MEASURING THE REAL EXCHANGE RATE MISALIGNMENT OF ETHIOPIA: A DYNAMIC OLS APPROACH

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Abstract

This paper tries to develop a model for the real exchange rate of Ethiopia .More specifically, the study attempts to examine whether Ethiopia's real exchange rate is misaligned with respect to its long-run equilibrium level and answers such question as: (1) what are the constituent parts of the long-run equilibrium RER? (2) Which variables set the movement of the equilibrium real exchange rate? (3) Based on the findings calculate the degree of misalignment and (4) what policy measures could be taken to realign the real exchange rate with its equilibrium level. The empirical estimation results conclude that, terms of trade (TOT), external aid inflows (ODA), commercial policy stance (CPS), central bank reserve (CBR) and investment to GDP ratio were found to influence the long-run real exchange rate in the case of Ethiopia. However, variables such as nominal devaluation and real money supply are found to have no effect on the real exchange rate.

1. Introduction

The Ethiopian economy, with support from the World Bank and International Monetary Fund (IMF), has since October, 1992 witnessed the introduction of adjustment program to halt the downturn of the economy and to move the economy on the path of sustained growth and development. The real exchange rate (RER), by virtue of its impact on the international competitiveness of an economy, assumed an overriding importance among the cohort of policy variables (Haile Kibret, 1994).

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Evidences from Latin America, Asia and African countries revealed that the link between real exchange rate behavior and economic performance is strong (Elbadawi and Soto, 1995). According to the evidences, sustained RER misalignment usually generates severe macro-economic disequilibrium (Edwards, 1989). The equilibrium exchange rate, according to Elbadawi (1994) is a path upon which an economy maintains both internal and external balance.

Real exchange rate misalignment as defined by Edwards (1989) refers to a situation where the real exchange rate diverges from its long-run equilibrium, though the equilibrium rate is not actually observed. Ethiopia's real exchange rate has been noted for being misaligned through out its development history (Tewodros, 2004: Melesse, 2001 and Equar, 2001). This misalignment has contributed to the deterioration of the trade balance, domestic inflationary pressure and the weak competitive position of the country (Asmerom Kidane, 1997).

The main objective of this paper is therefore, to develop an empirical model for the real exchange rate misalignment of Ethiopia. More specifically, the study attempts to examine whether Ethiopia's real exchange rate is misaligned with respect to its long-run equilibrium levels and answers such question as: (1) what are the constituent parts of the long-run equilibrium RER? (2) Which variables set the movement of the equilibrium real exchange rate? (3) Based on the findings calculate the degree of misalignment and (4) what policy measures could be taken to realign the real exchange rate with its equilibrium level.

Following this introductory part, section two reviews the literature, and section three deals with model specification. The data and methodology, empirical results and the computation of the real exchange misalignment will be done in section four, five and six respectively. Finally section seven gives the concluding remark and policy implications.

2. Literature Survey

Broadly speaking, there are three competing literatures on the real exchange rate for developing countries; a measure based on purchasing power parity (PPP) (Balassa, 1990), a measure based on using the black market premium (Quirk et al., 1987), and a model based approach (Edwards, 1988, 1989; Elbadawi 1994). The discussion of

the Orthodox Purchasing Power Parity - PPP theory defines the real exchange rate as e=E P*/P, where E is the nominal exchange rate, P* and P are foreign and domestic price indices, respectively. This approach assumes an unchanged equilibrium exchange rate throughout the period and calculates the misalignment by deducting the actual real RER from some base year in which case the RER is believed to be in equilibrium. Edwards (1989) has criticized the application of the PPP theory on the ground that it gives inadequate consideration to changes in the equilibrium RER caused by fundamentals (see equation 2 below).

The second approach measures the misalignment using the black market exchange rate. This approach is also criticized by Montiel and Ostry (1994) as the informational content of the parallel market is limited in terms of capturing various shocks along the adjustment path. According to Aron (1994) the parallel market is seen as a thinly traded market solely used for illicit activities.

In the modern theory of the real exchange rate, RER is defined as the relative price of tradable goods (P_T) to non-tradable goods (P_N) i.e., E P_T*/ P_N and uses a formal model for determining the RER. Its principal advantage is the capability of incorporating changes in the equilibrium real exchange rate and involves the calculation of the Fundamental Equilibrium Exchange Rate (Williamson 1994). Despite its advantages, however, there is no direct measure for the prices of tradable and non-tradable goods in this approach. Therefore, whether to use consumer price index (CPI) or world wholesale price index (WPI) to substitute price of non-tradable and tradable respectively, or what such choice represents has been an unsettled issue. Elbadawi (1994) and Edwards (1989) for instance, argued that WPI is a good proxy for the price of tradable and the CPI for that of non-tradable. Their reasoning is that WPI contains mainly tradable and CPI mainly non-tradable. This study will also use WPI as a measure of tradable and CPI as a proxy for non-tradable.

