ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

DETERMINANTS OF THE FOREIGN EXCHANGE AUCTION MARGINAL RATE IN ETHIOPIA (MAY 1993-APRIL 1998)

BY

SAMSON G.MICHAEL

JUNE 1998.

DETERMINANTS OF THE FOREIGN EXCHANGE AUCTION MARGINAL RATE IN ETHIOPIA (MAY 1993-APRIL 1998)

A Thesis Presented to the School of Graduate Studies
Addis Ababa University

In Partial Fulfillment of the Requirements for the Degree of Master of Science in Economics
(Economic Policy Analysis)

By
SAMSON G.MICHAEL

June, 1998
Addis Ababa

ADDIS ABABA UNIVERSITY
School of Graduate Studies

Determinants of the Foreign Exchange Auction Marginal Rate in Ethiopia
(May 1993 - April 1998)

By
Samson G/Michael Wakjira
Faculty of Business and Economics

Approval by Board of Examiners:

Dr. Alemayehu Geda
Advisor
Signature

Dr. Gerard Kambou
Examiner
Signature

Prof. Teshome Mulat
Examiner
Signature

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

I would like to express my heart felt gratitude to my advisor Dr. Almayehu Geda for his unreserved scholarly advise and constructive comments. I am also grateful to my instructors Dr. Andre Croppenstedt and Dr. Gerard Kambou during my stay in the MSc program. Thanks also goes to the AERC for sponsoring the research and my study at the Joint Facility for Electives (JFE) in Nairobi. I also thank my colleagues whose invaluable contribution has helped me pass through a lot of difficulties. Thanks also go to the staff of Research and Exchange Control Department of the National Bank of Ethiopia, particularly to Ato Tarkegne Assefa and Ato Demessew Tesfaye for their moral support and for the provision of data. Finally I would like to extend my heart felt thanks for all those who have contributed directly or indirectly for the successful completion of my study. Dedication is to my friend Israel Getachew who has always been beside me to extend her unreserved care.

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Abstract

Ethiopia has moved through a number of stages to achieve the determination of equilibrium exchange through market allocation mechanism. Among these, the devaluation of the *Birr* and the introduction of the Dutch auction market system for foreign exchange (Forex) in May 1993 are the first two measures taken. The auction system helped to unify the marginal rate and the official rate on the 59th auction, in July 1995. It has also made possible for the elimination of the parallel market premium which was 52% when it was started. The premium was totally eliminated in January 1998. The unification was speeded up as the parallel rate appreciates and the marginal rate depreciates. Empirical findings are made based on Log-linearized Autoregressive Distributed Lag Model (ADL) to determine the auction marginal rate. Number of bidders, demand and supply of Forex are found to determine the auction marginal rate. This study advances the following policy implications based on the empirical findings and in the light of the experience of some African countries; to instill methods to improve transparency, legalization of Forex bureaus (dealers), the maintenance of the sustainability of the unification of the rates and to sustain the stability of the supply of Forex to the auction, and further liberalization of the existing rules and regulation.

CHAPTER 1. INTRODUCTION.

1.1. Background and Statement of the Problem.

Following the economic crisis that impacted Sub-Saharan Africa (SSA) in the second half of the 1970's, the unification of exchange rates (official and parallel rates) thereby eliminating the parallel market has been a major policy objective for the reforming African countries.

These economic crises resulted in adverse and persistent terms of trade(TOT) shocks, drained the foreign exchange reserves of many of the SSA countries, and brought their exchange rate regimes under pressure. These countries were defending their overvalued exchange rates by rationing foreign exchange with the imposition of more stringent capital and import controls.

One consequence of this was the emergence of parallel markets in foreign exchange. These markets have shown a tendency to expand rapidly. So the question remains how a sustainable unification of multiple rates might be achieved. Flexible exchange rate arrangements to this end have characterized most of the IMF and World Bank supported programs since 1983 (Quirck et al, 1987).

Ethiopia was pursuing a fixed exchange rate regime until the introduction of the auction system for foreign exchange in May 1993. This has caused an overvaluation of the currency (the *Birr*) and resulted in lack of competitiveness in international trade. Furthermore, it paved the way for the flourishment of the parallel market for foreign exchange, in which considerable transactions have been carried out. This, coupled with strict controls on foreign exchange, forced importers to use the parallel market for their imports.

The economy of Ethiopia provided an example of a large parallel market for foreign exchange before the devaluation and the introduction of an auction market for foreign exchange. The parallel market premium (defined as the ratio of the parallel market rate to the official rate minus one) remained high. The presence of a sizable parallel market with substantial premium, such as the one that existed in Ethiopia, has important macroeconomic implications.

In order to solve this problem , therefore, Ethiopia has been implementing the structural adjustment program(SAP) since 1992. One aspect of this stabilization program is the liberalization of the foreign exchange market in the process of trade liberalization. Exchange rate policy and the allocation mechanisms affecting the availability of foreign currency to economic agents play an important role in shaping the structure of incentives. Besides, the principal objective of exchange rate liberalization was the unification of the multiple exchange rates into a single rate, or at least to narrow significantly the gap between the different rates.

The purpose of introducing the auction system was to determine the exchange rate by market forces, to achieve the unification of the different rates and to increase the government revenue by bringing all dealings in Forex to the official/legal market. The sources of funds for the auction have been export earnings, external loans and grants. The nature of the bids is that of retail auction where private and public sector importers are the potential bidders for final use except for a few commercial banks.

The process of liberalization of the exchange and trade controls, the nature of the auction design, the soundness of monetary and fiscal policies jointly determine the stability of the exchange rate, and the pace and speed of unification of the official and parallel exchange rates.

Given the above conditions, the major problems that I want to study are: the pace with which the unification of the different rates be effected, the problem of widening the foreign exchange market for efficient allocation of the scarce Forex, the problem of identifying the factors that affect the determination of the marginal exchange rate and arriving at a clear understanding of the process by which the equilibrium rate is determined.

1.2. Hypotheses of the Study.

The hypotheses motivated by auction theory concern the volatility of the number of multiple units offered for sale during every auctions. The supply of actionable funds is subject to shocks since it rests on primary agricultural exports and foreign inflows which are largely aid (bilateral, multilateral, private, etc). The other hypothesis relates to increased competition in the auction market. Auctions are said to be broadened over time as a result of relaxing entry barriers and abolishing the negative list for imports and allowing more bidders to participate in the auction. This is because the supply of actionable funds and the demand for Forex are believed to determine the auction marginal rate.

The questions that are to be answered in this particular study are summarized as follows;

- Is the level of transparency sufficient to guarantee the widening of the auction market for Forex in Ethiopia?
- Is the supply of actionable funds stable? Since it depends on foreign aid and primary agricultural exports.
- Can unification of the marginal and parallel rate be achieved in the long-run?
- Can sustainable unification of the rates be achieved in the long-run?
- Do supply and demand for Forex determine the auction marginal rate?

1.3. Scope and Objective of the Study.

The intent of this research is to evaluate the auction system with respect to its ability to achieve sustainable unification of the different rates, widening the scope of the allocation mechanisms and introducing a more liberal ways in handling and using foreign exchange, to identify the determining factors of the auction marginal rate and to assess the stability of the supply of actionable funds.

A quantitative evaluation of the performance of the Ethiopian auction system is undertaken. The effectiveness of exchange rate policies adopted so far will be examined and tested based on recent economic literature. It is hoped that the results of this study shall be instrumental in evaluating the foreign exchange market in Ethiopia. This is an attempt to highlight some aspects of the auction practice to facilitate the building up of efficient Forex allocation mechanisms through market forces.

Given the evidence from the recent history of exchange rate management in Ethiopia, appropriate macroeconomic management of the exchange rate policy is crucial. This study, therefore, attempts to explore the relationship between the auction marginal rate and fundamental auction variables, subject to the available data. This study is limited to the period between 1993 and 1997 for the purpose of analyzing the supply of actionable funds and it is extended up to April 1998 for the purpose of analyzing the auction marginal rate determinants. It has the broad objective of determining the level of efficiency of the auction market for foreign exchange.

Within the framework of this broad objective, specific objectives are:

- to analyze the effects of the reforms so far made in the auction

system after its introduction in May 1993; and
- to encourage further enquiries into the determination of equilibrium exchange rate in Ethiopia.

Using the data on the first 50 auctions, Genet (1995) has identified the following among other things;
- the major determinants of the auction marginal rate are the total demand for foreign exchange and the parallel rate,
- the supply of actionable funds is positively related to the auction marginal rate contrary to the prediction of economic theory,
- the number of bidders is insignificant in the role that it plays in the determination of the marginal rate,
- the parallel rate has shown the tendency to appreciate as the marginal rate tends to depreciate as expected,
- the dummy variable used to capture the effects of structural shift, is found to be positively and significantly related to the dependent variable, and
- in terms of data, Genet (1995) found that all the variables except one to be difference stationary.

The broad and specific objective of this particular study, therefore, is to evaluate the overall performance of the auction system in Ethiopia by expanding the data set. In this regard, an attempt is made to compare the findings of Genet (1995), using a wider auction data set and taking into account the new policy developments. In addition to this, an attempt is made to test all the hypotheses that have been advanced under the sub-section 1.2. (hypotheses of the study) and analyze all the issues mentioned under sub-section 1.3. (scope and objective of the study).

This study is meant to supplement the already existing MSc thesis which is one of its kind by Genet (1995) in the evaluation of the auction market for foreign exchange. It is by no means meant to be exhaustive even with the wider data set and the inclusion of

many of the Forex auction theories that have emerged in the recent past.

1.4. Types of Data and Sources.

When collecting data, accuracy is essential for producing reliability. This is because prediction technique gives a broader estimate of the expected reliability. Consequently the more dependable the data the higher the degree of confidence in the reliability of the estimate.

Monthly, fortnightly and weekly data on macroeconomic variables between 1993 and 1998 are used in this particular study. Data is collected from various sources on economic variables that play significant role in the determination of the auction marginal rate and supply of actionable funds such as exports, and imports. Furthermore, data on foreign exchange (Forex) auction, such as, the announced and actual supply of actionable funds, total demand for foreign exchange, the parallel rate, number of bidders and the marginal rate, are used in the analysis of the determination of Forex auction marginal rate in Ethiopia.

Most of the data used in this study are collected from the Foreign Exchange Control and Research Department of the National Bank of Ethiopia (NBE). The data is reported to the concerning units with care and is based on careful recordings of the foreign exchange transactions in the auction system. The data concerning exports and imports are collected from the Ethiopian Customs Authority. However, data sets on imports for the year 1996 and 1997 are collected from the NBE rather than the Customs Authority which could have been more reliable.

1.5. Organization of the Study

This study is organized as follows; Chapter two discusses the general background of the study. This comprises the theoretical framework on exchange rate and exchange rate regimes. Much of the discussion in this regard is devoted to the two major types of exchange rate regimes in practice, namely: the fixed and flexible exchange regimes. Brief comparisons between the two are made. The trend to move from fixed parity to a more flexible market determined exchange rate is given due attention both in the context of COMESA (Common Market for Eastern and Southern Africa) and IMF member states to highlight the global trend.

Chapter three is devoted to the theories on selected economic fundamentals and exchange rate. The chapter is mainly devoted to the particular interest of this study, i.e., the foreign exchange (Forex) auction market. The experiences of some African countries and that of Ethiopia for the last five years are reviewed. Chapter four contains the empirical modelling of the auction variables, statistical descriptions, estimation of the parameters and interpretations of the regression results. The fifth Chapter concludes the study and draws some policy implications.

CHAPTER 2. GENERAL BACKGROUND OF THE STUDY.

2.1. Theoretical Framework on Exchange Rate and Exchange Rate Regimes.

In this section, I introduce the context under which the exchange rate arrangement is required to maintain macroeconomic stability, and discuss the different types of arrangements, particularly the two broad exchange rate regimes. These two regimes are discussed in section 2.1.1. and 2.1.2 in depth followed by a tabular presentation of the exchange arrangements in the IMF member states and COMESA (Common Market for Eastern and Southern Africa) countries for the purpose of comparison, together with the relevant discussions.

The choice of an appropriate exchange rate regime, and the broad thrust of exchange rate policy is a crucial component of macroeconomic policy in any country. The exchange rate issue has been particularly prominent in developing countries in recent years following the introduction of IMF and World Bank's stabilization and adjustment polices, which frequently include devaluation and the introduction of new exchange rate management policies, along with trade liberalization measures (Atta et al, 1996). The exchange rate performs a dual role in small open economies; its movements can achieve and maintain international competitiveness and so ensure a viable balance of payments (BOP).

The principal objective of exchange rate liberalization in Sub-Sahara African (SSA) countries is unification of multiple exchange markets into a single market, or at least to narrow significantly the gap between the rates, so that the free (parallel) market premium no longer constitutes a major signal in the economy. Many of the COMESA countries, with the objectives of bringing their currencies closer to "equilibrium rates",

eliminating bureaucratic management in the allocations of foreign exchange, insulating the economy from both internal and external shocks and increasing their competitiveness, have moved through a wide spectrum of exchange rate regimes. Equilibrium rates in this context refers to the rate that yields simultaneous internal and external balance.

During the last few years there has been an increasing interest in understanding the relationship between exchange rate regimes and macroeconomic stability. The challenge of achieving the latter goals through an optimal exchange rate regime is becoming more important as many of the countries are struggling to cope with fiscal imbalances, monetary expansion and inflation. In fact, a major cause of deterioration in external competitiveness in most of these countries has been a high rate of domestic inflation coupled with the maintenance of a fixed nominal exchange rate.

According to Agheveli and Bijan (1991), developing countries have frequently been subjected to terms of trade (TOT) shocks. Conventional wisdom holds that a deterioration in TOT, i.e.,the world relative price of exportable to importables, results in a depreciation of the equilibrium real exchange rate. Suppose the TOT deteriorate because of a decline in the relative price of exportables. This creates an excess supply of non-tradables and excess demand for exportables, leading to a deficit in the current account balance(CAB). The current account imbalance is eventually corrected through a reduction in the relative price of non-tradeables, that is, a depreciation of the real exchange rate which shifts domestic supply from non-tradables to exportables and importables.

The solution to these problems revolves around some recurrent policy questions like:-

- Why do countries still choose a fixed nominal exchange rate

regime twenty-five years after the abandonment of the Bretton Woods System?

- Are exchange rate based stabilization programs effective?
- Does a fixed exchange rate regime impose an effective constraint on monetary and fiscal policies? And does it lower inflation over the long-run?

The reason why the exchange rate regime is considered important to achieve macro-economic stability is because of the inherent nature of exchange rate itself. The exchange rate has special properties that affect many other prices and links the general level of prices in the economy with prices in other countries. Though there have been controversies which still remain lively today, the advocator of an active exchange rate policy view it as a chief way in which governments can maintain internal and external balance, promote adaptation of the structures of production and demand in favor of tradables thereby ensuring viable balance of payments(BOP). It improves international competitiveness and it can anchor domestic prices (Aghevli and Bijan, 1991).

However, one should bear in mind that, in most developing countries, the exchange rate has continued to be regarded as an instrument of policy, with the rate being determined by the authorities. Consequently, exchange rate policy plays an important role in the process of external adjustment in these countries.

Most of the Sub-Sahara African (SSA) countries impose restrictions on foreign exchange transactions, especially on the capital account. The imposition of this type of restrictions generally leads to the emergence of a parallel foreign exchange market for certain trade and capital transactions. Parallel foreign exchange markets which are extremely common in developing countries are those in which a market determined exchange rate co-exists with one or more pegged exchange rates. Besides, many of these countries are coping with a history of import substitution, primary

agricultural exports, overvalued currencies and hyper inflation . All these problems are related to exchange rate policies.

The first stage to achieve macroeconomic stability is to introduce market reform through the liberalization of prices, the unification of the official exchange rate and the market exchange rate, and the opening of the economy to international trade. The practical issue facing governments and central banks is the appropriate management of the exchange rate after price liberalization both in the immediate aftermath and in the longer term.

The choice of an exchange rate regime revolves around two crucial issues: the relationship of the national economies to the global system and the degree of activism envisaged for domestic economic policies. With regard to the first issue, the choice of an exchange rate regime amounts to the expression of a national preference for either an open or a closed system. Earlier discussions on fixed versus floating rates implicitly assumed that the policy choice would be either pure fixity or pure flexibility that would succeed in seeking macroeconomic stability. Of course, neither of the extremes of permanently fixed or completely flexible exchange rate is optimal in seeking macroeconomic stability. Moreover, recently it has become evident that neither of the extremes of fixed nor flexible exchange rate is optimal in insulating the economy from different types of shocks. The optimal management of exchange rates, therefore, hinges on the policy makers' specific objectives, the main type of shocks, and the structural characteristics of the economy in question (Agheveli and Bijan, 1991).

> *'Macroeconomic stability' is defined in terms of minimizing the variance of real output, the price or real consumption in the face of random shocks is set as criterion to address the issue of optimality in recent literatures (Atta et al,1996).*

Generally, two major types of exchange rate arrangements are prevailing in the SSA countries, the pegged exchange rate regime dominated by a basket peg arrangement and some kind of "flexible" exchange regime. The choice of a typical exchange rate regime is technical in character and focuses on the following three issues: the types of disturbances to which the economy is exposed, the structural characteristics of the economies, the commonality of the risks to which they are subject to, and the objectives that they pursue. The choice of an exchange rate regime goes well beyond the technical aspects of exchange rate management. In effect, it entails a preference for internationally or nationally based systems and reflects the relative importance given to international and national considerations and objectives (Agheveli and Bijan, 1991).

2.1.1. Fixed (Pegged) Exchange Rates.

This type of exchange rate is characterized by prearranged schedule of exchange rate vis-a-vis a single currency, or a currency basket either within pre-established (typically narrow) margins or with fixed but adjustable peg, the adjustment that prevailed under the Bretton Woods par value system. Selecting a fixed exchange rate arrangement is equivalent to accepting a constraint on national economic policies. The country will be able to adopt only those policy combinations consistent with maintaining fixed exchange rate, i.e, domestic policy formulation thus becomes endogenous and subject to exchange rate commitment. In a nutshell, this option is tantamount to placing an international constraint on national economic policies. Therefore, it is a preference for an open system, in that no insulation is sought from the interactions between the national component and the world system. Extensive theoretical and empirical analysis gives three main reasons for preferring a pegged exchange rate at the outset of ending high inflation.

1. The pegged rate bolsters the government's commitment to the stabilization effort, by establishing clear, monitorable targets.

2. Exchange rate peg helps price & wage setters coordinate their actions and expectations around a new low inflation equilibrium.

3. The pegged exchange rate system provides a convenient way for households and enterprises to rebuild their real money balances after a bout of high inflation. At the start of a stabilization program, economic agents find themselves desiring to hold higher real money balances. Under pegged exchange rates, these desires are satisfied automatically through the BOP, as agents repatriate their offshore capital and convert it into domestic currency. The central bank is committed to purchasing the repatriated capital in return for domestic money.

2.1.2. Flexible Exchange Rate Regime.

Economies that adjust their currencies automatically to changes in selected indicators, such as development in the real effective exchange rate are said to follow a flexible exchange rate regime. Managed float refers to economies that adjust their exchange rates frequently on the basis of judgement made following developments in variables such as reserves and the payments positions, whereas, an independent float refers to economies that let markets and market forces determine the exchange rates for their currencies (Gulhati, 1985).

A flexible exchange rate arrangement, in principle, indicates a desire to accept no constraint on the pursuit of any particular domestic economic policy package. Whatever the effects of the policies undertaken maybe, exchange rate fluctuations will keep them within the domestic domain. In fact, this option is tantamount to keeping national economic policy free from international

constraints. Therefore, the preference for a flexible exchange rate regime reveals a corresponding preference for a closed system.

Domestic nominal shocks, such as those originating from money market imbalances, are best handled under a fixed exchange rate system. For example, a disturbance that creates an excess supply of domestic currency will lead to a BOP deficit that will restore balance to the money market through international reserve losses; the disturbance, in these circumstances, does not spill over to the real economy, which is protected by the fixed exchange rate regime. In contrast, domestic real shocks, such as those from imbalances in the goods market, are best coped with under a flexible exchange rate arrangement, because shocks to domestic demand will lead to changes in the exchange rate that will bring about offsetting movements in foreign demand, so that domestic output is not severely affected (Agheveli and Montiel, 1991).

2.1.3. Comparison Between Fixed and Flexible Exchange Rate Regimes.

Under fixed exchange rate, the effects of internal and external policies and shocks will be disseminated across the system at large. Under the flexible exchange rate, in contrast, each component of the international system remains insulated so that policy impacts and shocks don't carry across national boundaries. Fixed exchange rate will not allow domestic economic policies to be pursued independently. This is a typical feature of open systems, which because of the inevitability of leakage, cannot discourage an independent action. A flexible rate, in contrast, is a policy instrument that can be used to keep the scope of domestic policy action unconstrained by the economy's participation in the international system. Accordingly, national policies can be pursued actively without concern for the outside world and this arrangement is, therefore, akin in its basic features to a closed system (Agheveli and Montiel, 1991).

When an economy experiences external nominal shocks, whatever effects these shocks could have had on the foreign price level have been countered by compensating changes in the exchange rate, shielding the domestic economy from the disturbances. As for domestic disturbances, the traditional line of reasoning distinguishes them as either real or nominal in nature, on the ground that this is the relevant distinction for purposes of choosing an exchange rate regime.

Hereunder, a table is presented for the purpose of comparison to appreciate the different types of exchange rate arrangements adopted [1]in the IMF member countries.

