, 12) = 1.8186 [0.1344]$
- RESET F(1, 46) = 1.0798[0.3042]

Figures in the parenthesis under each coefficient are t-ratios while those in the square brackets are probability values for various tests. As it is shown in F test statistics the joint significance of the coefficients strongly reject the null hypothesis that all the coefficients are zero at the same time in both equations (5.4 and 5.5). The estimated coefficient in equations 5.4 and 5.5 are all significant with theoretical anticipated signs. The result of various diagnostic tests performed on the equations shows that there is no evidence of serial correlation up to two lags, the autoregressive conditional heteroscedastic test. The normality of the errors as well is not rejected

by the Jacque Bera test. Similarly, the White test for heteroscedasticity and Ramsey's RESET test of functional form did not detect statistical problems to which they are assigned.

A crucial parameter in the estimation of these short-run dynamic models is the coefficient of the error correction term, which measures the speed of adjustment of the RER to its equilibrium level. The adjustment speed estimated for the short-run are similar to that of the coefficients (-0.25 and -0.23 respectively for equation 5.4 and 5.5) in the corresponding estimate in the long run. As can be seen from the magnitude of the coefficient, definitely, about four years will take for the RER to adjust after a shock. This is in fact a slow adjustment. Perhaps, this could be partly explained by the fixed exchange rate regime that was in place in the early years of this study.

As to the coefficient of the short run dynamics, terms of trade, capital inflow and import tariff, of the fundamentals, are found to be significant and in the same direction as the long-run effect, while government consumption and exchange control are not significantly different from zero in both equations.

The short-run estimate provides direct evidence on the short run effect of excess credit on the real exchange rate. Monetary variables have a short run effect on the exchange rate. Hence, excess credit is significant in the short run but not in the long run as expected. However, Andualem Berhanu (1996) found a positive sign for Ethiopia indicating that expansionary credit policies induce real exchange rate depreciation.

The short-run estimate also provides evidence on the short-run effect of nominal devaluation. The coefficient for nominal devaluation, in this study, is also significant in the short run but insignificant in the long run. This also implies that nominal devaluations have at most a

transitional role to play in macroeconomic adjustment. The estimated short run elasticity of nominal devaluation is fairly substantial and this result suggest that 10% devaluation would depreciate the real exchange rate by 4.4 and 5.4% in the short run for equations 5.4 and 5.5 respectively. This indicates that, other things being constant, a nominal devaluation has been transferred in a less than one-to-one in to real devaluation. Edwards (1989) found that a positive and significant effect for some developing countries (Brazil, Columbia, S. Africa etc.), implying that nominal devaluation has an important impact on the real exchange rate in the short run. He also added that in the long run devaluation is neutral. Baffes, et. al (1997) also found a positive and significant coefficient for Cote d'ivior and Burkna Faso. Their result supports the view that devaluation will depreciate RER and nominal variables have only a short run effect on real variables.

5.2 The Equilibrium Real exchange Rate.

There are various ways of measuring equilibrium real exchange rates (ERER) in the literature and different researchers use a time series estimator to decompose a real exchange rate into permanent and transitory components. The permanent component is then taken to be the measure of equilibrium real exchange rate. There are also different techniques to decompose. According to Edwards (1989) there are at least two possible ways to smooth the series of fundamentals before using them in the construction of series for ERER. These are, the Beveridge-Nelson decomposition³⁰ and moving average method. In this study the second method is employed, 5 years moving average is computed in order to construct time series for the sustainable value of the real exchange rate fundamentals because it is a commonly used method in the literature (Edwards (1989), (Baffes (1997) et.al), Mongardini (1998) have used this

³⁰ This approach uses the ARIM model to decompose the permanent and transitory component of the fundamentals. For the detail of the ARIMA see (GRIFFITHS, W. (1993) et.al pp. 661).

methodology) and because of computational simplicity. However, this average reduces our sample by 5 observations since the first five observations are already lost in the five years moving average.