Another dilemma in using the modern theory of real exchange rate is that on the choice of nominal exchange rate. Whether to use bilateral exchange rate with respect to the strong US Dollar or the multilateral exchange rate of the trading partners and what weights and which country's currencies should be included in the multilateral exchange rate is still an unresolved issue. This study, in congruence with other empirical studies, such as Elbadawi and Soto (1997), Baffes et al (1999), Edwards

(1989), will use the multilateral real exchange rate and trade weights will be used in the selection of trading partners.

Various studies on the determinants of the real exchange rate and the effects of real exchange rate misalignment have been undertaken. Edwards (1989) for example, developed a theoretical model of real exchange rate behavior and devised an empirical equation of how to estimate the real exchange rate dynamics using pooled data for a group of twelve developing countries. According to him, the important fundamentals that determine the real exchange rate are; the terms of trade, level and composition of government consumption, controls on capital flows, exchange and trade controls, technological progress, and capital accumulation. The study found that in the short-run, real exchange rate movements are affected by both real and nominal factors. In the long-run however, only real factors affect the sustainable equilibrium real exchange rate. Edwards (1989) further investigated weather there was any link between real exchange misalignment and economic performance. His conclusion was that the countries whose real exchange rates were closer to equilibrium out-performed those with misaligned real exchange rates. Similarly Cottani et al (1990) also argued that in parts of Latin America, unstable real exchange rates inhibited export growth, while in Asia, export expansion was fostered by stable exchange rates. On the other hand, in Africa, the widespread poor performance of the agricultural sector and economic growth in general could be attributed to persistently misaligned real exchange rates.

Cottani et al's argument was authenticated by other empirical findings. Ghura and Grennes (1993), for example, investigated the impact of real exchange rate misalignment on economic performance using a panel data for sub-Saharan countries. They too found that real exchange rate misalignment negatively affected income growth, export and imports, and investment and savings. In all the above studies, the most common determinants of real exchange rate were found to be terms of trade, openness, capital inflows and nominal devaluation. Other studies employing cointegration analysis in the empirical analysis of the real exchange rate as stated in Mkenda (2001), include: Baffes et al (1999) for Cote d'Ivoire and Burkina Faso, Elbadawi and Soto (1997) for seven developing countries, Kadenge (1998) for Zimbabwe, Gelband and Nagayasu (1999) for Angola, and Aron et al (1997) for South Africa (see section 3 below for their findings).

Within the context of Ethiopia, empirical studies on the determination of the equilibrium exchange rate have been undertaken. Tewodros (2004), in his annually based construction of Equilibrium Real Exchange Rate for Ethiopia, for the periods 1970/71-2003/04, noted that both the actual REER and equilibrium exchange rate seemed to appreciate until the end of the Derg regime and depreciate there after. Melesse (2001), using quarterly data for the period's 1985/86 - 1990/00, also observed that the real exchange rate of the Birr had been overvalued from 1986/87 - 1990/91 and then fluctuates between undervaluation and convergence to the equilibrium afterwards. Equar (2001), in his Master's thesis and using quarterly data for the periods between 1985 and 2000 found that ERER is above the actually observed real exchange rate (i.e., the Birr was overvalued). According to him, after the introduction of the economic reform, however, the misalignment is gradually narrowed.

This study adds to the existing works on the real exchange rate for Ethiopia in a unique way. In all the empirical studies above (by Melesse, Equar and Tewodrose, for instance) important variables such as Central Bank reserve and real money supply were skipped from the regression analysis despite their relevance in the real exchange rate specification and hence the mission of the National Bank of Ethiopia (NBE). In addition to this, the present study replaces capital control by Official Development Assistance (ODA) as the latter constitutes major capital inflow to the country.

3. Model Specification

In the behavioral equilibrium exchange rate model, the real exchange rate (RER) is defined as the domestic relative price of tradable goods (P_T) to non-tradable goods (P_{NT}), that is, $RER = (eP_{T/}P_{NT})$ compatible with the attainment of internal and external equilibrium, and e is the nominal exchange rate. Internal equilibrium presupposes that the market for non-tradable clears in the current period and is expected to be so in the future. External equilibrium implies that the current account balances both in the current and future periods are compatible with long-run sustainable capital flows (Elbadawi, 1994). Thus, using equations below, the hypothesized relationships can be specified.

Based on the works of Melesse (2001) and Equar (2001), and as observed by Edwards (1989), the dynamics of the behavior of the real exchange rate are given by equation as follows:

$$LogRER = [\beta(LogRER^*_t - LogRER_{t-1}) - \lambda(MAC_t - MAC^*)_t + \alpha(LogNER_t - LogNER_{t-1}) \quad \textbf{(1)}$$

Where

$(LogRER^*_t - LogRER_{t-1})$ = Deviations of the actual real exchange rate from its equilibrium level

$(MAC_t - MAC^*_{t-1})$ [2] = Inconsistency in the macro-economic policy framework

$(LogNER_t - LogNER_{t-1})$ = Nominal exchange rate devaluation

β, λ, α = Positive parameters capturing vital aspects of the adjustment process

Equation (2) gives an indication of the main fundamentals that influence the behavior of the equilibrium real exchange rate:

$$LogRER^*_t = \beta_0 + \beta_1 Log(TOT)_t + \beta_2 Log(AID) + \beta_3 Log(GCN)_t + \beta_4 Log(CPS)_t + \beta_5 Log(GRGDP)_t + \beta_6 Log(INVGDP)_t + U_t \quad \textbf{(2)}$$

Where

RER^*_t = The equilibrium real exchange rate

TOT = External terms of trade

AID = External aid inflows (defined as real net ODA to Ethiopia)

GCN = Government consumption of non-tradable (measured by the share of government consumption in GDP)

CPS = Commercial policy stance (measured by the black market premium)

$GRGDP$ = Growth rate of real GDP (used as a measure of technological progress)

$INVGDP$ = Investment to GDP ratio.