---

[1]The proportion of countries adopting various exchange rate regimes is also affected by the increase in the number of countries included in the sample over this period, but this effect does not significantly change the observed pattern.

Table 2.1.3a

IMF Members: Exchange Rate Arrangements, 1988-1997

(in percent of total number of countries)

Classification	1988	1991	1994	1997
Pegged to a single currency	39.5	30.9	26.3	24.3
U.S.dollar	26.6	18.1	13.7	11.6
French franc	9.5	9.4	8.0	8.3
Other currency	3.4	3.4	4.6	5.0
Pegged to composite currency	24.5	26.8	16.6	12.1
SDR	4.8	4.0	2.3	1.1
Other (Currency basket)	19.7	22.8	14.3	11.0
Limited flexibility vis-a-vis	6.1	9.4	7.4	8.8
Single currency*	2.7	2.7	2.3	2.2
Cooperative arrangement**	3.4	6.7	5.1	6.6
More flexible	29.9	32.9	49.7	54.2
Adjusted to a set of indicators	3.4	3.3	1.7	0.0
Independently floating	12.2	14.8	31.4	28.2
Other managed floating	14.3	14.8	16.6	26.0
Total	100.0	100.0	100.0	100.0
Number of countries	147	149	175	181

SDR: Special Drawing Right

Source: IMF Annual Reports: 1988, 1991, 1994, 1997.

* In all countries listed in this row, the U.S. dollar was the currency against which exchange rates showed limited flexibility.

** This category consists of countries participating in the Exchange Rate Mechanism(ERM) of the European Monetary System (EMS).

Own computation of percentages.

The evolution of exchange rate regimes since the mid-1970's has changed a lot throughout the world. The shift has basically taken the form of a movement away from a fixed parity to a more flexible arrangement. This is particularly true for developing countries of the world.

The pattern of exchange arrangement of IMF member countries for the period 1988-1997 is presented in Table 2.1.3a. It can be observed that the proportion of countries choosing to retain single currency pegs has steadily declined from 40 per cent in 1988 to 25 per cent in 1997. The proportion of countries that pegged their currencies to the U.S. dollar declined from 27 per cent to 12 per cent during the same period. The shift away from pegging to the U.S. dollar reflects the high variability of exchange rates between the U.S. dollar and the currencies of other major industrial countries during the 1980's.

A number of countries have chosen to peg their currencies to the special drawing right (SDR) as a convenient method of approximating the relative importance of the major currencies in international transactions. The SDR was created in the late 1960s by collective agreement of the member countries of the IMF (currently 179 countries) and generally replaced the several gold units that had been used in international treaties and agreements. The SDR's value was defined to be the same amount of gold as one U.S.dollar was defined at that time(1970). Its valuation was first based on a basket of currencies in 1974, following the widespread floating of the major reserve currencies. The SDR is also used by the IMF to denominate all of its financial activities (for examples , loans to its members). The present definition of the SDR's value as a basket of the five major currencies has a number of attractions (Coats, 1994).

The proportion of countries opting for the SDR peg lost substantial ground in the late 1980's and declined from 5 per cent

to 1 per cent during the period under consideration. By contrast, the share of countries opting to peg to a trade weighted basket of currencies rose from 20 per cent to 23 percent between 1988-1991 but went into a marked decline in the 1990's, falling from 14 per cent in 1994 to 11 per cent in 1997.

The pattern of increase in flexible arrangements is evident in table 2.1.3a during 1988-1997, the proportion of countries relying on flexible arrangements increased from 30 per cent in 1988 to 54 percent in 1997. At the same time, the proportion of countries pegging to a single currency fell from 40 per cent to 25 per cent. Indeed, the tendency towards adopting more flexible exchange arrangements appears to be strengthening.

The increase in the use of more flexible arrangements can be attributed to a number of factors. First, many countries have experienced a sharp acceleration in their domestic rate of inflation during the 1980's. This is particularly true of the Western Hemisphere countries and developing countries in Africa and Europe. So these countries were forced to depreciate their currencies rapidly to avoid a deterioration in their external competitiveness due to the link between the exchange rate and domestic inflation. The second factor was the uncertainty associated with the fluctuations in the exchange rates of the major currencies, suggesting a need to manage nominal exchange rates (NER) more flexibly in order to avoid unintended movements in the real effective exchange rates (REER). Third, during the past two decades, developing countries have been subjected to a number of external shocks, including drying up of external sources of funds because of international debt crises and adverse movements in their TOT. Adjustment to these shocks has led many of these countries to seek to depreciate their REERs through a more active use of the NER as a policy tool.

Coming to Africa, the different types of arrangements adopted

by the COMESA countries is better exemplified by the table presented below. Generally, two major types of exchange rate arrangements are prevailing in the sub-region at present; the pegged exchange rate regime dominated by a basket peg arrangement and some kind of "flexible" exchange rate regime.

Table 2.1.3b.

Foreign Exchange Arrangement in the PTA Sub-Region

			Pegged to:						Limited Flexibility with respect to:		More Flexible Arrangements:		
			A Single Currency				Composit Currency						
			US $	Pound Sterling	French Franc	Other Currency	SDR	Non-SDR	Single	Cooperative Arrangement	Adjusted Accoring to a set of Indicators	Other Managed Floating	Independently Floating
1	Angola	New Kwanza											
2	Burundi	Burundi Franc											
3	Comoros	Commorian Franc											
4	Djibouti	Djibouti Franc											
5	Eritrea	–											
6	Ethiopia	Ethiopian Birr											
7	Kenya	Kenyan Shilling											
8	Lesotho	Lot (Maloti)											
9	Madagascar	Malagasyn Franc											
10	Malawi	Malawian Kwacha											
11	Mauritius	Mauritian Rupee											
12	Mozambique	Metica (Meticias)											
13	Namibia	South African Rand											
14	Rwanda	Rwandan Franc											
15	Seychelles	Seychelles Rupee											
16	Somalia	Somalian Shilling											
17	Sudan	Sudanese Pound											
18	Swaziland	Lilangeni-(Emalangeni)											
19	Tanzania	Tanzanian Shilling											
20	Uganda	Ugandan Shilling											
21	Zambia	Zambian Kwacha											
22	Zimbabwe	Zimbabwe Dollar											
TOTAL			3	–	1	3	2	6	–	–	1	2	3
			7				8						
			15						–		6		
			21										

Source: International Monetary Fund (IMF), Exchange Arrangements and Exchange Restrictions, Annual Report 1993, IMF Washington, D.C

Adapted From Birritu, 1995.

According to the table, at the end of 1993, a significant number of the former PTA countries maintained a pegged foreign exchange arrangement (71.4%); within the proportion of single currency peggers, only the Comoros in the sub-region has its currency, the Comorian Franc, linked to the French Franc. The Comoros is also a member of the group constituting mainly of West-African states with a common currency, commonly known as the CFA zone. Among the countries in the sub-region: Angola, Djibouti and Ethiopia were pegging their currencies to the single currency, U.S. dollar. Burundi and Kenya were among peggers to a non-SDR composite currency. Mozambique, Sudan and Uganda are countries that have adopted independently floating arrangements, in the period under consideration.

The important thing to note here is that exchange rate policies of Sub-Saharan countries have been characterized by pegged exchange rate arrangements. More and more countries are choosing to peg their currencies to a composite of currencies represented by a basket established mostly on the basis of weights to reflect bilateral trade shares. Thus, maintenance of the pegging arrangement should not be interpreted as going against the global trend towards more flexible arrangements, rather, it conveys another important message that movements of currencies of trading partners are being managed through collective efforts.

Developing economies are typically characterized by underdeveloped financial and money markets. Due to these constraints these economies are framing their exchange rate policies with the aim to subdue the undesirable consequences that are emanating form the instability of the major international currencies. This is, thus, believed to be the main justification for the African economies to maintain pegged arrangements. But as indicated above, there is also another fact, i.e., the arrangements are taking largely the form of a composite-basket pegging, a trend shared by most of the countries with its inherent implications of

According to the table, at the end of 1993, a significant number of the former PTA countries maintained a pegged foreign exchange arrangement (71.4%); within the proportion of single currency peggers, only the Comoros in the sub-region has its currency, the Comorian Franc, linked to the French Franc. The Comoros is also a member of the group constituting mainly of West-African states with a common currency, commonly known as the CFA zone. Among the countries in the sub-region: Angola, Djibouti and Ethiopia were pegging their currencies to the single currency, U.S. dollar. Burundi and Kenya were among peggers to a non-SDR composite currency. Mozambique, Sudan and Uganda are countries that have adopted independently floating arrangements, in the period under consideration.

The important thing to note here is that exchange rate policies of Sub-Saharan countries have been characterized by pegged exchange rate arrangements. More and more countries are choosing to peg their currencies to a composite of currencies represented by a basket established mostly on the basis of weights to reflect bilateral trade shares. Thus, maintenance of the pegging arrangement should not be interpreted as going against the global trend towards more flexible arrangements, rather, it conveys another important message that movements of currencies of trading partners are being managed through collective efforts.

Developing economies are typically characterized by underdeveloped financial and money markets. Due to these constraints these economies are framing their exchange rate policies with the aim to subdue the undesirable consequences that are emanating form the instability of the major international currencies. This is, thus, believed to be the main justification for the African economies to maintain pegged arrangements. But as indicated above, there is also another fact, i.e., the arrangements are taking largely the form of a composite-basket pegging, a trend shared by most of the countries with its inherent implications of

a common move towards currency unification. Moreover, most of the countries have exchange rates that are largely compatible with the maintenance of generally liberal systems of payments. According to the recent IMF publication (1997); Eritrea, Ethiopia, Kenya, Malawi, Madagascar, Mauritius, Rwanda, Somalia, Tanzania, and Zimbabwe have moved to more flexible arrangements from what they were following in 1993. The other countries have maintained the same regimes as before. The policy shifts indicate and support the global trend in moving to more flexible arrangements from pegging to a single or composite currency.

a common move towards currency unification. Moreover, most of the countries have exchange rates that are largely compatible with the maintenance of generally liberal systems of payments. According to the recent IMF publication (1997); Eritrea, Ethiopia, Kenya, Malawi, Madagascar, Mauritius, Rwanda, Somalia, Tanzania, and Zimbabwe have moved to more flexible arrangements from what they were following in 1993. The other countries have maintained the same regimes as before. The policy shifts indicate and support the global trend in moving to more flexible arrangements from pegging to a single or composite currency.

CHAPTER 3. THEORIES ON ECONOMIC FUNDAMENTALS AND FOREIGN EXCHANGE AUCTIONS.

In this Chapter, an attempt is made to explain the relations that exist between exchange rate and some selected economic fundamentals. A detailed treatment is given to existing theories on Forex auctions. In this regard we have tried to answer questions that revolve around auction markets for Forex. Such as; why is there a need to move to the auction market for Forex for the allocation of scarce Forex, how should auctions be designed, how can a move to an inter-bank market be effected, what are the advantages of auctions over an inter-bank market. Other details of the auction features are also been given due consideration.

3.1. Selected Economic Fundamentals and Exchange Rate.

Exchange rate affects, among other things, the level of imports, exports, the revenues of the government, interest rates, BOPs, and the general price level in the economy. The economy's response in turn affects the exchange rate. One of the key issues that arises in any effort to evaluate the consistency of exchange rates with economic fundamentals is the time dimension over which exchange rates and their determinants are to be assessed. The time horizon is important since those factors that have the most influence on exchange rates over the short-term are not necessarily the same ones that will exercise the most influence over the long term (Clark et al,1994).

In this section, an attempt is made to discuss selected economic variables and their relationships with the equilibrium exchange rate. The possible impact on exchange rate movements are also analyzed in a theoretical framework. Among others, the

purchasing power parity (PPP), the balance of payments (BOPs), and the money supply approaches to exchange rate determination.

3.1.1. Purchasing Power Parity(PPP) and Exchange Rate.

In recent years, perhaps the most important policy role of PPP in its guise as a theory of exchange rate determination has been to provide a benchmark against which to judge whether floating exchange rates exhibit excessive swings, causing unpredictably large changes in the relative trade competitiveness of nations. This is the notion of 'overshooting', that relative to some standard (usually PPP), exchange rate movements are excessive (Shapiro,1983).

Three versions of PPP have traditionally been used in the literature: the law of one price (LOP) relates exchange rates to individual, homogenous goods in different countries. It states that, assuming there are no transaction costs or trade barriers (such as tariffs or quotas), the price of identical goods sold in different countries should be the same when expressed in a common currency. In its absolute version, PPP extends the LOP to the general price level; under the same assumptions as the LOP, the same basket of goods and services should cost the same amount in all countries when expressed in a common currency. If the LOP holds for every good, then absolute PPP between baskets of goods should also hold. Absolute PPP, however, requires the parity relationship to hold only on average for all goods-not strictly for each good. Relative PPP relates exchange rate changes to inflation rates. This is an even weaker condition than absolute PPP and assumes only the rate of change in the nominal exchange rate will be equal to the difference between the domestic and foreign rates of inflation on equivalent baskets of goods (Clark et al, 1994).

PPP states that the equilibrium exchange rate between

domestic and foreign currencies equals the ratio between domestic and foreign price levels. In other words, a unit of currency should have the same purchasing power around the world. The relative version of PPP modifies this doctrine by stating the proportionate changes in the ratio of domestic and foreign prices will equal proportionate changes in the equilibrium exchange rate between domestic and foreign currencies (Shapiro, 1983).

$$R_{ab} = P_a/P_b$$

where,

R_{ab} equals the exchange the between the currency of nation A and the currency of nation B, and

P_a and P_b refer, respectively, to the general price levels in nation A and B.

The nominal exchange rate is a monetary concept that measures the relative price of two moneys, the real exchange rate (RER) is, as the name indicates, a real concept that measures the relative price of two goods. The real exchange rate is defined as the relative price of tradable with respect to non-tradable goods (Edwards 1988):

RER = price of tradables / price of non-tradables.

PPP theory is based on the implicit assumption that there are no transportation costs, tariffs, or other obstruction to the free flow of trade; that all commodities are traded internationally, and no structural changes(such as wars) take place in either nation. Since these assumptions are not true, the absolute version of the PPP cannot be taken seriously. The relative version of the PPP theory is potentially more useful.

The absolute version of PPP theory is grossly incorrect and cannot be taken seriously for several reasons. First, it appears to

domestic and foreign currencies equals the ratio between domestic and foreign price levels. In other words, a unit of currency should have the same purchasing power around the world. The relative version of PPP modifies this doctrine by stating the proportionate changes in the ratio of domestic and foreign prices will equal proportionate changes in the equilibrium exchange rate between domestic and foreign currencies (Shapiro, 1983).

$$R_{ab} = P_a/P_b$$

where,

R_{ab} equals the exchange the between the currency of nation A and the currency of nation B, and

P_a and P_b refer, respectively, to the general price levels in nation A and B.

The nominal exchange rate is a monetary concept that measures the relative price of two moneys, the real exchange rate (RER) is, as the name indicates, a real concept that measures the relative price of two goods. The real exchange rate is defined as the relative price of tradable with respect to non-tradable goods (Edwards 1988):

RER = price of tradables / price of non-tradables.

PPP theory is based on the implicit assumption that there are no transportation costs, tariffs, or other obstruction to the free flow of trade; that all commodities are traded internationally, and no structural changes(such as wars) take place in either nation. Since these assumptions are not true, the absolute version of the PPP cannot be taken seriously. The relative version of the PPP theory is potentially more useful.

The absolute version of PPP theory is grossly incorrect and cannot be taken seriously for several reasons. First, it appears to

give the exchange rate that equilibrates trade in goods and services so that a nation experiencing capital outflows would have a deficit in its BOPs , while a nation receiving capital inflows would have a surplus. Second, this version of the PPP theory will not even give the exchange rate that equilibrates trade in goods and services because of the existence of non traded goods and services. The more refined relative PPP theory postulates that the change in exchange rate over a period of time should be proportional to the relative change in the price levels in the two nations over the same period. However, difficulties remain with the relative PPP theory, one of these results from the fact that the ratio of the price on non-traded to the price of traded goods and services is systematically higher in developed than in developing nations. One possible reason for this is that techniques in the production of many not-traded goods and services (hair cutting, for example) are often quite similar in developed and developing nations. Since the general price index includes the price of both traded and non-traded goods and services, and prices of the latter are not equalized by international trade but are relatively higher in developed nations, the relative PPP theory will tend to predict under valued exchange rate for developed nations and overvalued exchange rates for developing nations, with distortions being greater the greater the differences in the levels of development. Significant structural changes also lead to problems with relative PPP theory (Salvatore, 1990).

Most economic theories suggest that PPP should hold in the long-run for traded goods, assuming that measurement problems involved in constructing comparable price deflators can be resolved. Evidence as a whole indicate that PPP is not a good guide for short and medium run exchange rate behavior. There are four reasons for this according to Clark et al(1991). These are: hysteresis (i.e., the phenomenon whereby changes in an effect lag behind changes in its cause) effect due to adjustment cost in trade; price rigidities in terms of currency in which the goods are

sold; imperfectly substitutable traded goods; and structural changes in technology and demand, particularly between traded and non-traded goods and services. The first two factors explain why PPP can fail over short horizons, while the last two can be associated with persistent changes in equilibrium real exchange rates.

Empirical results generally indicate that PPP alone cannot adequately explain the relationship between exchange rates and prices, especially in the short run. However, PPP does perform better for countries which are geographically close, and where trade linkages are high. One of the implications of PPP is that exchange rate policy cannot be used to alter the real exchange rate(where the latter is defined as the ratio of foreign to domestic prices, i.e., $RER = E*P^{*}/P$) (Atta et al, 1996).

So it is also worthwhile to look into the relation between the balance of payment and exchange rate. As far back as 1945, Nurkse defined the equilibrium exchange rate as the rate that would yield equilibrium in the Balance of payments, but with three important qualifications: that there be (i) no undue restrictions on trade flows, (ii) no special incentives for inflows or outflows of capital, and (iii) no excessive unemployment . In other words, the equilibrium in balance of payments should reflect appropriate policies and underlying economic conditions, and should not be achieved by policy distortions or unsustainable rates of resource utilization, by implication a balance of payments position associated with chronic excess demand and high rate of inflation would be regarded as an inappropriate external position (Clark et al, 1994).

3.1.2. Balance of Payments(BOP) and Exchange Rate.

Most models of exchange rates and the BOPs during the 1940s and 1950s treated the current account and usually simply the trade balance as the only endogenous component of the overall BOPs. At the same time, the exchange rate was regarded as either exogenously given or a choice parameter to be fixed by policy makers. The earliest models relating the current account to the exchange rate followed the "elasticities approach" in the Marshallian tradition of treating the exchange rate as a relative price that cleared a market with well defined flow demand and supply curves (Isard, 1995).

The trade or elasticities approach to exchange rate determination is based on flows of goods and services. According to this approach, the equilibrium exchange rate is the one that balances the value of the nation's imports and exports. If the value of the nation's imports exceeds the value of the nation's exports (i.e., if the nations faces a trade deficit), then the exchange rate will rise (i.e., the domestic currency will depreciate) under a flexible exchange rate system. This makes the nation's exports cheaper to foreigners and imports more expensive to domestic residents. The result is that the nation's exports rise and its imports fall until trade is balanced. Since the speed of adjustment depends on how responsive(elastic) imports and exports are to price(exchange rate) changes, this approach is referred to as the elasticity approach. If the nation is at or near full employment; a larger depreciation of the nation's currency is required to shift domestic resources to the production of more exports and imports substitutes than if the nation has unemployed resources. Alternatively domestic policies may be required to reduce domestic expenditures (absorption) to release domestic resources to produce more exports and imports substitutes, and thus allow the elasticities approach to operate (Salvatore, 1990).

Israd (1995) using the standard model, analyses the effect of an exchange rate change on the current account in terms of separate markets for home produced and foreign tradable goods, typically abstracting from the existence of any non-tradable goods. Following Dornbush (1975) export supplies and import demands depend only on nominal prices measured in the home currency units of exporters and importers, and cross-price effects between markets are ignored.

The basic equations of Israd (1995) are:

$$M\ (Pm) = X^*(P^*_m) \qquad \ldots(1)$$

$$X\ (Px) = M^*(P^*_x) \qquad \ldots(2)$$

$$T = PxX - PmM \qquad \ldots(3)$$

$$Pm = SP^*m \qquad \ldots(4)$$

$$Px = SP^*x \qquad \ldots(5)$$

where, M (M^*) denotes the quantity of imports that the home (foreign) country demands,

X (X^*) denotes the quantity of exports that the home (foreign) country desires to supply,

Pm and Px (P^*m and P^*x) are the home (foreign) currency prices of the home country's imports and export goods,

S is the nominal exchange rate measured in home currency per unit of foreign currency, and

T is the home country's trade (and current account) balance measured in home currency units.

(1) and (2) describe the market clearing conditions for the two goods, (3) defines the trade balance, while (4) and (5) assume the law of one price (LOP) prevails for each good.

Frenkel and Mussa (1981), opting for a moderate size country, define the RER, q, as the logarithm of the relative price of

domestic goods in terms of foreign goods. Domestic goods may either be exclusively non-traded goods or goods for which there is a less than infinitely elastic demand. Consistent with either of these interpretations, it is plausible to assume that the current account surplus ,b (measured in terms of imported goods), is determined by,

$$b = a(z-q) + r^{*} A \quad , a>0 \qquad \ldots(6)$$

where, z summarizes the exogenous real factor that affect domestic excess demand and foreign excess demand for domestic goods,

a is a parameter that reflects the relative price elasticities of domestic and foreign excess demand for domestic goods,

r^{*} is the (fixed) foreign real interest rate, and

A is the net stock of foreign assets (denominated in foreign goods) held by domestic residents.

a>0 implies that the Marshall-Lerner condition is satisfied.

