

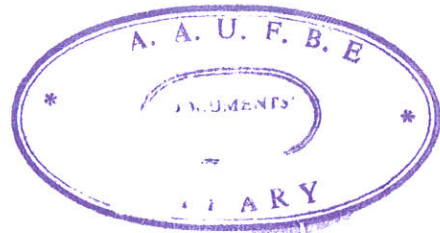
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**THE EFFECT OF DEVALUATION ON MAJOR MACRO
ECONOMIC VARIABLES (THE ETHIOPIAN CASE)**

**A THESIS
Presented to the School of Graduate Studies
Addis Ababa University**

In Partial Fulfilment of the Requirements for the Degree of
Masters of Science in Economics
(Economic Policy Analysis)



By
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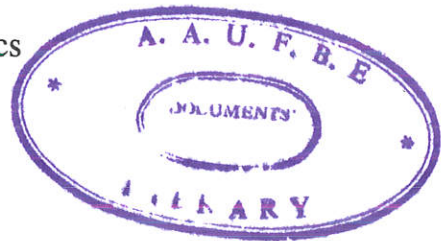


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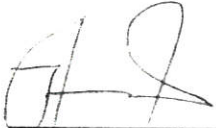
The Effect of Devaluation on Major Macro Variables (The Ethiopian Case)

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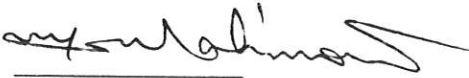


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Abstract

A Time series econometrics technique especially error correction Method employed for analyzing the efficiency of devaluation on Ethiopian economy. Secondary data was collected for the period 1964-1965 from different publication and government office.

Edward's real exchange, current account and output model adopted for the study; moreover, Elbadawi's real exchange and price model was applied for the study.

The result confirmed that devaluation could not lead to stagflation circumstance. It was rather expansionary (increasing output and employment) and inflationary. The result of this study adheres the view of that when initial condition of the economy at real exchange appreciation, nominal devaluation could accelerate the process of convergence towards its equilibrium. Devaluation improved the current account balance because of the increment of aid to the country after devaluation; however, it did not improve the trade balance due to the fact that the premium declined considerable degree but not abolished.

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CHAPTER 1

INTRODUCTION

1.1 Statement of the Problem

Like many other African countries Ethiopian faced serious economic crisis in the mid 1970's and the entire decade of 1980's. This economic crisis was manifested itself in various forms such as local growth rate of GDP (2.4% per cent per annum in the period 1973 to 1995), negative growth rate of per capita income, an increasing balance of payment deficit e.t.c. Agricultural out put grew at rate lower than population growth rate. Hence, the country had to either import basic necessities or to depend on external donations (Asmorem, 1992).

The poor performance of the economy could be attributed to both internal and external factors. In the internal side, the major cause for such event was the mismanagement of the macro economic policy of this country. The Derge regime followed "a socialist" oriented economy policy which did not use price signal as mechanism of the resource allocation. Price control and rationing were the principles of the system. Beside, since civil war was intensified at highest degree, the government used the scarce resource for the execution of the war. For the government to carry out its "Socialist" policy, a new system of state was established and existing bureaucracy was greatly expanded and launched a series of sequences campaigns (Teshome,

1994). It required a paramount government expenditure which was partly covered by printing money.

The expansionary macro economic policy, as general economics literature spells out, leads to inflation. If the inflation of the country is greater than that of the major trading partner's, the currency will be overvalued. Since the country's inflation was greater than that of its trading partners, the currency was overvalued. The spread of parallel market premium and the appreciation of real exchange rate can be used as a measure of how the currency overvalued. The premium increased from 1.5 in 1964 to 3.38 in 1991 and the real exchange appreciated significantly (see table 3.6 and 3.7). An overvalued exchange rate likely would have adverse effects on the economy such as discouraging exports by reducing the profitability of producing for world (Killick, 1991), it encourages the smuggling of exports, it paves way for rent seeking society; and the expansion of non-tradable goods.

The Transitional Government of Ethiopia (TGE), to mitigate the general economic problem, began implementing the comprehensive macroeconomic and structural reforms . The reform has been undertaken in three overlapping phases.

In the first phase, the focus would be primarily on economic stabilization which includes tightening fiscal policy, strengthening monetary control and adjusting the exchange rate. The second phase focuses on structural reforms which would aim at generating a supply response. In the third phase, the

initial stabilization and structural reform would be strengthened. The reform has similar objectives with countries undertaking the structural adjustment programme.

Devaluation of the Ethiopian Birr was one of the undertaken measures in stabilizing the economy. The Birr was devalued 59% in terms of dollars. The objective of devaluation, according to the TGE, seated to improve the current account balance. The rational for the said objective was set as:-

1. Due to the gap between the official and unofficial exchange rates, illegal exports of coffee, live animals flourished in the country. The government expected such trade to diminish as the gap between the official and unofficial value of the exchange rate disappeared and hence when illegal trade was directed to official channels.
2. Most Ethiopian exportable items unlike other African countries can be used in domestic consumption (coffee, oil seeds and oil nuts). By making foreign markets more attractive than domestic market, the volume of exports increases.
3. To encourage the production of exportables by shifting resources from non-tradables to tradables.



Given the TGE's devaluation objective, there is hot controversial issues whether SAP in general devaluation in particular would result in improving the current account balance by increasing the volume of exports , decreasing the import bills eliminating, market distortions, and economic growth (Befekdu 1994, Killick, 1993;and World Bank, 1994).

Most studies revealed that devaluation improves the balance of payments, but they have little ability to further objective of reducing inflation and stimulating growth (Killick, Melick; and Manuel, 1991; Khan, 1990 and The World Bank, 1989). Studies pointed out that, on the average, program countries had moderately better economic performance than non programme countries in terms of economic growth and internal balance. Mosley, Harrigan and Toye undertook a study on the effect of devaluation in 1991. Their finding indicated that devaluation had no measurable effects on real GDP, positive effect on export growth and the balance of payment and negative effect on investment levels.

Though no clear cut answer for the effect of devaluation on the economy, The TGE employed devaluation as instrument of exchange rate policy to improve the current account. Therefore, what would be the effects of devaluation in the Ethiopian economy was considered as problems in the study.

1.2 Objective of the study

1.2.1 General objectives

Devaluation is usually an important component of Orthodox stabilization programmes according to the traditional theory. It is expected that nominal devaluation will result in expenditure switching increased production of tradable, increased exports, and an improvement of the external position of a country.

Recently, traditional stabilization packages, especially their devaluation components, have come under attack by a number of authors. It has been argued that even though nominal devaluation may achieve its goal of generating a relative price adjustment it entails a high cost. In particular, it has been pointed out that one of such cost is the decline in total output generated by devaluation.

Devaluation as a stabilization package has two main goals these are:-

1. They seek to generate real devaluations.
2. They seek to provide an improvement in the external position.

The general purpose of the paper lays on test whether nominal devaluation has achieved its targets or not; moreover, it tries to investigate the effect of devaluation on GDP, real exchange rate, price and current account in the Ethiopian economy.

1.2.2 Specific Objectives

The study has the following specific objectives:- These are:-

1. It tries to what extent devaluation affects the level of GDP . Along with this investigation, a considerable attention will be paid to the effect of monetary and fiscal policy on the level of output.
2. The fundamental factors such as terms of trade, capital inflow, technological progress and the short run factor (fiscal, monetary and exchange rate policy) which influence the magnitude of the real exchange rate will be identified and tested. At what extent nominal exchange rate affects the real exchange will be empirically tested. Moreover, equilibrium real exchange rate and its misalignment will be calculated.
3. Empirical test will be made to examine whether current account balance and trade balance responds to devaluation.
4. How the price level of non-tradables and tradables responds to change in exchange rate will be tested.

1.3 Significance of the Study

Stabilization program has been going in almost in African countries as solution of economic crises in the continent. Devaluation has been taken as measure economic tool for

implementing such programme, through criticized by politician and different school of economics.

The study which tries to test the effect of devaluation in major macro variables in Ethiopia that had pursued "socialist command" economy and its political and social system was significantly affected by civil war. Hence, it may contribute for pedagogical development in the issue how devaluation affects real variables in such economic situation.

The Ethiopian government has been implemented the structural adjustment programme which was prescribed by the Fund and the Bank to Stabilize the country's economy. The government in this regard should pursue prudent fiscal and monetary policy along with devaluation to make the price at the right level and current account deficits at sustainable level. The out put of the paper may be used as input for government in assessing the efficiency and the effectiveness of the devaluation with above said objective, and it may be used as input in designing a better and sound macro economic policy.

The paper may give a highlight for those who are interested in making a study in the efficiency of exchange rate policy in developing countries, in general, in Ethiopia, in particular.

1.4 Methodology

Generally, the following four approaches are commonly used to evaluate the effectiveness of devaluation. The first

approach refereed us "before and after" which compares the results during the period in which devaluation take place with performance in preceding year. Such method is not free of critics, it is unsatisfactory because the influence of the changing world economic conditions and internal political systems which are unstable in Africa.

The second approach know as "with-without" approach. The method is applied for cross-sectional study. In this method, the problem lays on selecting the sample countries. The third method is "actual versus targets" approach which compares results with the given targets. And, finally an simulation system can be used to examine the impact of the exchange rate on the economic.

This study tries to use time series econometrics method(for the detail see chapter 5).

1.5 Data characteristics and source

Annual data for the European years 1964-1995 was collected from various source. The main source of the data for the paper was the International financial statistics(annual and monthly issue), Central Statistical Office (various annual reports), and National Bank of Ethiopia (quarterly and annual reports). Beside these, in later years (1994 and 1995), data was collected from the government file which has not yet officially published.

The appearance and existence of the different data in two calendar years become hazardous in data collection. Some of the data only avail in Gregorian years, especially those issued by international organization such as terms of trade, unit value of import, unit value of export, and different data of other countries. Data on national income and government account are reported in Ethiopian fiscal years which runs from July 1 to July 6. Attempt has been made to convert the national account and government account to Gregorian calendar year. Therefore, all the data in the study appeared according to Gregorian calendar.

1.6 Organization Of the Study.

The remaining part of the paper is organized in five chapters. Review of literature regarding devaluation and real exchange rate will be under taken in chapter two.

Chapter three emphasis to the general back ground of the economy and development of moneray, fiscal and exchange rate system of the country.

Chapter four presents the model employed in analyzing the effect of devaluation on the economy. Chapter five is devoted to the analysis of the empirical results. The last chapter presents the main ideas and findings of the study.

CHAPTER 2

LITERATURE REVIEW

2.1. Output

Despite widespread adoption of floating exchange rates among industrial countries after 1973, the vast majority of developing countries have continued to maintain official parities for their currencies. In the face of the frequent and severe external shocks as well as unstable domestic policies, such parities have been subjected to frequent deregulation. [Lizondo and Montiel, 1989]

Devaluation is a controversial issue in many developing countries, especially in Africa. Unconvinced by the economic arguments in favour of it, and suspicious of its political repercussion, many governments prefer to avoid the devaluation of their currencies.

Although currency devaluation has become quite common in developing countries, it continues to be resisted by the authorities and often are used only as a measure of last resort. Among the reasons that have been advanced for this aversion is the fear that devaluation may have contractionary effects on domestic activity while increasing the rate of inflation, and possible worsening of external indicators such as the trade balance or the change in net national reserves.

The reluctance to use devaluation has been a seemingly perpetuating bone of contention in negotiations between the

governments of some developing countries and the International Monetary Fund [Bird, 1983]. It is true that in many developing countries devaluation, trade liberalisation, and privatisation are associated with the IMF economic reform programmes.

Devaluation operates in such a way that it either increases the price of the domestic currency or reduces the foreign currency price of exports. It generates price incentives which tends either to lower domestic demand for imports expressed in foreign exchange, raise domestic demand for and supply of import substitutes, increase foreign demand for exports, and/or lower import substitutes, increase foreign demand for exports and lower domestic demand for and increased production of exports. The response for this price change depends on demand and supply elasticities.

The effect of devaluation on output and employment does not have a common consensus. According to the traditional theory, it is expected that a nominal devaluation will result in expenditure switching, increased production of tradable, higher exports, and in an improvement of the external position of the country in question. From an analytical point of view, devaluation can affect the real sector of the economy through a number of channels. According to the more traditional views, devaluation will either have an expansionary effect on aggregate output, or in the worst of cases it will leave aggregate output unaffected. If there is unutilized capacity, nominal devaluation will be expansionary, and total aggregate output will increase. On the other hand, if the economy is

operating under full employment, the nominal devaluation will be translated into equi-proportional increases in prices with the real exchange rate and aggregate output will not be affected.

(Diaz- Alejandro (1983) and Cooper (1972) were among the first to raise the possibility that devaluation could prove contractionary in developing countries [Lizondo and Montiel, 1989]. Krugman and Taylor (1978) formalized several channels of contractionary influence likely to prove particularly relevant in developing countries. There are three channels they described.

1. When devaluation takes place at trade deficits, it decreases the real income at home and increases it abroad. The fall in real income leads to the value of foreign savings to go up, ex-ante aggregate demand goes down. (Krugman and Taylor, 1978).
2. The redistribution of income affects the aggregate demand. The shift of income from wages to profits because of the increment of wage than price, [Cooper 1971a, 1971b; Diaz- Alejandro 1963; and Krugman and Taylor, 1978].
3. Krugman and Taylor (1978) pointed out that many governments in developing countries derive a substantial proportion of their revenues from import and export taxes. Thus, a nominal devaluation that succeeds in depreciating the real exchange rate will increase the real tax burden on the private sector by increasing the

real value of trade taxes for given level of imports and exports. The result depends, however, on ad valorem rather than specific taxes on foreign trade. It would be true if the government's propensity to save is unity.

In another way, devaluation affects the aggregate demand in the following mechanism. Devaluation can result in some contractionary pressures on aggregate demand which could more than offset the traditional expenditure - switching effect. Devaluation will result in a higher price level generating a negative real balance effect. This, in turn, will result in lower aggregate demand and output [Frankel and Johnson, 1976]

In the above theoretical analysis, we have presented the possible effect of devaluation on aggregate demand; however, Van Wijnbergen (1986) developed a model which shows the effect of a devaluation on aggregate supply.

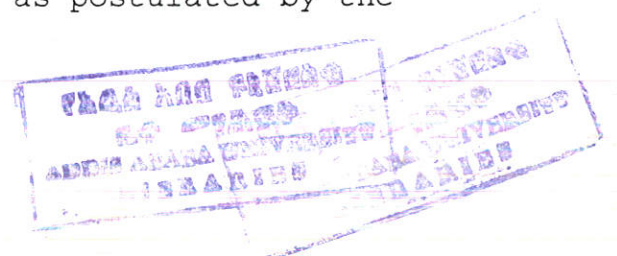
The channel affects the aggregate supply in three ways; i.e., nominal wages, imported intermediate inputs and working capital.

Several authors of the "New Structuralism" school have emphasised that a nominal devaluation could exert contractionary effects on the supply of domestic output by increasing the cost of working capital; that is, by financing cost of labour and imported inputs. (Taylor, 1983; Van Wijnbergen, 1983 and 1986).

The cost of financing working capital has two important supply consequences that affect the likelihood of contractionary devaluation. The first of these, and the most emphasised in related literature, is the "Carallo effect". Accordingly, an increase in loan interest rate adds up to the cost of financing working capital and shifts the output supply curve upwards. The second channel is the present working capital cost is likely to reduce short-run supply elasticities in both sectors because of the increase in the marginal costs associated with the need to finance additional working capital [Lizondo and Montiel, 1989; Rosassuarz, 1989].

The above theoretical discussion suggests that in the context of developing countries, a lot of empirical work has been done in this controversial area to ascertain whether devaluation is contractionary or expansionary in output.