[2] Expansionary macroeconomic policy causes an appreciation the RER, other thing being equal.

Edwards (1989) stressed that this equation of equilibrium RER does not provide an explicit distinction between permanent and temporary movements in the fundamentals. Thus, it would be necessary to break down the fundamentals into these components as the long-run equilibrium exchange rate is determined by the permanent components.

Equation (2) puts the equilibrium real exchange rate as a function of real fundamentals. But the actual real exchange rate, as given in equation (1), responds to both real fundamentals and macro-economic policies represented by $-\lambda(MAC_t - MAC^*)_t$. Thus, Aron et al (1997) and Mkenda (2001) included central bank reserve (CBR) and real money supply (M_2) to the model of the real exchange rate to capture the role of macro-economic policies. Finally, some measures of nominal devaluation should also be introduced to real exchange rate model to capture the impact of nominal devaluation.

Incorporating all the above, the model for the real exchange rate (RER) that is used for estimation can be formulated as:

$$LogRER_t = \beta_0 + \beta_1 \log(TOT)_t + \beta_2 \log(AID)_t + \beta_3 \log(GCN)_t + \beta_4 \log(CPS)_t + \beta_5 \log(GRGDP)_t + \beta_6 \log(INVGDP) + \lambda \log(CBR)_t + \log\hat{\alpha}(M2) + \alpha(\log NER_t - \log NER_{t-1}) + \eta \log RER_{t-1} + U_t$$

Where, $(\log NER_t - \log NER_{t-1})$ stands for nominal devaluation and U_t for the error term.

The expected theoretical impacts of the respective fundamentals are as follows:

TOT (?):- Since terms of trade is defined as the relative price of exports to imports, its impact on the RER is theoretically ambiguous and depends on the relative strengths of the direct income effect operating through the demand for non-tradable and the indirect substitution effects that operate through the supply of non-tradable. To illustrate the impact of the direct income effect, let the price of exports increase (improvement in TOT), and the price of imports stay constant. The increases in the price of exports increases income and then raises the demand for both imports and

non-tradable domestic goods. Since the price of imports is given, the higher demand would only affect the price of non-tradable goods and hence a real exchange rate appreciation will occur. If deterioration in the terms of trade occurs, it may lead to the opposite effect (reducing income and the demand for all goods and hence resulting in depreciation in the RER). Sometimes, the indirect substitution effect may dominate the direct income effect. For example, an improvement in terms of trade may provide sufficient foreign exchange resources to producers of non-tradable goods in the economy. The increased resources may then enable the producers to increase their production of non-tradable goods, hence lowering its price and to depreciation in the RER. If deterioration in terms of trade occurred, it may lead to the opposite effect (an appreciation of the RER). In Elbadawi and Soto's (1997) study of seven developing countries, in the three cases, an improvement in the term of trade appreciated the real exchange rate, while in the four cases an improvement in the terms of trade depreciated the real exchange rate.

AID (-): By increasing real incomes and consequently the demand for both traded and non-traded goods, it tends to cause the RER to appreciate. In his study of twelve developing countries, Edwards (1989) found that an increase in capital inflows appreciated the real exchange rate, as expected.

GCN (?): Increases in government expenditure on non-tradable appreciates the RER, while those on tradable causes the RER to depreciate. Edwards (1989) found that an increase in government consumption appreciated the real exchange rate in four of the equations he estimated for a group of twelve developing countries, while in the other two equations an increase in government consumption depreciated the real exchange rate.

CPS (+): A reduction in an import tariff can decrease the domestic price of imports, which are part of tradables. This can, in turn, decrease the local currency price of tradables, leading to an appreciation in the real exchange rate. An increase in import tariffs can have the opposite effect. That is, it can raise the domestic price of imports, thereby depreciating the real exchange rate. However, the demand for imports and consequently for foreign exchange will increase, leading to depreciation in the real exchange rate. In their study of Cote d'Ivoire and Burkina Faso, Baffes et al (1999)

found results consistent with the theory; reforms that are aimed at liberalizing trade are consistent with a depreciating real exchange rate.

$GRGDP$ (?): Technological progress appreciates the RER if gains emanating from productivity enhancement in the tradable Sector override those in the non-tradable sector. Edwards (1989) found that an increase in technological progress depreciated the real exchange rate in all his regressions. Aron et al (1997), on the other hand, found that an increase in technological progress appreciated South Africa's real exchange rate.