The Marshall-Lerner (M-L) condition tells us whether the foreign exchange market is stable or unstable. The M-L condition indicates a stable Forex market if the sum of the price elasticities of the demand for imports (Dm) and the demand for export (Dx), in absolute terms is greater than one. If the sum of the price elasticities of Dm and Dx is less than one, the Forex market is unstable, if the sum of these two demand elasticities is equal to 1, a change in the exchange rate will leave the balance of payments unchanged (Salvatore,1990).

3.1.3. Money Supply and Exchange Rate.

Lack of a clear understanding of the nature of the relationship between macroeconomic polices and exchange rate movement is likely to evade the role of policy dynamics. Exchange rate stabilization is often one of the monetary policy targets of a country, therefore, a clear understanding of the relationship between money supply and exchange rates is very important.

Existing views and evidences related to the nature of the relationship between the money supply and exchange rate are evaluated using the monetary approach to exchange rate determination, because this will provide the required theoretical link between the two macroeconomic variables. The survey will concentrate on evaluating the monetary hypothesis concerning exogeneity of money supply with respect to exchange rate. The review concentrates on the monetary approach to exchange rate determination including the stability of the demand for money function.

The basic monetary approach to exchange rate determination is a direct outgrowth of PPP theory and of the quantity theory of money. While PPP concludes that the exchange rate is the relative price of goods in the two countries, monetary theory suggests that the exchange rate is the relative price of two monies. In this context, it follows that exchange rate behavior reflects the evolution of the relative demands for two monies.

According to Salvatore (1990), the monetary approach postulates that exchange rates are determined in the process of equilibrating or balancing the stock or total demand and supply of the national currency in each nation. The supply of money in each country is assumed to be determined or set independently by the nations' monetary authorities.

The monetary approach to exchange rate determination suggests that the nature of the relationship between money supply and exchange rate is positive and the direction of causality runs from money supply to exchange rate. The empirical observation is explained by a body of macroeconomic theory which is based on the "quantity theory of money". However, there is no unanimity on this, money supply may passively and very steadily respond to variation in exchange rate.

The apparent inconsistency between the quantity theory of money and the efficient market hypothesis has provoked a number of researches in the applicability of the monetary approach to the determination of exchange rate. The classic definition of an efficient market is that of a market where prices "fully reflect" all available information (Fama, 1970). When this condition is satisfied, investors cannot earn an unusual profit by exploiting available information. When asset and commodity markets are efficient (in the above sense of reflecting information), economic agents who make decisions on the basis of observed prices will ensure an efficient allocation of resources. Much of the monetarists consider money to be the primary determinant of movements in exchange rates, and some studies have come up with contradictory evidence.

Dornbush (1990) points out that the evidence from the last fifteen years indicate that exchange rates have been moving in a manner which was more volatile than would have been envisaged by any of the proponents of flexible exchange rates, i.e, exchange rate movements were not related to any of the market fundamentals but rather on "news" in the financial and Forex markets.

In view of the volatility in exchange rates, it is argued that in a world where financial markets are integrated, it is only the countries with strong currencies which can afford to expand the money supply without exacerbating exchange rate misalignment and

undermining the international payment mechanisms.

The effectiveness of the monetary policy depends on the stability of variables in the demand for money function such as real income and interest rates and the predictability of its impact. The demand for money is the amount of money an individual would wish to hold after adjusting for prices. That is the reason why sometimes it is referred to as the demand for real money balances.

Therefore, it is only when the demand for money function is stable over time that the effect of money supply will have predictable effects on money income whose adjustment process affect the exchange rate as people try to change their asset holdings (Portfolio Adjustment).

Sometimes, the factors assumed to have little influence in the transmission mechanism from money supply to exchange rate may change and significantly affect the exchange rate. Thus, although money supply may remain constant, movements in the exchange rate may affect real cash or money balance(M/P) through the price variable. Since individuals now have less real cash balance than they would wish to hold at any one time, the demand for more money to make up for the required real cash balance increases. Money supply will respond to the increase in the demand for money until gradually the desired balance which economic agents wish to hold is satisfied. In this case its effect on exchange rate will not be predictable.

This would mean that money supply adjusts passively rather than actively in order to meet the desired demand for money in the economy. Hence, money supply will no longer be a policy variable capable of determining exchange rates in the economy. In this case money supply will be taken to be endogenous with respect to exchange rate.

Therefore, the presence of an unstable demand for money function would imply that other factors other than money have stronger influence on the decision to hold or spend money. These factors will have more influence in determining the exchange rate which may lead to its volatile movement. Exchange rate movements, in turn, may affect prices and real money balances. This ultimately causes changes in the money supply.

The money supply is analyzed in the context of the monetary approach to exchange rate determination to analyze the effects of changes of the money supply on exchange rate. This approach assumes the purchasing power parity (PPP) condition to hold.

That is,

$$P = E*P^* \qquad \ldots(1)$$

where, P is the domestic price level,
E is the nominal exchange rate,
p^* is the foreign price level.

It also assumes that the interest arbitrage condition holds. That is,

$$i = i^* \qquad \ldots(2)$$

where, i is the domestic interest rate,
& i^* is the foreign interest rate.

The PPP condition implies that the domestic and foreign goods are perfect substitutes while the interest arbitrage condition means that the domestic and foreign assets are equally risky and hence are perfect substitutes.

The starting point of the monetary approach to exchange rate determination is the quantity theory of money. The equation of this theory is represented by the following mathematical formulation.

$$V = P^*Y/MD \qquad \ldots(3)$$

where, MD is money demand,
V is velocity, and
Y is the national output.

By rearranging equation (3), we can obtain the following,

$$MD = P^*Y/V \qquad \ldots(4)$$

From Sachs (1993), the velocity of money in circulation is expressed as,

$$V = v(b,i) \qquad \ldots(5)$$

where, b is the transaction cost. That is, the cost of converting nominal assets into money. But from the PPP expression above , $P = E^*P^*$. By substituting for P in equation (4), the following expression is obtained,

$$MD = EP^{*}*Y/v(b,i) \qquad \ldots(6)$$

In the short run, b is fixed and hence velocity can be expressed as v(i). Throughout the theoretical discussion, velocity will be assumed to depend on domestic interest rate since Ethiopia is not fully integrated into the world economy due to capital controls. This means that i is not equal to i^*. In equilibrium money demand (MD) is equal to money supply (MS). This condition is represented below,

$$MD = EP^{*}*Y/v(i)=MS \ldots(7)$$

By rewriting equation (7), the following expression is obtained.

$$MS = EP^{*}*Y/v(i) \qquad \ldots(8)$$

Given a small country assumption, a country like Ethiopia cannot influence P^{*} and hence it is fixed in the short run. Real output is also taken to be constant. Given these restrictions, equation (8) can be transformed into the following equation,

$$MS = Ep^{*}*y/V(i) \qquad \ldots(9)$$

In equation (9), the lower cases for P^{*}, Y mean that they are fixed in the short run. By solving for E in equation (9), an exchange rate equation representing the monetary approach to exchange rate determination is derived as follows;

$$E = MS*V(i)/p^{*}*y \qquad \ldots(10)$$

In equation (10), the nominal exchange rate (E) is an endogenous variable. This means that it is determined by the value of money supply. However, money supply is an exogenous variable. That is, its value is independently determined by the monetary authority of the country. Therefore, exchange rate is explained by variables within the model while money supply is explained by variables outside the model. The above relationship can further be expressed in the following manner,

$$\Delta E / \Delta MS = V(i)P^{*} * y \qquad \ldots(11)$$

Equation (11) implies that changes in exchange rate with respect to changes in the money supply will depend on the behavior of the right hand side variables, especially on velocity and domestic price level. Given that $P = Ep^{*}$, if monetary expansion increases the

domestic price level, the exchange rate must depreciate in order to maintain the purchasing power parity condition. This is the case since foreign price is already fixed in the model. The final assumption in the model is that the public wishes to hold a constant amount of real cash balances (M/P). An increase in the real cash balances above this will be spent. Given the above conditions, an open market operation (OMO) leading to monetary expansion results in excess cash balance in the hands of the public. This excess cash balance leads to an increase in aggregate demand for goods and services. This increment drives the domestic price level upwards and the domestic interest rates downwards. The fall in domestic interest rate cannot be prevented since the economy cannot borrow from the rest of the world due to private capital controls.

The government cannot sell its foreign exchange reserves to the public under a flexible exchange rate regime. The flexible exchange regime and capital control imply that the current account must always be in equilibrium.

As already indicated, a fixed foreign price and a rise in the domestic price level call for the depreciation of the nominal exchange rate in order to maintain the purchasing power parity. The depreciation in turn raises the domestic prices of goods and services. The increase in prices reduce the real cash balances (M/P). The prices continue to rise until the required level of real cash balance is restored.

Thus, in the short run, the monetarist believe that money supply has real effects on exchange rate, although these effects are transitory or short lived in nature. However, the extent of these effects depend on the behavior of the right hand side variables over time.

3.2. Theories on Auctions for Foreign Exchange Market.

Given the structural characteristics of the SSA countries, where the banking system and the Forex markets are not developed, there comes a need to restructure the economy through a market determined allocation of Forex. This will allow scarce Forex to be utilized in an efficient manner. Damaging distortions have been introduced by the practice of manual allocation system, with favoritism and incentives for wasteful rent seeking activities. Moreover, the system perpetuated large, inefficient parastatals, which have proved a drain on the scarce Forex and on government budgets.

Foreign exchange management is central to the process of trade liberalization, and of structural adjustment program in general. Administrative exchange allocation has been used in developing countries, and in the SSA in particular, because it is the most direct and quickest means of dealing with BOPs crises, of indirectly taxing disfavored sectors (especially exports), and channelling crucial imports toward uses the government considers high priority. However, it is now recognized that direct exchange management has a number of adverse economic effects, and most structural adjustment programs have included steps to dismantle or at least modify these direct control mechanisms (Ferrara et al, 1994).

If foreign exchange (Forex) is priced improperly, it will be allocated inefficiently and the development of foreign exchange markets may be stunted. In light of the generally disappointing experience with conventional methods of allocating Forex, some countries have introduced Forex auctions as an alternative. Aron and Elbadawi (1994) believe that there is scope to design transparent Forex auctions which reduce manipulation by the seller. When properly designed auctions can be used in a variety of environments to allocate limited/scarce Forex more efficiently than

current methods do. Therefore, auctions potentially have an important role to play in exchange rate unification primarily as a transitional device to an efficient inter-bank market. Besides, auctions are informationally rich which avoids the problem of asymmetric information, i.e, uncertainty may be reduced, speculative pressures stemmed and collusion be limited (Dominguez,1991). Market determined exchange rates hold a number of advantages over the non-bank market alternatives. They are efficient in rationing foreign exchange, and can allow a more certain path for reserve management, avoid the choice of an appropriate exchange rate regime and can serve to distance the government from the political cost of devaluation (Krumm, 1985).

One of the most important questions to be addressed in the design of auctions of any kind is that what information should be disclosed to participants. Auction bidders face four sources of uncertainty: the valuations and bids of other participants, the floor (reservation) price (if any), the volume of Forex to be auctioned, and the quantity demanded by other bidders. In this regard, the disbursing authority has control over two of the sources of uncertainty: the floor price and the quantity to be auctioned. The release of these information depends on the desires and objectives of the authority (Guasch and Glaessner, 1993).

The theory of foreign exchange allocation mechanism basically fall in two categories, according to the nature of the participants. In a wholesale auction, the participants are commercial banks and authorized dealers, who then sell onward to importers: in a retail auction, Forex is sold directly to importers (Ferrara, 1994). A further final step towards convertability is the establishment of an inter-bank market where participants are established commercial banks and Forex dealers (e.g., Forex

bureaus)[2]. Forex bureaus are institutions that purchase and sell Forex at rates established by themselves. In principle, bureaus can be allowed to bid at the auctions so that auction funds can be channeled through Forex bureaus to the general public. The rationale for the official recognition of Forex bureaus is to legalize at least a portion of the parallel market, thus bringing under control part of the informal sector and laying the foundation for exchange rate unification. This brings competition and efficiency that can potentially create a non-volatile market if a sufficient amount of Forex is channeled through this system (ibid).

An auction system has significant advantages over an inter-bank system in the allocation of Forex in thin markets. There is no reason to assume that a fair and efficient allocation will occur where predominantly state-owned banks or a highly concentrated commercial banking sector allocate Forex to final customers (after a wholesale auction of export proceeds, or a decentralized purchase of export receipts). Auctions offer the possibility of restricting entry through a set of rules which reflect development priorities, but still maintain market-allocation. This rules can be liberalized over-time. Thus, for example, Forex for luxury goods can be limited to repatriated flown capital (Aron and Elbadawi, 1994).

Although interbank systems are relatively unregulated compared to other allocation schemes, some prudential regulations are usually set. Limits on stocks (maximum amount of Forex held) and flows (maximum volume of Forex surrendered per period to each commercial bank) have often been imposed to prevent major dealers from cornering the market and to avoid large exposure to risk. In principle in a pure interbank system all the supply and the demand for Forex should be channeled through the market, hence Forex is

---

[2]Countries which have established various types of exchange rate auctions include: Bolivia (1985 onwards), Jamaica (1984-89), Ghana (1986-92), Nigeria (1986-94), Guinea (1986 onwards), Zambia (1985-87), sierra Leone (1982,83), and Uganda (1982-85, 1992-93).

allocated though the price mechanism in an efficient manner; its availability for import necessities is increased and the degree of anti-export bias implicit in fixed overvalued exchange rate regimes is significantly reduced or eliminated since the interbank system is actually a floating regime. The movement to a decentralized market system should not translate, however, into disregard of the development priorities of the government. Accompanying policies, therefore, assure its compatibility with the medium and long term development prospects of the country.

Many of the SSA countries have adopted different polices to achieve efficient and decentralized inter-bank markets for foreign exchange. One of the widely used means to unify multiple rates, is the auction market which is believed to facilitate the move towards an inter-bank system.

Auctions may have some advantage over the inter-bank system where there is insufficient institutional depth to allow effective functioning of a decentralized foreign exchange market, where a few commercial banks have historically been dominant and where there is a danger of collusion in the face of limited source of foreign exchange. They offer an informationally-rich framework, greater transparency and fairness, lower transaction costs, increased competition, elimination of rent seeking opportunities as a result of clear rules, and discovery of the appropriate price which serves as reference and signal for enterprises, final users and Forex dealers (Guasch and Glaessner, 1993). Auctions potentially have an important role to play in the establishment of deeper and more stable markets in the transition to efficient, decentralized inter-bank markets (Aron and Elbadawi, 1994). Among the disadvantages are a greater vulnerability to collusion which can lead to lower revenue as a result of lower price, a tendency to attract the least desirable participants (adverse selection) and to provide the scarce Forex for less desirable imports (moral hazard), and auctions are relatively more attractive to institutions with high

propensities to take risks, so those institutions will end up with a larger than desirable proportions of Forex which can lead to a higher probability of misallocation, they offer Governments opportunities to manuplate and to engage in ad hoc intervention (ibid).

Auctions markets have two advantages over inter-bank markets in constraining volatility in markets of the SSA countries. First, they may be feasibly operated in conjunction with a stabilization fund, which can commit supply in the medium term and still offer a market-based rate. Secondly, auctions are informationally-rich, and this may be exploited by the seller in two ways. By appropriately revealing information or adjusting the reserve price and supply. Uncertainty may be reduced and speculative pressures stemmed and collusion limited , hence stemming volatility. On the other hand, auctions give the seller information about private agents' valuations, in signalling demand pressures auction can be used to enhance monetary management. It might be argued that a parallel market or Forex bureaux market offers the same signalling advantages as an auction. But this is not true; these markets are very thin markets and reflect the influence of remaining trade restrictions and exchange controls as well as various demand pressures not consistent with development priorities such as smuggling activities. This was found to be principal advantage of the auction in Bolivia (Dominguez,1991).

A slow and unambitious start together with gradual expansion of the auction through liberalization of the rules, serve both to facilitate institution building and learning. This enhances the credibility of the reform. A higher frequency of auctions would seem desirable to smooth disbursement, make firms' production more flexible and probably encourage investment. Typical entry barriers are: confining the use of Forex to particular sector; confining the use of Forex to particular types of imports (typically excluding luxury goods); and limiting participation by commercial banks,

licensed Forex Bureaux and the state-owned sector (e.g. with ceilings on their maximum allowable allocation, or complete exclusion from the auction). To enforce these various exclusions, bidders are monitored through documentation requirements, such as evidence of paid up tax, deposit with the commercial bank filing the application, and import and export invoices. All the SSA auctions required a local currency cover for bids, and some smaller companies apparently found their access unfairly restricted (e.g. in the Zambian and Ugandan auctions) (Aron and Elbadawi, 1994).

Under the auction market system, the available amount of foreign exchange is allocated by the central bank. There are two major types of pricing mechanism that have been used in these auctions; these are the discriminatory (Dutch) auctions where bidders pay their own price for each unit and competitive auctions where bidders pay the least accepted bid price for each unit. The clearing rate for both auctions is defined as the marginal rate at which the available supply is exhausted, when ordering the bids from the highest to the lowest price.

The Dutch system, compared to the competitive pricing has, the advantages of raising revenue through payments made by bidders more than the competitive system which serves as an incentive to the government to adopt it. However, large spread between bids is observed in the Dutch system.

3.2.1. The Analysis of the Allocation Mechanism in the Forex Auction Market.

The effects of allocation mechanisms through the auction market for Forex can be illustrated in a partial equilibrium framework. Auctions and parallel markets: price and premium determination and unification issues are explained using a hypothetical diagrammatical analysis (Ferarra et al, 1994).

Suppose there is an auction market operating simultaneously with a private (parallel market). The auction is funded through exogenously determined donor contributions and from export proceed. The auction has available Q^* (= Q_1 - Q_3 in fig 3.1*a* and 3.1*b*) of Forex each period. Sometimes buying from the auction costs more than buying from the parallel market; the extra cost may be in the form of paperwork requirements, fees, or the depreciation of the marginal rate more than the parallel rate. In the diagram below, *e* is the official marginal auction price of Forex and *p* the price on the private (parallel) market. In this discussion, an abstraction from the various issues revolving around the effects of the auction rules on the strategic behavior of bidders is made. It is assumed that bidders bid according to their true marginal valuation of a unit of Forex, Thus, the auction equilibrium is essentially a competitive market equilibrium. Hereunder, figure 3.1*a* and 3.1*b* are presented to supplement the analysis. They are adapted from Ferrara et al (1994).

(a)

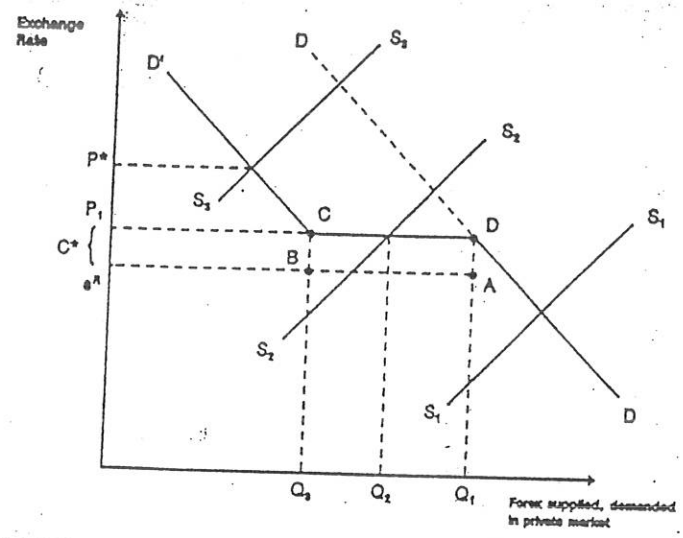


Figure 3.1 Effects of Auction; homogeneous cost

(b)

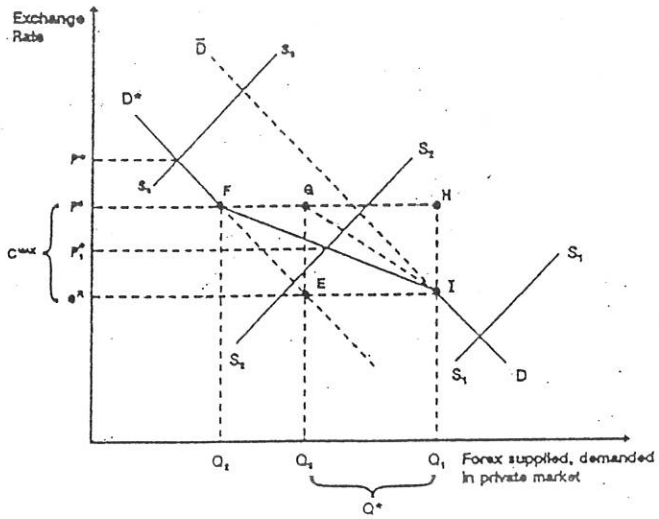


Figure 3.1 Effects of Auction; heterogeneous costs

Source : Ferrara et al, 1994.