Weak exogeneity is already tested for the real exchange rate fundamentals in the regression analysis section. However, strong exogeneity should be secured for the purpose of generating the equilibrium real exchange rate. Thus, testing for Granger causality of LOREER to fundamentals is mandatory. For this purpose, the Hausman's test for Granger causality, summarized in Gujarati (1995), is employed. Eview's output are summarized in

Table.8

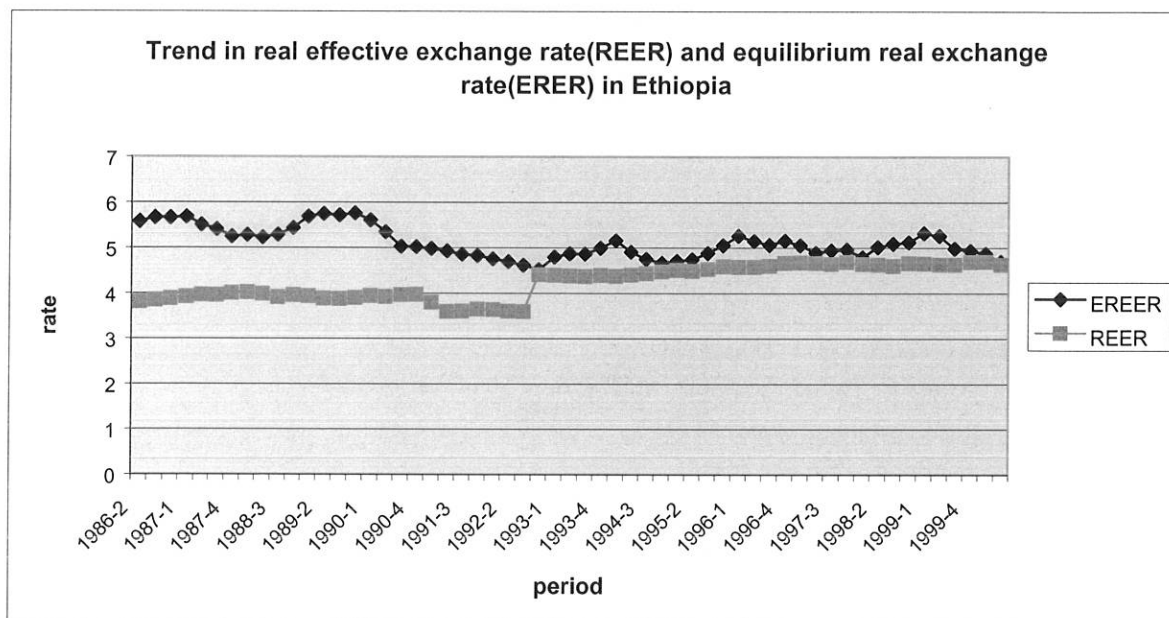
Table 8 Eviews output for Granger causality

Null Hypothesis	F.Statistic	Prob.
LOREER doesn't not Granger cause LTOT	1.67420	0.58580
" " " " LEXCON	0.95854	0.38976
" " " " LNKF	0.66883	0.51643
" " " " LGCGDP	2.90935	0.06294
" " " " LTARF	2.37195	0.10278

The null hypothesis that of 'LOREER doesn't Granger cause a specific variable' is not rejected in all cases. This result plus the above result of weak exogeneity test reveal that the fundamentals are strongly exogenous. Before the equilibrium exchange rate is generated using the time series based estimates of the permanent fundamentals, Granger causality from the real exchange rate to the fundamentals should be checked because there is an assumption that the dependent variable will not be causally related to the explanatory variables in the process of forecast. The above

results (table 8) indicate that no causality³¹ goes from RER to the fundamentals. Hence, ERER can be generated using these data.

Fig. 6.



We used a long run coefficient for the fundamentals from the long-run analysis (see table 1) and the statistically significant coefficients for the construction of ERER series for the sample period (1986Q2 – 2000Q2). Therefore, using these information (the coefficient of the fundamentals in the long-run analysis and 5-years moving average series) we generate an equilibrium real exchange rate for the sample period. In this exercise, the observed difference between the actual and equilibrium real exchange rate is found to be misalignment exchange rate, which starkly illustrated in the figure (1) above as a persistent misalignment during the entire period. The result in the above figure shows that the RER is substantially misaligned with the equilibrium rate in the first part of the period until the beginning of 1994. Since then, however, the RER has moved closer to equilibrium.

³¹ If the other way round is happened (the REER causes the variables) these explanatory variables are not strongly exogenous in the model and hence the problem of simultaneity arises. With this problem, a single-equation estimation procedure is invalid and the ERER generated from this may not be reliable.