CBR (?): Central Bank reserve intervention indicates the capacity of the Bank to defend the currency (Aron et al, 1997). An increase in reserve has the effect of appreciating the real exchange rate, while a decrease in reserves depreciates the real exchange rate. In their study of the determinants of the real exchange rate for South Africa, Aron et al (1997) found results consistent with the theory; an increase in reserves appreciated the real exchange rate.

NER_t (+): Nominal devaluation tends to depreciate the RER.

M_2 (-): Increase in real money supply depreciates the real exchange rate

$INVGDP$ (?): Its impact on the real exchange rate depends on whether an increase in investment changes the composition of spending on traded and non-traded goods. If an increase in the share of investment in GDP changes the composition of spending towards traded goods, it will lead to depreciation in the real exchange rate (see Baffes et al 1999 and Edwards, 1989). On the other hand, a change towards non-traded goods appreciates the real exchange rate. For example, Baffes et al (1999) found that an increase in the share of investment in GDP depreciated the real exchange rate in Cote d'Ivoire. Edwards (1989) also found that increases in the share of investment in GDP resulted in depreciation in the real exchange rate in his study of twelve developing countries.

Following the definition of the real exchange rate, a negative sign (-) represents an appreciation of the real exchange rate. This is because the real exchange rate is inversely related to spending (consumption) on non-tradable goods. This happens so

because if we start from a position of internal balance, a rise in spending creates an excess demand for non-tradable goods at the original real exchange rate. In order to restore equilibrium, a real appreciation is required, which would switch supply toward non-tradable goods, and demand toward tradable goods.

4. Data and Methodology

All data used in this study relate to the period 1970/71 to 2003/04 and were obtained from the Macro-econometric team of the National Bank of Ethiopia (NBE) and the Organization for Economic Cooperation and Development (OECD) website for the ODA. The data used are annual and the variables are in logs.

The paper employs the Stock Watson Dynamic OLS estimation procedure in determining the presence of relationship between the real exchange rate and its determinants. DOLS approach has certain advantages over both OLS and the Johansen maximum likelihood procedures. The OLS apriorily categorizes variables as endogenous and exogenous with implication of endogeneity problem and also the error term is not normally distributed (auto-correlation). The Johansen method, being a full information technique, is exposed to the problem of misspecification and small data observation. However, the Stock Watson method is a robust single equation approach, which corrects the problem of endogeniety by inclusion of leads and lags of the first difference of the regressors and for serially correlated errors by a Generalized Least Square (GLS) procedure. In addition DOLS has the same good property as the OLS for small sample size and it has the same asymptotic optimality property as the Johansen distribution.

5. The Stock-Watson (DOLS) Empirical Results

The Stock-Watson DOLS estimates for the equilibrium exchange rate in Ethiopia appear in Table 1 below. The behavioral exchange rate model is estimated including up to ± 2 leads and lags to the actual observations; insignificant lags and leads were dropped. By the rule of DOLS since the short-run model is the adjustment period where the leads and lags net out their effects, its analysis and interpretation is not discussed (Stock et al, 1993). Given the fact that a substantial amount of government

consumption contains foreign aid and that there is no disaggregated data for government consumption of non-tradable, GCN is excluded from the empirical

estimation. Similarly, since technological progress can be captured by investment to GDP ratio (see Jing Xu, 2003) and our economy is mainly agrarian, GRGDP has been also excluded from the empirical model. By the same logic as net foreign asset (NFA) is the component of broad money (M2) in Central Bank's asset specification; CBR is out of the empirical estimation. Finally dummy war (DWAR)[3] is included in the empirical estimation.

Variables qualified for the long-run model are TOT, AID, CPS and INVGDP and their respective coefficients are -0.250, -0.356, 0.637, and 0.559. Except for M2 and Nominal devaluation, all the variables are significant and the results show that taken together, these fundamentals explain 78 percent of the variation in the real exchange rate. The negative parameters on terms of trade, foreign aid and central bank reserve variables imply a tendency towards real exchange rate appreciation. However, commercial policy stance and investment to GDP ratio variables exhibit positive coefficients and, therefore, tend to depreciate the real exchange rate. Given the fact that macro-economic policies are intended to have only a temporary impact on the economy, the insignificant short-run negative coefficients on the money supply and nominal devaluation also cohorts special attention.

The negative and significant effect of the terms of trade on the real exchange rate implies that the indirect substitution effect dominates the direct income effect in the case of Ethiopia. The substitution effect may have been on the supply side, in which case deterioration in terms of trade (adverse terms of trade and drought) may not provide sufficient foreign exchange resources to producers of non-tradable goods in the economy. The decreased resources may then not enable the producers to increase their production of non-tradable goods, hence increasing its price and to appreciation of the real exchange rate.

The coefficient on external aid is also negative and significant. This result suggests that a large percentage of foreign aid may have probably been invested in the non-tradable goods and services such as wages, services and recurrent expenditure. As

[3] Takes the value 1 for years the war was serious (1976/76, 1981/82, 1989/90, 1990/91, 1997/98, 1998/99) and 0 for years the war was not serious.

has been evidenced in Yohannes (1996) "the growth in Ethiopia's net foreign asset (NFA) including official loans and grants caused monetary expansion". The same results have been obtained from studies on many developing countries (see for example, Elbadawi and Soto, 1997 and Edwards, 1989).