Gylfadon and Schmidt (1983) have constructed a small macro model with intermediate goods, where devaluation has two conflicting effects. On the one hand, they generate an expansion through aggregate demand; on the other hand, devaluation results through its effect on the cost of imported intermediate inputs in an upward shift in aggregate supply schedule. The implications of the model are analyzed by importing plausible values to the corresponding parameters for a group of five developed countries and five developing countries. With the exception of the United Kingdom and Brazil, these results suggest that, as postulated by the



traditional theory, devaluations have a positive effect on aggregate output.

Kruger (1978) discovered that the effect of devaluation on economic growth depends crucially on what happened to export earnings though she found very little evidence to suggest that devaluation leads to severe recession of prolonged duration.

Connolly (1983) considered a group of 22 countries and regressed the change in the rate of real growth over the change in the nominal exchange rate. The coefficient thus obtained was positive and marginally significant, providing some support to the hypothesis of expansionary devaluation. Branson (1986) constructed a small simulation model for Kenya which suggests that, contrary to the traditional view, devaluation had important contractionary effects in the Kenyan Economy. Cooper in 1971 analyzed 24 devaluations that took place between 1953 and 1966. After looking into the behaviour of the principal components of aggregate demand, he concluded that devaluation itself often initially tends to depress economic activity in the developing countries.

Edward (1986) constructed a model for 12 developing countries for 1965-80. He found out that devaluations are contractionary in the first year. The effect is completely reversed in the second year. According to these estimates, devaluations are neutral in the medium to long-run.

2.2. Real Exchange Rate

The degree of how nominal devaluation as an instrument in macro policy becomes effective depends on the effect of real exchange rate. It is so important that definitions be forwarded to Nominal Exchange Rate (NER) and Real Exchange Rate (RER).

The nominal exchange rate can be defined as:

1. The relative price of different monies,
2. The relative price of goods,
3. The relative price of bonds. [Dornbusch 1980]

The nominal exchange rate may be viewed in two ways:

1. As the price of foreign currency in terms of the units of local currency.

Example:- Units of Birr per U.S. Dollar

2. As the price of local currency in terms of the units of foreign currency.

Example:- Units of U.S.Dollar per Birr.

In most modern theoretical works, the real exchange rate is defined as the domestic relative price of tradable goods to non-tradable goods, i.e.,

$$e = P_T / P_N$$

Where;

e	-	Real Exchange Rate
P_T	-	Price of tradable goods
P_N	-	Price of Non-tradable

A more traditional but still popular definition of the real exchange rate relies on the purchasing power parity approach.

$$e = EP^* / P$$

Where;	e	-	Real Exchange Rate
	E	-	Nominal exchange rate
	P*	-	Price of tradable
	P	-	Domestic Price level

Although the purchasing power parity (PPP) real exchange rate is an index of the degree of international competitiveness of the country in question, it fails to capture changes in the relative incentive guiding resource allocation across the tradable and non-tradable sectors. Consequently, the purchasing power parity does not provide prices information on how relative prices impinge on the evaluation of the external sector and of the different accounts of the balance of payments.

Real exchange rate misalignments a term commonly used in policy discussions. It is defined as sustained deviations of the actual real exchange rate from its long-run equilibrium level. If the actual real exchange rate is below the equilibrium level, it is said that there is a real exchange rate overvaluation. Under reverse condition we say that there exists undervaluation.

Resorting to the approach taken by Sebastain Edwadr, the equilibrium real exchange rate (ERER) is defined as that"

relative price of tradable to non-tradable for given sustainable (equilibrium) values of other relevant variables; such as, taxes, international price and technology, results in the simultaneous attainment of internal and external equilibrium." Internal equilibrium means that the non-tradable goods market clears in the current period, and is expected to be in equilibrium in future periods. In this definition of equilibrium RER is implicit. The point is that this equilibrium takes place with natural levels. External equilibrium is attained when the inter-temporal budget constraint which states that discounted sum of a country's current account has to equal zero is satisfied. In other words, external equilibrium means, current account balances are compatible with long-run sustainable capital flows.

RER is a particularly practical measure of the direction of incentives in small open economy under pervasive price controls while the conventional measure of the real exchange rate emphasize the external competitiveness of the economy. RER strongly reflects the signals delivered by the price system actually prevailing in the domestic economy, accounting for the effects of all policy interventions on domestic prices, including administrative pricing and allocations. It is, therefore, a more direct measure of the competitiveness of the tradable and non-tradable sector of the economy. It reflects the relevant sectoral price relationships where producers are allowed to respond to the price signals.

RER as a measure of external competitiveness may not be fully transmitted into the domestic price incentives actually perceived by the economic agents. It is a fundamental principle of open macroeconomics that sustainable macroeconomic equilibrium requires that monetary and fiscal policies be consistent with the chosen predetermined nominal exchange rate regime.

The most outstanding case of macro and exchange rate inconsistency is when expansionary fiscal policy is considered. In most LDCs these deficits are mainly financed by monetization of the economy, which will create inflation. There will be a 'required' inflation to finance a fiscal deficit. But if this 'required' inflation is high (higher than world inflation) then inconsistencies between the fiscal deficit and the maintenance of a nominal exchange rate will arise. This will be reflected in real exchange appreciation.

The domestic price of non-tradable increase at the rate approximately equal to the rate of domestic inflation, and the domestic price of tradable grows approximately at the rate of world inflation. Since the domestic inflation is high (i.e., higher than the world inflation), then the domestic price of non-tradable will grow at a rate higher than that of the domestic price of tradable. Thus leading appreciation of the real exchange rate.

Under predetermined nominal exchange rates, the increase in domestic credit that exceeds the growth in the demand of domestic economy will be inconsistent with the maintenance of fixed nominal exchange rate. The mechanics is as follows: the excess of domestic credit allocation above the rate of growth of money demand will be translated into excess demand for tradable goods, and financial assets. The excess demand of tradable will be reflected in trade deficit (lower surplus); and , excess demand to non-tradable goods and services. This will lead to real exchange appreciation.

The implications of the above are quite straight forward. Either the inconsistent policies are reversed, or the real exchange rate appreciation will continue. Usually, the authorities respond by imposing foreign exchange controls, increasing tariffs and qualitative controls. This accelerates parallel market operations for foreign exchange and do not stop the crisis. Eventually, the country runs out of international reserves or its real exchange reach at a dismal low level which points towards nominal devaluation and unavoidable other corrective measures.

Empirical work investigating the relationship between nominal devaluation and real exchange rate was accomplished by Sebastain Edwards in 1987. He employed the real exchange model putting real exchange rate as dependant variable while letting other fundamental variables as TOT, Tariffs, technical progress, etc., as independent determinants. He estimated a pooled data for a group of 12 countries. The countries were

chosen because of the availability of sufficient data. The estimated coefficients of nominal devaluation was found to be significantly positive, ranging from 0.467 to 0.698. This indicated that, even with all other things given a nominal devaluation will be converted in to a less than one-to-one real devaluation.

2.3. Devaluation, Current Account and Price

One of the most important objective devaluation is to improve a country's international competitiveness and foreign reserve. Devaluation, by increasing the price of traded goods, i.e., the price of export in domestic market and increasing the price of imports, creates conducive environment to increase the supply of exports and decrease the level of imports. The ultimate result of this, however, depends on the elasticity of export and import demand.

The significance of variation in elasticities differs from country to country. Developing countries which rely heavily on a single product and the price of which is quoted by a foreign currency, devaluation fails to reduce this price and the export elasticity of demand. Therefore, it is largely irrelevant. Devaluation raises the domestic currency price and the profitability of exporting, thereby imposing the importance of the elasticity of supply.

With regard to imports, it is highly improbable that any developing country will be able to influence the foreign price

of its imports since its demand for any particular import will represent only a small fraction of the total world demand for the producer. The domestic price of imports may not rise to the full extent of devaluation if devaluation is accompanied by the removal of import controls that has previously maintained import prices at artificially high levels. Even in a country which has dual exchange rate, and the parallel market largely dominates the foreign exchange market, devaluation may not change the imported price in domestic price.

Devaluation will improve the trade balance provided that the sum of exports and imports elasticities exceed unity. This is what is known as the Marshall-Lerner Condition.

For exports, the increase in the domestic currency price is not automatically passed to the producer which depends on the exchange control mechanism, tax system, market organization, etc., The most important of all in the context of developing countries is the price elasticity of export supply.

Supply elasticity will depend on a number of factors. It will tend to be higher, the shorter the gestation period of production, the greater the domestic consumption of the good, the greater the capacity, the greater the availability of investment finance, and the greater the mobile resource. [Bird, 1983].

It is imperative to assert that in an inflationary world a distinction needs to be drawn between the nominal and real exchange rate. When nominal devaluation is accompanied by an offsetting acceleration in domestic rate of inflation, the real exchange rate will remain unchanged. The nominal devaluation is, therefore, unlikely to succeed in strengthening the current account.

Where nominal devaluation is accompanied by changes in tariffs and subsidies, the effective change in price and output will differ from the nominal one. This is particularly important in developing countries where devaluation and trade liberalization are frequently undertaken.

Cannoly and Taylor (1976) found out that over the two years post devaluation periods, the price of traded goods rose by an amount near to the extent of devaluation for eight devaluation they investigated.

Donovan (1981) confirmed that devaluation in developing countries initially and directly increases the price level and may raise the underlying rate of inflation, thereby tending to reduce the extent by which the real exchange rate depreciates over time.

Evidence presented by Cooper (1971a, 1971b) appears to substantiate the claims that, for the first twelve months after devaluation, the rise in price and wage is considerably less than the size of devaluations.

* Empirical evidences on the effect of devaluation on import and export are also ample. In a study of Bhaghawati and Onisuka (1991) about post -devaluation export performance in a number of non-industrial countries, it emerged that in the majority of cases export earning and volume did grew fully owing to devaluation, where little or no expansion in exports resulted, or where a decline occurred, special circumstances were usually found to exist.

Donovan (1981) drew on a considerable amount of research to suggest that both traditional and non-traditional exports respond in volume terms to the price incentives created by devaluation, though for certain primary commodities the supply elasticity is significantly greater in the long-run than in the short-run, confirming the supply elasticity exceed zero in the short-run even for traditional crops (Bird, 1972).

* The response of import demand to devaluations analyzed by Khan (1979) found that almost the 15 developing countries in his sample showed price elasticity close to greater than one. Donovan (1981) found an average real import growth higher in both the short-run and long-run following devaluation.

Edwards (1989) formulated and estimated a current account analysis model using pooled data for the 12 countries. He found that the current account and the real exchange has a positive relationship, i.e., a real exchange devaluation improves the current account.

CHAPTER 3

The Macro economic performance of the Ethiopian Economy

Being one of the developing countries, Ethiopia's economic development condition was worsened over the last two 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. This was a policy in which economic growth sought mainly through the mobilization and allocation of resource by the central government. The institutional and legal framework of the policy set up in the Derge regime in the course which private enterprise was driven out of the modern formal sector of the economy and infant official markets in land, labour, foreign assets and credits that had evolved during the sixties were replaced by the schemes for the rationing of the same resource and consumer goods in context of central planning [Taye, 1992].

In the external side, the first and the second oil crises, fall of terms of trade ,and the increment of the world interest rate could be identified for the poor performance of the economy.

It is imperative enough to review how the internal macro economic mismanagement and external shocks affected the economic condition of the country in the chosen sample period (1964-1995).

3.1 General Background

Ethiopian is mainly known with her natural environments and the size of its population stands third in the continent. Nevertheless, the economic and the social indicators show that it is at last bottom in the world. It is significantly attributed to the man made calamities (such as civil war and poor economic policy), natural calamities (recurrent appearance of the drought) and external shocks.

The GNP per capital of the country was Birr 217.97 in 1994¹ which was the lowest in the world. Infant mortality is 111 per 1000 and life expectancy is 46 years, health service covers only 45 per cent of the population. Malnutrition is rampant with a daily per capital calories of 1620 only, about 12 percent of the rural and 80 percent of urban population have access to the safe drinking water. Current enrolment rate for primary education is only 31 percent (Getachew, 1991).

The average growth rate of the real gross domestic product (RGDP) was about 2.21 percent in chosen sample period (see table3.1).

¹. It is calculated from IMF 1994 Statistical year Book.

Table 3.1

The growth rate of the real GDP

Period	Growth rate of real GDP			
	Ethiopia	Africa	Developing Countries	World
1964-1973	4.07	4.22	5.03	4.73
1974-1991	1.14	2.77	4.36	3.15
1992-1995	2.87	-	-	-
Average	2.21	-	-	-

Source: Calculated from various IMF Statistical year books

The growth of population which was about 2.9 percent per annum was higher than that of the real GDP. It indicated that the growth rate of per capita Income is decelerating.² It also depicted that the performance was less than the average developing and African countries (See table 3.1).

² The per capita income which is defined as

$$pgdp = RGDP/P$$

where:- pgdp= per capita of real gross domestic product.

RGDP= real gross domestic product.

P = population.

In terms of growth rate, it is possible to put in the following form

$$PGDP = RGDP - P$$

Hence from this equation, we can say that when the growth rate of population is greater than that of real GDP, the per capita income will be decelerating.

Table 3.2
The size of deficit relatively
with GDP and high powered money

Year	Ratio of Deficit to GDP	Ratio of Deficit to high powered money
1964	0.42	10.12
1965	0.10	22.97
1966	1.1	13.29
1967	0.66	8.46
1968	1.3	16.46
1969	0.72	8.09
1970	1.02	12.48
1971	1.06	14.41
1972	1.33	16.34
1973	1.00	10.42
1974	0.79	7.26
1975	4.05	27.09
1976	5.40	32.38
1977	3.43	23.22
1978	5.67	38.46
1979	3.10	21.05
1980	4.35	28.08
1981	3.82	21.51
1982	5.26	29.08
1983	14.46	79.93
1984	6.51	30.68
1985	8.40	40.71
1986	7.05	30.52
1987	6.01	26.54
1988	6.56	25.42
1989	11.52	40.46
1990	14.43	43.18
1991	13.65	32.74
1992	10.00	23.20
1993	10.77	29.30
1994	12.78	33.34
1995	13.38	36.39

Source: Calculated from IMF year book.

The ratio of deficit to high-powered money could be used as a measure of inflation tax required to finance the government deficit [Edwards, 1988]³. The required inflation to finance the deficit was high and increased over years. The average for the given sample period was 26.04. In the Monarchy period, It was about 13.04; however, in Derge period it reached 32.12. The major factor for accelerating the government deficits had been the growth rate of expenditure was greater than that of the revenue.

Teshome identified four reasonable cause for such accelerated growth of deficit in the Derge regime (Teshome 1994). These are:-

1. The government realized the management of the "socialist economy".
2. A new system of state machinery was established and the existing bureaucracy was greatly expanded.
3. The large scale transfers of economic resource from private to public sector had occurred.
4. The launching of a series of "campaigns" which required the large scale mobilization of human, material and financial resources.

The growing government deficits were bridged by external assistance, external loans and domestic bank borrowing. The share of external borrowing and domestic borrowing registered

³. High powered money is defined as net liability of the monetary authority. It is the sum of currency in circulation and the net reserve.

as 50.3 and 49.7 percent respectively in the entire sample period respectively (See, table 3.3).

Table 3.3

Means of deficit financing

Period	External borrowing	Domestic borrowing
1964-73	49.8	50.2
1974-1991	50.0	50.0
1992-1995	54.0	46.0
Average	50.3	49.7

Source:- Computed from various issues of IMF Statistical year book.

Let us review how the monetary policy looks like. M_1 increased from Birr 303 million in 1964 to Birr 9426.2 million in 1995⁴. It is almost 30 fold increase M_2 soared from Birr 371 million in 1964 to Birr 13 845 million in 1995⁵. The growth rate of domestic credit was also high in the period under consideration.