Suppose that all buyers in the auction (but not in the parallel market) incur the same cost, C^*, of buying from the auction instead of the private market, and that the auction has a reservation price of Forex e^R. If the total demand for Forex is DD, then the demand in the parallel market would look like DD' in figure 3.1*a*. There would be a kink at P_1 $(=e^R+C^*)$; at this price in the private market, demand would shift to the auction. How the total demand is divided between the two markets depends on the supply schedule in the private market. If the supply is like S_1S_1, there will be no demand for auction funds; and if the supply is like S_2S_2, the auction funds will be partially used (Q_1-Q_2 will be funded in the auction); if the supply is like S_3S_3, the auction funds will be fully disbursed. Assuming the last case, the total cost of using the auction is the rectangle ABCD$(= C^* * Q^*)$. In this model, the premium of the private (parallel) market rate over the auction rate is always C^*, provided only that the demand for auction funds is positive.

Now suppose that the buyers are not homogeneous with respect to their cost of using the auction. For example, in Ethiopia, participation in the auction requires opening a letter of credit (LC) which can impose an extra cost to the bidder. But for those importers who get other benefits from an LC, the marginal cost of using the auction is not as high as the others. Alternatively, suppose that documentation from the auction is also used to assess import tariffs, so that tariff evasion is much harder when imports are effected using auction funds. So the full cost of using the auction will be higher for importers of high-tariff goods than for those of low tariff goods (Ferrara et al, 1994).

In either of these cases, the private (parallel market) demand would look like DD* in fig. 3.1*b*. At any price over e^R, some buyers will switch to the auction. Importers of low-tariff items will be the first to switch. The higher the private market price, the

larger the number of buyers who will find it worthwhile to switch.

The price of Forex in the parallel market is determined by the intersection of the parallel supply schedule and the private market demand (DD' in fig. 3.1*a* or DD* in fig. 3.1*b*). The market-clearing auction rate is the parallel price minus the marginal cost of using the auction. In the case of constant marginal cost C^* (fig 3.1*a*), the auction price is always the parallel price minus C^*. In other words, the premium is constant and equal to C^*. In the case of rising marginal cost (fig 3.1*b*), the premium is larger under conditions that cause more auction funds to be disbursed, but only up to the point at which auction funds are fully disbursed.
In fig 3.1*b*, if supply is S_2S_2, the parallel market price is P^*_1, the auction price is still at the reservation price e^R. If auction funds are just fully disbursed (i.e., the quantity supplied in the private market is exactly Q_2), the parallel market price is P^e and the auction price is still e_R, so the premium is C^{max}. But if the parallel market supply is such that there is excess demand for auction funds (e.g., private supply is S_3S_3), the auction price is above the reservation price, e^R. In this case, the auction price is less than the private price (P^*) by the premium C^{max}, no matter what the level of the parallel price.

Assuming the auction funds are fully used, the total cost of using the auction is the area **EFI**. If the cost of using the auction is " transaction cost", then this area is a real economic cost. If the cost is only payment of tariffs which could otherwise be evaded, then this is a transfer from importers to the government.

Several conclusions can be drawn from this simple model:

- In both figures, if the auction funds are fully used (supply vis-a-vis demand is like S_3S_3), then small perturbations in supply or demand would cause the private market exchange rate and the auction

rate to move together. The premium would not change. The parallel market price will be P^*. The auction price will be equal to (P^*-C^*) in fig 3.1*a* or (P^*-C^{max}) in fig 3.1*b*. depending on whether the marginal cost of using the auction is constant or rises with the amount of auction funds used.

-- If the auction funds are not fully used (e.g., if supply is S_1S_2), then small perturbations will cause the premium and parallel market rate to change in fig 3.1*b*. (but not in fig.3.1*a*.), but the auction rate will not change in either figure.

- The level of the reservation price determines the vertical position (but not the slope) of the segment of the private demand schedule that lies between Q_1 and Q_3. Suppose that supply in the parallel market is stochastic, then the higher is the reservation price in the auction market, the less frequently will the auction funds be fully used and the less often will the quantity traded in the private (parallel) market be less than Q_3. This means that the auction and the parallel market rates will move together (which happens only when the equilibrium Q is less than Q_3) less frequently, so the premium becomes more volatile in the case of heterogeneous costs. It also means that the average price of foreign exchange increases in both the auction and private markets.

-If the reservation price is set high enough to have an effect, it will interfere with the full disbursement of the auction funds.

3.2.2. Experience of Some African Countries in the Auction for Foreign Exchange.

The experience of some African countries has shown that there are two types of multi-unit foreign exchange auctions that have been employed in SSA: retail auctions where the bidders are private and public sector importing firms without having competing banks; and the wholesale auctions where the bidders are registered banks or foreign exchange dealers.

To date there is little understanding of the functioning of the auction markets in SSA countries, and there has been virtually no research on the causes of frequent policy reversal or auction failure. Apart from supply problems of Forex which is based on highly concentrated primary agricultural export and vulnerability to TOT shocks and fluctuations in the disbursement of foreign aid, potential causes of failure include macroeconomic instability, inappropriate auction design and poor micro-management of auctions (Aron and Elbadawi, 1994).

Reviews of the literature on some African countries have shown that frequent policy reversal, lack of transparency in the auction system, and lack of commitment on behalf of the authorities have led to the failure of the auction system. Gradual liberalization of the rules and reduction of restrictions to trade and giving access to importers to participate in the market helps to enhance learning through experience and widens the scope of the market to serve a lot more in the official channel.

Various auction experiments have spanned widely at different periods. In Ghana, weekly auctions of varying design were held over almost six years & then replaced by an inter-bank system. In Uganda, considerable shorter period of auction (about 21 months) was observed. In both of these countries the auctions proceeded fairly smoothly, and the rules were gradually liberalized over

time. By contrast, an 18-month experiment in Zambia with 68 weekly auctions saw restrictions tightened overtime and frequent rule changes.The auctions were suspended for three months; subsequently a further 6 auctions were held, but a speculative run on the Kwacha(the Zambian legal tender) saw the system abandoned, with a return to a fixed exchange rate regime.

In Nigeria, auctions have similarly yielded mixed results, and have been subject to considerable rule changes. Auctions were held over six years, weekly for the first 67 auctions, during 1986-88 ; then daily during 1989-90, in conjunction with an inter-bank market. A weekly system was again initiated early in 1991, and continued until early 1994, when the exchange rate regime was again replaced by fixed exchange rate system. The danger in the Nigerian scenario, is that allowing banks full autonomy in bidding for and then dispensing Forex in a secondary market, could, in concentrated financial markets,lead to collusion. Banks could offer bids below their own value of the Forex, but resell at the market price, thus widening the spread between the buy rate (i.e:, auction rate) and secondary (inter-bank) market sell rate, with rents accruing to the banks. This appears to have occurred in Nigeria, obviously defeating the objective of unification. Moreover, it is not obvious that the subsequent allocation to final customers would be optimal. Indeed evidences from Nigeria suggests that the bank's share holders and favored customers had privileged access to Forex in the secondary market. The existence of considerable rents in the Nigerian auction is reflected in the proliferation of licensed banks which increased in number from 41 in 1986 to 112 by early 1991. Auction theory advised that auction managers employ a reserve price (below which Forex will not be sold) to combat suspected collusion. A reserve price was not employed in Nigeria (Aron and Elbadawi,1994).

According to Ferrera et al (1994), Ghana is often considered as the most successful example in this regard because it applie

the auction market in the form of two windows and lasted only for few months. The first window was administrated at the fixed official rate and was used for official debt-service, imports of petroleum products and surrender of traditional export proceeds. The second window consisted instead a weekly Dutch retail auction which was used to finance all other importers licensed to bid at the auction and to surrender non traditional export receipts. This dual system was only transitional device to prepare the market for a more extensive use of the auction. The auction became the only effective window in February 1987. Meanwhile, an export retention scheme with multiple rates had been introduced to guarantee exporters (mainly non traditional) access to Forex for their essential imports. The government subsequently legalized Fore bureaus in February 1988 to facilitate the efficient functioning of the auction and granted them eligibility to bid in the auction in December 1989. Exporters were allowed to sell their retained earnings to the bureaus as they wishes. This has led to the led to the reduction of the parallel market premium down to 6% in 1990, from what had been in 1987(46%). Transaction costs inherent in the operation of the auction were eliminated first by replacing the retail auction with a wholesale one in which commercial banks rather than the central bank were responsible for determining the eligibility of individual bids, and then replaced the auction itself with and interbank market in March 1992. The Forex system is liberalized, except for some control remaining on capital and the parallel market premium has been eliminated. Ghana can therefore be judged to have a virtually convertible currency.

Uganda is also noted as a success story in its dealings with the Forex liberalization measures. Although in principle an auction system could have been introduced first, the government believed the legalization of the Forex bureaus would be more likely to succeed, since it would merely recognize structures which were already existing in the parallel market, rather than creating new structures and new markets. The bureaus were thus legalized in June

1990, and soon absorbed a significant amount of Forex transactions. The next step of unification of exchange rates took place in 1992 with the introduction of a weekly Dutch in which commercial banks and bureaus were allowed to participate. The auction was funded by donors and the demand for Forex was less than expected and the auction funds were in general not fully utilized for several reasons. These included the reserve pricing rule, the higher administrative costs of using the auction, and the relative difficulty of tax evasion when using the auction. As of September 1993, the system has functioned smoothly and has led to a consistent reduction in the spread on the parallel rate. This has facilitated the move to an inter-bank market (Ferrera et al, 1994).

The experience of these countries show that weekly or bi-weekly frequencies of auctions were employed and, in general the demand for foreign exchange exceeded the supply in fairly deep markets except for Uganda at the onset of the auction. Auctions in Ghana and Uganda as whole can be considered as notable successes in SSA countries whereas, auctions in Zambia and Nigeria were characterized by instability due to frequent rule changes, uncertainty and suffered from lack of transparency.

3.2.3. The Ethiopian Experience in the Period of the Auction for Forex Market.

Ethiopia took the first step of unifying the official & unofficial exchange rates with a devaluation of the Birr (the legal tender) in October 1992 and started using a market determined allocation for foreign exchange (Forex) through a Dutch auction system on May 1, 1993. The objectives of the auction system in Ethiopia are to determine the exchange rate by market forces, to achieve the unification of the different rates and to increase the government revenue by bringing all dealings in Forex to the official/legal market. The source of funds for the auction are export earnings and external loans and grants. The nature of the

bids is that of retail auction where private and public sector importers are the potential bidders.

Auction has been organized by the National Bank of Ethiopia (NBE) and the sessions were initially held fortnightly; today they are being held weekly. The NBE has been the sole provider of Forex in each session of the auction, the source of which is mainly foreign grants and export proceeds. There were two exchange rates: the official rate and the marginal rate (i.e, the lowest successful bid) prevailing at each auction. The official exchange rate was pegged to the U.S. dollar, the intervention currency. It has been applied to imports of petroleum products, fertilizers, pharmaceutical goods, Ethiopia's contributions to international organizations, and external debt-service payments.

On June 12, 1993, the NBE began to preannounce the amount of Forex to be supplied to each auction session few days prior to the submission of the bid documents. On September 5 of the same year, the negative list for imports that may be financed with Forex bought at auctions was shortened. On December 31, 1993, the official exchange rate was Birr 5.00 per U.S.$1. Buying and selling rates for certain other currencies were set daily by the NBE on the basis of both the auction rate and the official exchange rate for the U.S. dollar and the previous day's closing rate of the currency against the U.S. dollar in London.

The auction rate is applied to all current and capital transactions during the period between auctions, with the exception of a limited number of payments to which the official rate applied. In practice, the prevailing auction rate is also applied to all Forex inflows and to Forex provided by the NBE outside the auction market for limited expenses, including: tuition fees,medical treatment abroad, business travel, and personal remittances by expatriate workers. All licensed importers are allowed to submit bids to the auction for Forex to import goods

that are not included in the published negative list.

Successful bidders purchase Forex at their bid prices. On December 31,1993, the prevailing auction rate was Birr 5.86 per U.S.$1. Authorized dealers charge a prescribed commission of 0.50 per cent on buying and 1.50 per cent on selling, the proceeds of which accrue to NBE. Dealers may levy service charges of up to 0.25 per cent on buying and 0.75 per cent on selling for their own accounts. For currencies other than the U.S. dollar, dealers may include the charges applied by correspondents abroad. In practice, the authorized charges are usually levied. The commission and service charges are also applied by the NBE in its dealing with the Government and certain public sector entities.

There are no taxes and subsidies on purchases or sales of Forex. Authorized dealers must have the approval of the NBE to undertake forward exchange transactions. There are no arrangement for forward cover against exchange rate risk in the official or the commercial banking sector. All Forex transactions must be carried out through an authorized dealer under the control of the NBE. The Exchange Controller of the NBE issues exchange licenses for all exports and payments abroad and issues permits for all shipments.

Payments abroad for imports require exchange licenses, which can be obtained when a valid importer's license is presented, particularly for goods imported under letters of credit. Forex was not available for imports included in the negative list. Most goods on the negative list were, however, used to be imported under the Franco-Valuta arrangement without a license (i.e, imports were financed with Forex from external sources outside the auction system).

In Ethiopia, auctions were used to be held every fortnight when it was started. Later a weekly auction has been introduced in July 1996. A higher frequency of auctions would seem desirable

that are not included in the published negative list.

Successful bidders purchase Forex at their bid prices. On December 31,1993, the prevailing auction rate was Birr 5.86 per U.S.$1. Authorized dealers charge a prescribed commission of 0.50 per cent on buying and 1.50 per cent on selling, the proceeds of which accrue to NBE. Dealers may levy service charges of up to 0.25 per cent on buying and 0.75 per cent on selling for their own accounts. For currencies other than the U.S. dollar, dealers may include the charges applied by correspondents abroad. In practice, the authorized charges are usually levied. The commission and service charges are also applied by the NBE in its dealing with the Government and certain public sector entities.

There are no taxes and subsidies on purchases or sales of Forex. Authorized dealers must have the approval of the NBE to undertake forward exchange transactions. There are no arrangement for forward cover against exchange rate risk in the official or the commercial banking sector. All Forex transactions must be carried out through an authorized dealer under the control of the NBE. The Exchange Controller of the NBE issues exchange licenses for all exports and payments abroad and issues permits for all shipments.

Payments abroad for imports require exchange licenses, which can be obtained when a valid importer's license is presented, particularly for goods imported under letters of credit. Forex was not available for imports included in the negative list. Most goods on the negative list were, however, used to be imported under the Franco-Valuta arrangement without a license (i.e, imports were financed with Forex from external sources outside the auction system).

In Ethiopia, auctions were used to be held every fortnight when it was started. Later a weekly auction has been introduced in July 1996. A higher frequency of auctions would seem desirable

since this could smooth disbursement, make firms' production more flexible, probably encourage investment, and allow the scarce Forex to be determined by market forces which is near to floating system rather than to a fixed arrangement. Furthermore, the speculative behavior or over-bidding that might occur would be curtailed (Aron and Elbadawi, 1994).

The Ethiopian Forex auction system has witnessed a number of changes and amendments in rules and regulations since its introduction in May 1993. During the past four years of the auction system, the abolishment of the Franco-Valuta and the negative list for imports are two notable changes among others which have considerable impacts on the parallel rate thereby affecting the auction marginal rate.

Restrictions were imposed on items to be imported on those licensed bidders. These items were contained and indicated as a negative list for imports in the custom's documents. But this list was totally abolished with the exception of used clothes on the 85th auction that was held on July 20, 1996. The franco-valuta mechanism was also phased out on the same date. The 100% Forex cover requirement for the Forex auction was gradually reduced to 25% and then to 2% cover as a bid bond, in July 1996. The frequency of Forex auctions was increased to weekly trading from bi-weekly trading on the same date. The export proceeds surrender requirement was reduced to 90% from 100% on October 1,1996; 50% to be surrendered to the National Bank of Ethiopia(NBE) and 40% to the auction Forex market within 3 weeks. The remaining 10% may be held in Forex deposits.

These and the abolishment of the negative list for imports with the exception of used clothes and items restricted for health and security reasons have attracted importers to participate in the auction market. One interesting feature of the Ethiopian auction

system is that the authorities have achieved the unification of the official rate and the marginal rate in July 1995. These achievements have helped the widening of the market and allowed more and more importers to use the auction market. Macroeconomic data shows that about 76% of the total imports that pass through the official channel are financed by the auction market for Forex (Genet, 1995).

Though the process of auctioning is not yet completed, there have been stable rules with gradual amendments. The informational content of the auction reveal that the pre-announced supply is found to be in accordance with the rule of transparency. There is no pre-announced reserve price that reflect the authorities valuation of a unit of foreign exchange. Publication of the nature and/or number of bidders / composite bids are not yet undertaken. Composite bid means listing each importer's bid by quantity, price, and by use, so as to create confidence through the improvement in transparency. Though the pre-announced supply of Forex is helpful to reduce the problem of asymmetric information in that bidders can take their own valuation of the probability of getting the required amount at the quoted price for a unit of Forex, the level of transparency motivated by auction theories is not yet achieved in Ethiopia.

CHAPTER 4. MODELLING, STATISTICAL DESCRIPTION, ESTIMATION AND REGRESSION ANALYSIS.

4.1. Empirical Modelling of the Auction Marginal Rate.

Autoregressive Distributive Lag (ADL) time series modelling approach from the general-to-specific approach of data generating process (DGP) is followed in the modelling and estimation technique of this particular study following Hendry (1995).

Suppose X_t is a vector of observations on all variables in period t, and $X_{t-1} = (X_{t-1}, \ldots, X_1)$, then the joint probability distribution of the sample X_t, the DGP, may be stated as,

$$\prod_{t=1}^{t} D(X_t / X_{t-1}; \Theta) \ldots (4.1)$$

where, θ is a vector of unknown parameters given the general DGP in the above equation, the structural equation of interest with a function of B can be derived as,

$$D(X_t / X_{t-1}; \Theta) = A(W_t / X_t, \alpha) B(Y_t / Y_{t-1}, Z_t, \beta) C(Z_t / Y_{t-1}, Z_{t-1}, \gamma) \ldots (4.2)$$

The first component A, specifies the determination of W, the variable of no interest, as a function all the variables X_t. The second term B gives the endogenous variables of interest Y_t as a function of lagged Y and the exogenous variable Z_t. The final term C gives the determination of the exogenous variable Z_t as a function of the lagged endogenous and exogenous variables.

The predictions of auction theory depend centrally on the nature of the underlying distribution of bidders' values of the auctioned object. It is clear, therefore, that a theoretically-consistent empirical methodology that attempts to estimate

structural models of auctions must involve as a first step the estimation of the values distribution. However, given the extreme non-linearities and numerical complexity, there are considerable difficulties in estimating structural econometric models derived from auction theory (Aron and Elbadawi, 1994).

An account of the auction fundamentals that have effects on the clearing marginal rate (MR) can be signed a priori. Namely; the number of bidders (NB), the announced and actual supply of Forex (SS and AS respectively), the actual demand for Forex (AD), and the parallel rate (PR). The expected sign of the fundamental variables that go into the model is given below;

$$\underset{(+)}{MR = F\ (NB\ ,} \quad \underset{(-)}{SS\ ,} \quad \underset{(-)}{AS\ ,} \quad \underset{(+)}{AD\ ,} \quad \underset{(+)}{PR\ )}$$

$$\frac{\partial MR}{\partial NB}, \frac{\partial MR}{\partial AD}, \frac{\partial MR}{\partial PR} > 0; \frac{\partial MR}{\partial SS}, \frac{\partial MR}{\partial AS} < 0 \ldots (4.3)$$

Harris and Raviv (1981) theory of Nash bidding behavior is the setting adopted here, for the case where multiple units are sold in a single auction, and bidders can purchase at most one of these units. Following Viewing and Laffont (1992), an empirical model that emerges from the solved-out equilibrium bidding strategy for the discriminatory (Dutch) pricing type is found to be appropriate for the Ethiopian Forex auction system. The suitability of this empirical model for the more general case of endogenous quantity decisions by bidders (bidders can purchase more than one unit of the good to be sold) is considered.

There are Q units of a homogeneous goods to be sold. The market consists of N > Q bidding agents, who each competes for a unit of the good. Assuming that bidding agent i, i = 1,2,...,N places a monetary value v_i on a unit of the good, and that each v_i is drawn with replacement from a distribution with density function h and probability function H, where the support of h is [O , v]. If

bidders i submits a sealed bid b_i which if accepted, then the monetary gain is $v_i - b_i$, with utility $u(v_i - b_i)$. It is assumed that $u(0) = 0$, that $u(.)$ is increasing, concave and differentiable, and that the utility of an unsuccessful bid is zero. Bids $b_i = b(v_i)$ are assumed to be symmetric Nash equilibrium strategies. The function $b(vi)$ will be a Nash equilibrium bid function if for every i, $b(vi)$ maximizes bidder i's expected utility, given that every other bidder j uses the same strategy $b(v_j)$. These bids are arranged by the auctioneer in decreasing order of price. In the Harris and Raviv model of the discriminatory auction, the Q highest bidders pay the rate that they bid. Assume that bidder i believes his competitors will bid according to the differentiable bidding function $b_j = b(v_j)$, for j is not equal to i, where b_j is increasing on [O, V]. Let π denote the inverse of b_j [i.e., $\pi(b(v_j)) = v_j$]. The probability that a bid b_i will be accepted, is the same as the probability that at least N-Q of the values drawn by bidding agent i's competitors are below $\pi(b_i) = v_i$. This probability , $F(\pi(b_i))$, is given by the distribution function of the $(N-Q)^{th}$ order statistic for a sample size N-1 from the distribution H:

$$F(\pi(b)) = \frac{(N-1)!}{(N-Q-1)!\,(Q-1)!} \int_0^{\pi(b)} [H(V)]^{N-Q-1} [1-H(V)]^{Q-1} h(v)\, dv \quad \ldots (4.4)$$

The i_{th} bidding agent then has to choose b_i to maximize $U(v_i-b_i)\ F(\pi(b_i))$, i.e., maximize the bidder's utility should the bid be accepted, multiplied by the probability that it will be accepted. Harris and Raviv (1981) show that the Nash Strategy emerging from the solution of the first order condition for this maximization problem:

$$b_{Dn}(v_i) = \frac{1}{F(v_i)} \int_0^{v_1} x\, dF(x) \quad \ldots (4.5)$$

where, Dn indicates risk neutrality under discriminatory pricing. Harris and Raviv also prove that where all bidders are risk averse and have the same strictly concave utility function, they will bid higher than risk neutral bidders.