Table 1: The Stock-Watson (DOLS) Empirical Results

Dependent Variable: LOG(REER)
Method: Least Squares
Date: 02/16/06 Time: 20:23
Sample(adjusted): 1972 2002
Included observations: 31 after adjusting endpoints
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.540841	0.937051	8.047414	0.0000
LOG(TOT)	-0.250354	0.097467	-2.568600	0.0199
LOG(AID)	-0.356436	0.082791	-4.305254	0.0005
LOG(CPS)	0.636917	0.098133	6.490342	0.0000
LOG(INVGDP)	0.558694	0.270346	2.066587	0.0544
DLOG(TOT)	0.189792	0.114774	1.653621	0.1166
DLOG(AID)	0.251486	0.111842	2.248581	0.0381
DLOG(M2)	-0.031646	0.361526	-0.087536	0.9313
DLOG(TOT(-1))	0.175415	0.107297	1.634849	0.1205
DLOG(AID(-1))	0.234128	0.153819	1.522103	0.1464
DLOG(CPS(+1))	0.169086	0.131477	1.286057	0.2157
DLOG(INVGDP(+1))	0.597379	0.251350	2.376687	0.0295
D(NOMDEVAL(1))	-0.260052	0.142871	-1.820192	0.0864
DWAR	0.149712	0.098011	1.527501	0.1450

R-squared	0.878032	Mean dependent var	4.945367
Adjusted R-squared	0.784762	S.D. dependent var	0.290335
S.E. of regression	0.134697	Akaike info criterion	-0.869122
Sum squared resid	0.308437	Schwarz criterion	-0.221514
Log likelihood	27.47138	F-statistic	9.413903
Durbin-Watson stat	1.313360	Prob(F-statistic)	0.000023

The positive coefficient on commercial policy stance implies a tendency towards real exchange rate depreciation. The result suggests that a relaxation of the extent of impediments to international trade (openness) resulted in equilibrium exchange rate

depreciation. This result supports the view that liberalization allows more goods and services into a country, with the impact of bringing in more competition for domestic goods. The competition could have exerted some downward pressure on the price of non-tradable causing the RER to depreciate. Similar to this result, Baffes et al (1999), in their study of Cote d'Ivoire and Burkina Faso, found results consistent with the theory.

The coefficient on investment to GDP ratio is also significant with the expected positive sign. It is to be expected that at the early stage of development an increase in investment to GDP ratio leads to an increase in demand for imports, which in turn brings about reduction in the price of non-tradable and hence real exchange rate depreciation. Although not significant in the long-run, the short-run impacts of money supply and nominal devaluation deserve special treatment consistent with the theory. Accordingly nominal devaluation has played an important macro-economic role in smoothening and depreciating nominal rigidities that used to prevent the price of non-traded goods from responding to shocks that affect the equilibrium exchange rate. The short-run depreciation effect of money supply on the real exchange rate also reveals that the sterilization policy[4] of the National Bank of Ethiopia has so far been efficient in neutralizing the inflationary pressure and real exchange rate appreciation impact of the influx of foreign exchange inflows.

From the results of test on residuals shown in Appendixes 1, 3, and 4 (ARCH test, serial correlation and normality test), model specification (i.e., RESET test or appendix 2), it is evident that the DOLS single equation model provided in table 1 passes the various diagnostic tests. The Breusch-Godfrey LM test statistics is given by the product of the number of observations and the coefficient of determination (i.e., Obs*R-squared) and is asymptotically distributed as chi-squared. The serial correlation test suggests the absence of second order serial correlation as evidenced in LM test statistics of 3.07 being less than its critical value of 5.99 (at the 5% level). In other words, the null hypothesis of no serial correlation is accepted. There are no ARCH effects in the residuals since the computed statistics of 0.92 is relatively lower than the critical F-value of about 4.17. Apart from these tests, there is an implication of appropriate specification in the sense that the Ramsey RESET test provides credence for this.

[4] Sterilization policy refers to selling securities and/or national bank's notes, increasing/decreasing the required commercial bank's reserves and imposing a credit ceiling on the lending of commercial banks.