6. Conclusion and policy implications.

6.1 Conclusion.

In view of the liberalization measures that had been taken and the government concerns to open the economy to international competitions, analysis of determinants of the country's real exchange rate is of paramount interest. In this respect, the purpose of this study has been to analyze the determinant of real exchange rate in Ethiopia and to check whether the exchange rate responds to both nominal and real disturbance using Edwards (1989) and Elbadawi (1992) real exchange rate model.

This paper traces the development of the RER in Ethiopia over 15 years period, with the prime objective of using an empirical framework to analyze the determinants of RER. The study had three specific objectives. First, to analyze empirically the relative importance of nominal and real variables in explaining RER movements in the short-run in Ethiopia. Second, to determine the equilibrium real exchange rate of the 'Birr' and see the misalignment of the RER from its equilibrium. The third objective is to discuss policy implications of the empirical results with the aim of making policy recommendations for improving the policy design in light of the finding in this paper.

In terms of the long-term effect of fundamentals, the ratio of government consumption to GDP showed a negative elasticity. This implies that fiscal spending which tended to concentrate more on non-traded goods push price of this goods upward and finally results in real exchange rate appreciation.

The finding confirms that the effect of terms of trade on real exchange rate was positive meaning a worsening TOT will lead to RER appreciation. This result is consistent with the structure of the economy i.e., subsistence agriculture and low intensity of imported inputs.

Another most interesting finding of this study is the importance of the level of import tariff in determining RER. The significant negative coefficient support the notion that trade reform aiming at reduced tariffs is consistent with a more depreciation of RER.

The result for the net capital flow variable is significant and negative, which supports the view that an increase in capital inflow associates with a real depreciation of the exchange rate.

The result of the dynamic error –correction model revealed that a nominal devaluation have a positive and significant effect on the RER in the short run indicating that nominal devaluation leads to RER depreciation. This shows that exchange rate policy has been an important tool for increasing incentives for export production as it makes export more competitive in the international market *ceteris paribus*. The result also showed that excess credit has a negative and short run effect on the RER, indicating that expansionary monetary policy worsens incentives for the production of tradable goods. In particular, expansionary credit to government has negative effect on export incentives as would be expected. Credit to government has been associated with higher public expenditure on non-tradable, increasing price of these commodities and switch resources away from the export sector.

Besides providing long run and short-run analysis of the real exchange rate. Equilibrium real exchange rate indices are computed so as to see the position of the RER from its ERER. This reveals that the exchange rate, despite being stable during the sample period, remained misaligned. For the whole sample period the ERER is above the actually observed real exchange

rate indicating that the 'Birr' is still overvalued. However, after the introduction of the economic reform program the misalignment is gradually narrowing.

6.2 Policy Implications.

The analysis and findings of this study can provide some guidance for economic policy formulation and execution particularly in improving policy design, monitoring and evaluation of the exchange rate management of Ethiopia.

In the foregoing analysis of the determinants of the RER we found that important determinants of the RER in Ethiopia are terms of trade, government consumption, net capital inflow, import tariff, domestic credit and nominal exchange rate.

The negative relationship between the government consumption and RER implies that excess government consumption on non-tradable leads to RER appreciation and overvaluation. Then overvalued exchange rate leads to deterioration of the economy in general and the external sector in particular. To this end it is advisable for the government to reduce consumption or expenditure on non-tradable goods. Since the government spends more in provision of public goods (like education, health, infrastructure and defense etc.,) cutting down on these expenditures is not an easy task. Therefore, shifting of resources from the non-productive to productive, privatization of some government undertakings and introducing cost sharing mechanism can help in solving this problem.

Trade liberalization, reduction of import tariff, allows more goods and services to enter the country and make domestically produced goods more competitive in terms of quality and quantity. The result in this study showed that a reduction in tariff leads to exchange rate

depreciation. Hence, the on going trade reform in Ethiopia should be strengthened so that it encourages competition and stable exchange rate.

The effect of the terms of trade shock on the RER depends on whether or not the income effect dominates the substitution effect. If the substitution effect dominates the income effect, a worsening of the terms of trade will result in RER depreciation. The result in this study supports this view.

In the case of capital flow, the result supported the view that an increase in capital inflow leads to RER appreciation. Thus, the government has to encourage foreign direct investment by creating conducive investment environment (like improving the land ownership issue) due to the fact that foreign direct investment have a long run and lasting effect on RER.