Data transformation helps us to extend the reach of the statistical mode to make inferences around the population mean of a norma distribution. The purpose of which is to transform data to normality. In a similar fashion, data transformation can be used to extend the reach of regression analysis (Mukherjee, 1997). In econometric practice, the logarithmic transformation is very popular. One reason is that functions which can be linearised with the aid of logarithms have coefficients which lend themselves to meaningful interpretations such as, for example, an elasticity or a growth rate (ibid).

So the double-log transformation can be derived as follows,

$Y = AX^{\beta 2}$ ...(1)

This is a function with a constant elasticity given by β_2

$dY/dX * X/Y = \beta_2$ ...(2)

Taking logarithm of both sides of equation(2) yields:

$\log Y = \beta_1 + \beta_2 \log X$ ...(3)

$\beta_1 = \log A$ ...(4)

As shown, this double-log transformation is linear with respect to its transformed variables. Linear regression with its assumptions about the error term is feasible. By adding an error term,

$\log Y = \beta_1 + \beta_2 \log X + \epsilon$ ...(5)

The above setting is, therefore, used for the specification of the reduced-form empirical model. The bid which is of special interest to this particular study of the auction market for Forex in

Ethiopia, is that of the clearing rate, which is the marginal rate prevailing during every auction. Keeping in mind these points, for the auction empirical investigation, it is proposed a simple Log-Linearised, Reduced-form empirical model for the clearing rate, for a series of mutually independent, multi-unit auctions where bidders bid for units of a homogeneous good. The model assumes a series of mutually independent auctions (Aron and Elbadawi, 1994):

$$MR_t = \sum_{i=1}^{m_1} \beta_i X_{it} + \sum_{i=1}^{m_2} \delta_i D_i + \epsilon_t = f(F_t) + \epsilon_t \ldots (4.6)$$

where, MR_t is the log of the auction Marginal (clearing) Rate. The X_{it} = [N, SS, Z] is a vector of variables in logs. Z variables are variables reflecting the observable characteristics of the auctioned object, and of the buyer side of the market which may affect the distribution of private values. These Z variables could be variables over which bidders can form expectations (Laffont et al, 1991). Important Z variables in the context of Forex auctions are PR and AD. PR reflects the opportunity cost to bidders and AD reflects the buyer side of the market. The 'D' reflects the qualitative auction policy intervention, such as the frequency of the auction or revision of the negative list for imports and to capture the effects of structural break. Finally, ϵ_t is a disturbance term.

Owing to the equation above the linear model can be represented as follows,

$$MR_t = \sum_{i=1}^{k} \alpha_{1_i} (F, MR)_{t-i} + \sum_{i=1}^{k_1} \beta_i (F)_t + \sum_{i=1}^{k_2} \gamma_i D_i + \epsilon_t \ldots (4.7)$$

where , ϵ is a stationary disturbance term, and f(F) is the log-linearised specification of equation above, giving the determinants of the auction clearing rate. The reduced log-linear empirical model is, therefore, stated below,

$$\log(MR)_t=\alpha_0+\alpha_1\log(NB)_{t-1}+\alpha_2\log(DD)_{t-1}+\alpha_3\log(SS)_{t-1}+\alpha_4\log(PR)_{t-1}+$$

$$\alpha_5\log(AS)_{t-1}+\alpha_6\log(MR)_{t-1}+\beta_1\log(NB)_t+\beta_2\log(DD)_t+\beta_3\log(SS)_t+$$

$$\beta_4\log(AS)_t+\beta_5\log(PR)_t+\gamma_1D_1+\gamma_2D_2+\gamma_3D_3+\epsilon_t \ldots (4.8)$$

where, D1 =Dummy variable to capture the policy shift that occurred on the 9th auction which was held on September 5, 1993 as a result of shortening the negative list for imports for the first time.

D2 =Dummy variable to capture the effect of the second revision of the negative list and abolishment of the Franco-Valuta imports,

D3 =Dummy variable to capture the effect of the introduction of the weekly auction.

Econometric Methodology

Time series allow us to specify equation which include lagged variables so as to capture dynamic interactions between variables over time. Furthermore, the inclusion of lags in the dependent variable allows us to distinguish between long-run equilibrium relations and short-run dynamic disequilibrium behavior (Mukherjee et al, 1997).

In regressing a time series variable on another time series

variable, one often obtains a very high R^2 although there is no meaningful relationship between the two. This situations exemplifies the problem of spurious regression. This problem arises if both time series involved exhibit strong trends (sustained upward or downward movements), the high R^2 observed is due to the presence of the trend, not to a true relationship between the two. Spurious regression arises if time series are not stationary (Gujarati, 1995). A stochastic process is said to be weakly stationary if its mean, variance and covariance (at various lags) remain the same no matter at what time we measure (ibid).

The unit root test is a test of non-stationary. This method will be used for two purposes. First, it will be employed as a way of testing the time series properties of the data sets. This is especially important since most macroeconomic variables are non-stationary. Secondly, non-stationarity tests for the exchange rates will be considered important in testing whether the movements in exchange rate are time related. This is particularly crucial when testing whether the movement in the current exchange rate is not related to the past behavior of its own price.

This test is also helpful to determine the order of integration of the individual data series. Two tests used for this particular study are the Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF). Although there are concerns about the low power of the unit root test against stationary alternatives, the ADF test appears to perform satisfactorily on this score even when the number of observations is small (Baffes et al, 1997). Testing is done from higher order of integration following the Pantula Principle. Hereunder, the DF and ADF tests are given in tabular form with trend and without trend together with the resulting order of integration.

variable, one often obtains a very high R^2 although there is no meaningful relationship between the two. This situations exemplifies the problem of spurious regression. This problem arises if both time series involved exhibit strong trends (sustained upward or downward movements), the high R^2 observed is due to the presence of the trend, not to a true relationship between the two. Spurious regression arises if time series are not stationary (Gujarati, 1995). A stochastic process is said to be weakly stationary if its mean, variance and covariance (at various lags) remain the same no matter at what time we measure (ibid).

The unit root test is a test of non-stationary. This method will be used for two purposes. First, it will be employed as a way of testing the time series properties of the data sets. This is especially important since most macroeconomic variables are non-stationary. Secondly, non-stationarity tests for the exchange rates will be considered important in testing whether the movements in exchange rate are time related. This is particularly crucial when testing whether the movement in the current exchange rate is not related to the past behavior of its own price.

This test is also helpful to determine the order of integration of the individual data series. Two tests used for this particular study are the Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF). Although there are concerns about the low power of the unit root test against stationary alternatives, the ADF test appears to perform satisfactorily on this score even when the number of observations is small (Baffes et al, 1997). Testing is done from higher order of integration following the Pantula Principle. Hereunder, the DF and ADF tests are given in tabular form with trend and without trend together with the resulting order of integration.

Table 4.1

Unit Root Tests for Auction Variables in Log

Auction Number 1-174 (Period:May 1993-April 1998)

Variable	Without Trend		With Trend		Order
	DF	ADF(1)	DF	ADF(1)	
LOG(MR)	-3.1723	-3.3055	-3.9691	-4.9134	I(0)
LOG(NB)	-5.2254	-3.9313	-6.2007	-4.8888	I(0)
LOG(AD)	-4.6086	-4.2180	-4.7811	-4.4031	I(0)
LOG(SS)	-3.8180	-3.4730	-3.5768	-3.4376	I(0)
LOG(PR)	-2.0668	-2.2779	-2.1025	-2.3160	I(1)
LOG(AS)	-4.3669	-3.7230	-4.4452	-3.7538	I(0)

95% Critical Values for the DF and ADF are given in brackets below:

	DF	ADF(1)
Without Trend	(-2.8782)	(-2.8783)
With Trend	(-3.4365)	(-3.4367)

Table 4.2

Unit Root Tests for Auction Difference-Log Variables.

Auction Number 1-174(Period May 1993- April 1998)

Variable	Without Trend		With Trend		Order
	DF	ADF(1)	DF	ADF(1)	
ΔLOG(MR)	-9.7198	-11.201	-9.7740	-11.341	I(0)
ΔLOG(NB)	-15.935	-9.6148	-15.888	-9.5855	I(0)
ΔLOG(AD)	-14.349	-9.5381	-14.350	-9.5394	I(0)
ΔLOG(SS)	-11.742	-9.5711	-11.774	-9.6062	I(0)
ΔLOG(PR)	-11.957	-10.242	-11.922	-10.212	I(0)
ΔLOG(AS)	-15.580	-10.694	-15.581	-10.699	I(0)

95% Critical Values for the DF and ADF are given in brackets below:

	DF	ADF(1)
Without Trend	(-2.8783)	(-2.8784)
With Trend	(-3.4367)	(-3.4368)

The unit root tests indicated that all variable except the parallel rate found to be trend stationary, I(0). The parallel rate is found to be difference stationary, I(1). The implication of which is that we can go ahead and use OLS estimation technique after differencing the parallel rate once to achieve stationarity thereby avoiding the problem of Spurious regression.

The unit root test indicated that all the variables become trend stationary as the data set is increased to 174 from what has been done by Genet (1995) using 50 observations. At that time, the only variable which was found to be trend stationary was the number of bidders (NB). All the rest were difference stationary.

4.2. Description of the Auction Fundamentals.

The Rates

There were three rates when the auction was started in May 1993. These were the official rate, the marginal rate(MR), and the parallel market rate(PR). The official rate was applicable to selected imports like petroleum, fertilizer, payments by the government for its international obligation and debt-service payments. The marginal rate has been applicable to special imports which are not listed in the negative list of the Customs Authority. The parallel rate is used as the opportunity cost to bidders and mainly served the Franco-Valuta imports which was officially abolished by the government. The official and the marginal rate were unified on July 25,1995 on the 59th auction.

On the determinants of the parallel exchange rate, evidence indicates that macroeconomic fundamentals (such as fiscal deficit, credit policies, and so on) matter most (Kiguel et al, 1994). The

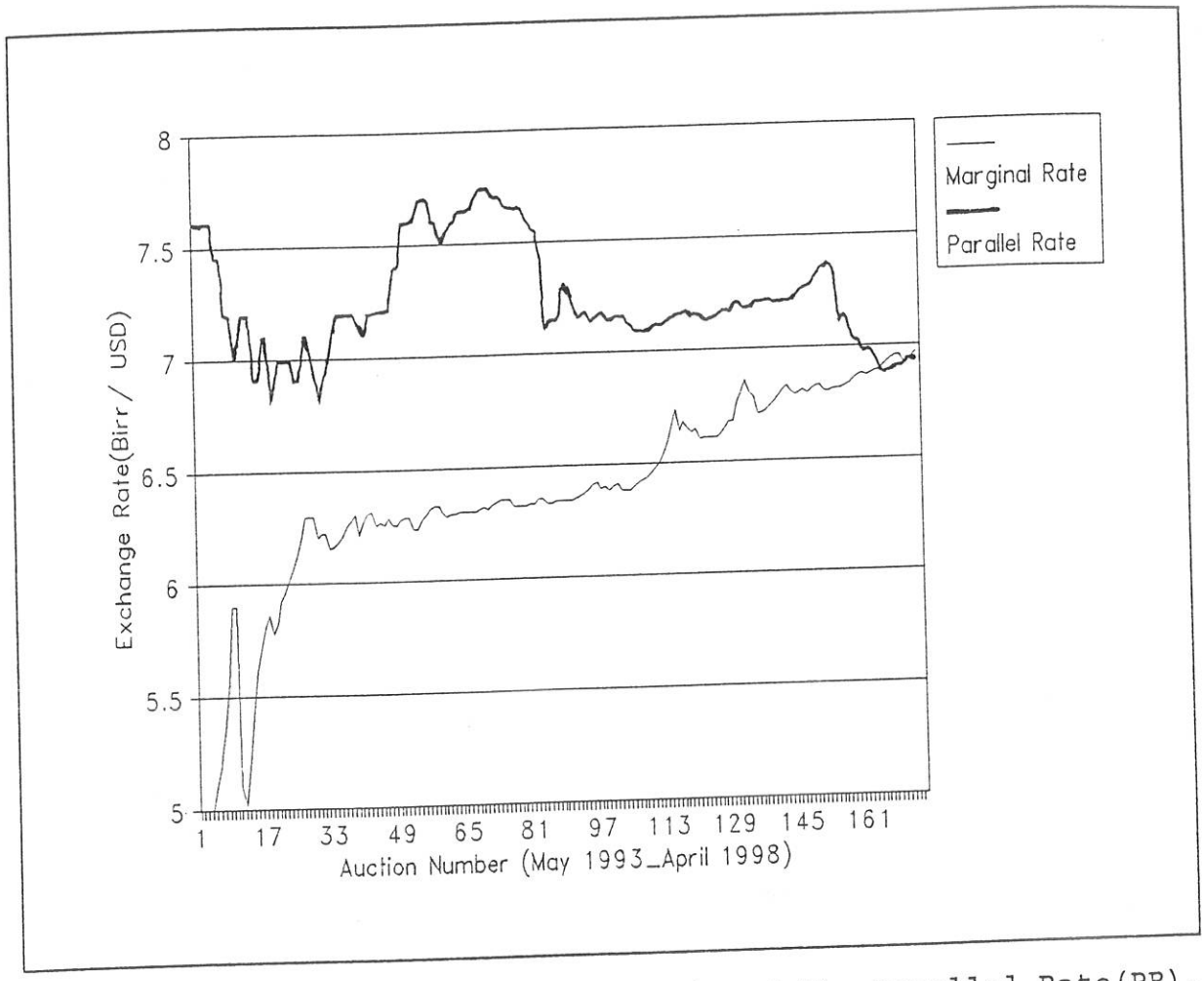


fig 4.1. Graph of the Marginal Rate(MR) and the Parallel Rate(PR).

parallel rate in Ethiopia is said to be determined by the export tax, and policy variables like trade restrictions and enforcement of exchange rate control and the desired level of imports (Derrese, 1996).

In the short-run the premium is driven by expectations about the evolution of these macroeconomic factors. There are essentially two ways in which parallel Forex markets develop and become important in the economy (i.e., the premium and volume of transactions become large). In the first, the authorities split the Forex market in order to phase in a devaluation when capital outflows prompt a BOPs crisis. In the second, the parallel market

emerges gradually in response to efforts to maintain an overvalued exchange rate.

According to Ferrara et al (1994), experience with unification indicates that it usually takes place at the parallel exchange rate. Practically unification of the different rates (official and parallel rates) has two interpretations: the first refers to the adoption of a single exchange rate for all external account transactions with full convertibility if the exchange rate is managed. The second refers to the adoption of a single exchange rate for all current account transactions and therefore a parallel market for portfolio and capital account operations.

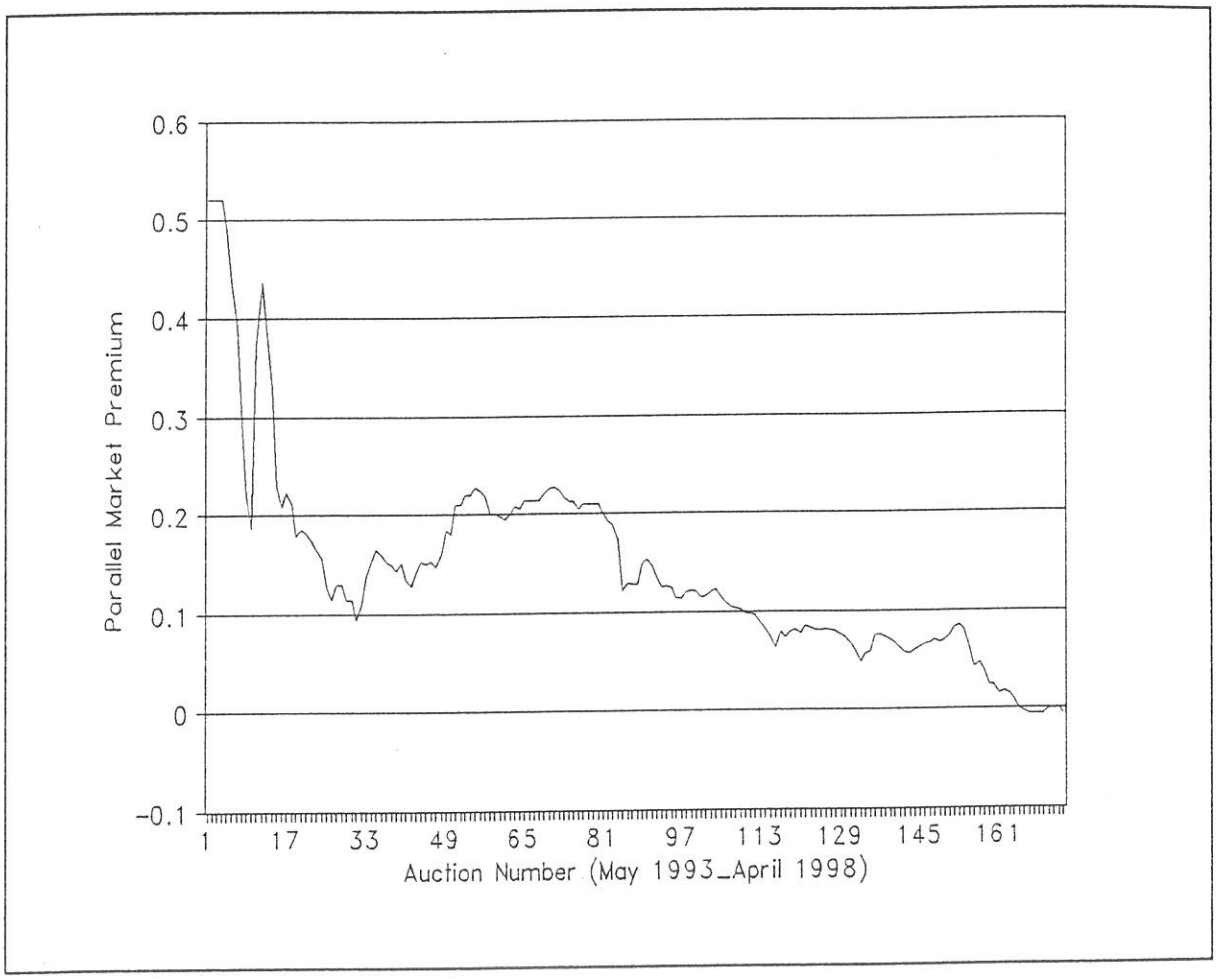
Considering the Ethiopian case, the parallel rate remained high when compared to the official and the auction marginal rate even after the huge devaluation of the Birr in October 1992. The premium [(PR/MR)-1] was 52% in May 1993 when the auction was started. It declined over the year and became 12% in may 1994. It declined sharply and became 7% in May 1997. It was totally eliminated by the end of January 1998 and has taken even negative values till the end of the period under the study, April 4, 1998 (ref. fig 4.2).

The parallel rate declined with marked variations in between and reached its minimum, Birr 6.80 for a U.S.D on the 31st auction which was held in June 1994 and it attained its peak 7.75 Birr for a U.S.D for the entire period under the study on the 70th auction which was held in December 1995. The rate has shown major reductions after the abolishment of the negative list for imports with the exception of used clothes and the phasing out of the Franco-Valuta imports that occurred in July 1996. One main reason for the premium to be eliminated is that of the abolishment of the Franco-Valuta imports which is said to be the major determinant of the parallel rate (Deresse, 1996). The declining premium indicated

the appreciation of the parallel rate and the depreciating marginal rate to unify the two rates in January 1998.

The auction marginal rate was at its minimum, Birr 5 per dollar when the auction started in May 1993. It depreciated for some time and reached 5.90 Birr/dollar on the 10th auction. Suddenly it failed to 5.10 Birr/dollar on the 11th auction where it shows a structural break. It started depreciating again and reached 6.30 Birr/dollar on the 60th auction which was held on August 5,1995. The rate showed stability between 6.30 and 6.42 Birr/dollar during the period of 1997. It has shown a further depreciation at the end of 1997 and reached 6.80 Birr/dollar. The rate further depreciated in the month of January 1998 and eventually unified with the appreciating parallel rate. The auction marginal rate attained its maximum Birr 6.969 for a dollar on the last auction covered by this study,i.e., April 4,1998 where the parallel rate remained at 6.93 Birr for a dollar with a premium of -0.005.

fig 4.2. Graph of the Parallel Market Premium.