6. Real Exchange Rate Misalignment

As mentioned in the introductory part, one of the reasons for finding the determinants of the equilibrium real exchange rate is to be able to estimate the degree of misalignment in the real exchange rate. In order to estimate the degree of misalignment, the long-run estimates of the fundamentals have been used to obtain the fitted values of the equilibrium real exchange rates. The misalignment in the real exchange rate is then calculated as,

$$e_{mis} = (RER - ERER)/ ERER$$

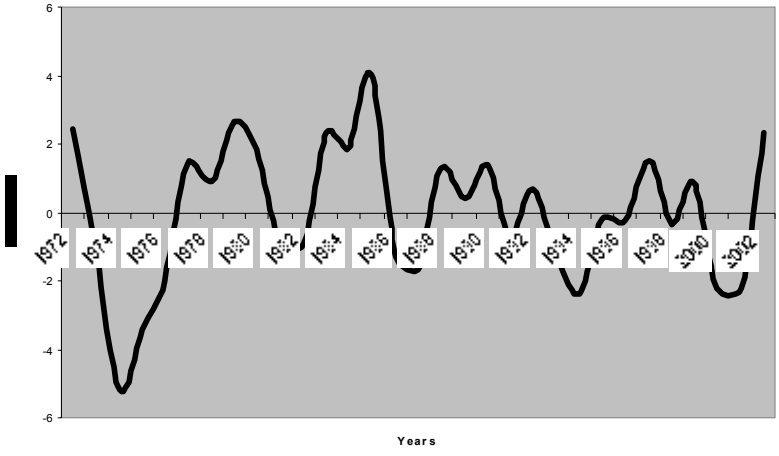
Where, RER is the actual real exchange rate, and $ERER$ is the equilibrium real exchange rate. The calculated percentage of misalignment for the real exchange rate is given in Table 2, and Figure1, and Appendix 5 plots the misalignment.

The computed indices of misalignment indicate that the real exchange rates were overvalued and undervalued in a number of episodes. The most notable period is the overvaluation of the exchange rate between 1973/74-1975/76, 1991, 1993/94-1995/96 and 2000-2001. The overvaluation of the exchange rate during 1973/74-1975/76 and 1991 could be due to change in governments and the particularly prolonged appreciation of the exchange rate during 1973/74-1975/76 was on account of the international oil price crisis of the 1973/74. Though the introduction of devaluation and the auctioning system initially resulted in the depreciation of the exchange rate during 1992, the real exchange rate appreciated in the following four years (between 1993 and 1996). This could be due to the inflationary impact of the international coffee price boom and the composition of foreign exchange inflows has shifted from official to private sources during these periods. As clearly indicated in Yohannes (1996) money supply registered a 20.9 percent growth at the end of June 1995 as against the targeted growth rate of 12.6 percent and also lending to the private sector as a percentage of GDP by the commercial bank of Ethiopia increased dramatically from 19.8 percent in 1993/94 to 22.1 percent in 1994/95.

Table 2. Computed Real Exchange Rate Misalignment (percentage)

Year	Misalignment
1972	12.48379
1973	-4.86368
1974	-22.9648
1975	-16.0113
1976	-9.86221
1977	7.341946
1978	4.597044
1979	14.06048
1980	9.283527
1981	-4.09735
1982	-4.57942
1983	12.3613
1984	10.37971
1985	23.32531
1986	-6.44944
1987	-8.36207
1988	6.715578
1989	2.022269
1990	7.594074
1991	-3.60069
1992	3.552866
1993	-5.9614
1994	-10.7156
1995	-0.95319
1996	-1.09436
1997	7.238411
1998	-1.72824
1999	3.806392
2000	-9.73367
2001	-9.48958
2002	10.99346

Figure 1: Missalignment of the Real Exchange Rate



The auctioning system was abandoned in October 2001 and also the Ethio-Eritrea war was ended at the beginning of 2001 and these may have been the causes for the severe depreciation of the real exchange rate in 2002. The appreciation of the real exchange rate in 2000 and 2001 can also be explained by the Ethio-Eritrea war. There were also episodes of undervaluation in the periods 1977 to 80, 1983 to 1985, 1988 to 1990, in 1997, in 1992, and in 2002. As one can see from Figure 1 and appendix 5, the resulting ERER is consistent with Edwards (1989) and Elbadawi (1994) in that the ERER shows some variability and calculating the misalignment based on the PPP will be misleading. However, as one would expect, whether these episodes of overvaluation and undervaluation trace adequately the actual trend in Ethiopia will of course depend on the reliability of the data used. It is well known that there were substantial price controls for commodities particularly in the period prior to 1990. This may make the official consumer price index suspect. It is also true that tracking the long-run equilibrium is quite tricky, and the method employed here can at best only provide a crude estimate.

7. Conclusion and Policy Implication

The purpose of this study was to find the main determinants of the real exchange rate in Ethiopia, and to estimate the degree of misalignment of the actual real exchange rate from its long-run equilibrium level. In doing so, the paper reviewed various literatures to emphasize the importance of the real exchange rate in showing the competitiveness of the country with its trading partners.

The empirical estimation results conclude that, terms of trade (TOT), external aid inflows (ODA), commercial policy stance (CPS) and investment to GDP ratio were found to influence the long-run real exchange rate. However, variables such as nominal devaluation and real money supply were found to have no effect on the real exchange rate.

Terms of trade have an appreciating effect on the real exchange rate. This finding has a theoretical underpinning and it implies that the substitution effect dominates the income effect. The finding that aid inflows have an appreciating effect on the real exchange rate has implications for using aid to infrastructural development and other development activities.