As supported by the coefficient of the nominal exchange rate movements showed that exchange rate policy has been an important tool for increasing incentive of tradable goods. It also implies that if a country's RER is overvalued, then a nominal devaluation is a powerful and useful tool to improve the misalignment. As evidenced by Edwards (1989) nominal exchange rate devaluation is a powerful tool in inducing depreciation in the RER. On the other hand, overvaluation of the RER imposes an implicit tax on exports and hence discourages export. It also set an implicit subsidy on imports and hence encourages imports. Obviously, the result will be worsening current account balance. As it is observed from the ERER and the actual RER (chart 6) in this study the misalignment is narrowing, indicating the need for exchange liberalization to be strengthened.

As evidenced by the obtained result that excess supply of domestic credit affects the RER negatively, which in effect is a disincentive for export production. In the structural adjustment

program that calls for outward orientation, there is a need for less expansionary policies in the economy. The result in this study also supports this view.

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Annex 1

As it is well known quarterly GDP series is not available for Ethiopia. Hence, a mechanism to disaggregate the annual data series is necessary. We, therefore, tried to find some coefficients and generate the data based on these coefficients.

Agriculture

We found a labor input requirement for each agricultural operation for major cereal crops from Development Bank. Based on this labor inputs for different activities coefficients for each quarter are derived. The activities are carefully identified to which quarter they belong. The labor requirement for hectare for a day is given in table below.

	Barely	Wheat	Teff	Maize	Sorghum	Average	Ratio
1 st Ploughing	4	4	5	7	5	5	0.075
2 nd Ploughing	4	4	5	7	5	5	0.075
3 rd Ploughing	3	3	5	3	-	3	0.045
Planting, sowing, covering	4	4	6	8	4	5	0.075
1 st weeding	15	11	22	20	24	18	0.268
2 nd weeding	-	-	-	24	7	6	0.089
Harvesting	13	18	18	9	9	13	0.194
Threshing, widowing (shelling)	7	10	17	19	9	12	0.179
Total	50	54	78	88	63	67	1.00

The allocation of each activity to each quarter and the derivation of the coefficient is performed as follows:

July, August & September (QI) = Sowing & 1st weeding

October, November & December (QII) = 2nd weeding & Harvesting

January, February & March (QIII) = Threshing

April, May & June (QIV) = Ploughing (1st, 2nd & 3rd)

For each quarter the coefficients are:

$$QI = 0.075 + 0.268 = 0.343$$

$$QII = 0.089 + 0.194 = 0.283$$

$$QIII = 0.179$$

$$QIV = 0.075 + 0.075 + 0.045 = 0.195$$

Since the Belg season (small rain season) is very small, about 5%, relative to main season, it is ignored.

Industry

For this sector we found quarterly data (1993/94 – 1999/00) on production of some 28 major public enterprises from MEDaC. This is used to obtain average coefficient for the breakdown of the industrial sector. The value of these productions in Birr and the corresponding coefficient for the quarters is given below.

Quarter	Total	Ratio
QI	1162178	0.217
QII	1385103	0.259
QIII	1412160	0.265
QIV	1388841	0.259
Total	5348282	1.000

Services

For the distributive service component of GDP (it includes like trade, hotel and restaurant transport and communication), data on disbursement from the banking system on quarterly basis are used to obtain coefficients that help to disaggregate the service. The disbursement for this sector is given in the table below. And the average ratio is used as coefficient to disaggregate the series. For the other service component of GDP (it includes items like (banking, insurance, real estate public administration and defense), the ratio is assumed constant for the quarters.

For distributive services the coefficients are:

Distributive Services	QI	Ratio	QII	Ratio	QIII	Ratio	QIV	Ratio
Domestic trade	458	0.164	3351.5	0.377	2705.3	0.304	1368.6	0.154
International trade	791.4	0.184	1006.4	0.234	1476.2	0.344	1019.8	0.237
Hotels & Restaurants	300.2	0.258	314.7	0.271	247.4	0.212	299.8	0.257
Transport & Comm.	459.1	0.198	598.6	0.258	566.4	0.244	693.1	0.299
Average Ratio		0.201		0.285		0.276		0.237
Other Services		0.25		0.25		0.25		0.25

Annex 2

Balance of Payments Ethiopia (1967/68 – 1999/00)

In millions of Birr.