⁴. M_1 is defined as the sum of currency in circulation and the demand deposit.

⁵. M_2 is defined as the sum of M_1 , time deposit and saving.

Table 3.4

The Growth Rate of Money

Year	Growth rate of		
	M ₁	M ₂	Domestic credit
1964-1973	8.44	11.6	12.47
1974-1991	13.88	12.70	16.61
1992-1995	11.25	13.66	8.95

Source:- Calculated from difference IMF Statistical Year Book.

The mounting of money supply could be explained by the external assets, domestic credits and government deficit and other items. In the period under consideration, the net foreign assets decreased at the average rate of 26 percent per annum. The share of domestic credit in money supply grew over time significantly. It grew 12 percent per annum.

The very factor in determining the supply of money are domestic credit⁶ and net foreign assets. The former became a considerable factor in post 1974; however, the later was in pre-1974 (Semu, 1992).

⁶. The Change in money supply can be express as $\Delta M = \Delta NFA + \Delta DC$.

Δ - change

where -M - Money Supply in broad sense

NFA - net foreign assets

DC - Net Domestic Credit involves

Δ - The Public and Private

The foregoing discussion depicted clearly that the government pursued expansionary monetary and fiscal policy. The expansionary policy in fixed exchange regime results in overvaluation of the currency in question.

3.3 Ethiopian's exchange rate policy

Before 1973 Ethiopian's exchange rate policy was in consonance with IMF par value system. The exchange rate was 2.48 Eth. dollar per U.S. dollar from July 23, 1945 to December 31, 1963. On January 1st it was devalued to 2.5 Ethiopian dollar per U.S. dollar (Tamiru, 1994).

From the late 1960 to early 1970's the relevance of par value monetary system predicated on U.S. dollar came under questioning. This culminated in the suspension of gold convertibility by the united on the August 15, 1971.

The currency crisis was developed and led to the devaluation of the dollar by 7.9 percent in December 1971. Under Smithsonian Agreement, gold price rose from \$35 to \$38 per ounce. The Ethiopian dollar (here after Birr); however, remained unchanged in terms of gold. This in effect meant a de facto revaluation of Birr in terms of dollar. Consequently, the Ethiopian Birr exchange rate changed to 1 US dollar = 2.30 Birr [Almost 7.9 per cent revolution in terms of Birr]. This rate served for the year 1971 and 1972. Not long after, however, the U.S. dollar once again come under pressure and was devalued by 10 per cent. The Ethiopian Birr was almost

revalued by 10 percent against U.S. dollar. The exchange had become 1 U.S. dollar = 2.07 Birr.

Following this, Ethiopia followed a fixed per determined nominal exchange rate pegged to the U.S. dollar. The government would have pursued appropriate monetary and fiscal policy to maintain the fixed predetermined rate at equilibrium level; nevertheless, the government fiscal and monetary policy had been expansionary. This was especially true in post revolutionary period (1974-1991). (See Table 3.4 and 3.5).

The expansionary macro policy augmented the demand for both tradable and non-tradable goods. While the excess demand for tradable would not change the price in home for given exchange rate. The rational for this that Ethiopia is a small country in world trade.⁷ Therefore, it can not influence the price of export and import items in the world market rather takes as given. The excess demand for tradable lead to the current account deficit and loss of international reserve. In given sample period, the import raised at rate 8.9 percent whereas export grew at 7.2 percent on the average. The current account balance was decelerating at rate of on the average rate of 29.8 per cent per annum in the given sample period.

The effect of the excess demand pressure on non-tradable soared the price of it. If we take Addis Ababa Consumer price retail index as a proxy for price of non-tradable, annual

⁷. The average share of Ethiopian export and import from 1964 to 1992 was about 0.019 and 0.037 percent in the world export and import respectively.

increment rate was about 7.27 on the average in the whole sample period (See table 3.5). The increment rate was higher in the period of the Derge.

Table 3.5
The Growth Rate of Price

Year	The Average Price Increment
1964-1973	1.76
1974-1991	9.89
1992-1995	7.9
Average	7.27

Source:- Computed from various issues of the annual report of Central Statistics Office.

The increment in price had not as much as expected. The probable justification lays on that the previous government pursued a strict price control, rationing of the basic commodity and the decelerating of the money velocity (GDP/M_2) which is know as monetary deepening.⁸

⁸. IF we take the Irving Fisher equation $MV=pq$ -

where -

M M_2

V - Velocity of money

p - Price

q - real transaction

the above equation in terms of growth rate and rearrange it, we get

$$\dot{P} = (\dot{M} - \dot{q}) + \dot{V}$$

This equation reveals that the effect of the money supply increment on price may be minimized if the growth rate of velocity is negative.

The relative increment of the price of non-tradable to that of tradable cause resource to shift from tradable sector to non-tradable sector. It resulted in the decline of the exports and imported substitute that aggravated the shortage of foreign currencies.

The then Ethiopian Government took a policy measure of foreign exchange allocation and exchange control to mitigate the problem of shortage in foreign currency, and trade deficits. The exchange controls and the government interference include:-

- a) denying private investor access to foreign exchange allocation.
- b) uncoordinated and arbitrary rationing of available foreign exchange among state owned enterprises.
- c) strict control of the type and quality of goods to be imported.
- d) increasing both imports and export duties (Asmorom, 1994).

The Exchange control and foreign exchange allocation did not give a solution for the problem of trade deficits and the shortage of foreign exchange. It rather aggravated the problem at the considerable degree because of the emergence of the parallel exchange markets. The premium⁹ increased from 1.50 in 1973 to 3.38 in 1991; it is almost on the average 5.92 percent increment per annum (see table 3.6). The underlying

⁹. The premium in the study is defined as the ratio of parallel exchange rate to official rate.

cause for the flourishing of the parallel exchange rate could be cited that major consumer items started to be marketed on parallel markets. On supply side, the source of foreign exchange may be smuggling of exports to earn higher profit, sale of foreign exchange by tourist, diplomats and foreign workers, remittance sent back by national residents abroad.

Table 3.6
The Official and Parallel Exchange Rate

Year	Official exchange rate	Parallel exchange rate	premium	Annual Increment in per.
1964	2.5	2.5	1	---
1965	2.5	2.5	1	0
1966	2.5	2.5	1	0
1967	2.5	2.5	1	0
1968	2.5	2.5	1	0
1969	2.5	2.5	1	0
1970	2.5	2.5	1	0
1971	2.3	2.3	1	0
1972	2.3	2.8	1.2174	21.7
1973	2.07	3.1	1.4976	23.0
1974	2.07	3.34	1.6135	7.7
1975	2.07	3.78	1.8261	13.1
1976	2.07	4.00	1.9324	5.8
1977	2.07	4.21	2.038	5.3
1978	2.07	4.11	1.9855	-2.4
1979	2.07	3.17	1.5314	-22.9
1980	2.07	2.82	1.3623	-11.0
1981	2.07	3.09	1.4928	9.5
1982	2.07	3.32	1.6039	7.4
1983	2.07	3.52	1.7005	6.0
1984	2.07	4.02	0.9420	14.2
1985	2.07	4.85	2.3430	20.6
1986	2.07	3.83	1.8502	-21.0
1987	2.07	6.02	2.9082	52.2
1988	2.07	6.62	2.1981	9.9
1989	2.07	6.03	2.9130	-8.9
1990	2.07	6.13	2.9614	16.5
1991	2.07	7.00	3.3816	14.2
1992	5.00	7.40	1.4800	-56.2
1993	5.00	7.60	1.5200	2.7
1994	5.95	7.70	1.2941	-14.8
1995	6.25	7.75	1.2400	-4.2

Source:- Calculated from different, IMF Statistical year book and world currency book.

Under certain conditions, the parallel markets rate can provide useful information on the extent to which the domestic currency has become overvalued in the official markets.

The overvaluation of the currency could also be seen in the appreciation of the real exchange rate. The official real effective¹⁰ exchange rate appreciated 1.42 percent per annum (see Table 3.7).

¹⁰. For method of calculation see chapter 5.

Table 3.7
The Multilateral real effective exchange rate

Year	Multilateral exchange rate	Rate of change
1964	136.23	
1965	138.77	1.86
1966	135.22	-2.49
1967	130.88	-3.87
1968	152.94	17.04
1969	149.75	-1.64
1970	140.61	-6.10
1971	138.34	-1.6
1972	154.04	-11.34
1973	136.30	-11.52
1974	118.99	-12.69
1975	120.38	8.72
1976	124.10	-4.08
1977	109.17	-12.03
1978	96.45	-11.65
1979	94.30	-2.23
1980	94.85	.5
1981	97.50	2.79
1982	97.51	0.2
1983	87.44	-10.52
1984	92.22	5.8
1985	31.43	-11.98
1986	96.22	18.15
1987	105.20	9.3
1988	95.91	-8.8
1989	98.21	2.40
1990	100.00	1.81
1991	83.13	-16.87
1992	200.63	141.34
1993	148.28	-26.09
1994	208.53	40.90
1995	212.77	1.83

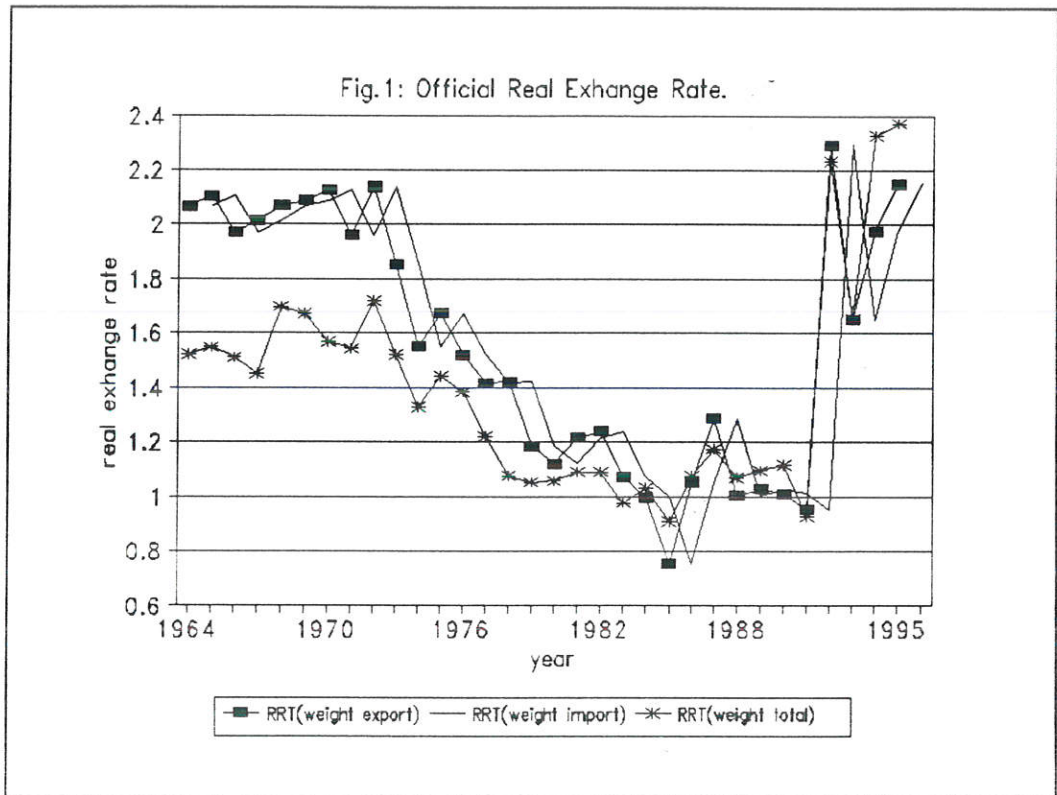
Source:-Computed from various issues of IMF statistical Year book and Central Statistics Office.

(-) sign show appreciation

(+) sign show depreciation

The movement in all the three real exchange rate¹¹ displayed a substantial degree of appreciation from 1966 to 1991. It, however, started to depreciated soon after the devaluation. [look graph 1).

Graph 1



The Bilateral real exchange rate¹² against Germany, U.S.A., Japan were also calculated. It depicted appreciation at a substantial rate. (See Table 3.7).

¹¹The three real exchange rates were calculated using the formulae in chapter 5.

¹². The formula employed to calculate the Bilateral exchange rate presented as:-

$$BRRER = E_i * CPI_i / CPI_H$$

Where :

BRRER Bilateral real exchange rate of the home country against country i.

E_i the nominal exchange of the home country against country i in terms of the home currency

CPI_i the consumer price index of country i

CPI_H the consumer price index of the home country.



Table 3.8
Bilateral Exchange Rate

Year	U.S.A.	Rate of change	Japan	Rate of change	Germany	Rate of change
1964	124.4486	0	52.02797		79.9193	
1965	123.3317	-0.8	54.18099	4.1	79.81207	-0.2
1966	129.0664	4.7	57.57076	6.3	84.34444	-5.6
1967	131.0515	1.5	59.33938	3.1	84.50539	0.2
1968	136.7047	4.3	62.62461	5.5	85.84979	1.6
1969	141.9966	3.9	64.80674	3.5	93.12642	8.5
1970	136.3862	-3.9	63.47949	-2.1	88.6127	-4.9
1971	130.4714	-4.3	64.33566	1.4	95.45867	7.7
1972	143.3692	9.8	82.5062	28.2	109.3872	14.6
1973	125.9259	-12.2	84.64128	2.6	114.4758	4.6
1974	129.0102	2.4	88.54627	4.6	126.5982	10.6
1975	131.6294	2	92.58473	4.6	115.4495	-8.8
1976	108.4577	-17.6	78.90617	-14.8	105.8155	-8.3
1977	98.9339	-8.9	80.4822	1.9	103.7046	-1.9
1978	93.09701	-5.9	93.33577	15.9	107.3885	3.5
1979	89.38907	-3.9	80.00135	-14.1	101.7216	-5.2
1980	97.07692	8.6	79.88811	-0.1	90.73356	-10.8
1981	101.016	4.1	81.66695	2.2	78.97992	-12.9
1982	101.2329	0.2	69.96839	-14.3	74.51805	-5.6
1983	105.1034	3.8	75.27273	7.6	67.58917	-9.3
1984	101.145	-3.7	70.97902	-5.7	55.27267	-18.2
1985	88.03419	12.9	60.77416	-14.3	60.63127	9.7
1986	99.40758	12.9	95.89948	57.8	85.13162	40.3
1987	105.5825	6.2	114.3204	19.2	107.3508	26
1988	102.6077	-2.8	121.8924	6.6	90.23136	-15.9
1989	99.7897	-2.7	106.9908	-12.2	90.15784	-0.8
1990	100	0.2	100	-6.5	100	10.9
1991	76.78703	-23.2	81.97948	-18	75.1918	-24.8
1992	172.9469	125.2	193.5408	136.1	160.4495	113.4
1993	172.0217	-0.5	215.599	11.4	150.8187	-6
1994	195.0667	13.4	267.3993	24	191.5542	27
1995	186.676	-4.3	301.4455	12.7	209.7943	9.5

Source:- Computed from Various. IMF year book

The foregoing discussion clearly indicated that how the multilateral and bilateral real exchange rate was appreciated.

If the process had continued without appropriate macro economic policy, its exports would have been declined and its reserves would have depleted. The contractionary macro economic policy could be considered as a remedy for overvalued currency; however, it entails a cost i.e. reduction of output and employment. The other remedy for these outlined problems is to devalue the currency. The government adopted the second remedy as a solution on October 1, 1992.

On May 1, 1993 the auction system started operation and the official exchange rate system was applied to very essential imports like petroleum products and fertilizers and for the government foreign exchange contributions to international organizations and official debt-service payments. The auction rate applied for all imports except those mentioned in the above "necessity" group. The above system operated in the nation until July 25, 1995.

The auction rate and official rate unified on July 25, 1995. One official exchange rate system determined in the auction system has been applied for all imports since then.