The significance of commercial policy stance (openness) with positive impact is also in support of a popularly held view that if a country increases its import tariffs, then this will increase the domestic price of imports, which are part of tradables. This can in turn increase the local currency price of tradables, thereby leading to a depreciation of the real exchange rate. One implication for the macro-economic management is that trade reforms should be undertaken with maximum care. This is because complete liberalization of trade requires a stable and flexible exchange rate with appropriate timing and sequencing of the reform program. For instance, complete liberalization of the current account has a paramount importance before trying to liberalize the capital account. The depreciation impact of investment to GDP ratio on the real exchange rate also calls for strengthening the meager foreign direct investment (FDI) by relaxing some of the restrictive policies that prevented FDI flowing in to the country.

With regard to nominal devaluation, the nominal exchange rate of the Birr vis a vis Dollar had been fixed for all the periods before 1992. Since 1992, however, due to the

slow response of exports and the substantial imports- caused by the built-up demand for consumer goods and capital imports to rehabilitate the devastated economy, the sustainability of devaluation has been endangered as has been seen in Table 2. The slow response of the export sector in a situation of fast increase in the level and growth rate of imports leads to a deeper and extended deterioration in the trade balance (the J-curve effect). This development calls for the delay of import liberalization (especially consumer goods) until the effect of export promoting policies becomes effective and exports begin expanding.

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Appendices

Appendix 1

ARCH Test:

F-statistic	0.924087	Probability	0.344633
Obs*R-squared	0.958461	Probability	0.327575

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/07/06 Time: 11:34
Sample(adjusted): 1973 2002
Included observations: 30 after adjusting endpoints
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.008049	0.003378	2.382679	0.0242
RESID^2(-1)	0.178525	0.146815	1.215986	0.2341

R-squared	0.031949	Mean dependent var	0.009820
Adjusted R-squared	-0.002625	S.D. dependent var	0.014457
S.E. of regression	0.014476	Akaike info criterion	-5.568306
Sum squared resid	0.005868	Schwarz criterion	-5.474893
Log likelihood	85.52459	F-statistic	0.924087
Durbin-Watson stat	1.991150	Prob(F-statistic)	0.344633

Appendix 2

Ramsey RESET Test:

F-statistic	0.171171	Probability	0.684566
Log likelihood ratio	0.329879	Probability	0.565730

Test Equation:
Dependent Variable: LOG(REER)
Method: Least Squares
Date: 03/07/06 Time: 11:30
Sample: 1972 2002
Included observations: 31
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.43904	25.60707	0.759128	0.4588
LOG(TOT)	-0.832243	1.251703	-0.664889	0.5156
LOG(AID)	-1.177223	1.770622	-0.664864	0.5156
LOG(CPS)	2.147144	3.267734	0.657074	0.5205
LOG(INVGDP)	1.862012	2.817339	0.660912	0.5181
DLOG(TOT)	0.632047	0.950743	0.664792	0.5157
DLOG(AID)	0.822291	1.187704	0.692337	0.4987
DLOG(M2)	-0.075581	0.365069	-0.207031	0.8386
DLOG(TOT(-1))	0.595718	0.917790	0.649079	0.5255
DLOG(AID(-1))	0.783262	1.224021	0.639909	0.5313
DLOG(CPS(+1))	0.563777	0.848523	0.664422	0.5159
DLOG(INVGDP(+1))	2.034130	3.152385	0.645267	0.5279
D(NOMDEVAL(1))	-0.937893	1.489958	-0.629476	0.5379
DWAR	0.496807	0.749130	0.663179	0.5167
FITTED^2	-0.240018	0.516688	-0.464531	0.6485
R-squared	0.879323	Mean dependent var		4.945367
Adjusted R-squared	0.773731	S.D. dependent var		0.290335
S.E. of regression	0.138106	Akaike info criterion		-0.815247
Sum squared resid	0.305172	Schwarz criterion		-0.121382
Log likelihood	27.63632	F-statistic		8.327520
Durbin-Watson stat	1.306084	Prob(F-statistic)		0.000069

Appendix 3

Breusch-Godfrey Serial Correlation LM Test:

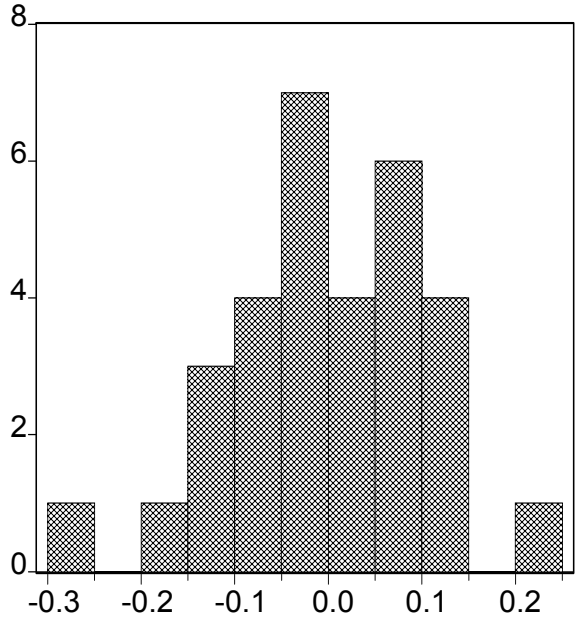
F-statistic	3.071500	Probability	0.076196
Obs*R-squared	9.006905	Probability	0.011071