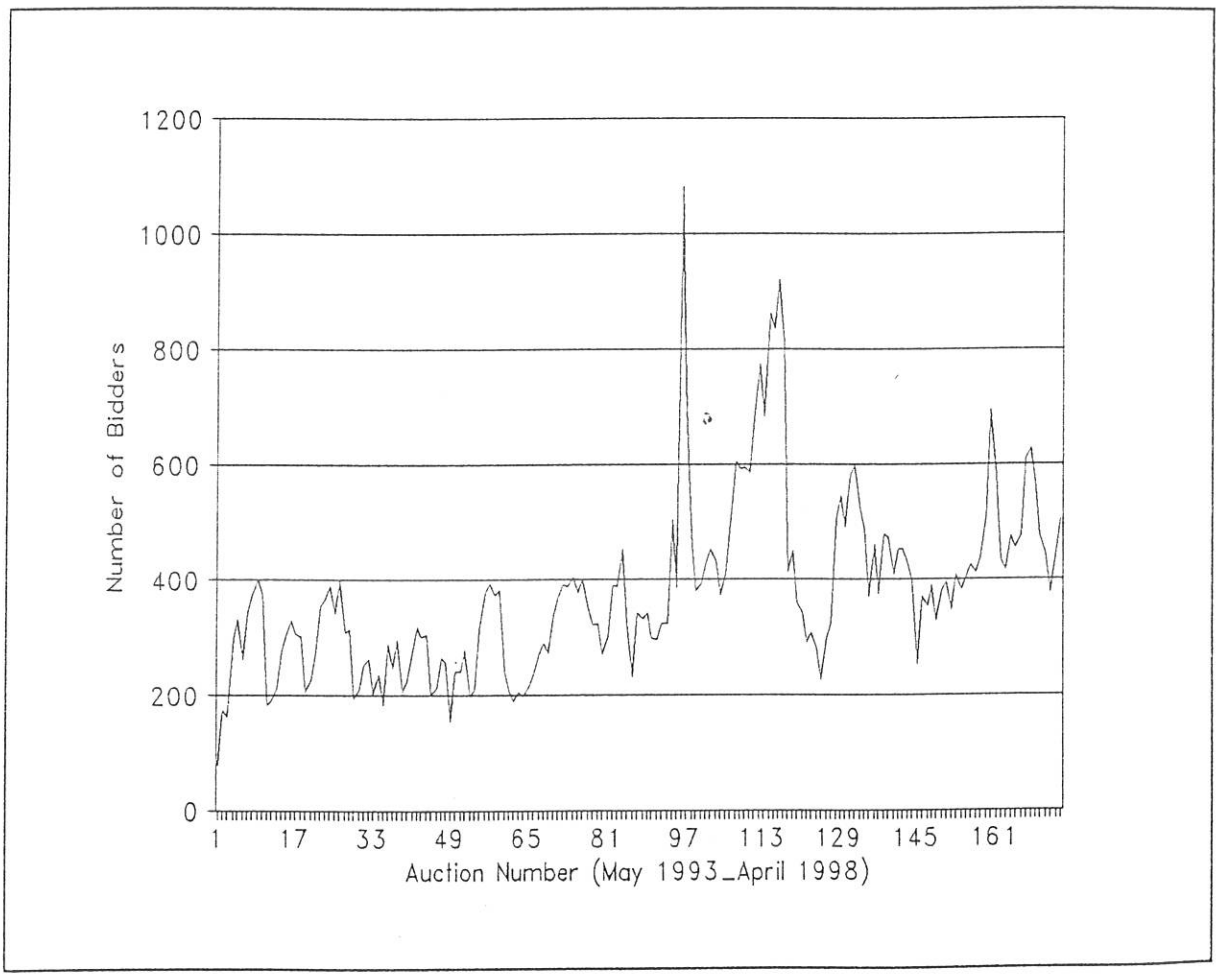


Number of Bidders, Demand and Supply of Actionable Funds

The demand for Forex in the auction market is the aggregate amount of Forex demanded by all bidders participating in the auction. This means that as the number of bidders increases the demand for Forex is assumed to increase. The data shows that total demand fairly exceeded the supply of actionable funds in the majority of cases, especially when we take the demand of all those rejected bids into account. The number of bidders has shown an increase especially after the abolishment of Franco-Valuta imports and the negative list for imports with the exception of used

clothes in July 1996. Due to this, it attained its maximum on October 5, 1996 registering 1081 bidders all in all. This can be depicted from fig. 4.3. below, the graph of the number of bidders across the auction period under the study. The number of bidders shows us the level of participation of bidders in the auction market and the widening of the market from time-to-time.

fig 4.3. Graph of Total Number of Bidders(NB).



Though there has been fluctuation as to the number of bidders participating in the auction, it showed an increase from time-to-time. On the average, the number of bidders is found to be 377 for the entire period.

Due to lack of recent monthly data on bilateral foreign inflows for a quantitative analysis, a qualitative analysis supplemented it to arrive at this conclusion. Monthly data on export proceed and fortnightly and weekly data on actual supply of auctionable funds converted to monthly data helped to undertake quantitative analysis that supports the above proposition about the contribution of export proceed and donors' funds for the supply of auctionable funds. Though the supply is related to exports and foreign inflows in the form of aid and grants, it is possible that these auctions may have experienced official intervention through supply manipulation to prevent exchange rate depreciation, or attain other objectives (Gilbert, 1986).

Donors' funds and primary agricultural export proceed constitute the main sources of Forex for auctions in most SSA countries including Ethiopia (Ferrara et al, 1994). Furthermore, supply could be well below export earnings since auctionable funds were frequently decided after satisfying the requirement of the government and public enterprises outside the auction as has been seen in Zambia and Uganda in the 1980's where supply was estimated to be as low as 25% (Quirck et al, 1987). Though the supply of Forex depends on the lagged export proceed and foreign aid/loan, in this study an attempt is made to evaluate the overall contribution of the export proceed to the supply of Forex on a year to year basis by way of generating the monthly data on the fundamentals that are relevant for its computation.

Hereunder two tables are presented for the purpose of comparisons of major exports and imports of Ethiopia. The Export table is between 1991 and 1997, whereas the import table is between 1991 and 1995. Since aggregates are used for 1996 and 1997 from the NBE for computations purposes, they are not shown in the table.

Table 4.3

Value of Imports, by Major Commodity Groups

(in Thousands of Birr)

Period	Machines & Aircraft	Road Motor Vehicles	Crude Oil	Chemicals	Others	Grand Total
1991	370,761	161,308	60,336	43,918	515,592	1,151,915
1992	633,593	293,000	288,683	64,294	1,200,387	2,479,957
1993	251,874	566,372	426,597	235,961	2,455,906	3,936,710
1994	519,088	902,234	494,486	178,050	3,564,647	5,658,505
1995	874,937	1,245,543	421,996	183,569	4,795,602	7,521,647

Source: Ethiopian Customs Authority.

Table 4.4

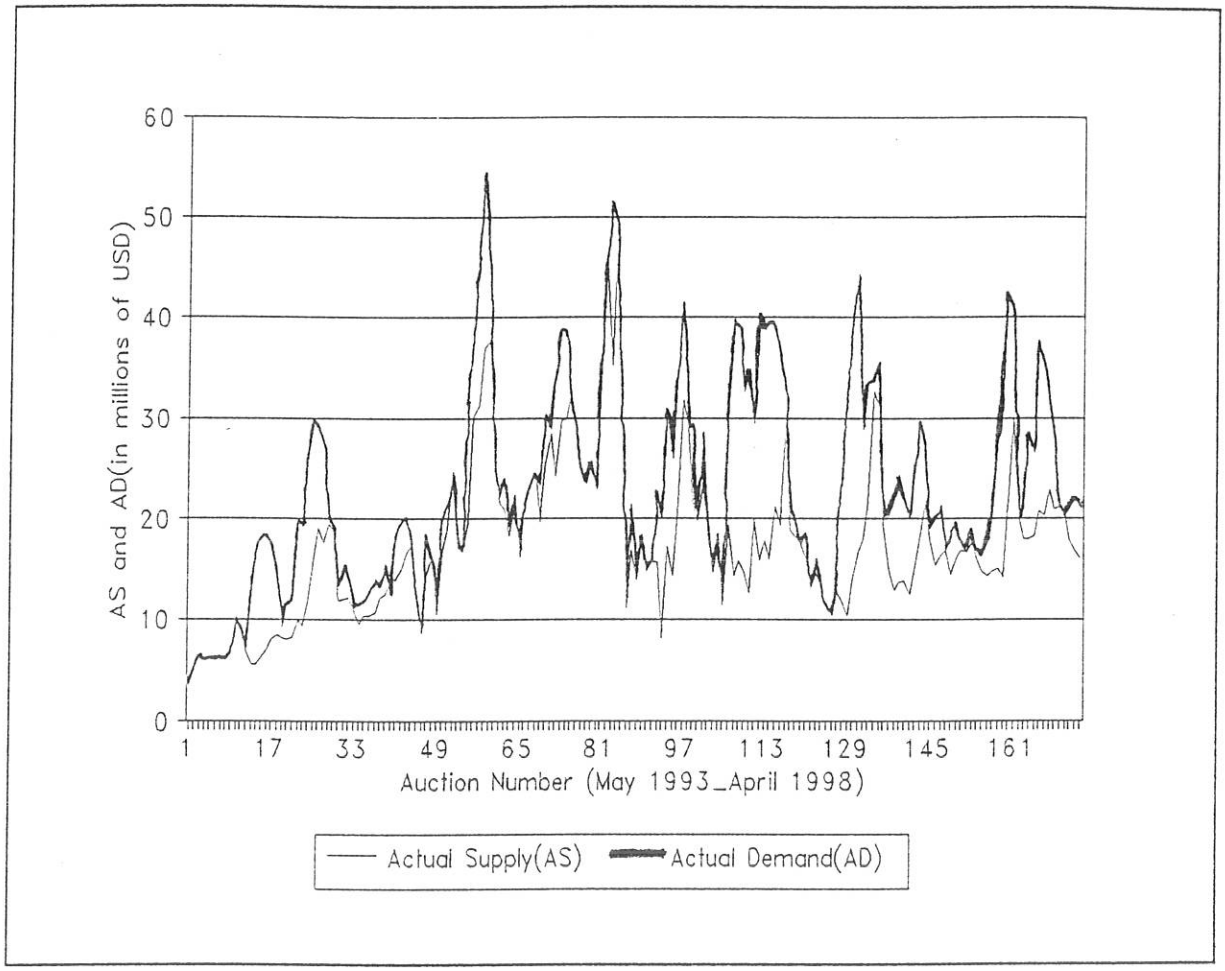
Value of Exports, by Major Commodity Groups

(in Thousands of Birr)

Period	Coffee	Oil Seeds	Hides & Skin	Pulses	Others	Grand Total
1990/91	268,451	3,633	92,206	15,716	162,479	542,485
1991/92	168,324	383	58,645	386	51,288	279,026
1992/93	475,126	1,186	134,515	4,050	185,935	800,813
1993/94	718,019	44,187	203,610	27,704	245,209	1,238,729
1994/95	1,799,034	50,130	373,549	103,287	406,042	2,732,044
1995/96	1,724,008	41,938	309,700	77,224	386,184	2,539,055
1996/97	2,307,393	74,016	372,252	87,263	776,863	3,617,789
1997/98	1,025,110	235,439	177,190	167,359	255,130	1,860,230

Source: National Bank of Ethiopia (NBE).

fig 4.4. The Graph of Actual Demand(AD) and Actual Supply(AS) of Forex.



The ratio of the supply of auctionable funds to the total imports is computed to appreciate the role played by the donors' in assisting the auction system. It is found that auctionable supply to total imports was 27% on the average between May 1993 and December 1994. This trend tended to increase over time and reached 43% in 1995, 55% in 1996 and 75% in 1997. The implication of which is that more and more imports are now being financed through the official auction market for Forex. The contribution of the auctionable supply to finance imports is found to be 45% on the average for the whole period of the auction. Furthermore, there is

also a role for the use of own funds either through export earnings retention scheme or other sources to finance imports to satisfy the demand for Forex.

4.3. Regression Results and Analysis of the Auction Data.

The regression analysis is conducted based on the outcomes of estimation techniques. The regression results arrived at by the data generating process(DGP) and by dropping those insignificant variables based on the t-ratio and the F-test from the general model to arrive at the specific parsimonious model. The result reported here consists of only those variables that are significant at least at the 10% level. The correlation matrix was constructed and examined to avoid the problem of multicolinearity before running all the regressions at each stage. For instance, it is found that there exists high degree of correlation between the actual supply and announced supply of Forex (more than 90%). This is also depicted from the data analysis, i.e, the authorities have maintained and supplied Forex according to the preannounced level in most cases and sometimes even more to satisfy demands. High degree of correlation is also found between the actual demand and that of actual supply of Forex in the auction.

The auction fundamental variables for which theoretically predicted effects on the auction marginal rate are the number of bidders, Forex supply, demand and the parallel rate. The empirical results of this study are found to be consistent with the predication of the theory on different magnitudes. Sustained increased Forex demand (supply) leads to an equilibrium auction rate depreciation (appreciation) as has been shown below in the estimation results (ref. table 4.5). The only difference stationary variable, the parallel rate, took an unexpected sign. It is found to affect the auction marginal rate negatively at 10% level of significance. This is one indicator of the credibility of the macro-economic policy of the system.

The regression results of the logarithmic transformation helps to correct for possible non-normality and heteroscedasticity and give meaningful interpretation of the coefficient of the regressors in the form of elasticities, i.e., it helps to measures the degree of responsiveness of the dependent variable (MR) with respect to the changes in the explanatory variables.

Table 4.5

Regression Results for the Model of the Auction MR Determinants.

Dependent Variable LOGMR

Regressors	Coefficients	T-ratios
$LOG(NB)_t$	0.0196	3.6896***
$LOG(AD)_t$	0.0089	5.2733***
$log(SS)_t$	-0.0120	2.2177**
$LOG(AS)_t$	-0.0060	1.8356*
$\Delta LOG(PR)_t$	-0.0170	1.8114*
$LOG(MR)_{t-1}$	0.7841	8.1652***
T	0.8251E-3	3.4141***
D1	0.0131	1.8002*

*,**,*** T-ratios at 10%, 5%, and 1% level of significance respectively.

R^2	0.96634
R-bar square	0.96464
RSS	0.02660
F-statistic F(8,163)	597.773

Tests based on the LM-version of Microfit econometric package version 386;

Functional form	0.14960[.699]
Normality	0.18770[.791]
Heteroscedasticity	0.06089[.805]
Observations	174

Estimation done using the Cochrane-Orcutt iterative method with hypothesis on an Autoregressive error process. The results reported are values obtained after correcting for genuine autocorrelation i.e., after checking for misspecification problem, if there is any.

The demand for total amount Forex and the number of bidders that are participating in the auction have shown to affect the auction marginal rate positively and significantly. The meaning of which is that on the average the addition of a 1% potential bidder to the auction market causes a depreciation of the auction marginal rate by almost 2%. A 1% increase in the demand for Forex results in the depreciation of the auction marginal rate by 0.009% on the average. A 1% increase in the announced supply of actionable funds causes an appreciation of the auction marginal rate by 0.01%. A 1% increase in the parallel rate has shown to cause an appreciation of the auction marginal rate by 0.01% but only at 10% level of significance. One of the interesting findings as a result of using longer data sets is that the auction marginal rate is found to depend on its own values lagged by one period (MR_{t-1}) significantly. Its coefficient is found to be 0.784 at 1% level of significance. On September 5, 1993 the negative list of imports that may be financed with Forex bought at auctions was shortened. Therefore, the dummy variable that is used to capture the first policy change, D_1, is found to affect the marginal rate positively at 10% level of significance. This result is consistent with the widening of the market which has influenced the marginal rate to depreciate as a result of shortening the negative list for imports. The trend variable, T, that is introduced in the regression analysis to capture the effects of trend in the variables, is found to be statistically significant at 10% level of significance but with a numerical value of almost zero.

Genet (1995) identified that declared (preannounced) supply and actual demand were significantly affecting the auction marginal

rate in the long-run at 1% level of significance and the parallel rate at 5% level using the first 50 auctions between May 1993_March 1995. The coefficient of the parallel rate was found to be -0.39 at 5% level of significance. The findings of this research using 174 observations from May 1993 - April 1998, have also verified the fact that the significant determinants of the auction marginal rate are the preannounced supply and that of the actual demand at 1% level of significance. Furthermore, the number of bidders and the lagged dependent variable (MR_{t-1}) are now found to be significant at 1% level of significance. The parallel rate in this study is found to affect the marginal rate only at 10% level of significance with the coefficient of -0.017.

All in all, the number of bidders (NB) which shows the increase in the participation rate of bidders in the auction system, the total actual demand (AD) for Forex, lagged dependent variable by one period (MR_{t-1}), and the preannounced supply (SS) have shown a tendency to affect the auction marginal rate (MR) significantly at the 1% level. The parallel rate (PR) and the actual supply (AS) of Forex have shown to affect the marginal rate at the 10% level. Though the preannounced supply and the actual supply of Forex haven't differed that much in most of the auction period under the study, the regression results have shown that the preannounced supply of auctionable funds remained stable and helped to stem down volatility in the auction market. It has also helped to reduce the number of unsuccessful bidders by way of signalling the stability of the auction market even in the absence of the reservation price which is depicted from the stable path followed by the auction marginal rate.

5.CONCLUSION AND POLICY IMPLICATIONS.

5.1. Conclusion.

The Ethiopian Forex auction system has witnessed a number of changes and amendments in the rules and regulations since its introduction in May 1993. The Dutch pricing system has been in force since the beginning of the auction. During the past five years of the auction system, the abolishment of the Franco-Valuta imports, the abolishment of the negative list for imports with the exception of used clothes and the requirement of 100% blocking of the invoice value by local currency was reduced to 25% and latter replaced by 2% as a bid bond (which is still enforce). The abolishment of the negative list for imports and the phased out Franco-Valuta imports have attracted importers to participate in the official auction market for Forex. These are the major changes among others which have had considerable impact on the parallel and marginal rates.

The existence of a large parallel market premium reflects inconsistencies between policies affecting domestic absorption (namely monetary and fiscal policies) on the one hand, and the official exchange rate on the other. The authorities in Ethiopia have succeeded at the first attempt of unifying the marginal rate and the official rate in July 1995. At a later stage, this has led to the main objective of bridging the gap between the parallel and marginal rates thereby reducing the premium from time-to-time and eventually unifying them on the 165th auction which was held on January 31, 1998. The recent feature of the auction market has witnessed that the premium was found to be negative after the 165th auction which was held on January 1998 until the end of the period under the study, i.e., up to the 174th which was held on April 4, 1998.

A successful unification is one that can be sustained without leading to significant increases in inflation or recurrent BOPs problems. Sustainable unification requires the adoption of a suitable exchange rate system, because large premiums create numerous macroeconomic distortions, and induce corruption. Automatic access to foreign exchange for trade creates large efficiency gains and increases transparency. The fact that unification has taken so long can be attributed to the government policy of introducing gradual changes so as to combat the eminent danger of inflation. Inflation in Ethiopia is found to be very minimal even at the stage of unification of the parallel and the marginal rate. This indicates the credibility of the system and the coordination effects of the underlying fiscal and monetary policies.

Though the reservation price is not announced by the auctioneer, it seems that bidders have been making their own judgement based on the past values of the auction marginal rate to complement their decision making in the bidding process. So far, the pre-announced supply is believed to minimize the problem of asymmetric information.

The contribution of foreign inflows is highly desirable to smooth and stabilize the auctionable supply funds when there is fluctuation in export earnings as a result of terms of trade (TOT) deterioration and at times of natural calamities that may drain down export earnings.

From this particular study and the one made by Genet (1995), therefore, one can safely conclude that the major determinants of the auction marginal rate are found to be the dependent variable lagged by one period, total demand for Forex, and the preannounced supply. The parallel rate is found to determine the marginal rate negatively contrary to what is predicted in theory. Besides, the auction data itself has justified this fact by depicting the

opposite movement between the two variables over time. As the marginal rate depreciates it is observed that in most cases, the parallel rate tends to appreciate.

This may lead to hypothesize that the marginal rate may not only be influenced by the parallel rate alone but also by the accompanying institutional framework. This is to say, even though bidders use the parallel rate as an opportunity cost to make their own valuation of a unit of foreign currency so as to quote a rate in the auction, as postulated at the beginning, the empirical finding doesn't support the positive relationship. Therefore, other factors such as the institutional framework obliges them to use the relatively expensive auction driven marginal rate for their imports rather than the relatively cheaper parallel rate, because they have to be licensed and open a letter of credit to import. Furthermore, importers have good reasons to use the official auction market for their imports. Among other things, the acceptance of the invoice price of imports by the customs authority for the computation of import taxes which could have been otherwise in the case of the Franco-Valuta imports.

5.2. Policy Implications.

The policy implications of this particular study are based on the empirical findings of the study and the experience of some African countries which I think are relevant to the auction system underway in Ethiopia. Keeping in mind the limitations of the study outlined in the introductory part, all the policy implications have to be taken with care.

The success of unification of the different exchange rates in an economy goes beyond a mere achievement of eliminating the different rates. It demands a lot on the part of the government to commit it self to realistic policies. The key element for successful unification has been the acceptance of the need for

consistency between the unified exchange rate and the two macroeconomic policies, namely, the monetary and fiscal policies. In practice this had meant that exchange rate policy had to accommodate the underlying inflationary pressures generated by the fiscal deficit. Inflation might increase at time of unification because unification usually takes place at the parallel rate (Ferrara et al, 1994). To attempt to bring inflation down and improve the external balance at the time of unification, therefore, requires the process to be accompanied by fiscal and credit policies that are supportive of this objective. Among others, cut in the budget deficit and tightening of domestic credit minimize the prospects for a reversal of the unification efforts made so far.