CHAPTER 4

Specification of the Model

In the preceding chapter, how the Ethiopian Economy looked like and how the macro expansionary policy affected the economy was analyzed. In this chapter, the model which is used for the paper in analyzing output real exchange rate, current account and price will be presented.

4.1 Real Exchange Rate

There are two types of effective exchange rate:- The nominal effective exchange rate (NEER) and real effective exchange rate (REER). Generally, two countries express their currencies one against another at a time; for instance, between the Birr and the US-dollar. This approach; however, becomes inadequate in a period when movements in the exchange rate of several countries occur simultaneously at frequent intervals [Kohmber, 1976].

After the break down of the Bretton-Woods monetary system, the exchange rate of many developed countries fluctuated. Under these circumstances, movements in the Ethiopian Birr against one currency do not adequately represent the change against all currencies. Hence, the effective exchange rate indices have been devised to measure the average change in the exchange rate of a country's currencies against all other currencies.

The concept of NEER for a given currency owes its origin to Hirsch and Higgins (1970). Several aspects of its manifestation were subsequently analyzed by many Scholars including Rhumburg (1973), Thakur (1975), Majejewsk (1983). It can be defined as a weighted average of a basket of currencies overtime.

The construction of the real exchange index incorporates both notion of nominal effective exchange rates and differences in inflation rate between countries. The real effective rate may not be used to measure the effect of undervaluation or overvaluation of currency; it rather shows how a country gain or loss in international price competitiveness between the country and the rest of the world (Kidane, 1994). In this study; however, the real effective exchange rate are considered as measure of overvaluation and undervaluation because of unavailability of data for price of tradables and non-tradables; and unclear demarkation among them.

The following formula is employed in measuring the real effective exchange rate.

$$REER_t = \frac{\sum_{i=1}^n \alpha_{it} E_{it} P_{it}}{P_{ht}} \dots \dots \dots (1)$$

Where:- REER_t = real effective exchange rate at period t.

- α_{it} = the trade share of country i at time t in total export and imports out of given countries.
- E_{it} = the bilateral nominal exchange rate of country i at time t against home country in terms of country i 's currency.
- P_{it} = price index of country i at time t .
- P_{ht} = price index of home country at time t .

In the process of the real exchange rate construction, eight countries were taken as major trading partner of the country (U.S.A. Japan, Germany, Italy, France, England, Belgium and Netherlands). They account for almost 80 percent of the country's export destination and import origin.

A problem was encountered in choosing the price index of foreign country for the sake of availability of competitive data such as wholesale price index, consumer price index, GDP deflator and wage index. A lot of scholars recommend that wholesale price index for the calculating the real exchange rate. The wholesale price index data does not avail for all the chosen country in the entire sample period. The consumer price index was used as a proxy for it in this study. Regarding to the home country, the consumer price index was considered as proxy of the non-tradable price though it only indicates and covers the movement of the price in Addis Ababa.

The bilateral exchange rate of the foreign countries (except U.S.A.) were calculated using the following formula:-

$$BNER_{it} = \frac{Y_{it}}{X_{it}} \dots \dots \dots (2)$$

where: -

$BNER_{it}$ = The bilateral nominal exchange rate of home country in terms of home currency against country i at time.

X_i = the bilateral nominal exchange rate of U.S. dollar against country i in terms of country currency at time t .

Y_i = the Bilateral nominal exchange rate of U.S. dollar in terms of Birr at time t .

For analyzing the effects of the devaluation on the real exchange rate, we employed two models such as the Edward's and Elbadawi's model though both of the models have the same premise.

4.1.1 Edward's Model

The fundamental assumption set up for the model are:-

1. The real exchange rate movement will respond to both real and monetary disturbance.
2. In the long-run equilibrium real exchange rate movements will depend on real variable only.
3. Inconsistency of expansionary macroeconomic policies will generate a situation of real exchange misalignment in the short-run.

4. Nominal devaluation will have a lasting effect~~s~~ on equilibrium real exchange misalignment and if they are under taken at a situation of real exchange rate mis-alignment; and, if they are accompanied by appropriate macro economic policy (Edwards, 1989).

Edwards defined the real equilibrium exchange rate in terms of economic fundamentals which result in the simultaneous attainment of internal and external equilibrium. According to him, the real economic fundamental include tariff, terms of trade, capital flows, government expenditure and fiscal debt, technological progress, credit rationing, price rigidity and unemployment.

Given the economic fundamentals the following equilibrium real exchange equation is proposed.

$$\log e_t^* = \alpha_1 + \alpha_2 \log^{TOT} + \alpha_3 \log^{GCGDP} + \alpha_4 \log^{open} + \alpha_5 \log^{technopr} + \alpha_6 KAFLOW + \alpha_7 others + U_t \dots (3)$$

13

where:-

- e^* = the equilibrium real exchange rate.
 TOT = external terms of trade.
 GCGDP = The ratio of government consumption on non-tradable to GDP.

Open = a measure of trade restrictions and exchange rate control.

Techpr = technical progress

KAFlow = Capital flow

Data for independent variable exist for TOT only. proxies are used for other. The growth rate of real GDP is used as measure of technical progress. The capital flow is proxied by the balance of the capital account in the balance of payment. The opens variable is proxied by the ratio of sum of export and import to GDP. The government consumption of real GDP is proxied by the ratio of the government expenditure to GDP.

The equilibrium real exchange rate in equation 3 can not be observable directly. To estimate the equilibrium real exchange rate the following dynamic equation can be introduced:-

$$\Delta \log e = \theta [\log e^* - \log e^{t-1}] + \lambda [Z_t - Z^*]$$

$$+ \phi [\log E^t - \log E^{t-1}] + \psi [PMER_t - PMPER_{t-1}] \dots (4)$$

Where:-
 e:- the actual real exchange rate which is calculated using equation 1.
 e* the equilibrium real exchange rate.
 Z_t an index of macro economic policies
 Z*_{t-1} the substantiable of macro economics policies
 E_t nominal exchange rate

PMRT_t the spread in the parallel markets for foreign exchange.

Equation 4 outlines that the changes in the real exchange are affected by the four factors.

- i) There will be the partial adjustments variable, which represent for real exchange rates to self correct. The closer the value θ to unity, the faster the real exchange adjusts towards its long-run equilibrium.
- ii) The second determinant of real movements is related to macro policies. When the long run macro policy become unsustainable in the long run, the real exchange rate will be appreciated.
- iii) The third and the main concern in this paper for determinant of the movement of RER is related to change in the nominal exchange rate. A nominal devaluation will have a positive effect on the real exchange rate on impact generating a short run depreciation.
- iv) The last element capture the increment in the premium of nominal exchange rate generates the real exchange appreciation.

It is essential to define the component of macro policy variables to estimate equation 4. Excess supply of domestic

credit (EXCRE)¹⁴ proxies as a measure of monetary policy. A ratio of fiscal deficit to lagged high powered money is incorporated as a measure of fiscal policy.

After substituting the above macro policy variable and equation 3 in equation 4, we obtain,

$$\begin{aligned} \Delta \log e^t = & \theta [\alpha_1 + \alpha_2 \log TOT + \alpha_3 \log GCGDP + \alpha_4 \log open \\ & + \alpha_5 \log Techpro + \alpha_6 Kapfolw - \log e_{t-1} + \lambda_1 EXCER + \lambda_2 FPV - \phi [\log E_t - \log E_{t-1}] \\ & + \psi (PMER - PMER_{t-1}) \end{aligned}$$

where:- All others variable as mentioned before

EXCRE = Excess credit

FPV = The ratio of fiscal deficit to the lagged high-power money

Rearranging equation 5 yield.

$$\begin{aligned} \log e^t = & \beta_0 + \beta_1 \log TOT + \beta_2 \log GCGDP + \beta_3 \log open + \beta_4 \log Tech \\ & pro + \beta_5 KapFLOW + \beta_6 EXCRE + \beta_7^{FPV} + \beta_8 \Delta \log E_t + \beta_9 \Delta PMRT + \\ & \beta_{10} \log e^{t-1} + U_t \dots \dots \dots (6) \end{aligned}$$

where:- $\beta_0 = \theta \alpha_1$, $\beta_1 = \theta \alpha_2$, $\beta_2 = \theta \alpha_3$, $\beta_3 = \theta \alpha_4$, $\beta_4 = \theta \alpha_5$, $\beta_5 = \theta \alpha_6$, $\beta_6 = \lambda_1$, $\beta_7 = \lambda_2$, $\beta_8 = -\phi$, $\beta_9 = \Psi$ and $\beta_{10} = 1 - \theta$

¹⁴ The excess supply of domestic credit can be defined as the difference between the growth rate of domestic credit and one year lagged growth rate of real GDP.

The expected sign and the implication of each variable will be explained as follows:-

The coefficient of B_1 is ambiguous. The terms of trade effects on RER operate through import and export price variations. If the world price of exports increase, the supply of foreign exchange also moves upwards under fixed exchange rate system. This increases supply of foreign exchange leads to an expansion in money supply and an increase in the general price level. This again makes the RER to appreciate. But a change in foreign price of imports may cause the demand curve for foreign exchange either to expand or shrink depending on the elasticity of demand. Consequently, the RER may depreciate or appreciate. In general however, a worsening of the terms of trade resulting from an increase in import price would raise the domestic price level. If domestic policies were not changed the real effective rate would tend to appreciate.

In the theoretical literature, an alternative way of examining the terms of trade effect on the RER is expressed in terms of income and substitution effects which depend on the source of the terms of trade relations. The income effect arise when RER depreciates/appreciates in response to a final rise in the relative price of exports. A decrease/increase in the relative price of exports tends to precipitate a decrease/increase in the real income of the economy. This in turn exerts a downward/upward pressure on the domestic demand for non-traded goods. The result of this is a fall/rise in

domestic price of non-traded goods and a depreciation/appreciation of real exchange.

In general, a fall in price of exports or a rise in the price of imports lowers disposable income, generating a higher excess supply of non-tradable, downward pressure of the price of non-tradable and; hence, a real depreciation. An increase/decrease in the price of imported goods relative to exported goods will stimulate a shift in domestic demand towards/away from non-traded goods and hence results in an increase/decrease in the domestic price of non-traded goods. This in turn leads to an appreciation/ depreciation of the real exchange rate.

A fall/rise in international terms of trade will tend to stimulate a depreciation/appreciation of RER where the income effect is stronger than the substitution effect. Conversely, where the price substitution effect is stronger than the income effect, a fall/rise in international terms of trade will tend to stimulate appreciation/depreciation of the RER.

The sign of B_2 is expected to be negative. When the government expenditure on non-tradable goods increases, i.e., the demand for non-tradable augments, then the price of non-tradable will increase. This will result in appreciation of the real exchange rate.

The general view in the literature is that trade liberalization characterized by the reductions of tariffs

and/or eliminations of quantitative restrictions will normally result in an equilibrium real depreciation. Import demand is expected to increase as the price of imports declines in line with lower tariffs or the removal of quantitative restriction generating a deficit. To restore external balance, the trade liberalization will need to be accompanied by an increase in the relative price of tradable or real depreciation; hence, the expected value of B_3 is positive.

David Ricardo (1821/1871) is considered to have been the first to postulate explicitly that, the existence of the negative relation between economic growth and the equilibrium relative price of tradable to non-tradable. Any type of productivity will have a positive income effect, generating positive demand pressure on the non-tradable markets. So the expected sign of B_4 is negative.

When we consider the effect of an exogenous capital inflow on the relative price of tradable and non-tradable goods, it allows expenditures to exceed income, generating an incipient excess demand for non-tradable. To restore equilibrium, the relative price of non-tradable has to rise; i.e, a real appreciation has to take place. Therefore, the sign of B_5 is expected to be negative.

In the equation where it will be fitted, the coefficient of the change in the parallel market spread expected be negative. It should be noted that this variable may capture the effect exchange control (i.e, trade and capital controls).

The estimated coefficient of nominal devaluation is expected to be positive. If this value approaches to one, nominal devaluation changes to real devaluation.

The estimated value of B_6 is expected to be negative since the excess credit will create excess demand for non-tradable and then the real exchange will be appreciated.

The coefficient of lagged RER are expected to be positive. Low value implies that the actual real exchange rate converge slowly towards its long-run equilibrium level in the absence of intervention.

4.1.2 Elbadawi Model

By following the definition of the real exchange rate which was given by Edwards, Elbadawi designed a model. According to him, the model at least should have three elements.

- it should specify the equilibrium real exchange rate as a forward looking function of the fundamentals.
- it should allow for flexible dynamic adjustment of the RER towards the equilibrium RER.
- it should allow for the influence of short to medium-run macro economic and exchange rate policy on the RER. (Elbadawi, 1994).

The following assumptions are the corner stone of his model:-

- i) The expenditure is divided into private and public where the public expenditure is assumed to be a policy variable.
- ii) Government expenditure on non-tradable is a fixed ratio to total government expenditure.
- iii) The ratio of private sector expenditure on non-tradable relative to private sector expenditure is endogenously determined as a function of the domestic price export.
- iv) The demand of non-tradable good is a function price of exports, imports and non-tradable.
- v) The supply of non-traded goods relative to GDP is also specified as a function of three aggregate.
- vi) The market of non-tradable clears itself.
- vii) The international prices of exportable and importable is given exogenously and a given set of exchange rate and commercial policies, the corresponding domestic price of export (P_x) and domestic price of import (P_m) are determined by foreign price of exports (P_x^*) and imports (P_m^*) respectively.

The linear version of the equation based on the above outlined assumptions and ideas are:-

$$\log^{et} = \pi_0 + \pi_1 \log^{TOT} + \pi_2 \log^{open} + \pi_3 \log(A/GDP) + \pi_4 \log(G.exp)$$

$$\pi_{5_{\log}} \left(\frac{Cur.G.expenditure}{G.expenditure} \right) + Et \dots \dots (7)$$

where:- A - Total absorption.
others variables as mentioned before.

Since the value of absorption is endogenous, he formulated the following equation.

$$\log(A/Y) = \gamma_0 + \gamma_1 \frac{(NK1)}{GDP} + \gamma_2 [\log^{et+1} - \log e_t] \dots (8)$$

$$\gamma > 0, \gamma < 0$$

where - NK1 Net capital flow

Substituting equation 8 into equation 7, it gives us.

$$\log e = \pi_0 + \pi_1 \log^{TOT} + \pi_2 \log^{open} + \pi_3 [Y_0 + Y_1 \left(\frac{NK1}{GDP} \right) + Y_2 (\log^{et+1} - \log e_t)] + \pi_4 \log \frac{G.exp}{GDP} + \pi_5 \left(\log \frac{Cur.exp.}{g.exper} \dots (9) \right)$$

rearranging equation 9, give us, the dynamic equation for the real exchange rate.

$$\log e_t - \lambda \log e_{t-1} = \delta_0 + \delta_1 \log^{TOT} + \delta_2 \log^{open} + \delta_3 \left(\frac{NK1}{GDP} \right) + \delta_4 \log \left(\frac{Cur.G.Expe.}{G.exp} \right)_t + \delta_5 \left(\frac{\log^{GExp}}{GDP} \right) \dots (10)$$

$$\text{where } - \lambda = \frac{Y_2 \pi_3}{1 + \pi_3 Y_2}, \delta_0 = \frac{\pi_0 + \pi_3 Y_2}{1 + \pi_3 Y_2}$$

$$\delta_1 = \frac{\pi_1}{1 + \pi_3 Y_2}, \delta_2 = \frac{\pi_2}{1 + \pi_3 Y_2}$$

$$\delta_3 = \frac{\pi_3 Y_1}{1 + \pi_3 Y_2}, \delta_4 = \frac{\pi_4}{1 + \pi_3 Y_2}$$

$$\delta_5 = \frac{\pi_5}{1 + \pi_3 Y_2}$$

$$\delta_1 = ?, \delta_2 > 0, \delta_3 < 0, \delta_4 < 0, \delta_5 < 0$$

Since the expected sign of the variable in equation 10 are quite similar to equation 4, it will not be discussed here.