Year	Trade Balance	Invisible (net)	Private transfers	Current account	Public Transfers	Capital Account	Errors and Omissions	Overall Balance
1967/68*	-157.5	50.1	-6.0	-113.2	35.4	75.3	10.3	-7.8
1968/69*	-86.7	37.0	-7.5	-57.2	35.4	31.7	1.2	-11.1
1969/70*	-121.8	22.9	-6.6	-105.5	26.6	45.0	8.4	42.3
1970/71	-140.4	25.3	-11.5	-126.6	28.4	72.5	-21.1	-46.8
1971/72	-140.3	26.2	3.2	-114.9	29.7	76.3	26.3	17.4
1972/73	16.9	33.0	16.6	66.5	28.8	63.4	34.7	193.4
1973/74	76.0	65.9	34.3	176.2	48.5	65.7	-27.3	263.1
1974/75	-195.2	13.3	31.0	-151.0	61.5	160.1	-56.8	13.8
1975/76	-140.3	89.6	42.9	-6.8	60.8	71.2	-45.0	80.2
1976/77	-101.4	42.7	34.2	-23.4	88.1	112.1	-127.7	48.1
1977/78	-127.1	41.0	30.7	-55.4	110.1	48.1	-363.3	-260.5
1978/79	-475.2	42.2	48.2	-334.8	123.5	111.8	54.3	-95.1
1979/80	-517.6	55.1	41.3	-421.2	124.0	169.5	44.1	-83.6
1980/81	-552.7	70.3	51.2	-411.2	123.9	322.0	-158.3	123.6
1981/82	-853.5	60.2	33.6	-709.7	139.8	679.4	-22.8	125.3
1982/83	-943.4	85.9	175.8	-681.7	191.4	401.7	-59.4	-148.0
1983/84	-1137.4	112.0	222.0	-803.4	335.2	395.8	-15.2	-87.6
1984/85	-1026.5	103.1	403.7	-520.0	617.6	423.7	-425.5	95.8
1985/86	-1277.4	107.8	353.9	-815.8	607.1	547.5	11.5	350.3
1986/87	-1442.0	121.3	336.4	-984.3	438.6	395.4	106.7	-43.6
1987/88	-1501.1	90.6	245.3	-1165.2	388.7	549.7	-198.6	-383.3
1988/89	-1205.0	66.9	389.1	-749.0	433.0	425.2	-132.2	-23.0
1989/90	-1067.3	89.2	354.6	-623.5	335.4	237.6	-498.7	-549.2
1990/91	-1538.2	-62.0	413.9	-1206.3	604.3	330.2	140.6	-131.2
1992/93	-2668.8	-36.0	1057.9	-1646.9	1708.7	-45.4	-515.6	-499.2
1993/94	-3321.1	173.2	1434.3	-1713.6	1447.7	1233.2	635.6	1602.9
1994/95	-3711.2	333.0	1944.9	-1431.3	2560.2	186.6	-275.2	1038.3
1995/96	-6255.5	415.0	1980.0	-3860.5	2474.2	-30.1	1141.2	-275.2
1996/97	-3562.2	718.7	1671.6	-1171.9	1453.0	-785.3	-881.6	-1385.8
1997/98	-4226.7	699.3	2186.5	-1341.0	1793.0	751.2	-1357.9	-154.7
1998/99	-8066.9	612.2	2172.1	-5282.7	1598.9	1725.8	1213.5	-744.6
1999/00	-8156.6	399.9	3341.6	-5117.4	2368.3	1233.6	-1463.6	-2977.0

Source: National Bank of Ethiopia

Annex 3

Construction of effective exchange rate indices of the Birr

The data for this study were obtained from different sources. Exchange rates and price indices were obtained from IFS database, October 2000 and trade weights were computed from the direction of trade of country as reported in the quarterly bulletin of NBE. The nominal exchange rate of the trade partner countries (currency/USD) obtained from IFS database and converted to Birr per respective currency for each partner. In the selection of the base year, the years before 1991 and after 1997 are not taken to be considered for the obvious reason of war or drought. Therefore, 1995 is chosen as base year for the fact that it is recent and relatively normal year (there was no war and drought).

Selection of partner countries to be included in the study.

As it is practically difficult to include all the trade partners of Ethiopia a threshold of one percent and above (the ratio of import plus export of the partner country to total trade of Ethiopia) is used for selecting the country. Hence 13 countries have passed this criterion which covers about 80 percent of total trade. These countries are given below with their corresponding weight. Djibouti is omitted from this because of the an availability of data on price indices.