In an economy like Ethiopia, where there has been price controls on some important imported goods, like fuel and pharmaceutical, barriers to trade and above all underdeveloped financial markets, a gradual approach to unification would be appropriate. The attempt of unification has been done together with the implementation of structural reforms aimed at enlarging the role of market mechanisms in determining resource allocation. Legalization of the parallel foreign exchange market is a good step towards full unification.

The publication of composite bids by bidders will be a good way of increasing the level of transparency of the auction market that could supplement the preannounced supply (which is found to be a significant determinants of the auction marginal rate) by promoting bidders confidence in the system. Furthermore, it helps to improve the level of the informational contents of the auction and allows more and more bidders to participate in the auction from time-to-time. This can be used to attain one of the broad objectives of the authorities of widening the market, of course, with the expectation of a further depreciation of the auction marginal rate as evidenced by the empirical findings, unless and

otherwise supplemented by increasing contributions of the export proceedings and foreign inflows as a result of grants/aids (which is not feasible in the long run).

Export retention schemes should be strengthened to minimize the shortages of Forex on exporters, reduce the implicit export tax, and fund a legal private exchange market if at all it is legalized and increased substantially in number so as to determine the allocation mechanism by market forces.

REFERENCES

Aghevli, Bijan B, Mohsin S. Khan, and Peter J.Montiel(1991). **"Exchange Rate policies in Developing Countries"**, IMF occasional papers, No.78, Washington D.C.

Aron, J. and Elbadawi, I.(1994)."**Foreign Exchange Auction Markets in Sub-Saharan Africa.**",The World Bank Working Papers.No.1396. December.

Atta.J.K, K.R.Jefferis and J.Mannathoko(1996)."**Small Country Experiences with Exchange Rates and Inflation: the case of Botswana.**" Journal of African Economies, VOL.5.No.2.

Birritu, Publication of the National Bank of Ethiopia, No. 37-47, 1980-82, and, No.60,1995.

C.Bliss and V.Joshi(1988)."**Exchange rate protection & exchange rate conflict**" Oxford Economic Papers. VOL.36,No.1 England.

Chandan Mukherjee(1995).Howard White and Marc Wuyts, **"Econometrics, Data Analysis and Development"**, Institute of Social Studies, REPRO.

Coats, Warren(1994)."**In search of a Monetary Anchor: A 'New' Monetary Standard**", International center for Economic Growth, Occasional Paper, No. 48, California.

Cuthbertson Keith, Hall, S G and Taylor M P(1992)." **Applied Econometric Techniques**", Harvester Wheatsheaf, BPC Wheatons Ltd, Exeter.

Deresse Degefa(1996). **"The Parallel Exchange Rate and the Premium in Ethiopia"**, MSc Thesis, A.A.U. Addis Ababa.

Dominguez, K.(1991)."**Do Exchange Rate Auctions Work? An examination of the Bolivian experience**" NBER Working Paper Series, No. 3683, National Bureau of Economic Research.

Dominick Salvatore(1990)."International Economics", 4th edition, London, Macmillan press.

Dornbush. R (1990)."Exchange Rate Economics", Llewellyn.D ed(1993), Current Issues in International Monetary Economics, Macmillan Press Ltd, London.

Dornbush. R (1975)."Expectations and Exchange Rate Dynamics", Journal of Political Economy", PP 1161-1176.

Eliana La Ferrara, Gabriel Castillo, and John Nash(1994). "The Reform of Mechansisms for Foreign Exchange Allocation", The World Bank Policy Research Working Paper, No. 1268, Washington D.C.

Fama, E.F(1965). "The Behavior of Stock Market Prices", Journal of Business, 38:34-105.

Frankel. J.A.(1978)."PPP: Doctrinal perspective and Evidences from the 1920's", Journal of International Economy, May, PP:169-191.

Genet Teshome(1995)."Evaluation of the Auction Exchange Rate System in Ethiopia, A Master thesis ,A.A.U.

Gilbert, C.(1986)."Professor Hendry's Econometric Methodology", Oxford Bulletin of Economics and Statistics, 48,3,283-307.

Goldstein, H.(1962)." The Friedman Proposal for Auctioning Treasury Bills," American Economic Review, papers and proceedings, 75, 2: 56-159.

Guasch J.Luis and Glaessner Thomas(1993)."Using Auctions to Allocate and Price Long Term Credit", Research Observer Vol.8 No. 8. July.

Gulhati, Ravi(1985)."Exchange Rate Policies in Eastern Africa, 1965-1983". The World Bank Working Papers, NO.720. Washington D.C.

Gujarati, D.(1995)." Basic Econometrics", Third Edition, McGraw-Hill International Edition, Singapore.

Harris, M. and Raviv, A.(1981)."Allocation Mechanisms and the Design of Auctions", Econometrica,49,1477-99.

Hendry, D.F.(1995)."**Dynamic Econometrics**", Oxford: Oxford University Press, England.

Jeffery D.Sachs,"**Exchange Rate Regimes & Macroeconomic Stability**", American Economic Review, May 1996.

John Baffes, Ibrahim A. Elbadawi, and Stephen A.O'Connell (1997)."**Single-Equation Estimation of the Equilibrium Real Exchange Rate**", Policy Research Working Paper No.,1800.

Krumm, K.(1985)."**Exchange auctions: a review of experiences**", CPD Discussion paper, No. 1985-22, The World Bank.

Laffont, J. and Vuong, Q.(1992)."**Structural Econometric Analysis of Descending Auctions**", Working Paper NO.92-06D, Institut National de la Recherche Agronomique.

Miguel A.Kiguel(1992)."**Exchange Rate Policy, the Real Exchange Rate, and ,Inflation.**"The World Bank 25 Working Papers, No.880.

Miguel A.Kiguel and Stephen A. O'Connell(1994)."**Parallel Exchange Rates in Developing Countries**": Lessons from eight case studies", Policy Research Working Paper series, WPS No. 1265.

Peter B.Kenen(1987)."**Exchange Rate Management:What Role for for Intervention**",American Economic Review, May.

Peter Clark, Leonardo Bartolini, Tamim Bayoumi and Steven Symansky(1994)."**Exchange Rates & Economic Fundamentals**", IMF Occasional Papers, No.115, December.

Peter Isard(1995)."**Exchange Rate Economics**", IMF, Washington, Cambridge University Press.

Quirk, P.J., B.V. Christensen(1987)."**Floating exchange rates in developing countries, Experience with auctions and inter-bank markets**", IMF, Occasional paper 53.

Richard M.Levich(1985)."**Empirical Studies of Exchange Rate: price behavior, rate determination and market efficiency**", Hand Book of International economics, Volume II, International Monetary Economics and Finance, North-Holland Publishing Company, Elsevier Science Publisher B.V.

Ronald W.Jones and Peter B.Kenen(1985). **Hand Book of International Economics**, Volume II, International Monetary Economics and Finance, North-Holland Publishing Company, Elsevier Science Publisher B.V.

Sebastian Edwards(1988)."**Exchange Rate Misalignment in Developing Countries**", The World Bank occasional papers, No.2(New series).

Shapiro, A.C.(1983)."**What is PPP Mean?**", Journal of International Money and Finance 2, pp 295-318.

Sjoo. Bjoo(1997)."**Time Series Econometrics**", Unpublished.

Warren Coats(1994)."**In Search of a Monetary Anchor**", International Center for Economic Growth, Occasional Papers No.48.

Williamson, John(1985)."**The Exchange Rate System**", Institute for Internatinal Economics, Second Edition, Washington D.C.

W.M.Corden(1985)."**Inflation, Exchange Rates and the World Economy**", Third Edition. Clarendon Press. Oxford.

Appendix I Data on Auction Variables

National Bank of Ethiopia: Exchange rates

auction #	auction Date	Bid rate (Birr per US$) marginal	(AVG)wt Demand	(AVG)wt Supply	lowest	highest	Announced Supply mm.USd	Total supply ('000 USD)	Total demand	Number of bidders Suc-cessful	Unsuc-cessful	Rejected	Total	Other Rates (Br/ US$) Parallel Mkt rate	Official (Nominal)	starting from	Marginal Rate (avg) 1/
	1988/89													5.50	2.07	1973	
	1989/90													8.00	"	"	
	1990/91													7.00	"	"	
	1991/92													7.20	"	"	
	1992/93													7.50	5.00	Oct. 1,92	
	Year 1993																
1	May 01	5.00	5.74	5.74	5.00	7.00		3,553	3,553	62	0	15	77	7.60	5.00	Oct. 1,92	
2	May 15	5.00	5.30	5.30	5.00	6.50		5,047	5,047	102	0	71	173	7.60	5.00	"	
3	May 29	5.00	5.17	5.17	5.00	7.05		6,294	6,294	112	0	49	161	7.60	5.00	-	5.0000
4	Jun 12	5.00	5.13	5.22	5.00	6.50	6.00	6,000	9,975	203	0	94	297	7.60	5.00	-	
5	Jun 26	5.10	5.15	5.22	5.00	6.56	6.00	6,047	14,090	135	99	97	331	7.60	5.00	-	5.0182
6	July 10	5.20	5.14	5.28	5.00	6.10	6.00	6,000	17,637	108	123	28	259	7.45	5.00	-	
7	July 24	5.35	5.33	5.48	5.00	5.76	6.00	6,252	14,808	117	177	48	342	7.45	5.00	-	5.2023
8	Aug. 07	5.56	5.56	5.68	5.56	6.50	6.00	6,039	14,395	84	229	61	374	7.20	5.00	-	
9	Aug. 21	5.90	5.88	6.03	5.90	6.51	6.00	6,570	14,434	169	194	36	399	7.20	5.00	-	5.6205
10	Sep. 04	5.90	5.98	6.17	5.25	6.75	10.00	10,291	15,207	271	49	53	373	7.00	5.00	-	
11	Sep. 18	5.10	5.95	5.95	5.10	6.40	10.00	8,989	8,989	172	0	9	181	7.00	5.00	-	5.5952
12	Oct. 02	5.01	5.29	5.29	5.01	6.10	8.00	6,873	6,873	162	0	27	189	7.20	5.00	-	
13	Oct. 16	5.18	5.33	5.21	5.00	6.50	6.00	5,533	13,116	88	102	21	211	7.20	5.00	-	
14	Oct. 30	5.41	5.36	5.53	5.41	5.75	6.00	5,516	17,165	66	166	44	276	7.20	5.00	-	5.0952
15	Nov. 13	5.61	5.57	5.73	5.20	6.05	6.00	6,157	18,271	86	175	41	302	6.90	5.00	-	
16	Nov. 27	5.71	5.58	5.86	5.20	6.51	7.00	7,015	18,406	145	148	36	329	6.90	5.00	-	5.5282
17	Dec. 11	5.80	5.73	5.85	5.16	6.10	8.00	8,000	16,807	116	148	40	304	7.10	5.00	-	
18	Dec. 25	5.86	5.88	5.96	5.20	6.20	8.00	8,426	13,780	145	109	47	301	7.10			5.7817
	Year 1994																
19	Jan. 08	5.77	5.89	5.96	5.02	6.12	8.00	8,068	9,290	153	30	22	205	6.80	5.00	-	
20	Jan. 22	5.82	5.84	5.93	5.02	6.01	8.00	7,997	11,838	114	80	31	225	6.90	5.00	-	5.8047
21	Feb. 05	5.92	5.84	5.99	5.02	6.01	8.00	8,226	11,837	76	183	15	274	7.00	5.00	-	
22	Feb. 19	5.96	5.95	6.05	5.20	6.25	10.00	9,878	19,990	101	204	47	352	7.00	5.00	-	5.9120
23	Mar. 05	6.01	6.01	6.04	5.40	6.25	10.00	9,378	19,353	169	152	44	365	7.00	5.00	-	
24	Mar. 19	6.06	6.04	6.09	5.10	6.25	12.00	11,643	26,085	184	178	28	390	7.00	5.00	-	6.0236
25	Apr. 02	6.12	6.10	6.16	5.10	6.35	15.00	15,963	29,695	122	173	45	340	6.90	5.13	Apr. 1,94	
26	Apr. 16	6.20	6.19	6.22	5.77	6.65	17.00	19,137	29,030	236	130	31	397	6.90	5.13	"	
27	Apr. 30	6.29	6.29	6.32	5.50	6.40	17.00	17,682	27,458	167	104	35	306	7.10	5.13	-	6.2033
28	May. 14	6.29	6.38	6.39	5.87	6.76	19.00	19,394	19,636	280	10	23	313	7.10	5.13	-	
29	May 28	6.29	6.46	6.47	5.76	6.80	17.00	18,882	19,377	160	18	15	193	7.00	5.58	May 16,94	6.2900
30	June 11	6.20	6.33	6.36	5.76	6.61	17.00	11,826	13,281	178	9	22	209	6.90	5.66	June 1,94	
31	June 25	6.22	6.29	6.33	5.90	6.52	12.00	11,988	15,527	174	63	14	251	6.80	5.66	"	6.2364
32	July 9	6.22	6.26	6.28	5.81	6.50	12.00	12,201	13,945	207	25	30	262	6.90	5.59	July 1,94	
33	July 23	6.15	6.25	6.25	5.90	6.40	12.00	10,849	11,187	172	8	21	201	7.00	5.59	"	6.2033
34	Aug. 6	6.16	6.21	6.23	6.00	6.41	9.00	9,477	11,563	163	31	41	235	7.10	5.57	Aug. 1,94	
35	Aug. 20	6.18	6.21	6.21	6.10	6.31	10.00	10,354	11,823	128	37	17	182	7.20	5.57	"	6.1648
36	Sep. 3	6.21	6.23	6.24	6.15	6.35	10.00	10,340	12,745	193	65	29	287	7.20	5.55	Sep. 1,94	
37	Sep.17	6.25	6.27	6.29	6.18	6.45	10.00	10,642	14,036	159	62	25	246	7.20	5.55	"	6.2236
38	Oct. 1	6.27	6.32	6.32	6.21	6.42	12.00	12,200	13,240	153	23	20	196	7.20	5.60	Oct. 1,94	
39	Oct. 15	6.30	6.32	6.33	6.23	6.50	12.00	12,519	15,498	153	39	13	205	7.20	5.60	"	6.2814
40	Oct. 29	6.21	6.34	6.34	6.21	6.46	14.00	14,000	12,516	193	0	29	222	7.15	5.60	-	
41	Nov. 12	6.26	6.27	6.29	6.11	6.46	12.00	13,895	18,378	180	70	28	278	7.10	5.95	Nov. 7,94	6.2450
42	Nov. 26	6.30	6.31	6.32	6.20	6.41	14.00	14,993	19,875	216	72	29	317	7.10	5.95	-	
43	dec.10	6.31	6.34	6.35	6.11	6.45	15.00	16,560	20,168	211	52	37	300	7.20	5.95	-	6.2932
44	dec.24	6.25	6.34	6.34	6.25	6.42	17.00	17,308	17,308	282	0	20	302	7.20	5.95	-	

National Bank of Ethiopia: Exchange rates

auction #	auction Date	Bid rate (Birr per US$) marginal	(AVG)wt Demand	(AVG)wt Supply	lowest	highest	Annonced Supply mm.USd	Total supply ('000 USD)	Total demand	Number of bidders Suc-cessful	Unsuc-cessful	Rejected	Total	Other Rates (Br/ US$) Parallel Mkt rate	Official (Nominal)	starting from	Marginal Rate (avg) 1/
	Year 1995													7.20	5.97	Jan. 2,95	
45	Jan.7	6.26	6.31	6.31	6.26	6.41	15.00	11,745	11,745	177	0	23	200	7.20	5.97	"	6.2541
46	Jan.21	6.25	6.30	6.30	6.25	6.40	14.00	8,688	8,688	194	0	17	211	7.20	5.97	"	
47	Feb.4	6.28	6.27	6.30	5.27	6.39	13.00	14,299	18,470	191	54	19	264	7.25	5.94	Feb. 8,95	6.2650
48	Feb.18	6.25	6.31	6.31	6.00	6.40	18.00	16,022	16,215	227	5	23	255	7.40	5.94	"	
49	Mar.4	6.25	6.29	6.29	6.20	6.40	16.00	10,462	11,430	142	3	9	154	7.40	5.94	"	6.2591
50	Mar.18	6.27	6.29	6.29	6.25	6.41	16.00	16,477	19,943	199	27	14	240	7.60	5.94	"	
51	Apr.1	6.28	6.30	6.30	6.24	6.38	18.00	19,004	21,308	174	46	20	240	7.60	5.94	"	
52	Apr.15	6.28	6.31	6.31	6.25	6.35	18.00	24,574	24,681	242	5	30	277	7.60	5.94	"	6.2900
53	Apr.29	6.23	6.30	6.30	6.23	6.35	20.00	17,078	17,078	181	0	17	198	7.60	6.26	May 15,95	
54	May 13	6.23	6.28	6.28	6.23	6.32	17.00	16,761	16,761	189	0	19	208	7.70	6.26	"	6.2360
55	May 27	6.27	6.27	6.29	6.20	6.40	18.00	19,570	32,886	153	116	44	313	7.70	6.25	June 1,95	
56	June 10	6.29	6.30	6.32	6.01	6.45	25.00	30,065	38,328	240	109	27	376	7.70	6.25	"	6.2905
57	June 24	6.32	6.32	6.34	6.25	6.45	25.00	31,324	46,724	204	169	21	394	7.60	6.25	"	
58	July 8	6.33	6.35	6.36	6.25	6.42	30.00	36,902	54,358	232	113	26	371	7.60	6.25	"	6.3276
59	July 22	6.33	6.34	6.35	6.25	6.40	30.00	37,640	42,766	316	43	22	381	7.55	Unified	July 25,95	
60	Aug. 5	6.30	6.35	6.35	6.25	6.42	30.00	26,129	26,225	214	4	22	240	7.50			6.2973
61	Aug. 19	6.28	6.32	6.32	6.25	6.40	20.00	21,556	22,063	189	8	9	206	7.55			
62	Sep. 2	6.29	6.30	6.31	6.25	6.36	18.00	20,861	24,011	153	26	8	187	7.60			
63	Sep.16	6.29	6.31	6.31	6.26	6.35	20.00	18,184	18,231	187	2	15	204	7.60			6.2900
64	Sep.30	6.30	6.31	6.32	6.28	6.35	20.00	21,338	22,331	180	11	7	198	7.65			
65	Oct. 14	6.30	6.32	6.32	6.30	6.36	20.00	16,148	16,148	200	0	13	213	7.65			6.3000
66	Oct. 28	6.30	6.32	6.32	6.29	6.35	20.00	21,911	21,992	220	2	10	232	7.65			
67	Nov. 11	6.30	6.32	6.32	6.29	6.35	20.00	23,391	23,402	253	1	15	269	7.65			6.3000
68	Nov. 25	6.30	6.31	6.31	6.30	6.38	21.00	24,427	24,427	246	0	43	289	7.65			
69	Dec. 9	6.31	6.32	6.32	6.27	6.36	23.00	19,653	23,325	190	44	37	271	7.70			6.3095
70	Dec. 23	6.32	6.32	6.33	6.30	6.40	23.00	25,514	30,367	243	56	37	336	7.75			
	Year 1996													7.75			6.3191
71	Jan. 6	6.31	6.34	6.34	6.30	6.40	23.00	28,365	28,804	199	2	166	367	7.75			
72	Jan. 20	6.33	6.33	6.34	6.30	6.50	25.00	24,254	34,583	268	96	28	392	7.72			6.3430
73	Feb.3	6.34	6.35	6.35	6.31	6.41	27.00	29,701	38,808	290	69	28	387	7.70			
74	Feb.17	6.35	6.35	6.36	6.30	6.40	30.00	29,936	38,643	289	64	49	402	7.70			
75	Mar.2	6.35	6.36	6.36	6.34	6.40	30.00	32,356	32,631	336	5	34	375	7.65			6.3500
76	Mar.16	6.35	6.36	6.36	6.35	6.50	30.00	29,001	29,001	365	0	34	399	7.65			
77	Mar.30	6.32	6.36	6.36	6.30	6.40	30.00	23,968	23,989	319	1	28	348	7.65			6.3200
78	Apr. 13	6.32	6.34	6.34	6.27	6.37	28.00	23,475	23,519	283	1	37	321	7.65			
79	Apr. 27	6.32	6.34	6.34	6.20	6.37	28.00	25,601	25,857	293	7	22	322	7.65			6.3219
80	May 11	6.32	6.34	6.34	6.30	6.37	25.00	22,878	22,863	247	1	22	270	7.65			
81	May 25	6.33	6.35	6.35	6.32	6.40	30.00	33,680	35,339	261	21	17	299	7.60			6.3350
82	June 8	6.33	6.35	6.35	6.32	6.40	33.00	45,474	45,568	361	2	27	390	7.55			
83	June 22	6.35	6.35	6.36	6.32	6.55	35.00	35,230	51,389	193	167	27	387	7.55			
84	July 6	6.35	6.36	6.36	6.33	6.41	35.00	46,365	49,738	392	24	35	451	7.45			
85	July 20	6.33	6.36	6.36	6.33	6.40	30.00	29,598	29,598	283	0	40	323	7.10			
	Weekly auction introduced						67.29										6.3411
auction no.	date													7.15			
86	July 27	6.33	6.34	6.35	6.29	6.40	15.00	11,107	12,845	197	7	26	230	7.15			
87	Aug. 3	6.34	6.34	6.35	6.30	6.45	15.00	16,896	21,423	245	68	30	343	7.15			
88	Aug. 10	6.34	6.35	6.35	6.33	6.40	15.00	13,992	14,002	287	1	42	330	7.28			
89	Aug. 17	6.34	6.35	6.35	6.31	6.50	15.00	18,408	18,408	302	1	39	342	7.31			
90	Aug. 24	6.34	6.35	6.35	6.33	6.40	15.00	14,791	14,806	260	1	37	298				