The equilibrium real exchange is that value real exchange rate that satisfies equation 10. Solving the equation 10 by recursive substitution, for the sustainable value of the parameter in the equation gives us the cointegration relationship. If the cointegration condition is satisfied, the error-correction specification of the model can be presented as:-

$$\Delta \log^{ett1} = \alpha_0 \left(\frac{1}{1-\lambda} \right) [ECM] + \alpha_1 \Delta \log^{TOT}_{t+1} + \alpha_2 \Delta \log open_{tt1} + \alpha_3 \Delta \log$$

$$\Delta \left(\frac{NK1}{GDP} \right)_{t+1} + \alpha_4 \Delta \log \left(\frac{go.exp}{GDP} \right)_{t+1} + \alpha_5 \Delta \log$$

$$\left(\frac{Cur.G.exp}{G.exp} \right)_{t+1} + \alpha_6 \Delta \log E_{t+1} + \epsilon_{t+1} \dots \dots \dots (11)$$

where Δ - changes.

The coefficient of α_0 shows the speed of adjustment its values lays between 0 and 1. If it become one it significantly promote adjustment over just one period; however if the value is smaller, the adjustment period become so longer.

The expected coefficient from α_1 to α_6 would take the same sign as equation (9) and (10). α_7 shows the effect of devaluation on the value of real exchange rate. If we state at condition overvaluation, it has a power of leading the real exchange to its long run path [Edwards, 1989 and Elbadawi, 1992].

4.2 Price

The price level is defined as a geometric weight of the price of non-traded goods and traded goods. The country like Ethiopia that produces both tradable and non-tradable good and the exchange rate system consists of a dual rate regime in which an official pegged nominal exchange rate coexists with an illegal parallel markets for foreign exchange, the price of tradable can be given as:-

$$P_t = (P_t^T)^\theta (P^{NT_t})^{1-\theta}$$

$$0 < \theta < 1$$

where:- The θ measures the share of traded good in total expenditure.

P_t^{T15} - Price of tradable at time t.

P_t^{nt} - Price of non- tradable at time t.

Equation 12 could not be estimated in the study because of the non-availability of the data. We got convenient that for the existing data structure to estimate the price equation for tradable and non-tradable.

4.2.1 Tradable good

The price of tradable can be defined as the geometric average of foreign price of exports and price of imports.

$$P_T = P_{xt}^{*\lambda} P_{mt}^{*1-\lambda} \dots \dots \dots (13)$$

$$0 \leq \lambda \leq 1$$

where:- P_{xt}^* - foreign price of export at time t.
 P_{mt}^* - foreign price of import at time t.
 λ - the share of imports good in consumption.

¹⁵ In this study p_t is proxied by

$$\sum_i^n \alpha_{it} E_{it} P_{it}$$

where all variables have the same definition as that of equation 1.

Now let us define the home price of export and import.

$$P_x = e_{ot}^{1-\beta} e_{pt}^\beta [P_{xt}^*] (1-t_x) \dots 14$$

$$0 \leq \beta \leq 1$$

- where:- P_x - price of export in home market at time t.
- E_{ot} - the official exchange rate in terms of domestic currency per U.S. dollar at time t.
- E_{pt} - parallel exchange rate in terms of domestic currency per U.S. dollar at time t.
- t_{xt} - export tax at time t.
- β - share of the official exchange rate in determining the price of tradable.

The home price of import can be defined as:-

$$P_m = e_o^{1-\beta} e_b^\beta P_m^* (1+tm) \dots (15)$$

- where:- P_m = price of import in home at time t.
- t_{mt} = import tax at time t.

if we substitute equation 14 and 15 in equation 13, it yields.

$$P_T = [e_{ot}^{1-\beta} e_{pt}^\beta [P_{xt}^*] (1-t_x)]^{1-\lambda} [e_{ot}^{1-\beta} e_{pt}^\beta P_{mt} (1+tm)]^\lambda \dots (16)$$

Transforming equation 16 into log levels and rearranging it, gives us:-

$$\log P_T = \beta \log (E_{pt}/e_{eo}) + \lambda \log (P_x^*/P_m^*) + \lambda \log^{1-tx} +$$

$$(1-\lambda) \log^{1+tm} + \log^{Eo} + \log^{Pm^*} \dots (17)$$

hence for estimating purpose equation 17 could be written as:-

$$\log P_T = \alpha_0 + \alpha_1 \log \text{prem} + \alpha_2 \log^{\text{TOT}} + \alpha_3 \log^{\text{open}} + \alpha_4 \log E_o + \alpha_5 \log P_{*m} + E_t \dots (18)$$

where:-

$$\text{Prem} = e_p/e_o$$

$$\text{TOT} = P^*/P_m^*$$

$$\text{Openes} = \frac{\text{exporttimeport}}{\text{GDP}}$$

$$\alpha_0=0, \alpha_1>0, \alpha_2=?, \alpha_3<0, \alpha_4>0, \alpha_5>0$$

The above equation shows that the price of tradable depends on the four factors. These are:-

- i) foreign price of export
- ii) foreign price of import
- iii) exchange rate policy
- iv) trade policy.

4.2.2 Non tradable goods:-

The price of non tradable goods is determined by the supply and the demand condition of the home country concerned. The demand and the supply function of non tradable can have

different form. We take the following demand and supply function for non-tradable.¹⁶

$$D_N = f\left(P_X/P_{NT}, \frac{P_M}{P_{NT}}, Y, \pi\right) \dots \dots \dots (19)$$

$$S_N = f\left(P_X/P_{NT}, \frac{P_M}{P_{NT}}, Y\right) \dots \dots \dots (20)$$

where:-	D_N	-	Demand for non-tradable
	S_N	-	Supply for non-tradable
	P_x/P_{NT}	-	Price of non-tradable in terms of exports goods
	P_m/P_{NT}	-	Price of non-tradable in terms of imports goods
	Y	-	GDP
	π	-	A measure of excess aggregate demand which is proxied by EXCRE and the share of government expenditure in GDP in this study.

The linear version of equation 19 and 20 in log form:-

$$\log D_N = a_0 + a_1 \log P_x/P_{NT} + a_2 \log P_m/P_{NT} + a_3 \log SGTE + a_4 \log Y \dots \dots \dots (21)$$

$$\log S_N = \alpha_0 + \alpha_1 \log P_x/P_{NT} + \alpha_2 \log P_m/P_{NT} \dots \dots \dots (22)$$

where:- SGTE = Share of government total expenditure in GDP.

¹⁶ a similar demand and supply function was employed by Elbadwi (1989).

The Assumption of that the market of non tradable clears itself is considered. It eventually leads to that in static equilibrium equation 21 (Demand) equals to equation 22 (Supply).

$$D_N = S_N \dots\dots\dots(23)$$

In excess demand equation, equation 23 may be written as $D_N - S_N = 0$, the substitution of equation 21 and 22 in this equation give us.

$$0 = (a_0 - \alpha_0) + (a_1 \log^P_x - a_1 \log P_{NT}) + (a_2 \log P_M - a_2 \log P_{NT}) + a_3 \log SGTE + a_4 \log y - [(a_1 \log P_x - \alpha_1 \log P_{NT}) + \alpha_2 \log P_m - \alpha_2 \log P_{NT}] \dots\dots\dots(24)$$

Collecting the like terms and rearranging equation 24 gives.

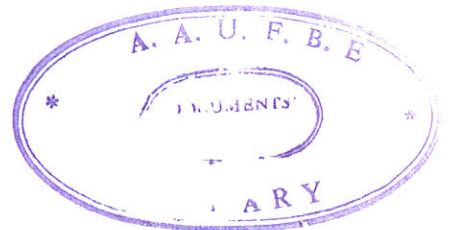
$$\log^{P_{NT}} = \theta_0 + \theta_1 \log^{P_x} + \theta_2 \log P_m + \theta_3 \log^{SGTE} + \theta_4 \log y \dots\dots(25)$$

$$\text{where: } \theta_0 = - \frac{a_0 - \alpha_0}{(a_1 + a_2) - (\alpha_1 + \alpha_2)}$$

$$\theta_2 = - \frac{a_2 - \alpha_2}{(a_1 + a_2) - (\alpha_1 + \alpha_2)}$$

$$\theta_3 = - \frac{a_3}{(a_1 + a_2) - (\alpha_1 + \alpha_2)}$$

$$\theta_1 = - \frac{a_1 - \alpha_1}{(a_1 + a_2) - (\alpha_1 + \alpha_2)}$$



$$\theta_4 = -\frac{a_4}{(a_1 + a_2) - (\alpha_1 + \alpha_2)}$$

The substitution of equation (14) and 15 in equation 25 and rearranging give us.

$$\log PNT_t = Y_0 + Y_1 \log E_t + Y_2 \log \text{prem} + Y_3 \log \text{TOT} + Y_4 \log \text{open} + Y_5 \log Y + Y_6 \log \text{SRGTE} + Y_7 \log P_m^* + E_t \dots \dots \dots (26)$$

$$Y_0=0, Y_1>0, Y_2>0, Y_3=?, Y_4<0, Y_5<0, Y_6 Y_7>0.$$

Equation 26 asserts that the price of non tradable is determined by exchange rate policy, foreign price, macro policy and the level of output.

4.3 Current account, and Trade balance

Devaluation may affect the current account and trade balance through two channels. The first channel by affecting absorption directly i.e. increasing expenditure for the home products may improve the trade balance. In the second case, devaluation may lead to a depreciation of the real exchange rate which augment and improve the competitiveness of tradable goods (Himrus, 1987).

4.3.1 Current account Model

The following model is applied to investigate the relation between the real exchange rate and the current account. The model was designed by Edwards [Edwards, 1989].

$$\left(\frac{CA}{y}\right)_t = \alpha_0 + \alpha_1 \log^{(Et-1)} + \alpha_2 EXCER + \alpha_3 FPV_{t-1} + \alpha_4 \log SGTE + \alpha_5 growth(t-1) \dots \dots \dots (27)$$

where:- (CA/y). The ratio of current account¹⁷ to GDP. others as defined earlier.

$$\alpha_1 > 0, \alpha_2 < 0, \alpha_3 < 0, \alpha_4 < 0, \alpha_5 = ?$$

4.3.2 Trade balance

The following model used to investigate the effect of devaluation in trade balance which is formulated as:-

$$TB = f(y, P_x, P_m, Y^*) \dots \dots \dots (28)$$

Where:-

TB= Trade balance

Y^{*18}=GDP of the rest of the world

others variable as defined earlier

¹⁷The definition of IMF for current account was applied for this study which states that it equals the trade balance plus the balance on service, income, private unrequited transfers not included elsewhere.

¹⁸The rest of world GDP was proxied in this study by the following value:-

$$Y = \sum_i^n B_i Y_i$$

Where:- B_i =the share of country i in total trade of the country.

Yⁱ =GDP of country i in terms of Birr.

and eight countries which were selected for construction of real exchange rate used for this calculation.

The trade balance depends on the income, and domestic price of imports and exports. The effect of income on trade balance is ambiguous which depends on the extent it affects the level of import and exports. When the elasticity of income with respect demand for import is greater than that of the supply for exports, it bears the negative sign. Whereas in the converse case, it shows positive sign. The foreign income through increasing the demand for exports may improve the trade balance. The increment of the price of exports is expected to augment the level of export then improves the trade balance. The converse holds true for imports.

The linear form of equation 27 could be written as:-

$$T\beta = \beta_0 + \beta_1 \log^{PX} + \beta_2 \log^{PM} + \dots \dots \dots (29)$$

$$\beta_3 \log y + \beta_4 \log y^*$$

Substituting equation (14) and (15) in to equation 29, it gives us:-

$$T\beta = Y_0 + Y_1 \log E_0 + Y_2 \log^{prem} + Y_3 \log opens + Y_4^{TOT} + Y_5^{Pm^*} + Y_6 \log y$$

$$+ Y_7 \log y^* + E_t \dots \dots \dots (30)$$

where $Y_1 > 0$, $Y_2 < 0$, $Y_3 > 0$, $Y_4 = ?$, $Y_5 < 0$, $Y_6 = ?$ and $Y_7 > 0$

4.4 Output Model

To know the effects of devaluation on output, the following assumption are considered. In a small country that produces exportable, importable and non-tradable goods, capital stock is sector specific and the world prices of exports don't change. With these give assumption Edward (1989), at state of equilibrium, established the following model.

$$\log y = \beta_0 \text{time} + \beta_1 \text{MS}_{t,i} + \beta_2 \log \text{TOT}_{t,i} + \beta_3 \log \text{SRGtE} + \beta_4 \log \text{Et-i} + U_t \dots \dots \dots (31)$$

where - Y - real GDP
 Time - the trend of time
 M_s - Money Supply (broadly) defined.
 - other as defined before.

The expected sign of B₀ is positive since, with time, technology developed and productivity improves; and therefore, they generate positive growth.

The expected sign of β_1 is to be positive since increase in money supply decreases the rate of interest, encouraging investment. Output, thus, expands. This coefficient captures how monetary policy holds effective in affecting the real variable.

The expected sign on β_2 is also positive since it is clear that worsening of the terms of trade (i.e. reduction in TOT) will result in real GDP reduction. This implies an extra amount of export is necessary to maintain the previous amounts of imports if the terms of trade become worsen.

Coefficient of β_3 measures the roles of fiscal policy and according to the model, it is expected that it will bear a positive sign.

The main interest of this analysis lies in the coefficients of the exchange rate which β_4 measures. If devaluations are contractionary (i.e. decreasing real output, it is stressed that the value of β_4 should be significantly negative. If, however, devaluation is expansionary (i.e. increasing real output). The sign should be positive and statistically significant.

CHAPTER 5

Implementation of the model and empirical results.

In the foregoing chapter the model, the variable used and its proxy was analyzed. In this chapter, the method of estimation and its result will be presented.

5.1 Method of estimation and test

All macro variables which employed for estimation found to be non-stationary.¹⁹ The test has been performed using Dickey fuller (DF) and "Augmented" Dickey -Fuller (ADF) technique.²⁰

The Dickey -Fuller recast the test in the following form.

$$\Delta Y_t = pY_{t-1} + E_t \dots \dots \dots (32)$$

where we test the significance of P against the null $P = 0$. The test reject the null in favour $p = 0$ Which means the series is stationary [Adam, 1992].

¹⁹1. The data are non-stationary when the mean and the variance of the variable is not constant. It is dependant of time whereas, it the variable mean and variance is independent of time, it is stationary.

²⁰2. The test result for stationary appeared in appendix 3.

The ADF test is identical to the standard DF test but is constructed with a regression model of the form.

$$\Delta Y_t = \rho Y_{t-1} + \sum_j^n K_j \Delta Y_{t-j} + \varepsilon \text{-----} (33)$$

When the data are non-stationary, if we simply apply the ordinary least square method, the result would be spurious and inconsistent.

The power of cointegration is thus allows us to capture the equilibrium relationship between non-stationary model. It is therefore a method of avoiding both spurious and inconsistent regression problems which otherwise occurs with regression of non-stationary data series. It thus permits the combination of the long run and short information that occurs from attempting to address non stationary through differencing [Adam, 1992].

The test of cointegration can be performed using the DF and ADF which tests either the residual of the long run equation is stationary or not. When the residual found to be stationary, the variables said to be cointegrated.

When the cointegration is valid, the Error Correction Model (ECM) (Granger and Engle, 1987) can be employed which has got wide acceptance for estimating time series data. It has a form

$$\Delta Y_t = B_0 + B_1 X_t + B_2 (Y_t - \gamma X_t)_{t-1} + \varepsilon \dots \dots \dots (34)$$

where X a vector of variable

B_1 is a vectors of coefficient of the dynamic model.