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 03/07/06 Time: 11:39
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.239299	1.125748	-0.212569	0.8345
LOG(TOT)	0.017352	0.108010	0.160651	0.8745
LOG(AID)	0.044836	0.097710	0.458871	0.6529
LOG(CPS)	-0.060279	0.107969	-0.558295	0.5849
LOG(INVGDP)	-0.069821	0.328869	-0.212307	0.8347
DLOG(TOT)	-0.034038	0.130236	-0.261353	0.7974
DLOG(AID)	-0.022697	0.125457	-0.180919	0.8589
DLOG(M2)	-0.393661	0.370632	-1.062134	0.3050
DLOG(TOT(-1))	-0.135757	0.125250	-1.083888	0.2955
DLOG(AID(-1))	-0.127136	0.142736	-0.890707	0.3872
DLOG(CPS(+1))	-0.037538	0.140296	-0.267564	0.7927
DLOG(INVGDP(+1))	-0.435938	0.323350	-1.348191	0.1976
D(NOMDEVAL(1))	-0.061671	0.167816	-0.367492	0.7184
DWAR	-0.154303	0.113779	-1.356164	0.1951
RESID(-1)	0.855923	0.361560	2.367306	0.0318
RESID(-2)	-0.340048	0.381869	-0.890485	0.3873

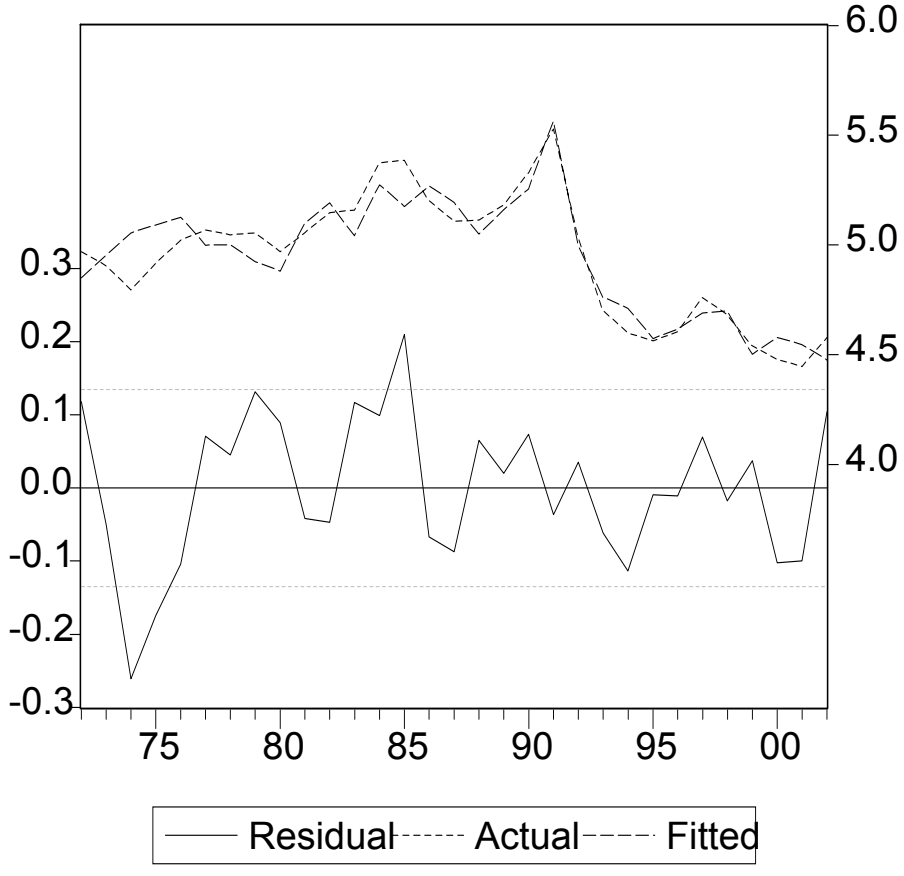
R-squared	0.290545	Mean dependent var	-1.56E-15
Adjusted R-squared	-0.418909	S.D. dependent var	0.101396
S.E. of regression	0.120781	Akaike info criterion	-1.083348
Sum squared resid	0.218822	Schwarz criterion	-0.343225
Log likelihood	32.79189	F-statistic	0.409533
Durbin-Watson stat	1.988124	Prob(F-statistic)	0.952901

Appendix 4



Series: Residuals	
Sample 1972 2002	
Observations 31	
Mean	-1.56E-15
Median	-0.009578
Maximum	0.209655
Minimum	-0.260908
Std. Dev.	0.101396
Skewness	-0.331763
Kurtosis	2.980182
Jarque-Bera	0.569185
Probability	0.752321

Appendix 5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5.0
4.5
4.0
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0.2
0.1
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-0.1
-0.2
-0.3
75
80
85
90
95
00
Residual
Actual
Fitted