auction #	auction Date	Bid rate (Birr per US$) marginal	(AVG)wt Demand	(AVG)wt Supply	lowest	highest	Annonced Supply mm USd	Total supply ('000 USD)	Total demand	Number of bidders Suc-cessful	Unsuc-cessful	Rejected	Total	Other Rates (Br/ US$) Parallel Mkt rate	Official (Nominal)	starting from	Marginal Rate (avg) 1/
91	Aug. 31	6.34	6.35	6.35	6.34	6.40	16.00	15,760	15,760	271	0	25	296	7.27			6.3391
92	Sep. 7	6.35	6.35	6.36	6.33	6.40	15.00	15,644	22,718	227	73	23	323	7.20			
93	Sep. 14	6.36	6.36	6.36	6.34	6.41	15.00	8,108	20,073	125	175	23	323	7.15			
94	Sep. 21	6.37	6.37	6.37	6.34	6.42	15.00	17,189	30,956	304	158	40	502	7.17			6.3563
95	Sep. 28	6.39	6.39	6.39	6.35	6.42	15.00	14,241	26,014	144	211	31	386	7.18			
96	Oct. 5	6.41	6.41	6.41	6.33	6.60	20.00	20,687	34,542	409	626	46	1081	7.14			
97	Oct. 12	6.42	6.43	6.44	6.36	6.52	25.00	31,691	41,367	592	37	65	694	7.15			
98	Oct. 19	6.39	6.44	6.44	6.39	6.50	25.00	29,020	29,020	409	0	49	458	7.16			6.4026
99	Oct. 26	6.40	6.41	6.42	6.35	6.50	25.00	21,721	29,326	322	17	40	379	7.18			
100	Nov. 2	6.38	6.42	6.42	6.38	6.50	20.00	19,715	19,715	341	0	51	392	7.15			
101	Nov. 9	6.40	6.40	6.40	6.36	6.50	20.00	23,536	28,638	309	75	43	427	7.13			
102	Nov. 16	6.41	6.41	6.42	6.37	6.50	18.00	18,405	21,093	353	58	41	452	7.15			
103	Nov. 23	6.38	6.42	6.42	6.38	6.48	18.00	14,574	14,574	394	0	36	430	7.15			6.3929
104	Nov. 30	6.38	6.40	6.40	6.37	6.46	18.00	17,612	18,297	335	3	33	371	7.16			
105	Dec. 7	6.381	6.401	6.401	6.363	6.925	18.00	11,353	11,376	287	1	118	406	7.11			
106	Dec. 14	6.401	6.399	6.404	6.381	6.451	17.00	19,310	31,495	262	160	73	495	7.10			
107	Dec. 21	6.413	6.408	6.426	6.381	6.468	17.00	14,222	39,625	335	180	90	605	7.08			6.3967
108	Dec. 28	6.426	6.428	6.438	6.391	6.511	17.00	15,849	39,183	252	282	57	591	7.09			
	Year 1997													7.09			
109	Jan. 4	6.436	6.439	6.446	6.412	6.925	17.00	14,869	32,592	369	171	54	594	7.08			
110	Jan. 11	6.451	6.457	6.476	6.421	6.751	17.00	12,618	34,826	298	224	62	584	7.10			
111	Jan. 18	6.473	6.478	6.492	6.431	6.653	17.00	19,881	39,410	264	328	86	678	7.12			6.4603
112	Jan. 25	6.497	6.497	6.510	6.439	6.753	17.00	15,806	40,439	479	231	63	773	7.11			
113	Feb. 1	6.532	6.531	6.542	6.405	6.783	17.00	17,840	38,998	216	382	83	681	7.13			
114	Feb. 8	6.587	6.591	6.622	6.441	7.152	17.00	15,926	39,455	392	401	69	862	7.14			
115	Feb. 15	6.653	6.660	6.682	6.575	6.932	17.00	21,192	39,131	365	367	103	835	7.16			6.6265
116	Feb. 22	6.734	6.743	6.770	6.573	7.123	19.00	19,278	34,719	424	399	95	918	7.16			
117	March 1	6.635	6.786	6.809	6.299	7.001	30.00	29,995	33,051	613	19	178	810	7.16			
118	March 8	6.677	6.715	6.725	6.511	7.052	18.00	18,891	21,515	288	66	56	410	7.17			
119	March 15	6.651	6.734	6.746	6.617	7.021	18.00	18,182	20,039	380	8	61	449	7.18			
120	March 22	6.631	6.697	6.697	6.631	6.923	18.00	17,402	17,402	297	0	61	358	7.17			6.6482
121	March 29	6.643	6.676	6.681	6.601	6.881	17.00	16,230	18,450	268	14	60	342	7.15			
122	April 5	6.601	6.669	6.670	6.451	6.852	16.00	13,098	13,106	241	1	48	290	7.16			
123	April 12	6.604	6.640	6.645	6.121	6.921	15.00	14,567	15,793	237	9	61	307	7.15			
124	April 19	6.604	6.640	6.640	6.604	6.781	14.00	13,256	13,256	224	0	55	279	7.13			6.6111
125	April 26	6.604	6.633	6.633	6.581	6.852	14.00	10,922	10,934	177	1	46	224	7.13			
126	May 3	6.604	6.639	6.640	6.591	6.801	13.00	10,318	10,342	233	2	63	298	7.14			
127	May 10	6.621	6.647	6.662	6.441	6.896	12.00	12,710	17,939	160	115	47	322	7.15			
128	May 17	6.645	6.650	6.666	6.611	6.801	12.00	11,809	24,629	206	228	68	502	7.17			
129	May 24	6.673	6.671	6.692	6.431	6.999	14.00	10,227	33,594	203	254	87	544	7.18			6.6338
130	May 31	6.672	6.710	6.748	6.615	6.932	15.00	13,832	39,424	277	212	78	489	7.16			
131	June 7	6.752	6.752	6.801	6.654	6.978	17.00	16,644	44,250	198	285	97	580	7.20			
132	June 14	6.802	6.814	6.836	6.655	7.159	18.00	18,006	28,819	311	219	66	596	7.21			
133	June21	6.853	6.854	6.870	6.655	7.111	22.00	21,650	33,613	278	178	65	521	7.18			6.7726
134	June28	6.801	6.905	6.910	5.993	7.159	32.00	32,604	33,610	401	24	60	485	7.18			
135	July 5	6.781	6.832	6.849	6.555	7.111	30.00	30,926	35,561	253	60	57	370	7.18			
136	July 12	6.701	6.788	6.799	6.437	6.991	20.00	19,289	20,852	374	20	65	459	7.21			
137	July 19	6.706	6.721	6.735	6.504	7.151	15.00	14,997	20,313	226	74	74	374	7.21			
138	July 26	6.718	6.731	6.745	6.060	6.954	14.00	12,843	21,951	262	121	94	477	7.21			6.7416
139	Aug.2,	6.737	6.744	6.755	6.701	6.963	14.00	13,727	24,370	238	148	86	472	7.21			
140	Aug.9	6.757	6.765	6.777	6.703	6.912	14.00	13,807	22,236	291	116	93	407	7.21			

National Bank of Ethiopia: Exchange rates

auction #	auction Date	Bid rate (Birr per US$) marginal	(AVG)wt Demand	(AVG)wt Supply	lowest	highest	Annonced Supply mn.USd	Total supply ('000 USD)	Total demand	Number of bidders Suc-cessful	Unsuc-cessful	Rejected	Total	Other Rates (Br/ US$) Parallel Mkt rate	Official (Nominal)	starting from	Marginal Rate (avg) 1/
141	Aug.16	6.781	6.787	6.795	6.722	6.999	14.00	12,457	20,130	243	139	69	451	7.20			
142	Aug.23	6.807	6.815	6.829	6.759	7.005	15.00	14,974	24,241	248	140	64	452	7.20			
143	Aug.30	6.826	6.821	6.856	6.645	7.005	18.00	18,306	29,683	289	94	43	426	7.21			6.7680
144	Sept.6	6.802	6.834	6.853	6.752	6.955	20.00	21,810	27,533	348	4	46	398	7.21			
145	Sept.13	6.786	6.819	6.821	6.755	6.951	18.00	18,006	19,013	201	5	45	251	7.21			
146	Sept.20	6.797	6.809	6.816	6.751	6.907	16.00	15,380	19,894	257	47	66	370	7.24			
147	Sept,27	6.808	6.815	6.820	6.769	6.912	16.00	16,426	21,287	226	50	75	351	7.26			6.8033
148	Oct. 04	6.793	6.829	6.829	6.793	6.991	16.00	16,811	16,811	321	0	69	390	7.27			
149	Oct. 11	6.809	6.820	6.825	6.751	7.101	15.00	14,378	18,567	217	46	63	326	7.27			
150	Oct.18	6.821	6.838	6.843	6.798	7.103	15.00	16,099	19,664	239	71	69	379	7.30			
151	Oct. 25	6.825	6.848	6.850	6.801	7.103	16.00	16,808	17,429	321	16	58	395	7.33			6.8115
152	Nov. 1	6.801	6.847	6.847	6.801	6.981	16.00	16,745	16,745	283	0	63	346	7.36			
153	Nov. 8	6.802	6.829	6.833	6.751	6.953	18.00	17,601	19,007	322	15	70	407	7.38			
154	NOv. 15	6.804	6.826	6.827	6.282	6.957	16.00	16,102	16,775	306	7	69	382	7.35			
155	NOv. 22	6.809	6.823	6.825	6.804	6.925	15.00	14,871	16,330	281	31	91	403	7.23			
156	Nov. 29	6.813	6.824	6.828	6.807	7.001	15.00	14,308	17,658	298	47	80	425	7.10			6.8040
157	Dec. 6	6.821	6.829	6.833	6.811	6.953	15.00	14,740	19,947	258	78	75	411	7.14			
158	Dec. 13	6.832	6.834	6.840	6.809	6.977	15.00	15,022	27,795	203	149	84	436	7.10			
159	Dec. 20	6.851	6.857	6.876	6.482	6.953	15.00	14,139	33,122	172	267	68	507	7.02			
160	Dec. 27	6.864	6.865	6.880	6.532	7.245	22.00	21,289	42,333	366	229	99	694	7.03			6.8338
	Year 1998																
161	Jan. 3	6.874	6.881	6.887	6.722	7.103	27.00	30,082	41,097	392	120	68	580	6.98			
162	Jan. 10	6.864	6.894	6.895	6.848	7.011	20.00	20,014	20,094	374	3	55	432	6.98			
163	Jan. 17	6.875	6.882	6.886	6.732	6.965	17.00	18,002	20,998	288	56	71	415	6.98			
164	Jan. 24	6.884	6.891	6.899	6.825	6.999	18.00	18,004	28,630	330	70	74	474	6.95			
165	Jan. 31	6.891	6.900	6.906	6.881	6.985	18.00	18,262	26,494	331	51	72	454	6.88			6.8736
166	Feb.7	6.903	6.909	6.918	6.692	6.999	20.00	20,738	37,704	267	127	82	476	6.88			
167	Feb.14	6.922	6.925	6.933	6.852	7.011	20.00	20,315	34,590	306	212	88	606	6.88			
168	Feb.21	6.939	6.942	6.952	6.231	7.222	20.00	22,943	31,300	451	100	76	627	6.90			
169	Feb.28	6.953	6.961	6.968	6.912	7.435	20.00	20,930	28,546	374	103	91	568	6.91			6.9138
170	March 7	6.953	6.976	6.976	6.953	7.115	20.00	21,257	21,257	401	0	74	475	6.91			
171	March 14	6.921	6.975	6.975	6.921	7.111	20.00	20,286	20,286	389	0	56	445				
172	March 21	6.934	6.944	6.947	6.731	7.055	17.00	17,956	20,827	272	50	54	376	6.93			
173	March 28	6.951	6.957	6.961	6.697	7.055	17.00	16,844	22,024	280	102	65	447	6.95			6.8038
174	April 4	6.969	6.972	6.978	6.777	7.101	15.00	16,029	21,883	322	104	77	503	6.93			

1/ Weighted by transaction date

Appendix II. Variables Used in the study.

MR = Marginal Rate
NB = Total Number of Bidders in the Auction.
AD = Total Actual amount of Forex Demanded by bidders
SS = Preannounced Supply of Forex by the NBE.
AS = Actual Supply of Forex by the NBE.
PR = Parallel Rate
D_i = Stands for the Dummy variables used (i=1,2,3)
LOG= Prefix that stands for the logarithm of the variables listed above
Δ = Stands for the first-difference of the variables

Commonly used acronyms in the study

COMESA= Common Market for Eastern African Countries
Forex = Foreign Exchange
SDR = Special Drawing Right
NBE = National Bank of Ethiopia
PPP = Purchasing Power Parity

Appendix III. Notes on Measures of Summary Statistics (Chandan M., et al, 1995).

The mean is given by;

$$\mu = E(Y) \qquad \ldots(1)$$

$$Y = 1/n\Sigma Y_i \qquad \ldots(2)$$

The spread of a distribution is measured by its standard deviation, the square root the variance which is the second centered(around the mean) moment of the distribution. The population and sample variances are respectively given by,

$$\sigma^2 = E(Y-\mu)^2 \qquad \ldots(3)$$

$$s^2 = 1/n-1\Sigma(Y_i-Y)^2 \qquad \ldots(4)$$

Another measure of the variation of a probability distribution is its coefficient of variation, CV. This is a relative measure defined as the ratio of its standard deviation to its mean, as follows;

$$CV = \sigma/\mu \qquad \ldots(5)$$

while the corresponding sample estimate is given by;

$$CV = s/Y \qquad \ldots(6)$$

We now come to the measures of shape. The coefficients of skewness and kurtosis. These are derived from the higher central moments of a distribution.

α_3 (the coefficient of skewness), is derived from the third moment of the probability distribution,

$$\alpha_3 = \mu_3/\sigma^3 = E(Y-\mu)^3/\sigma^3 \qquad \ldots(7)$$

where $\alpha_3 = 0$ if the distribution is symmetric. A distribution is skewed to the right (meaning its long tail is to the right) if $\alpha>0$, and to the left if $\alpha_3<0$. This explains why we say that a distribution is positively or negatively skewed. The coefficient of skewness, a_3 is given as follows,

$$a_3 = 1/n\Sigma(Yi-Y)^3/s^3 \qquad \ldots(8)$$

The coefficient of kurtosis, α_4, is derived from its fourth centered moment(hence, the subscript 4) and defined as follows,

$$\alpha_4 = \mu_4/\sigma^4 = E(Y-\mu)^4/\sigma^4 \qquad \ldots(9)$$

α_4 measures the "heaviness" of the tails of the distribution. The sample coefficient of Kurtosis,

$$a_4 = 1/n\Sigma(Y_i-Y)^4/s^4 \qquad \ldots(10)$$

All normal distributions are symmetrical(hence, their skewness equals 0) and have a kurtosis equal to 3. A symmetric distribution with $\alpha_4 > 3$ has heavier tails than a normal distribution. A unimodal (a distribution with one mode) bell-shaped empirical distribution with skewness close to 0 and a sample kurtosis close to 3 can be taken to behave similar to normal distribution. An empirical distribution with a_3 roughly equal to 0 and $a_4 > 3$ has heavier tails than a normal distribution would have, while $a_4 < 3$ indicates thinner tails than normal.

Table III.1

Summary Statistics of Data on Forex Auction Variables

Auction Number 1-174, (Period:May 1993-April 1998).

Variable	Maximum	Minimum	Mean	Std. Dev.	Skewness	Kurtosis	Coef. of Var.
MR*	6.9690	5.000	6.3674	0.4363	-1.3496	2.1779	0.0685
NB**	1,081	77	378	153	1.4444	3.3123	0.4044
AD***	54,358.0	3,553.0	23,015.1	10,330.8	0.5769	-0.053	0.4488
SS***	35,000.0	3,553.0	17,125.8	6,460.0	0.4940	0.3002	0.3772
PR*	7.7500	6.800	7.2393	0.2421	0.5976	-0.5932	0.0334
AS***	46,365.0	3,553.0	17,348.9	7,607	0.9857	1.5550	0.4384

Foot note: *amount stated in Birr/U.S.D.

**number of bidders.

***amount stated in thousands of U.S.D.

Table III.2

Summary statistics of Imports(IM), and Exports(EX) (Period: May 1993-December 1997).

Variable	Maximum	Minimum	Mean	Standard deviation	Skewness	Kurtosis	Coef. of variation
IM*	1218296	204613	575627	198661.6	0.75	0.90	0.34
EX*	555233	30681	217737	116126.5	0.91	0.81	0.53

Foot note: *amount stated in Thousands of Birr

Appendix IV. Notes on Unit Root Tests (Sjoo Bjoo, 1997).

i) DF-test:

The assumed Data Generating Process (DGP) is,

$y_t = y_{t-1} + \epsilon_t$ with $\epsilon_t \sim NID(0, \sigma^2)$

Subtracting i y_{t-1} from both sides, and estimating

$$\Delta y_t = \pi y_{t-1} + \epsilon_t, \ldots (1)$$

or

$$\Delta y_t = \alpha + \pi y_{t-1} + \epsilon_t, \ldots (2)$$

or

$$\Delta y_t = \alpha + \pi y_{t-1} + \beta_t + \epsilon_t \ldots (3)$$

where $\pi=0$ if y_t is I(1). A one side t-test $H_0 : \pi=0$ against, $H_1: \pi<0$, determines if y_t is I(0) or I(1).

ii) The ADF-test:

Like all tests of I(1) versus I(0), the ADF-test is sensitive to deviations from the assumption $\epsilon_t \sim NID(0, \sigma^2)$. If there is autocorrrelation in the residual process the OLS estimated residual will be inappropriate, the residual variance estimate will be biased and inconsistent. The ADF-test seeks to solve the problem by augmenting the equations with lagged Δyt,

$$\Delta y_t = \pi y_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta y_{t-i} + \epsilon_t, \ldots (1)$$

or

$$\Delta y_t = \alpha + \pi y_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta y_{t-i} + \epsilon_t, \ldots (2)$$

or

$$\Delta y_t = \alpha + \pi y_{t-1} + \beta t + \sum_{i=1}^{k} \gamma_i \Delta y_{t-i} + \epsilon_t \ldots (3)$$

The ADF test is better than the original DF-test since the augmentation leads to empirical white noise residuals.

Appendix V. Diagnostic Tests

The test of Functional form based on Ramsey Reset test using the square of the fitted values, has indicated that we accept the null hypothesis. That is, we donot have problem in the functional forms.

Two test procedures which take special advantage of the properties of the recurssive residuals are the CUSUM and the CUSUMSQ test of Brown, Durbin and Evans(1975). Both tests consists
of a series of statistics, defined as follows (Keith C. et al, 1992);

$$CUSUM_t = \left(\frac{1}{S}\right) \sum_{i=k+1}^{t} W_i$$

where s is the full sample estimate of the standard error(S.E) of the regression

$$CUSUMSQ_t = \left(\sum_{i=k+1}^{t} W_i^2\right) / \left(\sum_{j=k+1}^{T} Wi^2\right) = \frac{RSS_t}{RSS_T}$$

CUSUM is the sum of recurssive residuals normalized by the S.E of the residuals. If the residuals are random we would expect the CUSUM statistic to remain close to zero; and any systematic departure from zero; would suggest misspecification. Both tests are used generally in the form of a plot of either the CUSUM or CUSUMSQ statistics against time. It is not formal but it is a sequential form of Chow test. The plot of CUSUM and CUSUMSQ verified the stability of the parameters of the marginal rate determination model. This is part of the Chow test used to test the stability of the regression coefficients.

The test for Heteroscedasticity based on the regression of squared residuals on squared fitted values has indicated that we accept the null hypothesis, that is, the disturbances terms have constant variance across observations or they are homoscedastic.

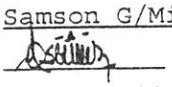
The test for Normality based on a test of skewness and kurtosis of residuals has indicated that we accept he null hypothesis, i.e., that error terms are normally and independently distributed with mean 0 and variance σ^2.

The diagnostic test indicated that the test for serial correlation using the Lagrange Multiplier (LM) test for residual serial correlation has indicated the presence of Serial Correlation in the residuals, that is, we rejected the null hypothesis and accept the alternative hypothesis. The presence of serial correlation in the OLS estimate make the estimators inefficient, therefore, it is essential to look for remedial measure. The alternative method the is frequently used is the Cocharane-Orucutt (C-O). The test for serial correlation to determine the serial in the residual is 2. Using the C-O method AR(2) converged after 3-iterations, has shown that the T-ratio improved. The DW-statistic is now improved too but we don't use it in the presence of lagged dependent variable instead Durbin's h-statistic is used. So the C-O method has helped us to tackle the problem of genuine auto-correlation.

Appendix VI. Declaration

DECLARATION

I, the undersigned, declare that this thesis is my own original work and has not been presented in any University. All sources of materials for this thesis are dully acknowledged.

Name: Samson G/Michael Wakjira
Signature: 
Date: June, 1998
Place: Addis Ababa