Y - is a vectors of coefficients of the long run model.

B_2 is the proportion of past period's disequilibrium adjustment.

These methods of estimation were applied for all models used in the paper.

The test of fit of regression has been performed using R^2 and \bar{R}^2 which test that with a null of the coefficients of all variables in the model are zero.

The diagnostic test of serial correlation was performed using God Frely test for high order residual serial correlation with a null of serial correlation. To test the functional form, we applied Ramsey's test with a null of no functional form from mis- specification problem. To test normality, the Jarque - Berais test was used with a null of no problem of normality. The heteroscedasticity test was performed based on the regression of squared residual on square fitted values with a null of homoscedasticity of the error term.

The cumsumsq (the cumulative sum of residual) which was proposed Brown, Durbin and Evan (1975) was used as test for the overall model stability.²¹ The estimated models in the study found stable.

The recursive least square estimation method was used in the paper to test each coefficient stability²² and efficiency.²³

5.2 The Estimated Model and its results.

5.2.1 The Real Exchange Rate

Elbadawi's and Edward's real exchange model was estimated to investigate the impact of the nominal exchange rate on real exchange rate. First, we will present the result found in estimating equation 11.

²¹In this test under the null the plot should lie along a 45° ray from the origin. Time correlation of residual and structural breaks will exhibit the deviation from the smooth line.

²²The stability of the coefficient clearly under the null the plot will be perfectly horizontal. To accept the null it is necessary that all values of the coefficient lie within the narrowest band formed by standard error.

²³The efficiency of estimate is seen by rapid contraction of the standard-error.

Table 5-1

Estimation Results from the regression of equation 10 and 11
for the period 1964-1995.

The dependant variable is the real exchange rate.

Explanatory variable	Long run model ⁷	Dynamic Model ⁵
logToT	-0.60399 ⁴ (-2.5974)	-0.28922 ⁴ (-2.7374)
logopen	0.024387 ¹ . (0.16525)	-0.12772 ² (-0.221)
log(NkI/GDP)	-0.090639 ³ (-1.8090)	0.0413630 ³ (2.9152)
logSRGTE	- 0.48020 ⁴ (-3.6097)	-0.18159 ¹ (-1.2029)
logDCGDP	2.3641 (1.6764) ¹	0.351312 ² (1.67012)
ECM		0.62242 ⁴ (3.3395)
DD		0.45391 ⁴ (3.3895)
constant	2.3661 ² (1.6764)	
	<u>Unit root test⁶</u>	
DF without trend	-4.0613 (2.9591)	
ADF " "	-1.3577 (-2.9627)	
DF with " "	-4.0274 (-3.5615)	
ADF without " "	-1.1494 (-3.5671)	
R ²	0.39	0.85
\bar{R}^2	0.30	0.80
F-Statistic	F(5,26)=4.2746	F(7,23)=22.08
D.W.	1.51	
Serial Correlation	$\chi^2(1)=3.1418$	$\chi^2(1)=0.0084998$
Functional form	$\chi^2(1)=3.6023$	$\chi^2(1)=1.9210$
Normality	$\chi^2(2)=7.7076$	$\chi^2(2)=0.030377$
Heteroscedasticity	$\chi^2(1)=.13470$	$\chi^2(1)=0.44860$

1. significant at less than 10 percent
2. significant at 10 percent
3. significant at 5 percent
4. significant at 1 percent.
5. all variables except ecm are in their first difference.
6. figures in brackets are critical value.
7. the value in brackets indicate t-ratio.

The individual variable for equation (11) were found to be non-stationary. Since the series are non stationary, the

conintegration tests was carried out. As seen in table 5-1, there exist a conintegration relationship among them.

All the variables except opens are significant at conventional level. The negative sign accompany the external terms of trade is consistent with the real exchange theory in the Ethiopian Economy, the income effects of a change in the external terms of trade dominates the substitution effect. It is statistically significant at the conventional levels.

Capital flow holds the expected sign as suggested by Dutch disease theories and real exchange rate theory. The increment of foreign aid results in real appreciation.

Government consumptions bears the correct sign and it is statistically significant. The increment of government expenditure leads to the real apperception. 10 percent increment in government expenditure has the impact of 5 percent real appreciation.

The opens shows the expected sign though it is not statistically significant at the conventional levels. When the country tumbles down exchange and trade control , the efficiency increase and the economy become more competitive in the world markets. The real exchange rate depreciates with the increased openness.

The short run dynamic econometric results of the equation 11 are shown in table 5-1. It indicated that external terms

of trade, capital flow and devaluation are the variable which are statistically significant at the conventional levels.

The short run impact of the flow of capital in the real exchange apperception is higher than that of the long run. This also holds true for the case of government consumption and terms of trade.

The macro economic policy variable which is proxied by the ratio of domestic credit to GDP bears the expected sign and significant at 10% level. It implies that expansionary macro economic policy tends to generate upward pressure on the aggregate demand hence the price of non-tradable increases. This will eventually result in real appreciation.

The main interest of the paper and particularly this model lays on testing the effectiveness of devaluation in generating real depreciation. The result indicated that the nominal devaluation variable which is proxied by dummy variable for the period of devaluation shows a positive sign, it could generate a real depreciation. 10 percent devaluation of the nominal exchange rates leads to 4.5 percent depreciation of the real exchange rate. This validates the view that when the initial condition of the economy at the real exchange apperception, nominal devaluation could accelerate the process of convergence towards its equilibrium.

The error correction coefficients reflects the dynamics of the self-correcting mechanism of the error correction model.

If the fundamentals in pervious years show a value less than equilibrium, the real exchange rate will depreciate in the following period since the coefficient is positive. The estimated value is about 0.62 which is less than that of chile (0.78), Ghana and india (0.67). [Elebadawi, 1994]

The Edward's real exchange model which report at table (5-2). The variables that are significant at the conventional levels are the lagged term of the real exchange rate, the dummy variable for devaluation and the government consumption. The remaining variables are statistically insignificant however, they hold the expected sign.

Table 5-2

Estimation results from the regression of equation 6
for the period 1964 -95.

The dependant variable is the real exchange rate

Explanatory Variable	Long -run ⁶
loget-1	0.122991 ¹ (0.74898)
log SRGTE	-0.344000 ⁴ (-3.88931)
logKapFlow	-0.0130555 (-0.36671) ¹
logtot	-0.035521 (-0.11626) ¹
EXCRE	-0.22294 (0.77697) ¹
DD	0.65176 ⁴ (5.91)
constant	-0.0784341 ¹ (-0.62410)
DF without trend	Unit root test ⁵ -5.4293(-2.9605)
ADF " "	-3.2208(-2.9706)
DF with " "	-5.3273(-3.5731)
ADF " "	-3.1573(-3-5796)
R ²	0.83
\bar{R}^2	0.74
F-Statistics	F(6,24)=19.33
D.W.	-0.5297
Serial Correlation	$\chi^2(1)=0.24494$
Functional Form	" =3.1958
Normality	$\chi^2(2)=3.5763$
Heteroscedasticity	$\chi^2(1)=3.6194$

1. significant at less than 10 percent
2. significant at 10 percent
3. significant at 5 percent
4. significant at 1 percent.
5. figures in brackets are critical value.
6. the value in brackets indicate t-ratio.

The model has a good power in explaining that the change in the real exchange variable is due to the fundamentals. The diagnostic test depicted that no problem in serial correlation, functional form and normality ; nevertheless, it is not free

from heteroscedasticity. White heteroscedasticity adjustment mechanism employed to mitigate the problem faced.

The nominal devaluation in this model also holds a positive sign and is significant at 1 percent level. It could generate a real depreciation if other things hold constant. 10 percent devaluation in nominal exchange in the current periods brings about 6.5 percent real depreciation.

The one year lag of real exchange variable is statistically significant and holds the expected sign. It asserts that the pervious period appreciation(depreciation) call for depreciation (appreciation) in the coming period.

The Elebadawi's real exchange model was selected to calculate the equilibrium real exchange values since most of the explanatory variable holds significant. It requires the permanent value of the fundamental. A three year moving average method adopted in getting the permeant value of the fundamentals. The permanent value was substituted in equation 10 and we got the following equilibrium value of the real exchange rate for each period.

Table 5-3

The equilibrium real exchange rate

Year	real value	equilibrium value	rate of Misalignment ²⁴
1964	1.52	-	
1965	1.55	2.29	0.49
1966	1.51	2.48	0.64
1967	1.45	2.55	0.76
1968	1.70	3.00	0.77
1969	1.67	2.72	0.63
1970	1.57	2.75	0.76
1971	1.54	2.53	0.65
1972	1.72	2.52	0.47
1973	1.52	2.55	0.68
1974	1.33	2.32	0.75
1975	1.44	1.94	0.35
1976	1.38	1.47	0.07
1977	1.21	1.29	0.06
1978	1.07	1.27	0.19
1979	1.05	1.35	0.29
1980	1.06	1.47	0.39
1981	1.09	1.55	0.43
1982	1.09	1.54	0.42
1983	0.97	1.44	0.48
1984	1.03	1.46	0.41
1985	0.91	1.11	0.23
1986	1.07	1.19	0.12
1987	1.17	1.08	0.07
1988	1.07	1.42	0.32
1989	1.09	1.47	0.35
1990	1.11	1.78	0.60
1991	0.93	2.29	1.48
1992	2.23	2.59	0.16
1993	1.65	2.34	0.4
1994	2.33	2.35	0.0
1995	2.37		

Source (calculated from the estimated equation)*

The rate of misalignment after the devaluation decreased significantly. The last three years average of the misalignment after devaluation was about 0.19, however, the

²⁴The rate of mis-alignment was calculated using the following formulae:-

$$\text{Rate of mis-alignment} = (e^* - e)/e$$

where : e^* equilibrium real exchange rate value
 e actual; real exchange rate value.

preceding years was 0.81. It clearly confirms that devaluation moves real exchange rate towards to its equilibrium levels.

5.2.2. Price

As explained in the previous chapter, the effect of devaluation on price was carried out at dis-aggregate levels, i.e the price of non tradable and tradable.

Equation 18 was estimated for the case of tradable goods. The variables used in the model are non-stationary. The test of conitgration assured that the variables have the long run relationship which permit us to estimate the model at their levels. (See Table 5-4)

The long run model holds significant at the conventional level. The diagnostic test indicate the model is free from mis-specification, non-normality and heteroscedasticity. The problem of serial correlation was solved using coehrn-orcutt method.

The explanatory variable in the models bears the expected sign and statistically significant at 1 percent levels.

The increment of the nominal exchange rate i.e. devaluation generates the increment of the price of tradable as expected.

Table 5.4

Estimation results from the regression equation 18
for the period 1964 - 1995.
The dependant variable is the price of tradable.

Explanatory Variable	long run ⁷ (statistic)	Short run ⁵
logopen	-0.16760 (2.1862) ³	0.12099 (-1.5265)
logtot	0.0024101 (.021312) ¹	0.098901 (.93277) ¹
logE	1.4269 (14.269) ⁴	1.2224 (6.6025) ⁴
logprem	0.28067 (2.6923) ⁴	0.13441 (.89629) ¹
logp _m *	0.58471 (9.885) ⁴	0.21248 (1.0452) ¹
constant	0.13290 ¹ (.16501)	0.030653 (1.4690) ¹
ECM		-0.56354 (-2.8103) ⁴
DF without trend	Unit root test ⁶ -3.9970 (-2.5951)	
ADF " "	-3.9292 (-2.9627)	
DF with " "	-3.9819 (-3.5615)	
ADF " "	-3.912 (-3.1671)	
R ²	0.98	0.84
\bar{R}^2	0.96	0.80
F-Statistic	F(5, 26) = 29.1.5	F(6, 24) = 20.99
D.W	1.46	2.22
Serial Correlation	x ² (1) = 2.1726	x ² (1) = 1.8109
Function form	" (1) = 0.032894	" (1) = 0.041048
Normality	" (1) = 2.6086	" (2) = 16.655
Heteroscedasticity	" (1) = 2.2716	" (1) = 0.19859

1. significant at less than 10 percent
2. significant at 10 percent
3. significant at 5 percent
4. significant at 1 percent.
5. all variables except ecm are in their first difference.
6. figures in brackets are critical value.
7. the value in brackets indicate t-ratio.

The explanatory variable which represent openness bears a negative sign as expected. Trade liberalization and minimizing exchange control have a paramount importance in reducing the price of the tradable good in the economy.

The terms of trade effect shows a positive sign. The improvement of the external terms of trade has the consequence of soaring the price of the tradable goods in the Ethiopian economy.

The coefficient of premium holds a positive sign. It implies that intensity of foreign exchange control and expansionary macro policy contribute for the increment of premium at the considerable degree. It eventually leads to price increment of the tradable goods.

The variable which stands for foreign price of imported goods holds positive sign. It is also statistically significant. This result confirms that the domestic inflation could be also explained by the word inflation.

The dynamic model which is represented by the ECM passed the test for overall significance. It does not show any problem in the diagnostic test.

The coefficients of all variable except the nominal exchange rate are not statistically significant; nevertheless, they hold the expected sign.

The dynamic result confirms that the effect of devaluation in increasing the price of tradable is short run is not as much as that of the long run.

The adjustment coefficient is also statistically significant. It implies that 56 percent of the previous disequilibrium from the price of tradable is corrected per annum.

Equation (26) was estimated to investigate the effect of devaluation on non tradable. The price of non tradable is proxied by the consumer price index (CPI). The variables like others in the models are non stationary. Tests of cointegration indicate the variables have long run relationships (see table 4.5).

The model's powers of explaining the change in the dependent variable is somewhat high. The diagnostic tests show the model was not tied with any problem except functional form.

The variable for opens has a negative sign and is statistically significant. Free trade as classical international economics argues accelerates the growth and efficiency of the economy. It eventually leads to the increase in the supply of non tradable which generates a decline in the price of tradable.

Table 5-5
Estimation results from the regression of the equation 26
page for the period of 1964-95.
The dependant variable is price of non-tradable.

Explanatory Variable	long run ⁷	short run (dynamic) ⁵
logopen	-0.35433 ⁴ (-5.5082)	-0.15196 ² (-1.8191)
logtot	0.2171 ³ (2.2460)	0.13006 ² (1.6638)
logE	0.43148 ⁴ (4.9444)	0.066558 ¹ (0.46272)
logprem	-0.11085 ¹ (-1.1461)	-0.087149 ¹ (-0.89074)
logp _m *	0.51345 ⁴ (6.4505)	0.19858 ¹ (1.4553)
logSRGTE	0.68193 ⁴ (5.7522)	0.17868 ² (1.539)
logY	-0.007884 ¹ -(0.03498)	-0.63582 ¹ (-1.5105)
constant	0.78161 ¹ (0.35813)	0.059805 ⁴ (2.818)
ECM		-0.70730 ⁴ (-3.8394)
DF without trend	Unit root test ⁶ -6.988 (-2.9595)	
ADF " "	-5.3075 (-2.9627)	
DF with " "	-6.6113 (-3.5615)	
ADF " "	-5.3953 (03.5671)	
R ²	0.99	0.65
\bar{R}^2	0.985	0.54
F-Statistic	F(7, 25)=300.7847	F(8, 23)=5.15
B - W	2.28	2.08
Serial Correlation	$\chi^2(1)=1.3416$	$\chi^2(1)=0.3498$
functional form	$\chi^2(1)=2.3877$	" (1) =0.42928
Normality	$\chi^2(2)=0.5977$	" (2) =0.24838
heteroscedasticity	$\chi^2(1)=0.0092006$	" (1) =0.37335

1. significant at less than 10 percent
2. significant at 10 percent
3. significant at 5 percent
4. significant at 1 percent.
5. all variables except ecm are in their first difference.
6. figures in brackets are critical value.
7. the value in brackets indicate t-ratio.