Partner Countries	Weight
Belguim	0.02393
Kenya	0.021201
France	0.027475
Germany	0.153757
Italy	0.106772
Netherlands	0.032652
Sweden	0.018556
United Kingdom	0.045422
US	0.090562

India	0.019495
Korea	0.086301
Japan	0.015355
Saudi Arabia	0.120473

The mathematical formulation of the effective exchange rates

Nominal effective exchange rate (NEER) is a weighted average of exchange rate of the domestic currency per unit of domestic currency.

$$NEER = \sum_1^n W_{jt} E_{jt}$$

Where W_{jt} = relevant weight (trade share of country j at time t)

E_{jt} = nominal exchange rate defined as domestic currency per foreign currency.

N = number of trading partner

The real effective exchange rate (REER) is obtained by deflating the NEER by the ratio of relative prices of tradable to non-tradable. In choosing the relevant price indices we take the wholesale price index (WPI) of the partner countries as a proxy for the price of tradable as this comprises mostly of tradable goods and CPI of the country to proxy the non-tradable price. However, due to unavailability of WPI for Kenya, Canada and Sweden CPI of these countries is taken instead of WPI.

$$REER = \sum_1^n W_{jt} E_{jt} \frac{P_t^*}{P_t}$$

Where P_t^* = Wholesale price indices of partner countries.

P_t = CPI of Ethiopia.

The REER used in this study is computed in the above ways. Furthermore, a real exchange rate based on parallel market exchange rate is also computed by replacing the official exchange rate(E_{jt}) in the above equation by the parallel market rate.

Annex 4

Periods	Official exchange rate	Parallel Exchange rate	market
1985Q1	2.0700		4.6745
1985Q2	2.0700		4.7795
1985Q3	2.0700		4.8505
1985Q4	2.0700		4.8459
1986Q1	2.0700		3.7107
1986Q2	2.0700		3.7940
1986Q3	2.0700		3.8504
1986Q4	2.0700		3.8467
1987Q1	2.0700		5.8021
1987Q2	2.0700		5.9325
1987Q3	2.0700		6.0207
1987Q4	2.0700		6.0149
1988Q1	2.0700		5.8118
1988Q2	2.0700		5.9423
1988Q3	2.0700		6.0307
1988Q4	2.0700		6.0248
1989Q1	2.0700		6.2250
1989Q2	2.0700		5.9250
1989Q3	2.0700		5.8750
1989Q4	2.0700		5.8100
1990Q1	2.0700		5.8950
1990Q2	2.0700		6.0350
1990Q3	2.0700		6.0850
1990Q4	2.0700		6.0850
1991Q1	2.0700		6.1500
1991Q2	2.0700		6.5500
1991Q3	2.0700		6.8500
1991Q4	2.0700		6.8500
1992Q1	2.0700		6.9000
1992Q2	2.0700		7.8000
1992Q3	2.0700		8.6250
1992Q4	5.0000		8.5500
1993Q1	5.0000		7.6000
1993Q2	5.0000		7.6000
1993Q3	5.0000		7.2167
1993Q4	5.0000		7.0857
1994Q1	5.0000		6.9500
1994Q2	5.6600		6.9571
1994Q3	5.6000		7.1000
1994Q4	5.9500		7.1643

1995Q1	5.9400	7.2750
1995Q2	6.2500	7.6429
1995Q3	6.3000	7.5714
1995Q4	6.3200	7.6750
1996Q1	6.3200	7.7029
1996Q2	6.3500	7.6083
1996Q3	6.3900	7.2133
1996Q4	6.4300	7.1346
1997Q1	6.6400	7.1354
1997Q2	6.8000	7.1646
1997Q3	6.8100	7.2123
1997Q4	6.8600	7.2215
1998Q1	6.9500	6.9262
1998Q2	7.0600	6.9808
1998Q3	7.2700	7.3762
1998Q4	7.5000	7.5685
1999Q1	7.9000	7.7900
1999Q2	8.1200	8.0054
1999Q3	8.1200	8.3077
1999Q4	8.1300	8.2115
2000Q1	8.1700	8.3723
2000Q2	8.2200	8.4846

Sources: NBE and different World Currency Year Books

DECLARATION

I, the undersigned, declare that this thesis is my own original work and it has never been presented in any other university. All sources of materials for this thesis have been dully cited and acknowledged.

Name: Equar Desta

Signature 

Confirmed by advisor:

Name: Gebrehiwot Ageba (PHD)

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Place and Date of Submission: Addis Ababa University, June 2001