The main concern in estimating this model lays on knowing the effect nominal devaluation on the price of non tradable. The estimated model confirms that the nominal exchange rate holds a positive sign and is statistical significant. Ten percent change in the nominal exchange rate produce 4.3 percent change in the price of non tradable. The probable channel that devaluation affects the price of non-tradable in the economy may be outlined as:- 1. When the price of tradable starts to increase because of devaluation as explained previously, the society continue to substitute non tradable goods for tradable. It eventually leads to the increment of the price of non-tradable. 2.The other channel is that devaluation may augment the working capital and wage in the economy, it makes the supply curve to shift upward and increases the price of non-tradable.

The foreign price of importable good is also statistical significant and has a power of influencing the price of non-tradable goods in home. The Ethiopian Economy, like other developing countries, employs the imported input at considerable degree in the production process. So in effect, the increment of it contribute for the inflation in the country. 10 percent increase in the price of imported good has a result of 5.1 percent increase in price of non-tradable.

The other main variable which influence the price of non-tradable is the macro policy variable which is proxied by the ratio of the government expenditure to the real GDP. The sign of it is positive and statistically significant. It

confirms that fiscal policy has considerable power in changing the price of non-tradable. The effect of the change in real GDP bears the negative sign. It implies that the supply effects dominates the demand even though it is significant 10 percent level.

The short run dynamic models confirms no problem in overall significance of the coefficient. The diagnostic test does not show the problem of serial correlation, heteroscedasticity, mis-specification.

The variables in the models are not statistical significant except the premium and the adjustment mechanism variable. Hence, it confirms that devaluation does not generate inflation in short run.

The coefficient on ECM gives the levels 73 percent of adjustment in any pervious disequilibrium from the long run equilibrium relationship per unit period of analysis.

5.2.3. Current account and Trade balance

The effect of devaluation on foreign sector in the study analyzed through estimating the model for current account and trade balance.



5.2.3.1 Current account

The Edward's model was estimated for Ethiopian case to investigate the effects of devaluation on current account.

The F-Statistics test shows that the coefficient of the whole variables have a value different from zero jointly. The diagnostic test does not give any sign of serial correlation mis-specification and heteroscedasticity. The Test for the conitigration confirms that the variable in the model have long run relation. (See Table 5 - 6).

The model almost collapsed to give the expected sign and to be significant at the conventional levels.

Table 5 - 6
Estimation results from the regression of equation 27
for the period 1964-95.
The dependant variable is the current account

Explanatory variable	Long-run ⁶
logE _{t-1}	0.026046 ⁴ (2.6894)
EXCRE	0.10734 ⁴ (3.6506)
logsgte	-0.0086292 ¹ (-0.98381)
logtot(-1)	0.0004611 ¹ (0.042924)
logfpv	-0.0068774 ¹ (-0.34890)
constant	-0.057349 ¹ (-1.0089)
	<u>Unit root test⁵</u>
DF without trend	-4.5629(-2.9665)
ADF without trend	-2.7863(-2.9706)
DF with trend	-4.4792(-3.5731)
ADF with trend	-2.7115(-3.5796)
R ²	0.51
\bar{R}^2	0.41
F-Statistic	F(5,26) = 5.02
D - W	1.81
Serial correlation	$\chi^2(1) = 0.22430$
functional form	$\chi^2(1) = 0.36840$
Normality	$\chi^2(1) = 2.0911$
heteroscedasticity	$\chi^2(1) = 1.4695$

1. significant at less than 10 percent
2. significant at 10 percent
3. significant at 5 percent
4. significant at 1 perce.
5. figures in brackets are critical value.
6. the value in brackets indicate t-ratio.

The one year lagged nominal exchange rate bears positive sign and statistically significant at the conventional level. It implies that devaluation could improve the current account. An attempt was made to analyze through which channel the improvement the current account was realized. The estimated equation trade balance equation exhibits that devaluation make to decline the other component of current account is public

transfers. The volume of the public transfer shows accelerating growth rate since the devaluation took place because the multilateral and bilateral aid for the country has increased after the starting of structural adjustment programme.

The coefficient of the excess credit shows a surprising result. It bears a wrong sign and statistically significant. It contradicts with the monetary theory of the balance of payment which says that the expansionary monetary policy resulted in depleting the country's foreign reserve.

The short dynamic model was not estimated because most of the long run coefficient found to be statistically insignificant.

5.2.3.2 Trade balance

The trade balance model which was explained in equation 30 was estimated. The variable in the model like other are non-stationary. The cointegration test indicates that they have long run relationship. (see Table 5-7)

Table 5-7
Estimation results from the regression of equation 30
for the period 1964-95.
The dependant variable is the trade balance

explanatory variable	long run ⁷	short run ⁵
logE	-5271.1 ⁴ (-4.0582)	-4083.9 ⁴ (3.2211)
logprem	-431.6002 ³ (1.9072)	-560.1879 ³ (-2.3823)
logp _m *	-667.6198 ⁴ (.2.7951)	-1068.9 ⁴ (-3.2162)
logp _x *	233.3127 ¹ (1.2256)	364.9553 ³ (1.9242)
logy*	1105.3 ⁴ (7.5180)	664.2172 ⁴ (2.7649)
logy	-2723.11 ⁴ (-4.6428)	-4022.0 ⁴ (-3.6211)
logopen	410.6733 ² (2.0710)	364.6226 ³ (2.88991)
constant	22092.1 ⁴ (3.7533)	86.6201 ² (1.4696)
ECM		-0.9001 ⁴ (-5.1836)
	<u>Unit root test⁶</u>	
DF without trend	-4.582 (-2.9798)	
ADF " "	-3.2140 (-2.9850)	
DF with trend	-4.7909 (-3.5943)	
ADF " "	-3.2779 (-3.6027)	
R ²	0.92	0.85
\bar{R}^2	0.90	0.78
F-Statistic	F(7, 25) = 33.1498	F(8, 23) = 12.06
D.W	1.89	1.93
Serial correlation	$\chi^2(1) = 0.0018579$	$\chi^2(1) = 0.18837$
functional form	" (1) = 7.6154	" (1) = 4.2304
Normality	" (2) = 0.59968	" (2) = 0.95621
heteroscedasticity	" (1) = 4.9930	" (1) = 0.0003891

1. significant at less than 10 percent
2. significant at 10 percent
3. significant at 5 percent
4. significant at 1 percent.
5. all variables except ecm are in their first difference.
6. figures in brackets are critical value.
7. the value in brackets indicate t-ratio.

The long run models shows that the join test of the all coefficients have zero value rejected at the conventional level. The model is not tied with serial correlation and mis-

specification. We solved a problem of heteroscedasticity using White heteroscedasticity approach.

All the variables in the models are significant enough except the world price of export.

The nominal exchange rate which we are more concerned shows a negative sign and statistically significant. The implication that devaluation worsen the trade balance in the Ethiopian case which is contrary to the economic theory and the government rational for devaluation. The possible justification for the result may be the increment of import due to the policy change in foreign exchange allocation and the availability of foreign exchange because of to the aid flow; and the liberalization of trade that lowers the import tax. The import value²⁵ and export value²⁶ function was estimated for

²⁵The import value function take the following forum
 $m=f(p^m, Y, X)$

where m- import value in birr

p_m - price of import in domestic price

X - Value of exports

Y - real GDP

in question form, we put

$$\log M = \alpha_0 + \alpha_1 \log P_m + \alpha_2 \log Y + \alpha_3 \log X$$

after substituting the value P_m in above equation it become

$$\log M = b_0 + b_1 \log E + b_2 \log p^{rem} + b_3 \log^{open} + B_4 \log^Y + B_5 \log X_{t-1} + B_6 \log p^{m*}$$

where:- The notation of variable as explained before.

the result of this equation appear in appendix (1)

searching the reason why trade balance relates negatively with devaluation. The estimated equation confirms that the elasticity of nominal exchange with import value is positive and greater than that of export.

The variable of exchange premium bears a negative sign and statistically significant at the conventional levels. The increment of the premium encourages exporter to participate in smuggling the exports to reap the difference. It also has a positive impact in the demand for importable good in the official channels. when it declines, it diverts the illegal export to official channel and relatively decreases imports. It eventually leads to the improvement in the trade balance.

The variable for international price of import shows the correct sign and statistically significant. The increment of it demand more foreign currency to import the same quantity of imports. Most of the imports commodity which are categorized in the group of necessity i.e petroleum, medicine, fertilize etc. The elasticity of demand for such good is inelastic (see appendix 1 and 2).

²⁶ The export value function assumed to be depend on the value of production and domestic price of export hence it take the form of

$$x = f(y, P_x)$$

where - x - value of exports in Birr.

y - real GDP.

P_x - domestic price of exports

in question form

$$\log x = d_0 + d_1 \log y + d_2 \log p_x$$

After substituting the value for p_x in above equation, it become

$$\log x = a_0 + a_1 \log p_x + a_2 \log E + a_3 \log Y + a_4 \log \text{prem} + a_5 \log \text{open}.$$

Where:- the notation of the variables as explained before.

The variable for world GDP shows a positive sign implies that trade balance and world GDP have direct relationship. The transmission mechanism may take the following form. The growth of foreign income could increase the demand for their imports (It results in the rise of export the country in question).

The home GDP bears a negative sign and statistically significant. It confirms that the growth of the GDP has a greater impact in increasing import than export.

The openness has been found with positive sign and statistically significant at the conventional levels. It improves the trade balance through directing the illegal exports to official channel and making the economy more efficient due to the fact that the country faced competition with the rest of the world.

The short run dynamic model also does not show any problem in overall test. The diagnostic test confirms that the model is free from the problem serial correlation heteroscedasticity but tied with the mis- specification.

The sign and the levels of significant of the coefficient on the error correction term (ECM) confirmed that the existence of adjustment towards long-run equilibrium. Almost 90 percent of the pervious disequilibrium from the long -run is corrected per year. all the included variable except premium and world price of export give the short run impact effect on trade balance.

5.2.4 Output

The model described in equation 31 was estimated. Different lag length for nominal exchange rate was introduced despite the fact that the one year lag got statistically significant. The unit root test confirms that the long run relationship among the variable holds valid (see Table 5.8).

The fitted model shows good fit statistically. It does not have the problem of heteroscedasticity, normality and functional form. The problem of serial correlation was detected which was adjusted using the cohrence orcutt method.

The time trend variable was drooped which was supposed to measure the technological progress since it did not bear the assumed sign and statistically insignificant.

The one year lag monetary variable indicates that the monetary policy holds effective in changing the level of output though the rate is very low. It shows positive sign and statistically significant at the conventional level. 10 percent increase in M_2 could generates 1.3 percent growth in GDP.

The terms of trade and government expenditure show the expected sign; however, they are not statistical significant.

Table 5-8
Estimation results from the regression of equation 31
the period 1964-95.
The dependant variable is real GDP.

explanatory variable	long run (statist.) ⁷	Short run ⁵ (dynamic)
logM ₂ (-1)	0.13645 ⁴ (3.1352)	0.0452 ³ (2.7090)
logtot	-0.015744 ¹ (-0.53194)	0.036780 ¹ (0.96496)
logsrgte	-0.013659 ¹ (-1.21317)	-0.073860 ² (-1.2335)
logE	0.07485 ² (1.8195)	0.052092 ¹ (1.09595)
constant	8.1143 ⁴ (21.9615)	0.045200 ³ (2.7020)
ECM		0.56330 ⁴ (2.5762)
DF without trend ADF " "	Unit root test ⁶ -2.8940 (-2.9627) -3.8672 (-2.9665)	
DF with trend ADF " "	-2.8419 (-3.1567) -3.8254 (-3.573)	
R ²	0.97	0.39
R ²	0.96	0.27
D.W	1.62	1.31
F-Statistic	F(4, 27) = 128.4453	F(5, 25) = 3.1372
Serial correlation	x ² (1) = 12.7739	x ² (1) = 4.8379
functional form	x ² (1) = 8.6157	x ² (1) = 1.7298
normality	x ² (2) = 6.8943	x ² (2) = 25.1661
HeteroScedasticity	x ² (1) = 1.5743	x ² (1) = 0.61939

1. significant at less than 10 percent
2. significant at 10 percent
3. significant at 5 percent
4. significant at 1 percent
5. all variables except ecm are in their first difference.
6. figures in brackets are critical value.
7. the value in brackets indicate t-ratio.

The nominal exchange rate bears a positive sign and statistically significant at 8 percent level. It implies that devaluation is expansionary which agrees with the traditional economics saying when the country has a lot of unemployed resource the rise of the price due to devaluation encourage the producer to use the resource effectively and efficiently.

The short run model fitted statistically in the better way even though the individual variable does not hold the appropriate sign and statistically insignificant. It implies that the economy responds hardly in short run for the macro economics policy such as exchange rate. monetary and fiscal policy.

The coefficient of ECM gives the level 56 percent of adjustment in any provides disequilibrium from the long run equilibrium relationship per unit period of analysis.



CHAPTER 6

SUMMARY AND CONCLUSION

The Ethiopian Birr was overvalued in last two decades. The premium increased at accelerating rates. The real effective exchange rate appreciated at considerable degrees. The appreciation of the real exchange rate and the increment of the premium had adverse effects not only on the macroeconomy but also on microeconomic performance of the country. The previous governments did not take the right corrective measures, rather they pursued a policy of exchange controls and foreign exchange allocation. This aggravated the problem of real exchange rate appreciation and depletion the country's foreign reserve.

The TGE adopted a policy that focused on stabilization of the economy in early 1992. Devaluation of the currency was one of the measures taken with the objective of improving the current account balance.

The study has tried to identify the effects of devaluation on the economy. A variety of economic models and time-series econometrics technique were employed. The main findings of the study may be summarized as follows:-

- 1) The main determinants of the real exchange rate in the economy are the terms of trade, government consumption of non-tradable goods, capital flow and nominal exchange rate. The improvements of the terms of trade either through the increasing of the export price or the decline of import price generates the appreciation of the real exchange rate. The

capital flow which main source can be cited as aid or borrowing results in appreciation of the real exchange rate; moreover, the rise of government consumption of non-tradables leads to the appreciation of the real exchange rate. In the short run, the expansionary macroeconomic policy generated an appreciation of the real exchange rate.

The nominal devaluation of the exchange rate could lead to the devaluation of the real exchange rate. This idea validates the view that when the initial condition of the economy at real exchange appreciation, nominal devaluation could accelerate the process of the convergence towards equilibrium .

Hence, the government has the policy option for the adjustment of the real exchange rate using the macro policy in short run since the exchange rate system of the country has moved to quasi-market since July 24, 1995. Moreover, the government should aware of that the improvement in terms of trade and the inflow of capital to the country will appreciate the real exchange rate, it will eventually lead to the worsening of the external position of the country. Therefore, the government at this circumstance should pursue the right macro policy.

3) Nominal devaluation, opens of the economy and the terms of trade influence directly of the price of tradable. Devaluation can generate the increment of price of tradable in the country; improvement of the terms of trade leads to the increment of the

price of tradable. The opens also increases the price of the tradable. The main policy instruments according to the estimated model in affecting the price of tradable is the opens of the economy. When the government reduce import tax, the price of the tradable in home would be lower.

4) The price of non-tradable in the estimated model is related directly with devaluation, Price of importable goods, the government expenditure; nevertheless, it is related inversely with opens, the growth of real GDP. It dose not respond to the change in the premium. In the short run, the models collapsed to be significant at the conventional levels. It implies that devaluation in short run does not exert pressure in increasing the price of non-tradable.

5) Devaluation in the static model could improve the current account according to the estimated model. The excess credit which captures the macro policy element shows unanticipated sign, and statistically significant. The improvements of the current account may be attributed to the inflow of aid from both bilateral and multilateral donors due to the fact that the TGE starts to pursue "a democratic system in politics" and "market oriented economic policy". The estimated equation for trade balance confirms that devaluation is related inversely with it. The underlying reason for such outcome which contradicts with the economic principle may be cited as the rise of imports. Imports bills increased for the fact that the avilbility of foreign currency augments and the society expectation of the policy reversal. The government lowered the

import tariff in 1992 and 1993 and the society expectation for the adopted policy was that it may become higher in the coming future which eventual leads to the rise for the demand of importable. The estimated equation of the value of import and export depicted that the elasticity of value of imports and exports with the nominal exchange rate bears a positive sign. The former is greeter than the latter. The volume of exports didn't increase significantly because of the existence of premium between the official and the parallel markets even if the gap between them diminished after the devaluation.

The premium and the trade balance are related inversely due to the fact that it encouraged exporters to participate in the illegal trade rather than official one to reap the difference. The increment of international price of imports has a consequence of worsening the trade balance according to the estimated model. The estimated models of trade balance confirmed that the growth of the world GDP and adoption of a policy of opennes in the economy generate the improvement of the home trade balance.

6) The last estimated models for the GDP depicted that devaluation is expansionary, i.e. increased output and employment. It adheres the view of the traditional economics which articulates that when there is unemployed resources in the economy, devaluation could increase the level of GDP. The result of the estimated models refuted the idea which says that devaluation leads to stagflation (i.e. decrease the level of output and employment; and increase the price level). Our

estimated models depicted that devaluation could increase the level of output and price level. The increment of the price ,however, is not high as expected. The estimated model shows that monetary policy may be employed in affecting the level output positively. The terms of trade, government expenditure and technological progress has found to be insignificant in influencing the level of output. The short run models revealed that devaluation couldn't generate any increment in the level output.

REFERENCES

- Adam, C. (1993a). "Time Series Econometrics for Africa." (Mimeographed).
- Amenu, Tameru (1994). "An Empirical Macro Economic Model for policy design in Ethiopia" (unpublished M.S the is paper presented to AMU, Economic Department.
- Branson, William H., "Stabilization, stagflation and Investment Incentive: The case of Kenya (1975-80)" In S. Edwards and L. Ahmed (eds.), Economic Adjustment and Exchange rate in Developing countries, (Chicago:- University of Chicago Press: forthcoming 1986).
- Central Statistical Authority (various year). "Annual Report" (various issues).
- Chole, E. and Manayazewal, M (1992). "The Macro economic performance of the Ethiopian Economy" in Mekonnen Tadesse (ed.), The Ethiopian Economy: Structure, problems a and policy Issues, Addis Ababa.
- Collier, Paul and Vijay Joshi (1992). "Exchange Rate policy in Developing Countries", Oxford Review of Economic Policy, Volume 5, Number 3.
- Connolly, Michael (1983). "Exchange Rates, Real economic Activity and the Balance of Payments:- Evidence from the 1960's in E. Classen and P. Salin (eds.) recent INT issues In the theory of the flexible exchange rates" (Amsterdam: North-Holland).
- Cooper, Richard (1971). "Currency Depreciation in Developing countries", Princeton essay in International Finance 86.
- Cooper, Richard (1972). "Currency devaluation in Developing countries", In G. Rain (ed.)
- Degefe, Befekadu and Moges, Kebera (1994). "Post Devaluation Ethiopian Economy from stagflation to stagflation" in Mekonnen Tadesse and Abdulhamid Bedri (ed.) The Ethiopian Economy problem of Adjustment, Addis Ababa.
- Devarajan, Shantayanan and Jeffery D. Lewis, and Sherman Robinson (1993). "External Shocks, purchasing Power Parity and the Equilibrium Real Exchange Rates", The World Bank Economic Review, Vol.7, Num.1.1993.
- Donovan, Donal J. (1981), "Real Responses Associated with Exchange rate action in Selected upper credit tranche Stabilization Programmes", IMF, Staff Papers, December.
- Dornbush, Rudiger, "Open Economy Macroeconomics", (New York :Basic books, 1980).

- Dornbush, Rudiger (1980), "Exchange Rate Economics: Where Do We Stand?", in Economic interdependence and flexible exchange rates e.d. (Bhadnari, Jagdeeps and Bluford H. Putnam).
- Edwards, "Real and Monetary Determinants of Real Exchange Behaviour: Theory and Evidence from Developing Countries", in (ED.) John Williamson, "Estimating Equilibrium Exchange Rate", Sep. 1994, U.S.A.
- Edwards, Sebastain (1985), "Are devaluation Contractionary?", NBER Working papers 1676 (Cambridge Massachusetts: -National bureau of Economic Research, August 1985).
- Edwards, Sebastain (1989), "Real Exchange Rates, devaluation and Adjustment: Exchange Rate policy in Developing Countries", Cambridge, Massacuetts, MIT Press.
- Elbadawi, Ibrahim A. (1994). "Estimating Longrun Equilibrium Real Exchange Rate", In (ED.) John Williamson, "Estimating Exchange Rate", Sep. 1994, U.S.A.
- Elbadwi, Ibrahim (1992), "Real Overvaluation, Terms of Trade, Shocks, and the cost to Agriculture in Sub-Sharian Africa", The World Bank working papers, January
- Gylfason T., and M. Schmidt (1993) "Does devaluation Cause stagflation?", Canadian Journal of Economics (1993).
- Hirsch, F. and Higgins, I (1970). "An Indicator of Effective Exchange Rage" IMF Staff papers. Vol. 17 (November).
- IMF (various years). "International Financial statistic monthly book" (various issues).
- Khan, M.s. (1974). "Import and Export demand in developing countries," IMF Staff Papers, November.
- Kidane, Asmorem (1994). "Exchange Rate policy and Economic Reform in Ethiopia", AERC Research Paper.
- Kifle, Semu (1994). "An Interaction of Government Deficit, Money supply and Inflation in Ethiopia (1967-1992)". [unpublished M.S thesis presented to AAU, Economic Department]
- Killick, Tiny (1993). "The adaptive Economy: Adjustment policies in small, low Income countries" Washington D-C., 20433, U.S.A.
- Koedijk, Kees G, and Peter Schotmam. "How to Beat the Random walk: An Empirical Model of Real Exchange Rates", Journal of International Economics, Vol.29, No. 314, Nov.
- Kruger, A.o. "Liberalization Attempts and Consequences (Cambridge, MA: Ballinger, 1978)

- Krugman, P. and L. Taylor, "Contractionary effects of Devaluation", Journal of International Economics number 8, August 1978.
- Krumm, Kathie L. (1993). "A Medium term Frame Work for analyzing the Real Exchange Rate with Applications to the Philippines and Tanzania", The World Bank, Economic Review, Vol. 7, Num. 2, May 1993.
- Lizondo, Saul J., and Peter J. Montiel (1989), "Contractionary Devaluation Developing Countries", IMF staff Papers, March.
- Maciejewski, E.B. (1983). "Real Effective Exchange Rate Indices." IMF Staff paper Vol. 30 (September).
- Maddala, G.S. (1992). "Introduction to Econometrics". Second ed. Macmillan.
- Mengistate, Taye (1992). "Public policy, markets and Technical progress in the Grain-Plough Culture" in Mekonnen Tadesse (ed.). The Ethiopian Economy Structure, problems, and policy Issues, Addis Ababa.
- Minas Getachew (1994). "A Review of Macro Economic imbalances in the Ethiopian Economy in 1980's and Recently years", in Mekonnen Tadesse and Abdulhamid Bedri (ed.), The Ethiopian Economy Problems of Adjustment, Addis Ababa.
- Mulat, Teshome (1992). "Financing Government expenditure in Ethiopia" in Mekonnen Tadesse (ed), The Ethiopian Economy:- Structure, problems, and policy Issues, Addis Ababa.
- Mulat, Teshome (1994). "Trends in Government Expenditure Finance" in Mekonnen Tadesse and Abdulhamid Bedri (ed.) The Ethiopian Economy problem of Adjustment, Addis Ababa.
- National Bank of Ethiopia (various year). "Annual Report" (various issues).
- National Bank of Ethiopia (various year). "quarterly Bulletin" (various issues).
- Ndungu, Njuguna (1994). "Price and Exchange Rate Dynamics in Kenya"; Economics Department, University of Nairobi, Unpublished Report presented to AERC.
- Obandan, Mike I (1994). "Real Exchange Rates in Nigeria: A Preliminary Study", National Centre For Economic Management and Administration, Ibadan, Nigeria.
- Ogan, Olulemi (1994). "Real Exchange Rate Movements and Export growth, Nigeria, 1960-1980.", Unpublished Memo., AERC, 1994.

Pick, Daniel H. and Thomas L. Vollrata, "Real Exchange Rate Misalignment and Agricultural Export performance in Developing countries", Economic Development and Cultural Changes, Volume 42, Number 3, April 1994.

Rohmberg Rudolf (1976). "Indices of Effective Exchange rates."

Tibana, Roberto J. (1993). "Detereminants of effective exchange rate movements in Mozambique:- Alternative Specification and Empirical Tests", Unpublished memo, AERC, 1993.

Transitional Government of Ethiopia (1992). "Policy Frame work paper 1991/93-1994/95." (Mimeographed).

Van Wijnbergen, Sewder, "Exchange Rates Management and Stabilization Policies in Developing countries In S. Edwards and L. Ahmaes (eds.) Economic Adjustment and exchange rate in Developing countries (Chicago:- University of Chicago Press, forthcoming 1986).

Yoseph, Getachew (1994). "Structural Adjustment programs an overview of the conceptual Framework" in Mekonnen Tadesse and Abdulhamid Bedri (ed), the Ethiopian Economy problems of Adjustment, Addis Ababa.

Appendix 1

Estimation result of the regression equation which appeared in footnote for the period 1964-1995.
The export value is the dependant variable.

Explanatory variable	long run model	dynamic model
logE	.43299 ⁴ (6.5520)	0.051359 ¹ (0.52778)
Logprem	0.014395 ¹ (0.26177)	-0.089493 ¹ (-1.1832)
lopen	0.61111 ⁴ (11.5412)	0.90932 ⁴ (12.5151)
logp _x	0.18034 ⁴ (5.1197)	0.086577 ⁴ (2.2939)
logY	1.18880 ⁴ (12.0189)	0.77323 ⁴ (2.1285)
constant	-10.6545 ⁴ (-7.8103)	0.048443 ⁴ (3.6374)
ECM		-0.23522 ¹ (0.69488)
	Unit Root Test	
DF without trend	-3.3402(-2.9627)	
ADF without trend	-2.3703(-2.9665)	
Df with trend	-3.3041(-3.5671)	
ADF with trend	-2.4482(-3.5731)	
R ²	0.99	0.98
\bar{R}^2	0.98	0.97
F	F(5,26)=100.3959	142.83
D.W.	2.0621	2.35
serial Correlation	5.0703	1.6452
Functional form	1.7394	0.62763
Normality	1.57199	3.5493
Heteroscedasticity	4.4622	4.2531

1. significant at less than 10 percent
2. significant at 10 percent
3. significant at 5 percent
4. significant at 1 percent
5. all variables except ecm are in their first difference.
6. figures in brackets are critical value.
7. the value in brackets indicate t-ratio.

Appendix 2

Estimation result of the regression equation which appeared in footnote for the period 1964-1995.

The import value is the dependant variable.

Explanatory variable	long run model	dynamic model
logE	0.54854 ³ (2.3149)	1.0245 ³ (2.6789)
Logprem	-0.052372 ¹ (-0.4070)	0.25879 ¹ (0.75923)
logopen	0.64827 ⁴ (3.2987)	0.30159 ¹ (1.2475)
logY	2.4368 ⁴ (3.6107)	3.8462 ⁴ (3.2634)
logX _{t-1}	-0.12874 ¹ (-1.5294)	-0.21160 ¹ (-1.2271)
logp ^{m*}	0.46994 ¹ (1.5294)	1.0308 ¹ (1.7199)
constant	-15.1291 ³ (-2.6019)	-0.06422 ¹ (-1.3072)
ECM		-1.45528 ⁴ (-2.5461)
DF without trend ADF without trend Df with trend ADF with trend	<u>Unit Root Test</u> -3.3402(-2.9627) -2.3703(-2.9665) -3.3041(-3.5671) -2.4482(-3.5731)	
R ² R ² F D.W. .. serial Correlation Functional form Normality Heteroscedasticity	0.94 0.86 2.5 17.7 7.19 6.8157 0.09384 1.3019	0.85 0.76 9.24 2.73 6.13 6.19 2.82 0.0003336

1. significant at less than 10 percent
2. significant at 10 percent
3. significant at 5 percent
4. significant at 1 percent
5. all variables except ecm are in their first difference.
6. figures in brackets are critical value.
7. the value in brackets indicate t-ratio.

Appendix 3

Test of stationary⁵ for the variable used in estimating the outlined models

variable	DF		ADF	
	with outtrend ¹	with trend ²	with outtrend ³	with outtrend ⁴
REal GDP	-2.303	-1.668	-1.798	2.702
REAL government expenditure	-1.121	-2.107	-1.154	-2.452
nominal exchange rate	-0.197	-0.374	-0.336	-0.661
Deficit	-0.979	-1.247	-1.493	-0.676
Import unit value	-0.833	-1.267	-1.051	-2.168
domestic credit	-1.263	-2.440	-1.070	-2.642
M ₂	-	-	5.277	3.869
Export	0.549	-2.065	-2.743	-3.455
Import	-1.789	-1.319	-0.977	-2.962
CPI	-0.857	-2.215	0.458	-2.623
Parallel exchange rate	-0.385	-2.426	-0.301	-2.294
current account	-3.172	-3.094	-2.208	-2.071
Terms of trade	-4.655	-2.876	-1.295	-2.149
highpower money	-0.118	-2.171	0.142	-1.878
m ₁	-0.382	-2.390	0.121	-1.829

1.The 95 percent critical value for n=32 is -2.9591.

2.The 95 percent critical value for n=32 is -3.5615.

3.the 95 percent critical value for n=32 is -2.9627

4.The 95 percent critical value for n=32 is -3.5671.

5.when the absolute value of the calculated value is greater than the critical value ,it is stationary;otherwise, it is non-stationary.

Appendix 3

Test of stationary⁵ for the variable used in estimating the outlined models

variable	DF		ADF	
	with outtrend ¹	with trend ²	with outtrend ³	with outtrend ⁴
REal GDP	-2.303	-1.668	-1.798	2.702
REAL government expenditure	-1.121	-2.107	-1.154	-2.452
nominal exchange rate	-0.197	-0.374	-0.336	-0.661
Deficit	-0.979	-1.247	-1.493	-0.676
Import unit value	-0.833	-1.267	-1.051	-2.168
domestic credit	-1.263	-2.440	-1.070	-2.642
M ₂	-	-	5.277	3.869
Export	0.549	-2.065	-2.743	-3.455
Import	-1.789	-1.319	-0.977	-2.962
CPI	-0.857	-2.215	0.458	-2.623
Parallel exchange rate	-0.385	-2.426	-0.301	-2.294
current account	-3.172	-3.094	-2.208	-2.071
Terms of trade	-4.655	-2.876	-1.295	-2.149
highpower money	-0.118	-2.171	0.142	-1.878
m ₁	-0.382	-2.390	0.121	-1.829

1.The 95 percent critical value for n=32 is -2.9591.

2.The 95 percent critical value for n=32 is -3.5615.

3.the 95 percent critical value for n=32 is -2.9627

4.The 95 percent critical value for n=32 is -3.5671.

5.when the absolute value of the calculated value is greater than the critical value ,it is stationary;otherwise, it is non-stationary.

DECLARATION

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

Name: Sentayehu w/michael

Signature: 

Date: 25/06/96